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How corporate engagement with German Energiewende: based on the stakeholders analysis of nonmarket strategy

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Abstract. In 2010, the German government officially initiated the Energiewende as the concept underpinning its energy transition, a plan to shift from nuclear and fossil fuels to renewables towards Green Germany. At the intersection of corporate activities and public policy, this dissertation aims to analyse the roles of corporations in facilitating the German Energiewende from the lens of stakeholder theory. It begins with unpacking the German Energiewende and corporate engagement with public policy. Then in the case of Siemens, it delves deeper into its non-market strategies in promoting renewables use, lobbying activities, decarbonisation cooperation and green finance. Siemens's non-market strategies are categorized into three roles: strategic adaptor, innovator and investor. From the lens of stakeholder theory, enterprises effectively interact with various stakeholders to jointly facilitate the formation and implementation of the German Energiewende. Overall, it examines the engagement of the private sector in public energy policies and offers insights into the broader discourse on long-term energy transition towards sustainability.

Keywords: German Energiewende, corporate engagement with public policy, stakeholder theory

1. Introduction

Germany is often considered a role model for the transition to renewable energy as a frontrunner in offshore wind and solar PV. In late 2010, the German government officially initiated the Energiewende as the concept underpinning its energy policy. The initiative has two strategic-level objectives: expanding the use of renewable energy and boosting energy efficiency. It is aimed at realizing a stable supply of energy, which is economically viable and environmentally friendly. On the one hand, energy transformation has altered global power distribution and geopolitical instability. On the other hand, in the context of the Russia-Ukraine conflict, the geopolitical problems of Energiewende have increasingly become one of the most prominent and critical issues in world energy geography and politics. Hence, it is of great significance to research German Energiewende, and Germany's experience has typical and exemplary significance for the global energy transition.

In addition, the development of large-scale renewable energy projects, such as wind and solar power, increasingly involves enterprises operating as project developers, investors, and technology suppliers. However, we generally know little about the specific role that they play in terms of how to harness their enormous potential for energy transition. Corporate engagement with public policy encompasses the strategic management of relationships, interactions, and negotiations between corporations and their diverse stakeholders in the global business arena. From the lens of stakeholder theory, corporations are committed to not only improving business and shareholder value, but also demonstrating responsibilities to other stakeholders, especially the energy policy objectives of the German government. It has been posited that corporations have a responsibility to engage in the public policy arena, therefore this dissertation will examine the intersection of corporate activities and public policy dynamics from the lens of stakeholder theory.

This study aims to delve into the role of corporations in facilitating Germany's long-term energy transition (LTE) from both theoretical and specific case perspectives, particularly focusing on nonmarket strategies including Corporate Social Responsibility (CSR) and Corporate Political Activity (CPA) in the case of Siemens. Overall, it scrutinizes the relationship between corporate strategy and public policy within the scope of the German Energiewende. It aims to illuminate the roles of companies in facilitating the German Energiewende, particularly in the case of Siemens. It focuses on how companies fulfill their social responsibilities to maximize the value of the business and relate to their stakeholders. It provides important reference and inspiration for enterprises' sustainable development and strategic decisions to better exploit or leverage opportunities amid the German Energiewende. Besides, an in-depth analysis of the role of corporations in German Energiewende will help promote a network between the public

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and private sectors. This study will analyze how corporate energy strategies align with and foster the implementation of public policies of the German Energiewende, thus promoting the process of global energy transition.

Throughout, this paper will use stakeholder theory to analyze the relationship between enterprises and their stakeholders, especially the German government. The dissertation will provide a timeline of the dynamics of the German Energiewende, and then focus on the case study in Siemens and Siemens Energy, to analyze their roles in the German Energiewende. To be specific, the first part of this paper will briefly introduce the notion of German Energiewende and corporate engagement with public policy. Then it follows with theoretical perspectives on stakeholder theory. Subsequently, this theoretical framework will be applied to a case study. Following this, a 10-year timeline will be first given to clarify the German Energiewende, then use Siemens as a case study to categorize and evaluate the mechanism of corporations' role in LTE, including categories including active strategic adaptability, as an innovator in smart grid technologies and collaborations, and as an investor in green financing.

2. The roles of non-market strategies in the German Energiewende

2.1. The German Energiewende narrative: LTE

2.1.1. Drivers of LTE

German Energiewende is characterized by a dynamic co-evolution and interaction among several pivotal dimensions. To be specific, the growing individual preferences for clean energy have increased the demand for renewable energy, thus facilitating MNEs to be innovative and creative for cleaner and renewable energy sources that emerging as a technological driver. All these efforts are in line with global energy alignment and institutional support, which further enhanced the firm-level capabilities [9].

As for the economic drivers, despite the increasing reliance on nonrenewable energy, a contradictory surge in demand for renewable energy and low-carbon solutions. The prediction of IEA in 2020 indicates that there will be a 50% surge in global renewable power capacity by 2024, with energy demand necessitating a blend of nonrenewable and renewable sources into the foreseeable future. As a consequence, the increasing demand for low-carbon supply posed new challenges to governments and businesses to navigate energy strategies. Initiatives like RE100, which unites major multinational enterprises (MNEs) including Facebook, Google, Walmart, and General Motors in a commitment to 100% renewable electricity usage, alongside the Renewable Energy Buyers Alliance, a coalition aiding clean energy transactions, underscore the global shift towards sustainable energy goals and timelines. At the same time, both energy suppliers and consumers find themselves navigating a world marked by volatility, uncertainty, complexity, and ambiguity (VUCA). Hence, it could be inferred that this scenario presents a prime setting to investigate decision-making in uncertain environments and to scrutinize how evolving supply and demand dynamics influence market and infrastructure development, offering rich insights into the transformative landscape of global energy.

There are both global alignment and national regulations that facilitate the German Enegiewende. On the one hand, the Strategy on Climate Foreign Policy, adopted by the Federal Government in December 2023, creates a coherent framework of climate foreign policy and indicates that Germany is a reliable partner who acts with solidarity. On the other hand, domestic regulations were drafted and enacted to encourage low-carbon usage. As a result, carbon taxes and governmental incentives uniquely promote renewable energy adoption in electricity generation, offering multinational enterprises (MNEs) chances to innovate and profit from emerging products like electric cars and offshore solar panels [9].

In conclusion, all these economic, regulatory, social, and technological elements collectively facilitate the shaping of the energy landscape towards a renewable and low-carbon energy solution.

2.1.2. Overview of German Energiewendedynamics

Table 1. German Energiewende dynamics from 2010 to 2020

Year	Dynamics	Discourses and power constellations
2010	ConceptulizeEnergiewende	The government sets out climate and renewables targets for 2020 and 2050.
2011	Nuclear phase-out #2	Merkel declares nuclear phase-out by 2022 following Fukushima, with broad legislative support.
2014	Renewable Energy Sources Act#2	Reduces feed-in tariffs, and introduces PV auctions (BMWi, 2015).
	National Action Plan on Energy Efficiency (NAPE)	The fields covered in the uptake of NAPE include energy efficiency of consumptions, construction, and transportation (BMWi, 2014).
	Amendment of the EEG law	Initial resistance arises from political and social entities, including lobby groups and affiliations, that reap benefits from renewable energy sources (Hake, 2015).
2015	Slow Process	Agora Energiewende Analysis described the targets of cutting 40% of emissions by 2020 and sharing 60% renewable electricity consumption by 2035 as unachievable.

Table 1. (continued)

2016	Decarbonization Plan 2050	Federal government Climate Action Plan 2050 provides an initiative to individual economy supply must be "almost completely decarbonized" by 2050 and the share of solar and wind power in total electricity production should be significantly increased.
2017	COP23 & G20	Chancellor Merkel reinforces the German voice in the Paris Climate Agreement; the German delegation negotiates its implementation at the UN climate conference in Bonn.
2019	Climate action package	The climate cabinet presents major policy packages including national CO2 prices for transport & buildings.
	Climate action law	Germany's inaugural climate legislation enforces legally obligatory reductions in emissions.
2020	Coal exit law	The German parliament has passed coal exit legislation that agreed on a shutdown schedule to end coal-fired power generation by 2038.

2.2. Case study: Siemens in Energiewende industry upheaval

2.2.1. Case selection

Siemens AG, a world-renowned engineering and technology giant with more than 170 years of innovation, operates in a variety of sectors, including energy, industrial, infrastructure and medical devices [2]. In the energy sector, Siemens is particularly known for its vital position in intelligent infrastructure for distributed energy systems, including power generation and transmission technologies, as well as renewable energy solutions [2]. Annanth et al. [2] initiates the implementation of Siemens as a case study to evaluate the Intelligent Manufacturing System in the context of industry 4.0. Their research is in line with the claims of Zhu and Achauer [47] that the smart upgrading of manufacturing helps to enhance the development of real economy in Germany.

As a towering figure in German industry, Siemens epitomizes the profound effects of the German Energiewende on one of the world's leading economies. Through its innovations in renewable energy technologies, especially in wind energy and smart power grid, Siemens significantly contributes to facilitating the Energiewende [1]. For example, Siemens' decision to exit the nuclear sector and increase investment in wind technology [31]. It is a strategic adjustment that not only aligns with the objectives of the German Energiewende but also reflects how companies respond to the country's sustainable energy policy through technological innovation and market adjustments [31].

There are several reasons for choosing Siemens as the case study. First, Siemens claims to be committed to business integrity and responsibility with all stakeholders. As the President and CEO of Siemens AG, Dr. Roland Busch, indicates that Siemens put integrity and ethical compliance at the core of business ethics and operations (Siemens Business Conduct Guidelines, 2023). Additionally, the Chief Compliance Officer of Siemens AG claims that the compliance to integrity and responsibility is based on the awareness and adherence on laws and regulations (Siemens Business Conduct Guidelines, 2023).

Additionally, as Siemens' active participation in Germany's Energiewende makes it an ideal case to investigate the roles of companies in supporting and engaging in the German Energiewende. In Germany's energy transition, wind and solar are seen as key renewable energy sources. Siemens not only produces wind turbines and solar modules, but also continuously improves the development of these technologies to meet the growing demand for renewable energy in Germany [41]. At the same time, Siemens actively proposes and promotes smart grid solutions, including smart meters, grid monitoring systems and energy management software [43]. These help to integrate renewable energy more effectively and improve the stability and efficiency of the grid. In the energy transition, storage technology is crucial to balancing the impact of fluctuations in renewable energy [15]. Siemens develops a variety of energy storage solutions, including battery technology, compressed air storage and thermal energy storage towards Green Germany, making it a pivotal position in the German Energiewende [15].

Siemens' global presence and energy project practices in multiple countries provide a unique perspective to observe its implementation of non-market strategies. For example, Siemens is working with the government of Oman on a green hydrogen project in Oman [10]. The project is aimed to use renewable energy sources such as solar and wind power to produce hydrogen through electrolysis of water, thereby enabling clean energy production [10]. In addition, Siemens contributed significantly to the implementation of the project by providing the electrolysis technology and the overall intelligent system solution. For instance, Siemens is collaborating with the Sydney region of Australia to improve the power grid facilities [8]. This initiative is designed to augment the grid's intelligence, thereby stabilizing energy supply and optimizing grid operations [8]. Hence, it could be suggested that Siemens is actively supporting Australia's transition towards a sustainable energy landscape through the provision of advanced smart grid technologies and comprehensive systems integration services.

Finally, Siemens Energy, as an independent company spun off from Siemens AG, is focused on the development of the energy sector, further deepening the role of the Siemens Group in driving the German Energiewende. In fiscal year 2023, Siemens Energy brought in €31 billion with 96,000 employees across over 90 countries [39]. Siemens Energy leads the global renewable energy

market because of its wind power subsidiary Siemens Gamesa Renewable Energy (SGRE). Siemens Energy's technology are thought to be the foundation for around one-sixth of the electricity produced globally [39]. It could be suggested that the establishment of Siemens Energy and its efforts to advance the decarbonization and digitization of the energy system reflect the company's long-term strategy commitment to the German Energiewende.

In summary, by taking an in-depth look at Siemens and Siemens Energy and their actions and strategies in the German Energiewende, this case study will delve deeper insights into how companies can navigate and engage in the German Energiewende dynamics and achieve Green Germany.

2.2.2. The roles of Siemens's nonmarket strategies in the German Energiewende

The long-term energy transition has placed significant demands on corporations to adapt and innovate within rapidly changing energy landscapes. The German Energiewende, a comprehensive energy transition initiative, exemplifies such a shift by advocating for decreased reliance on fossil fuels and increased adoption of renewable energy sources. This section will examine the role of corporate nonmarket strategies in navigating the complexities of the Energiewende, specifically in the case of Siemens AG, a leading figure in this transformative agenda. From the lens of stakeholder theory, this analysis will delve into three main roles that Siemens has played in the context of the German Energiewende, including active strategic engagement, leading in innovation, and acting as an Investor.

Each role highlights distinct aspects of Siemens' nonmarket strategy aimed at facilitating and adapting to the evolving energy policy landscape in Germany. First, Siemens actively engages in implementation and development related to the energy transition by collaborating with Germany government, industry associations, business partners, and other stakeholders. This proactive engagement reflects Siemens' commitment to sustainability and its recognition of its influence and responsibility in shaping energy policies and dynamics. Second, Siemens is committed in innovation amid the German Energiewende through developing and promoting advanced renewable energy technologies such as wind and solar energy. This innovative approach not only meets shareholders' expectations but also takes the interests of other stakeholders, such as governments, business partners, and clients into consideration. By prioritizing innovation, Siemens aligns with stakeholder theory's emphasis on considering the interests of all stakeholders. Third, Siemens acts as an investor in renewable energy through green financing, demonstrating its commitment to the German Energiewende and providing crucial financial support towards low carbon emissions and energy sustainability. These investments on green energy are a testament of Siemens' social responsibilities to achieve Green Germany, in line with stakeholder theory's emphasis on CSR.

In summary, Siemens' active strategic adaptation, leadership in innovation, and role as an investor exemplify its comprehensive approach to the energy transition, reflecting its commitment to considering the interests of all stakeholders in accordance with stakeholder theory.

2.2.2.1. As a strategic adaptor: renewables expansion and lobbying efforts

Siemens has demonstrated remarkable adaptability in the German Energiewende, transitioning from nuclear power to renewable energy sources. This transition aligns with broader trends in Germany towards sustainability and increased utilization of renewables, a shift that Siemens has strategically embraced [24]. On the one hand, it aligns with the widespread brief shown by the Germans towards the energy transition and negative diffusion of nuclear power. According to Renn and Marshall [15], under the German Energiewende, it is less likely to return to nuclear power despite the rising energy prices and volatile energy consumption. Similarly, the quantitative research results of Guidolin and Guseo [15] verified a measurable impact of the substitution dynamics of renewables on the decline of nuclear power, in which the wind and photovoltaic energy for energy provision represent a duopolistic consumption in Germany. To be specific, current capacity of renewable energy has surpassed that of nuclear power, which once had a 23% market share, could easily be replaced by the expansion of renewable energy renewables. In addition, the consensus reached by the Ethics Committee on phasing out nuclear energy, together with the support of a large majority in Parliament, has indicated the commitment of industry, technology and environmental organizations to the German Energiewende [15].

A clear sign of the irreversibility of this decision was the reaction of the German nuclear industry, among which Siemens played a pivotal role. In September 2011, Siemens-KWU, which was initially responsible for designing and constructing all 17 nuclear power plants reactors unites in Germany, announced the cessation of its involvement in nuclear power facilities worldwide [45]. This decision also entailed ending its cooperation with Russian State Atomic Energy Corporation on new nuclear projects [45]. It could be suggested that its strategies in alignment with the nuclear power phase out plan proposed by the German government and the push for renewable alternatives. This historical strategic shift underscores Siemens' foresight and its commitment to aligning with evolving energy policies. Then the strategic shift of Siemens significantly contributes to the shaping of public opinion. Following Siemens' lead, all major political, social, and civil society actors are now actively engaged in supporting the German government's official proposal for a nuclear-free future [15]. Prior to this widespread acceptance, attempts by nuclear energy proponents to derail the energy transition through online initiatives and mail campaigns had failed to resonate with or gain public support [15]. This shift underscores the changing public and political sentiment towards energy policy in Germany, influenced significantly by Siemens' strategic realignment towards renewable energy.

In addition, Siemens actively engages in corporate political activities (CPAs) to influence energy climate policy in alignment with Germany. These activities engagements include lobbying efforts and strategic alliances with key stakeholders. On the one hand, Siemens actively lobbied for energy efficiency policy and positioned on energy transition. According to its 2022 Sustainability Report, Siemens generally supported carbon pricing and supported higher ambitions of GHG emission reductions proposed by the EU Green Deal [33]. Besides, Siemens AG publicly supported the Paris Agreement in its 2022 CDP Climate Change Disclosure, which affirmed with its long-term energy strategy (CDP Climate Change Disclosure, 2022). Specifically, a validated 1.5°C target was set by Siemens in 2011, followed with a formal commitment to RE100, EP100 and EV100. All engagement activities conducted by Siemens AG are in line with the goals of the Paris Agreement and the UN's 2030 Agenda for Sustainable development (CDP Climate Change Disclosure, 2022).

Furthermore, Siemens's active engagement in industry association governance could be seen through public disclosure of its industry association memberships. For example, through its involvement in the German Association of Energy and Water Industries (BDEW), Siemens contributes to energy policy discussions that promote regulatory frameworks facilitating the integration of renewable energy [21]. Additionally, Siemens's CEO, Roland Busch, even holds a board position of Federation of German Industries (BDI) and Business Europe [21]. Moreover, Siemens has publicly supported initiatives and agreements that aim to advance the goals of the Energiewende. This includes advocating for policies that support the expansion of renewable energies and energy efficiency facilities, aligning with Germany's commitment to reduce greenhouse gas emissions and increase the share of renewables in energy production [21]. Even though it lacks of accessibility of detailed disclosure about its specific roles within industry associations, which limits the access to see its specific influence on the policy making, but it could be seen from their ultimate policy implementation and Siemens's strategic adaptability.

Siemens' strategic engagement in the German Energiewende through a sophisticated application of stakeholder exemplifies its non-market strategies amid the German Energiewende. According to Castelo and Lima [7], the useful notions of corporate social responsibility are based on a stakeholder perspective to address is instrumental and normative issues. In other words, it is an obligation for corporations to take sustainability into consideration, which implies their active participation in the development of public policies [7]. These strategies allow Siemens to align its corporate actions with national energy goals effectively.

In conclusion, through active engagement with key external stakeholders, including the German government and industry associations, Siemens actively shapes the energy landscape and adapts to ongoing policy transitions. These adaptations help to enhances its corporate reputation and builds trust in the energy sector, securing a competitive advantage. Additionally, these strategic approaches suggest the crucial role of stakeholder engagement in achieving corporate success during global energy transitions, demonstrating how Siemens leads in sustainable practices and navigates public policy to support both corporate and environmental well-being.

2.2.2.2. As an innovator: decarbonization and collaborations

Siemens's role in advancing technological innovation is pivotal to the success of the German Energiewende. This section will examine Siemens' contribution through smart grid technologies and collaborative partnerships.

Innovation has been an indispensable part in the German Energiewende. German Federal Government [12] claims that a critical factor for a successful energy transition is Germany's commitment to enhance and sustain its innovative capabilities. In the third meeting of the Alliance for Transformation hosted in 2 June 2023, the issues of how the German innovation system could be improved was discussed by the participants of the meeting with experts. During which Federal Chancellor Scholz emphasized that Germany is looking forward to lead in these developments as a nation known for innovation. "It requires joint efforts with everyone involved and a broad alliance with corporations and citizens enable us to safeguard and renew prosperity. This is our goal, and we will accomplish it", emphasized by him [12]. This issue will continue to be discussed in an ongoing work process, with outcomes to be revealed and deliberated at the forthcoming Alliance for Transformation meeting in October [12]. According to Koirala et al. (2018), flexibility, productivity, and cooperative efforts are essential for fostering innovation in the dynamic energy landscape of modern business. In the case of Siemens Energy, innovation is at the core of its brand, and there are multiple approaches to energy transition, including incremental Innovation, disruptive innovation, significant innovation and adjacent innovation [39].

First, Siemens Energy is committed to developing smart grid technologies, a new pathway to a decarbonized society. With the growing demand for energy, the conventional power grid that mainly relies on fossil fuels has gradually shown some shortcomings due to a large amount of carbon emissions [9]. To solve it, Germany is witnessing a shift from coal to gas to reduce carbon emissions, as well as the use of gas turbines with hydrogen for lower CO2 intensity [40]. In addition, compared with conventional power grids, smart grid technologies help to reduce GHG emissions and thus contributing to energy efficiency and sustainability [43]. Hence, it could be suggested that the carbon footprint of traditional power grids is an important factor in global climate change. Therefore, it is necessary for local and regional governments to conduct experiments with regionalized energy flows and smart grids.

Siemens is proven a success to validate and promote smart grid technology. To be clear, smart grid refers to an electricity grid with digitalization and automation through the use of adaptive defense schemes and fast power-based load shedding [30]. For instance, Siemens built up and operated a pilot project on Sulawesi is land in 2021, a remoted island suffering from electricity sustainability and reliability issues in Indonesia [30]. In this project, Siemens first conducted preliminary research to determine the appropriate grid in the given island geography, then it calculated the its feasibility, KPIs, cost-benefit analysis. After the

proposed project was taken into execution, a Siemens app DEOP (Distributed Energy Optimizations) was used to monitor asserts and keep track of KPIs. According to Rohman [30], the data stored in the Siemens cloud server is useful to optimize the smart grid and the continuous improvement, thus giving stakeholders a potential to utilize smart grid technology in remoted areas and eventually in big cities.

Additionally, Siemens Energy strive to build a collaborative framework and strategic partnerships to accelerate net-zero missions. Siemens Energy actively collaborates with various stakeholders, including academic institutions, customers, industry partners, and governmental bodies, to drive innovation in the energy sector. First, Siemens has built a close relationship with the Ministry of Energy and Mineral Resources and the state-owned utility company to bring smart grid technology into reality [30]. Moreover, the strategic value of such partnerships are underscores by scholars, particularly emphasizing the pivotal role of large corporations, often regarded as national champions, in bridging the gap between public objectives and private innovation. Kramer and Porter [19] proposed the concept of shared value, which focuses on the connections between economic benefits and societal progress. According to this concept, public-private cooperation is mutual beneficial and essential for driving national objectives like less carbon emissions and technological innovations of the company [19]. In addition, the involvement of national champions in public-private partnerships often leads to enhanced policy influence and more effective implementation of technology solutions, fostering a synergy that accelerates technological adoption and regulatory compliance [17]. These statements illustrate a practical application of CSR, highlighting how strategic alliances can serve broader economic and societal objectives. To be specific, the private-public partnerships help to accelerate the commercialization of new technologies and ensure that Siemens' innovations are well-aligned with market needs and regulatory standards. In addition, several Innovation Centers were built by Siemens Energy to provide a dedicated workforce for making use of regional cooperation frameworks, involving start-ups, industrial partners, academia and external funding opportunities [39]. They are located in different regions to make Siemens's innovation efforts tailored to meet the diverse and differentiated demand [39].

For example, Siemens have partnered with Energy Union (EU) to support the installment of a smart feeder switching system, a 12-kV Boomer delivery point with a poor reliability record [23]. Its functionality is to initiate alternative power supply automatically upon losing normal energy supply. Initially, communication was the main challenge for the project because of the hilly and rugged terrain, and it is impossible to use fireless in some of the devices [23]. Finally, Siemens rapidly adapted to the geographical restriction and seamlessly integrate all elements. According to the co-op reports, the modified configuration that designed and implemented by Siemens has been proven successful, especially in terms of the customized system and the test simulations, which were tested successful as expected [23]. Following the successful completion of this project, the European Union is planning to collaborate with Siemens about further digital-to-analog projects within the energy network [23].

Leveraging its technological expertise, Siemens develops innovative solutions that integrate renewable energy sources into the energy grid, contributing to energy efficiency and sustainability. These innovations including energy storage and smart grid technologies, which are crucial for meeting the technical and operational expectations of its stakeholders. For instance, Siemens Energy has built an electro fuel facility that will take electricity and CO2 in and it will deliver e-methaneol, claimed by Claes Fredriksson, CEO of Liquid Wind [39]. Second, Siemens has carried out continuous research in the field of smart grid, including smart grid control systems, smart meters, smart substations and distributed energy management systems [37]. These technologies enable real-time monitoring, remote control and intelligent dispatch of the grid, which can optimize the use of renewable energy and ensure the stability and reliability of the grid (ibid).

In addition, Siemens actively helps its stakeholders to upgrade their power grids, including governments around the world and business partners. In promoting the development of smart grid, Siemens has established an extensive network and partnerships around the world, providing tailored smart grid solutions for different regions and markets [38]. These projects involve the application of smart grid technologies, the integration of renewable energy sources, the improvement of grid security, and the digital transformation of the power system (ibid). Siemens' innovation in smart grid also involves Asia, especially China, one of the world's largest energy consumers. For example, Baoding Transformer and Shenyang Transformer both introduced Siemens Technologies and jointly developed ± 500-kV converter transformers with Siemens [6]. Thanks to this joint project, they mastered the basic technology of converter transformers design and manufacture (ibid).

For instance, Siemens' cooperation with the State Grid of China has greatly improved the efficiency, stability and reliability of the grid. To be specific, Siemens has collaborated with the State Grid to develop China's inaugural smart energy village [36]. Within the framework of the Shanghai Lianmin Village Green Energy Application Demonstration Project, Siemens was committed to providing a comprehensive solution that spans from planning and consultation to the implementation of a pivotal energy management platform (ibid). This initiative is projected to decrease energy consumption in the village by 10% and reduce CO2 emissions by approximately 50-55% (ibid). Hence, it could to referred that through these demonstration projects, Siemens has accumulated rich experience and provided reference and support for the promotion and application of smart grids.

All in all, Siemens has made a significant contribution to the smart grid innovation, driving the energy industry towards a smarter and more sustainable future. Siemens' commitment to innovation in smart grid exemplifies its strategic approach to stakeholder engagement with the German Energiewende. Siemens is committed to developing smart grid technologies and fostering collaborative partnerships with governments, suppliers, clients and academia. All these strategies underscore the pivotal role of Siemens in engaging and fostering the German Energiewende.

2.2.2.3. As an investor: green financing

Siemens is contributing as a financer towards a more sustainable energy future through investment in clean energy. Green Finance emerges as a new and universal paradigm of the financial sectors to mobilize private capital towards a Green Economy [32]. As for Green Economy, which are defined by the United Nations Environmental Program, it refers to a community with enhanced human-being, environmental sustainability and social equity [3].

According to *Net Zero by 2050*, a roadmap for the global energy sector posted by the International Energy Agency (IEA), annual global investment on clean energy is supposed to be triple to USD 4 trillion by 2030 for the aim of reaching net zero emissions by 2050. Such an assert was embraced by Siemens AG, with Hakan Ozdemir, CEO at Siemens Qatar and CEO at Siemens Middle East described it as "a hefty upfront requirement but long-term yield", which are too crucial to be overlooked. To be clear, it is Siemens and Siemens Financial Services (SFS) that at the forefront of facilitating renewable energy infrastructure [34]. Their efforts are exemplified by their financial support for over 18 gigawatts of wind and solar power installations worldwide, underscoring their commitment to advancing sustainable energy solutions [34].

For such a goal the private sectors of German economy are supposed to increase financial flows to sustainable development priorities. Among these, as the entrepreneurial heart of Siemens Energy founded in 2020, Siemens Energy Ventures focus on the investment, construction and navigation of ventures towards energy transition and climate goals [35]. To be specific, leveraging financial acumen with extensive industry knowledge, Siemens Energy Ventures is committed to providing a range of financing solutions, conducting decarbonized projects jointly with its customers and collaborative partners [35]. For example, Siemens was investing a billion euros in Germany, for example in a high-tech campus and smart automated factories, claimed by the Federal Chancellor Olaf Scholz when visiting a geothermal energy project in Bavaria [12]. In addition, in 2016, a group including Siemens was granted permission to construct facilities capable of generating 850 MW of wind energy across five projects. Siemens committed to a $110 million investment in a local plant to produce turbine blades. This facility was designed to serve the needs within the country and to export blades to Africa and Europe, aligning with the consortium's broader objectives [46].

Additionally, Green Financing solutions posed by Siemens could enhance the feasibility of hydrogen projects, which represents one of the clean and renewable energy sources. In 2014, Northland Power, an Ontario company that started in forestry, successfully completed the biggest non-hydro renewable energy financing 79 In With The Good, Out With The Bad: Phasing Out Polluting Sectors as Green Industrial Policy Chapter 5 deal in history—a US$ 5.8 billion agreement to build a 600 MW offshore wind farm in the Netherlands in collaboration with Siemens AG and two Dutch firms (McCarthy 2014). Most recently the German company Siemens, which is leading in offshore wind technology, bought 59 per cent of the Spanish company Gamesa, which has a strong position in emerging country markets (Spiegel, 2016). With about EUR 9.3 billion in annual sales volume, the merger has created one of the world's biggest multinational wind companies. Notably, China has invited pioneer foreign companies to produce green hydrogen. For example, Siemens Energy Company, with Beijing Green Hydrogen Technology Development Co. Ltd., will provide the first-megawatt green hydrogen production project in the Yanquing District of Beijing [42]. All these projects indicate the significant contributions of Siemens in Green Financing solutions and clean energy investment.

In conclusion, from the lens of stakeholder theory, Siemens effectively engage with various stakeholders in the German Energiewende through active strategy adaptation, innovation in smart grid technologies, as well as investment in green financing. Hence, it could be seen that Siemens plays a pivotal role and engage in the German Energiewende. This engagement not only facilitates the development and innovation of the Siemen's technology but also supports the achievement of broader social and environmental goals.

3. Conclusion

In conclusion, this dissertation examines the intersection of corporate activities and public policy dynamics from the lens of stakeholder theory. First, it begins by identifying Germany's critical position in the global energy transition, specifically through its well-defined policy framework known as the German Energiewende, which sets a precedent for national energy policies worldwide. The detailed description of the German Energiewende Narrative, the roles of non-state actors and corporate engagement with public policy provide a literature basis for further discussion of how Siemens engage in the German Energiewende through non-market strategies. Using Siemens as a case study, this dissertation explores Siemens' roles in Germany's Energiewende, including active strategic engagement, leading in innovation, and acting as an Investor. Through the analysis, it can be seen how Siemens can effectively interact with the government, industry associations, business partners and other multi-stakeholders using non-market strategies to jointly promote the formation and implementation of the German Energiewende. These roles in Germany's energy transition highlights the active role of the private sector in driving national energy policy. Siemens not only meets the demand for sustainable development through technological innovation, but also supports the development of clean energy projects through green financing.

In addition, the successful practice of Siemens's mechanism in Germany provides valuable insights for other countries to achieve energy transition. However, the replicability of Siemens' success is contingent upon specific political, economic, and social contexts, including substantial governmental support for renewable energies, which might not be uniformly present across different national settings. Thus, while Siemens' experience provides valuable lessons for the global energy transition, the effectiveness of these strategies may be limited by different institutions and market conditions. Additionally, this dissertation enriches the academic

discourse on Energiewende by providing empirical insights into the strategic roles multinational corporations like Siemens play within public policy frameworks. In particular, the Siemens case highlights the importance of non-market strategies navigating in the policy dynamics and its role in promoting alignment of corporate and societal goals.

However, there are still some limitations throughout the analysis. First, the single case study approach may limit the general applicability of the conclusion. Future research could further validate the adaptability and effectiveness of non-market strategies in different contexts by comparative analysis across multiple regions. Moreover, the future study may also explore how policymakers can better leverage the innovative capacity of the private sector in the formulation of energy transition frameworks that promote public-private partnerships to contribute more comprehensively to Green Germany. Nevertheless, this dissertation could help to gain a deeper understanding of the roles of private sectors in the German Energiewende, and provide strategic insights for corporations and policy makers in promoting non-market strategies for fostering energy transitions, and thus provide a solid strategic foundation for the global response to climate change.

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