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INSTITUTIONAL MODELS FOR PROVIDING AND FINANCING HIGH-VOLTAGE ELECTRICITY TRANSMISSION

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OVERVIEW

Electricity transmission policies are currently facing a dilemma: on the one hand, the transformation of energy systems towards distributed generation and a higher share of renewable requires an extensive upgrade and expansion of high-voltage transmission grids; on the other hand, the existing regulatory framework and other obstacles have hampered an optimal expansion of transmission thus far. Also, the institutional basis of decision making and planning of transmission lines is often not transparent and methodologically unclear.

This paper provides a survey of institutional models for providing and financing high-voltage electricity transmission, with a special focus on configurations that work, or that could be put to work provided some reform took place. The objective of the paper is to inform the stakeholders about the breadth of institutional options, as larger infrastructure packages are prepared on both sides of the Atlantic, e.g. the European Union's energy infrastructure guidelines, and the U.S. ambitions towards developing high-voltage electricity grid overlay ("super grids", Hirschhausen, 2010). We also see important implications for the longer-term design of sustainable infrastructures.

METHODS

We apply a comparative institutional economic approach that was pioneered by Nobel Prize Laureates Oliver Williamson (1971, 1975, 1985) and Elinor Ostrom (1993, 2005). The approach suggests that the optimal institutional structure for electricity transmission depends upon several criteria, such as allocative and dynamic efficiency, investment and innovation efficiency, the level of private and public transaction costs, including the costs of system transformation and the political implementation process. This approach has been applied to the organization of national highway systems by Beckers, Klatt, and Maerschalk (2009); a stylized presentation of planning mechanisms in electricity transmission is provided by Brown and Moselle (2007). Taking these approaches into account, we analyze, compare, and evaluate different organizational forms for the development of sustainable electricity infrastructure.

One specificity of the approach is to separate the analysis between the provision of infrastructure, i.e. the decision which infrastructure should be built, and the financing which can be user-based or not, and provided by private, public, or public-private agents. This distinction has important implications, amongst others, on the costs of financing the transmission networks, and the coordination costs of the market design, the transaction costs (Helm, 2008). The approach indicates, for example, that performing the two tasks (provisioning, and financing) jointly may not be the optimal solution, e.g. private companies may have a competitive advantage in the production of infrastructure, but not in the siting decision. Our approach thus complements the more top-down technical optimization of high-voltage electricity transmission, such as Oren and Sauma (2007).

EXPECTED RESULTS

The comparative institutional approach identifies the trade-offs between different mechanism designs, and it also identifies shortcomings of existing structures. The approach relies on a technico-economic understanding of the sector, and is both quantitative and qualitative. We will derive results, both from the identification of stylized indicators, and from case studies, of which the following are dealt with:

- PJM (Pennsylvania, New Jersey, Maryland), an electricity with an LMP-based central transmission planning by an ISO (Lin, 2008);
- California (CA-ISO), where system expansion is based on a detailed cost-benefit analysis in the framework of the Transmission Expansion Assessment Technology (TEAM) (CAISO, 2004);
- Australia, where a centralized approach, based on quantitative assessment, was chosen (Brown and Moselle, 2008);
- The UK that is gradually moving towards more standardized transmission expansion methodology such as cost-benefit analysis (National Grid, 2009);
- Scandinavia, which is the first European region to have implemented self-organized inter-TSO coordination of network expansion (Nordel, 2008, Nylund, 2009);
- Germany, a traditional TSO system, now largely publicly owned, though with dispersed ownership, and an absence of strong regulatory oversight over transmission planning.

The comparison will yield a ranking of different market designs with respect to each of the criteria, and identify good practice and obstacles to overcome. The analysis will also take into account “hard” data, such as the level of annual congestion rent, the price differentials between zones/nodes within one jurisdiction, or the level of investment over the years.

CONCLUSIONS

In this paper, we take a comparative institutional approach to analyzing high-voltage electricity transmission expansion. Given the difficulties of implementing first-best regulatory mechanisms in practice, a bottom-up approach of identifying strengths and weaknesses of different market designs can help to identify means to overcome these obstacles. We draw conclusions for an optimal “institutional design” of infrastructure planning and the related economic policy implications. This should be useful for network operators and policymakers alike.

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