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Promoting efficiency with neutral operational/capital incentives under uncertainty: A comparison of electricity distribution remuneration schemes

M.A. Ruiz Hernández; T. Gómez San Román; J.P. Chaves Ávila

Abstract-

The proliferation of decentralized renewable generation and the electrification of demand require new investment in electricity networks. In this context, combining traditional investment in grid infrastructure with smart-grid solutions is required to minimize consumers’ costs. Because electricity distribution is a regulated monopoly, the efficient combination of both solutions critically depends on the incentives embedded in remuneration schemes. This paper formulates a methodology to quantitatively assess how different distribution remuneration schemes: cost of service, revenue cap, and total expenditure with a fixed capitalization rate, impact the investment decisions of a profit-maximizing distribution company. Our results show that the total expenditure scheme with a fixed capitalization rate, despite common belief among actual regulators, leads to cost misallocation, which, when combined with efficiency incentives, creates distortive investment signals. In contrast, the revenue cap scheme, if designed with a sufficiently high incentive rate, not only fosters efficiency but also mitigates the capital-intensive solutions advantage. Furthermore, once efficiency is properly incentivized, adaptable planning can deliver substantial savings and should be prioritized by regulators, following the shift from cost-of-service to revenue cap with profit-sharing schemes.

Index Terms- Electricity distribution remuneration; Capital expenditure bias; Flexibility; Neutral incentives; Investment under uncertainty

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