ANALYSIS OF THE PRODUCTION EFFICIENCY OF THE FRENCH POWER DISTRIBUTION NETWORK OPERATOR IN LIGHT OF ITS BUSINESS MODEL EVOLUTION, FROM OPERATING THE NETWORK TO MANAGING THE DISTRIBUTION SYSTEM

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Overview

The liberalization of European electricity markets, which started back in 1999, flagged a set of major turning points in France. Following the unbundling of the national electricity firm (EDF) was created Enedis in 2008, the French national power distribution operator. The core business model of Enedis has since consisted in securing concession contracts with local authorities and municipalities, which own the distribution infrastructures, in exchange for the operation and maintenance of the medium-and-low voltage power network.

Over the past decade, the growing urge to comply with the requirements of sustainable development, combined with the digitalization of public utilities in the wake of the “smart city” concept, have prompted Enedis to develop new business models: from "pure" electricity distribution to the deployment of new innovative energy services priced at marginal cost, the French distribution network operator fully commits to supporting its concessions (the French local authorities) in their energetic transition.

However, as a regulated natural monopoly for electricity distribution on 95% of the French territory, Enedis must ensure the best possible quality of delivery for its public service, and guarantee a minimum level of firm performance to citizens and public authorities. Therefore, the company is to determine how its innovative solutions (e.g. deployment of smart meters and data processing, delivery of exploratory studies for urban planning processes or for the insertion of electric vehicles, development of open data portals and web applications, etc.) still manage to ensure a certain threshold of production efficiency for the firm.

This paper is organized in four parts as follows: after introducing the power distribution landscape in France as well as the diversification into new services being sustained by Enedis, we put forward the relevance of evaluating the determinants of production inefficiency for power network firms as demonstrated by the academic literature. We then perform a quantitative analysis of several different variables which may discriminate the production efficiency of Enedis, according to the geographic concession in which the firm operates the delivery of its new services (regional branch). These variables will be plugged into a flexible cost function, in order to assess the degree of heterogeneity in production efficiency among these concessions. Ultimately, the results shall give insights about the most consistent variables to plug into this cost function.

Methods

A dataset based on a panel of 259 territorial concessions in France shall be used in order to complete the quantitative analysis. The timeframe for the analysis is 2016-2017. The innovative services deployed by Enedis, and for which the production efficiency analysis will be carried out, are the deployment smart meters and the consecutive development of a digital services dedicated to final consumers, as well as the delivery of network impact assessment studies for the integration of renewable energy sources or for the integration of electric vehicles on the distribution grid.

The production efficiency assessment will be based on a stochastic frontier analysis "SFA" (Aigner, Lovell, and Schmidt, 1977 ; Meeusen and Van Den Broeck, 1977), often used in the assessment of energy network costs. The SFA – as opposed to other traditional statistical methods such as DEA (Data Envelopment Analysis) – is preferred in the sense that it estimates a production cost frontier representing the minimum cost rather than the average cost of a firm, and also helps distinguish statistical noise-related effects from inefficiency-related effects.

The SFA will be performed on a flexible form cost function which includes:

- A dependent variable: the total operating cost for Enedis for the concession, including the new services on top of "pure" electricity distribution, and based on intermediary costs such as total payroll, and total marginal cost of service deployment;

- A set of several parameters used as explanatory variables: output vectors, input price vectors, environmental vectors and service quality vectors.

Results

The main modeling results from the SFA indicate that both certain environmental and service quality variables in the translog cost function seem to play a key role in order to characterize disparities among electricity concessions in France, with respect to the new services deployed in the concession, among others: population density, share of energy losses on the power network, duration of power breakdowns for both medium and low-voltage customers, and satisfaction rate with respect to customer reltationship and new smart metering services provided.

Therefore, in most of the concessions considered within the panel, the addition of environmental and quality variables in the cost function do appear as drivers of the production efficiency – and thus of the local performance – of Enedis with respect to the new services deployed in a regional branch.

Conclusions

The global evolution of power distribution firms' business model towards becoming operators of the distribution system goes hand-in-hand with the delivery of new value-added services to their territorial markets. However, the delivery of these innovative solutions, beyond coping with the national or local regulation framework, shall not be sustainable in the long-run if they create production inefficiencies for the DSO. The analysis of the development of these solutions to the 259 largest concessions in France reveals that the heterogeneity of efficiency observed among concessions is mainly due to environmental and service quality factors which should be taken into account in the long-run cost function of the DSO. These results may provide guidance as to how the French distribution network operator could tailor and segment its new innovative energy services to the type of electricity concession it has secured a contract with, and more generally have its regional branches adapt their cost strategy to the type of concessions those new services are targeted for.

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