

THE RISE OF VALUE NETWORKS IN THE POWER SECTOR: RE-IMAGINING UTILITIES

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Overview

The triple transition—decarbonization, decentralization and digitalization—is rendering obsolete traditional power sector value chains. Value networks are emerging, which will significantly alter the power sector’s landscape and call into question the long-term viability of the traditional electric utility business models. There are two broad categories of drivers triggering the transition from value chains to value networks: (1) regulatory influences and government policy changes, and (2) technological innovations, transforming the grid edge. This paper is concerned with the second category of transformation drivers, particularly distributed generation and storage (relatedly, prosumage), demand side management, digitalization, and cross-sector coupling (e.g. electrification of transportation). The paper provides a framework to better understand the emergence of value networks in the power sector and implications thereof.

Methods

The paper first synthesizes the academic and practitioners’ discourse on the emergence of value networks in the power sector. Second, we characterize alternative patterns of value network development by mapping the technological drivers of change at the grid edge, discussing the potential roles for incumbent utilities. We evaluate alternative approaches for assessing the impact on utilities’ disintermediation risk. Finally, a cooperative game theoretic framework is developed for quantifying power structure in distribution networks.

Results

The framework can be useful to track the emergence of alternative value network architectures in the power sector, to link the emerging architecture to the transformation driver, and to assess the potential impacts on incumbent utilities. The transformations are described in the form of narratives, highlighting among others the roles of aggregators and other intermediaries as well as the rise of new entrants (and, where relevant, their subsequent fall through consolidation). The game theoretic model provides insights about likely evolution of power structure in distribution networks. We discuss strategic implications for utilities and regulatory policy.

Conclusions

The approaches proposed herein provide a beginning point to quantify power utilities’ disintermediation risks, which has to date been extensively by only qualitatively discussed. Our paper thus bridges an important gap in research and practice. Some research challenges are highlighted. Access to reliable data (e.g., from pilot studies) is key to refining the model in view of informing the governance of power industry transformation going forward.

Keywords: Triple transition, disintermediation, utilities, value networks, cooperative game theory

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