

# ***FROM OPERATING ENERGY NETWORKS TO MANAGING ENERGY SYSTEMS: HOW ELECTRICITY DISTRIBUTION FIRMS ARE PAVING THE WAY FOR NEW AND INNOVATIVE BUSINESS MODELS IN ENERGY DISTRIBUTION - A FOCUS ON THE CASE OF FRANCE***

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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. The national electricity firm EDF - a former regulated monopoly integrated across the whole value chain - eventually unbundled and turned into several companies, each specialized in one key area of this value chain. Amongst those was created ERDF in 2008 (renamed Enedis in 2016), the French national network distribution operator. Over the past decade, the growing urge to comply with the requirements of sustainable development (need for de-carbonated economies and overall cleaner energy mixes via the use of renewable technologies) and the emergence of alternative energy production and consumption schemes within cities (distributed generation, micro-grids, storage, smart grids/meters and internet of things, electric mobility...) have prompted Enedis, and more generally electricity distribution firms across Europe, to innovate and diversify their activities in order to cope with such evolutions. Long gone are the days where the business of distribution network operators only consisted in dispatching electricity at medium or low voltage. They are now committed to embarking on a path to becoming full-fledged enablers of the energy transition, in order to support cities in their urban planning processes and favour the effective management of their energy system, infrastructures, and policies. However, this diversification towards operating energy systems for distributors often goes hand-in-hand with their status of public utility and the goal of maximizing social surplus for all end-users. As a result, in the case of France as a regulated monopoly for electricity distribution, Enedis must determine how its innovative solutions (e.g. insertion of electric vehicles on the grid, distributed energy, implementation of online data platforms...), concretely create value thanks to all stakeholders involved in the energy system.

The paper is organized as follows: after introducing the business model transition sustained by electricity distribution firms with a focus on the case of Enedis in France, the second section shall address the results of specific market experiments conducted with these new solutions as regards their impact on the price elasticity of power demand. Finally a statistical approach will be used in order to classify French territories according to their "sensitivity" level regarding the delivery of certain services provided by the DSO, and in order to figure the underlying reasons, from an economic and spatial standpoint, behind this need for these new services.

## **Methods**

The first part of the paper estimates the value of the price elasticity of power demand for three innovative services deployed by Enedis: smart metering, data platforms, and exploratory studies for electric vehicles. The methodology used in a double-differences model based on the impact of signals sent by Enedis to the different groups of customers in the experimentation. This analysis gives insight over how the new services may generate value for the electric system via their impact on power demand.

The spatial analysis performed in the second part uses a statistical multivariate analysis based on a hierarchical cluster analysis of 224 cities/urban areas in France according to the deployment of four services (the dependent variables) proposed by the DSO on their territory. Cities are grouped into three main statistical clusters according to the type of services they seem to favour best and a principal component analysis is then performed on the dependent variables. We then use a discriminant analysis on a number of macroeconomic explanatory variables, in order to figure the underlying rationale for the deployment of these services.

## Results

First, the experiment based on the price elasticity of power demand indicates that the three services deployed (smart meters; exploratory network impact studies performed for charging infrastructures dedicated to electric vehicles; and development of energy data platforms) seem to create a certain shift in elasticity and generate value and flexibility on the electric system, upon condition that end customers be provided with adequate signals (information about power price as well as their incumbent and historical consumption).

Second, the results from the spatial analysis for the set of the 224 cities observed suggest that the growth of the main services of the DNO (data platforms and exploratory studies for electric vehicles) seem to be crystallized in large and highly attractive urban areas and metropolises, whereas more rural or remote areas are either more prone to services linked to their spatial and industrial development (urban planning or renewable energy studies), or are yet to be acquainted with the role of the DNO as an "enabler" of the energy transition on their territory.

## Conclusions

The business model of Enedis as the national distribution network operator has literally gone the distance in France, from being a strict public utility post-World War II to an enabler of the energy transition, allowing France to stand out in terms of best practices in the context of climate change. However, not all French urban areas react the same way as regards energy transition, owing to specific parameters linked to their empirical attractiveness. This is particularly true with the recent territorial reforms in France, which have given rise to new administrative metropolises since 2015, whose influence shall be significant on the strategies of public utility companies. In order to remain successful and make its business model sustainable over the long-run, Enedis must adapt its diversification and set priorities on cities where the utility generated by its new solutions will be the highest, notwithstanding the need to abide, as a regulated monopoly, by the principle of non-discrimination for all the other cities on the French territory.

## References

*An exhaustive list of references is provided in the full paper.*

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