

Optimal Regulation of Natural Monopolies in Electricity Distribution Grids

Rakel Murillo-Rivas¹, Maria Paz Espinosa¹, Cristina Pizarro-Irizar^{1,2}

¹University of the Basque Country (UPV/EHU), Bilbao, Spain. ²BC3, Bilbao, Spain

Extended Abstract

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Abstract Summary

The ongoing energy transition, characterized by a growing share of intermittent renewable generation and increasing electrification of the economy, poses new regulatory challenges for the electricity sector. In particular, regulators must design policies that provide adequate incentives for long-term investment in grid infrastructure while supporting decarbonization objectives. This paper examines how regulatory commitment and tariff design affect investment incentives in the electricity sector.

We develop a theoretical model of a regulated natural monopoly providing electricity grid services. First, we analyze alternative regulatory regimes under complete information, focusing on Rate of Return regulation as a benchmark. We then extend the framework to a dynamic setting in which the regulator cannot fully commit to future policies. In both settings, we consider scenarios with and without environmental externalities associated with decarbonization, which create a gap between private and social demand for grid services.

Our results show that, under full information and without external effects, Rate of Return regulation can deliver a second-best outcome by allowing cost recovery while limiting excessive capital accumulation. However, when the social benefits of decarbonization are considered, standard regulatory mechanisms are no longer sufficient to align private incentives with social objectives. Additional regulatory clauses are required to prevent inefficient investment patterns. Furthermore, when regulatory commitment is incomplete, firms face an intertemporal substitution mechanism that may distort the timing of investment and lead to systematic underinvestment in grid capacity.

These findings show the importance of regulatory commitment and tariff design in aligning private investment incentives with broader decarbonization goals and offer guidance for future regulatory reforms in electricity markets.

Presenting Author Biography

Rakel Murillo-Rivas is a PhD researcher in Economics at the University of the Basque Country (EHU). Her research focuses on industrial organization and electricity market regulation in the context of the energy transition. Her work examines how regulatory frameworks and market design shape investment incentives in electricity networks and electricity markets. In her doctoral research, she also studies household energy consumption and energy vulnerability. The research presented in this paper is part of her ongoing doctoral work.