

京都大学大学院経済学研究科
再生可能エネルギー経済学講座
ディスカッションペーパー

Electricity and District Heating Supply Business by Finnish Municipal Companies

Examination of the Finnish Version of Stadtwerke



March 2024

Shin SUZUKI

Ph.D Student,

Graduate School of Economics, Kyoto University



Electricity and District Heating Supply Business by Finnish Municipal Companies

Examination of the Finnish Version of Stadtwerke

Shin SUZUKI

Ph.D Student, Graduate School of Economics, Kyoto University

Abstract:

This paper examines the municipal energy business models in Finland, drawing parallels with Germany's Stadtwerke, against the backdrop of Japan's demographic challenges and economic shifts impacting local governance and infrastructure sustainability. With a comprehensive overview of Finland's energy landscape, including consumption patterns, source diversification post-liberalization, and the pivotal role of municipal enterprises in local economies, we embark on a transversal analysis highlighting the structural and operational nuances of Finnish municipal energy businesses. These entities, crucial for the municipal management and welfare state maintenance, are posited as potential blueprints for addressing Japan's urban-rural disparities and fiscal strains. By exploring the Finnish model's resilience amidst economic austerity and its innovative engagement in the energy sector, particularly through decentralized production and distribution networks, this paper underscores the significance of municipal energy businesses in fostering sustainable local economies. The comparative analysis with Japanese and German counterparts further enriches the discourse on municipal energy management's role in supporting citizen welfare and infrastructure renewal. The study concludes with propositions for future research, emphasizing the need for deeper insights into the operational strategies, revenue models, and contributions of municipal energy businesses to local governance and economic stability.

Keywords: Municipal Energy Businesses, Finland's Energy Landscape, Stadtwerke, Decentralized Energy Production

1. Introduction

This discussion paper closely examines municipal energy businesses in Finland, presenting them as potential models reminiscent of Germany's Stadtwerke. The paper begins by outlining Finland's energy landscape and provides a broad overview of its operators. It then conducts an extensive examination of municipal energy businesses, shedding light on their structures, operations, and contributions to the local economy.

Japan is currently facing a significant population decline, leading to economic contraction, particularly in rural areas. This demographic shift brings numerous challenges, including over-centralization in major cities like Tokyo. The resulting decrease in municipal and property tax revenues has significantly affected local governments, the primary beneficiaries of these taxes. Additionally, the need for substantial renewal of infrastructure—developed during the period of high economic growth until the 1990s—is becoming urgent as these structures approach the end of their service life. According to projections by Morotomi (2018), the costs associated with maintenance and renewal of this infrastructure could escalate to between 18 to 19 trillion yen by 2044. This financial burden poses a serious challenge for local governments already struggling with revenue generation following the Trinity Reform.

In this context, Germany's Stadtwerke offers invaluable insights. Stadtwerke consists of municipal-owned firms primarily engaged in providing essential services such as electricity, gas, transport, and internet. Unlike traditional profit-driven corporations, Stadtwerke's primary objectives center on providing stable services to citizens. The German concept of "Daseinsvorsorge," which values accessibility to essential goods over ownership, deeply influences their operations. Traditionally, the state, municipalities, and Stadtwerke collaboratively shoulder the responsibility of ensuring accessibility (Hizikata, 2018). Significantly, major Stadtwerke effectively transfer funds internally between profit and loss-bearing sectors to fulfill their mission, ensuring service stability and efficiency.

One of Stadtwerke's significant revenue sources is their electricity sector. While state enterprises oversee transmission, various companies participate in liberalized generation, distribution, and sales. Stadtwerke is actively involved across these sectors, generating profits that are resilient to climate or market trends. This stability ensures consistent revenue for municipal services and mirrors the innovations observed in Japan's local power providers following electricity liberalization.

Like Stadtwerke, energy business is an important element for the management of municipalities, but there are various possibilities regarding its governance form. Similar forms exist depending on the country, and studying them is very important. This paper focuses its analysis on Finland, renowned for its robust welfare state with high welfare benefits and substantial tax burdens (Esping-Anderson, 1990). The severe recession following the Soviet Union's collapse in 1990 led to reduced tax revenues, prompting expenditure cuts (Yokoyama, 2019). This government-induced austerity and decentralization presented significant challenges for municipalities traditionally responsible for providing welfare and administrative services.

In Finland, municipal public enterprises have traditionally overseen electricity and heating businesses, with the revenues generated being vital for municipal finances. The operations of these Finnish energy businesses bear resemblance to those of Stadtwerke, making a thorough analysis essential for understanding the relationship between welfare, administrative services, and energy businesses. Such analysis could provide valuable insights for Japan's emerging local electricity providers.

Therefore, this paper conducts a transversal analysis of the operations of Finland's municipal energy businesses. Chapter 2 offers an overview of the general energy situation in Finland, while Chapter 3 analyses Finland's energy providers with a focus on municipal operators. Chapter 4 compares Finnish operators with their Japanese and German counterparts, exploring



their potential as foundational supports for citizens, like Stadtwerke.

2. Energy Situation in Finland – Electricity and Heat Supply Business

2.1 Energy Consumption and Source Proportions in Finland

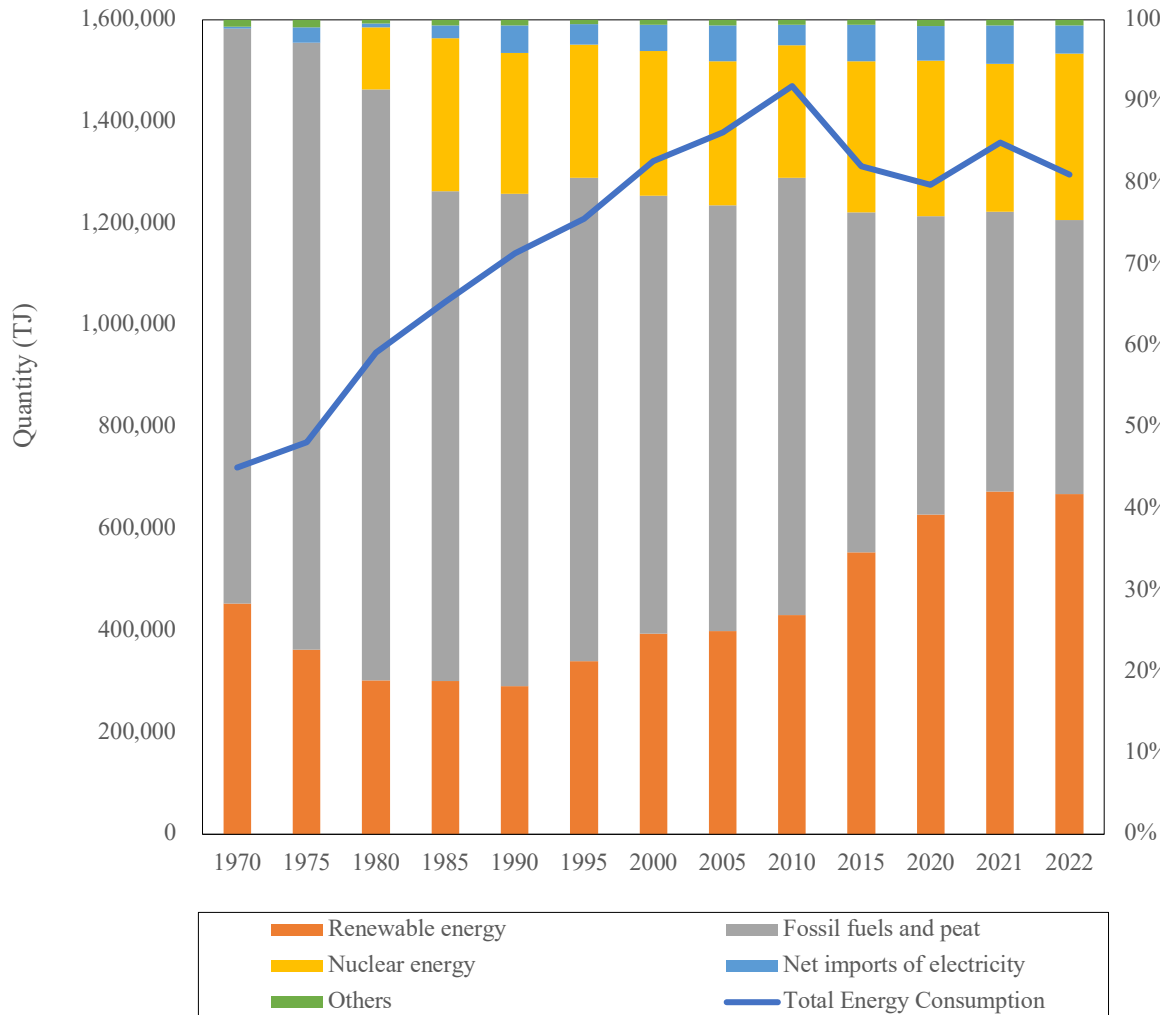


Figure 1. Total energy consumption and the share of each energy source in Finland

Source: Statistics Finland (2023b)

Figure 1 outlines Finland’s total energy consumption and the share of each energy source. Energy consumption increased until 2010 and has stabilized since. While fossil fuels supplied approximately 70% of energy in the 1970s, the introduction of nuclear power in 1977 and rising adoption of renewable energies since the 1990s have altered the energy landscape. In 2022, the share of renewable energy, thermal power, nuclear power, and other energy sources (including imported power) are 41.8%, 33.7%, 20.4%, and 0.7% respectively. Presently, renewable energy is the predominant energy source in Finland.

Regarding renewable energy, woody biomass constitutes 70-80% of the total, with black liquor—a by-product from the paper-making process accounting for one-third of this

biomass—being used significantly within the industry for in-house consumption. Other renewable sources include hydropower (10-20%), wind power (around 5%), and a negligible percentage from solar energy (about 0.2%).

2.2 Energy Consumption Sectors in Finland

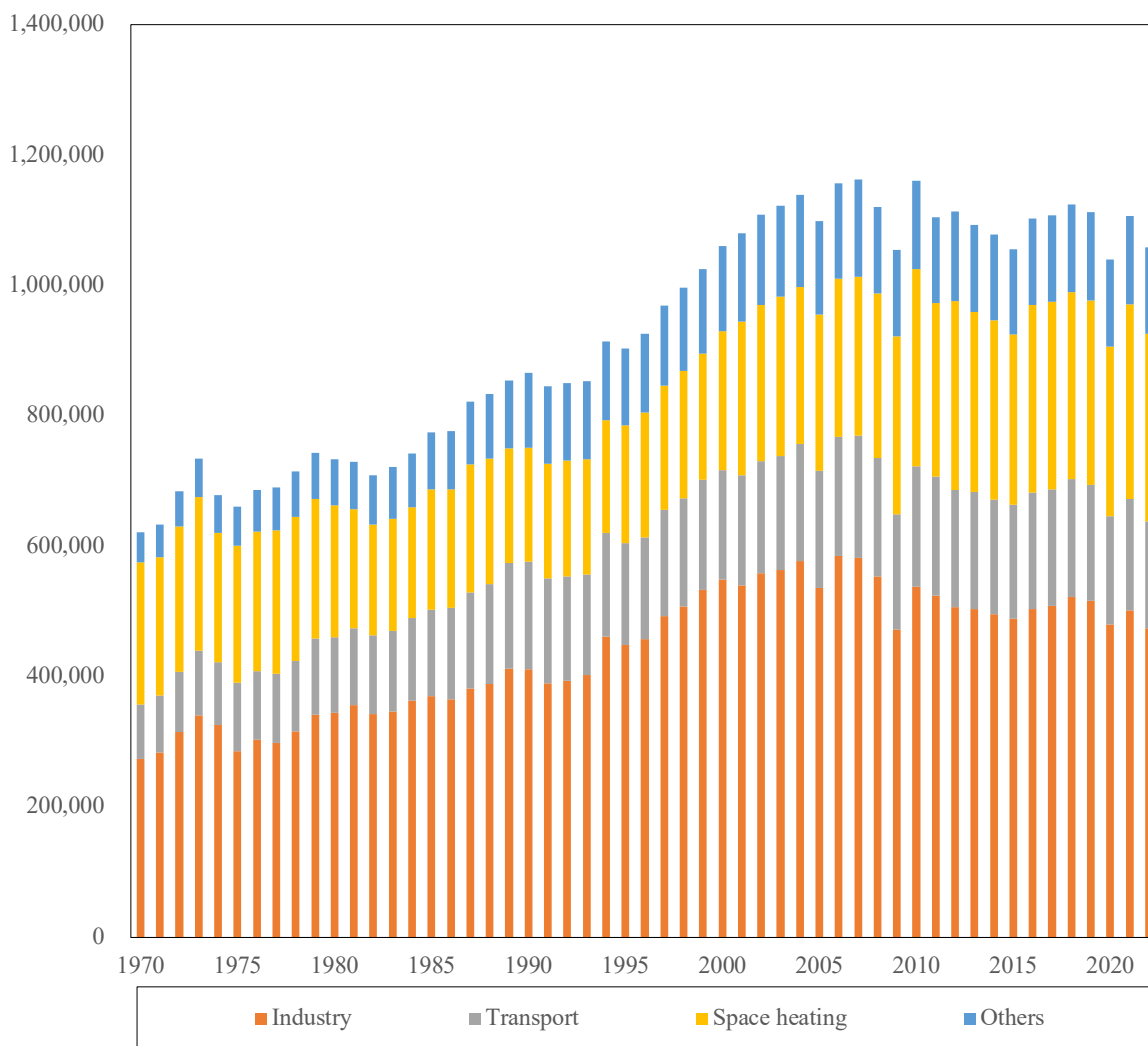


Figure 2. The Energy Consumption Sectors in Finland

Source: Statistics Finland (2023b)

Figure 2 depicts the energy consumption sectors in Finland. Industry consumes approximately half of the total energy. Another distinctive feature is the considerable energy used for space heating. District heating is the predominant heat supply method in Finland (refer to the Ministry of Economic Affairs and Employment of Finland (2023) for details), with various companies, including local energy firms, providing heating services particularly in urban areas¹.

2.3 Electricity in Finland

¹ Finland is one of the countries with the highest prevalence of district heating supply in the world (Finnish Energy, 2023).

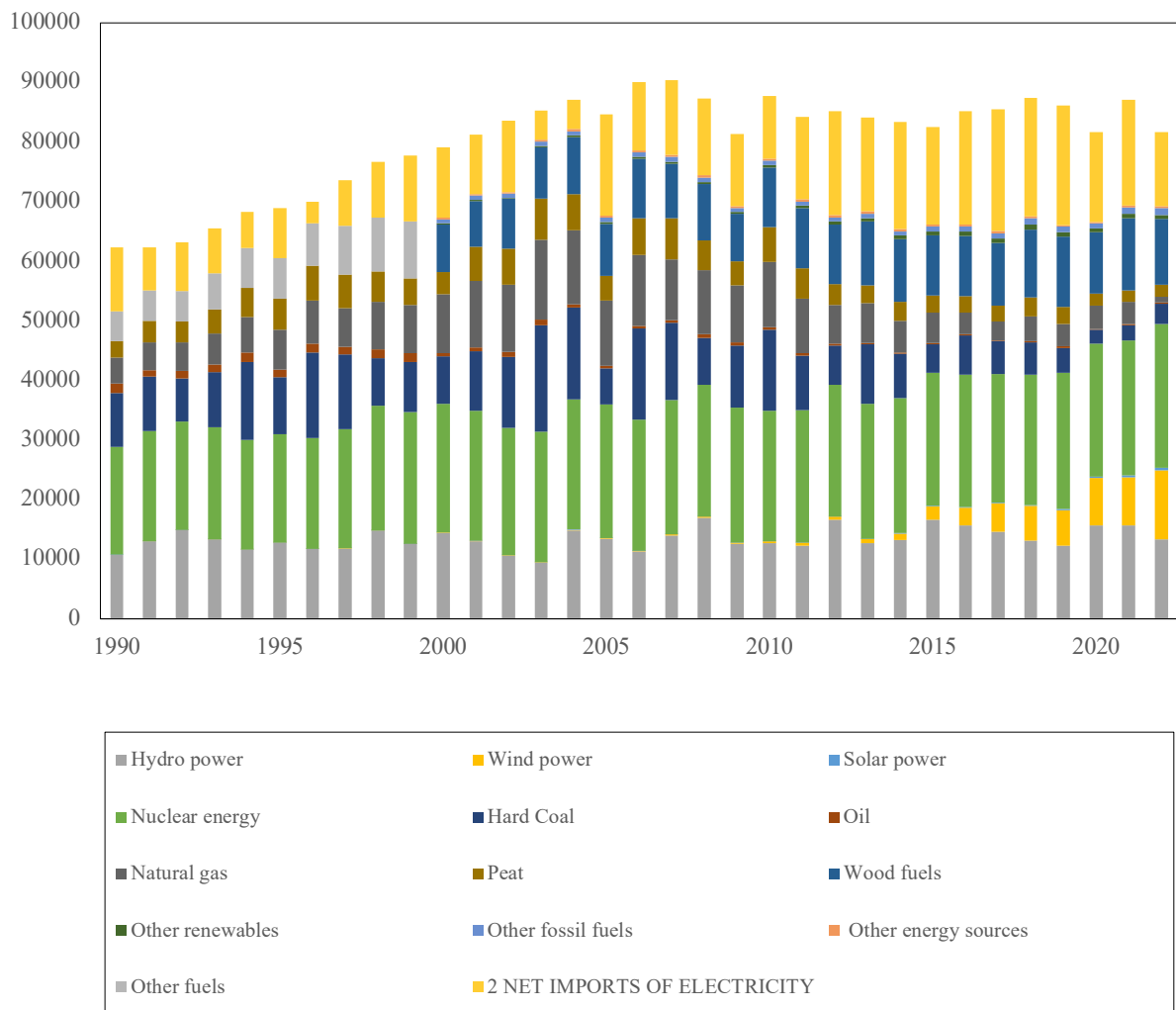


Figure 1. The Composition of Electricity Generation in Finland

Source: Statistics Finland (2023c)

Figure 3 illustrates the composition of electricity generation in Finland. The country is 80% self-sufficient in electricity, relying on imports for the remainder. Thermal power is the principal electricity source, followed by nuclear and hydropower. While the proportion of renewable energy, notably wind power, increases annually, solar power only contributes approximately 0.2% to total electricity generation.

2.4 Electricity Market Evolution: Pre and Post-Liberalization

The enactment of the Electricity Market Act (EMA)² in 1995, also known as electricity liberalization, marked a significant transformation in Finland's electricity market. Pineau &

² The EMA is a law created to ensure fairness in Finland's electricity market, detailing various provisions and operations for generation, transmission, distribution, and sale of electricity, as well as its regulation.

Hämäläinen (2000)³ provide an analysis summarizing the market prospects pre and post-liberalization.

Before EMA, state-owned enterprises (predominantly Imatran Voima Oy, the precursor to Fortum) and numerous small-scale operators, including municipal-run entities, generated electricity. While a wholesale market existed, Imatran Voima Oy dominated it. The company, along with Phojolan Voima Oy, also managed transmission of 100 kV or higher. Municipalities primarily handled distribution⁴ and retail locally.

Post-EMA enactment and full participation in Nord Pool in 1998 saw significant shifts, particularly in the transmission network of 110 kV and above. The transmission departments of both Imatran Voima Oy and Phojolan Voima Oy merged into Fingrid, facilitating free market participation for power generation and retail companies. The 1996 mandate requiring separate accounting for generation and distribution companies introduced competition in local distribution and retail.

2.5 Trends and Business

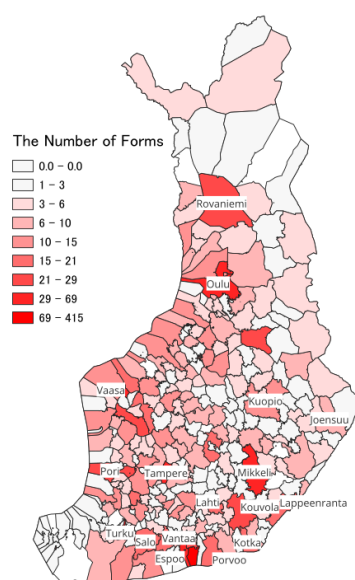


Figure 4 : The Number and Location of Energy Forms

Source: Produced by author

Analysis of data from the "Company and Organization Search" of The Business Information System (YTJ) reveals trends among energy businesses in Finland (for company count details, see Appendix 1). Finland hosts approximately 2,476 energy businesses, with 80% (or 2,063 companies) operating as Limited Companies (Osakeyhtiö). The industry-specific breakdown

³ For detailed information on the restructuring of the electricity market in Finland, please refer to the relevant literature mentioned herein.

⁴ The construction of transmission lines with a voltage of 110kV or less did not require approval from the Ministry of Economy, Trade and Industry (approval was necessary for voltages higher than this) (Pineau & Hämäläinen, 2000).



shows 919 entities in hydropower and wind power electricity production, and 549 in district heat and air conditioning production and distribution, indicating a decentralized energy production approach in Finland. Figure 4 shows the number and location of these entities. With 415 businesses in Helsinki and 512 in the broader metropolitan area⁵, the data suggests that the number of entities is proportional to city population sizes.

3. Municipality-Run Energy Businesses Analysis

In the preceding chapter, we examined the general energy sector. This chapter will analyze the current state of energy businesses operated by municipalities. Initially, we will delve into Finland’s municipal system and the legal framework governing the operation of public enterprises. This examination will lay the groundwork for understanding the structure, form, and types of public energy enterprises, followed by a discussion on their roles, location trends, and reliance on distribution networks as primary revenue sources in the electricity sector.

3.1 Municipalities and the Municipality Concern (Kunta Konserni) in Finland

Figure 3 illustrates the composition of electricity generation in Finland. The country is 80% self-sufficient in electricity, relying on imports for the remainder. Thermal power is the principal electricity source, followed by nuclear and hydropower. While the proportion of renewable energy, notably wind power, increases annually, solar power only contributes approximately 0.2% to total electricity generation.

3.2 Forms of Public Enterprises within the Municipality Group

Public enterprises within the Finnish Municipality Group can assume various forms, primarily categorized into four types as outlined in the following table:

Tytäryhteisö: En) Subsidiary	Independent entities, primarily operating as Limited Companies (Osakeyhtiö), with more than half of the voting rights.
Osakkuusyhteisö En) Associated company	Independent entities, often taking the form of Limited Companies (Osakeyhtiö), holding between one-fifth and half of the voting rights.
Liikelaitos En) Municipal enterprise	Departments within a municipality, enjoying a status of greater independence compared to other business units within the municipality.
Taseyksikkö En) A balance sheet unit	Departments within a municipality, enjoying a status of greater independence compared to other business units within the municipality.

Table 1: The Type of Municipality Concern

The distinction between Subsidiaries and Associated Companies is delineated by the 'Kirjanpitolaki' (Accounting Act), which is based on the ownership percentage held by the

⁵ The four cities of Helsinki, Espoo, Vantaa, and Kauniainen are often treated as the metropolitan area, though there isn't a clear definition for the capital region. In many cases, these four cities are collectively referred to as the capital area.

municipality.

As will be discussed in detail in the subsequent sections, a significant number of energy businesses operate as Tytäryhteisö (Subsidiary) and Osakkuusyhteisö (Associated Company). In other sectors, structures like housing, real estate management, and public facilities - including stadiums and skating rinks - often adopt these forms as well. Conversely, forms like Liikelaitos (Municipal Enterprise) ⁶and Taseyksikkö (Balance Sheet Unit) are prevalent in services like water supply operations and waste management.

3.3 Engagement of Municipalities in Energy Sector

Population of Municipality	A)The Number of Municipality	B) Municipalities Engaged in Energy Operations	C)The Number of Energy sector	A/B
1,000,000-500,000	1	1	2	100%
200,000-500,000	4	3	3	75%
100,000-200,000	4	4	7	100%
50,000-100,000	12	10	17	83%
20,000-50,000	32	20	26	63%
10,000-20,000	44	25	30	57%
5,000-10,000	71	36	51	51%
2,000-5,000	89	38	41	43%
1,000-2,000	37	7	8	19%
1-1000	15	0	0	0%

A total of 144 municipalities actively participates in the energy sector, with nearly half of them involved in various forms of energy operations, amounting to 186 different businesses⁷. Table 1 below presents the count of municipalities and businesses engaged in energy operations, categorized by population scale. A discernible trend from the data is the correlation between the size of a municipality's population and the likelihood of it owning energy operations; this propensity tends to diminish in municipalities with populations under 50,000.

For instance, Helsinki, the largest city with a population of approximately 664,000, owns Helen Oy and holds investments in Vantaan Energia Oy. In the population bracket of 200,000 to 500,000, cities like Tampere and Oulu (which are the hubs of Finland's second and fourth-largest urban areas respectively), along with Espoo and Vantaa (integral parts of the capital region alongside Helsinki), are present. Notably, among these, only Espoo does not possess energy operations⁸. Moreover, within the population range of 50,000 to 100,000, Hämeenlinna

⁶ In the YTJ (Finnish Business Information System), they are registered as "Municipality Business".

⁷ Only those registered with TUTUKI HALLINTOA.FI (2013) are counted.

⁸ Originally, the city of Espoo owned energy businesses. However, during the 2000s, it progressively sold off these businesses, completing the sale in 2006 (Jukka, 1992).



and Joensuu are the sole municipalities without energy operations.

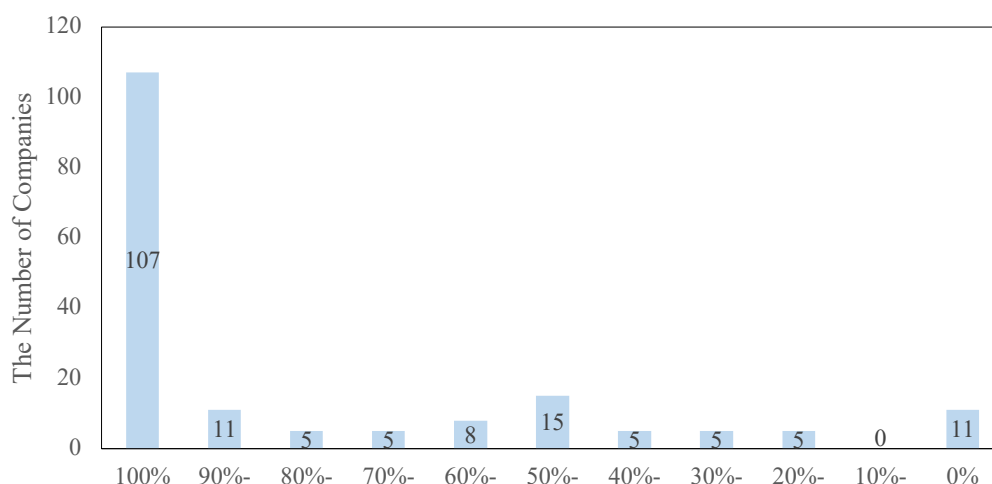


Figure 2: The rate of Ownership Stake

Source: Produced by author

Upon analyzing the ownership stakes and voting rights within these companies, we find that 107 companies—approximately 60% of the total—are wholly owned with a 100% ownership stake. Further, there are 150 companies where the ownership stake exceeds 50%. Conversely, there are nine companies with a 0% ownership stake; interestingly, six of these have a parent or investing company that is wholly owned by municipalities, effectively making them subsidiaries.

Next, we turn our attention to matters pertinent to public procurement. According to the Public Procurement Law (Laki julkisista hankinnoista ja käyttöoikeussopimuksista/1397), all candidate bidders must be afforded equal treatment in the procurement process, even if there’s a relationship with the procuring entity (as stipulated in Section 3) ⁹. However, an exemption to this rule exists for companies that hold the status of a “related department” (Sidosyksiköllä), with 56 business entities, all taking the form of limited companies, falling under this exemption. These exempted companies are potential candidates for collaborative energy supply initiatives with cities and other public enterprises.

Further examination of industries registered with YTJ, based on the TOL2008 classification, reveals that most companies, 99 in total, are engaged in the separate production and distribution of district heat and air conditioning. When considering the range of tasks municipalities are mandated within various industry types, it’s noteworthy that Combined Heat and Power (CHP)

⁹ "Sidosyksikkö" refers to a unit that is formally separate and independent from the procurement unit, as detailed in Section 15 of the Procurement Law. This law does not apply to procurements made by the procurement unit from its affiliated unit (sidosyksikkö). For this exemption to apply, the procurement unit, either alone or with others, must exercise control over the sidisyksikkö similar to its own operations. Additionally, the sidisyksikkö should conduct no more than five percent or up to 500,000 euros of its business with parties other than those procurement units controlling it. The sidisyksikkö's capital should not come from entities other than procurement units. (Laki julkisista hankinnoista ja käyttöoikeussopimuksistam, section 15)

production is a significant responsibility, accounting for 24.8% of the total. This data suggests that municipalities predominantly engage in heat supply-related tasks. This observed trend is likely a reflection of initiatives by municipalities to expand and develop district heating and similar services.

	Municipality(A)	All(B)	A/B
Separate production and distribution of district heat and air conditioning	99	549	18.0%
Combined heat and power production	37	149	24.8%
Transmission of electricity	16	156	10.3%
Distribution of electricity	12	123	9.8%
Trade of electricity	10	284	3.5%
Production of electricity with hydropower and wind power	6	919	0.7%
Heat and power production for industry	3	76	3.9%
Manufacture of gas	2	78	2.6%
Separate production of heat and air conditioning for industry	1	23	4.3%

Table 3: The classification of Industry

3.6 Distribution Network

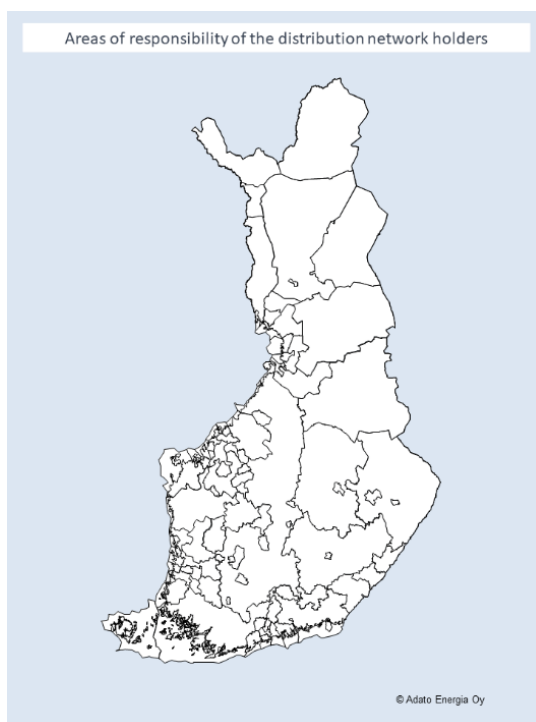


Figure 6. The Map of Distribution Network
Source: Adato Energia Oy (2023)

Figure 6 provides a visual representation of the specific areas of responsibility for distribution networks managed by different companies within Finland. Currently, the nation is home to 79 companies that are responsible for overseeing distribution networks¹⁰. The extent of the areas these companies cover varies significantly; while some manage extensive regions, others operate exclusively within the confines of municipalities.

In terms of company types, the landscape consists of one Public Limited Company, five Cooperatives, and the remainder are Limited Companies. It's notable that 41 of these distribution companies have affiliations with municipalities. This configuration means that approximately half of the distribution areas within the country are under the stewardship of companies that have some form of relationship with municipal bodies.

A more detailed breakdown of these municipally affiliated companies is as follows:

- 13 are 100% owned Subsidiaries.
- 3 are Subsidiaries but with less than 100% ownership.
- 2 are Associated Companies
- 23 operate as Sub-Subsidiaries

This composition underscores the substantial involvement of municipalities in the distribution sector, with participation characterized by various degrees of ownership and diverse forms of

¹⁰ The statistics from YTJ, which list 123 distribution companies, have discrepancies due to focusing only on the “Main line of business”. In this case, all companies involved in distribution are counted. Conversely, companies that conduct distribution as a subsidiary business are not counted in YTJ. For example, Helen Oy is listed in YTJ with “Combined heat and power production” as its main business, not accounting for its distribution operations.

affiliation, highlighting a complex and nuanced operational landscape.

4. Discussion and Conclusion

In Chapter 3, we explored the structures and trends of municipal energy businesses in Finland. In this chapter, we aim to draw implications through comparing Finnish municipal energy businesses with those in Japan and Germany, concluding with propositions for future research topics.

A notable trend within Finland's municipal energy sector is the prevalent operation of these businesses as Limited Companies, with distinct business sectors managed independently. These entities collectively form the 'Kunta Konserni', a group uniquely administered by municipalities. This approach contrasts with Germany's 'Stadtwerke', where various business sectors—including electricity, gas, water, cable television, and public pools—are integrated under a singular umbrella, with the parent company coordinating these diverse operations. In the Finnish model, the responsibility of coordination amongst various business units is shouldered by the municipalities' executive branches, as mandated by the 'Kuntalaki' (Local Government Act).

Japan's municipal energy landscape offers a point of comparison. With many of its municipal power companies operating as corporations and prefectures managing electric businesses as unified administrative entities, the Finnish model exhibits parallels with the Japanese approach. As noted by Inagaki (2022), it is commonplace for municipal electric businesses in Japan to function as corporations.

Despite these operational differences, there are instances in Finland that echo the 'Stadtwerke' model. For instance, 'Kemin Energia ja Vesi' in Kemi City initially provided only electricity and district heating under 'Kemin Energia Oy'. However, a strategic consolidation occurred in 2016 when it acquired shares of 'Kemin Vesi Oy', expanding its service portfolio to include water. There are eleven¹¹ other municipal companies in Finland that have embarked on similar integrative journeys, meriting further scrutiny.

This analysis yields several pivotal research questions for future exploration:

Transition to Limited Companies¹²: The predominant operation of municipal energy businesses in Finland as limited companies is intriguing. Understanding the impetus behind their transition from city departments and examining the evolving relationship dynamics between municipalities and these companies is crucial.

Operational and Revenue Planning: With many municipal energy businesses adopting the Limited Company structure and navigating within competitive markets, understanding their

¹¹ Here is the list : Tervolan Energia ja Vesi Oy, Vieremän Lämpö ja Vesi Oy, Pihtiputaan Lämpö ja Vesi Oy, Pyhäjärven Energia ja Vesi Oy, Ähtärin Energia ja Vesi Oy, Haapaveden Energia ja Vesi Oy, Kemijärven lämpö ja vesi Oy, Kuhmon VesiEnergia Oy, Mäntän Lämpövesi Oy, Mäntän Kaukolämpö ja Vesihuolto Oy, Kemin Energia ja Vesi Oy

¹² There are numerous examples of Finnish energy companies, and it would be useful to check the history or background of specific companies like "Tornion Energia Oy" and "Kemi Energia Oy" on their respective official websites for more information.



operational planning, revenue determination, and balancing between profitability and public service mandate is essential. This examination is especially crucial for businesses with pronounced regional characteristics, where pricing and service provision strategies significantly impact local citizens.

Profitability and Municipal Finance Contribution: The revenue and profitability dynamics of these municipal energy businesses and their financial contributions to municipalities warrant deeper investigation¹³. Future studies should explore how these entities bolster municipal finances, employing both in-depth case studies and cross-sectional analyses to yield comprehensive insights.

By addressing these research questions, future studies can offer valuable insights into the operational nuances and strategic choices of municipal energy businesses in Finland, providing a foundation for informed policy and business decision-making. Ensure to validate all data and references to produce a robust and reliable comparative analysis and research agenda.

Acknowledgments

This study was conceived and developed based on findings garnered during the overseas training segment of a renewable energy course conducted in February 2023. Furthermore, it draws significantly from the project titled "Regional Development Policy and Innovation in Finland during the Restructuring of the Welfare State," generously supported and facilitated by the Scandinavia-Nippon Sasakawa Foundation.

Additionally, the study considers and incorporates the results obtained from a visiting research stint at the Geography Unit of the University of Oulu, which took place starting in September 2023. Notably, valuable insights regarding Germany's Stadtwerke were provided by Assistant Professor Chihiro Shiraishi of the Department of Human Environment Studies at Hiroshima Shudo University. Professor Shiraishi's contribution was especially vital, as they accompanied and supported our training initiative in May 2023, providing essential perspective and analytical depth to our exploration and understanding of Stadtwerke.

We extend our heartfelt gratitude to all contributors, supporters, and participants who played a pivotal role in the various stages of this study, providing invaluable insights, guidance, and resources that significantly enriched the quality and depth of our research.

Reference

1. 稲垣 憲治 (2022). 地域新電力—脱炭素で稼ぐまちをつくる方法. 学芸出版社.
2. 諸富 徹(2018). 人口減少時代の都市 - 成熟型のまちづくりへ. 中央公論新社.
3. 土方 まりこ (2018). ドイツの地域鉄道政策における「生存配慮」概念の意義. 交通学研究, 61, 37-44.
4. 横山 純一(2019). 転機にたつフィンランド福祉国家 - 高齢者福祉の変化と地方財政調整制度の改革. 同文館出版社
5. Statistics Finland (2023a). Supply of electricity by energy source, 1990-2022.

¹³ Helen Oy and Oulun Energia Oy are representative example.

6. Statistics Finland (2023b). Final energy consumption by sector, 1970-2022.
7. Statistics Finland (2023c). Supplies and total consumption of electricity, 1992-2023.
8. Finnish Energy (2023). District Heating. Retrieved from https://energia.fi/en/energy_sector_in_finland/energy_production/district_heating
9. The Ministry of Economic Affairs and Employment of Finland (2023). Heating Market. Retrieved from <https://tem.fi/en/heating-market>
10. Esping-Andersen, G. (1990). The Three Worlds of Welfare Capitalism. Princeton University Press.
11. Pineau, O. & Hämäläinen, R. P. (2000). A perspective on the restructuring of the Finnish electricity market. Energy Policy, Vol.28, No.3, pp.181-192.
12. Jukka, E. (1992). Energiavirtoja - Espoon Sähkö oy 75 vuotta. Espoon sähkö oy.
13. YTJ (2023). Company and Organization Search. Retrieved from <https://tietopalvelu.ytj.fi/>
14. TUTUKI HALLINTOA.FI (2023). Kunta Konserni. Retrieved from <https://www.tutkihallintoa.fi/kunnat/kuntakonsernit/>
15. Adato Energia Oy (2023). Jakeluverkon haltijoiden vastuualueet -kartta. Retrieved from <https://verkkokauppa.adato.fi/Verkkokauppa/Tuotesivu/jakeluverkonhaltijoidenvastuualueet-kartta-pptx>