Price Regulation for Independent Transmission Companies

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Abstract
This paper considers methods of price structure regulation of electricity transmission in the context of an independent transmission company (TRANSCO). The focus is on two-part tariffs where the variable part would reflect congestion charges (and ancillary services) while the fixed part would reflect capacity costs. The two-part tariffs form a price-cap index, and the firm could rebalance prices, as long as the index satisfies the price-cap constraint. The firm would then have incentives to trade off congestion against capacity expansion in such a way that it becomes profitable to expand, whenever the costs of congestion on average exceed the costs of expansion. However, with chained Laspeyres weights in the price-cap index expansion may be suboptimal. We therefore discuss ways to improve the expansion factor. Implementing the regulatory schemes considered suggests a hybrid approach combining a TRANSCO with an independent system operator (ISO).

1. Introduction

Rather than simplifying regulation the opening of electricity markets to competition has made regulation more complicated. In particular, the regulation of transmission services has proven to be difficult. In terms of governance, there are a number of possibilities. For example, transmission can be provided by independent regional transmission companies (TRANSCOs), or the transmission grid of formerly integrated electric utilities can be leased to an independent system operator (ISO) in charge of network coordination and generation dispatch (Awerbuch et al. 2000). Since we want to concentrate on the monopoly regulation aspect, through most of the paper we consider the TRANSCO approach. However, we later provide room for an ISO as the entity that runs the market for transmission capacity utilization, while the transmission network would be owned by a TRANSCO that does the transmission investment, maintains the system, bears the costs and collects the revenues.

What makes regulation of transmission networks particularly challenging is that

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providing electricity transmission is complex. For example, transmission capacity, following Kirchhoff’s laws, depends in a complicated way on the location of generators and users. It is thus difficult to set incentives in such a way that the transmission network ideally complements generation and distribution. This includes minimizing distances between power stations and demand centers for competitive alternatives, providing system reliability (frequency and voltage levels), smoothing load patterns, coordinating maintenance of power plants and providing emergency responses (Joskow and Schmalensee 1983).

While dealing with all these complications would be rewarding, the current paper concentrates on the single issue of price regulation that combines incentives for capacity utilization and capacity expansion. The current literature on transmission pricing is very elaborate and mature with respect to pricing that achieves optimal capacity utilization (Hogan 1992, on spot pricing; Wilson 1993, on priority pricing). Conditions for optimal capacity expansion are also well known from the peak-load pricing literature (Crew, Fernando and Kleindorfer 1995). Optimal investment would mean that investment occurs at the margin when the marginal cost per unit of new capacity equals the expected congestion cost arising from not adding that unit.\(^1\) However, while optimal capacity utilization can be achieved by creating a competitive market with a market maker, optimal capacity expansion probably cannot. The prevalence of economies of scale and externalities in transmission networks mean that congestion prices that utilize an optimally sized network optimally would likely cover only about 25% of average network costs (Pérez-Arriaga et al. 1996) and that competitive markets for investment in transmission networks are hard to create. One suggestion has been to use tradable capacity rights to finance and direct expansion (in Chao and Peck 1996). This paper takes another route by assuming a profit-maximizing monopolist to own the transmission grid and to make investment and pricing decisions, subject to regulation. While Nasser (1997) and Leautier (2000) also target both capacity utilization and capacity expansion with a price-cap mechanism, this paper is the first attempt to allow for optimal spot pricing within the context of an overall constraint on the firm’s price level and to provide good or even optimal signals for capacity expansion. This requires some type of two-part tariffs or capacity charges in order to compensate for the freedom of spot pricing and for the low level of the resulting prices. The main contribution of the paper is that it makes the fixed fee systematically responsive to the variable/spot prices.

In the tradition of U.S. regulation the revenue requirement refers to the level of a regulated firm’s prices, while rate design refers to the price structure. The revenue requirement can, among others, be fulfilled through rate-of-return regulation, profit sharing (or sliding-scale regulation) or through price caps. Because we want to concentrate on rate design as a way to balance capacity utilization with capacity expansion, this paper uses price caps as the only approach to the revenue requirement. Overall, an appropriate price level appears to be paramount for investment. However, the current paper

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\(^1\) Leautier (2000) notes that, for electricity transmission systems, this rule does not generally hold for marginal costs of lines as measures of marginal costs of capacity and nodal price differences as measures of congestion costs.