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Leaders or laggards? The evolution of electric utilities' business portfolios during the energy transition

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ABSTRACT

Effectively mitigating climate change requires a fundamental and rapid transition in the way electricity is generated and used. The global electricity sector, however, is still dominated by large incumbent utility companies, which have historically been slow to embrace change. Given this seeming contradiction, in this paper we investigate whether and how 25 of the biggest electric utilities worldwide have adapted their business portfolios during the energy transition from 2003 to 2015. We observe three developments in utilities' business portfolios, namely an increase in (1) de-carbonization, (2) decentralization and servitization, and (3) system integration and balancing. Our results indicate that utilities have been more proactive in embracing de-carbonization as the core goal of the energy transition than the two successive challenges of decentralization and system integration. The lag in system integration is surprising, given that utilities traditionally possess considerable knowledge and assets that they could leverage to integrate decentralized low-carbon generation. We conclude that utilities can play a major role in integrating and balancing the components of a low-carbon electricity system, but that regulatory changes or additional policy incentives may be necessary to spur system integration as a critical part of the energy transition.

1. Introduction

Urgent societal issues, such as climate change and resource depletion, call for fundamental changes in the way we generate and use electricity (IPCC, 2014). Since a large share of the global greenhouse gas emissions are caused by electricity supply and demand, policy makers around the world have sought to incentivize both the development and use of novel renewable energy technologies, such as solar photovoltaic and wind power (Jacobsson and Lauber, 2006; Mitchell, 2016), as well as energy efficiency measures (Hoffman et al., 2017; Stern et al., 2016). These two endeavors started a profound process of change in the energy sector, which has become known as the energy transition.

Electric utilities play an important role in ensuring a successful energy transition for three main reasons. First, the business of electricity generation and supply is still dominated by large, vertically integrated electric utilities, which produce, transmit, distribute, trade, and sell electricity. In fact, in 2015 the top 5% of utilities in the OECD owned over 50% of the world's electricity generation capacity (Platts, 2015). Second, utilities are traditionally part of, owned by, or at least well connected to public entities and policy makers and therefore likely to be influential in the policy-making process. As a result, failure to consider the interests and capabilities of electric utilities may lead to a situation where utilities undermine political initiatives aimed at spurring the energy transition, e.g., through lobbying activities (Downie, 2017; Jacobsson and Lauber, 2006). Third, due to their long history of operating power plants and supplying electricity, utilities possess considerable knowledge and assets. These capabilities and assets, e.g. the distribution grid and its operation, may be deployed to efficiently manage and execute the energy transition in a way that reaches the ambitious emission targets that have been set to prevent catastrophic consequences of climate change (Ngar-yin Mah et al., 2017).

Getting large incumbent utilities on board with the fundamental changes of the energy transition, however, seems to be a serious challenge, as these players have traditionally been risk averse, slow to change, and have been shown to invest only minimally in innovation (Berlo et al., 2017; Downie, 2017; Richter, 2013a; Shah et al., 2013). This observation—that the electricity sector is in need of major change but is dominated by large incumbents that may show reluctance to change—raises the question of whether and how these central players have adapted their business portfolios during the last years to meet the ambitious climate goals set by policy makers.

The existing literature has suggested frameworks to describe business portfolio shifts of electric utilities. As early as 1982, Lovins and

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Lovins developed a framework that showed how utilities can change from "vendors of kilowatt-hours to financiers of least-cost energy investments" (Lovins and Lovins, 1982, p. 165). More recently, De Fusco et al. (2016) and Facchinetti et al. (2016) proposed conceptual frameworks for emerging utility business models and business innovations. Scholars have also investigated in detail the drivers and barriers for specific business portfolio shifts of utilities. For example, Helms (2016) identifies the shift from tangible to intangible assets as the most important barrier to utilities becoming energy service providers. Burger and Luke (2017) find that regulatory factors are more important than technological factors in driving a shift to distributed energy resources, whereas Gsodam et al. (2015) show that the proximity to the traditional business directs utilities' preferences for investing in large-scale rather than small-scale renewable energy production. Using the investment in offshore wind energy as an example, Richter (2013b) identifies 10 key drivers for utilities to invest in these technologies, such as marketing and public relations considerations or scarcity of investment alternatives. Finally, Apajalahti et al. (2015) identify conflicting institutional demands, such as unbundling regulations, as key barriers to utilities including energy efficiency services in their business portfolios.

While prior studies have proposed helpful frameworks and provide valuable insights into utilities portfolio shifts, we currently lack a comprehensive worldwide overview of how electric utilities' business portfolios have changed during the energy transition. Such an overview would be a valuable tool for policy makers for two main reasons. First, it would help identify the extent to which the biggest companies contribute to the energy transition targets. Second, and more importantly, such an overview would help determine which specific aspects of the energy transition utilities have embraced and to what extent. These insights might help identify possible frictions throughout the course of the transition that could provide an important basis for future policy interventions. Moreover, analyzing the evolution of utility business portfolios over time can help both managers and policy makers benchmark their current positions in the energy transition to further steer its evolution.

In this paper we investigate whether and how 25 of the biggest electric utilities worldwide have adapted their business portfolios during the energy transition from 2003 to 2015. Drawing on unique qualitative and quantitative data, we show three major developments in utilities' business portfolios, which emerged sequentially and differ in intensity: (1) De-carbonization, (2) decentralization and servitization, and (3) system integration and balancing. While the development toward de-carbonization is very pronounced, system integration activities in particular lag behind. This finding is surprising given that utilities have traditionally played a key role in integrating and balancing the components of the electricity system. As integration efforts remain limited, our findings suggest that additional regulatory changes or policy incentives may be necessary to spur system integration as a critical part of the energy transition.

The paper is organized as follows. Section 2 describes the method underlying our study, providing insights into the sampling, data collection, and data analysis. Section 3 presents the results, including a detailed description of the three developments we identified in the course of our analysis. Section 4 discusses the policy implications of our findings and offers avenues for future research.

2. Methodology

2.1. Sample

We selected our sample from the largest electric utilities globally by revenue (in USD) in 2015. The revenue information was drawn from the Thomson Reuters EIKON database, which covers financial information on all publicly listed companies worldwide (Thomson Reuters, 2015). To derive meaningful implications for policy makers, we strove for an equal representation of countries within our sample. Therefore, we chose a maximum of three utilities from ten different countries as our sample. Due to their considerably smaller size, we excluded the third biggest utility from France and the second and third biggest utilities from Portugal and South Korea since these could not be categorized under the top 200 companies measured by revenue.

In total, our sample covers 25 utilities from ten countries, which generate 47% of the global revenue of electric utilities and independent power producers listed in Thomson Reuters Eikon. The term "independent power producers" captures those electric utility companies that do not own electricity transmission or distribution assets. Table 1 provides an overview of our chosen sample sorted by country and size. In addition, Table A1 in the Appendix A provides an overview of the regulatory environments of the sample, showing whether a utility company operates in a monopolistic environment, is vertically integrated, or owned by the state. The table shows that the sample utilities differ with regard to the three important factors we analyzed. For example, in contrast to all the other companies we studied, the three Chinese utilities in our sample are all state-owned. Moreover, in several countries, such as the U.S., utilities still operate in monopolized markets.[1]

2.2. Data collection and analysis

To analyze the business portfolio evolution of the 25 biggest electric utilities worldwide from 2003 to 2015, we applied a three-step methodology. First, we extracted all business activities from the annual reports of the utilities in our sample and compiled business portfolios for all the firms over time. Second, we complemented our annual report data with quantitative data on business activities where available. Third, we enriched the developments we identified in our data with illustrative quotes from the annual reports that shed light on the rationales behind the observed portfolio changes.

2.2.1. Document analysis

Annual reports provide a reliable source of historical business activities and also include information on the rationales behind company strategies. Therefore, we collected the annual reports of the sampled companies from 2003 to 2015. For some companies within our sample, annual reports were only available from later years as visible in Table 1. To analyze the data contained in the annual reports, we used the MaxQDA 12 software package and applied a coding scheme, which we developed in a bottom-up manner by identifying business activities in the reports and clustering them into categories (see Table A2 in the Appendix A). Using this scheme, we coded the annual reports from every second year—173 annual reports in total. In the case of larger changes in the business activities within the two-year timeframe, we checked the annual report for the intermediate year for clarification. In cases of larger company mergers or spin-offs, we used the company with the larger portfolio share in the electricity sector. We did not differentiate between domestic business activities and business activities in other countries. Since one of the central changes within the electricity sector is the diffusion of distributed technologies, we used an additional coding dimension to specify whether technologies were deployed in a distributed or in a centralized manner for the firms in our sample. All data was coded by one researcher and checked by a second

[1] Table A1 indicates that whether firms operate in monopolistic markets, are vertically integrated, or are state-owned barely changes over time, implying that the regulatory environment of utilities remained quite stable. As a result, the regulatory environment itself is unlikely to be the main driver of the developments we present in the results section. Indeed, a more detailed comparison of the regulatory environment with utilities' activities in (1) de-carbonization, (2) decentralization and servitization, and (3) system integration and balancing showed no clear pattern pertaining to whether utilities are more or less active in these activities depending on whether they operate in monopolistic markets, are vertically integrated, or are state-owned. We thus do not believe that using a sample of utilities that operate in different regulatory environments biases our results or undermines our findings.