


RESEARCH ARTICLE OPEN ACCESS

Governing Positive Energy Districts: The Role of Legitimation and Identity Across Residential and Industrial Contexts

Jussi Valta¹  | Tuomas Vanhanen² | Tuomo Joensuu³ | Saku Mäkinen⁴

¹Industrial Management, Faculty of Management and Business, Tampere University, Tampere, Finland | ²Electrical Engineering, Faculty of Information Technology and Communication Sciences, Tampere University, Tampere, Finland | ³Construction Management and Economics Research Group, Faculty of Built Environment, Tampere University, Tampere, Finland | ⁴Faculty of Technology, Department of Mechanical and Materials Engineering, University of Turku, Turku

Correspondence: Jussi Valta (jussi.valta@tuni.fi)

Received: 5 August 2025 | **Revised:** 10 March 2026 | **Accepted:** 21 April 2026

Keywords: discursive strategies | ecosystems | identity creation | legitimation | positive energy districts | regulation

ABSTRACT

Increasing electricity demand from data centres, industrial applications, electric vehicles and domestic heating is creating pressure to develop electricity systems in many parts of the world, but especially in Western countries. In response to challenges such as grid congestion, interconnection queues and climate-related hazards, network operators, municipalities and entrepreneurs are turning their attention to local solutions. Positive energy districts (PEDs) are emerging as a prominent new organisational model to implement these solutions. The main objective of a PED is to achieve net-zero emissions on an annual basis, which requires investments in local energy production and its flexible use. However, their success is not guaranteed, as they must overcome the 'liability of newness'. PEDs require strong policy support and a shared understanding among diverse stakeholders, who often have conflicting business objectives and interests. This article examines the legitimation processes of four distinct frontrunner PED projects in Finland and qualitatively analyses the challenges associated with their legitimation. Drawing on the ecosystem literature on legitimacy, we categorise legitimation efforts into identity creation, discursive legitimation and performative legitimation. The qualitative case analysis reveals that the primary legitimation challenges facing PEDs can be distilled into four identity-creation dilemmas: (1) differentiation versus conformity in relationships with energy incumbents; (2) holistic versus focused scope; (3) top-down versus bottom-up governance; (4) balancing timescales and uncertainties through stability versus innovation. This paper contributes to the literature in two main ways. First, it explores the challenges that PEDs face in legitimising themselves. Second, it compares legitimation dynamics across industrial and residential PED contexts. The findings enhance our understanding of PED creation processes and can inform the development of more effective policy support to facilitate their diffusion.

1 | Introduction

Positive energy districts (PEDs) are regarded as an important driver of the transition to low-carbon smart energy systems, based on flexible, district-scale energy management, because they generate learnings into how to use new technologies and

identify which organisational models can be replicated in different contexts (Sareen et al. 2022). The European Commission urges member states to implement PEDs through various initiatives, such as the Strategic Energy Technology (SET) Plan (PI Urban Europe/SET Plan Action 3.2 2020). This paper follows this group's definition of PEDs as 'energy-efficient and

This is an open access article under the terms of the [Creative Commons Attribution](https://creativecommons.org/licenses/by/4.0/) License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited.

© 2026 The Author(s). *Environmental Policy and Governance* published by ERP Environment and John Wiley & Sons Ltd.

energy-flexible urban areas or groups of connected buildings which produce net zero greenhouse gas emissions and actively manage an annual local or regional surplus production of renewable energy'. PEDs can vary significantly depending on the context, for example on how their geographic boundaries are defined, how their energy balances are achieved and how they interact with the surrounding energy system. For instance, some PEDs may own energy production facilities outside the district area, whereas in an autonomous PEDs, such as islands, all energy is produced and consumed locally (Albert-Seifried et al. 2022).

PEDs are closely related to other concepts, such as energy communities and sustainable neighbourhoods, and in many cases, the literature on these concepts is complementary (Brozovsky et al. 2021; Fichera et al. 2025; Gjorgievski et al. 2021). The main differentiating characteristic for PEDs comes from their high ambition of annual energy production surplus and smart control across electricity, heating and cooling and transport sectors (Brozovsky et al. 2021) whereas, for example, energy communities focus more on community-driven ownership models and related issues like fairness of the value sharing, creation of social value and promoting energy democracy (Fichera et al. 2025). As PEDs combine different energy vectors under a single concept, PEDs also face the differing regulatory environments of these energy vectors. For example, electricity distribution is a natural monopoly business with strict national rules for tariff setting and revenue adoption (Decker 2023, Ch. 9), while district scale heating networks are subject to varying regulatory environments across the EU member states (Billerbeck et al. 2023).

The diffusion of a new market entrant depends on their ability to 'win acceptance' for the innovative activity in general, as well as on establishing their own legitimacy as actors within the field (Suchman 1995). Large socio-technical systems, such as energy systems, have technological lock-ins, institutional commitments, organisational vested interests and behavioural path dependencies that make it challenging for new entrants to introduce new systems, such as PEDs (Seto et al. 2016). PEDs consist of several stakeholders, all of whom have their own interests and operating logics in the transition (Gohari et al. 2024). Polycentric settings like PEDs decentralise accountability, ownership, control and authority at least on some level to the local level (Brisbois 2020; Coy et al. 2023; Sareen et al. 2025). For instance, urban planning does not typically include energy matters in an integrated way (PI Urban Europe/SET Plan Action 3.2 2020). Techno-economic conditions and opportunities are constantly developing, including new digital business models (Ford et al. 2021; Hiteva and Foxon 2021), sector coupling (Lowitzsch et al. 2020) and new legislation (Trevisan et al. 2023). Because there is a lack of best practices and the solutions are still context-specific (Gohari et al. 2024), these numerous stakeholders operate in an uncertain and dynamic environment. For PEDs to scale, the creation process should be theorised and developed across contexts (Karvonen et al. 2025). Because of this ambiguity, it is hard for PED service providers and other stakeholders to position themselves, invest in product development and develop their offerings with partners. To accelerate the transition towards PEDs, project leaders and other stakeholders must overcome the 'liability of newness' (Suchman 1995) and manage the legitimisation process of PED creation in a coherent

way because the PED stakeholders and their actions are tightly interconnected. Cracks in the ecosystem can have unintended and dynamic consequences on other members (Wolsink 2020).

Therefore, this paper adopts an ecosystem-based perspective to complement the previous PED governance studies. Ecosystem *is the evolving set of actors, activities, and artefacts and the institutions and relations, including complementary and substitute relations, that are important for the innovative performance of an actor or a population of actors* (Granstrand and Holgersson 2020, 1). Essentially, ecosystem actors are autonomous and hierarchically independent actors which, however, possess complementarities that produce certain 'surplus value' when engaging in collaboration (Jacobides et al. 2018). This ecosystem lens includes essential similarities to the concept of PEDs, reflected also in similar challenges in legitimisation. Thomas and Ritala (2021) state that in an ecosystem context, legitimisation challenges stem from participant heterogeneity, chicken-and-egg problems with investments and adoption, a need for collective identity, interdependence-related risks and a lack of pre-existing structures. PED-related topics, including energy communities and microgrids, have been studied also from the perspective of polycentric governance (Blasch et al. 2021; Petrovics et al. 2022), socio-technical transitions (Ford et al. 2021) and legal approaches (Hoicka et al. 2021; Valta et al. 2025), however, the ecosystem legitimisation perspective directs attention to the local level and how the participating actors—municipalities, network operators, entrepreneurs, utilities and citizens—frame and make sense of the emerging solutions and co-create collective identities while establishing the governance structures. In other words, creating a 'sense of co-ownership' (Sareen et al. 2022, 4) is needed for developing integrated creation processes with actors coming from multiple industries and both from public and private sectors.

The purpose of this paper is to address the liability of newness problem in PED legitimisation processes. The article takes one step forward in solving the idiosyncrasy issue related to PED creation by comparing two industrial and two residential PEDs in Finland, which pose distinctively good conditions for PED creation with highly volatile but affordable electricity markets (Energiavirasto 2025), advanced demand response markets, and a high diffusion of supportive technologies and infrastructures, including electric vehicles, smart metres and heat pumps (Bjerkan-Wade et al. 2024), and a relatively high activity in PED projects (PED-EU-NET 2026). However, there is no dedicated regulation or organisational models for PED creation in Finland (Valta et al. 2025), which makes the creation process emergent and context-dependent. By studying the PED context from the ecosystem perspective, this paper asks the following research question: 'What identity-creation dilemmas do emerging industrial and residential positive energy district ecosystems face while seeking legitimacy?' The findings show that the main PED legitimisation challenges can be divided into four dilemmas of identity creation: (1) relationships with the energy incumbents, (2) scope, (3) governance and (4) management of timescales and uncertainties. The main novelty of this paper is in explaining how the ecosystem perspective is crucial in PED legitimisation and what kind of challenges it involves. Second, this paper maps the challenges for diffusing PEDs in industrial and residential contexts. Third, this paper strengthens

knowledge of the relationship between PEDs and construction sector value chains, including regulatory processes related to urban planning.

2 | Theoretical Background

2.1 | Ecosystem Legitimation

In the context of ecosystems, legitimation has its particularities because the heterogeneous ecosystem members are not hierarchically interconnected (Adner 2017). The theoretical framework utilised in this study, formulated by Thomas and Ritala (2021), addresses legitimation in the emergent phase of ecosystems. It is particularly relevant for two reasons. First, it recognises that legitimation efforts face challenges stemming from uncertainty and a lack of information regarding the ecosystem's value proposition and how stakeholders will react to it. Second, it acknowledges that strategic decisions regarding design, governance and other aspects are not predefined but rather collectively created as part of the legitimation process.

The framework divides legitimation into two main processes: discursive and performative legitimation. This approach can be viewed as a legitimacy-as-a-process perspective, in which the dynamics and activities that occur during ecosystem creation also legitimise the ecosystem (Suddaby et al. 2017). Discursive legitimation includes four main activities. First, ecosystem legitimation requires *framing* to direct attention towards necessary and notable features of the ecosystem. This includes visioning while identifying issues and demonstrating the ecosystem's benefits to the wider public. It also includes motivating different ecosystem members (Fisher et al. 2017), often done by categorising the ecosystem into familiar offerings or processes (Greenwood et al. 2002). Meanwhile, commonly used performance criteria are updated with new, more relevant ones (Bergek et al. 2008). The second activity is *sensemaking*, by which the ecosystem members begin to comprehend the ecosystem's value proposition (Weick et al. 2005). This includes developing and sharing insights of various components of the ecosystem value proposition and forming shared views. Experimentation is also included in the sensemaking process. The third activity is the *positioning* of the ecosystem. Here, the ecosystem members aim to answer what is distinctive and valuable in the user's value proposition and how this differs from ordinary models. A successful positioning should argue the ecosystem's benefits to the stakeholders (Thomas and Ritala 2021). The fourth discursive legitimation activity is *recognising*, performed by external stakeholders such as the media, regulators and analysts. Politicians can also legitimise new ecosystems when they endorse new kinds of business ventures (Zhang and White 2016).

The second primary process in ecosystem legitimation, performative legitimation, involves demonstrating superior performance compared to other solutions. Unlike discursive legitimation, it represents the ecosystem members' tangible, concrete actions. The activities related to it signal the growing commitment to the emerging ecosystem via various kinds of investments. First, these include *strategic actions*, most notably from the ecosystem leader. These include ecosystem-specific investments in resources and technologies, organisational

changes or new governance changes that devote resources to the development of the ecosystem. Decisions on governance mechanisms include pricing, membership rules, standardisation activities and controlling the entrance (Jacobides et al. 2018; Thomas and Ritala 2021). The second activity class in performative legitimacy is *value realisation*. This refers to the whole ecosystem's comparative success in delivering the ecosystem value proposal to the customer. Here, ecosystem members are aligned profitably, effectively and fairly in the ecosystem value blueprint (Adner 2017). The third activity for performative legitimation is its *adoption* by users and complementors. Complementors play a significant role in ecosystem development through resource and skill deployment, and high-status complementors help most significantly to legitimise the ecosystem. Similarly, high-status customers help to prove the viability of the ecosystem's offering (Thomas and Ritala 2021). The fourth activity is the *intervention* of the ecosystem by external actors. This includes actions by financiers, governments, regulators and incumbents that prove the viability of the ecosystem. Partnerships and good ties with key incumbent actors can increase the ecosystem's status (Bengtsson and Johansson 2014) and act as legitimating elements (Bitektine 2011).

In the framework, these two main legitimation processes lead to a strengthened ecosystem identity—'what we do'—which is defined as the 'central, enduring, and distinctive characteristics of the ecosystem' (Thomas and Ritala 2021). Mutual understanding of PEDs across different industries can help clarify what PEDs aim to achieve, identify the various roles of PED actors within the ecosystem and reduce the cognitive distance between actors in their interpretations of PED value propositions. In this way, the unfamiliarity, instability and incoherence of planned constructions are mitigated collectively (Navis and Glynn 2010). With a shared understanding of the overall value proposition, actors can more easily develop an alignment structure that allows it to materialise (Hakanen et al. 2024). For example, Dentoni et al. (2018) studied identity creation in community-led enterprises and found that these groups developed their identity through distributed experimentation and subsequent sensemaking based on their successes. From a stakeholder perspective, ecosystem identity coexists with their individual organisational identities (Drori and Lavie 2023). Since PEDs are still an emerging concept, they have not yet established clear actor roles, funding mechanisms or other benefits typically found in mature market categories (Lee et al. 2017). The theoretical framework is illustrated in Figure 1.

2.2 | Specificities in Positive Energy District Ecosystem Legitimation

PED ecosystem legitimation is influenced by the nascent stage of the market and the related business models. Traditionally, renewable energy (RE) production in buildings has been based on simple commercial arrangements and supported by political incentives such as feed-in tariffs. More recently, the PED ecosystem has been transforming towards digitally driven modular systems, which are based on a multitude of actors and new technologies, such as solar panels, electric vehicles, batteries and automation systems (Hiteva and Foxon 2021; Schwidtal et al. 2023). Current development is heading towards systems

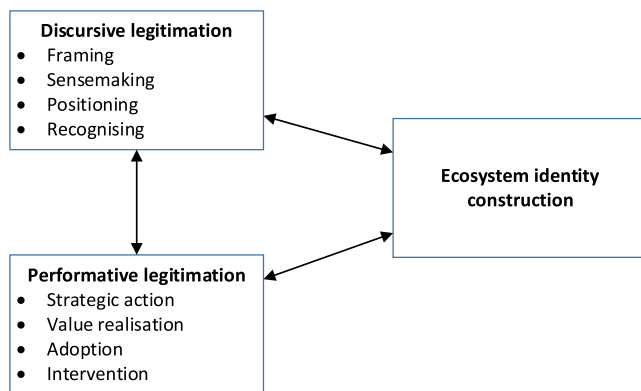


FIGURE 1 | Theoretical framework (adapted from Thomas and Ritala 2021).

that self-consume locally produced energy, increase smart controls for local system balancing, integrate different energy carriers (i.e., heat, gas and electricity) and include local governance structures (Ford et al. 2021). Aside urban residential PEDs, industrial PEDs are rapidly developing. Due to the needs for industry electrification, sustainability regulation, data centre diffusion, slow permitting processes and inability to guarantee grid connections, industrial and commercial companies have turned their focus strongly towards on-site energy production and sharing (Gimon et al. 2024). However, the energy sharing schemes in industrial PEDs are not well defined.

Regulatory governance is also in transition as PED-related models like microgrids and energy communities are being increasingly noticed by policymakers and academics analysing the regulatory landscape (Behrendt 2023; Hoicka et al. 2021; Krug et al. 2022). Recent European-level directives on energy communities are being transpositioned in member states (Trevisan et al. 2023). These directives offer freedom in their implementation, and there is no clear continent-wide direction (Campos et al. 2020). Important questions to solve include, what are the boundaries of the PED, and how do they relate to the incumbent distribution system operator (DSO) and electricity retailers (Brozovsky et al. 2021; Di Silvestre et al. 2021). Directives on Citizen Energy Communities and Renewable Energy Communities steer organisational structures for PEDs of different sizes, of which industrial Closed Distribution Networks are one option (EU 2018, 2019). Adjoint to the Renewable Energy Community directive, there is a definition and conditions for peer-to-peer trading (EU 2018). The directive for Jointly Acting Renewable Self-Consumers steers PEDs based on single buildings and multi-apartment complexes (EU 2018). Whereas many EU member states have created frameworks applicable for neighbourhood-level PEDs utilising the public grid, the case country Finland has implemented only a model in which self-consumption is limited within property boundaries (Neij et al. 2025). Similarly, energy performance certification of buildings in Finland does not consider district-level structures, hindering legitimation (Valta et al. 2025).

The emerging PED sector may combine various fields (e.g., construction sector, electricity, district heating and cooling, gas) that

are regulated differently (Lindkvist et al. 2019; Markard 2018; Sareen et al. 2025), induce public–private partnerships (Dujany et al. 2026) and affect the urban planning processes (Nielsen et al. 2018). Many PED-related studies emphasise the importance of a shared vision, but that is hard to reach in reality due to various interests different stakeholder have (Parkhill et al. 2015; Petrovics et al. 2022; Planko and Cramer 2019). PEDs generally reduce the revenue of external incumbent actors, such as the DSO, transmission system operator (TSO) energy retailers and large centralised energy producers. For this reason, incumbents may attempt to steer the development of such initiatives to their own advantage, for instance, by introducing solutions that allow them to retain control over customers or by limiting the dissemination of knowledge to the wider public (Envall and Rohrer 2025). On the other hand, incumbents can use PEDs to solve arising issues in energy system operations, such as the need to reinforce ageing infrastructure or integrate variable renewables into the energy system.

Overall, the polycentric nature of PEDs brings several governance challenges (Moroni and Tricarico 2018; Petrovics et al. 2022). PEDs entail a certain level of decentralisation of energy sector duties and responsibilities, and this has been seen as bringing forth the multi-level nature of governing energy as a common pool resource (Brisbois 2020; Wolsink 2020). This means that the users are increasingly interdependent on one another while they are using a finite pool of collective resources. Scharnigg and Sareen (2023) highlight that effective decentralisation requires several conditions to be in place, including sufficient local capacity to manage project complexity, clear rules and accountability mechanisms, high levels of citizen awareness and the presence of reliable intermediaries. Meanwhile, ensuring social justice in decentralised energy systems is an increasingly important topic because there is a risk that such systems may increase inequalities between citizens as only wealthier people are able to afford investing in such systems (Bruehwiler et al. 2025; Hearn et al. 2021).

3 | Research Methodology

3.1 | Case Descriptions in the Context of the Finnish Energy System

This article studies four PED frontrunner projects, summarised in Table 1. C&I Park and WindPED are located in industrial and commercial areas, while EcoVillage and EcoDistrict are in residential areas. What makes these four cases worth studying is their strong multi-stakeholder nature, including public and private actors. All projects are mostly greenfield areas without major existing infrastructure and involve municipal urban planning processes. Municipalities also occupy the major role of landowners, although in EcoVillage, most of the land is owned by a couple of families living in the area. The dispersed land ownership makes the planning process potentially more complex as it is not solely the municipality that decides upon the construction requirements (Healey Trulstrup and Van Der Leer 2024). The four cases are from different parts of Finland. C&I Park, EcoVillage and WindPED are in middle-sized municipalities with approximately 10,000 to 30,000 residents. EcoDistrict is in a larger city. At the time of writing this article,

TABLE 1 | Case-specific data and main events.

Case	Industrial PEDs			Residential PEDs		
	A: C&I Park	B: WindPED	C: EcoVillage	D: EcoDistrict		
Ecosystem actor roles	<p><i>Focal actor:</i> Municipal utility <i>Complementors:</i> Municipality, technology providers <i>External:</i> DSO, NRA (National Regulatory Authority), Ministry, university <i>Users:</i> Local companies</p>	<p><i>Focal actors:</i> Wind energy developer, municipality <i>Complementors:</i> Municipality, local farmers, solar PV developer, battery provider, biogas developer, university <i>External:</i> DSO, NRA <i>Users:</i> Local companies</p>	<p><i>Focal actor:</i> Landowners <i>Complementors:</i> Municipality, technology providers <i>External:</i> DSO, NRA, Ministry <i>Users:</i> Local citizens</p>	<p><i>Focal actor:</i> City-owned regional developer <i>Complementors:</i> Municipality, district heating utility, DSO, technology providers, real-estate companies <i>External:</i> NRA, Ministry <i>Users:</i> Local citizen and companies</p>		
Data	<p>19 interviews, 1 project planning meeting, 2 seminars, 1 guided tour in the area, 26 news articles, 13 strategy papers/meeting notes, 27 stakeholder websites and reports</p>	<p>4 interviews, 17 news articles, 9 strategy papers/meeting notes, stakeholder websites and reports</p>	<p>6 interviews, 2 workshops with 25 and 13 participants, 1 seminar, 10 news articles, 7 strategy papers, stakeholder websites and reports</p>	<p>10 interviews, 2 workshops, 7 news articles, 24 stakeholder websites, announcements and reports, 7 academic publications</p>		
Energy-related goals	Energy self-sufficient industrial district	Carbon-neutral industrial district	Smart own energy network, carbon-neutrality	Carbon-negative residential area		
Land ownership	Municipal	Municipal	Private and municipal	Municipal		
Main technologies and infra	Solar PV, battery storage, fuel cells, gas motors	Wind, Solar PV, battery storage, district heating system, biogas	Solar PV, seawater heat pumps, small-scale bio-cogeneration	Solar PV, bi-directional district heating and cooling system (use of excess heat with combined heating and cooling heat pumps; sources of energy: ground, air, lake), biogas and energy storage		
Investor	Municipal utility	Private energy producers, municipal utility to the grid	Different options: Energy community/cooperative with public and private investors	Different options: Utility, PED operator and/or individual real-estate developers		
Development phase	In operation	Preparation	Urban plan under preparation	Construction started		

C&I Park was operating, EcoVillage was in its urban planning process, WindPED had been suspended and EcoDistrict's first apartments are available for purchase in the first parts of the district.

Finland has several PED initiatives participating in EU projects, although the cases differ significantly in terms of technologies, geographical boundaries and composition of stakeholders (PED-EU-NET 2026). Finland also has six EU Climate mission cities aiming for carbon neutrality by 2030, which is the highest number relative to population in all of Europe (Froissard 2022). In addition, two-thirds of Finnish municipalities have defined climate goals, which often foster investments in local RE generation and utilisation (Mattinen-Yuryev et al. 2021). Municipalities can indeed play a significant role in PED development, as they control urban planning processes, typically own the local utilities and have long-lasting customer relationships.

While European directives steer the Finnish energy system, the Finnish example has several characteristics that need to be noted before this study can be generalised internationally. When compared to many other countries with dominant incumbents such as EDF in France or EDP in Portugal, the Finnish energy sector is relatively decentralised, with over 70 DSOs and 70 retailers for a population of five million people (ACER and CEER 2022; Eurelectric 2020). The main sources of the electricity mix are divided into nuclear (39%), hydro (18%), wind (20%) and biomass (12%) (Energiategollisuus 2025a). In the heating sector, district heating plays a significant role in urban areas with a market share of 45%. In new buildings, ground-source heat pumps are becoming more popular; their increasing market share is currently around 30% (Energiategollisuus 2025b). Demand for system flexibility is high as Finland has relatively cheap yet among the most volatile electricity prices in Europe (Energiavirasto 2025). The transposition of the Renewable Energy Community and Citizen Energy Community directives has not been fully implemented in Finland since they can be established only in a restricted context (Neij et al. 2025). Namely, in 2021, a new law enabled virtual net metering within property boundaries, mainly for housing companies. In summary, Finland poses many supportive conditions, however, because there are no established PED models, new projects need to be jointly created by various actors who have to define their positions and roles in the emerging ecosystem.

3.2 | Research Approach

In this study, we employ a qualitative research method along with a comparative case study. Compared to single case studies, this method is more conducive to theory building, generalisation and achieving an appropriate level of abstraction. By selecting different types of cases, such as industrial and residential cases in this instance, it becomes possible to identify contrasting patterns across these cases (Eisenhardt and Graebner 2007). In the analysis, we deploy an abductive logic (Dubois and Gadde 2002) by taking the theoretical framework by Thomas and Ritala (2021) as a starting point, and extending it inductively by identifying and comparing four identity-creation dilemmas

that these legitimisation activities aim to address across the residential and industrial PEDs.

The data collected was based on semi-structured interviews with relevant case representatives, such as project leaders and initiators, technology providers, network operators, officials, ministries and regulators. In total, 39 interviews were conducted and transcribed (see Appendix A for interviewee profiles). We also held and transcribed two workshops for the EcoVillage with 25 participants in the first workshop and 13 in the later one, including researchers and public and private organisations. Before the interviews and the workshops, participants were introduced to the research aims and asked for consent to publish the results anonymously. In addition, available studies, media coverage and public announcements were gathered. The results of the study were introduced to each PED project's main stakeholders in online meetings for validation of the results (Miles et al. 2014). The data analysis was done in several stages. First, we took a processual view on the projects by constructing the timelines of the projects' main activities using swimlanes on MS Visio with different stakeholders. Second, we coded the data deductively according to the legitimisation activities presented by Thomas and Ritala (2021). We connected the identified activities to the relevant stakeholders and then studied them both case-by-case and across the industrial and residential cases. From these summaries, we were able to inductively identify four identity-creation dilemmas and the related discursive and performative activities (Table 2 illustrates this data structure). Last, we compared the results from our cases with previous PED-related studies that take a process perspective, in order to position the findings from our four cases within the existing understanding of what each phase in a PED creation process entails (Healey Trulstrup and Van Der Leer 2024; Lindkvist et al. 2019; Trevisan et al. 2023).

4 | Results

The results of the four case studies are presented through four identity-creation dilemmas faced by industrial and commercial PEDs. First, we describe how the PEDs position themselves in relation to incumbent energy companies, such as DSOs operating local grids, TSOs balancing national electricity systems, and district heating utilities responsible for investing in and maintaining their infrastructure. The second dilemma, which is closely linked to the incumbency relationship, concerns the definition of geographical boundaries and the scope of the services the PED offers. The third dilemma relates to who controls the creation process and who participates in decision-making. Finally, the fourth dilemma highlights the challenges that PED ecosystems encounter in managing the differing timescales of investments and the associated uncertainties. The main findings are then compared across industrial and residential PED and summarised in Table 2.

4.1 | Relationship With the Energy Incumbents

The initial challenge in PED legitimisation involves how much the PED's identity is based on problematising the status quo in the energy sector versus aligning with the incumbents and supporting the transition through collaboration. Both perspectives

TABLE 2 | Summary of legitimization elements in case industrial and residential PEDs.

	Industrial PEDs		Residential PEDs	
	Performative legitimization	Discursive legitimization	Performative legitimization	Discursive legitimization
<i>Relationship with incumbents:</i> Aligning or challenging?	<ul style="list-style-type: none"> - Closed Distribution Network permit applications challenge DSOs (A, B) - Provision of excess heat align with district heating operators (A, B) - Demand response market participation aligns with TSO's interests (A) - Grant from ministry signals political support 	<ul style="list-style-type: none"> - Problematising energy sector's ability to integrate renewables to the system (A) - Aim to maintain legitimacy of wind power (B) - Support for local industry (A, B) 	<ul style="list-style-type: none"> - Seeking collaboration with DSOs but regulatory barriers exist, for example, local tariffs (C, D) - Bidirectional district heating system differ from business-as-usual for DHSOs (D) 	<ul style="list-style-type: none"> - Problematisations regarding 'traditional' urban development (C)
<i>Scope:</i> Holistic or Narrow?	<ul style="list-style-type: none"> - Dedicated PED operators with holistic service responsibilities and pricing (A, B) - Ability to connect to private distribution network saves costs (A, B) 	<ul style="list-style-type: none"> - Avoiding sub-optimisation between energy networks (A) - Improving security of supply entail holistic service (A) 	<ul style="list-style-type: none"> - Sustainability certificates and eco-labels signal holistic approach (C, D) - Centralised data platform enables holistic approach (D) - Space reservations for district-level RE and storage facilities (C, D) 	<ul style="list-style-type: none"> - Vision of flexible, energy efficient, customer-centric energy system leaves does not define scope of PED services (C, D) - Vision of energy autonomy (C) which is also questioned (D) - Need for a new actor aside housing managers: energy manager (C, D)
<i>Governance:</i> Top-down or bottom-up?	<ul style="list-style-type: none"> - Top-down management and investments (A) - RE production by several companies (B) 	<ul style="list-style-type: none"> - Increased transparency on power flows in the PED (A) 	<ul style="list-style-type: none"> - Development companies coordinate progress (C, D) - Urban planning determine plot size. - Land transfer rules and steer properties' energy investments (C, D) - Real estate developers as main decision-makers (D) 	<ul style="list-style-type: none"> - Visions of peer-to-peer-based society (C) - Experimentation of new housing and construction models envisioned in plans (C)

(Continues)

TABLE 2 | (Continued)

Identity dilemmas	Industrial PEDs		Residential PEDs	
	Performative legitimization	Discursive legitimization	Performative legitimization	Discursive legitimization
<p><i>Managing Timescales:</i> Flexibility or certainty?</p> <ul style="list-style-type: none"> - Infrastructure and energy production built in advance ('backbone') (A) - Different timescales for permits, construction and users as a challenge (B) 	<ul style="list-style-type: none"> - Companies benefit from having synergistic loads with others - PED is a testbed for new technologies (A, B) 	<ul style="list-style-type: none"> - Plot transfer rules guaranteeing data interoperability (D) - Pressure to sell plots quickly for revenue (D) - Uncertainty on whether properties connect to district heating or not (D) 	<ul style="list-style-type: none"> - PED is a testbed for new service models (C, D) - Use of excess heat (D) 	

have their benefits, as networking with incumbents brings market legitimacy, but differentiating from them justifies the new operating models and helps to create identity. These issues reflect the reasons for the emergence of case PEDs.

The industrial PEDs had a more disruptive stance towards the surrounding energy system. The C&I Park was first framed as a 'self-sufficient industrial microgrid'. The use of RE was connected to cheaper and more stable energy prices, which could be controlled as the system would be run independently from the macro grid. A second important theme in the project, which was less visible in the media coverage, was in improving system-level energy optimisation through sector coupling. This related to sharing energy locally, implementing cogeneration and hydrogen solutions while optimising all energy carriers together, which enabled it also to stabilise the macro grid by participating in TSO's flexibility markets. These framings were connected to the project's application for a Closed Distribution Network permission, which was, however, neglected by the regulator. That permission would have allowed setting prices within the PED but also having one entity in charge of the whole system optimisation.

WindPED was initiated by a wind power developer driven by economic and environmental incentives. He wanted to find new ways to maintain wind power's acceptance in areas with a high diffusion of wind power. 'We should leave as many euros as possible to the locals so they would be more supportive of wind power' (wind power developer). This project was framed as a 'smart grid project', yet a central argument behind it was savings from the network tariffs and taxes by self-consuming the local energy production. The main strategic actions behind the project were the ongoing wind power developments in the area. The project was projected to start as under the city ownership, but eventually it would have been sold, possibly to the companies in the area.

The residential cases wanted to some extent differentiate from incumbents but did not yet have a clear relationship with them. EcoVillage emerged from the initiative of local landowners, who faced regional plans for urbanisation on their lands. Their mission was to protect the local environmental and social values from 'traditional' urban planning while also creating affordable living conditions: 'In relation to housing, these renewable energy solutions are important to us, because they are seen as having a significant impact on residential comfort and the cost of living' (landowner in EcoVillage). One driver for changing the urban planning processes accommodating renewable energy came from the European directives on energy communities, proposed in 2016 and published in 2019 (EU 2018, 2019), which opened a window of opportunity to explore new solutions. 'There have been exceptions in getting electricity across property boundaries [...], so we know the direction is changing' (landowner in EcoVillage).

EcoDistrict represents a large new urban district with high sustainability targets, for which PEDs have been identified as one solution to achieve these targets. It is collaborating with the local utility, which is building there a bi-directional district heating system. Bidirectionality means that the network is open for third parties and end-users who can feed in heat produced as

a side product of their primary energy usage, such as cooling. In contrast to energy autonomy, it was merely envisioned to be a complementing part of the city's energy system. The PED is part of its decarbonisation strategy and increases the use of excess heat, which partly replaced burning biomass. It can be argued that the vision of controlling customer-level assets contradicts with the utility's identity of managing and optimising large-scale assets. For example, the district heating utility's strategy includes carbon capture from recent biomass and waste burning cogeneration units. Instead of top-down control, the bi-directional district heating network would open the system for many actors: 'But I think there really should be the possibility for all actors to produce heat. Because we can't know what the market mechanisms or the technologies will be that actually take hold in the future' (municipal energy expert in EcoDistrict).

4.2 | Scope: Geographical Boundaries and Service Levels

The case studies show that PED's identity is closely related to the scope of its geographical and activity-based boundaries. However, significant disparities exist in the conceptualisation of PEDs, especially in the residential cases. Within EcoDistrict and EcoVillage, some imagined the PED as an individual housing company that would prosume solar energy (aligned with the existing Finnish Renewable Energy Community regulation), whereas others envisioned the whole district as operating under a single property: 'But here there have maybe been some kinds of alternatives, like whether it's the housing company, whether it's a giant housing company that has a giant plot of land, which could now—by which one could get around or override some of these regulations ...' (EcoVillage workshop participant). PEDs that span the whole district are heavily linked to regulation and urban planning processes because the PED targets need to be integrated into early-stage public infrastructure planning and reflected in the property requirements set for real estate developers. For the time of writing this article, these thoughts of large property boundaries had not been realised in EcoDistrict. In contrast, it was seen more economical for the developer company to sell smaller plots. Smaller plots also enabled investments by small local real estate developers, whereas only large multinational investors would have had resources to acquire larger plots. As a compromise, smaller actors could have formed larger consortia for operating within larger plots, but such arrangements had not been implemented by the time of writing this article.

The scope of the PED includes also the inclusion of different services. The identity of both residential cases was built on the idea that energy would be served in a more holistic, digitalised and servitised way, which also includes subscription-based contracts on technical hardware: '... and now, when technology develops at such a fast pace, that outdated device [...] someone comes along and is constantly calculating when it makes sense for me to replace that one, and they take it away and replace it, and you just notice that something different has arrived' (EcoVillage workshop). A consultant related to EcoDistrict evaluated the service levels of an energy operator in three scenarios: a traditional role concentrating on networks, an extension for also managing building energy systems and a further extension for managing

indoor conditions and offering virtual power plant operations. This report concluded that the division of entities is imperative because existing actors lack the capabilities to manage all the functions required, especially in holistic models. A consultant for EcoVillage supported a horizontal integration plan that involved having a single operator to plan and operate all the different energy carriers centrally. However, the DSO representative said it would be simpler to maintain the status quo and keep separate entities operating district heating, electricity and gas.

In any case, to validate the holistic district-level approach, the residential cases applied for different certifications. EcoVillage aimed to receive the Nordic Swan-ecolabel for the neighbourhood. This certificate is given to products and services that fulfil high sustainability standards. The EcoDistrict PED received the Building Research Establishment Environmental Assessment Method (BREEAM) Communities certificate, which is given to sustainable regional projects.

The industrial PEDs had initially clear geographical boundaries due to the applications for Closed Distribution Networks. According to a consultant in the WindPED case, this model could open more profitable models for energy producers: 'the closed network would give more opportunities for them, let them be batteries, hydrogen, solar... In this way, the interconnection fee is very low for them'. At C&I Park, the focal actor positioned the PED operator's scope by comparing it to old paper mill areas, where the mill owner acted as a coordinator of energy flows within factory premises. Open district heating systems and the use of excess heat within the area played an important role in this positioning. The area included logistics centres that could provide excess heat from their operations. However, making them useful for others requires transparency, knowledge sharing and an understanding of the logistics centre's operations.

Also, in the industrial PEDs, customer value arose as a major identity creation tool. It came often across that industrial customers prioritise convenience and do not wish to bear responsibilities and risks of PED operation. In larger cases like the industrial parks, this can become a selling argument for the PED. Demand response, but also energy provision could be offered as a service to industrial actors. As reported by a consultant in the WindPED project, 'we aim to package it so that the industrial park has power purchasing agreements with [...] so that the companies don't need to transact with the energy purchasing [...] It is a great benefit, especially for small and medium sized enterprises'.

4.3 | Governance: Ownership Structures and Decision-Making

Although few governance models for the case PEDs were decided during the time of the research, a key legitimacy challenge regarding PED ecosystem governance in all cases centred on determining who controls the decision-making process. Within PEDs, conventional top-down governance models are frequently substituted or complemented by democratic decision-making and distributed ownership, and possibly location of assets. This approach aims to involve PED members in investing, participating in PED operations and ensuring social justice. The

governance model influences the whole PED identity because of the distinctiveness of the community logic compared to incumbent energy business models, which are based on state and market logics.

Bottom-up governance mechanisms were discussed in the industrial but mostly in the residential PEDs. At EcoVillage, the landowners envisioned achieving resource efficiency through peer-to-peer collaboration, digitalisation and low hierarchy levels in the opening meeting in 2018. Later, in 2023, the preliminary urban plan set a target that the development encourages group construction and innovative housing models. In the workshop held, it was argued that having multiple governance structures would increase transaction costs. Furthermore, in Finland there are no established governance models for locally owned community assets, apart from those used for housing companies. This was expressed in the workshop related to EcoVillage: ‘So if you invest with your own money, say, in a house on your own land, but then some cooperative, company or something else comes into play, and then you also incur some kind of condominium-like cost [...] What if you want to disengage at some point? So, at least the rules must be clear about how to proceed’. A general social justice challenge in both residential cases is that the future citizens are not included in the planning process from the beginning (see an exemplary case in, e.g., Hearn et al. 2021). Although, in EcoVillage, the aim is to use various construction project models, including group construction, which creates a strong user-centric process at least to some parts of the PED.

Besides the sensemaking of community-level organisational models, the EcoDistrict was steered towards more traditional property-based solutions through land transfer conditions, which real estate developers had to commit when buying the plots. Also, the vision in EcoDistrict did not define the roles for properties clearly. The municipal energy expert expressed the dilemma of coordination: ‘It’s more about the fact that we don’t really know—like I just said—we don’t know where or how the city’s means should be used. They’re more like guiding or enabling tools, the kind of things that can be done in urban planning. And when there’s no clear answer about what is actually wanted, it’s hard to prepare for anything specific, and it’s hard to figure out what exactly should be done differently in zoning or what should be done differently in infrastructure planning’. Even if municipalities do not have means to control the PED creation within properties, creating large properties and not having control on them would also entail a significant identity change for them: ‘There is a fear of losing control by having these kinds of satellites, [...] and what if they all collapse and you must act for water and wastewater issues [...] this would require education and discussions so that there would be a better understanding of self-sufficient, independent solutions’ (architect in EcoVillage).

Consequently, the creation of district-level energy solutions seemed to be a challenging task for both residential PEDs. At EcoDistrict, a consultant proposed various ownership and operation models for the energy system, including a cooperative, a dedicated service company and the utility. The utility model and the dedicated service company models are rather closely related to the business-as-usual, including the involvement of external decision-making and market logics. An energy community

model was also analysed, but its limitation is in how it can acquire and integrate different services professionally. If the PED were to be implemented as an energy community, the subsequent question would revolve around its integration with other governance structures linked to housing.

In the industrial PEDs, the governance was done more in a top-down manner. Concerning sharing of excess heat, the representatives of the industrial C&I Park discussed whether a transparent, bottom-up model like a cooperative would foster support and build trust. This approach could potentially help to address mismatched interests between the PED operator, the source of the excess heat and the buyer. The development of these structures was, however, halted when the project did not receive Closed Distribution Network permission. The top-down governance structure was linked also to the governmental grant that covered approximately 30% of the investment costs in the case of the C&I Park. In contrast, the ownership of energy production in the WindPED case primarily resided with already existing independent energy production projects. Here, the potential PED operator planned to establish long-term deals with these independent producers, but rising electricity wholesale prices complicated the situation for both parties.

4.4 | Managing Timescales: Innovativeness and Timing the Investments

The fourth critical legitimisation challenge involved managing the timescales and the appropriate complementarities in an uncertain future. The first challenge involved extended development times and determining how to fund upfront costs. In the residential cases this meant founding new development organisations. At EcoDistrict, the entity initially owned the lands and subsequently sold them to real-estate developers, setting rules for plot planning. Importantly, it operated independently of municipality’s internal budgeting rules, allowing for significant investment in developing a new and highly sustainable district. A regional developer representative highlighted that ‘for the municipality, it is really hard to invest upfront and gain income later’. Also, the EcoVillage project founded a new development organisation, but the financing was not planned as this article was written.

The second challenge was to ensure that initial PED investments would be interoperable with future add-ins. To guarantee future-proof technical solutions, EcoDistrict’s land transfer rules incorporated requirements for collecting and transferring data from the building automation system to the district’s local data hub where ‘energy-related and other data from both buildings and public areas is collected and made visible’ (workshop series report). To prevent vendor lock-ins, real-estate developers had to maintain transparency and openness in data protocols and application programming interfaces. These plot transfer rules were followed and updated as necessary throughout the district’s development.

The third challenge involved planning amid uncertainties regarding the EC’s members and synergies in their energy profiles. The case study PEDs were still in the preliminary stages of their lifespans, so how customers would come to the area had not yet

been defined. To construct infrastructure and energy production before being certain of its utilisation rates posed a 'chicken-and-egg' dilemma. However, in the industrial and residential cases, the situation is somewhat different. In the industrial C&I Park, the utility undertook the risk and decided to invest in the networks and local energy production upfront, referring to them as the 'EC's backbone' (utility representative at C&I Park). In this industrial PED, the existing energy infrastructure and production is an asset to attract companies to the area. C&I Park showed that the PED operator must be patient when attracting complementary customers. Here, the municipality built a swimming hall, which provided both energy demand base and flexibility potential. Also, a network of actors made initial agreements to build a hydrogen production plant and fill-up station to offer excess heat to the EC. Synchronising energy investments with customer demand posed a challenge, which the municipal manager at WindPED commented: 'wind power has its own schedule, the solar park its own and the municipal grid its own. Then you should find customers to fit in the same schedule and build their premises'. To connect large-scale energy production to the PED necessitated finding a large-scale anchor investor with a power demand of 2–10 MW to make the grid investment feasible for the municipality. In the residential cases, the situation is different in a sense that the utility cannot be sure which buildings will connect to the district heating system. In Finland, the municipality cannot legally force the customer to join a district heating network, and construction companies may opt out if they perceive ground-source heat pumps, for example, as more profitable or appropriate.

The fourth challenge involved accommodating innovation, experimentation and open-mindedness towards novel solutions within the framework of affordability and stable pricing. All four cases involved sensemaking on open data-driven innovation for new organisational and operating models, with the potential for these references to eventually be utilised to promote export businesses. EcoDistrict held innovation and idea competitions for companies and an extensive workshop series involving a wide range of ICT, construction and energy field experts. This process' report concluded that 'for developing new business and services [...] sharing and offering data is crucial'. For example, energy and charging service developers can be provided data on users, traffic and costs. Meanwhile, energy affordability was set as a core benefit in all cases. EcoVillage's landowner and DSO representative tried to make sense of this dilemma and suggested that energy pricing would resemble mobile phone contracts, based on available capacity rather than volume, with separate incentives for demand response. Besides the customer perspective, there is also the energy producer's perspective, especially in the industrial PEDs. WindPED project's feasibility report highlighted that the PED operator needs to consider the increasing volatility in the electricity wholesale markets and what kind of incentives energy producers see as attractive.

Overall, the four legitimisation challenges are interlinked and form different configurations within the industrial and residential cases. A holistic approach challenges incumbents more than a focused solution; the case of an independent microgrid is a special case for this. The two residential cases have yet to establish clear relationships with their network operators, despite their aligning ambitions with the municipalities, thus

leaving the PEDs' final operational scopes unclear. Governance choice was not clearly linked to a specific configuration, but the industrial PEDs showed that a top-down approach with municipality-backed operator offers clarity on accountability and therefore certainty to customers. However, the investments in WindPED were distributed to several energy producers due to the significant size of the investments. Comparatively, the residential cases included more bottom-up decision-making due to distributed ownership of land in EcoVillage and the important role of real estate developers in EcoDistrict. Overall, the industrial cases managed to create clearer identities even in the early phases of the projects. This was due to the more top-down governance they had, but also because the PED was a selling point for companies to locate in the area. In the residential cases, energy matters are arguably less central to the property developers and residents. Yet, the industrial cases are also more dependent on the anchor investors who are large customers but also important actors for energy sharing. The main factors in both PED types are summarised in Table 2.

5 | Discussion

The legitimisation of PEDs is a gradual and longitudinal process shaped by various contingencies. The dynamics between the three elements—performative legitimisation, discursive legitimisation and identity construction—present distinct yet interdependent challenges. For a PED facilitator, synchronising them is a strategic challenge to overcome. In this section, we project the results of this comparative case study to previous process studies related to PEDs (Healey Trulstrup and Van Der Leer 2024; Lindkvist et al. 2019; Trevisan et al. 2023). The different phases of this process, along with the associated legitimisation efforts, are illustrated in Figure 2.

Since PEDs are infrastructure projects, many decisions are made upfront, making changes difficult in later stages. In previous PED studies, the preparation phase of the residential cases highlighted the importance of creating a common vision for the future PED ecosystem (Healey Trulstrup and Van Der Leer 2024; Trevisan et al. 2023). Both residential PED cases had very ambitious goals set by the landowners or the political lead. The residential PEDs aimed to create concrete targets with specific labels and certificates but also included statements like carbon negativity. However, the EcoDistrict case showed that even if there are such targets, they might not turn into PED-promoting local level policies due to lack of legitimacy and vagueness of the PED concept. Lindkvist et al. (2019) noted how visioning work included organising workshops between the main actors and setting coherent multi-criteria. Also, the case PEDs held several workshops to make the vision more tangible with various stakeholders. In some cases, existing energy resources—such as waste heat—create potential and prerequisites for further performative legitimisation (Healey Trulstrup and Van Der Leer 2024; Karvonen et al. 2025). However, the four case studies examined here lacked such clear preconditions. Early design choices must be effective in mobilising resources (Thomas and Ritala 2021). This potential was somewhat more pronounced in the two industrial PEDs, which had some energy resources in place (wind power, gas network) and a clear aim to attract an anchor investor to the area, who would also provide excess heat to other PED

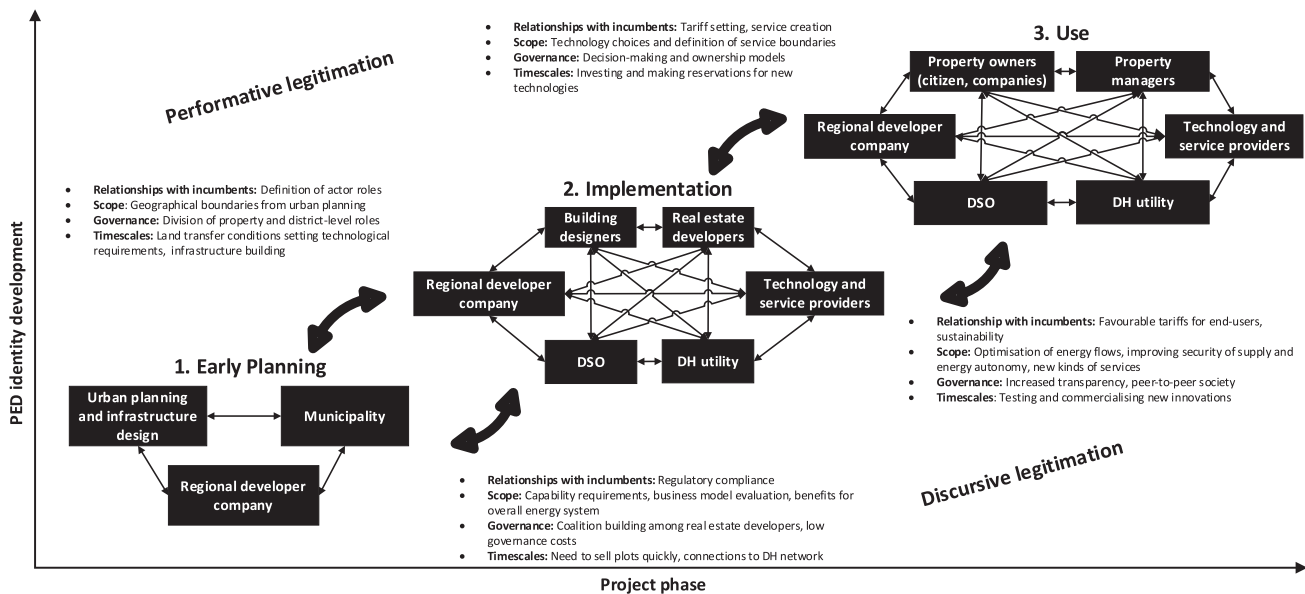


FIGURE 2 | Elements of PED identity creation throughout the creation process.

members. The main steering mechanisms for PED creation in the residential cases were the choices in the urban planning and plot allocation conditions, as was the case in the study by Healey Trulstrup and Van Der Leer (2024). However, these measures merely recommend rather than mandate PED creation.

In the implementation phase, the actual constructors—primarily real estate developers—respond to these earlier decisions and contribute to the extent they find them techno-economically feasible, implementing the organisational and business models accordingly. Trevisan et al. (2023) described this stage as involving the definition of governance structures between the members, internal bodies and third-party entities, as well as the types of investments. In the industrial cases, the centralised operational lead created clarity on how future responsibilities were divided, whereas this was not as clear in the residential cases, which necessitated investments from the real estate developers as well. Besides energy technologies, also the data system governance and management require clarity, for which the EU's Data Act provides a foundation (Nicolai and Münchmeyer 2026). Defining the roles is important for creating and sustaining the required agreements, for example, public–private partnerships and tendering processes (Sareen et al. 2022). Also, PED operators that form clearly identifiable local entities creates accountability, which makes decentralised governance often effective (Brisbois 2020). Weak accountability can lead to uncertainties regarding whether the visions are being implemented. The main challenge in setting the PED operator role was the lack of good benchmarks or existing actors who would have posed the required capabilities. Finally, Healey Trulstrup and Van Der Leer (2024) described how the municipality followed up the implementation of PED objectives by real estate developers by periodically conducting a checklist on the required functionalities. In contrast, Lindkvist et al. (2019) identified clear gaps in intermediating the energy system visions and the implementation.

In the use phase, the operating service providers and actual users of the infrastructure and technologies determine how

successfully PED targets are achieved. Embedding performance-based targets in contracts could better align actors across phases and reduce the fragmentation in the PED creation process. Healey Trulstrup and Van Der Leer (2024) found that their case PEDs lacked this kind of follow-up and there were practically no sanctions for underperformance. One regulatory barrier for this comes from the unclarity of how Finnish energy performance certification regulations impact collectively owned energy production (Ympäristöministeriö 2018), which is currently under revision. Trevisan et al. (2023) analysed the different ways of operating in the energy markets, including collective purchasing and selling of energy and other services. These choices were discussed mostly in the case of C&I Park, which participated in the demand response markets.

Overall, the identity creation challenge for PEDs is twofold. At the macro level, companies must establish a PED identity as a market category, including the relevant regulatory frameworks and financial credibility (Navis and Glynn 2010). This involves standardising rules, technology providers, building and system designs across the relevant sectors, as well as developing educational programmes. Supportive EU-level policies are in place that contribute to standardising the rules, but the related policies are still rather dispersed and often target single technologies or sectors (Valta et al. 2025). Policies across PED-relevant sectors should more explicitly integrate the concept of a PED to enhance legitimacy. Furthermore, the national implementation of, for example, EPBD was still ongoing in Finland while conducting this research. The incoherence of macro-level policy implementation makes local-level identity creation more challenging as there is reduced visibility regarding long-term development of the concept. Namely, various organisations need to undertake the identity shift on their behalf as well. For example, district heating utilities opening their heating networks to external heat providers must move from a production-centred mindset to a more customer-oriented approach; urban planners and other municipal officers need to include new stakeholders such as PED operators in the planning process and enable decentralised

solutions; real estate developers need to create long-term partnerships with other companies to accomplish lifecycle services instead of merely building and selling the buildings; and technology providers need to open and share data for district-level innovations. Stakeholders' disagreements may lead to compromises or abstractions of the vision, thereby reducing its ability to guide interorganisational collaboration (Valkering et al. 2013). Arguably, if the PED's identity and potential collective gains remain contested and a distinctive, enduring identity is not clearly articulated, the qualities that differentiate and sustain it may not be strong enough for actors to make decisions based on the PED's needs rather than on existing organisational identity.

Finally, the PED cases examined in this article do not significantly engage end-users; however, involving them in the creation process could strengthen discursive legitimation by introducing elements of collectivism and mission-driven purpose (Dentoni et al. 2018). For example, in Hunziker Areal, Zurich, interested citizens were able to participate in the PED creation from early stages of the projects (Hearn et al. 2021; Purтик et al. 2016). Case studies handling energy community creation could provide more insights for customer engagement, as citizen ownership and control are more central in these cases (Wahlund and Palm 2022) when compared to PEDs which are more about active participation. The industrial cases, by contrast, sought to differentiate themselves from incumbents by developing their own distribution systems. This approach requires a different type of discursive legitimation—specifically, lobbying national policymakers and regulators responsible for electricity markets.

6 | Conclusions

This paper addresses the research question, 'What identity-creation dilemmas do emerging industrial and residential positive energy district ecosystems face while seeking legitimacy?' It examines how two industrial and two residential PED ecosystems navigate the complex institutional environment of PEDs. The main practical contribution of this paper relates to the four identity-creation dilemmas for PEDs. Early coordination, co-creation and articulation of the expected PED model with different stakeholders could significantly speed up the process. This paper suggests that different audiences should be targeted with a nuanced but consistent approach. In part, this challenges previous findings in legitimation literature, which emphasise audience-specific messaging (Fisher et al. 2017). Although PED stakeholders have varying interests, rules and logics, it is essential for PED ecosystems to negotiate, create and communicate a clear core identity early on to facilitate value alignment. Unclear definitions of value propositions slow down individual companies' strategic actions, mutual creation processes, the discovery of complementarities between ecosystem members and, eventually, the marketing to end users. Unclear definitions also hinders local policy makers willingness to set strong policy guidance for PED development. If possible, PEDs should experiment with potential solutions early on in the process to create a continuum of experiences, which then inform and reinforce the creation of a shared identity (Dentoni et al. 2018).

For regulators and policymakers, this paper highlights the importance of clear legislations and regulations for PED diffusion.

The European directives steer member states to include RE and demand response in their spatial planning and permitting procedures, but the progress has been negligible so far (Krug et al. 2022). Several EU countries have created specific tariffs for local energy sharing on the neighbourhood level, and this could be applied in Finland, too. However, it should be done while embracing the system-level benefits of PEDs and the impacts for the building and transportation sectors. Other interesting upcoming policy is the requirement to calculate a buildings carbon footprint (EU 2024). It remains to be seen if the PEDs' contribution (solar panels, community owned heat pumps or similar) could contribute to the carbon calculations of individual buildings. So far, the Energy Performance of Buildings Directive has been implemented in Finland in a way that does not account for community scale investments.

The main limitation of this study is that, besides the C&I Park, the case studies were mainly in their early stages. Consequently, this study primarily focused on the initial phase of the projects and less data was gathered from the implementation phase, which would present its own set of legitimation challenges (Nielsen et al. 2019). All the case studies were based in Finland, which reduced the generalisability of the results due to the specificities of Finnish institutions and suitable technologies. This applied most notably to the significant role of cogeneration plants and district heating networks in the Finnish energy system. However, many PEDs include different energy carriers, functionalities and sector and system integration, making this paper's findings relevant. Future research could study the four legitimation dilemmas within different PED projects and diverse contexts, especially where district level structures are already integrated into the national policy mix. Longitudinal studies could delve into the legitimation process and dynamics in stakeholder relationships, as well as the institutional context throughout the entire PED creation process. Further studies might also concentrate more on real-estate developer, urban planner and end user perspectives.

Acknowledgements

We thank Associate Professor Anne-Lorène Vernay and other colleagues from the Grenoble Ecole de Management for their valuable feedback on the previous versions of this paper. Open access publishing facilitated by Tampereen yliopisto ja Tampereen ammattikorkeakoulu, as part of the Wiley - FinELib agreement.

Funding

This work was supported by the ECADEC project, which received funding from Business Finland (grant number 8852/31/2022) and the 2IMatch project, which received funding from the Strategic Research Council at the Research Council of Finland (grant 358648).

Conflicts of Interest

While conducting interviews, Tuomas Vanhanen was working as a project manager in one of the involved municipalities.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

References

- ACER, and CEER. 2022. *Annual Report on the Results of Monitoring the Internal Electricity and Natural Gas Markets in 2021*, 97.
- Adner, R. 2017. "Ecosystem as Structure: An Actionable Construct for Strategy." *Journal of Management* 43, no. 1: 39–58. <https://doi.org/10.1177/0149206316678451>.
- Albert-Seifried, V., L. Murauskaite, G. Massa, et al. 2022. "Definitions of Positive Energy Districts: A Review of the Status Quo and Challenges." In *Sustainability in Energy and Buildings 2021*, edited by J. R. Littlewood, R. J. Howlett, and L. C. Jain, vol. 263, 493–506. Springer Nature. https://doi.org/10.1007/978-981-16-6269-0_41.
- Behrendt, J. 2023. "Microgrids and EU Law: Three Microgrid Models to Solve One Regulatory Puzzle." *Energy Policy* 177: 113483. <https://doi.org/10.1016/j.enpol.2023.113483>.
- Bengtsson, M., and M. Johansson. 2014. "Managing Competition to Create Opportunities for Small Firms." *International Small Business Journal* 32, no. 4: 401–427. <https://doi.org/10.1177/0266242612461288>.
- Bergek, A., S. Jacobsson, and B. A. Sandén. 2008. "'Legitimation' and 'Development of Positive Externalities': Two Key Processes in the Formation Phase of Technological Innovation Systems." *Technology Analysis & Strategic Management* 7325: 575–592. <https://doi.org/10.1080/09537320802292768>.
- Billerbeck, A., B. Breitschopf, J. Winkler, et al. 2023. "Policy Frameworks for District Heating: A Comprehensive Overview and Analysis of Regulations and Support Measures Across Europe." *Energy Policy* 173: 113377. <https://doi.org/10.1016/j.enpol.2022.113377>.
- Bitektine, A. 2011. "Toward a Theory of Social Judgments of Organizations: The Case of Legitimacy, Reputation, and Status." *Academy of Management Review* 36, no. 1: 151–179. <https://doi.org/10.5465/amr.2009.0382>.
- Bjerkman-Wade, B., M. Jugé, U. Keliuskaitė, B. McWilliams, R. Rossini, and S. Tagliapietra. 2024. "European Clean Tech Tracker." <https://www.bruegel.org/dataset/european-clean-tech-tracker>.
- Blasch, J., N. M. Van Der Grijp, D. Petrovics, et al. 2021. "New Clean Energy Communities in Polycentric Settings: Four Avenues for Future Research." *Energy Research & Social Science* 82: 102276. <https://doi.org/10.1016/j.erss.2021.102276>.
- Brisbois, M. C. 2020. "Decentralised Energy, Decentralised Accountability? Lessons on How to Govern Decentralised Electricity Transitions From Multi-Level Natural Resource Governance." *Global Transitions* 2: 16–25. <https://doi.org/10.1016/j.glt.2020.01.001>.
- Brozovsky, J., A. Gustavsen, and N. Gaitani. 2021. "Zero Emission Neighbourhoods and Positive Energy Districts—A State-of-the-Art Review." *Sustainable Cities and Society* 72: 103013. <https://doi.org/10.1016/j.scs.2021.103013>.
- Bruehwiler, N., A. Hearn, R. Roysen, et al. 2025. "Energy Justice in Innovative Living Spaces: Examining Positive Energy Districts and Ecovillages in Europe." *Energy Research & Social Science* 127: 104248. <https://doi.org/10.1016/j.erss.2025.104248>.
- Campos, I., L. G. Pontes, E. Marín-González, S. Gährs, S. Hall, and L. Holstenkamp. 2020. "Regulatory Challenges and Opportunities for Collective Renewable Energy Prosumers in the EU." *Energy Policy* 138: 111212. <https://doi.org/10.1016/j.enpol.2019.111212>.
- Coy, D., S. Malekpour, and A. K. Saeri. 2023. "Putting the Power Back in Empowerment: Stakeholder Perspectives on Community Empowerment in Energy Transformations." *Environmental Policy and Governance* 33, no. 5: 459–473. <https://doi.org/10.1002/etp.2043>.
- Decker, C. 2023. *Modern Economic Regulation: An Introduction to Theory and Practice*. 2nd ed. Cambridge University Press. <https://doi.org/10.1017/9781009083621>.
- Dentoni, D., S. Pascucci, K. Poldner, and W. B. Gartner. 2018. "Learning 'Who We Are' by Doing: Processes of Co-Constructing Prosocial Identities in Community-Based Enterprises." *Journal of Business Venturing* 33, no. 5: 603–622. <https://doi.org/10.1016/j.jbusvent.2017.12.010>.
- Di Silvestre, M. L., M. G. Ippolito, E. R. Sanseverino, G. Sciumè, and A. Vasile. 2021. "Energy Self-Consumers and Renewable Energy Communities in Italy: New Actors of the Electric Power Systems." *Renewable and Sustainable Energy Reviews* 151: 111565. <https://doi.org/10.1016/j.rser.2021.111565>.
- Drori, I., and D. Lavie. 2023. "How Do Innovation Ecosystems Emerge? The Case of Nanotechnology in Israel." *Journal of Management Studies* 61: joms.13026. <https://doi.org/10.1111/joms.13026>.
- Dubois, A., and L. E. Gadde. 2002. "Systematic Combining: An Abductive Approach to Case Research." *Journal of Business Research* 55, no. 7: 553–560. [https://doi.org/10.1016/S0148-2963\(00\)00195-8](https://doi.org/10.1016/S0148-2963(00)00195-8).
- Dujany, N., F. A. Perotti, and K. Sohag. 2026. "Exploring Governance for Sustainable Transitions in Renewable Energy Communities: A Comparative Inquiry of Private and Public Initiatives." *Energy Policy* 212: 115183. <https://doi.org/10.1016/j.enpol.2026.115183>.
- Eisenhardt, K. M., and M. E. Graebner. 2007. "Theory Building From Cases: Opportunities and Challenges." *Academy of Management Journal* 50, no. 1: 25–32. <https://doi.org/10.5465/amj.2007.24160888>.
- Energiategollisuus. 2025a. "Sähkövuosi 2024." https://energia.fi/files/4428/Sahkovoosi_2022.pdf.
- Energiategollisuus. 2025b. "Energiavuosi 2024 Kaukolämpö."
- Energiavirasto. 2025. "Sähkömarkkinat Nyt—Katsaus Vuoteen 2024." https://www.motiva.fi/files/23023/Energiaviraston_mediainfo_16.01.2025.pdf#page=6.00.
- Envall, F., and H. Rohracher. 2025. "Experimenting to Remain the Same: The Politics of Smart Grid Pilot Projects in the Swedish Energy Transition." *Environmental Innovation and Societal Transitions* 57: 101037. <https://doi.org/10.1016/j.eist.2025.101037>.
- EU. 2018. "Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the Promotion of the Use of Energy From Renewable Sources." *Official Journal of the European Union*: 82–209.
- EU. 2019. "Directive 2019/944 on Common Rules for the Internal Market for Electricity." *Official Journal of the European Union*.
- EU. 2024. "Directive (EU) 2024/1275 of the European Parliament and of the Council of 24 April 2024 on the Energy Performance of Buildings (Recast)." https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=OJ:L_202401275.
- Eurelectric. 2020. "Distribution Grids in Europe Facts and Figures." 2020.
- Fichera, A., E. Marrasso, C. Martone, G. Pallotta, M. Sasso, and R. Volpe. 2025. "Ten Questions Concerning Renewable Energy Communities." *Building and Environment* 281: 113193. <https://doi.org/10.1016/j.buildenv.2025.113193>.
- Fisher, G., D. F. Kuratko, J. M. Bloodgood, and J. S. Hornsby. 2017. "Legitimate to Whom? The Challenge of Audience Diversity and New Venture Legitimacy." *Journal of Business Venturing* 32, no. 1: 52–71. <https://doi.org/10.1016/j.jbusvent.2016.10.005>.
- Ford, R., C. Maidment, C. Vigurs, M. J. Fell, and M. Morris. 2021. "Smart Local Energy Systems (SLES): A Framework for Exploring Transition, Context, and Impacts." *Technological Forecasting and Social Change* 166, no. 120612: 120612. <https://doi.org/10.1016/j.techfore.2021.120612>.
- Froissard, P. 2022. "European Missions Climate-Neutral & Smart Cities."

- Gimon, E., M. Ahlstrom, and M. O'Boyle. 2024. *A New Strategy to Meet Rising Electricity Demand*. Energy Innovation Policy & Technology LLC.
- Gjorgievski, V. Z., S. Cundeva, and G. E. Georghiou. 2021. "Social Arrangements, Technical Designs and Impacts of Energy Communities: A Review." *Renewable Energy* 169: 1138–1156. <https://doi.org/10.1016/j.renene.2021.01.078>.
- Gohari, S., S. C. Silvia, T. Ashrafian, et al. 2024. "Unraveling the Implementation Processes of PEDs: Lesson Learned From Multiple Urban Contexts." *Sustainable Cities and Society* 106: 105402. <https://doi.org/10.1016/j.scs.2024.105402>.
- Granstrand, O., and M. Holgersson. 2020. "Innovation Ecosystems: A Conceptual Review and a New Definition." *Technovation* 90–91: 102098. <https://doi.org/10.1016/j.technovation.2019.102098>.
- Greenwood, R., R. Suddaby, and C. R. Hinings. 2002. "Theorizing Change: The Role of Professional Associations in the Transformation of Institutionalized Fields." *Academy of Management Journal* 45, no. 1: 58–80. <https://doi.org/10.2307/3069285>.
- Hakanen, E., V. Eloranta, C. Shaw, and P. Töytäri. 2024. "Signaling Collective Action in Ecosystems." *Academy of Management Perspectives* 39, no. 1: 22–43. <https://doi.org/10.5465/amp.2023.0101>.
- Healey Trulstrup, T., and J. Van Der Leer. 2024. "Towards a Positive Energy Balance: A Comparative Analysis of the Planning and Design of Four Positive Energy Districts and Neighbourhoods in Norway and Sweden." *Energy and Buildings* 318: 114429. <https://doi.org/10.1016/j.enbuild.2024.114429>.
- Hearn, A. X., A. Sohre, and P. Burger. 2021. "Innovative but Unjust? Analysing the Opportunities and Justice Issues Within Positive Energy Districts in Europe." *Energy Research & Social Science* 78: 102127. <https://doi.org/10.1016/j.erss.2021.102127>.
- Hiteva, R., and T. J. Foxon. 2021. "Beware the Value Gap: Creating Value for Users and for the System Through Innovation in Digital Energy Services Business Models." *Technological Forecasting and Social Change* 166: 120525. <https://doi.org/10.1016/j.techfore.2020.120525>.
- Hoicka, C. E., J. Lowitzsch, M. C. Brisbois, A. Kumar, and L. Ramirez Camargo. 2021. "Implementing a Just Renewable Energy Transition: Policy Advice for Transposing the New European Rules for Renewable Energy Communities." *Energy Policy* 156: 112435. <https://doi.org/10.1016/j.enpol.2021.112435>.
- Jacobides, M. G., C. Cennamo, and A. Gawer. 2018. "Towards a Theory of Ecosystems." *Strategic Management Journal* 39, no. 8: 2255–2276. <https://doi.org/10.1002/smj.2904>.
- Karvonen, A., D. Bruggeman, D. Magnusson, M. Ornetzeder, and H. Rohrer. 2025. "Heterogeneous Energy Infrastructures in Europe: Layering and Orchestrating Positive Energy Districts." *Sustainability Science*. <https://doi.org/10.1007/s11625-025-01676-w>.
- Krug, M., I. Alonso, K. Anfinson, et al. 2022. "COME RES Deliverable 7.1 Comparative Assessment of Enabling Frameworks for RECs and Support Scheme Designs."
- Lee, B. H., S. R. Hiatt, and M. Lounsbury. 2017. "Market Mediators and the Trade-Offs of Legitimacy-Seeking Behaviors in a Nascent Category." *Organization Science* 28, no. 3: 447–470. <https://doi.org/10.1287/orsc.2017.1126>.
- Lindkvist, C., E. Juhasz-Nagy, B. F. Nielsen, H.-M. Neumann, G. Lobaccaro, and A. Wyckmans. 2019. "Intermediaries for Knowledge Transfer in Integrated Energy Planning of Urban Districts." *Technological Forecasting and Social Change* 142: 354–363. <https://doi.org/10.1016/j.techfore.2018.07.020>.
- Lowitzsch, J., C. E. Hoicka, and F. J. van Tulder. 2020. "Renewable Energy Communities Under the 2019 European Clean Energy Package—Governance Model for the Energy Clusters of the Future?" *Renewable and Sustainable Energy Reviews* 122: 109489. <https://doi.org/10.1016/j.rser.2019.109489>.
- Markard, J. 2018. "The Next Phase of the Energy Transition and Its Implications for Research and Policy." *Nature Energy* 3: 628–633. <https://doi.org/10.1038/s41560-018-0171-7>.
- Mattinen-Yuryev, M., A. Parkkinen, T. Huotari, et al. 2021. "Missä Mennään Kuntien Ilmasto- ja Luontotyössä?"
- Miles, M. B., A. M. Huberman, and J. Saldaña. 2014. *Qualitative Data Analysis—A Methods Sourcebook*. Sage Publications. <https://doi.org/10.4324/9780203093801.ch12>.
- Moroni, S., and L. Tricarico. 2018. "Distributed Energy Production in a Polycentric Scenario: Policy Reforms and Community Management." *Journal of Environmental Planning and Management* 61, no. 11: 1973–1993. <https://doi.org/10.1080/09640568.2017.1379957>.
- Navis, C., and M. A. Glynn. 2010. "How New Market Categories Emerge." *Administrative Science Quarterly* 55, no. 3: 439–471. <https://doi.org/10.2189/asqu.2010.55.3.439>.
- Neij, L., J. Palm, H. Busch, et al. 2025. "Energy Communities—Lessons Learnt, Challenges, and Policy Recommendations." *Oxford Open Energy* 4: 1–18. <https://doi.org/10.1093/ooenergy/oiaf002>.
- Nicolai, S., and M. Münchmeyer. 2026. "The EU Data Act and Electricity Consumer Participation in Demand Response and Flexibility Services." *Journal of Energy & Natural Resources Law* 44, no. 1: 41–65. <https://doi.org/10.1080/02646811.2025.2485725>.
- Nielsen, B. F., D. Baer, and C. Lindkvist. 2019. "Identifying and Supporting Exploratory and Exploitative Models of Innovation in Municipal Urban Planning; Key Challenges From Seven Norwegian Energy Ambitious Neighborhood Pilots." *Technological Forecasting and Social Change* 142: 142–153. <https://doi.org/10.1016/j.techfore.2018.11.007>.
- Nielsen, B. F., E. Resch, and I. Andresen. 2018. "The Role of Utility Companies in Municipal Planning of Smart Energy Communities." *Sustainability and the City* 213: 695–706. <https://doi.org/10.2495/SDP-V13-N4-695-706>.
- Parkhill, K. A., F. Shirani, C. Butler, K. L. Henwood, C. Groves, and N. F. Pidgeon. 2015. "'We Are a Community [but] That Takes a Certain Amount of Energy': Exploring Shared Visions, Social Action, and Resilience in Place-Based Community-Led Energy Initiatives." *Environmental Science and Policy* 53: 60–69. <https://doi.org/10.1016/j.envsci.2015.05.014>.
- PED-EU-NET. 2026. *PED Database*. Driving Urban Transitions. <https://peddatabase.dutpartnership.eu/>.
- Petrovics, D., D. Huitema, and A. Jordan. 2022. "Polycentric Energy Governance: Under What Conditions Do Energy Communities Scale?" *Environmental Policy and Governance* 32, no. 5: 438–449. <https://doi.org/10.1002/eet.1989>.
- PI Urban Europe/SET Plan Action 3.2. 2020. "White Paper on PED Reference Framework for Positive Energy Districts and Neighbourhoods." <https://jpi-urbaneurope.eu/ped/>.
- Planko, J., and J. Cramer. 2019. "Coping With Coopetition—Facing Dilemmas in Cooperation for Sustainable Development: The Case of the Dutch Smart Grid Industry." *Business Strategy and the Environment* 28, no. 5: 665–674. <https://doi.org/10.1002/bse.2271>.
- Purtik, H., E. Zimmerling, and I. M. Welp. 2016. "Cooperatives as Catalysts for Sustainable Neighborhoods—A Qualitative Analysis of

the Participatory Development Process Toward a 2000-Watt Society.” *Journal of Cleaner Production* 134: 112–123. <https://doi.org/10.1016/j.jclepro.2016.02.075>.

Sareen, S., V. Albert-Seifried, L. Aelenei, et al. 2022. “Ten Questions Concerning Positive Energy Districts.” *Building and Environment* 216: 109017. <https://doi.org/10.1016/j.buildenv.2022.109017>.

Sareen, S., P. O. Eikeland, and T. H. J. Inderberg. 2025. “Ten Questions Concerning Decentralised Energy Systems Governance.” *Building and Environment* 286: 113717. <https://doi.org/10.1016/j.buildenv.2025.113717>.

Scharnigg, R., and S. Sareen. 2023. “Accountability Implications for Intermediaries in Upscaling: Energy Community Rollouts in Portugal.” *Technological Forecasting and Social Change* 197: 122911. <https://doi.org/10.1016/j.techfore.2023.122911>.

Schwidtal, J. M., P. Piccini, M. Troncia, et al. 2023. “Emerging Business Models in Local Energy Markets: A Systematic Review of Peer-to-Peer, Community Self-Consumption, and Transactive Energy Models.” *Renewable and Sustainable Energy Reviews* 179: 113273. <https://doi.org/10.1016/j.rser.2023.113273>.

Seto, K. C., S. J. Davis, R. B. Mitchell, E. C. Stokes, G. Unruh, and D. Ürge-Vorsatz. 2016. “Carbon Lock-In: Types, Causes, and Policy Implications.” *Annual Review of Environment and Resources* 41, no. 19: 1–28. <https://doi.org/10.1146/annurev-environ-110615-085934>.

Suchman, M. C. 1995. “Managing Legitimacy: Strategic and Institutional Approaches.” *Academy of Management Review* 20, no. 3: 571–610.

Suddaby, R., A. Bitektine, and P. Haack. 2017. “Legitimacy.” *Academy of Management Annals* 11, no. 1: 451–478. <https://doi.org/10.5465/annals.2015.0101>.

Thomas, L. D. W., and P. Ritala. 2021. “Ecosystem Legitimacy Emergence: A Collective Action View.” *Journal of Management* 48, no. 3: 515–541. <https://doi.org/10.1177/0149206320986617>.

Trevisan, R., E. Ghiani, and F. Pilo. 2023. “Renewable Energy Communities in Positive Energy Districts: A Governance and Realisation Framework in Compliance With the Italian Regulation.” *Smart Cities* 6, no. 1: 563–585. <https://doi.org/10.3390/smartcities6010026>.

Valkering, P., C. Beumer, J. De Kraker, and C. Ruelle. 2013. “An Analysis of Learning Interactions in a Cross-Border Network for Sustainable Urban Neighbourhood Development.” *Journal of Cleaner Production* 49: 85–94. <https://doi.org/10.1016/j.jclepro.2012.09.010>.

Valta, J., T. Vanhanen, U. Saari, et al. 2025. “Stakeholder and Regulatory Perspectives on Creating District Level Structures for Positive Energy Districts: Case Hiedanranta.” *Journal of Energy & Natural Resources Law* 43: 517–542.

Wahlund, M., and J. Palm. 2022. “The Role of Energy Democracy and Energy Citizenship for Participatory Energy Transitions: A Comprehensive Review.” *Energy Research and Social Science* 87, no. 2021: 102482. <https://doi.org/10.1016/j.erss.2021.102482>.

Weick, K. E., K. M. Sutcliffe, and D. Obstfeld. 2005. “Organizing and the Process of Sensemaking.” *Organization Science* 16, no. 4: 409–421. <https://doi.org/10.1287/orsc.1050.0133>.

Wolsink, M. 2020. “Distributed Energy Systems as Common Goods: Socio-Political Acceptance of Renewables in Intelligent Microgrids.” *Renewable and Sustainable Energy Reviews* 127: 109841. <https://doi.org/10.1016/j.rser.2020.109841>.

Ympäristöministeriö. 2018. “Asetus Rakennuksen Energiatodistuksesta”. <https://www.finlex.fi/fi/laki/alkup/2017/20171048#Pdm46263582822768>.

Zhang, W., and S. White. 2016. “Overcoming the Liability of Newness: Entrepreneurial Action and the Emergence of China’s Private Solar Photovoltaic Firms.” *Research Policy* 45, no. 3: 604–617. <https://doi.org/10.1016/j.respol.2015.11.005>.

Appendix A

Profiles of the Interviewees

Interviewees	
No.	
C&I Park	
1	Municipal leader A
2	DSO representative A
3	Fuel cell provider representative
4	Solar PV provider A representative
5	Solar PV provider B representative
6	Automation provider representative A
7	Direct current lightning firm representative
8	Battery provider representative
9	Municipal entrepreneurs office representative A
10	Gas motor provider representative
11	Ministry representative A
12	National regulatory authority representative
13	Municipal utility representative B
14	Automation provider representative
15	Professor, University
16	Municipal utility representative
17	Finnish Gas Association representative
18	Municipal utility representative A
19	Municipal utility representative C
WindPED	
1	Wind power developer
2	Municipality representative
3	Consultant
4	Consultant
EcoVillage	
1	Landowner
2	Regional developer company representative
3	Automation system provider representative
4	Architect company representatives x 3
5	DSO representative
6	Landowner
EcoDistrict	
1	Municipal climate expert
2	Regional developer company representative A
3	Energy storage provider
4	Construction company representative
5	Heat pump system provider representative

Interviewees	
No.	
6	Building automation provider representative
7	Public sustainability office representative
8	District heating utility representative
9	Software provider representative
10	Regional developer company representative A
