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**EVALUATION OF MARKET POTENTIAL IN
NEW GEOGRAPHIC ELECTRICITY MARKETS**
OTC Trading Marketplaces

ABSTRACT

Estefanía Hernández: Evaluation of Market Potential in New Geographic Electricity Markets - OTC Trading Marketplaces

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The demand for more advanced technological and digitalized solutions is not only being motivated by technological changes, but also the present transition of the energy industry towards cleaner energy and efficiency. Companies within the electricity sector are capitalizing on these shifts by developing innovative digital platforms that meet such present market needs. Moreover, many companies are aware that different geographic areas present these energy transition characteristics in the market and thus motivate them to expand geographically. Nevertheless, the electricity market presents complex dynamics, especially in the wholesale sector—where electricity is actively bought and sold—creating a big challenge for companies entering such a market. This significant challenge arises primarily because evaluating market potential in the electricity sector requires more than traditional economic and qualitative metrics, it needs a deep and comprehensive analysis that incorporates quantitative metrics with a rigorous evaluation of external operational factors that directly impact the adoption and usability of the platform.

The objective of this thesis is to develop a framework for assessing market potential for an OTC electricity trading platform aiming to enter the U.S. electricity market. The framework integrates quantitative metrics with critical operational dynamics factors, such as regulatory framework, grid infrastructure, wholesale market liquidity, and electricity demand, to evaluate the attractiveness of the market. In order to develop the proposed framework, the first stage consists of analyzing the German electricity market and identify the critical operational factors. Furthermore, the second stage includes analyzing such critical operational factors in the U.S. electricity market and once the three most potential states are identified, apply them quantitative metrics to identify the state with the highest quantitative market potential. This framework allows for a detailed comparison of market readiness and identification of optimal entry points for the case company.

The results after applying the proposed framework indicate that the three specific U.S. states that present high market potential due to favorable regulatory conditions, well-connected infrastructure, high electricity demand, strong level of market liquidity, and significant economic metrics are Ohio, Pennsylvania and New York. However, among these three states, Ohio stands out as the state with the highest economic potential. The findings underscore the importance of aligning market demand with operational feasibility to facilitate successful platform adoption. This framework provides a practical tool for energy trading firms to prioritize regions with high growth potential and operational readiness, and it suggests directions for future research to further enhance market entry strategies within the evolving electricity sector.

Keywords: Market Potential, New Geographic Market, Operational Factors, Electricity Trading, OTC Trading, Wholesale Electricity Market.

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PREFACE

The inspiration for this research emerged from a conversation with one of the CEOs at the case company while discussing potential topics for my master's thesis, which I was fortunate to undertake being employed as growth revenue working student. Initially, the idea centered on developing a commercialization plan to launch the product in a non-European market. However, following advice from my thesis supervisor at the company, the scope of the thesis evolved to focus on creating a framework to evaluate both quantitative and qualitative market potential. This shift was considered more beneficial, as the company lacked a tool to systematically assess the market potential for product expansion into new geographic regions. The resulting framework is thus the company's first tool designed specifically to aid in evaluating new market opportunities.

My experience working at this company has been deeply enriching, offering me the chance to expand my knowledge across not only business development but also multiple other domains. This has strengthened the skillset I aspire to bring to my professional career—a blend of both technical expertise and business acumen. I am sincerely grateful for the opportunity to work in Germany and collaborate with such talented individuals.

I would like to extend my gratitude the case company for supporting my thesis work. Additionally, I am profoundly grateful to my university thesis supervisors, Jussi Valta and Ulla Saari, for their invaluable guidance throughout this process. Lastly, I am especially thankful to my family for their unconditional support, which has motivated me to pursue my master's studies in Finland and Germany, and to my friends, who shared unforgettable moments with me along this journey.

Tampere, 16 November 2024.

Estefanía Hernández

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LIST OF SYMBOLS AND ABBREVIATIONS

ACER	Agency for the Cooperation of Energy Regulators
AF	Access Fee
B2B	Business-to-Business
B2C	Business-to-Consumer
DACH	Alemania, Austria and Switzerland
DSO	Distributor System Operator
EEX	European Energy Exchange
EEG	Renewable Energy Law
EnWG	German Energy Industry Act
EU	European Union
FERC	Federal Energy Regulatory Commission
ISO	Independent System Operator
ISO-NE	Independent System Operator New England
MWh	Megawatt-hour
MISO	Midcontinent Independent System Operator
NAICS	North America Industry Classification System
NYISO	New York Independent System Operator
OFGEM	Office of Gas and Electricity Markets
OTC	Over-The-Counter
PUC	Public Utility Commission
RSO	Regional System Operator
SaaS	Software as a Service
SPP	Southwest Power Pool
TF	Trading Fee
TSO	Transmission System Operator
TWh	Terawatt-hour
U.S.	United States

1. INTRODUCTION

1.1 Research background

In the contemporary global economy, companies are increasingly driven to explore and penetrate new geographic markets as part of their growth strategies (Cavusgil et al., 2017). Expanding into new regions offers different opportunities, including access to untapped customer bases, diversification of revenue streams, and leverage of emerging market potentials (Rossum, 2017). However, companies must undertake a meticulous process of evaluating the potential of the market to ensure that their entry will yield favorable outcomes and align with their strategic objectives.

According to Kotler and Keller (2016), the analysis of market potential allows companies to categorize countries and quantify market potential. Consequently, organizations are able to identify growth drivers and barriers, and at the same time develop strategies to effectively exploit growth by tailoring their products or services accordingly. It is possible to categorize market potential into two broadly different dimensions: quantitative and qualitative. Quantitative analysis involves measuring the size, revenue, growth, and profitability of a market using numerical data and statistical analysis (Kotler and Keller, 2016). On the other hand, the qualitative dimension is further sub-categorized. One qualitative sub-category is known as cultural alignment, referring to the degree of how much the values and behaviors align with the existing market (Hofstede, 2001; Trompenaars and Hampden, 1997). Moreover, the analysis of the competitive landscape (Porter, 1979; Prahalad and Hamel, 1990) is another sub-category of the qualitative dimension. Additionally, another sub-category includes network relationships. This analysis oversees characteristics that shape and influence the connection, interactions, and relationships between businesses and organizations within a market (Coviello and Munro, 1998). These qualitative factors, although less tangible, are crucial in determining how well the products or services of a company will be received in a new region.

Existing literature provides extensive insights about market potential quantification through different metrics and models (Simkin and Dibb, 1998; Vitale et al., 2011). Similarly, there is extensive literature about qualitative factors related to cultural alignment (Hofstede, 2001; Trompenaars and Hampden, 1997), competitive landscape (Porter, 1979; Prahalad and Hamel, 1990), and network relationships (Coviello and Munro, 1998; Ellis, 2000). However, the existing literature does not offer a holistic evaluation of market potential when considering the operational dynamics factors that can significantly impact the success in the market.

In some cases, the nature of the product or service offered requires a more holistic and comprehensive approach to evaluate the potential of the market. Even if quantitative metrics,

contextual elements, and network relationships factors are positive, the practical realities of operational dynamics elements can hold back successful market penetration. Operational dynamics elements refer to the external macro-environmental factors that influence the adoption and operability of the product in the dimensions of political, economic, social and technological. These factors might be determined based on the different categories of the PEST analysis. If these operational dynamics factors are not well-aligned with the product offerings of the company, the organization may face substantial challenges, potentially resulting in market failure.

This gap in the literature is particularly evident in specialized sectors such as the electricity market, which is heavily regulated at multiple levels. As noted by Lenz (2019), the electricity market is governed by a complex framework of national and international regulations, designed to ensure market stability, security of supply, and fair competition. These regulations include areas such as prices in the market, grid network access, environmental standards, and the integration of renewable sources (Joskow, 2008). Regulatory bodies, such as national regulative authorities and at a higher level, the European Union, require strict compliance on the different participants in the market such as utilities, traders, and grid operators. Additionally, the existing regulations directly control the conditions under which new market entrants can participate, thus influencing the overall market structure and competitive dynamics. Joskow (2008) advises that market regulations, infrastructure requirements, and market mechanisms, are essential to understand the especial dynamics of the electricity market. Figure 1 illustrates how this research thesis aligns with the process of entering new geographic markets and how it addresses the existing gap in the literature.

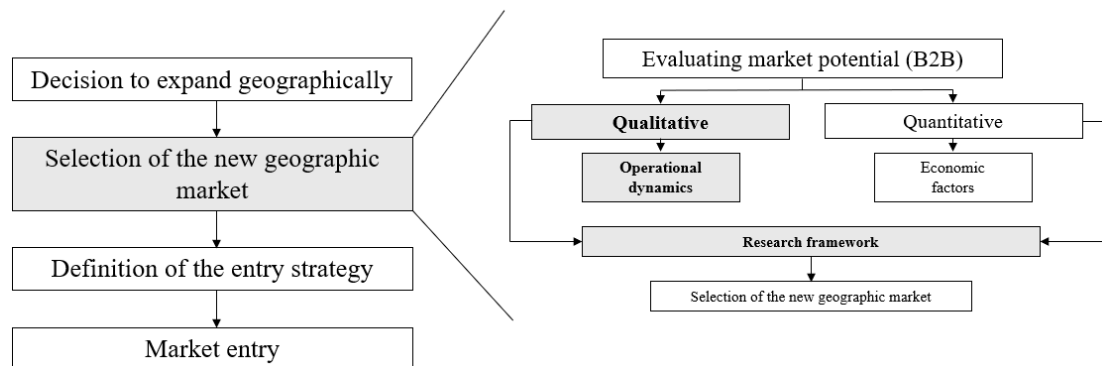


Figure 1. Overview of how existing literature gaps are addressed through the research objective.

The left side of the figure shows, in a very broad way, the different stages of geographic expansion, starting with the decision to enter a new region. The following step, shaded in gray, focuses on the selection of the target geography, which is where this research study provides significant value. On the right side, the figure illustrates that evaluating market potential in B2B markets requires consideration of both qualitative and quantitative factors.

Quantitative factors, shaded in white, are derived from existing literature. In contrast, qualitative factors, shaded in gray, represent the existing gap that this research study addresses. The result is the development of a framework that integrates existing quantitative elements with the operational dynamics factors identified in this study.

1.2 Research objective

This master thesis aims to develop a model, from the product perspective of an electricity trading platform, for evaluating market potential in a new geographic electricity market and apply it within the context of a specific company. Entering a new geographic market offers numerous benefits but also demands substantial resource allocation. Therefore, it is crucial for organizations to select the right geographic location to maximize potential benefits and ensure resources are effectively utilized. Organizations seeking to enter a new geographic market must undertake a comprehensive and holistic assessment of market potential, rather than relying solely on estimated economic variables.

The electricity market is an industry where evaluating only economic and existing qualitative factors does not fully reveal the true potential of the market. There are additional critical factors that must be considered when entering this business. Although there is extensive literature on geographic expansion and market potential evaluation from economic and qualitative perspectives, the operational dynamics have not been adequately addressed, particularly within the electricity market.

Given the critical importance of operational dynamics in the electricity industry, this study aims to develop a framework that incorporates both quantitative and operational dynamics factors to assess market potential in a new geographic region in the electricity market for an electricity trading platform. The framework is designed specifically for a technology firm in the electricity trading sector. The goal is to apply this framework to identify which state in the U.S. presents the highest market potential for the entry of the firm into this new geographic area.

To achieve the stated objective, four distinct research questions have been identified. The study will first focus on addressing the following two primary questions:

1. *What are the key operational dynamics factors to consider when qualitatively analyzing the attractiveness of a new geographic electricity market for an electricity trading platform?*
2. *What are the key market factors to quantitatively consider when analyzing the attractiveness of a new geographic electricity market for an electricity trading platform?*

Additionally, as part of applying the proposed framework, this research study will focus on addressing the following two secondary questions:

3. How can the identified operational dynamics factors be applied to the U.S. electricity market to determine the top three states with the highest market potential?

4. Based on the proposed framework, which of the top three previously identified U.S. states has the highest quantitative market potential?

To achieve this objective, the study examines the electricity markets in Germany and the U.S. to identify relevant operational dynamics factors for an electricity trading platform. The selection of the German market was due to its importance to the success of the case company, as Germany was the first market where the company began operations and where its platform established a strong foothold. Additionally, it reviews scientific literature on estimating market potential in B2B and technology contexts. This literature review includes an analysis of the market segmentation process, outlining various segmentation variables and how defined segments are evaluated and selected for targeting.

By integrating insights from the literature, a framework is developed to evaluate market potential in the electricity market from the product perspective of an electricity trading platform. This framework is then applied to the context of the case firm. The results are analyzed, and based on this evaluation, a recommendation of the U.S. state with the highest market potential for the case firm is provided.

1.3 Context of the study

The case company is located in Germany, where it was originally founded. It operates as a digital marketplace for over-the-counter (OTC) electricity trading, particularly physical electricity contracts, with a focus on the European energy market. Since its establishment in 2016, the platform has facilitated trading in gas, electricity, and environmental products. It serves as an online marketplace where energy companies and traders can negotiate and execute trades directly. The platform has continually evolved to address customer needs and industry trends.

The majority of the customer base of the case firm is located in the DACH region, though the company also has a presence in several other EU countries. The current market segmentation implemented by the company includes municipal suppliers, energy suppliers, industrial firms, trading houses, transmission operators, and consulting firms, with a particular focus on small and medium-sized enterprises.

The company is exploring expansion into new countries, with a particular focus on the U.S. However, the case organization recognizes that energy markets outside the EU can exhibit significant differences from the dynamics the case company is familiar with. The firm acknowledges that relying solely on economic variables to estimate market potential is

insufficient for making informed decisions about entering the U.S. energy market. Given these complexities, the company currently lacks a comprehensive framework for evaluating new geographic regions in a holistic manner. This underscores the need to develop a robust framework that can effectively assess the market potential of new regions for an energy trading platform, considering both economic and non-economic factors.

1.4 Research process

This master thesis started in March 2024 with the exploration and definition of the research topic in collaboration with the case company. The timeline for the project was then divided into three distinct stages as shown in Figure 2.

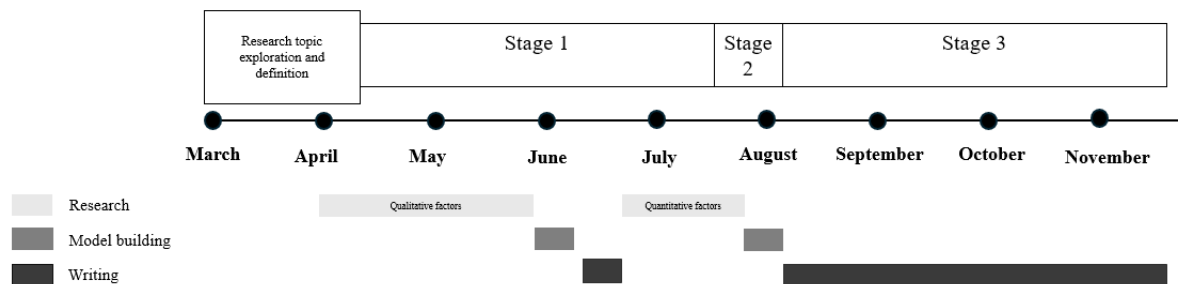


Figure 2. Timeline of the master thesis.

As depicted in figure 2, the first stage spanning from early April to late June, focused on the qualitative dimension by identifying the operational dynamics factors and applying them to the U.S. electricity market. This first stage included a literature review, model development, and initial writing. The second stage, from late June to early August, concentrated on quantitative factors, involving further literature review, model building, application to the U.S. electricity market and writing. Finally, the third stage, from early August to mid-November, was dedicated to completing the remaining chapters of the thesis.

1.5 Structure of the thesis

This study is organized into six chapters. The following text offers an overview of each of them.

Chapter 1 provides the background for conducting this study, identifies the research gaps addressed, and delineates the main topic along with the research questions to be examined. It also includes a brief description of the case company and its current situation.

Chapter 2 encompasses a comprehensive review that addresses two areas. First, it examines a thorough literature review about new geographic market expansion and PEST analysis, estimation of market potential including the segmentation process, segmentation variables, and the evaluation of target segments. Second, it explores the dynamics of the German electricity market including concepts such as regulation, market participants, infrastructure and wholesale trading. This chapter lays the foundation for understanding the proposed framework.

Chapter 3 details the research process undertaken in the development of this research study.

Chapter 4 provides an analysis of the literature review, develops the proposed framework, and details its application.

Chapter 5 summarizes the results and provides recommendations for the case company on which state to focus its efforts.

Chapter 6 provides a comprehensive summary of the research study, discusses the managerial implications, addresses the limitations of the study and provides potential avenues for future research.

2. THEORETICAL BACKGROUND

2.1 Expansion into new geographic markets

Companies are aware that by expanding their market presence, they can reduce their dependency on a single region, mitigate risks, and capitalize on new opportunities where the demand for their products or services is present (Hitt et al., 2020). Although geographic expansion yields attractive benefits for the organization, it also brings inherent risks and challenges (Hitt et al., 2020) that can be identified and addressed through understanding the new market dynamics. Moreover, Hitt et al. (2020) denotes that entering a new geographic market represents a key milestone for any organization, as they must navigate unfamiliar aspects such as legal, cultural, and economic, yet doubling forces to keep their brand consistency and operational efficiency.

Cavusgil et al. (2017) suggest that organizations must consider the differences in topics such as market regulation, local competition, infrastructure, and customer preferences. Additionally, the initial set-up costs, operational changes, and marketing investment that are needed to success in the new market could be impactful elements in the financial statements and human capital of the company (Hitt et al., 2020).

Nevertheless, despite the mentioned challenges, there are also significant advantages to entering a new geographic market that ultimately most of these advantages lead to increasing revenue. This opportunity of increasing revenue comes from reaching new customers, expanding their business model (Rossum, 2017), and economies of scale—increasing production volume and lowering the costs per unit (Hitt et al., 2020). Additionally, market expansion provides an opportunity to strength the brand presence of the company at a global level that ultimately creates a competitive advantage by becoming a multinational organization, as further highlighted by Hitt et al. (2020).

It is crucial for companies to ensure that, before they choose a market, they perform an analysis of potential revenue and profitability in the new geography and based on the calculated figures, they decide whether the investment is worthwhile. According to Hitt et al. (2020), this analysis includes elements such as local demand, market size, competition, and regulatory environment, all of which directly impact the ability of the company to succeed in the new geographic market. An inaccurate evaluation, such as overestimating demand or not considering important market regulations, could result in costly mistakes for the organization, wasting resources and efforts and possibly leading to failure in the new market.

Steenkamp and Hofstede (2002) highlight that one of the most important initial steps in estimating market potential is the appropriate segmentation of the market. By dividing the market into different segments based on factors such as demographics, buying behaviors, and geographic preferences, organizations are able to understand better the specific needs and

characteristics of each segment (Kotler and Keller, 2016). Furthermore, they also mention that this allows businesses to tailor their products, services, and marketing strategies more effectively, ultimately improving their chances of success in the new geography.

The next section will explore the market segmentation process, providing the tools and frameworks needed to further refine the analysis of market potential. This will be followed by discussions on the PEST analysis and operational dynamics of the electricity market as well as OTC electricity trading fundamentals.

2.2 Market segmentation process

According to Steenkamp and Hofstede (2002), segmenting international markets is essential for successfully developing, positioning, and marketing products across different countries. It allows businesses to focus on potential customer groups at the international segment level and align their positioning strategies across borders. However, Steenkamp and Hofstede (2002) also suggests that a major challenge for companies is addressing the diverse needs and preferences of consumers across various regions. By targeting specific segments within different countries, companies can reach groups of consumers who are likely to respond similarly to their marketing and sales efforts (ibid).

At its core, market segmentation refers to the process of dividing a larger market into smaller segments based on shared characteristics, similarities, or connections (Thomas, 2019). Essentially, members of each segment share something in common that distinguishes them from the broader market.

Burk (2004), suggests that market segmentation is not a comprehensive solution for all marketing challenges. It is only appropriate and beneficial under specific situations as described in Table 1.

Table 1. *Specific cases where market segmentation is beneficial (Burk, 2004)*

Specific case
Customers within each segment share identifiable characteristics.
Each segment responds differently to marketing strategies.
Segments are accessible through targeted marketing efforts.
Focusing on specific segments can provide a competitive edge.
By concentrating on particular segments, companies can achieve profitability and other organizational objectives.

Table 1 shows that market segmentation is effective when customers share identifiable traits and respond differently to targeted marketing. Focusing on specific segments can enhance competitive advantage and profitability.

At the same time, several crucial factors are essential for defining the unique characteristics of a particular market segment (Hutt and Speh, 2013). Kotler and Keller (2016) outline five fundamental criteria that a market segment must meet favorably to be considered valuable. This criterion is summarized in Table 2.

Table 2. *Criteria for a market segment to be considered valuable (Kotler and Keller, 2016)*

Criteria	Description
Measurable	The characteristics of the segment, including their size and purchasing power, can be quantified.
Substantial	Segments should be large enough to be profitable and represent a homogeneous group worth targeting with specific marketing efforts.
Accessible	It is essential that these segments can be reached and effectively served through marketing channels.
Differentiable	Segments must be distinct from one another, exhibiting varied responses to different marketing approaches.
Actionable	Effective marketing strategies can be developed to engage and serve these segments successfully.

According to the criterion presented in table 2, in summary, market segmentation focuses on identifying distinct customer groups that are sufficiently large, reachable, and unique to justify individualized marketing strategies for each segment. The objective of market segmentation is to maximize the differences among the segments while ensuring substantial similarities within each group.

Moreover, Hooley et al. (2012) highlight several advantages that can be gained from effective market segmentation:

- ✓ *Tailored marketing approach*: It enables smaller businesses to align their strengths with specific target markets.
- ✓ *Market gap identification*: Segmentation helps uncover underserved areas, creating opportunities for new products or service expansions.
- ✓ *Growth opportunities*: It can identify segments that continue to grow, even within mature or declining markets.
- ✓ *Enhanced product-market fit*: This approach aligns products or services with the needs of the target audience, strengthening competitive advantage.

Additionally, Burk (2004) further increases the number of benefits obtained through market segmentation. These benefits include removing markets that cannot be effectively reached or are not suitable, forming groups of customers with similar needs but varied responses to marketing efforts, and increasing the effectiveness of marketing strategies.

According to Burk (2004), the standard market segmentation process consists of three key steps:

1. Market choice
2. Application of market segmentation variables
3. Evaluation and selection of segments

According to Burk (2004), first, the segmentation process involves selecting a market, which includes identifying which markets warrant further exploration and which should be excluded. Second, after removing inappropriate markets, meaningful segments need to be defined to create groups that are internally homogeneous while differing from other segments. Various variables can be utilized to segment both consumer and business markets. Third, the last step is to evaluate the attractiveness of each segment based on opportunities, environmental factors, reach, and response, ensuring alignment with the mission of the company, capabilities, and resources.

2.2.1 Market choice

While the criteria for market selection can vary across organizations, specific factors must be assessed when identifying markets for exclusion. Burk (2004) advises that the following criteria should be considered for eliminating certain markets, as detailed in Table 3.

Table 3. Main reasons for market exclusion (Burk, 2004)

Reasons
Insufficient purchasing power or other serious economic difficulties.
Ethical controversies of concern.
Legally intense, political, social, or competitive pressures.
Ongoing ecological issues
Significant logistical challenges.

As shown in table 3, markets may be excluded from consideration when they present challenging reasons that can hinder business success.

Furthermore, Hollensen (2011) identifies significant barriers that companies face when entering new regions or countries, categorizing them into three distinct groups, as summarized in Table 4.

Table 4. Barriers to market entry (Hollensen, 2011)

Type of barrier	Elements
General market	Variations in market distance.
	Competition from local businesses in the target market.
	Differences in how products are utilized.
	Language and cultural challenges.
	Issues in sourcing distributors.
	Complications related to international shipping.
Commercial	Fluctuations in exchange rates.
	Disputes over contracts and potential non-payment.
	Delays or damage during shipment and distribution.
Political	Restrictions imposed by foreign governments.
	National policies affecting exports.
	Political instability, including revolutions and wars, disrupting market access.

The table summarizes the various barriers that companies may encounter when entering foreign markets. These barriers are categorized into three primary types: general market risks, which include challenges such as market distance and cultural differences; commercial risks, which involve financial uncertainties like exchange rate fluctuations and contract disputes; and political risks, encompassing government restrictions and political instability.

After excluding inappropriate markets according to the previously discussed criteria, the organization should concentrate on distinguishing significant segments within the remaining options. This can be accomplished through the use of segmentation variables.

2.2.2 Market segmentation variables

Kotler and Keller (2016) classify the variables for segmenting consumer markets into two broad categories. The first category – *descriptive characteristics* – includes geographic, demographic, and psychographic factors. The second category – *behavioral considerations* – refers to factors such as consumer responses to benefits, usage patterns, and brand preferences.

Similarly, Burk (2004) categorizes segmentation variables into two main groups: user-based and behavior-based. The suggested segmentation variables are displayed in Table 5.

Table 5. Segmentation variables (Burk, 2004)

User based	Behavioral based	
Demographic Age Family size Marital status Gender	User types Regular Non-user First-time Potential	Brand loyalty Loyal / satisfied Experimenters Unsatisfied Unaware
Geographic Global, national, state, city Climate Rural vs urban	Price sensitivity Low-cost orientation Higher-cost quality / differentiation focus	Application
Socioeconomic Income Education Religion Ethnicity	Consumption patterns / usage frequency Low Medium Strong	Purchase occasion/buying situation
Lifestyle / personality Attituded / opinions Interests Tastes and preferences	Perceived benefits Performance Quality Image enhancement Service	Media exposure

Burk (2004) argues that user-based characteristics are easier to identify and apply, whereas behavior-based variables, though more challenging to analyze, offer deeper insights into effective marketing strategies for each segment. He also notes that using a single segmentation variable is uncommon; instead, a combination of variables is recommended to better define each segment.

2.2.3 Market segmentation variables in business markets

Existing literature related to market segmentation differentiates between market segmentation variables in consumer and business markets. A distinctive aspect of business market segmentation is that it allows a focus not only on the organization as a whole but also on individual buyers within it (Brassington and Pettit, 2007). Hooley et al. (2012) propose three groups of segmentation variables that can be applied to both consumer and business markets: (1) *Background company characteristics* (2) *Attitudinal characteristics* (3) *Behavioral characteristics*.

First, background company characteristics refer to demographic factors of the company, which serve as a foundation for business segmentation. This also includes operational variables like the technology and capabilities of the customer. Second, attitudinal characteristics focus on the benefits sought by buyers, such as urgency or ease of use. Third, behavioral characteristics consider the individual traits of the buyer, recognizing that business products are ultimately purchased by people. This category also includes factors such as product status and purchase volume.

Furthermore, within the background company characteristics, they incorporate several operating variables, including:

- *Company technology*: The product demand of a customer is influenced by their technological development in manufacturing and product use, necessitating specialized distribution and integration methods.
- *Customer capabilities*: Differences in the internal strengths and weaknesses of business customers affect their demand for various products and services.
- *Purchasing organization*: The structure of a customer's purchasing approach—whether centralized or decentralized—can reveal key operational distinctions, such as those related to account management and sales strategies.
- *Power structures*: Understanding which organizational units hold decision-making power helps in targeting suppliers that align with customer needs, such as matching engineer-led clients with appropriate engineering suppliers.

- *Purchasing policies*: The purchasing approach of different customers can serve as a segmentation factor, distinguishing between those who prefer leasing versus outright purchasing.
- *Product application*: The specific use of products significantly impacts supplier selection and purchasing processes, as requirements may vary across different applications.

Moreover, Shapiro and Bonoma (1984) categorize demographic variables into three key areas as follows.

1. *Industry*: Understanding the industry is essential for identifying customer needs and enabling further segmentation based on specific product requirements.
2. *Company size*: Large companies often need specialized programs due to significant volume requirements, affecting how markets are segmented.
3. *Customer location*: Proximity is important for low-cost products and personal services, leading manufacturers to focus on areas with higher customer concentrations.

Kotler and Keller (2016) argue that when it comes to segmenting business markets, demographic variables play the most pivotal role, with operating variables being of secondary importance. They also highlight the need to account for the buyer's personal traits. Table 6 illustrates the various types of variables employed in business market segmentation and its description.

Table 6. Main segmentation variables for business markets (Kotler and Keller, 2016)

Variable category	Description	Variable category	Description
Demographic		Situational factors	
<i>Industry</i>	Identifies the relevant industries to target.	<i>Urgency</i>	Considers the urgency related to purchase decisions.
<i>Company size</i>	Differentiates between large and small enterprises.	<i>Product application</i>	Examines the specific applications of products.
<i>Location</i>	Specifies the geographical regions for market focus.	<i>Order size</i>	Defines the scale of orders placed by customers.
Operating variables		Personal characteristics	
<i>Customer technologies</i>	Addresses the technologies utilized by customers.	<i>Buyer-seller similarity</i>	Assesses the similarity between buyers and sellers.
<i>User status</i>	Differentiates between users and non-users of products.	<i>Attitude towards risk</i>	Evaluates buyer attitudes toward risk in purchasing.
<i>Required services</i>	Identifies necessary services for customers.	<i>Loyalty</i>	Measures customer loyalty to brands or suppliers.
Purchasing approaches			
<i>Purchasing organisation</i>	Distinguishes between centralized and decentralized purchasing structures.		
<i>Power structure</i>	Analyzes influential organizational units in purchasing.		
<i>Existing relationship</i>	Evaluates the nature of current buyer-seller relationships.		
<i>Purchasing policies</i>	Outlines the general purchasing policies of companies.		
<i>Purchasing criteria</i>	Determines the criteria influencing purchasing decisions.		

Table 6 summarizes five different categories of segmentation variables that can be employed to analyze business markets effectively. These categories encompass demographic factors, operating variables, purchasing approaches, situational factors, and personal characteristics, each contributing to a comprehensive understanding of customer needs and preferences.

This type of segmentation provides literature on segmentation variables in business markets. However, there is a segmentation model focused on industrial and technological markets as further described.

2.2.4 Process of market segmentation in technology markets

According to Powers and Sterling (2008), although there is an abundance of demographic data available for business-to-business segmentation, this information alone does not fully address customer needs. To enhance the effectiveness of segmentation, they propose a combination of demographic insights with needs-based analysis. By integrating

macrosegmentation variables—such as demographic data—with microsegmentation variables that reflect the specific requirements of customers, businesses can achieve a more precise and cost-effective segmentation strategy.

A commonly recognized method for connecting micro and macro segmentation is the nested approach introduced by Shapiro and Bonoma (1984). This multi-step segmentation framework not only allows for straightforward categorization of potential customers but also highlights more intricate purchasing scenarios. The nested approach comprises five distinct layers, each associated with specific segmentation variables, as illustrated in Figure 3.

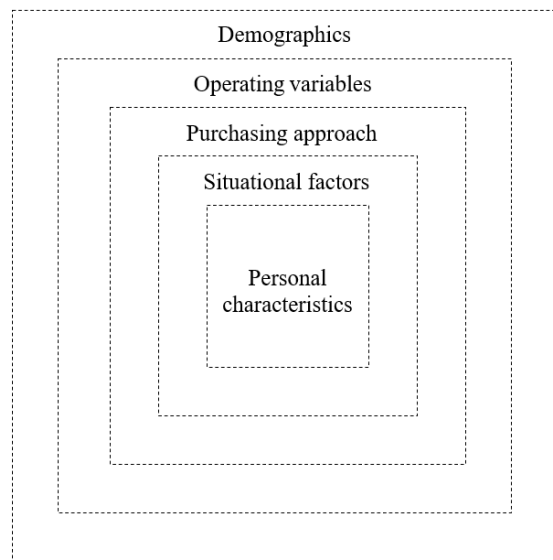


Figure 3. *Nested approach [Adopted from Shapiro and Bonoma (1984)]*

As shown in figure 3, the nested hierarchy framework organizes segmentation criteria into a series of interconnected categories, resembling a set of boxes that fit within one another. The aim is to transition from the broadest outer box to the more specific inner boxes, starting with demographics at the border. This structure represents a journey from general, easily identifiable traits to more nuanced characteristics.

Demographic variables are placed in the outermost layer due to their general nature and accessibility. Examples of significant demographic factors include industry type, the size of the company, and geographical location (Shapiro and Bonoma, 1984). According to Shapiro and Bonoma (1984), although demographic data is beneficial and readily obtainable, it falls short of capturing the full spectrum of segmentation options, primarily serving as an introductory component in marketing segmentation strategies.

The second level introduces operating variables, which allow for a more precise identification of potential and existing customers within the demographic categories defined earlier. These

variables tend to remain consistent and include aspects such as the technological capabilities of the company, user status, and customer strengths (Shapiro and Bonoma, 1984).

The third level focuses on purchasing approaches, which are often undervalued yet crucial for segmenting industrial markets. According to Shapiro and Bonoma (1984), this includes considerations of how purchasing functions are organized, the influence of power dynamics, the nature of buyer-seller interactions, and the criteria for purchasing decisions.

Lastly, the fourth level addresses situational factors, highlighting the significance of the purchasing context. Shapiro and Bonoma (1984) highlight that these factors are temporary and require a deeper insight into customer needs, encompassing aspects such as the urgency for order fulfillment, specific product applications, and the overall size of the order.

The innermost layer of the nested model emphasizes that purchasing decisions are ultimately made by individuals rather than organizations, even though corporate policies and structures may influence their choices. This level incorporates variables such as the similarity between buyers and sellers, buyer motivations, individual perceptions, and strategies for managing risk (Shapiro and Bonoma, 1984). It is crucial to highlight, however, that collecting data on personal characteristics presents significant challenges.

Hutt and Speh (2013) recommend that business marketers initiate the segmentation process at the macro level by identifying significant macrosegments, which can then be further subdivided into microsegments. To facilitate this, internal company data maintained in information systems, along with secondary data sources, can be utilized to establish macrolevel segments, while customer relationship management systems can help in recognizing individual organizations' purchasing patterns.

Shapiro and Bonoma (1984) suggest that it may not be essential or beneficial for all industrial marketers to apply every stage of the nested approach for every product. Additionally, it is possible to bypass certain stages that may not be relevant. However, it is crucial for readers to have a comprehensive understanding of the entire approach before deciding the most appropriate level at which to conclude their analysis.

2.2.5 Segments evaluation in technology markets

Weinstein (2014) emphasizes the importance of analyzing segment appeal when selecting target markets. Research conducted by Simkin and Dibb (1998) clarifies how businesses prioritize their target markets, allowing them to concentrate their marketing strategies on specific segments. While companies can consider various factors to assess market attractiveness, Simkin and Dibb (1998) found that profitability, market growth, and size are the most critical elements for market selection. Table 7 lists the 20 criteria most frequently

used for target market selection, according to Simkin and Dibb (1998).

Table 7. *Criteria for evaluating segment attractiveness (Simkin and Dibb, 1998)*

Criteria	
1. Profitability	11. Market share
2. Market growth	12. Relative strengths in key functions
3. Market size	13. Customers' price sensitivity
4. Likely customer satisfaction	14. Customer image of company
5. Sales volume	15. Technological factors
6. Likelihood of sustainable differential advantage	16. Fit with business strategy
7. Ease of access of business	17. Stability of market
8. Opportunities in the industry	18. Environmental factors
9. Product differentiation	19. Threat of substitutes
10. Competitive rivalry	20. Barriers to entry

According to McDonald and Dunbar (1998), organizations should apply weighted criteria to assess segment attractiveness based on their specific needs. In his research, Weinstein (2014) posed a question regarding the most vital criteria for selecting target markets within the business technology sector. The study identified the following ten key criteria:

1. Opportunities within the industry
2. Sustainable competitive advantage
3. Profitability
4. Differentiation of products
5. Customer satisfaction levels
6. Size of the market
7. Accessibility for businesses
8. Growth potential of the market

9. Volume of sales

10. Intensity of competitive rivalry

Building on the insights of McDonald and Dunbar (1998) and Weinstein (2014), it is evident that both sources emphasize profitability, market size, sales volume, ease of business access, product differentiation, sustainable competitive advantage, industry opportunities, and competitive rivalry as the most critical elements for evaluating market segments. This highlights the need for a strategic approach to target market selection, recognizing it as a nuanced and complex process.

2.2.6 PEST analysis and operational dynamics factors

According to NielsenIQ (2022), market dynamics include a range of factors that influence the behavior and performance of the market. This author outlines that market dynamics include supply and demand fluctuations, competitive forces, technological developments, regulatory changes, consumer preferences, and broader economic trends. Moreover, he suggests that these market dynamics shape the interaction between buyers and sellers, influence the pricing strategies, and ultimately set market share and profitability.

A common approach for analyzing market dynamics is through the PEST analysis. The PEST analysis is a framework that assesses different external environmental categories, namely: political, economic, social, and technological that ultimately impact the macro-environment of the market (Kotler and Armstrong, 2017). By identifying which operational dynamics factors impact each category, it is possible to understand better the feasibility of the market and simultaneously detect potential barriers for a successful market entry.

Yüksel (2012) suggests that by aligning strategies —crafted by the organizations—with the operational dynamics factors, organizations can better cope with evolving market conditions and be able to anticipate potential shifts in the market. In short, the PEST framework provides a systematic analysis to identify external forces that influence the market.

Moreover, Kotler and Armstrong (2017) emphasize the importance of understanding these macro-environmental factors when evaluating the potential success and profitability of the business. By thoroughly evaluating the different PEST categories, organizations can gain a better knowledge of regulations, consumer behavior, key economic elements and technology level, thus enhancing their understanding of the new market and enabling them to develop strategic decisions for market entry and long-term sustainability.

Table 8 presents a detailed overview of each PEST category according to Porter (1980) and Aguilar (1967).

Table 8. Different categories of the PEST model (Aguilar, 1967; Porter, 1980)

Category	Description
Political	Focuses on government policies, regulatory frameworks, and political stability. These factors are crucial for assessing the overall market environment and determining the feasibility and attractiveness of entering a market.
Economic	Includes inflation, interest rates, and economic growth cycles. Analyzing these factors helps businesses understand market stability, anticipate changes in consumer spending, and assess investment opportunities in economically stable markets.
Social	Involves cultural trends, demographics, and societal values that influence consumer demand and product acceptance. Understanding shifts in consumer preferences, lifestyle changes, and societal trends like sustainability helps businesses align products with market expectations.
Technological	Assesses infrastructure, innovation rates, and technological advancements. A strong technological environment, including robust digital networks, is essential for efficient operations and scalability, allowing businesses to determine if a market can support their technological needs.

As shown in table 8, these categories together provide a comprehensive framework for evaluating a market's operational landscape. By analyzing each factor, businesses gain insights into the risks and opportunities unique to each market, enabling more informed strategic decisions and a greater alignment with local conditions and customer expectations.

In a more practical overview, Arrieta et al. (2017) conducts an analysis of these four categories applied to the energy market. He provides a summary of how each category impacts and shapes the energy market dynamics:

- *Political:* Adapts the traditional political category by focusing specifically on regulatory frameworks, government stability, and policy predictability as vital components for assessing market readiness. He considers that the main determinant for operational feasibility relies on the level of market regulation and intervention of the government, rather than considering the general political stability.
- *Economic:* Expands the analysis beyond the usual focus on macroeconomic indicators such as inflation and interest rates by incorporating market liquidity and the availability of capital. He points out that understanding the access to financing and the stability of the financial institutions.

- *Social*: Considers that cultural trends and demographics shift over time and thus, it is critical to evaluate consumer behavior and values in the society as forces shaping the demand in the market.
- *Technological*: Focuses on infrastructure readiness and how often innovation in market technology occurs. He analyses the adoption rates of new technologies and how this adoption impacts operational efficiency, especially in markets where infrastructure is “rapidly” advancing.

Each category analyzed by Arrieta et al. (2017) includes a list of operational dynamics factors that shape the market environment. These dynamics introduce the opportunity of diving deeper into each category and determine specific key operational dynamics factors that collectively influence market readiness and strategic decision-making. This layered approach allows companies to identify and prioritize the unique elements within each category that are most relevant to the energy sector’s operational landscape.

2.3 Electricity market in Germany

2.3.1 Current overview

The electricity market in Germany is undergoing a profound transformation driven by both national and international regulations, policies, and initiatives. Central to this transformation is the *Energiewende* (energy transition), a strategic initiative that aims to shift Germany's energy system away from fossil fuels and nuclear power to predominantly renewable energy sources (Federal Ministry of Education and Research, 2024). However, the *Energiewende* is just one of several key elements shaping the German electricity market today. As noted by Horváth (2024), a variety of other regulatory frameworks and technological advancements are also influencing the market dynamics, particularly in electricity trading, and driving the need for more flexible, digital, and automated trading systems, such as OTC (Over-the-Counter) trading platforms.

More recent regulative initiatives and frameworks shaping the energy market in Germany include:

- *Erneuerbare Energien Gesetz* (Renewable Energy Sources Act) (EEG): first introduced in 2000 and regularly updated, incentivizes the generation of renewable energy through guaranteed feed-in tariffs or market premiums (BMWi, 2022b). The act ensures long-term financial stability for renewable energy producers, which has made investments in green energy more attractive (ibid).

- *Strommarktgesetz* (German Electricity Market Act): governs the operation of electricity markets in Germany. According to BMWi (2022b), it aims to ensure efficient, transparent, and competitive markets for electricity trading, focusing on improving market liquidity, ensuring fair competition, and increasing the integration of renewable energy sources.
- *Kohleverstromungsgesetz* (German Coal Exit Law): outlines Germany's roadmap for phasing out coal-fired power plants by 2038 (Federal Ministry of Education and Research, 2024). The law seeks to accelerate the transition from fossil fuels to renewables, reduce carbon emissions, and reduce Germany's reliance on coal-generated power as described by Federal Ministry of Education and Research (2024).

These regulatory initiatives and frameworks collectively reshape Germany's electricity market, setting the stage for a dynamic system where renewable energy and decentralized production play increasingly pivotal roles, with the *Energiewende* as the main element driving this transformation forward (BMWi, 2022b).

Impact of the Energiewende on the electricity market

The *Energiewende* is driven by the need to reduce greenhouse gas emissions, increase energy security, and foster sustainable economic growth (Federal Ministry of Education and Research, 2024). BMWi (2022b) notes that the *Energiewende* has three main pillars:

1. *Expansion of renewable energy*: The goal is to increase the share of renewables in the energy mix, particularly wind and solar energy.
2. *Energy efficiency*: Reducing energy consumption across all sectors, including industry, transportation, and households.
3. *Grid modernization*: Modernizing the electricity grid to accommodate the decentralized nature of renewable energy sources.

As the central policy driver, this reform is reshaping the entire energy system, bringing both challenges and opportunities, particularly in areas such as market volatility, decentralization, and digitalization (Horváth, 2024), as denoted in Table 9.

Table 9. Impact of the Energiewende on the electricity market (Horváth, 2024)

Impacts of the Energiewende
1. Increased use of renewables and market volatility
2. Decentralization and the need for digitalization
3. Response to volatility and complexity through automation trading

First, increased use of renewables and market volatility. The intermittent nature of renewable energy sources—particularly solar and wind—has led to significant market volatility (Horváth, 2024). Unlike traditional, centralized power plants that can provide a steady supply of electricity, renewable energy production fluctuates with weather conditions, making the market more difficult to predict and manage (BMWi, 2022b).

As noted by BMWi (2022a), in such a volatile environment, OTC trading platforms offer increased flexibility compared to traditional exchange-based trading. These platforms allow for customized contracts tailored to specific risk profiles, providing greater market liquidity and the ability to manage volatility (BMWi, 2022a).

Second, decentralization and the need for digitalization. According to the Federal Ministry of Education and Research (2024), the German electricity grid is becoming more decentralized as a result of the Energiewende. An example of this decentralization includes homes equipped with solar panels or community-based wind farms. These small-scale producers are playing a bigger role in the energy sector by generating their own electricity (Federal Ministry of Education and Research, 2024). Creating a more decentralized production of energy triggers complexity to the grid as it is required to develop more efficient systems with real-time data that can assist in ensuring a correct match of supply and demand (ibid).

In order to manage the new decentralized system, Horváth (2024) claims that digitalization. For instance, according to the Federal Ministry of Education and Research (2024), smart grids are being implemented to enhance the management of the grid and the challenge of integrating renewable energy as these renewable sources present high fluctuations and thus, create a more complex management of electricity. The technology of smart grids harness digitalization by using real-time data to match supply and demand, supporting the distribution and allocation of electricity in a more efficient manner yet reducing the risk of overloading the grid (BMWi, 2022b).

Digital trading interfaces are becoming critical tools for market participants, allowing them to interact with the grid and other market participants in real time (Horváth, 2024). These trading tools provide traders the most updated information regarding electricity generation, conditions and prices of the market, allowing them to take faster data-driven decisions as

further noted by Horváth (2024). In the case of OTC platforms, they are including digital key data to streamline operations and give the opportunity to market participants of executing trades based on real-time information (BMW, 2022a).

Third, response to volatility and complexity through automation trading. Horváth (2024) outlines that the increasing complexity and volatility of the energy market demand more sophisticated trading strategies. Automated trading algorithms are increasingly used to execute trades quickly based on predefined criteria, reducing human error and enhancing efficiency (ibid).

The automation of trading processes enables traders to respond to market movements in real time, taking advantage of price fluctuations and the unpredictability inherent in renewable energy generation (Horváth, 2024). These automated systems are especially relevant in OTC trading platforms, where the flexibility of negotiated contracts, combined with automation, can create more efficient, faster transactions and better risk management (BMW, 2022a; Horváth, 2024).

Furthermore, the integration of smart grid data and market forecasting tools into trading algorithms is driving the development of automated marketplaces (Federal Ministry of Education and Research, 2024). These digital platforms enable market participants to make real-time decisions about buying and selling electricity, reducing the time lag between when electricity is generated and when it is traded (ibid).

It can be noted that the Energiewende, along with a variety of supporting regulatory initiatives, is transforming the German electricity market. The result after integrating renewable energy sources, the latent volatility of the market, and the decentralization of energy production, is demanding more than ever flexible, efficient and automated trading tools. Under this new market need, OTC trading marketplaces with their ability to offer customized contracts, automation and real-time data, are key to alleviate some needs of the new market transformation.

2.3.2 Regulation and governance

The German electricity market stands out as one of the most advanced in Europe, showing a structured design to foster competition and create a smooth integration with neighboring countries (German Federal Ministry for Economic Affairs and Climate Action, 2024a).

The German electricity market has been transformed through different regulatory changes over the past years, starting as a monopolistic and vertically integrated market to an open and competitive liberalized market (Bundesnetzagentur, 2017). According to Germany Trade & Invest (2023), Germany's electricity market initially operated as a vertically integrated system, where a few large utilities controlled all stages of the supply chain, from generation

to distribution. This centralized system limited competition and innovation. However, following the European Union’s directives in the 1990s, the Energy Industry Act (EnWG) was introduced to unbundle the market and promote competition (Germany Trade & Invest, 2023).

Furthermore, Germany Trade & Invest (2023) notes that enacted in 1998, the EnWG aims to foster a competitive environment, ensures fair access to the grid, and allows new players to enter the market. Initial steps of this process involved *accounting unbundling*, requiring utilities to keep separate financial records for different parts of the supply chain (Next Kraftwerke, n.d.). Over time, regulatory reforms intensified to include *legal and ownership unbundling*, which required transmission operators to be legally and functionally separate from generation and supply entities (Next Kraftwerke, n.d.).

The liberalization process transformed the electricity market structure in 2003 as Germany implemented *legal unbundling*, which required transmission system operators (TSOs) and distribution system operators (DSOs) to operate independently of electricity suppliers (Next Kraftwerke, n.d.). Figure 4 visually represents the transformation of the German electricity market from a vertically integrated framework to a liberalized, unbundled system.

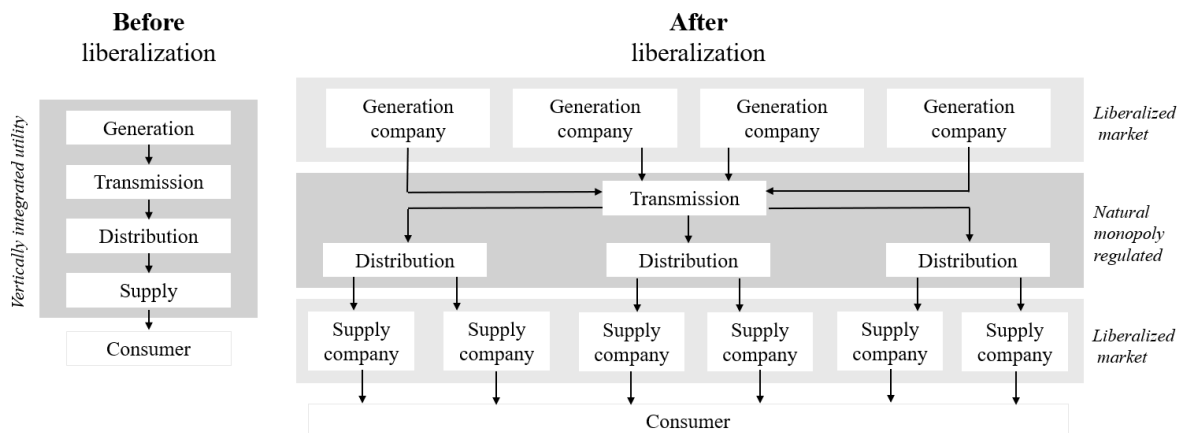


Figure 4. Liberalization of the German electricity market [Adopted from Next Kraftwerke (n.d.)]

On the left side, the previous structure shows the dominance of large, state-owned utility companies that controlled generation, transmission, and distribution. The right side illustrates the current, liberalized market, where generation, transmission, distribution, and supply functions are separated to promote competition, transparency, and efficiency. Nevertheless, the sectors of transmission and distribution, due to the high capital investment of entering such sectors, operate under natural monopolies yet regulated.

This regulatory shift was crucial in dismantling vertically integrated structures and fostering a competitive, decentralized electricity market (Germany Trade & Invest, 2023). The introduction of the EnWG further solidified this transition, laying out regulatory measures for market transparency, non-discriminatory grid access, and consumer protection (ibid). According to Germany Trade & Invest (2023) the EnWG mandates that grid operators offer open access to their networks under fair conditions, enabling renewable energy providers and other small players to participate without facing barriers from larger entities.

The German Federal Network Agency, known as Bundesnetzagentur, plays a key role in enforcing regulatory requirements (Next Kraftwerke, n.d.). Among the multiple responsibilities of this agency are the supervision and management of grid access, competition, and consumer rights. Nevertheless, one of the most relevant tasks of the Bundesnetzagentur is to ensure that all market players, including renewable energy producers, have equal access to the grid network infrastructure (ibid).

Moreover, Germany Trade & Invest (2023) notes that a strong force shaping the German regulatory environment is the European Union's Clean Energy Package. This EU framework establishes key elements regarding cross-border energy trade, consumer rights, and integration of renewable energy sources (Germany Trade & Invest, 2023). Hence, as further noted by Germany Trade & Invest (2023), Germany has adjusted its national policies in order to comply with the Clean Energy Package by fostering a more interconnected European electricity market.

The current German electricity market emerges as a competitive and liberalized environment allowing different actors to operate at different levels of the electricity supply chain (Next Kraftwerke, n.d.). For instance, TSOs—TenneT, Amprion, 50Hertz, and TransnetBW—manage the grid independently, while DSOs work on the distribution stage and provide equal access to all market participants.

The liberalization of the market has not only impacted the upper part of the electricity value chain, but also the lower part with end consumers as well as the prices in the market (Germany Trade & Invest, 2023). Fostering market competition in the different stages of the electricity value chain has given the opportunity to consumers to select among a pool of different energy suppliers, from traditional utility companies to independent producers of renewable energy. Additionally, this competition has increased innovation, price differentiation and better quality of service as highlighted by Germany Trade & Invest (2023).

The German electricity market has significantly evolved from a monopoly to a liberalized system being recognized as market that fosters competition, innovation, and clear support on renewable energy This transformation demonstrates the potential benefits of a competitive and decentralized electricity market.

2.3.3 Market participants

The German electricity market is constituted and run by different key market participants—producers, transmission system operators (TSOs), distribution system operators (DSOs), electricity suppliers, and consumers—each with a specific role that culminates in keeping a reliable and competitive energy supply (GridX, 2024). Figure 5 represents the main participants in the electricity value chain.

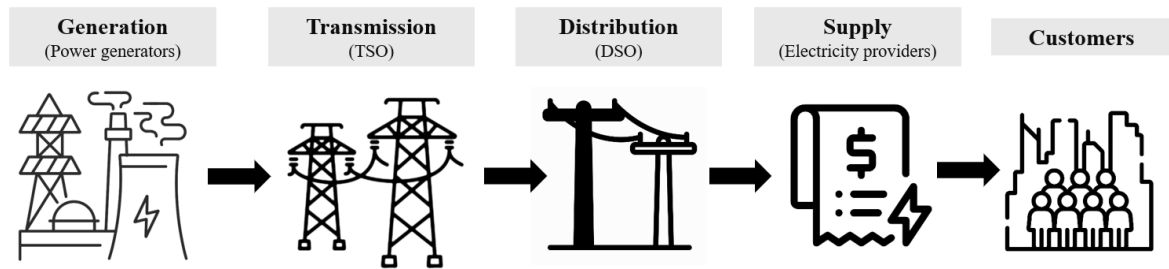


Figure 5. Main participants in the electricity value chain.

First, the value chain starts with the power generators or also known as producers. These entities are responsible for generating electricity. In Germany, electricity generation is decentralized, with both large utilities and smaller producers contributing to the overall supply (Reppert, 2023). According to Statistisches Bundesamt (2024), these producers operate across a range of energy sources, including fossil fuels, nuclear power, and an increasing share of renewables like wind, solar, and biomass.

As the market liberalized, producers now sell their electricity either through wholesale markets or directly to suppliers, depending on market conditions and contractual arrangements (Germany Trade & Invest, (2023). As noted by Bundesnetzagentur (2024c), the liberalized market has enabled a wider range of players to enter the electricity production sector, with renewable energy taking on an increasingly prominent role, encouraged by the Renewable Energy Act (EEG).

Second, once the electricity is generated, it must be transported through the grid, a task managed by the transmission sector. TSOs are responsible to transport electricity over long distances across whole Germany, they operate the high-voltage transmission networks with typically voltages of 220 kV or higher (Bundesnetzagentur, 2024c). This network infrastructure allows electricity that is generated at major energy plants, such as power stations and offshore wind farms, to reach the following step in the electricity value chain (Bundesnetzagentur, 2024c). For example, TSOs networks allows the transportation of wind-generated electricity in the northern part of Germany to meet the electricity demands in the southern part of the country.

GridX (2024) highlights that the role of TSOs has become progressively crucial due to the result of shifting towards a more decentralized energy structure in the German market, especially with the need of integrating local renewable sources into broader systems. Additionally, TSOs also have the responsibility that Germany contributes to a more stable and efficient integrated European electricity market by maintaining grid security and supporting cross-border energy exchange (Reppert, 2023). According to Bundesnetzagentur (2024c), the German transmission sector is divided into four different TSOs across the whole country: Amprion, 50Hertz, Transnet BW, and TenneT.

Third, at a more localized level, the distribution sector manages the lower-voltage infrastructure that delivers electricity directly to consumers, including households, businesses, and industrial users (GridX, 2024). As noted by GridX (2024), DSOs are critical for connecting end-users to the grid, ensuring that the electricity supply is reliable, and managing the integration of decentralized generation from prosumers—consumers who also produce electricity, primarily from solar panels. As more consumers adopt renewable technologies, DSOs face increasing challenges in managing bidirectional flows of electricity, requiring continuous innovation and upgrades to grid infrastructure (Reppert, 2023). Hence, they must ensure that these decentralized generation sources do not destabilize the local grid, while also facilitating the transition to a more sustainable and resilient energy system (GridX, 2024).

Fourth, the last stage before the electricity reaches the consumers is managed by electricity suppliers. Electricity suppliers purchase electricity from the wholesale market or directly from producers and then sell it to end consumers (NESO, 2022). According to Germany Trade & Invest (2023), the liberalization of the electricity market has enabled consumers to choose from a variety of suppliers, which has increased competition, improved pricing, and expanded service options. Suppliers play a significant role in this competitive landscape, offering diverse pricing plans and green tariffs.

Finally, consumers, who represent the end users of electricity, are crucial participants in the market, especially in a decentralized system. As noted by Appun and Russel (2021), many consumers in Germany are becoming prosumers—customers who generate their own electricity mainly for their own needs but might also sell their excess. This new prosumer model contributes to the growth of smart grids, which assist in managing more efficiently the demand and allow a better integration of prosumers into existing broader systems. Additionally, consumers are not only becoming prosumers but at the same time they are being more concerned about sustainability and as a result, demanding more renewable energy solutions (Appun and Russel, 2021). Hence, consumers are also contributing to accelerate the green transition in the German electricity market (ibid).

Moreover, in addition to the key participants in the electricity value chain, regulatory bodies play an essential role in shaping and supervising the electricity market. Regulatory bodies include the Bundesnetzagentur (Federal Network Agency), an authority organization

responsible for ensuring that the electricity grid is accessible and operates efficiently (Bundesnetzagentur, 2024a).

Similarly, the Bundeskartellamt (Federal Cartel Office) monitors competition within the electricity market, ensuring that monopolistic practices are prevented, and mergers do not harm market dynamics (Bundeskartellamt, 2024). Additionally, at the European level, the European Commission and Agency for the Cooperation of Energy Regulators (ACER) establish policies and regulations that encourage market integration, cross-border energy exchanges, and sustainable energy development (Reppert, 2023).

2.3.4 Grid distribution network

Due to the challenges of storing electricity in large quantities, it must be generated and delivered exactly at the moment it is needed (Edwards, 2017). The electricity grid is a critical infrastructure that ensures the reliable supply of electricity to consumers. The grid comprises transmission and distribution lines, substations, and transformers, which collectively enable the efficient transmission of electricity from generation points to end users (German Federal Ministry for Economic Affairs and Climate Action, 2024b).

The German electricity grid consists of both high-voltage transmission networks, managed by TSOs, and lower-voltage distribution networks, managed by DSOs. Figure 6 visually represents the coordination between these two different sectors.

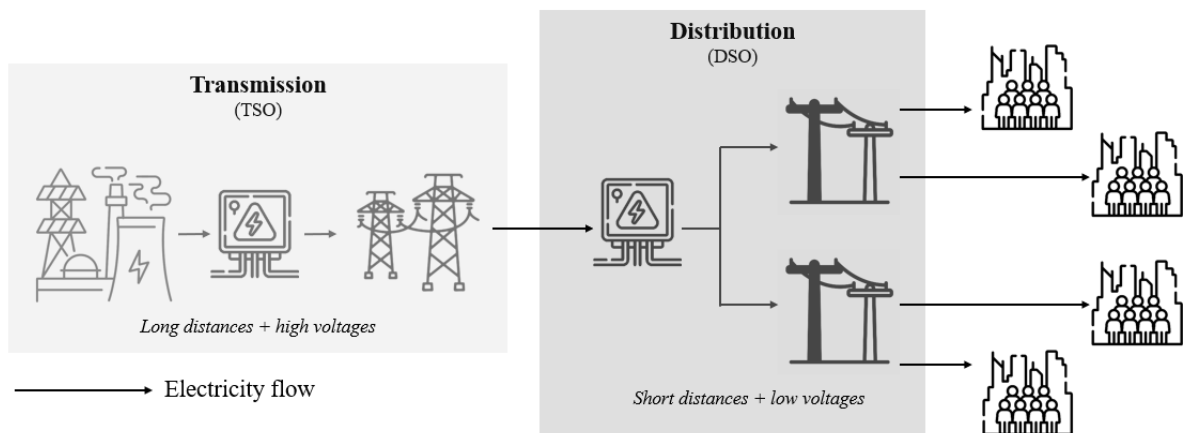


Figure 6. Coordination of electricity flow between transmission and distribution system operators.

As shown in figure 6, while TSOs oversee the transmission of electricity over long distances and high voltages, DSOs manage the delivery to end consumers through local distribution grids over shorter distances and lower voltages (GridX, 2024).

As previously mentioned, the transmission sector is divided into four different balancing zones, each managed by a different TSO (Bundesnetzagentur, 2024c). These TSOs ensure the secure and efficient transport of electricity across the country. Nevertheless, Bundesnetzagentur (2024c) highlights that despite the division into distinct regions, the grid is highly interconnected, allowing for the transfer of electricity across balancing zones to match supply with demand. Additionally, the transmission systems also connect Germany's network with neighboring countries via cross-border interconnectors and subsea cables, facilitating electricity trade across European borders (Bundesnetzagentur, 2024c). Figure 7 shows how these TSOs are distributed across Germany.

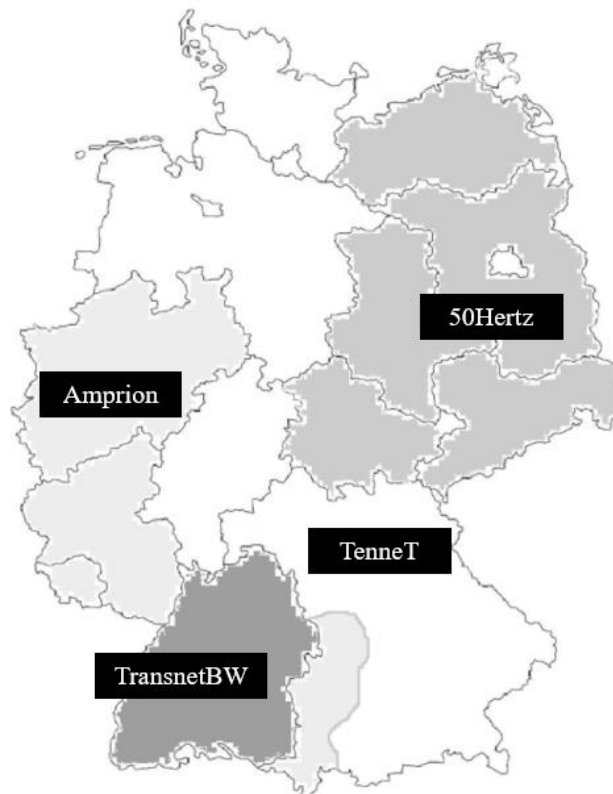


Figure 7. Distribution of transmission system operators in Germany [Adopted from Bundesnetzagentur (2024c)]

As figure 7 shows, Amprion oversees the western region, while 50Hertz operates in the eastern part of Germany. TenneT is responsible for sections of the northern, central, and southern areas, and TransnetBW covers the southwestern region. Collectively, these TSOs ensure the efficient and secure transmission of electricity across the country.

This interconnection helps optimize resource distribution, particularly important in a country with growing renewable energy sources that are intermittent and often geographically dispersed (German Federal Ministry for Economic Affairs and Climate Action, 2024b).

Alongside the TSOs, DSOs play a pivotal role in the interconnected electricity system of the German nation. As noted by GridX (2024), DSOs oversee the local networks that deliver electricity to consumers, from residential areas to industrial clients. These distribution system operators ensure the safe and reliable distribution of electricity, operating local substations, transformers, and the low-voltage lines that form the last mile of the energy supply chain. In fact, GridX (2024) reports that in Germany there are over 900 DSOs operating across the country, each responsible for specific geographic areas.

DSOs are closely integrated into the broader grid, with strong interconnections to the transmission network, ensuring seamless coordination across the entire system (GridX, 2024). This interconnection is fundamental to keeping a reliable system. According to Deloitte (2015), DSOs are the key organizations to balance the local grids when there is an imbalance of generation and demand. Similarly to TSOs, DSOs are responsible for managing renewable energy integration into the grid, but on a local level. Deloitte (2015) further notes that DSOs must ensure that the local infrastructure can handle the added difficulty to the grid as a result of the different variable and distributed energy sources.

In addition to local or domestic interconnection, the German electricity grid extends beyond national borders through cross-border connections, allowing Germany to import and export electricity with its nine neighboring countries (German Federal Ministry for Economic Affairs and Climate Action, 2024b). This international connectivity plays a crucial role in balancing electricity supply and demand, particularly when renewable generation in Germany surpasses domestic demand. In such instances, Germany can export surplus electricity to neighboring countries and import electricity when domestic generation is insufficient, thereby contributing to the stability of the European grid and enhancing energy security (German Federal Ministry for Economic Affairs and Climate Action, 2024b).

It can be inferred that the interconnection of the German electricity grid, both domestically and internationally, is a key component of its efficiency and reliability. The close cooperation between transmission and distribution system operators enables the smooth flow of electricity across regions and ensures that power reaches consumers.

2.3.5 Wholesale trading market

According to Taillon (2023), the wholesale electricity market is where electricity is bought and sold in bulk between different market participants. The system is structured to allow large-scale electricity transactions among producers, distributors, and traders before it reaches retail markets. Trading electricity in the wholesale market yields several benefits for the electricity market, as outlined in Table 10.

Table 10. *Benefits of trading electricity in the wholesale market (Bundesnetzagentur, 2018; FERC, 2024a; German Federal Ministry for Economic Affairs and Climate Action, 2024a; Joskow, 2008)*

Benefit	How?
Balancing supply and demand	By enabling market participants to buy and sell electricity in real-time, ensuring grid stability and reducing blackout risks (Bundesnetzagentur, 2018)
Price discovery and competition	Establishes competitive prices, benefiting consumers with lower costs and providing price transparency, which helps prevent market manipulation (Joskow, 2008)
Hedging against price volatility	Allows participants to lock in prices through forward / futures contracts, protecting against price fluctuations and offering stability for large consumers (FERC, 2024a)
Facilitating renewable integration	By enabling the sale and purchase of excess renewable energy, helping stabilize the grid and encourage investment in renewables (German Federal Ministry for Economic Affairs and Climate Action, 2024a)
Cross-border energy flow	Balance regional shortages and surpluses through imports and exports. This is particularly vital within the European electricity market, where interconnected grids allow countries to leverage each other's resources (Bundesnetzagentur, 2018)
Ensuring grid reliability and capacity management	By facilitating regional exchanges, trading improves grid efficiency, reduces the need for costly infrastructure expansions, and ensures long-term stability (Bundesnetzagentur, 2018)

These benefits highlight the essential role of electricity trading in ensuring market efficiency and stability. In Germany, trading supports the energy transition by balancing renewable energy production and fostering competition (Bundesnetzagentur, 2018).

Moreover, Germany's electricity demand is consistently high due to its large industrial base and a growing population, which makes managing supply and demand particularly challenging (Bundesnetzagentur, 2018). The country's commitment to renewable energy sources further complicates the situation since these sources are variable and dependent on weather conditions. As a result, the wholesale electricity market plays a crucial role in balancing these fluctuations (Bundesnetzagentur, 2018).

The wholesale electricity market operates on supply and demand principles, with electricity prices influenced by various factors such as production costs, market demand, and government regulations (Taillon, 2023).

As indicated by Epex spot (n.d.), the wholesale electricity market includes multiple participants: power producers, electricity suppliers, large consumers, and market intermediaries like exchanges and brokers. Producers generate power from various sources, while suppliers buy electricity to meet the needs of end consumers. Large consumers, such as industrial facilities, may purchase directly from the wholesale market to control costs. Figure 8 illustrates the various participants involved in the wholesale electricity trading market.

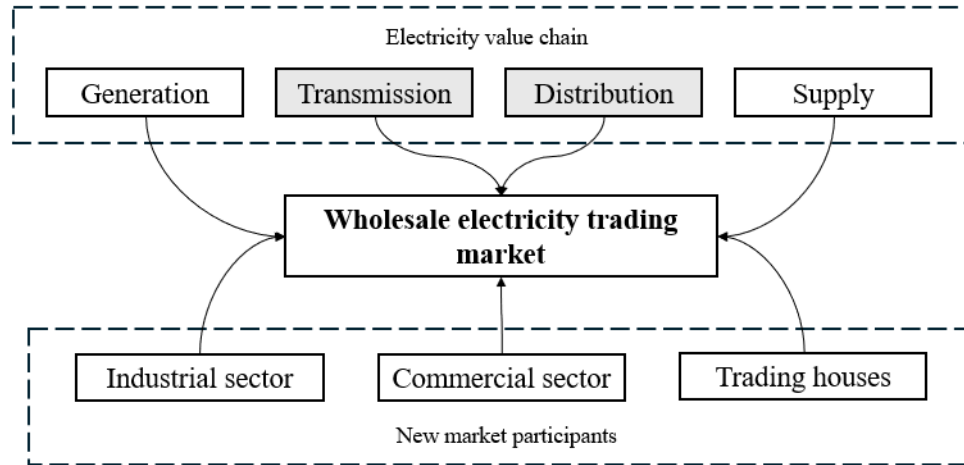


Figure 8. Market participants engaged in the wholesale electricity market.

The figure illustrates the diverse range of participants engaged in the electricity trading market, each driven by distinct motivations. At the top of the figure, highlighted in gray, the transmission and distribution sectors engage within the wholesale electricity trading market with the purpose of balancing the grid. Industrial and commercial sectors may participate strategically to better manage their electricity supply and reduce costs, while trading houses are drawn to the market by the prospect of capitalizing on future fluctuations in electricity prices to maximize profitability (Worldforex, 2021).

In Germany, the number of market participants involved in electricity supply chain and the wholesale electricity market reveals a substantial presence (Bundesnetzagentur, 2024b). Table 11 summarizes these figures.

Table 11. Total number of organizations involved in the German wholesale electricity market (Bundesnetzagentur, 2024b)

Sector	Number of organizations
Generation	560
Transmission	4
Distribution	879
Supply	1,370
Total	2,813

As summarized in table 11, in Germany the electricity supply chain includes approximately 2,813 organizations, reflecting a high concentration of market participants relative to the size of the nation. Additionally, sales traders and financial traders further contribute to an even greater number of market participants engaged in the wholesale electricity market.

As indicated by Bundesnetzagentur (2018), three distinct mechanisms based on different time horizons enable electricity trading: futures, day-ahead, and intraday markets, each with potentially varying prices. In the futures market, companies can secure electricity deliveries up to six years in advance, providing a long-term planning tool (Bundesnetzagentur, 2018). The spot market, by contrast, includes both day-ahead and intraday trading, where electricity is bought for the following day (day-ahead) or within the same day (intraday) (ibid). This structure allows traders flexibility in meeting their obligations over varying timeframes.

Furthermore, Bundesnetzagentur (2018) describes that in Germany it is possible to execute the electricity trading through different channels, the exchange and OTC (Over-The-Counter). These trading channels are further explained in the following section.

2.4 OTC trading

As indicated by Bundesnetzagentur (2018), in Germany, electricity trading occurs through standardized contracts on exchanges, namely the European Energy Exchange (EEX) in Leipzig and EPEX SPOT in Paris. Nonetheless, many companies continue to form direct supply agreements with electricity producers, a practice referred to as OTC trading.

OTC markets operate differently from traditional stock exchanges as they are decentralized and do not have a central physical location. Instead of using automated matching engine systems, these markets facilitate trades through a network of broker-dealers (Charles Schwab, 2024).

2.4.1 Exchange vs OTC trading

Electricity exchanges provide a platform for their members to engage in trading activities. Members connect to the platform and submit orders to buy and/or sell electricity, which are recorded in an order book (EpeX spot, n.d.). These orders represent the supply and demand for electricity in a specific market area at a given time. Using the order book, power exchanges calculate the market price. Since trades result from open and transparent competition between the members' orders, they reflect the most accurate information available at that moment, based on current market conditions (EpeX spot, n.d.). By matching supply and demand, power exchanges facilitate transparent and reliable price formation, ensuring the delivery and payment of traded electricity (ibid).

A key characteristic of exchanges, according to Scholz and Reez (2010), is the standardization of contracts, which means that all trading parties adhere to predefined terms regarding quantities, delivery dates, and pricing structures. On the contrary, as expressed by DNV GL Energy (2020), OTC trading allows for the customization of contracts, offering greater flexibility in terms of contract conditions, including price, quantity, and other specific

parameters, such as delivery schedules and payment terms. In fact, the wholesale electricity market in Germany is predominantly characterized by OTC trading, with approximately 85-90% of transactions occurring through this channel (Scholz and Reez, 2010).

The OTC market facilitates the trading of these customized contracts through bilateral agreements, in contrast to exchanges, where a third-party clearinghouse is typically involved (DNV GL Energy, 2020). When trading through OTC, it is often referred to as bilateral agreements (ibid).

Bilateral agreements can be facilitated through brokers, who serve as intermediaries between the parties, assisting in negotiations and ensuring mutually acceptable terms (Next Kraftwerke, 2024). Alternatively, bilateral agreements can be established through direct communication, such as phone calls or emails (ibid). Moreover, according to Next Kraftwerke (2024), another method for conducting bilateral transactions is through digital marketplaces. The case company operates within the digital marketplace category, where it holds a prominent position in the wholesale electricity market. Figure 9 visually represents the two channels available in Germany to execute electricity trading and the different types of OTC trading.

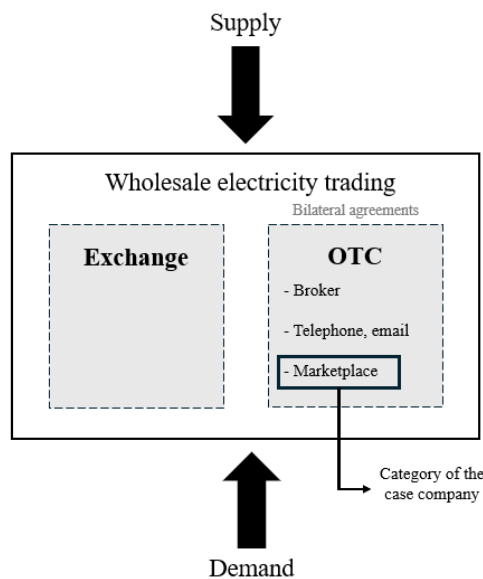


Figure 9. Different channels for wholesale electricity trading and different types of over-the-counter methods.

As represented in figure 9, the electricity trading environment operates on fundamental market principles, supply and demand. In Germany, organizations seeking to procure or sell electricity in the wholesale market have two primary options: trading on an exchange or through different types of OTC transactions (Scholz and Reez, 2010).

As described in section 2.3.5, the trading of electricity in the wholesale market may be done through two different mechanisms, on a long-term or short-term basis (Bundesnetzagentur, 2018). However, considering the scope of this study, it is necessary to drill down into the long-term dynamics. Figure 10 represents the two different types of mechanisms in electricity trading based on time horizons.

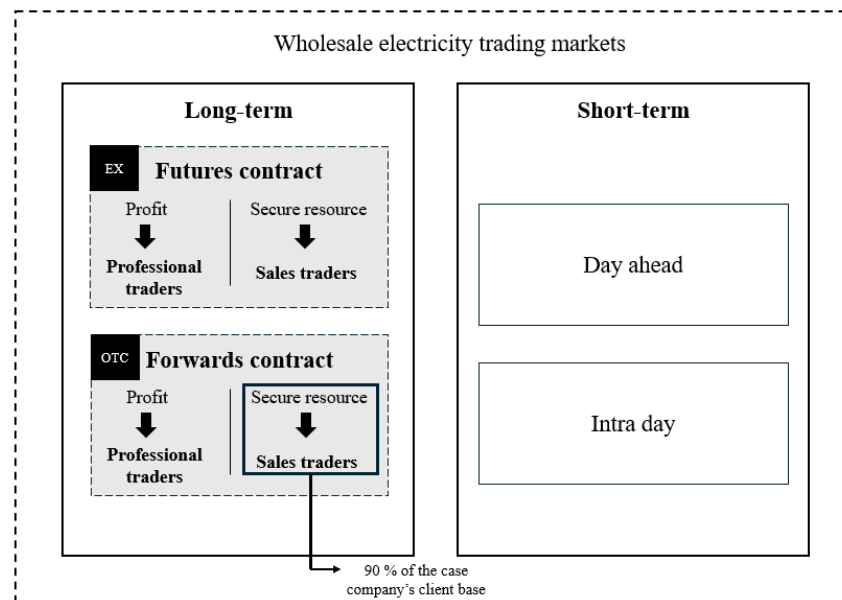


Figure 10. Different trading mechanisms in the wholesale electricity market.

Figure 10 shows that within the long-term basis, it is essential to distinguish between the types of electricity contracts. The gray rectangle marked "EX" (representing the exchange) in the top left corner represents "Futures contracts," which are the types of contract traded through an exchange (CME, 2021). In contrast, the gray rectangle below indicates that these contracts are known as "Forward contracts" when traded OTC (CME, 2021). Moreover, both futures and forward contracts serve two distinct purposes: generating profit and securing resources (Worldforex, 2021).

As outlined by Worldforex (2021), the first trading purpose is to generate economic profit from trading. Market participants can exploit price differences between markets to achieve this. For example, if electricity is priced lower in one market than another, traders can buy in the cheaper market and sell in the more expensive one to capture the price differential. Additionally, the profit may come from speculation. This practice involves buying electricity at a lower price with the expectation that prices will rise, enabling a sale at a higher price later for a profit (Worldforex, 2021). Moreover, Worldforex (2021) refers to these types of traders as "professional" or "financial" traders—individuals or organizations that enter the wholesale electricity trading market with the primary goal of generating economic profit. The

type of contracts negotiated by these type of traders are known as financial contracts (OFGEM, 2009).

The second trading purpose is to secure the physical delivery of electricity under predetermined terms, ensuring its availability at specified times and costs in the future (Worldforex, 2021). For example, a utility company might enter into a forward contract to purchase electricity at a fixed price for the upcoming winter months. This arrangement guarantees that the company will receive the electricity it needs at the agreed-upon price, regardless of fluctuations in the market, thereby providing stability and predictability in its energy costs. According Worldforex (2021), traders who enter the wholesale electricity market to secure the physical delivery of electricity in the future are referred to as "sales" traders. Moreover, these type of traders engage with physical contracts, as reported by OFGEM (2009).

As outlined, there are significant differences between the exchange and OTC markets. However, when engaging in electricity trading within the wholesale market, regardless of the trading channel, one critical concept that must be considered is liquidity. The meaning and importance of liquidity in this context is further explored in the following subchapter.

2.4.2 Market liquidity

At the core of the wholesale electricity trading market lies the concept of liquidity, that according to ACER (2021), is a crucial feature of a well-functioning market. While liquidity can vary in meaning across different contexts, in the wholesale energy market, OFGEM (2009) defines it as the ability to quickly buy or sell a desired commodity or financial instrument without causing significant price fluctuations or incurring substantial transaction costs. According to DNV GL Energy (2020), the more liquid a market is, the easier it becomes for non-vertically integrated firms to compete, as they can enter and exit positions more efficiently, thus reducing risks and barriers to participation. Higher liquidity in the forward market also enhances opportunities for fundamental market participants to execute their hedging transactions swiftly, thereby managing their exposure to price volatility more effectively (DNV GL Energy, 2020).

Table 11 outlines three characteristics of a liquid market according to DNV GL Energy (2020), and how entering a market with well-established liquidity impacts positively.

Table 12. Advantages of entering a market with well-established liquidity (DNV GL Energy, 2020)

Characteristic	Advantage	Why?
High number of existing participants	Immediate access to market participants	A liquid market already has a large number of active buyers and sellers.
High trading volumes	Revenue opportunities	Higher trading volumes translate to higher sales revenue.
Active user base	Scalability	An active and engaged user base provides a solid foundation for scalability.

One effective strategy for identifying these liquid areas is the use of liquidity metrics. According to OFGEM (2009), key liquidity metrics include trading volume, churn factor, and bid-ask spread, which they interpret as follows:

First, the trade volume represents the total amount of contracts traded for a specific commodity within a defined timeframe.

Second, the churn factor measures the total volume traded in comparison to the physical consumption of the commodity. For instance, if the total traded volume of electricity contracts is 5,000 MWh, while the physical consumption of electricity is 1,000 MWh, the churn factor would be 5, indicating a high level of trading activity relative to actual consumption.

Third, the bid-ask spread is the average difference between the highest price a buyer is willing to pay and the lowest price a seller is willing to accept. For example, if buyers are willing to pay up to 50 €/MWh and sellers are willing to accept as low as 45 €/MWh, the bid-ask spread would be € 5, reflecting the price difference between buyers and sellers.

Moreover, a collaborative research initiative undertaken by ECA (2015) sought to provide insights into the operations of forward markets within the EU. Their findings indicate that liquidity is influenced by multiple factors, encompassing market structure, transparency, costs of participation, and cross-border networks. Table 12 briefly describes each factor.

Table 13. Factors influencing liquidity (ECA, 2015)

Factor	Description
Market structure	A major driver of liquidity in the forward market is the presence of a sufficient number of participants. A higher number of market actors typically correlates with increased demand for hedging and increased trading activity.
Transparency	Denoting the provision of sufficient market information regarding volumes and prices.
Costs of participation	Setup costs such as taxes and license fees can be substantial, contributing to elevated transaction costs.
Cross-border networks	Ability to import or export power among countries.

Table 12 identifies critical factors influencing liquidity in the forward electricity market. Market structure relates to the number of participants, which drives trading activity. Transparency involves the availability of market information, essential for informed trading. Costs of participation refer to setup costs like taxes and fees that impact transaction costs. Lastly, cross-border networks enhance liquidity by enabling power trade across national borders.

It is inferred that liquidity is undeniably a fundamental component of the wholesale electricity market, as it not only supports efficient trading and reduces risks but also facilitates the entry of non-integrated firms. Especially, liquidity provides smaller or new firms with the flexibility to enter and exit the market with greater ease, fostering competition and enabling market participation.

2.5 Research framework

Based on the literature review presented in this chapter, a model to estimate the market potential of a new geographic electricity market can be developed, tailored specifically to the product and industry of the case company. As previously discussed, estimating market potential in the electricity sector requires a more comprehensive analysis that incorporates both operational dynamics and economic variables. The innovative aspect of the proposed model lies in its identification of these operational dynamics factors. However, existing literature on estimation of market potential in technology industries can still be applied to support the quantitative elements of the framework. An overview of the proposed model is illustrated in Figure 11.

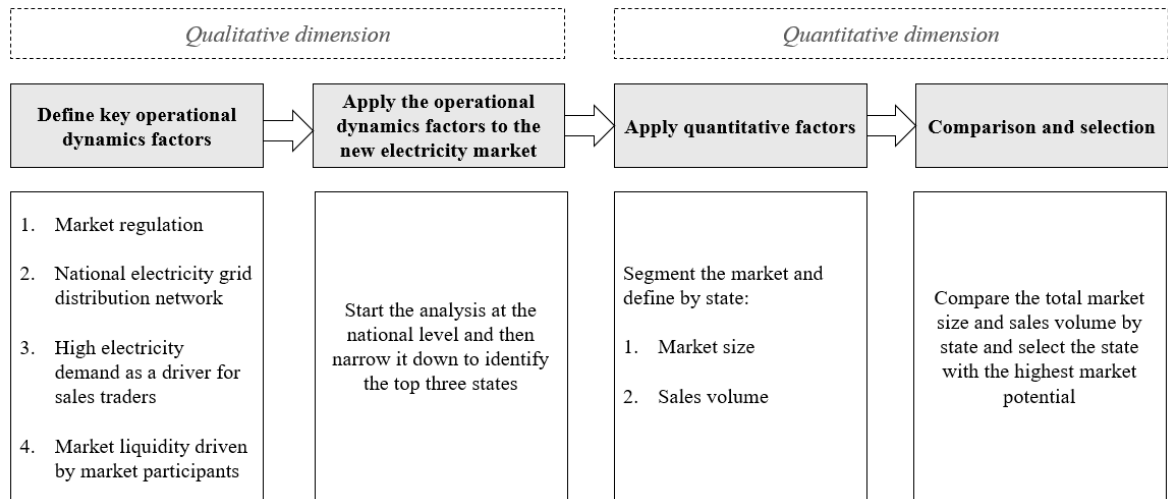


Figure 11. Proposed research framework.

The process for estimating market potential and ultimately selecting a geographic market, driven by data-based decisions, is divided into two dimensions: qualitative and quantitative. It is essential to begin with the qualitative dimension because, even if economic metrics appear promising, it would be unwise for the case company to pursue a geographic area if the operational dynamics criteria are not satisfied.

The research framework first identifies the operational dynamics factors that are critical to the success of the company. Once these factors are defined, the next step is to apply them to the new geographic market. This analysis starts at the national level, with the goal of progressively narrowing down the number of potential states by applying these factors.

After the key operational dynamics factors have been incorporated into the analysis of the new region, the next phase is the quantitative analysis, which begins by segmenting the market. Accurate market segmentation is crucial; if the segmentation is too broad or inaccurate, it could lead to miscalculations that affect the economic metrics. Following the segmentation, the next step is to estimate the market size and potential sales volume. Finally, these figures are compared to determine and select the region with the highest potential.

3. RESEARCH METHODOLOGY

The research methodology employed in this master thesis is based on the onion model proposed by Saunders et al. (2007). This model is structured into five distinct layers, each representing a different aspect of the research process. The layers are systematically examined to provide a comprehensive approach to the methodology and are defined as:

1. Research approach
2. Research strategy
3. Research choice
4. Research time horizon
5. Research technique

First, the research approach addresses how theory is utilized and developed in a research project, influencing the overall design and methodology. Second, the research strategy outlines how the researcher will gather the data. Third, the research choice focuses on the method used to combine quantitative and qualitative techniques. Fourth, the time horizon distinguishes between studies conducted within a specific time frame or over an extended period. Finally, the research technique concerns the type of data collection sources employed in the study. The following subchapters explain each layer for this master thesis.

Figure 12 depicts the adaptation of these five distinct layers specifically for this research.

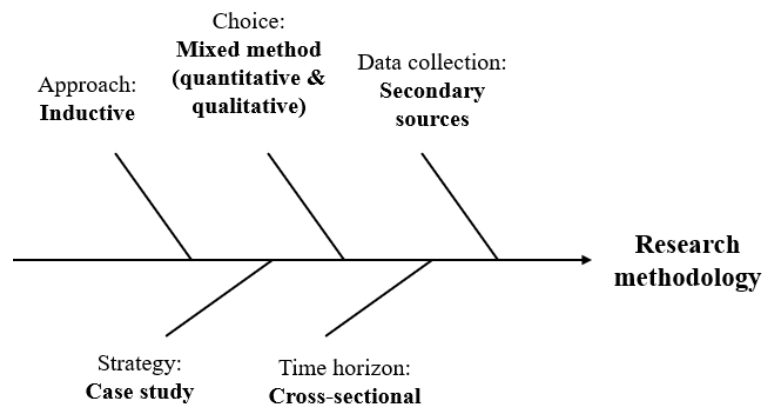


Figure 12. The research methodology and its different layers implemented in this master thesis.

As shown in Figure 12, the research methodology employed in this thesis consists of five distinct layers. The chosen approach is inductive. Moreover, the strategy is based on a case study. The research choice adopts a mixed-methods approach, combining both qualitative and quantitative techniques. Additionally, the time horizon is cross-sectional. Finally, the data

collection relies on secondary sources. The rationale for each selection is further explained in the following subchapters.

3.1 Research approach

In academic research, according to Saunders et al. (2007), two primary approaches to theory development are commonly recognized: deductive and inductive. The deductive approach begins with an established theoretical framework, from which hypotheses are derived and subsequently tested through data collection. The goal is to confirm or refute the proposed theory (Saunders et al., 2007). In contrast, the inductive approach starts without a predetermined theory, allowing patterns and insights to emerge directly from data analysis. These insights then lead to the development of new theoretical perspectives (ibid)

Based on the purpose of this thesis, this research focuses on analyzing the German market, chosen by the success already achieved by the case company, with the purpose of identifying critical operational dynamics factors that directly influence the attractiveness of a new market. The preference of data over a predefined framework is because this approach offers more flexibility and enables a broader exploration where unexpected factors not previously considered may arise, opposite to a deductive framework. Saunders et al. (2007) suggest that an inductive approach is especially important in more complex research environments, where open-ended exploration gives the opportunity to discover unforeseen elements and reduces the possible biases that can be included when using defined hypothesis.

Moreover, the selection of an inductive approach in this research allows the creation of theory based on empirical data from the German electricity market. By letting theory arise from data, the inductive approach enables a better understanding of operational dynamics relevant to the electricity sector, ultimately creating a framework that is relevant based on the context and that is considering the complexities of the field.

3.2 Research strategy

The purpose of research is to create insights yet expanding theoretical understanding and answering specific questions in a methodical way to ensure valid and reliable conclusions (Saunders et al., 2007). As noted by Saunders et al. (2007), in the field of business and management, research holds an additional responsibility: it must balance methodological rigor with practical relevance. Business and management research, therefore, must engage both the theoretical and practical realms, delivering insights that are meaningful to practitioners while advancing academic knowledge (Saunders et al., 2007; Tranfield and Starkey, 1998). This double objective is even more important in fields like market analysis because practical application and dynamics specific to the context play a significant role.

To fulfill this double purpose, this thesis adopts a case study strategy, which involves an in-depth investigation of a specific situation within its real-life context, utilizing multiple sources of evidence. This approach is particularly well-suited for exploring the dynamics of the success of the case company in the German electricity market. Case studies are well known for being an effective strategy for understanding complex and context-dependent situations (Saunders et al., 2007) and are principally useful for addressing questions of “how” and “why” (Yin, 2003), such as in this research- understanding how and why factors influence the potential of a market in OTC electricity trading marketplaces. Additionally, single case studies are especially beneficial considering their capacity to provide deep access to specific contexts, facilitating a full description and analysis of the situation under investigation (Saunders et al., 2007).

By using the current situation of the case company as a case study, this research links the gap between theory and practice, providing a robust framework relevant to the context and supporting both academic requirements and practical application of market potential evaluation.

3.3 Research choice

The type of research choice selected for this thesis includes a mixed-method approach, incorporating both qualitative and quantitative data. According to Saunders et al. (2007), the selection of the type of data depends on the research objectives, which in this thesis is to evaluate the different PEST categories in the context of the electricity market and ultimately estimating economic potential. Moreover, Saunders et al. (2007) explain that the research choice determines if the study will include quantitative, qualitative, or a combination of these two types.

In this study, qualitative data is essential for identifying the key operational dynamics of the German electricity market. These insights need a deeper understanding of the context and qualitative methods are well-suited to provide it. On the other hand, quantitative data is essential for estimating economic potential, allowing a mathematical evaluation of market potential and ensuring that the proposed framework includes measurable data.

By combining these two types of data, the mixed-method approach offers a more comprehensive analysis yet linking qualitative and quantitative data. This mixed-method supports that the resulting framework is robust enough for addressing not only the operational dynamics but critical economic factors in evaluating market potential.

3.4 Time horizon

When considering a research study, one crucial element to consider is the time horizon that the study will have. As Saunders et al. (2007) explain, the time horizon refers to whether the research is designed as a "snapshot" (cross-sectional) taken at a particular moment or as a "diary" (longitudinal) capturing changes over time. The choice depends on the research objectives, available time, and the nature of the phenomena being studied.

This research uses a cross-sectional horizon due to the limited timeframe, a few months, available to conduct the study. While certain characteristics being analyzed, such as regulatory framework, change gradually over long periods of time, this study focuses on examining a snapshot of the German and U.S. electricity market as they currently are. This time horizon is suitable for creating a framework that identifies key market potential factors, and for providing well-time actionable insights without needing to spend long observation periods.

Although there are some market characteristics, such as infrastructure or regulatory changes, that happen through stages and long periods of time, the cross-sectional approach offers a practical solution to offer relevant findings considering the timeframe constraints of the study.

3.5 Techniques for collecting data

According to Saunders et al. (2007), techniques for collecting data can include either primary data—data collected directly by the research for a specific purpose—or secondary data—data collected previously for other purposes but that can be reused and reanalyzed to answer new research questions.

Furthermore, Saunders et al. (2007), suggest that secondary data is particularly beneficial when the research needs broad comparisons or extensive data sets, as this type of data offers a practical alternative to the costs and time involved in the process of gathering primary data. Additionally, Dale (2004) and Saunders et al. (2007) agree that secondary data is frequently used in business and management research especially for case study analysis, mainly because this data source allows to access pre-existing discoveries and can lead to unexpected findings. For example, Dale (2004) illustrates how secondary data can lead to unforeseen findings, as demonstrated by the link between smoking and lung cancer, which was established through reanalyzing medical records not initially collected for that purpose.

This master thesis relies on secondary data as the primary data collection technique. By analyzing pre-existing data on economic and energy factors in Germany and the United States, this approach supports the exploratory and inductive nature of the study. According to Saunders et al. (2007), secondary data is especially suitable for projects requiring national

or international comparisons, as it provides large, reliable datasets that are often of higher quality than data collected independently. Additionally, the use of secondary data aligns with the research's need for broad and reliable insights. Government reports and industry studies, for example, offer high-quality information crucial for understanding regulatory frameworks, market demand, and economic performance in the electricity sector.

4. RESEARCH EXECUTION

4.1 Identification of operational dynamics factors

The first part of the research, which identifies the key operational dynamics factors, begins with a thorough analysis of the various forces shaping the German electricity market, as illustrated in Figure 13.

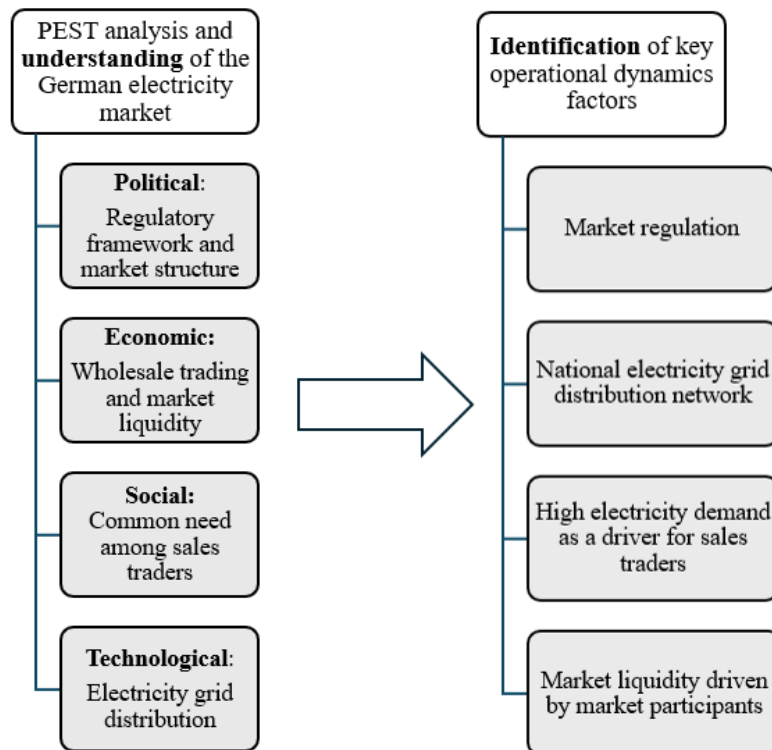


Figure 13. Key operational dynamics factors and the process to identify them

Figure 13 shows that the process involves analyzing the German electricity market through the lens of the PEST model, focusing on key elements such as market structure, regulatory framework, wholesale trading, market liquidity, a common need among sales traders, and the electricity grid distribution. Building upon this foundational understanding from the literature review, the key operational dynamics factors influencing the success of the case company within the German electricity market were subsequently identified.

4.1.1 Market regulation

The first category of PEST analysis—Political—addresses government policies and regulatory frameworks, which are particularly critical in electricity markets. In Germany, the electricity market is strictly regulated, with policies that govern market entry, pricing, renewable energy integration, and electricity trading. Given this rigorous oversight, evaluating the political and regulatory landscape is essential for understanding compliance requirements, operational constraints, and strategic opportunities within the market.

This market is not only regulated at a national level but also at a European Union level under policies that aim to strength competition, foster innovation and enable a cross-border integration of electricity trading. The EU regulations assist in increasing the liquidity and the size of the overall market by ensuring that all the electricity markets of the member states are coupled and can interact more efficiently. This creates an ideal environment, both politically and operationally, for the establishment of electricity trading platforms.

First, the liberalized access to the German grid encourages competition. This available competition attracts a high number of participants from the different stages of the electricity supply chain such as generators, suppliers, and traders, all trying to harness the competitive opportunities of the market. Consequently, the wholesale electricity market becomes more dynamic and diverse, enabling opportunities for electricity trading platforms to interact with a wider pool of participants.

Second, the high level of competition requires market participants to be constantly innovating. In a competitive environment, the participants who are not capable of innovating have more disadvantages and thus a higher risk of not achieving their desired goals. Hence, participants look for advanced technologies and strategies to gain competitive lead. OTC electricity trading platforms, known for their flexibility and capacity for digital innovation, are well-suited to meet this demand. These platforms offer solutions that may be customized and the integration of real-time data that enable traders to innovate and remain competitive in the market.

Third, the liberalization of the German market supports cross-border integration within the European Union. As Germany's electricity market is interconnected with those of other EU countries, this interconnection allows cross-border electricity trading. The possibility of being internationally interconnected increases the potential to reach more participants and at the same time the liquidity of the trading platform, allowing market participants to optimize their trading strategies across different countries.

This underscores the critical importance of market liberalization and the creation of competitive regulatory frameworks to enable the success of electricity trading platforms. Thus, the first key market factor identified is recognized as:

Market regulation

The platform of the case company, positioned at the intersection of technology and finance, leverages this point to provide advanced trading tools, customizable solutions, and value added services. By fostering innovation, the platform of the case company enhances market efficiency and attracts users. Therefore, the principle of open competition—central to a liberalized market—emerges as a crucial factor in evaluating the potential for entering new geographic markets.

4.1.2 National grid distribution network

In the context of the case company, the second most relevant category from the PEST model is Technology, as the company’s targeted customers—sales traders—depend entirely on the grid network. This is a critical factor influencing trading volumes and, consequently, the company’s market revenue. Since sales traders' operations are reliant on grid availability, it is crucial for them to have access to a well-integrated grid network that facilitates the smooth flow of electricity from a variety of suppliers to multiple delivery points.

Such a network enables market participants to execute trades without being constrained by the physical location of generation or delivery points. For example, if a trader wishes to purchase electricity from Generator A but the plant is not connected to the desired delivery point, the transaction becomes unfeasible. In this case, a trader would not opt for that supplier. Therefore, the more interconnected the grid, the more opportunities there are for sales traders to select from diverse suppliers. This, in turn, increases the demand for platforms that consolidate these transactions.

Germany’s grid stands out due to its extensive interconnectivity, both within the country and with neighboring nations, offering a significant advantage for sales traders in this region. Figure 14 illustrates how transmission lines within Germany and across borders enable the seamless exchange of electricity between different states.

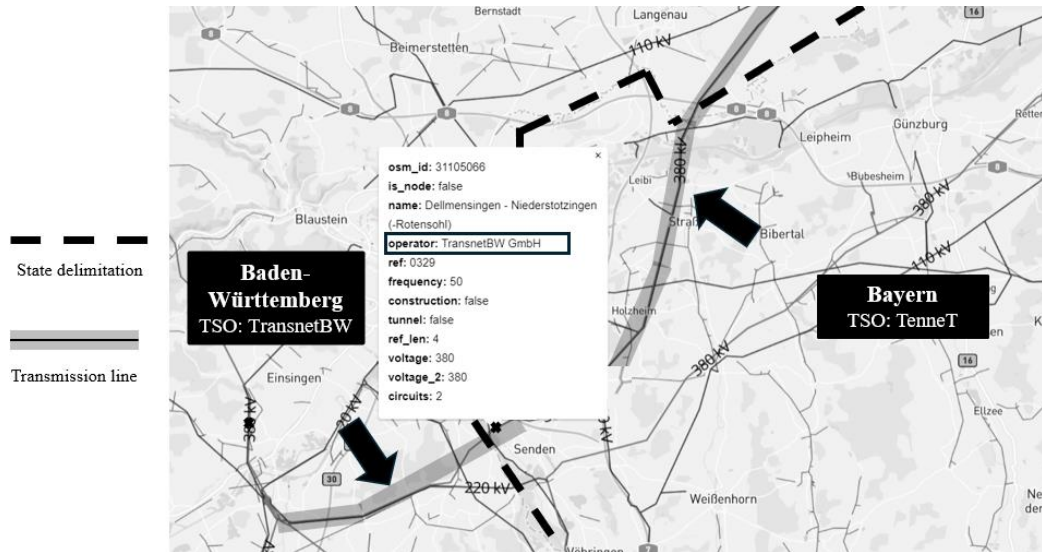


Figure 14. Different states interconnected through the same transmission system operator line.

The dashed line in figure 14 represents the boundary between Baden-Württemberg and Bayern, with black arrows pointing to the transmission line that crosses both regions. Despite being part of different balancing zones—Baden-Württemberg within TransnetBW and Bayern within TenneT—the grid's strong interconnection allows electricity to be efficiently transported between these two states, enhancing market liquidity and stability.

For sales traders, this means they can purchase electricity from a generator in Bayern and request delivery in Baden-Württemberg. Without such interconnectivity in the grid, executing trades between these states would be impossible, thereby limiting competition. In the absence of such flexibility, traders may be forced to rely on specific providers with pre-existing agreements, ultimately restricting trading activity and reducing market dynamism.

Recognizing the grid distribution network as the backbone of electricity transportation and understanding how its interconnectedness positively impacts sales traders activity, the second key market factor identified is:

National grid distribution network

The efficient interconnection of the grid across various TSOs, DSOs, and international borders enhances the number of physical electricity contracts by offering greater trading flexibility, thereby attracting more market participants. As a result, the strength of grid interconnectivity becomes a vital consideration when evaluating the potential for expansion into new geographic markets.

4.1.3 High electricity demand as a driver for sales traders

The third key element affecting the attractiveness and usability of the case company's platform falls within the "Social" category of the PEST model. Rather than addressing technical aspects of the electricity market, this factor focuses on meeting customer needs. As with any product, the primary objective is to fulfill a customer requirement—in this case, addressing their intensive electricity consumption needs.

The company has demonstrated its ability to add value in the fragmented wholesale electricity market, particularly in regions with abundant sales traders. The main motivation of sales traders is ensuring a stable electricity supply for the future, a need driven by the high electricity demand in their operations.

The electricity market is a complex environment, mainly characterized by its remarkable fragmentation. This fragmented setting forces market participants to interact with a multiple range of members, including utilities, producers, brokers, and intermediaries. In this fragmented setting the case company adds value by simplifying the interaction process. The platform enables sales traders to manage multiple suppliers efficiently, ensuring that sales traders can lock the best contract terms yet reducing manual workload and time investment. With capabilities to generate quotes rapidly and automate processes that happen after signing a contract, the platform allows to save considerable amount of time, enhancing the productivity of the trader.

Additionally, sales traders often have electricity needs that fluctuate during the year. For instance, companies with seasonal production cycles may need higher electricity volumes during peak seasons and less during non-peak periods. To address this fluctuation, traders harness flexibility of customized contracts available through OTC trading, which offers more adaptability than the standardized contracts found on exchanges. The case company's platform serves this need, by enabling traders to customize contracts that align with their specific operational demands.

The largest customer base for the case company in Germany consists of sales traders, and Germany presents a very particular characteristic, it is the largest electricity consumer in the European Union. This suggests a possible correlation between high electricity demand and sales traders' activity. In Germany, the majority of wholesale electricity transactions—approximately 85% to 90%—take place through OTC trading. This trend yields bigger opportunities to tap into a large market and thus, generate higher revenues.

Hence, the third market factor focuses on a critical element driving sales traders to engage in forward contracts, which is defined as:

High electricity demand as a driver for sales traders

Sales traders, representing organizations with critical energy needs, rely heavily on platforms that enable them to efficiently secure future energy resources. Electricity demand is a key factor influencing their trading strategies, pushing them towards long-term contracts to mitigate price volatility and ensure supply security. In markets with high consumption, such as Germany, the role of the platform of the case company is particularly significant, as it provides the necessary tools for traders to manage their future energy needs in a volatile and complex market environment.

4.1.4 Market liquidity driven by market participants

The final category of the PEST analysis to be examined—Economic—focuses on the liquidity of the wholesale electricity trading market. Liquidity is crucial because it enables market participants to quickly buy and sell contracts. Hence, in liquid markets, trading is relatively easy compared to less liquid markets, where the process of buying and selling is slower and often more costly due to fewer market participants and wider bid-ask spreads. For example, in markets with low liquidity, such as niche or new energy products, trades can be more difficult to execute, leading to delays and higher transaction costs.

In contrast, a liquid market is characterized by a large pool of active participants. This creates a network effect, where the value of the market platform increases as more participants engage in it. Specifically, the more buyers and sellers there are, the greater the opportunities for trading, which in turn attracts even more participants. This self-reinforcing cycle is essential for fostering liquidity. As more participants join, there are more contracts available to trade, ensuring that trades can be executed quickly and at fair market prices. This is particularly important in the context of electricity trading, where price volatility and the need for timely execution can significantly impact business outcomes.

Additionally, the ease of buying and selling in a liquid market increases trading volumes. For the case company, this is particularly advantageous, as a large portion of its revenue is tied directly to trading volumes. The more contracts that are executed on the platform, the more the company benefits financially.

Moreover, this high liquidity also means that market participants are more aware of adopting innovative trading solutions, such as the case company's platform, which offers a more efficient way to execute trades. In liquid markets with a high concentration of participants who understand the value of such innovations, the company will face less resistance in creating market awareness compared to less liquid markets, where such urgency may not exist.

Thus, liquidity plays a pivotal role in evaluating market potential. To effectively measure liquidity, it is essential to define its key drivers. While specific metrics exist for assessing market liquidity, the objective of this research is to develop a robust framework for evaluating

market potential, which deems more beneficial to adopt a more holistic approach. Instead of relying solely on traditional metrics, the focus is placed on identifying the most impactful factor that drives liquidity in the market: the market structure—defined by the number of active participants.

While other factors, such as market transparency, participation costs, and cross-border networks, also contribute to market liquidity, they are not the primary focus. Transparency and participation costs principally influence how accessible the market is for participants, but they do not directly determine the level of liquidity in the market. Cross-border networks, while important for the flow of electricity across regions, have already been addressed in the operational factor of "grid distribution networks." By excluding these factors, the analysis is streamlined to focus on the number of active participants in the market—both buyers and sellers—and how this density of participants directly impacts trading activity and liquidity.

In the German wholesale electricity market, a high concentration of participants relative to the size of the country, ensures not only the availability of counterparties for transactions but also competitive prices, which in turn drives higher trading volumes. This participant density creates an environment where liquidity thrives, providing a solid foundation for the effectively operation and success of the case company.

Hence, given the significance of liquidity in the wholesale electricity market and the various benefits it brings to the case company, it is essential to focus on a key market factor that is recognized as one of the major drivers of liquidity. This key market factor is defined as:

Market liquidity driven by market participants

The presence of a large, diverse, and engaged participant base not only drives liquidity but also establishes the conditions necessary for the platform to grow and thrive.

4.2 Application of operational dynamics factors to the U.S. electricity market

The first stage of the research process, detailed in the previous subchapter, involved identifying key operational dynamics factors in the German electricity market that contributed to the success of the case company in this market. This subchapter proceeds to the second stage by applying the four key operational dynamics factors to the U.S. electricity market with the goal to identify three states that align the most with the criteria established. Figure 15 visually represents the key operational dynamics factors that are applied .

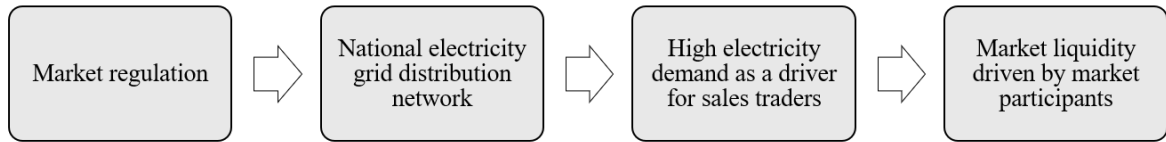


Figure 15. Operational dynamics factors of the qualitative dimension of the research framework

Starting with all 50 states at a national level, the application of each market factor progressively narrows down the potential regions. After the final key market factor is applied, three U.S. states are selected for further analysis and estimation of their quantitative market potential.

4.2.1 Analysis of the U.S. electricity market regulation

The initial and most critical factor in evaluating the feasibility of deploying an electricity trading platform in a new geographic market is the nature of market regulation. As outlined in Section 4.1.1, understanding whether the market promotes open competition or remains vertically integrated is essential. An open and competitive market is vital for the successful implementation and operation of an electricity trading platform. It allows multiple participants to engage in trading activities, enhances efficiency, and encourages innovation—key characteristics necessary for the adoption and success of a digital trading marketplace.

The U.S. electricity market operates under a complex regulatory framework, with authority divided between federal and state governments. At the federal level, the FERC (Federal Energy Regulatory Commission) oversees the interstate transmission of electricity, wholesale electricity markets, and electricity pricing (FERC, 2024c). Meanwhile, PUCs (Public Utility Commission) in each state regulate retail electricity rates, local distribution, and the operations of utility companies within their jurisdictions (FERC, 2024c).

According to EIA (2023b), the U.S. electricity industry was dominated by vertically integrated utilities that controlled generation, transmission, and distribution within defined service areas, operating as regulated monopolies. However, starting in the 1990s, the industry began a gradual shift toward deregulation, with several states introducing competitive wholesale and retail electricity markets (ibid). This deregulation aimed to break up monopolistic control, introduce competition, and drive innovation across the energy value chain (EIA, 2023b).

The current wholesale electricity market in the U.S. can be broadly categorized into traditional regulated (vertical integration) and deregulated (market competition) (EPA, 2024a). Figure 16 illustrates these distinctions. This separation plays a pivotal role in

advanced trading tools. These deregulated markets highlighted in white, encompass Northeast, Midwest, Texas, and California. These sectors are overseen by ISOs and RTOs, which are crucial in deregulated markets. Beyond managing the transmission grid, ISOs and RSOs operate wholesale markets where electricity is bought and sold, ensuring the market functions efficiently and reliably (FERC, 2024b).

In the U.S these ISOs/RSOs are the equivalent to the TSOs in Germany. RTOs/ISOs are responsible for managing transmission without direct ownership or maintenance of the infrastructure. Presently, approximately two-thirds of the U.S. population is served by electricity markets operated by regional RTOs/ISOs (FERC, 2024a). There are seven separate RTO/ISOs, each serving a specific zone within the country. Table 14 list the different ISO/RSOs and their corresponding operating areas according to (EPA, 2024b).

Table 14. *U.S independent/regional system operators and their respective operating areas (FERC, 2024b)*

ISO/RSO	Operating states	Cross-border connection
California Independent System Operator (CAISO)	(2): Most part of California and small portion of Nevada.	Mexico
Electric Reliability Council of Texas (ERCOT)	(1): Most part of Texas.	Mexico
ISO New England (ISO-NE)	(6): Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island and Vermont.	Canada
Midcontinent Independent System Operator (MISO)	(15 + 1 Canada state): Montana, North Dakota, South Dakota, Minnesota, Iowa, Wisconsin, Michigan, Indiana, Illinois, Missouri, Kentucky, Arkansas, Mississippi, Louisiana, and Texas. It operates the Canadian province of Manitoba.	Canada
New York Independent System Operator (NYISO)	(1): New York.	Canada
PJM Interconnection (PJM)	(13): Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia and West Virginia) and the District of Columbia.	Canada
Southwest Power Pool (SPP)	(14): Arkansas, Iowa, Kansas, Louisiana, Minnesota, Missouri, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, and	Canada

Among the seven ISOs/RTOs in the U.S., two operate within a single state: NYISO and ERCOT. Although CAISO also extends into a small portion of Nevada, it could be primarily considered a single-state operator. In contrast, MISO, SPP, and PJM are the largest operators, each managing more than ten states. Additionally, all ISOs/RTOs are interconnected cross-border through the grid with either Mexico or Canada.

Evaluating the potential for implementing an electricity trading platform in the U.S. requires a focus on regions with competitive market structures. The vertically regulated areas, which

do not foster competition, are deemed unsuitable for such platforms. Conversely, the competitive markets in the Northeast, Midwest, Texas, and California, managed by the ISOs/RSOs: CAISO, SPP, MISO, JPM, ISO-NE, NY ISO, and ERCOT represent high-potential markets. These markets enable multiple generators, retailers, and other participants to engage in wholesale trading activity, creating opportunities where the case platform of the company can add significant value.

4.2.2 Analysis of the U.S. grid distribution network

The second key market factor in the framework focuses on the capacity to physically transport electricity, emphasizing the movement of power from its origin to its intended destination. The grid distribution network plays a crucial role in this process, particularly for physical forward contracts. Effective grid connectivity and the management of cross-border electricity flows are vital for fostering a competitive and efficient market. High levels of interconnection enhance trading flexibility and attract more market participants, creating an optimal environment for the platform of the case company.

The U.S. electricity grid is physically divided into three major interconnections: the Eastern Interconnection, the Western Interconnection, and the Texas Interconnection (EPA, 2024a). Figure 17 visually represents the division of these three major interconnections.

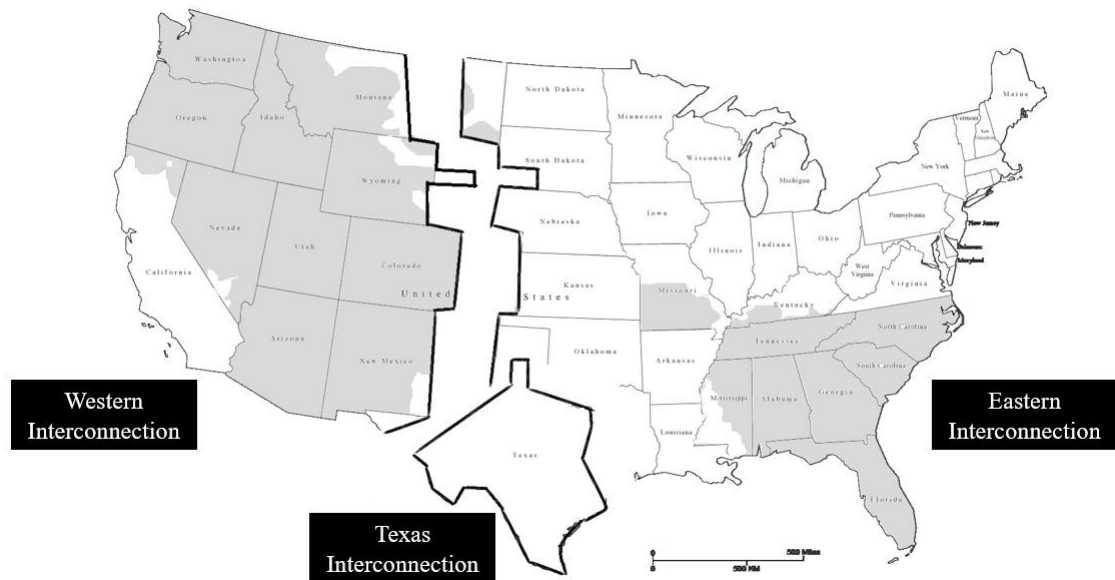


Figure 17. Major U.S. grid interconnections (EPA, 2024a)

Each interconnection operates largely independently, with limited electricity transfer capabilities between them. For example, trading physical electricity between the Eastern and

Western Interconnections is challenging due to the lack of direct physical connections of the grid network. Each interconnection is managed by its respective ISO or RTO. In the Western Interconnection, the deregulated market is represented solely by CAISO, while the Texas Interconnection is managed by ERCOT. The Eastern Interconnection, however, encompasses the remaining five ISOs/RTOs. Table 15 summarizes the ISO/RTOs associated with each major interconnection (EPA, 2024b).

Table 15. Major U.S. grid interconnections and their respective independent / regional system operators (EPA, 2024b)

Major interconnection	ISO/RSO	Cross-border connection
Eastern	ISO-NE	Canada
	MISO	
	NYISO	
	PJM	
	SPP	
Texas Interconnection	ERCOT	Mexico
Western Interconnection	CAISO	Mexico / Canada

The Eastern Interconnection is the largest of the three major U.S. electricity grids, featuring an extensive network of transmission lines and generation facilities. Its significant inter-state connectivity supports robust electricity trading and market operations across state lines, and it facilitates power transmission with Canada.

The Western Interconnection operates independently from both the Eastern Interconnection and ERCOT (EPA, 2024b). Moreover, the Western Interconnection covers parts of Canada, northern Mexico and the western U.S. However, U.S. electricity trade with Mexico is minimal, representing less than 0.01% of total U.S. electricity use, according to the EIA (2013).

ERCOT serves most of Texas and operates almost entirely independently from the Eastern and Western Interconnections (EPA, 2024b). The ERCOT grid is notable for its minimal interconnections with other states, although it does exchange power with Mexico.

These three interconnections are vital for facilitating trading opportunities and ensuring market efficiency (EPA, 2024b). Regions with robust connectivity can better manage supply and demand fluctuations, integrate diverse energy resources, and enhance market liquidity, thereby attracting more market participants.

However, the Western Interconnection and ERCOT present more challenges for the platform of the case company compared to the Eastern Interconnection. Consequently, California and Texas are excluded from further analysis, as detailed below.

Within the Western Interconnection, California —managed by CAISO— possess limited connection with other major U.S. grid regions, operating largely in isolation (FERC, 2024a). Furthermore, according to FERC (2024a), although there are some electricity exchanges with neighboring states, these are minimal compared to the trading volumes in more active regions like the Eastern Interconnection. The integration of CAISO with vertically regulated markets further limits its participation in competitive wholesale markets. This isolation and restricted interconnection reduce the potential for CAISO to support case company success, as it affects the liquidity and flexibility of physical electricity trading across broader regions. Consequently, California does not fully meet the desired characteristics for grid network distribution.

Additionally, ERCOT is notable for its significant independence from the rest of the U.S. electricity grid. Operating largely as a separate entity, ERCOT manages its own grid with minimal interconnections to other regions (FERC, 2024a). While this isolation allows ERCOT to establish unique market conditions and regulatory frameworks (FERC, 2024a), it also limits the ability to trade electricity across state and regional boundaries. The lack of robust interconnection with other major grids restricts trading flexibility for physical contracts with other states, making ERCOT unsuitable for the case company platform, when considering the need for high levels of grid interconnectedness.

In contrast, the remaining regions—SPP, MISO, PJM, NYISO, and ISO-NE—demonstrate more robust grid network interconnections among their states. This extensive connectivity makes them more suitable for further analysis, as their grid distribution networks better support the platform of the case company, particularly for trading forward physical contracts.

The interconnectedness of the grid network between different states is essential for facilitating electricity trading, enhancing market liquidity, and providing flexibility in physical electricity contracts. The assessment of the U.S. electricity grid distribution network identifies that regions within the Eastern Interconnection—SPP, MISO, PJM, NYISO, and ISO-NE—are more suitable for market expansion due to their superior liquidity and trading opportunities. In contrast, while California and Texas are part of competitive wholesale markets, their relatively isolated grid operations impose limitations, affecting their suitability for broader market engagement.

4.2.3 Analysis of the U.S. electricity demand

Building on the grid distribution network analysis, this subchapter narrows the focus to a more granular state-level analysis within the five selected ISO/RSO areas. The third operational dynamic factor—electricity demand—will be applied to identify states with the highest consumption. As discussed in subchapter 4.1.3, electricity demand is a critical driver of market activity, particularly for platforms facilitating the trading of electricity forward

contracts. Sales traders, representing entities with substantial and stable electricity needs, are more likely to engage in high-demand regions. Therefore, this subchapter aims to identify the most promising states for market expansion based on their electricity consumption patterns.

In 2022, the U.S. consumed approximately eight times more electricity than Germany, positioning it as the second-largest consumer globally, just behind China (Statista, 2024b). This significant difference underscores the vast market potential the U.S. holds for the case company, particularly in terms of electricity consumption, making it a highly attractive target for expansion.

The U.S. ranks among the largest electricity consumers globally (Statista, 2024b), driven by diverse factors such as economic activity, industrialization, population density, urbanization, and weather patterns (EIA, 2023b). Table 16 provides a summary of how each of these factors contributes to increased electricity consumption.

Table 16. *Factors contributing to high electricity consumption (EIA, 2023b).*

Factor	Why?
Economic activity and industrialization	States with a large industrial base typically have higher electricity consumption due to the energy-intensive nature of these activities.
Population density and urbanization	Highly populated states with large urban centers use more electricity to support residential, commercial, and public infrastructure needs.
Climate	States experiencing extreme weather, such as hot summers or cold winters, typically use more electricity to meet heating and cooling requirements.

States with a high level of industrialization tend to exhibit greater electricity usage, as industries such as manufacturing require substantial energy inputs. Similarly, states characterized by high population densities and extensive urban centers have elevated electricity consumption to meet the demands of residential buildings, commercial enterprises, and infrastructure. Additionally, climatic conditions play a pivotal role in influencing electricity consumption. States experiencing extreme temperatures, whether hot or cold, typically require more energy for heating and cooling to maintain comfortable living conditions.

To facilitate a more streamlined analysis of electricity consumption, it is advantageous to examine data that quantifies electricity usage per state. Figure 18 presents this information, excluding the states previously discarded.

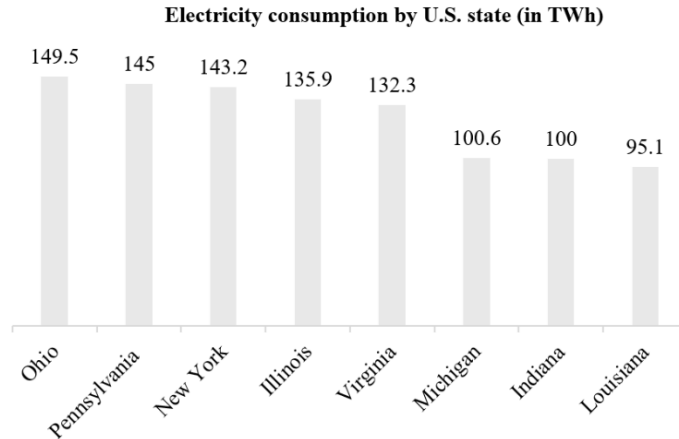


Figure 18. *Deregulated states with the highest electricity consumption within the Eastern Interconnection in 2022 (Statista, 2024b)*

Figure 18 illustrates that, within the eastern interconnection and specifically the areas managed by ISO/RTOs, Ohio, Pennsylvania, and New York are the top three states in terms of electricity consumption, each reporting similar volumes exceeding 140 TWh. Hence, these three states are prioritized for further analysis due to their high electricity demand. Illinois and Virginia are also included for further analysis, as their consumption levels slightly above 130 TWh are comparable to those of Ohio. In contrast, Michigan, Indiana, and Louisiana, with consumption ranging from 95 to 100 TWh, are comparatively lower and thus excluded from further analysis. Therefore, the top five states—Ohio, Pennsylvania, New York, Illinois, and Virginia—are selected for detailed examination.

The U.S. electricity market offers substantial opportunities for the case company, in states with the highest electricity demand. The top five states—Ohio, Pennsylvania, New York, Illinois, and Virginia—are particularly significant due to their high consumption, driven by factors such as industrial activity, population density, and climate conditions. Targeting these high-demand states enables the company to engage with markets where sales traders are actively seeking solutions to meet their future energy requirements. Prioritizing these states in market analysis and strategic planning will support consistent growth and effective market penetration.

4.2.4 Analysis of market participants

This subchapter focuses on analyzing the number of relevant market participants engaged in trading physical forward contracts, a crucial factor for assessing market liquidity and, consequently, market potential. As outlined in section 4.1.4, a liquid market significantly boosts the chances of the case company of success when entering a new geographic market.

The analysis is specifically for the states selected in subchapter 4.2.3: Ohio, Pennsylvania, New York, Illinois, and Virginia. Each state is evaluated and scored based on the volume of relevant participants across different segments. This evaluation aims to identify the top three most attractive states according to the qualitative criteria outlined in the research framework.

Power generation organizations, electricity suppliers, and industrial consumers, particularly within the manufacturing sector were identified as relevant market participants who directly influence the liquidity of physical forward markets. The rationale for selecting these three segments is detailed below.

OFGEM (2009) underscores that generators and suppliers are the principal participants in the forward electricity market due to their central role in energy trading. Moreover, this aligns with the client base of the case company and thus justifies their inclusion in the analysis. Figure 19, according to EIA (2023a), summarizes the total number of power generation plants and electricity providers.

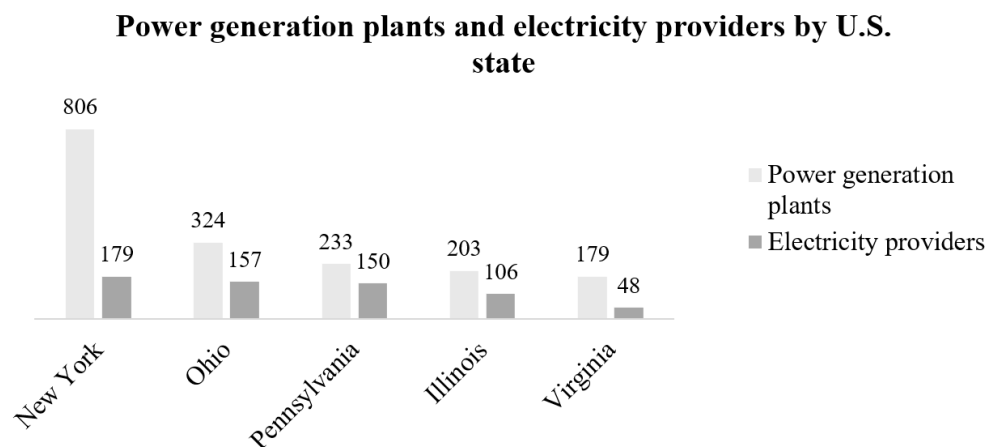


Figure 19. Total number of power plants and electricity suppliers by U.S. state (EIA, 2023a)

New York stands out significantly in the number of power generation organizations compared to the other four states, highlighting its robust electricity generation market. However, the number of electricity providers across the states is relatively similar, with the exception of Virginia, which has fewer than 50 providers.

The rationale behind choosing the industrial sector and discarding the rest -as explained below- lies in the significant amount of electricity consumption of the industrial sector and the sales strategy of the case company.

In 2022, according to Statista (2024a) the residential sector emerged as the largest electricity consumer in the U.S., accounting for nearly 40% of total consumption. However, from a

business perspective, the residential sector is served primarily by electricity suppliers; thus, this sector is already indirectly being considered for analysis.

The commercial sector followed with 35% of consumption; however, this segment is less relevant for the case company, as the case organization primarily targets industrial customers.

The industrial sector, besides being part of the target customers of the case company, it represents a substantial market share of national energy consumption with slightly over 25% of the total (Statista, 2024a). Furthermore, within the U.S. industrial sector, the manufacturing industry is the largest consumer, accounting for nearly 80 % of the total electricity consumed by the industrial segment (EIA, 2022), as shown in Figure 20. Consequently, a deeper focus on the manufacturing sector is especially relevant for the analysis.

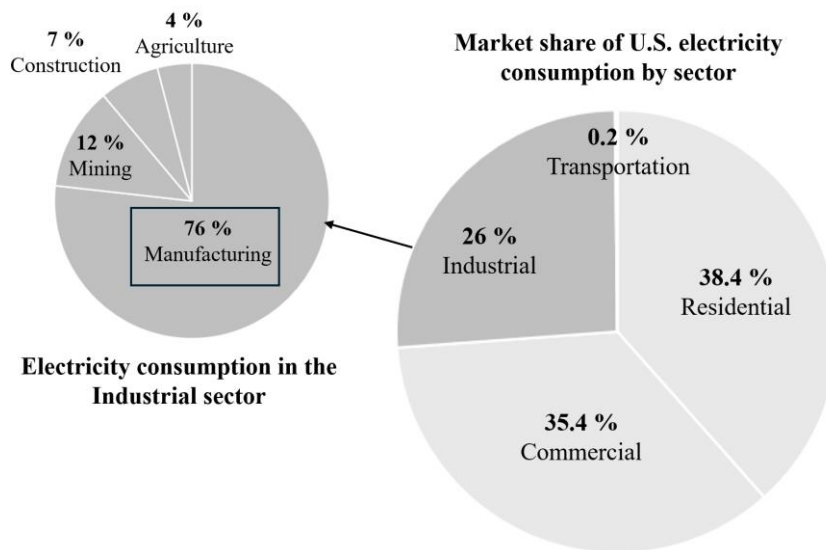


Figure 20. Market share of U.S. electricity consumption by sector (EIA, 2022; Statista, 2024a)

The manufacturing industry is the dominant consumer of electricity within the industrial sector, accounting for nearly 80 % of its total consumption. In comparison, mining contributes 12 %, construction 7 %, and agriculture 4 %. Collectively, these three industries represent less than half of the electricity consumed by the manufacturing sector, and therefore, coupled with the sales strategy of the case company, these remaining sectors are excluded from further analysis. Figure 21 presents the total amount of manufacturing companies in the selected states according to IndustrySelect (2024).



Figure 21. Number of total manufacturing companies by U.S. state (IndustrySelect, 2024)

Ohio leads in the total number of manufacturing companies by state. However, the figures are quite similar among the other states, except for Virginia, which has only about 35% as many manufacturing companies compared to the others.

After compiling data on the total number of relevant market participants who directly influence the liquidity of physical forward markets, a scoring scale for each state can be established. Table 17 summarizes the scoring for the selected countries.

Table 17. Scoring table based on number of market participants.

State	Power generation	Electricity supply	Manufacturing industry	Total
New York	5	4	5	14
Ohio	3	5	4	12
Pennsylvania	3	4	4	11
Illinois	2	4	3	9
Virginia	1	1	1	3

Furthermore, as explained by OFGEM (2009), the generators and the suppliers are the most frequent traders of physical forwards contracts. Additionally, the manufacturing industry is the minority of the customer base of the case company. Thus, a weight of 40 % is assigned to power generation and electricity suppliers, while the 20 % remaining is allocated to the manufacturing industry. This enables the identification of the top three states with the highest qualitative market potential. The details of this analysis are presented in Table 18.

Table 18. Scoring table based on different weights by sector.

Sector		Weight
Power generation		40%
Electricity suppliers		40%
Manufacturing industry		20%

State	Power generation	Electricity supply	Manufacturing industry	Total
New York	2	1.6	0.8	4.4
Ohio	1.2	2	1	4.2
Pennsylvania	1.2	1.6	0.8	3.6
Illinois	0.8	1.6	0.8	3.2
Virginia	0.4	0.4	0.2	1

After analyzing the operational dynamics factors to qualitatively assess the market potential of the U.S. electricity market, Table R summarizes the top five states selected for evaluating the liquidity of their physical forward markets, based on the number of relevant participants. Each state was scored across different segments of market participants, with New York emerging as the leader with a total of 14 points, indicating the highest liquidity in physical forward markets. Ohio follows with 12 points, and Pennsylvania with 11 points. These three states, therefore, represent the highest market potential according to the qualitative analysis and will be further examined for their quantitative market potential in the following subchapter.

4.3 Analysis and estimation of quantitative market potential

This subchapter details the final stage of the research process, which involves analyzing and estimating the quantitative market potential of the three U.S. states identified in the second stage of the study—New York, Ohio, and Pennsylvania. The primary objective is to determine which of these states holds the highest quantitative market potential.

Drawing from the literature review, a model can be created to guide the design of a segmentation strategy and the selection of an appropriate market segment for the specific industry of the case company. The foundational steps outlined by Burk (2004) will be applied initially, with each step adjusted and refined based on the insights provided by the literature review.

To effectively evaluate the segment, the analysis must be broken down according to the sources of revenue. The revenue model of the case company is based on two distinct streams: access fee and trading fee. Access fee (AF) is charged at the company level of the customer, with organizations paying an annual fee for platform access. Therefore, estimating the market potential for this revenue source requires considering the number of potential companies.

Additionally, trading fee (TF) is charged for each MWh of electricity traded by customers; hence, essential to determine the potential trading volume.

The proposed sequence for the segmentation process of a specialized software firm is divided into three main steps, as illustrated in Figure 22. Since estimating the market size for the AF depends on the number of companies, while the TF market size is determined by electricity volume, the segmentation process must account for these differences.

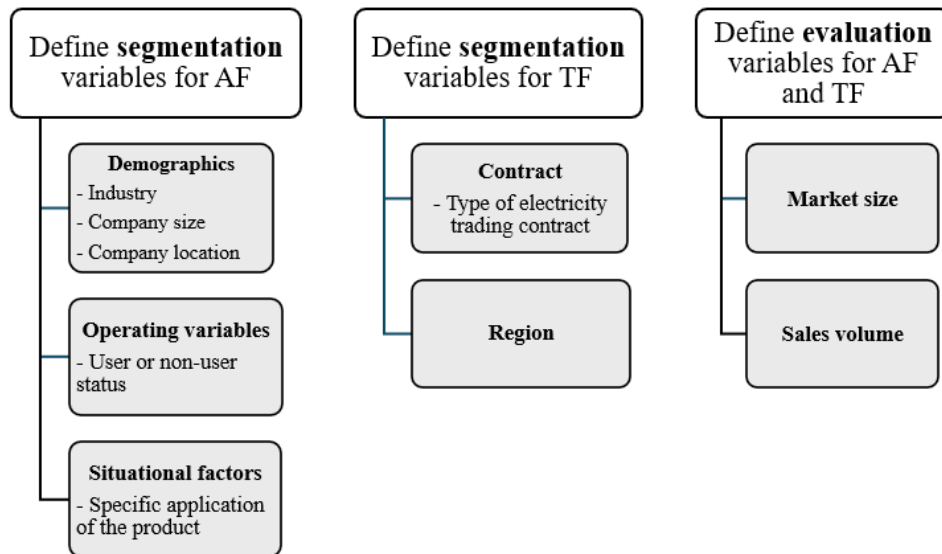


Figure 22. Proposed process to analyze and estimate market potential.

The initial step involves identifying and applying relevant segmentation variables for AF to define target companies, following the methodologies outlined by Hooley et al. (2012), Kotler and Keller (2016), and Weinstein (2014). This first stage includes utilizing demographic variables to establish market segments, then incorporating operational variables and situational factors.

The second step focuses on identifying and applying essential segmentation variables to determine the electricity volume required for calculating the TF. Key variables in this context include the type of electricity trading contract and the geographical region.

In the third step, the segments identified through the application of the chosen variables in the first and second steps will be evaluated geographically, following Weinstein (2014) research on market selection criteria for business technology markets. These criteria will serve as a guideline, while also considering the internal characteristics of the case company. Specifically, two main criteria will be used to assess the segments: market size and sales volume.

4.3.1 Segmentation for access fee

Demographics

The three primary demographic variables defined by Shapiro and Bonoma (1984) are industry, company size, and customer location. For the case company, industry is a critical variable due to the specialized nature of their products; understanding the specific needs of different industries is essential. Company size is also significant, as small and medium companies, in terms of employees, may be more relevant across various sectors. Customer location is another crucial variable, as the case company aims to assess the overall attractiveness of the geographic regions identified in section 4.2.

To identify the relevant industries, it is essential to analyze the client base of the case company, which predominantly includes electricity providers and industrial corporations. Consequently, these two industries are prioritized for further examination.

According to the data of the case company, the target organizations are categorized as small and medium-sized. The classification is based on the number of employees, with small organizations having between 20 and 129 employees, and medium-sized organizations ranging from 130 to 499 employees.

The geographic location of the target companies is determined by the regions selected in the initial part of the research framework, as detailed in section 4.2. These regions are Ohio, Pennsylvania, and New York.

Operating variables

The second key segmentation element is operating variables. These variables are often employed to differentiate between prospects and existing customers within a general industry category (Shapiro and Bonoma, 1984). In this context, a pertinent variable is user status. Since this segmentation process is part of a framework for entering a new geographic market, the focus is on non-users, defined as individuals or organizations that are neither customers nor familiar with the product or brand.

Situational factors

Although situational factors share similarities with operating variables, situational factors are characterized by their temporary nature, necessitating a deeper understanding of the customer. As previously noted, situational factors include elements such as urgency, specific application, and order size (Kotler and Keller, 2016).

The approach a customer takes toward purchasing can vary significantly based on the urgency of order fulfillment. However, in the instance of the case company, urgency has not

been a significant factor influencing sales operations. Given that the company operates in the SaaS (Software as a Service) sector, where physical inventory is not involved, considerations like availability are irrelevant. Thus, urgency and order size will not be examined further.

In contrast, the specific application of the product is a crucial factor currently utilized by the case company. Therefore, it is important to refine the segmentation by considering how the product is applied. While the product offering of the case company serves a range of segments, demographic variables help distinguish between electricity providers and industrial corporations. Despite this differentiation, the segmentation remains broad, and focusing on the application of the product will further narrow down the segment.

The case company further categorizes the electricity providers sector into municipal suppliers and electricity suppliers. Additionally, the industrial corporation segment requires more detailed analysis, as not all industries may require a marketplace for electricity trading.

Currently, the case company focus is on energy-intensive manufacturing companies that are likely to be interested in participating in the electricity wholesale market and would fall into the sales trader segment. Thus, it is important to incorporate this strategic focus into the segmentation process. To create a more effective grouping of target industries, the North American Industry Classification System (NAICS) will be utilized. This classification system is regularly updated to reflect changes in economic activities, ensuring its relevance. From the NAICS list, categories were selected that focus on energy-intensive industries likely to benefit from the product. According to the US Energy Information Administration (2023), Figure 23 outlines the major manufacturing industries with the highest energy consumption and their corresponding NAICS codes.

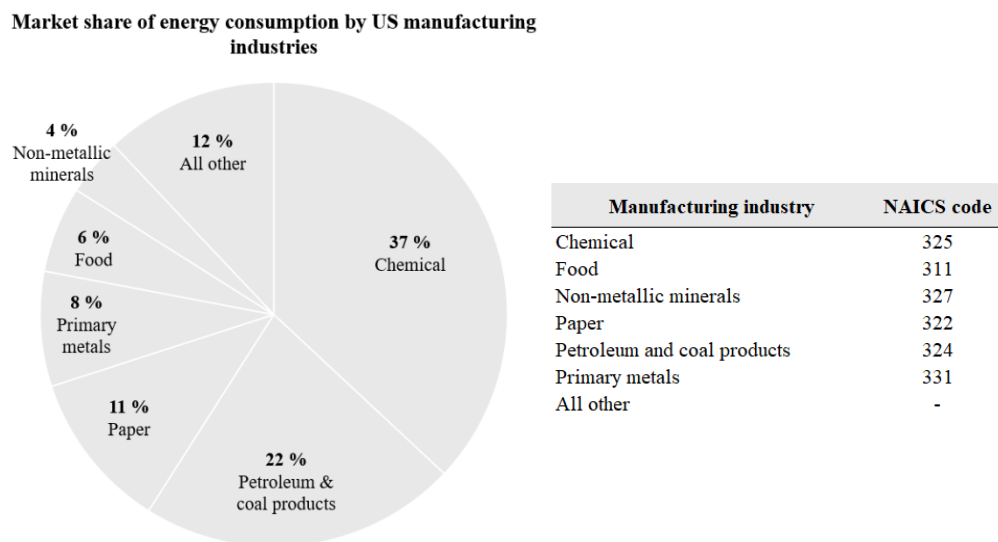


Figure 23. Market share of energy consumption by U.S. manufacturing industries and the corresponding NAICS code [Adopted from Energy Information Administration, (2023)]

According to figure 23, the chemical sector accounts for 37% of energy consumption within U.S. manufacturing industries, representing over one-third of the total. The petroleum and coal products industry follows with more than 20%. Additionally, the paper and primary metals industries combined contribute nearly 20%, while the food and non-metallic mineral industries together account for 10%. Collectively, these six industries represent 88% of the market share in terms of industrial energy consumption, making them pivotal for further analysis in line with the strategy of the case company.

The overview of the resulting segments based on the combination of the literature and the data of the case company is visually represented in Figure 24.

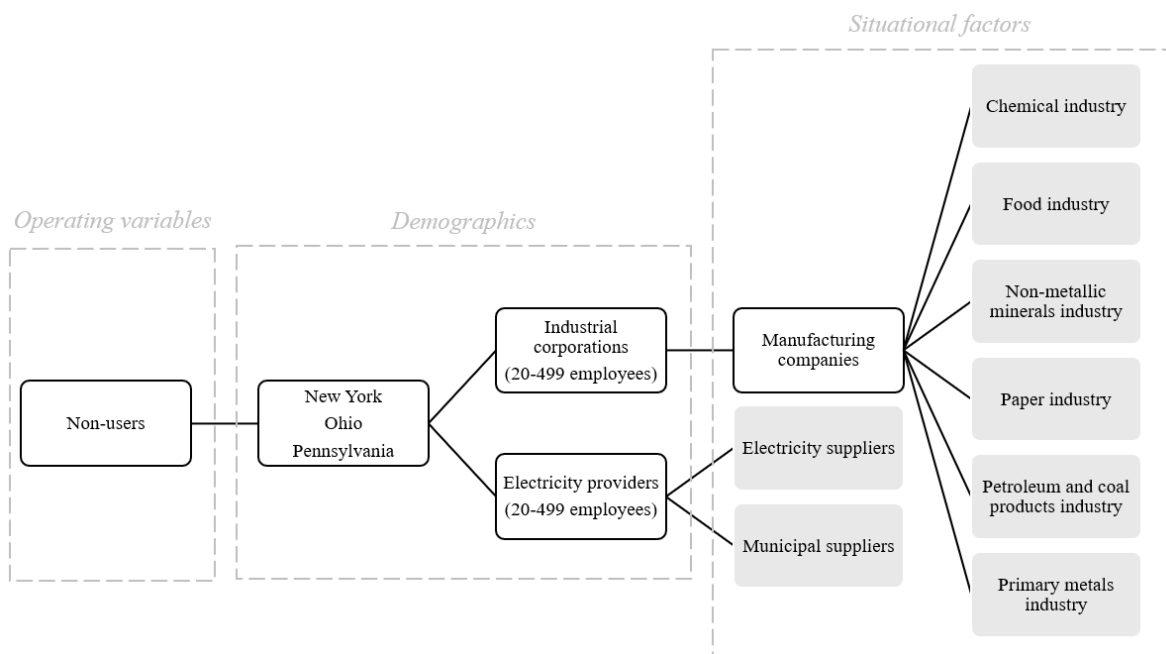


Figure 24. Segmentation variables and the resulting segments for access fee.

Figure 24 visually depicts the relationship between the segmentation variables and the resulting segments, highlighted in gray. The segmentation map begins by identifying non-users located in New York, Ohio, and Pennsylvania, focusing on two primary industry types: industrial corporations and electricity providers. Within industrial corporations, the segmentation narrows further to manufacturing companies, specifically targeting energy-intensive sectors such as chemicals, food, non-metallic minerals, paper, petroleum and coal products, and primary metals. For electricity providers, the segmentation distinguishes between electricity suppliers and municipal suppliers. A total of eight distinct segments are identified and further analyzed to determine by state the market size and sales volume for the access fee.

4.3.2 Segmentation for trading fee

Type of electricity trading contract

The process of defining segmentation variables for electricity volume differs partially from the approach used for companies segmentation. In this case, it is essential to explore the intricacies of the electricity market. As outlined in section 2.4.1, various types of contracts can be traded in the electricity wholesale market. The platform of the case company supports the trading of several of these contracts. However, the focus of this research is on sales trading. Therefore, this segmentation targets the specific contracts relevant to sales traders and currently traded through the platform of the case company.

The type of contract being examined is known as physical contract. Physical contracts can be traded through an exchange, where they are referred to as futures contracts. However, when traded OTC, as is the situation with the platform of the case company, they are known as forward contracts. Therefore, physical forward contracts are the primary focus for further analysis.

Region

It is crucial to distinguish the volume of electricity traded as physical forward contracts by region, as the case company aims to estimate the potential of the segment based on geographic areas. Consequently, this research focuses on physical forward contracts traded in Ohio, Pennsylvania, and New York, the states identified in section 4.2.

4.3.3 Evaluation for access fee

To evaluate the previously defined segments, the criteria outlined by Weinstein (2014) can be applied, with adjustments to fit the specific needs and characteristics of the firm. The following criteria have been selected to assess the market segments:

1. Market Size
2. Sales Volume

In the context of the case company, the access fee and trading fee will be calculated separately for each segment based on the relevant data, and then combined according to the geographic region.

Market size

To estimate the sales volume, it is essential to first determine the market size. Since the access fee is calculated based on the number of companies paying for platform access, the market size for this revenue stream is determined by the number of companies operating within the

previously selected subindustries, which were identified based on situational factors. The number of manufacturing companies was determined using data from the US Census Bureau (2023), while municipal suppliers are summarized by the American Public Power Association (2024). Additionally, electricity suppliers are detailed by AES Ohio (2024), New York State (2024), and Pennsylvania Public Utility Commission (2024). This information is compiled and presented in Table 19.

Table 19. Total number of companies by sub-industry and geographic region (US Census Bureau, 2023)

Industry	Sub-industry	New York (companies)	Ohio (companies)	Pennsylvania (companies)
Electricity providers	Electricity suppliers	130	70	115
	Municipal suppliers	49	87	35
Manufacturing companies	Chemical	2,003	2,276	1,980
	Food	1,949	882	1,163
	Non-metallic minerals	1,941	1,895	2,139
	Paper	663	763	746
	Petroleum and coal products	215	211	238
	Primary metals	448	1,107	1,107
	Total companies	7,398	7,291	7,523

Table 19 presents the total number of companies by sub-industry. The total number of electricity provider companies is significantly lower compared to the manufacturing sub-industries. Among the manufacturing sub-industries, the chemical and non-metallic minerals industries have the highest number of companies. In contrast, the petroleum and coal products sector has the fewest companies within the energy-intensive industries analyzed. When aggregating all the sub-industries, Pennsylvania emerges as the leader with over 7,500 companies, followed by New York with nearly 7,400 companies, and Ohio with approximately 7,290 companies.

However, it is still necessary to apply the company size variable to refine these figures. According to the CRM data base of the case company, 95% of the customer base consists of small and medium-sized corporations. Therefore, as outlined in section 4.3.2, only companies with 20 to 499 employees are considered. Table 20 displays the percentage of small and medium-sized companies based on number of employees, organized by sub-industry and geographic region according to US Census Bureau (2023) .

Table 20. *Percentage of small and medium-sized companies relative to the total number of companies (US Census Bureau, 2023)*

Sub-industry	New York	Ohio	Pennsylvania
Chemical	26 %	35 %	30 %
Electricity suppliers	88 %	86 %	87 %
Food	18 %	21 %	25 %
Municipal suppliers	92 %	86 %	86 %
Non-metallic minerals	26 %	34 %	30 %
Paper	33 %	46 %	41 %
Petroleum and coal products	27 %	31 %	45 %
Primary metals	25 %	45 %	42 %

Table 20 provides additional data necessary to calculate the net number of companies, following the segmentation variables outlined in section 4.3.1. The percentage of small and medium-sized electricity providers differs significantly from that of other sub-industries. While the electricity provider industry has a percentage of small and medium-sized companies of no less than 86 %, the highest percentage among the other sub-industries is only 46%. This data indicates that the majority of electricity suppliers are small and medium-sized companies, whereas energy-intensive industries tend to have a higher concentration of companies that either employ fewer than 20 people or have at least 500 employees.

After applying the percentage of small and medium-sized companies to the total number of companies, Table 21 shows the potential market size for estimating the access fee, broken down by geographic region and based on the number of companies.

Table 21. *Total estimated market size for access fee by geographic region, based on the number of small and medium sized companies (US Census Bureau, 2023)*

Industry	Sub-industry	Ohio (companies)	Pennsylvania (companies)	New York (companies)
Electricity providers	Electricity suppliers	60	100	115
	Municipal suppliers	75	30	45
Manufacturing companies	Chemical	797	594	521
	Food	185	291	351
	Non-metallic minerals	644	642	505
	Paper	351	306	219
	Petroleum and coal products	65	107	58
	Primary metals	498	465	112
Total companies		2,676	2,534	1,925

According to table 21, when combining the number of small and medium-sized energy-intensive companies and electricity providers, Ohio emerges as the state with the largest market size. This contrasts with the data in Table 1, which shows Pennsylvania as having the

highest total number of companies overall. However, when focusing exclusively on small and medium-sized companies, Ohio leads with over 2,600 companies, followed closely by Pennsylvania with more than 2,500, and New York with approximately 1,900.

Sales volume

To estimate the potential sales volume for access fee, it is crucial first to determine the potential number of companies, as detailed in Table 3. Subsequently, the achievable market share in the new geographic region must be considered.

Once the number of companies is established under various market share scenarios, the next step is to calculate the sales volume by multiplying these figures by the AF. Given that the case company is entering a new market, it is advisable to evaluate several scenarios with market share projections of 1%, 5%, and 10%, as presented in Table 22.

Table 22. *Estimated number of potential companies based on different market shares.*

Industry	Sub-industry	Ohio (companies)			Pennsylvania (companies)			New York (companies)		
		Market share			Market share			Market share		
		1%	5%	10%	1%	5%	10%	1%	5%	10%
Electricity providers	Electricity suppliers	1	3	6	1	5	10	1	6	12
	Municipal suppliers	1	4	8	0	2	3	0	2	5
Manufacturing companies	Chemical	8	40	80	6	30	59	5	26	52
	Food	2	9	19	3	15	29	4	18	35
	Non-metallic minerals	6	32	64	6	32	64	5	25	50
	Paper	4	18	35	3	15	31	2	11	22
	Petroleum and coal products	1	3	7	1	5	11	1	3	6
	Primary metals	5	25	50	5	23	46	1	6	11
	Total companies	27	134	268	25	127	253	19	96	193

The data from table 22 demonstrates that the potential number of companies in Ohio and Pennsylvania are remarkably similar. In the electricity provider industry, when considering a market share of 1%, Pennsylvania and New York estimate having zero municipal suppliers. Across Ohio and New York, the chemical industry stands out as the sector with the highest estimated number of potential companies.

According to the estimated potential number of companies from table 22, the sales volume for the access fee can now be calculated. Due to the confidentiality of the access fee amount, it will be denoted as “X.” Table 23 provides a summary of the projected sales volume.

Table 23. *Estimated sales volume for access fee by market share and geographic region.*

Geographic region	Total sales volume (AF)		
	Market share		
	1%	5%	10%
Ohio	27 * (X)	134 * (X)	268 * (X)
Pennsylvania	25 * (X)	127 * (X)	253 * (X)
New York	19 * (X)	96 * (X)	193 * (X)

X = access fee

According to table 23, while Ohio and Pennsylvania show very similar outcomes, Ohio leads with the highest potential sales volume for access fee, with over 260 companies at a 10% market share. Pennsylvania closely follows, but the slight edge of Ohio underscores its potential as a key market.

4.3.4 Evaluation for trading fee

Market size

As previously discussed, accurately estimating the market potential in a new geographic market for the case company requires evaluating the market size according to each revenue source. While the access fee represents one-third of sales of the case company, the trading fee constitutes the remaining two-thirds. Unlike the access fee, which is a fixed charge, the trading fee is based on the volume of electricity traded per transaction, measured per MWh. Consequently, estimating the potential sales volume for trading fee necessitates determining the market size based on electricity volume.

As outlined in section 4.3.2, and within the scope of this research, the type of electricity contract used for segmenting the market for trading fee is the physical forward contract. Moreover, it is necessary to determine the traded volume of this type of contract by geographic region. However, since specific regional data is unavailable and only national figures for physical forward contracts are accessible, an estimation must be made based on the following data.

According to PJM (2020), the volume of electricity traded in physical forward contracts in the US power market amounted to 5,000 TWh in 2018. In the same year, total US electricity consumption was 3,830 TWh (IEA, 2020). This indicates that approximately 130% of the total electricity consumption was traded through physical forward contracts.

Since the objective is to determine the market size by geographic region, the national data is similarly represented at the state level. By applying the percentage of physical forward contracts to the total electricity consumption for each state, the regional market size can be derived. According to the US Department of Energy (2021), the total electricity consumption in 2018 was 259 TWh for Ohio, 248 TWh for Pennsylvania, and 227 TWh for New York. Table 24 presents the estimated market size for each geographic region based on the volume of electricity traded through physical forward contracts.

Table 24. Total estimated market size for trading fee based on volume of electricity traded through physical forward contracts by geographic region (IEA, 2020; PJM, 2020; US Department of Energy, 2021)

Total electricity consumption (TWh)	3,830
Physical energy forward contracts (TWh)	5,000
Percentage of physical forward contracts	131%

State	Volume of total electricity consumption (TWh)	Volume of physical forward contracts (TWh)
Ohio	259.00	338.13
Pennsylvania	248.13	323.93
New York	226.57	295.78

As presented in table 24, considering that 131% of the total national electricity consumption was traded through physical forward contracts, and applying this to state-level data, Ohio stands out as the state with the largest estimated market size for trading fee, exceeding 335 TWh. Pennsylvania follows closely with just over 320 TWh, and New York comes in at 295 TWh.

Sales volume

Similar to estimating the sales volume for the access fee, it is crucial to estimate the sales volume for trading fees under various market share scenarios. Table 25 summarizes the estimated volume of physical forward contracts by state.

Table 25. Estimated volume of physical forward contracts by state and market share.

State	Market share (in TWh)		
	1%	5%	10%
Ohio	3.4	16.9	33.8
Pennsylvania	3.2	16.2	32.4
New York	3.0	14.8	29.6

Table 25 demonstrates that the trading volumes between Ohio and Pennsylvania are considerable similar. However, Ohio exhibits the highest estimated trading volume with almost 34 TWh under a market share of 10 %.

Since the case company charges trading fees based on MWh, it is necessary to convert the estimated volumes to MWh and then multiply these figures by the trading fee amount. However, as the price of trading fee is confidential, the trading fee amount is represented as "Y". Table 26 displays the estimated volumes based on different market share percentages

and geographic region.

Table 26. *Estimated sales volume for trading fee by market share and geographic region.*

Geographic region	Total sales volume (TF)		
	1%	5%	10%
Ohio	3,381,200 * (Y)	16,906,000 * (Y)	33,812,010 * (Y)
Pennsylvania	3,239,295 * (Y)	16,196,475 * (Y)	32,392,950 * (Y)
New York	2,957,832 * (Y)	14,789,165 * (Y)	29,578, 165 * (Y)

Y = trading fee

Ohio stands out as the state with the highest potential for sales volume for trading fee, reflecting its significant market opportunities. Pennsylvania follows with a robust potential, while New York ranks third. These findings underscore the leading position of Ohio in estimating the sales volume for trading fees compared to Pennsylvania and New York. The data highlights the strategic importance of Ohio in the electricity trading market, positioning it as a key area of focus for maximizing trading fee revenue.

5. SUMMARY OF THE RESULTS

5.1 Identification of the operational dynamics factors

The identification of the operational dynamics factors focuses on answering the first research question:

- 1. What are the key operational dynamics factors to consider when qualitatively analyzing the attractiveness of a new geographic electricity market for an electricity trading platform?*

To identify these factors, the study focuses on analyzing the key characteristics of the German electricity market that contributed to the case company's success. These factors, though distinct in their nature, are deeply interconnected and together create a framework that can be employed to assess market viability.

First, in evaluating new markets, it is imperative to assess the level of liberalization of the regulatory framework. A market with strict regulations and limited competition may hinder the ability of the platform to attract users and facilitate trades effectively. Therefore, the first criterion for evaluating a new market should focus on the degree of market liberalization and the presence of competitive market dynamics. Markets that are similar to the German electricity regulation framework, with policies that encourage competition and transparency, are more likely to offer bigger potential for the expansion of the platform of the case company.

Second, the national grid distribution network is one of the most critical elements when it comes to trade of physical electricity contracts. The natural interconnection of the German electricity grid, both at a national level and with neighboring countries, fosters a smooth and efficient electricity flow and simultaneously supports a robust trading environment. The platform of the case company, which facilitates long-term physical contracts, depend heavily on a well-connected and reliable grid infrastructure.

Third, high electricity demand is a driving force behind the participation of sales traders in the market. In Germany, the consumption of electricity is related to the significant presence of sales traders, who are interested in securing their future supply of electricity through long-term contracts. The platform of the case company serves mainly to these traders, making the level of electricity demand a critical factor in market evaluation.

Finally, market liquidity is a vital component of a well-functioning electricity trading market. Markets with a high number of market participants are more likely to have the level of liquidity that the platform needs to success. In Germany, the high number of market participants across the whole supply chain contributes to a liquid market where trades can be

executed efficiently. The presence of a diverse and active participant base enhances the value proposition of the platform, making it an attractive option for both sales and financial traders.

5.2 Application of operational dynamics factors to the U.S. electricity market

The application of the key market factors to the U.S. electricity market addresses the third research question:

3. How can the identified operational dynamics factors be applied to the U.S. electricity market to determine the top three states with the highest market potential?

To begin with the market regulation factor, the current landscape shows a divide between fully deregulated and more traditionally regulated regions. Regulated regions include the Southeast and most of the Midwest, where traditional structures prevail. In contrast, states such as those in the Northeast, parts of the Midwest, Texas, and California have embraced competitive markets, allowing multiple electricity providers to compete.

The analysis prioritizes deregulated regions—Northeast, parts of the Midwest, Texas, and California—due to their promotion of competition and innovation. In contrast, vertically integrated states, such as those in the Southeast and parts of the Midwest, limit competition and are less conducive to the introduction of new electricity trading platforms. Deregulated regions, managed by ISOs and RTOs, offer a more favorable environment for the case company success, supporting multiple participants and enhancing market efficiency.

Subsequently, the next key factor is the grid distribution network, essential for supporting physical electricity trading. The U.S. grid is divided into three major interconnections: the Eastern, Western, and Texas Interconnections. Each operates largely independently, with the Eastern Interconnection being the most interconnected and supportive of broad market operations. This extensive connectivity enhances trading flexibility and market efficiency.

In contrast, the Western and Texas Interconnections face challenges due to their limited connectivity with other major grids. The Western Interconnection, with CAISO, and the Texas Interconnection, managed by ERCOT, are somewhat isolated. This isolation affects the liquidity and flexibility of physical trading, making these regions less suitable for the platform of the case company. The Eastern Interconnection, including areas served by ISOs and RSOs such as SPP, MISO, PJM, NYISO, and ISO-NE, exhibits superior grid connectivity, making it a more attractive option for further analysis.

The third key market factor, analysis of high electricity demand, is another critical factor influencing market potential. The U.S. is a leading global electricity consumer, significantly outpacing Germany.

In 2022, several states exhibited particularly high electricity consumption, indicating robust demand for electricity. States such as Ohio, Pennsylvania, New York, Illinois, and Virginia emerged as the top consumers. These states not only consume large quantities of electricity but also operate within deregulated markets, making them especially relevant for the trading platform of the case organization.

Therefore, targeting these high-demand states presents a strategic opportunity. Their significant electricity consumption, combined with their deregulated market environments, enhances their attractiveness, offering the case company a promising foundation for successful market entry and platform deployment.

Lastly, the analysis of market participants, which is critical for assessing market liquidity, focused on power generation organizations, electricity suppliers, and industrial consumers in the selected states—New York, Ohio, Pennsylvania, Illinois, and Virginia. We employed a scale from 1 to 5 to rank the states based on their liquidity potential, with weights assigned as follows: 40% for power generation, 40% for electricity suppliers, and 20% for manufacturing industry. New York, Ohio, and Pennsylvania emerged as the top states with the highest number of relevant participants. Figure 25 displays the estimated total number of market participants by state.

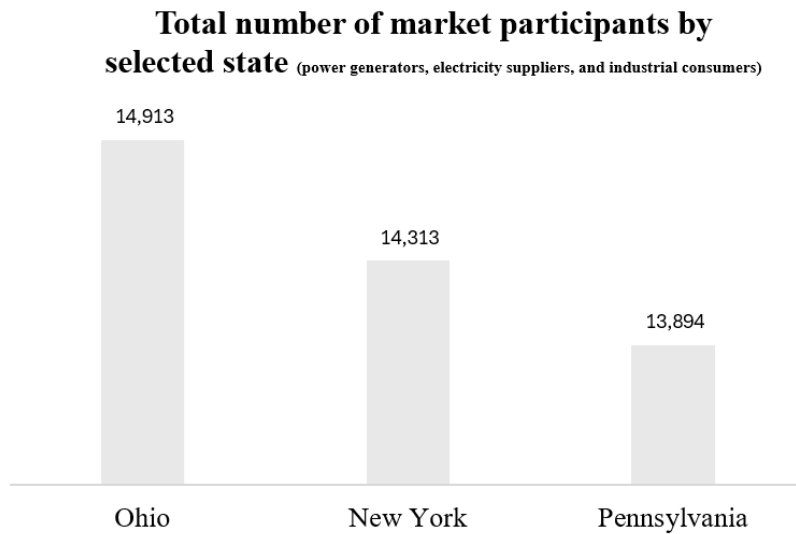


Figure 25. Total number of relevant market participants by selected state.

Ohio has the highest number of market participants, followed by New York and then Pennsylvania. Consequently, these top three states were identified as having the greatest

market potential after analyzing the qualitative key market factors in the U.S. electricity market.

5.3 Estimation of quantitative market potential

The research process culminates in addressing the second and fourth research questions:

2. *What are the key market factors to quantitatively consider when analyzing the attractiveness of a new geographic electricity market for an electricity trading platform?*

4. *Based on the established framework, which of the top three previously identified U.S. states has the highest quantitative market potential?*

Therefore, the study aims to identify the quantitative factors needed to estimate the potential of New York, Ohio, and Pennsylvania and subsequently determine the state with the highest market potential. To achieve this, a structured analysis was carried out in two distinct stages—first, segmentation for access fees and trading fee—followed by the identification and evaluation of factors to assess market potential.

First, the segmentation for access fees and trading fees is outlined in Table 27.

Table 27. *Resulting segments for access fee and trading fee.*

Access fee	Trading fee
Demographic variables	Type of electricity trading contract
Energy-intensive manufacturing and electricity providers in New York, Ohio, and Pennsylvania, with number of employees between 20 and 499	Physical forward contracts
Operational variables	Region
Non-users	Contracts traded in New York, Ohio, and Pennsylvania
Situational factors	
The chemicals, food, non-metallic minerals, paper, petroleum and coal products, and primary metals industries	

The segmentation for access fee, includes demographic factors such as industry type, company size, and geographic location. The focus is on energy-intensive manufacturing and electricity providers. Companies are categorized by size into small (20-129 employees) and medium-sized (130-499 employees). The geographic emphasis is in Ohio, Pennsylvania, and New York. Operational variables distinguish between prospective and current customers, particularly targeting non-users who are not yet familiar with the platform. Additionally,

situational factors play a significant role, with attention given to energy-intensive sectors like chemicals, food, non-metallic minerals, paper, petroleum and coal, and primary metals, which stand to gain the most from the platform.

Regarding the segmentation for trading fee, the analysis centers on the type of electricity contract, specifically physical forward contracts, as these are the contracts facilitated by the platform of the case company. Estimating the trading fee potential requires assessing the volume of physical forward contracts traded in each state, achieved by applying national trading volume data to state-level electricity consumption. Moreover, estimating access fee is based on number of companies.

In terms of key market factors for estimating quantitative market potential, market size and sales volume are crucial, with sales volume directly dependent on market size. These metrics are calculated for both access fees and trading fees. The market size for both sources of revenue is further estimated based on different market share scenarios, as summarized in Figure 26.

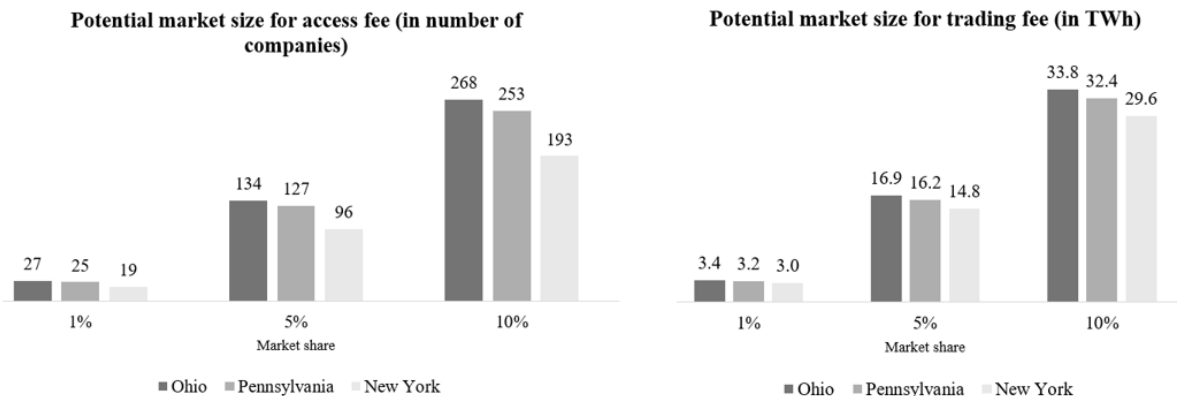


Figure 26. *Estimated market size for access fee and trading fee by state.*

Figure 26 shows that Ohio has the largest market size in both, access fee and trading fee, compared to Pennsylvania and New York. This suggests that with a 10% market share, the case company could secure a market size in Ohio of over 260 companies for the access fee and more than 33 TWh for the trading fee.

The sales volume for access fee is calculated by multiplying the market size by the access rate of the company. For trading fees, the volume is determined by multiplying the estimated market size by the trading rate per MWh. Since the exact pricing details are confidential, they are represented as X and Y respectively. As a result, Ohio stands out as the state with the greatest market potential, as shown in Table 28.

Table 28. Estimated sales volume by state.

	Market share		
	1%	5%	10%
Sales volume in Ohio	27 * (X) + 3,810,010 * (Y)	134 * (X) + 16,906,000 * (Y)	268 * (X) + 33,812,010 * (Y)
Sales volume in Pennsylvania	25 * (X) + 3,239,300 * (Y)	127 * (X) + 16,196,475 * (Y)	253 * (X) + 32,392,950 * (Y)
Sales volume in New York	19 * (X) + 2,957,830 * (Y)	96 * (X) + 14,789,165 * (Y)	193 * (X) + 29,578, 165 * (Y)

X = access fee
Y = trading fee

After applying the proposed model —identifying the most relevant operational dynamics factors that contribute to the success of the case company and combining this dimension with existing economic metrics to quantitatively estimate market potential— Ohio emerges as the leading state with the highest market potential.

Merging the insights from both, access and trading fee analyses, as shown in bold in table 28, Ohio has an estimated sales volume of **268 * (X) + 33,812,010 * (Y)**, the highest revenue for the case company. Its superior market size and sales volume for both revenue streams make it the top candidate for initial market entry. While Pennsylvania and New York also present valuable opportunities, they are secondary to Ohio. Therefore, Ohio should be prioritized for entering the U.S. market to maximize revenue potential and market impact.

6. CONCLUSIONS

6.1 Summary of the research study

In the global business environment, companies are increasingly looking to enter new geographic markets as a key strategy for growth. Entering a new market involves a comprehensive evaluation process that encompasses both quantitative and qualitative analyses. Quantitative evaluations focus on numerical factors that provide an overview of the potential financial opportunities that the new market may present. Qualitative evaluations are equally important, as they focus on complex factors that influence the success of the organization in the new market. So far, these qualitative factors only include cultural compatibility, competition in the market, and existing business relationships. To some extent, these aspects provide an idea of how well the organization's products or services will be received and whether they can deal with the local business environment effectively.

Nevertheless, despite the considerable number of tools and models available for market analysis, these current frameworks fall short in addressing the implications of operational challenges that can impact market entry. This is particularly evident in more specific industries where unique factors such as regulatory environment, infrastructure requirements, and specific market mechanisms come into play. For instance, in sectors like the energy market, these operational dynamics considerations are crucial for a successful market entry. Companies that overestimate the analysis of operational factors may face unexpected barriers that could significantly affect their opportunity to succeed in new markets.

This thesis aims to develop a model that integrates existing quantitative metrics with newly identified operational dynamics factors in the electricity market, focusing specifically on the product perspective of an electricity trading platform. Additionally, the proposed framework is applied to the U.S. electricity market to support the case company in identifying the state with the highest market potential.

To achieve the objective of the thesis, the study performed a thorough investigation of the electricity market dynamics in Germany to identify the key operational dynamics factors that contributed to the success of the case company in this region. The identification of these factors was crucial for understanding the elements that drive success in a competitive electricity market environment.

The key findings of this research reveal four crucial operational dynamics factors that organizations, particularly those with a product application like an electricity trading platform, should consider when entering a new geographic electricity market. These factors include:

(1) *Market regulation*: competition in the electricity market drives innovation and efficiency. An open and competitive market is essential for leveraging new technologies and attracting users. (2) *National grid distribution network*: a robust well-interconnected grid across countries, states, and urban areas is needed for successful market potential. (3) *High electricity demand as a driver for sales traders*: strong demand for electricity drives sales traders to seek reliable platforms. Understanding local demand is key for assessing market opportunities. (4) *Market liquidity driven by market participants*: a higher number of market participants involved in the trade of physical electricity increases liquidity which is a crucial element for an electricity trading platform. In addition to these operational dynamics, key quantitative market factors such as *market size* and *sales volume* were identified.

By integrating these operational dynamics with quantitative factors and applying them to the U.S. electricity market, this analysis identified Ohio as having the highest market potential among the states evaluated. The favorable combination of Ohio in operational dynamics and a substantial sales volume—calculated as $268 * (X) + 33,812,010 * (Y)$, where X represents the access fee and Y represents the trading fee (charged by the case company)—positioned it as the leading candidate. Consequently, Ohio is recommended as the optimal state for market entry due to its alignment with key operational factors and its strong sales performance.

6.2 Managerial implications

The study underscores the crucial role of operational dynamics in evaluating new geographic markets. Firms seeking to enter a new region must assess these factors specifically in relation to their unique product or service offerings. This entails a comprehensive evaluation of how operational dynamics—such as regulatory conditions, infrastructure, and local market operations—affect their business.

Operational dynamics factors play a crucial role in the creation of a better segmentation of the market and a better value proposition that ultimately will contribute to a more exact estimation of market potential. As these key operational dynamics factors directly influence how the product could fit in the new market, identifying such factors becomes critical when evaluating market potential.

Organizations engaged in the OTC energy trading sector can harness the proposed framework as a tool to guide their estimations on market potential. After applying the framework to their chosen geography and customizing it according to their target segment strategy, organizations can detect more accurately if entering a new geographic market could yield the expected profit.

6.3 Theoretical contributions of the research

This thesis makes meaningful contributions to both theoretical literature and practical applications in the field of market potential evaluation, focusing on electricity trading platforms. By proposing a framework that integrates **quantitative and** critical qualitative operational dynamics factors, **this research offers** an innovative approach to assessing market potential in new geographic regions, particularly within the complex and dynamic electricity sector.

From a theoretical perspective, the first contribution is that this study introduces operational dynamics factors as a critical element when assessing market potential in the electricity market, as well as the process to follow for their identification. Existing literature about market potential mainly focuses on the importance of estimating market potential through established economic metrics (Kotler and Keller, 2016; Simkin and Dibb, 1998) and qualitative factors such as cultural alignment (Hofstede, 2001; Trompenaars and Hampden, 1997), competitive landscape (Porter, 1979; Prahalad and Hamel, 1990), and network relationships (Coviello and Munro, 1998; Ellis, 2000). This study claims that although these existing factors are valuable and offer a significant understanding of the potential in the new geographic market, little attention has been put on external operational factors that directly affect the adoption and performance of more technical and specific products such as electricity trading platforms.

Arrieta et al. (2017), in order to understand better the different market dynamics impacting the adoption of a specific energy solution like smart grids, analyzes the different categories of the PEST model. Similarly, this thesis addresses the need of extending market evaluations to include operational dynamics factors. By conducting a PEST analysis, this thesis identifies the different operational dynamics factors influencing the adoption and operability of an electricity trading platform, expanding the traditional scope of current market evaluation frameworks, offering a more holistic yet deeper understanding of what is a viable market environment for electricity trading platforms.

The second theoretical contribution includes the development of a framework that combines qualitative and quantitative approaches for market potential in the electricity market. Traditional models often separate these categories, focusing on either economic elements or qualitative factors (Arrieta et al., 2017). In contrast, this thesis incorporates operational dynamics factors with relevant economic elements that ultimately offer a more robust identification and evaluation of factors influencing market expansion choices.

From a practical perspective, this study offers guidance on how to methodologically identify key external elements for market potential evaluation within the electricity sector. Stakeholders may follow the implemented process for analyzing complex and dynamic sectors similar to the energy market. Additionally, this research proposes a tailored framework for specific products like OTC electricity trading platforms, emphasizing the need

of understanding not only the main stakeholders but the characteristics of the market that directly impact the adoption and usability of OTC platforms. By following the proposed model, individuals can better anticipate market challenges and make more informed decisions when exploring new market opportunities.

In conclusion, this thesis contributes to both theoretical and practical aspects by enhancing the understanding of market potential through analyzing operational dynamics factors as well as economic metrics. By offering a novel framework for assessing market potential in the electricity sector and addressing the existing gap in the literature, this study aids in the decision-making stage for choosing a new geographic electricity market.

6.4 Limitations of the study and recommendations for future research

Limitations

Despite the valuable insights provided by this study, there are several limitations that must be taken into consideration. First, this research does not implement primary data sources that could contribute to a better management of the data's quality.

Second, existing qualitative factors- cultural alignment, competition, and network relationships- may have an impact on the potential of the market and are not analyzed in this study. Including other existing qualitative elements could improve the level of accuracy.

Third, the accuracy of OTC trading volumes by states in the U.S. represents a challenge. The complexity of obtaining reliable and accurate figures on trading volumes might include potential variations in the estimation of the market size.

Lastly, this thesis implements a cross-sectional approach focusing on the current market situation. This consideration leaves out potential future trends or evolving conditions that could affect the success of the platform or failure over time.

Recommendations for future research

This research opens several areas for further exploration. First, the incorporation of primary data in collecting information directly from industry participants and other market stakeholders. By having more direct communication with active members within the industry, it would allow to gain deeper understanding of the specific operational challenges and market dynamics faced by OTC electricity trading platforms.

Additionally, future research should consider other qualitative factors in analyzing market potential for a new geographic market. By understanding how business relationships, cultural

alignment, and competition influence the success of OTC electricity trading platforms, organizations can develop more accurate entry strategies.

Moreover, future studies should account for regulatory entry barriers for OTC trading platforms in the electricity market. Finally, including forecasts and trend analysis for having a long-term visibility would provide a different perspective and understanding of the best time to enter the new region as having a forward-looking perspective could support in identifying future opportunities and challenges.

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