

# Trust and Transparency in Electricity Distribution – the Role of Social Responsibility Disclosures in Natural Monopoly Market

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**Abstract**— Electricity distribution companies (DSOs) are natural monopolies in their respective network areas. Ownership varies, from private companies to consumer cooperatives to some form of public sector ownership. A core challenge for all actors in the electricity sector is dealing with change arising from climate concerns. Among these, the timing of consumption is considered very important, and the price of electrical power is important in determining total price. Dealing with price variation is routine for large consumers but an unintelligible black box for households. Shifting household electricity consumption is the objective of dynamic tariffs used by some electricity transmission companies. However, even if households were able to respond to dynamic tariffs, they would need to trust their electricity distributor to follow their advice. Trust depends on understanding the fundamental character of the business to be trusted, in this case, the distributor company. Whereas the natural monopoly character of the distribution company is well understood in economics and regulation, households are not as well informed. This paper starts with the link between households and electricity distributors. It investigates the disclosures related to social responsibility as an indicator of the extent to which distribution companies disclose information about their special market character to households. We use disclosures made to regulators to comply with the EU CSRD directive regarding the Corporate Social Performance of Companies to trace whether or not distributors acknowledge their monopoly characteristics.

**Index Terms**— trust, transparency, CSR disclosures, distribution system operator (DSOs), nature monopoly

## I. INTRODUCTION

After the deregulation of the electricity market, competition was introduced among electricity retailers, while the electricity transmission and distribution businesses remained natural monopolies[1]. The main reason behind this is to make network companies focus only on operating their network and improve the efficiency and quality of their service[1]. Moreover, the separation between the distribution business and electricity retailer was also expected to improve the quality of the regulation and network performance evaluation[1]. As a natural monopoly network operator, the electricity transportation

industry has high fixed costs and low or decreasing marginal costs. Electricity transition and distribution companies are regulated to maintain fair prices and deliver efficient services to customers. Over the past 10 years, the number of Danish electricity distribution firms (operators or DSOs), has decreased substantially from 92 in 2008 to 44 in 2018 due to a series of mergers among companies[2]. Appendix A provides an overview of the geographical location of different distribution firms in Denmark.

The integrated electricity companies of the past were legally unbundled as natural monopolies and electricity sellers, they are nevertheless mostly owned by the electricity retailers. The top 10 largest distribution companies account for nearly 90% of the market. Table 1 provides an overview of Denmark's top 10 largest distribution companies. Radius, Cerius dominate Sjælland whereas Vores, Konstant, and N1 are the dominant geographic players in Fyn and Jutland.

Table 1. An overview of the top ten largest DSOs in Denmark

	Number of customers	Total electricity delivered (GWh)	Net revenue
Radius	1057000	7980.6	2456175
Cerius	408937	3998	1113490
Vores	220000	2345	474836
Konstant	235000	2123.5	516528
Nord Energi	100000	945.8	192007
Tre-for	137000	1843.2	290250
Dinel	111000	919.6	257196
N1	802300	8796.6	1697871
Elværk	44600	482.9	121067
RAH	53000	998.9	181395

Note: Net revenue is in thousands of Danish Kroner (DKK). Numbers are data in 2023.

Economies of scale can act as the driving factor for these merges, and customers should benefit from it by paying lower tariffs. Table 2 shows the tariffs for residential consumers from the ten largest distribution firms. The highest tariffs are approximately four times higher than the lowest, regardless of the load periods. This tariff difference means that consumers in neighboring regions pay for the same product at different rates. Business conditions and quality of service vary little in a small, flat country with very few delivery disruptions. Consequently, one may ask whether the DSOs as monopolies are inefficient or exploit the consumers in some way, or both.

Table 2. Statistics of grid tariff of major DSOs (unit in Øre/kWh)

Company name	Low	Summer tariff		Winter tariff	
		High	Peak	High	Peak
Tre-for (East)	17.12	25.68	66.77	51.36	154.08
Radius	12.15	18.22	47.38	36.45	109.34
Cerius	11.26	16.89	43.91	33.78	101.33
Vores	6.31	9.47	24.62	18.94	56.81
Konstant*	6.61	9.91	25.78	19.82	59.48
Nord Energi	5.88	8.82	22.93	17.64	52.91
Tre-for (West)	6.13	9.2	23.91	18.39	55.17
Dinel	8.82	13.23	34.39	26.45	79.36
N1	4.46	6.70	17.41	13.39	40.18
Elværk	9.08	13.61	35.40	27.23	81.69
RAH	10.16	15.25	39.65	30.50	91.49
Min	4.46	6.7	17.41	13.39	40.18
Max	17.12	25.68	66.77	51.36	154.08
Medium	8.82	13.23	34.39	26.45	79.36
Mean	8.91	13.36	34.74	26.72	80.17
S.D.	3.66	5.48	14.26	10.97	32.91

Note: \* The Tariff includes a 20% discount in 2023. S.D. = standard deviation. The numbers are data from 2023. High, Low, and Peak refer to different load periods.

10 Øre ≈ 0.0134 Euro cents

Source: Authors' summary based on the information from the distribution firms' homepages.

Table 3 shows the major financial performance indicators for the top ten electricity distribution firms. The major DSOs had a very high gross margin, and EBIT and return on equity (ROE) are different financial metrics.

According to BDO, one of the largest advisory and accounting firms in Denmark, there was a discrepancy between DSOs annual report and the regulatory report in terms of major financial matrices such as EBIT and net asset value between 2013 and 2017[3]. The reasons for the discrepancy may be attributed to accounting principles for capitalization and depreciation, respectively[3].

As natural monopolies, DSOs must disclose their activities and performance to the regulatory authorities. Given the differences in tariffs and high gross margins, an obvious question arises regarding the trustworthiness and transparency of their reporting. The objective of this paper is to investigate

the trustworthiness and transparency of both financial and CSR disclosure of Danish DSOs.

Table 3: Major financial performance of DSOs

In %	Gross margin	EBIT %	Equity Ratio	Return on Equity
Radius	58.0	30.5	18.1	13.7
Cerius	54.3	27.2	29.6	6.7
Vores	69.6	31.1	30.4	10.3
Konstant Nord Energi	69.0	38.0	31.0	17.0
Tre-for	62.7	7.0	17.3	4.0
Dinel	73.2	37.3	64.1	7.5
N1	66.0	3.1	37.4	1.2
Elværk	66.8	30.2	76.9	5.3
RAH	75.3	20.1	65.4	4.0

Note: EBIT=earnings before income and tax. Numbers are data in 2023.

Source: Numbers are taken from the companies' 2023 annual reports, which are publicly accessible from the Central Business Register from <https://datacvr.virk.dk/>.

This paper is organized with a theoretical section that outlines the arguments supporting the two different aspects of disclosure identified. For regulatory annual reports, the argument for requiring such is that these reports give consumers access to data related directly or indirectly to the efficiency of each DSO, and consumers can, in theory, draw their own conclusions as to whether one DSO is more or less efficient than comparable DSOs. For CSR disclosures, the regulatory framework is equally clear: Companies of a certain size must publish detailed reports on their corporate social responsibility. Less clear are the theoretical arguments underpinning the rules in this area.

## II. LITERATURE REVIEW

In this section, we first review the literature on the regulatory framework for electricity distribution, followed by a review of the literature on corporate social responsibility disclosure. We then examine the literature on regulatory control over the disclosure of corporate information by monopolistic firms.

The regulatory framework for electricity distribution

Natural monopolies are expected to reduce their average and marginal costs with scale. There are two main forms of regulation for electricity distribution: "cost-plus" and "incentive" regulation[4]. Under the cost-plus regulation, the regulated firms are allowed to set consumer prices equal to actual costs plus a reasonable rate of return on the invested capital[4]. This approach provides no incentives for monopolies to increase productivity to reduce costs or limit cost increases[4]. The incentive regulation approach refers to the regulator setting a price cap or revenue cap for the monopoly based on its performance[4]. The difficulty in a price cap incentive regulation is to assess the appropriate measure of performance. This is usually the expected productivity growth

for the monopoly[4]. On the one hand, the monopoly will have less incentive to increase productivity if the assumed productivity growth is set too low, as it can still earn above-normal profits. On the other hand, the monopoly may encounter financial difficulties when the expected productivity growth is set too high. The difficulty in using a revenue cap incentive regulation is to determine the appropriate expected increase in performance and productivity growth[4]. To overcome the issues associated by incentive regulation, regulators often use benchmarking as a basis for improving efficiency among comparable monopolies[4]. Regulators can assess the efficiency of each company by comparing their productivity, and then determine the revenue cap and/or price cap for each company in the industry, incorporating a specified productivity improvement based on benchmarking data[4]. According to CEER (Council of European Energy Regulators), most EU countries practice incentive regulation, while a few use cost-plus regulation in the electricity distribution sector[5]. The Danish Utility Regulator (DUR) is using the revenue cap approach for regulating electricity distribution business [5]. One challenge with benchmarking in the context of incentive regulation is that it is difficult to create a model that accurately measures the performance of every monopoly and is suitable for comparing all monopolies. According to Angrell and Teusch, there is also a problem related to strategic behavior in an incentive-based regulation system [4]. These strategic behaviors include that a monopoly firm can 1) deliberately report incorrect data to increase the efficiency results in the regulation model, 2) make strategic investment decisions based on how this will make the firm perform in the regulatory model, or 3) merge with one or several of the most efficient firms to make the merged business become relatively more efficient than the remaining unmerged firms. Finally, the electricity distribution firm's parent company can try to transfer its operation costs to its subsidiaries to increase the "cost base" in the regulation model[4].

Therefore, the accurate and reliable disclosure of the electricity distribution companies is crucial for the regulation of their business.

#### Corporate social responsibility disclosure

Corporate social responsibility (CSR) plays an important role in encouraging companies/organizations to go beyond their economic responsibilities and address their social and environmental concerns. CSR can help businesses gain or maintain legitimacy with relevant stakeholders[6]. In a natural monopoly setting, regulatory authorities can use CSR disclosures to hold companies accountable for socially irresponsible practices. Several theories, such as institutional theory, social contract theory, legitimacy theory, stakeholder theory, etc., can support the firm/organization's CSR practice.[7]. Among these, legitimacy theory and stakeholder theory are widely used theories to explain the disclosure of CSR[8].

According to Suchman, legitimacy refers to "a generalized perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions." [9] The legitimacy theory is constructive[8]. It

emphasizes that business entities should strive to ensure they operate within acceptable standards and that their actions are considered "legitimate" by communities[8, 10]. Furthermore, external stakeholders expect business entities to follow economic principles and be transparent[11]. Thus, the legitimacy theory is often related to how business entities disseminate information about their practices to gain a license to operate[6, 7].

Stakeholder theory explains the interactions between the management decisions of an organization and its stakeholders[12]. It addresses morals and values in managing an organization. An important element in stakeholder theory is stakeholder engagement. Accord to Greenwood, stakeholder engagement refers to "practices which the organization takes to involve stakeholders in a positive manner in organizational activities"[13]. Stakeholder engagement is an important means to build stakeholder relations in stakeholder management[14]. CSR disclosure can serve as a strategic tool for natural monopolies to improve stakeholder engagement and commitment.

The literature on organizational information disclosure suggests that an effective disclosure practice is important for building trust, enhancing accountability, and stimulating sustainable practices within organizations. The theory of organizational information disclosure is multidimensional, encompassing transparency, stakeholder engagement, and the mitigation of information asymmetry. Transparent information disclosure, often of high quality, can help reduce uncertainty and information asymmetry, thereby fostering trust and enhancing organizational legitimacy[15]. Stakeholders' demand for increased CSR disclosures can be attributed to the desire to gain or maintain credibility[8]. The more accurate the information available to consumers, the more they are willing to pay for a product labeled as socially responsible (or "green"), creating stronger incentives for firms to adopt responsible products and methods.[16] Improved information accuracy benefits both monopolist firms and competing companies seeking to attract "conscious" consumers[16]. Lastly, effective CSR disclosure can enhance a company's financial outcomes.

While companies can be honest or silent, two primary forms of CSR disclosure dominate corporate sustainability disclosure: greenwashing and brownwashing. Greenwashing refers to the practice of companies exaggerating or portraying their environmental and social efforts to create a false impression of responsibility while brownwashing involves underreporting or downplaying actual environmental and social performance in order to not appear wasteful to investors[17]. Both practices can significantly affect stakeholder perceptions and corporate legitimacy. Greenwashing involves exaggeration while brownwashing may arise from a fear of backlash due to perceived overcommitment to sustainability efforts. This underreporting can lead to confusion among stakeholders, making it challenging to distinguish between companies truly dedicated to sustainable practices and those merely engaging in symbolic actions[17]. According to Lyon and Maxwell, firms are more likely to engage in greenwashing, especially when their environmental performance is below expectations[18]. The probability of such dishonest practices increases when

there is a risk of audits and penalties from external stakeholders such as non-governmental organizations (NGOs)[18].

Finally, research revealed that information asymmetry is negatively correlated with the quality of the annual report and investor relations activities but positively correlated with the quality of quarterly report disclosures[15].

Regulatory control on monopolistic firms' corporate information disclosure

DSOs hold absolute market power in their geographic regions, which can lead to information asymmetries and negatively impact market efficiency. Saglam investigated the influence of regulation on monopolistic firms' price setting and concluded that a monopolistic firm would respond to regulatory threats by adjusting its price strategies[19]. Iossa & Stroffolini suggested that regulated monopolists have stronger incentives to disclose information as compared to their unregulated counterparts[20]. Therefore, regulatory frameworks that impose disclosure requirements — based on the principle of transparency and aimed at protecting consumers — can help mitigate these negative effects.

Several aspects of regulatory control can influence a monopolist's incentives to disclose information: privacy regulation[21], and consumer awareness[22]. Lefouili et al. suggested that the share of privacy-concerned users can influence the relationship between privacy regulation and innovation[21]. A small share of privacy-concerned users harms innovation and vice versa[21]. Li et al. found that a large share of unaware consumers can lead to reduced information disclosure by monopolists, as firms may prefer to target informed consumers to maximize their profits[22].

Thus, energy policymakers can design more effective regulatory frameworks by understanding the interplay between regulations, consumer awareness, and information asymmetries. This understanding can encourage monopolists to be more trustworthy and better protect consumer welfare.

### III. METHODOLOGY

To answer the research question, we examine three aspects of information disclosure by Danish electricity distribution companies (DSOs). One is the annual regulatory disclosure submitted to the Danish Utility Regulator (DUR). We have restricted our analysis to the ten largest DSOs. Most of these are operated as wholly owned subsidiaries of electricity retailing companies, which are, in turn, organized as consumer-owned cooperatives. The subsidiaries are regulated entities, and they can comply with legislation if they submit their annual reports in a special regulatory annual report. The second aspect is the extent to which the same sample of companies makes their special character clear to consumers in their sustainability reports. Since they are subsidiaries of corporations with a cooperative ownership structure, these 10 DSOs do not publish their own CSR reports, nor do they publicize the content of their regulatory filings.

### IV. RESULTS

Danish Utility Regulators (DUR) publish regulatory filings, and the management reports of DSOs every year, which are publicly accessible on the DUR's homepage (<https://forsyningstilsynet.dk/>). The regulatory report follows the legitimacy framework, outlined in the *Executive Order on grid companies' regulatory accounts* (BEK nr 816 af 07/06/2022)[23]. It describes, among other things, income, costs, and investments in the network assets. The related management report typically includes comments from management on how the methods and results in the regulatory reports deviate from the DUR's guidelines.

Table 4 reveals the latest discrepancies between the annual reports and regulatory reports of the top 10 DSOs. There is a gap between the information disclosed in the DSOs' annual reports and the data in their self-reported regulatory accounting reports. The gross revenue reported in the DSOs' annual reports is significantly lower than the figures in their regulatory reports for most companies, except for Elværk and Nord Energi. For Elværk, there was no difference between the annual report and their self-reported regulatory annual report, but Nord Energi reported a higher gross income in their annual report than in their self-reported regulatory report. The discrepancies can be as large as several million Danish Kroner. Additionally, DSOs appear to report higher operating costs in their annual reports compared to the figures in their self-reported regulatory annual reports. Some of the distance between the reports may be the result of methodological variation but neither DSOs nor regulators appear to take any notice or seek to explain the differences. In any case these are relatively small compared to total annual revenue.

We classify the extent of the management reports of DSOs into three categories: large, moderate, and limited. The evaluation is based on whether the management reports include the following aspects: the DSO's main activities, financial condition, uncertainties and risks to the business, major activities such as investments and sales during the financial year, accounting principles, net losses, the efficiency requirements set by DUR, adjustments in the regulatory report, differences in net loss compensation between self-reporting and results from the Danish Energy Agency, increases in income limits, tariff models, sustainability, and impacts on consumers.

Among the management reports of the TOP 10 DSOs, Radius and Cerius provided very detailed management statements about their regulatory reports. Cerius reported the efficiency requirements set by DUR from 2020 to 2022, which were 10.1, 12.77, and 9.72 million DKK, respectively. Radius reported the efficiency requirements set by DUR from 2020 to 2022, which were 30.1, 27.6, and 22.6 million DKK, respectively. Both Radius and Cerius are 100% subsidiaries of the largest electricity retail company, Anel.

Konstant ranks at the top of the benchmark for economic efficiency among all grid companies in Denmark[24], with N1 and Nord Energi also being among the most efficient[25, 26]. However, Vores, Dinel, Trefor, Elværk, and RAH's management reports do not disclose economic efficiency information[27]. Elværk and RAH provide limited information

in their management reports, offering only basic details about net losses, accounting principles, etc.[27].

Table 4 The extent of information disclosure on the regulatory report and the management report of DSOs

	Differences between annual report (AR) and regulatory accounting report (RR) in gross income	Management report
Radius	AR<RR	Large
Cerius	AR<RR	Large
Vores	AR<RR	Large
Konstant	AR<RR	Large
Nord Energi	AR>RR	Medium
Tre-for	AR<RR	Medium
Dinel	AR<RR	Limited
N1	AR<RR	Large
Elværk	No difference	Limited
RAH	AR<RR	Limited

Note: The differences are only based on the Datafile which is available upon request. The data for comparison are based on the financial calendar year 2023.

Source: Own summary based on DSOs annual reports, regulatory annual reports by the Danish Utility Regulator, and management reports[24-33].

DSOs’ annual reports contain only financial metrics. They do not disclose any information about CSR. We decided to review the annual reports of their related parent companies. We included four major elements in CSR disclosure that are directly linked to DSOs: the nature of the firm, key events in the financial year, consumers’ rights, and future perspectives. Table 5 sums up the disclosures of notes in the annual report material reviewed. We examined both the annual reports, and the CSR reports available. Column 1 indicates that the parent companies do not mention the phrase “monopoly” in their regular annual reports. One company mentioned the phrase “monopoly” but in a manner that was clearly inadvertent rather than as part of any substantial disclosure of the monopoly character that is integral to all utilities. They do mention key events and expected future developments (column 2 & 4) but are only superficial with respect to consumer rights and membership of internal governance arrangements. The same lack of concern for the risks associated with monopoly characterizes the CSR report, even though electricity is not the only network industry involved. The electricity companies are also involved in natural gas, water, household waste and broadband, all industries with elements of monopolistic competition at their core.

Table 5: Results of CSR disclosure of DSO’s parent company

DSO	Parent company	Elements in CSR Information Disclosure			
		1	2	3	4
Radius	Andel	N	Y	N	Y
Cerius	Andel	N	Y	N	Y
Vores	Energi Fyn	N	Y	N	Y
Konstant	NRGi	Y	Y	N	Y
Nord Energi	Nord Energi	N	Y	N	Y
Tre-for	EWII	N	Y	N	Y
Dinel	AURA	N	Y	N	Y
N1	Norlys	N	Y	N	Y
Elværk	Thy-Mors Energi	N	Y	N	Y
RAH	RAH Elhandel	N	Y	N	Y

Note: 1 = Clearly mention their monopolistic distribution firm  
 2= Key events in the financial year  
 3= Consumers’ right  
 4= Future perspectives  
 Y= Yes, N= No.

Source: Based on the annual reports of the parent company of DSOs [24-26, 28-42]

## V. CONCLUSION AND DISCUSSION

In summary, electricity distribution companies are very quiet about governance and efficiency. The corporate parents are more voluble but there is no evidence that there is an awareness of the special type of firm that forms part of the parent companies. A company that does not acknowledge the importance of fair tariffs (for the service of moving electricity) and fair governance that ensures overall operational efficiency should be subject to intense scrutiny. Transparency and disclosure practices are essential for monitoring effectiveness and ensuring the social responsibility of natural monopolies. The information disclosure practices of Danish DSOs align poorly with their obligations regarding legal requirements for natural monopolies. Transparent CSR disclosure, tariff structures that account for emerging technologies, and a focus on improving the quality of CSR disclosures are crucial for these companies if they are to meet the expectations of various stakeholders.

In this study, we found a discrepancy between the DSOs’ annual reports and their self-reported regulatory annual reports. Unfortunately, we are unable to determine the reasons for this, other than the limited information available regarding accounting principles. CSR reports from DSOs in Denmark are only reported by the parent company, which covers a range of businesses, including electricity supply, internet and TV services, water supply, and heating, among others. All the annual financial reports and nearly all CSR reports fail to mention the monopoly character of part of the DSO. Even if they look ahead and even if they review some aspects of past performance, they fail to include information on their efficiency gains, even if this matter is of great relevance to all

customers, large and small. the four elements identified in this study. Similarly, we did not observe consumer rights being disclosed in any of the CSR reports.

Detailed benchmarking and learning from high-efficiency companies could help lower-efficiency companies improve their performance. Seven of the ten largest firms have reported their economic efficiency in the electricity distribution sector. Three of them stated that they were among the most efficient firms, two mentioned that they had received efficiency requirements from the DUR over the past three years, two mentioned that they did not receive any efficiency requirements from DUR, and the remaining firms did not mention efficiency requirements at all[24-33]. It is worth noting that the top five largest DSOs share a consensus that implementing economic efficiency requirements for each DSO faces significant challenges and considerable uncertainty. Therefore, there is a need to redesign the current model for efficiency requirements to meet the goals of the green transition and ensure future supply security. The current model of efficiency regulation focuses narrowly on economic efficiency, as it should. However, the net product of ambiguous regulatory filings by DSOs in Denmark at best makes it very difficult for consumers to navigate DSO activities.

Given the questionable transparency in the disclosure of cooperation information by Danish electricity distribution firms (DSOs), it is difficult to understand the rationales behind many mergers between DSOs and the effects of those mergers. One direction for further research could be to investigate the reasons and processes behind these mergers, such as how the mergers were implemented and whether external stakeholders are adequately informed. This could be done through qualitative interviews, alongside an analysis of the specific filings made by DSOs to the regulator, DUR, and DUR's decisions on approving such mergers and granting operating licenses.

Furthermore, there is also a need to increase consumer awareness of DSOs regarding their business and information disclosure. According to previous studies, consumers are often confused about DSOs and their parent companies, electricity retailers[43]. Although paying electricity bills has become simple, it is still difficult for consumers to understand the billing details, especially the grid tariffs, why they received discounts during certain periods, and why they paid significantly more than their neighbors. As indirect owners of the distribution network, consumers can play a more active role in monitoring DSOs and their major decisions, such as investments, mergers, and acquisitions. Energy policymakers will need to consider how to involve consumers in ensuring the efficient operation of DSOs in the future, which could contribute to more effective regulations. A good control environment can ensure the reliability and credibility of the CSR information disclosure of DSOs.

The most radical solution would be to separate ownership of Electricity sales and DSOs, possibly leaving the DSOs as consumer-owned consumer cooperatives. This would break up

the large regional supply utilities and complete the unbundling advocated in the three EU Electricity directives.

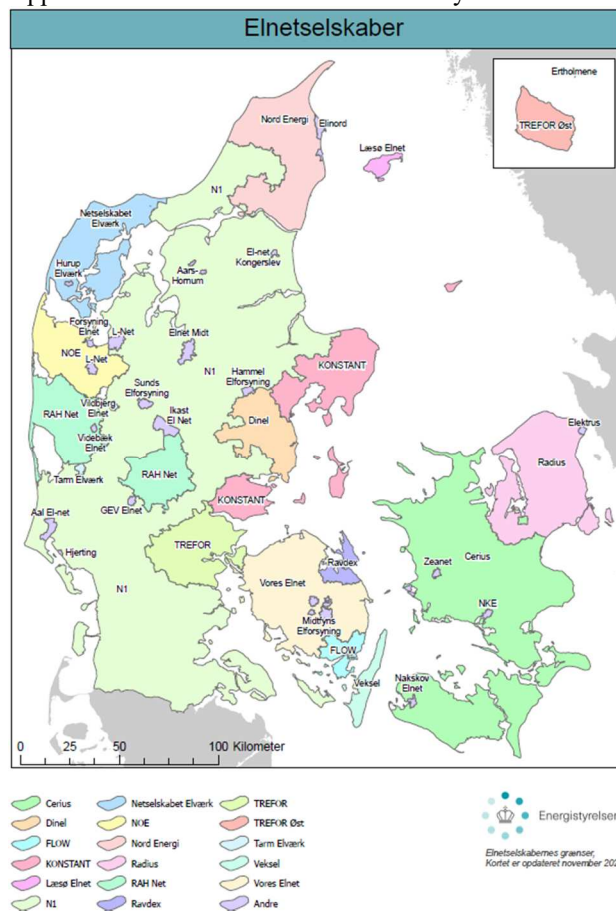
Finally, one of the limitations of this study is that the findings are highly specific to the Danish context. A comparative analysis among EU member states could be conducted to strengthen the significance of the results. Additionally, further studies, future studies such as the development of a transparency index that includes weighted indicators for different dimensions, could serve as useful tools for measuring the level of disclosure among DSOs and providing insights to improve the regulatory framework.

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## Appendix A: An overview of electricity distribution firms



Source: Danish Energy Agency (2022). Elnetselskaber, Available at <https://ens.dk/sites/ens.dk/files/Statistik/elnetgraenser.pdf>