Institutional Complexity and Organisational Characteristics in the Emerging Sector of Local Energy Systems - Case Study

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***Abstract*— The formation of local energy systems (LES) is at a very early stage but their number is expected to increase rapidly. This paper aims to investigate the characteristics of the stakeholders and how their characteristics influence the activities they are engaged in regarding the LES emergence process. This way, our study lays the foundation for further analysis of the causal patterns in LES emergence. The recognition of the entity characteristics is done through a case study of an industrial microgrid. The case study shows how LES emergence is an interplay of stakeholders from different levels with different guiding institutional logics. Institutional complexity becomes apparent in strategic decisions of the municipality and its utility and their negotiations of the microgrid borders with the local DSO.**

***Index Terms*—Energy communities; stakeholder characteristics; institutional logics**

I. INTRODUCTION

Local energy is based on context-specific and local conditions. LESs emerge through local activities, meaning that their diffusion cannot be fully predicted. In general, increased uncertainty on where and how such systems emerge is new to the energy field, which has been accustomed to steady changes during many decades. Participating stakeholders have different characteristics and aims that influence their activities in LES emergence process. On the one hand, stakeholders' characteristics determine their role in the system, and on the other hand, characteristics of all stakeholders in aggregation determine the mechanisms of the system. Recognising and grouping the characteristics of different stakeholders helps to trace causal patterns of the emergence process.

During the emergence of innovation, the goals of the sectors are uncertain and actors do not have clear positions in the field [1]. Periods of emergence are strategic situations for new entrants and incumbents. New entrants are agile in moving towards new markets, whereas incumbents may resist the change completely or seek to use their resources and wide-ranging experience for capturing the emerging market [2], [3]. Innovations occur when previously distant actors start to cooperate and different institutional logics across each other [3]. Institutional logic complexity has been discovered in many industries, most notably in sectors like health care and education and research [4]. In the energy transition, sector coupling, as well as the location of energy resources closer to communities, create opportunities for new business models and actors. However, governance of the energy transition is a challenge because existing logics are sometimes challenged. Previous literature has not studied the energy field from this standpoint besides some exceptions. Microgrids are a good example of such a model that challenges incumbent logics that have been stabilising the industry for centuries. The research question of this paper is:" What institutional logics are involved in local energy systems creation and how they affect the process of their emergence?"

II. THE EMERGENCE OF LOCAL ENERGY LOGIC

There are several differences in the governance logics and innovation opportunities of LESs and the conventional macro grid. Microgrids are a prominent concept in the sphere of local energy. Whereas DSOs can operate in a large area serving hundreds of thousands of customers, microgrids form clear local boundaries and capabilities, such as the ability to shift to island mode and controllability of a well-defined entity [5]. They are related to ideas of self-sufficiency, community ownership and governance, high interdependence and involvement of users, collective bargaining, contractual commitment and sharing of risk and benefits [6]. They are also seen as a way to inform and bring customers closer to the technicalities of energy supply. In contrast, the unidirectional centralised energy model has made energy seen as a homogenous product that is difficult to marketise as a consumer good. Discourses are also related to local economic development and environmental protection [7].

The immaturity of LESs can be seen in the unsettlement of various concepts around them. In the USA, the term microgrid is often used, for example, in policy papers [8]. In the EU,

LESs have been referred under the term Local Energy Communities (LECs), which was included in the draft of the EU's Clean Energy Package, launched in 2016 [9]. The term became widely used and gained a prominent position in academic literature. The term LEC did not specify the type of participants from industrial, commercial or residential customers. However, "Citizen Energy Communities" (CECs) replaced the term in the final version of the directive. Closely related directive articles refer to "Renewable Energy Communities" and "Jointly acting renewable self-consumers" [10].

The definition of CECs includes elements of governance structures and a position in regulatory frameworks. CECs are appointed to non-profit projects with an emphasis on the participation of local citizens and make therefore a distinction to industrial microgrids, which are appointed merely as Closed Distribution Systems (CDSs), defined in the Article 38 of the directive of Internal Market for Electricity [10]. The implementation of the directive in EU member states will provide precise meanings for the terms in local contexts. Even though the juridical terms of LESs differ, they include similar technologies that exist in microgrids already. They can be categorised according to the degree of integration, referring to self-sufficiency and self-provision, and value generation for the external energy system [11].

III. Institutional Complexity in Emerging Sectors

The perspective of institutional logics has lately gained popularity among studies handling organisations' environment. It is used for studying social constructions, historical patterns, material practices, assumptions, values, beliefs and rules, which steer actors' behaviour and diffusion of practices.[3] In more general, institutional theory presumes that, alongside economic success, legitimacy is the main driver for organisational decision-making. Legitimacy is driven by coercive, normative and mimetic pressures from its key stakeholders [12], to which organisations respond with different strategies [2].

Institutional logics perspective has been used as an analytical lens for studying institutional changes related to sharing economy, accounting, higher education publishing or architecture, for example [13][14]. The institutional logic perspective sees the world as a mixture of different value spheres, which are elaborated by individuals and organisations. During technological disruptions and convergences, organisations face complex institutional pressures, as they seek legitimacy in different institutional settings at the same time. Whereas new entrants contest many previous assumptions, incumbents have usually settled stable priorities in logics determined by material interests and normative beliefs. As summarised in [15], the prevailing institutional logic affects decision-making in several ways. Firstly, it directs decision-makers' attention to certain issues. Secondly, it offers interpretive schemes that guide decision-makers' perception of what actions are legitimate. Thirdly, the prevailing logic provides the rules of appropriateness that make certain actions legitimate.

Incompatible expectations create challenges and tensions. Sometimes the incompatibility arises from the goals that organisations have but sometimes also from the means or courses they take [4]. Structural overlap exists in situations where individual roles or organisations that were previously distinct are forced together [14]. There may be jurisdictional overlap between logics or just unsettled prioritisation [16]. Facing incompatible tensions leads inevitably to prioritising some logic at the expense of others [4]. However, interpreting and making sense of the environmental changes helps to decide on viable tactics and even to find strategic opportunities. For instance, positioning a company in between two logics can minimise the burden of being embedded in one logic. In some cases, incompatibility may also lead to fruitful and constructive coexistence and interdependence between logics. Such blending was seen, for example, in the pharmacy industry where market logic helped spreading professional advice on drug use efficiently. [16]

The maturity of a field is an important aspect of the framework of institutional logics. Mature fields often have lower institutional complexity because field-level prioritisation has been happening for a long period. Stability of a field may also exist if competing logics happen in geographically dispersed areas. Emerging fields have high uncertainty regarding logics, which also increases the institutional pressures. They have typically permeable and unsettled boundaries, which makes it possible to bring practices from other fields. New entrants may shift the logic and hierarchy of logics in the field. Structure of the field can be characterised through its degree of fragmentation (number of uncoordinated constituents, having different logics); formal structuring (how formally organised are the different proponents) and centralisation (hierarchical power structure of constituents). [4]

The characteristics of an organisation affect the salience of institutional complexity. In general, a central position in industry causes more exposure to institutional complexity than a more peripheral position. The size and status of the organisation intensify the institutional demands [4]. Structural differentiation, meaning creating separate sub-units, can decrease the severity of change. Governance and ownership are important, as a change of institutional setting can take place within an organisation, for example, in the case of changing ownership. Ownership matters especially in settings that include ambiguity of field-level logics. Family-owned and investor-owned companies can have very different goals. The structure also influences the institutional pressures because organisations divisions may represent different logics and have different ties, like club memberships, to various formal or informal structures representing different fields.[4]

Academics have categorised these different institutional logics into seven ideal types: Family, Community, Religion, State, Market, Profession and Corporation [3], [17]. These ideal types and their differences have been structured according to institutional orders, like root metaphor, sources of legitimacy and authority and types of norms and control mechanisms [10]. Ideal types are useful for giving a starting point for further analysis of case-specific analysis and interpreting the results. The theoretical goals and operating principles of these ideal types are listed in Table 1.

The market logic is dominated by monetary evaluation and the idea that growth produces winning companies [18]. State logic is based on the assumptions that states are interested in the well-being of their citizens. They redistribute the welfare and stabilise markets by enforcing rules of exchange and

establishing governance structures. Community logic lays somewhere in between the state and market logics. It refers to the idea that local norms, values, infrastructure, rules and understandings steer local actors [3]. In the energy sector, community-based governance is seen as an enabler for innovation, new economic models, sources of competition and behavioural change among citizen [19].

Stakeholders' organising principles of these different ideal types are structured on the y-axis to different elements, which represent how the organisations see themselves and what are their motives. The ideal types represented in the literature are shown in Table 1 [3]. In general, different studies use different elements favouring ones that are the most relevant to their research questions.

TABLE 1. IDEAL INSTITUTIONAL LOGICS [3]

	State	**Market**	**Community**	**Profession**
Root metaphor	State as a distribution mechanism	Transaction	Common boundary	Profession as relational network
Source of legitimacy	Democratic participation	Share price	Reciprocity	Personal expertise
Source of authority	Bureaucratic domination	Shareholder activism	Commitment to community values and ideology	Professional association
Basis of strategy	Increase community good	Increase efficiency profit	Status & honour of members	Increase personal reputation
Basis of attention	Status of interest group	Status in market	Personal investment in the group	Status in hierarchy

IV. RESEARCH APPROACH

This paper is a single case study, which is a purposeful approach to understand complex phenomena by bringing a rich understanding of the studied case [19]. The research is based on secondary sources and 12 thematic interviews conducted between October 2018 and May 2019. Each interview lasted approximately 50 minutes. Three of the interviews were group interviews and in total, 15 people were interviewed face-to-face. The main actor, CEO of a municipal utility, was interviewed twice. All interviews besides one were recorded and transcribed. In addition to interviews, seminar presentations by five stakeholders were recorded.

Interviewees were not asked their institutional logics directly; instead, the interviews concentrated on what happened during the project. This was done to avoid biases in answers which is a challenge in studies using institutional logics [10]. The interviews were structured so that different phases, ideation, preparation, planning, implementation and future of the project were handled. The collected data was used for pattern matching, which means identification and comparison of the data to the ideal types of institutional logics [20]. Transcriptions were analysed by looking at points that refer to perceptions and motivations behind actions. Secondary sources included newspaper articles, municipal council meeting notes and various presentations of the project.

This paper uses elements of the institutional logics framework that are most appropriate related to a case. The size of an organisation and the focus of attention are emphasised as the energy field is moving towards a more decentralised system. Organisation's status affects how they strategically react to change as central actors have different levels of political power and vested interests. Coupling new local actors to the energy field means divergence of organisational goals. As a consequence, this requires looking at the source of legitimacy and authority because they tell the dependences these actors have. The chosen elements are somewhat different for macro-level and meso-level organisations as their statuses are differently constructed. Therefore, macro and meso-level actors are compared slightly differently.

V. CASE STUDY: INDUSTRIAL MICROGRID

The case microgrid was initiated in the autumn of 2015 and will be functioning during 2019. Its main purpose is to create a self-sufficient industrial area. It uses two 2 MW solar PV fields, MW-size energy storages, six gas engines of a total capacity of 8,1 MW and 130 kW fuel cells. First, the microgrid will use natural gas as backup power but the purpose is to shift later to biogas usage. The planning process started after the project received 4,7-million-euro funding from the Finnish government in 2017. The most important stakeholders of the project and their tasks in the project are illustrated in Fig. 1.

On the macro-level, important stakeholder has been the Ministry of Economic Affairs and Employment of Finland. Its main motivation in funding the project was to develop new innovative energy solutions. The main criteria for project applicants were emission reductions, demonstration value, scalability, feasibility and schedule of the projects. The transmission system operator (TSO) is a publicly owned actor, who encourages a market-based approach on the reserve market and is, in that sense, a driver of energy communities. Its goal is to harness potential flexibility in the energy system. The reserve markets have gained the attention of private actors, like the automation provider, to learn and gain references for other markets that are opening globally. The National Regulatory Authority (NRA) ensures that regulation is being implemented and obeyed. The state logic is inherent in these actors by their activities marked in law. The macro-level stakeholders' characteristics are summarised in Table 2.

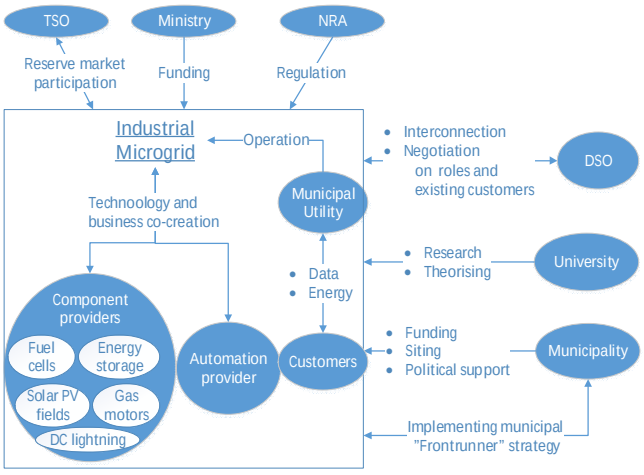

Figure 1. Microgrid stakeholders and their main activities

TABLE 2. CHARACTERISTICS OF MACRO-LEVEL STAKEHOLDERS

	Ministry	NRA	TSO
Owners	State	Ministry	>50% publicly owned
Source of legitimacy	Democracy	Democracy	Prices, democracy
Source of authority	National parliament, citizen election	Ministry, EU regulation	Shareholders; NRA
Main rules and targets	EU regulation and climate policies, target of 50 % RE, 55% self-sufficiency, by 2030	Act on the Energy Authority	Electricity Market Act
Basis of attention	Demonstration value of the project, scalability of the model, feasibility, schedule, environmental impact.	Markets, security of supply, price, governance of national climate efforts.	System supervision, planning, promotion of market. Using flexibility potential. Predicting future needs.
Case-specific goals	See how a local energy system functions and what benefits and learnings it brings.	Guarantee legality of the microgrid.	Reliability of electricity system, development of DR markets
Inst. logics	State	State	State Market

The main actors on the meso-level (see Table 3) are the municipality and its utility, which can be argued to represent several logics. Firstly, they follow a community logic, since the size of the municipality is only a couple of tens of thousands of habitats. According to the mayor, the acceptance of the microgrid among citizen was high, which points to sharing the same values. Besides, the project differed from other spearhead projects, mainly by private actors, due to relatively high risks. The CEO of the municipal utility and the mayor also highlighted the security of supply and importance of research. The CEO also expects non-economic motives from microgrid customers. Interest in sharing data, cooperating with other local companies for balancing local demand and long-term investments in energy efficiency were points he wished from companies in the area.

Secondly, these actors represent market logic. The utility has supplied previously gas and heat to its customers. A major motivator for the project was to develop the usage of the gas infrastructure as a source of flexibility to accommodate more renewable energy (RE) in the system. Gas infrastructure became under pressure after significant tax increased in 2010. The microgrid is also a way to create economic benefits through a better brand and in that way, attract new companies to the municipality. Participating in the reserve markets,

TABLE 3. CHARACTERISTICS OF MESO-LEVEL STAKEHOLDERS

	Municipality	Municipal Utility	Distribution System Operator (DSO)	New entrant Technology Providers	Automation provider	Incumbent Technology Providers	University
Owners		Municipality.	Mainly foreign capital investors.	Investors and founders of the companies.	Mostly institutional investors.	Various investors and founders of companies.	Foundation.
Centrality (size and status)	Relatively small but growing municipality.	Relatively small utility.	Large DSO with international status.	Several promising local companies headed to export markets.	Large global corporation. Also local knowledge and references.	Established companies in Finnish energy sector.	One of the largest technical universities in Finland.
Source of legitimacy (authority)	Democratic elections.	Council, citizen, local companies.	Shareholders, (NRA)	Entrepreneurial success, sustainability potential.	Share price.	Share price.	Funding, ratings.
Main rules and targets	Constitution; Local Government Act; The Carbon Neutral Municipalities project	Heat unregulated activity, Natural Gas Market Act, (liberalisation in 2020); Microgrid-related regulation	Electricity Market Act, Security of supply (e.g. even pricing, incentive regulation, rate of return).	Innovation policy instruments like spearhead projects.	TSO's market regulation. Act on Excise Duty on Electricity and Certain Fuels.		R&D funding policy and rules.
Basis of attention	Sustain and secure municipal services; improve economy.	Security of supply; heat and gas deliveries; RE targets; industrial customers.	Security of supply; services, non-discrimination.	Growth, efficiency and profit.	Gain position in frontrunner markets.	Increase efficiency and profit.	Sustainability, cooperation in networks, innovations.
Case-specific goals	Being frontrunner, support local businesses, branding, improve economy.	Self-sufficiency, competitiveness, develop gas infrastructure.	Avoid eruption of the monopoly-based network system.	Increase sales and gain references, improve own processes.	Develop technologies and gain references for new customers.	Find new markets	Launch research projects for new solutions, theorise.
Inst. logics	Community State Market	Community Market Profession	State Market	Market	Market	Market	Profession

savings from network tariffs and possibly on taxes were reasons behind the project. Also, savings by using excess heat, proven in recent data centre investments in Finland, attracted the municipality since they improve not only employment but bring also heat energy supply for the district heating network. Thirdly, profession logic is evident in the utility's ambitions. The CEO has an interest in developing technologies related to gas infrastructure, most notably fuel cells.

Discussions were held between the DSO and municipal utility since the microgrid area expands to DSO's existing customers. This contradiction reflects differences in the state, community and market logics. The DSO has a monopoly and related duties set by the Electricity Act and it works with a blend of market and state logics. Making an exception for the microgrid, even if it includes elements of a community logic, offers an example, which may not be societally desirable on a broader scale. The COO of the DSO reflected this contradiction between state logic and community logic: *"It's about picking the best customers … and then we have the distant locations, who are interested in them and developing the security of supply for them?"* Otherwise, the DSO agrees on the need for developing energy communities, but mostly within property boundaries.

Actors have somewhat different perspectives on the security of supply. The LES taking responsibility for energy supply capacity in the era with a high share of RE came several times up in the interviews with the CEO of municipal utility and the mayor of the municipality. TSO's discussion paper on the need for an electricity market reform was a driver of the microgrid. The DSO highlighted the effect of underground cabling and large-scale virtual power plants. This stems perhaps from the different focus of attention, which in municipality's case is steered towards the needs of local actors rather than larger-scale thinking added with non-discriminatory logic that steers DSOs. Although, the DSO has initiated a small battery-based microgrid pilot in a remote location for providing electricity during storms.

VI. Discussion

This paper has focused on the characteristics of different actors who participate in the emergence of LESs. The institutional logics of main actors vary from state and community to market logic. Even tough local context brings community logic into the game, market logic has a prevalent role in the development, at least in this case. We can see that such a system includes stakeholders of different sizes and sources of legitimacy. The emergence of the LES is a co-evolution of different level stakeholders, especially at this point of time when the field is very young. Different types of local, meso-level, actors have seen opportunities in the LES but would not not have been able to implement the project on their own. Macro-level incentives for local energy enabled the project, yet the state logic behind DSO also form incompatible logics. On the other hand, the macro-level goals require bottom-up movements such as the municipality's ambitions in the energy sector in this case.

From the methodological perspective, institutional logics are challenging to research, for which reason the results of the study show only the major characteristic differences between actors. As it was seen from the results, the ideal types of institutional logics are only a starting point because they leave many dynamics unrevealed. Numeric evaluation of the logics or longitudinal changes, for example, were not evaluated. A longitudinal or action research approach would enable a more thorough picture of the organisations. Even though this paper does not tell the actual story of the project, it offers a new perspective for LES diffusion by structuring the main differences in the logics of the different stakeholders.

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