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## **REGULATING ELECTRIC DISTRIBUTION AND TRANSMISSION NETWORKS**

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### Outline

It is my intention to focus on the regulation of electric distribution and transmission networks in countries/states that have implemented wholesale and retail electricity competition programs that “unbundle” the prices of and the investment in distribution and transmission networks from generation and associated power marketing services. The discussion of incentive regulation mechanisms will focus primarily on England and Wales (which is the gold standard in terms of regulation of unbundled) T&D) with some references to experience in the U.S. and other countries, including experience in some developing countries that have been burdened by bad advice from the World Bank. I will examine some of the issues associated with unbundling, default service and stranded cost recovery that have accompanied the introduction of retail competition and affected its diffusion, especially for residential and smaller commercial and industrial consumers. I will try to work with Frank Wolak to make sure that we do not overlap too much or leave important gaps in the material covered on electricity. This will be especially challenging for transmission where there are fundamental interdependencies between transmission operations and investment, wholesale markets, and detailed features of wholesale market design (especially the treatment of congestion and losses and the reliance on property-rights based systems). I will also discuss some regulatory and market power issues associated with vertical and horizontal organizational arrangements.

1. Basic electricity supply segments, what they do, how they are related, traditional governance and regulatory arrangements, and the new challenges created by introducing wholesale and retail competition. (See my 1997 *JEP* paper or my 2000 Brookings paper -- coordinate with Wolak).
  - a. Distribution
  - b. Retail supply
  - c. Generation
  - d. Transmission
  - e. System operations
  
2. Traditional governance arrangements (coordinate with Wolak)
  - a. Vertically integrated geographic monopolies
  - b. Regulated private firms
  - c. State-owned entities
  - d. Cost-of-service/rate of return regulation of some type

3. The “standard restructuring prescription” for successfully introducing wholesale and retail competition to electricity (coordinate with Wolak).

- a. Vertical restructuring issues
- b. Horizontal restructuring issues

4. Basic principles of sound regulation of monopoly infrastructure suppliers where regulators are imperfectly informed about the about firm’s cost opportunities, service quality, managerial effort, product and process innovations and the regulatory is at an information disadvantage to the firms it regulates. (Incentive regulation with uncertainty and asymmetric information --- adverse selection, moral hazard, commitment issues)

- a. Tradeoffs between incentives and rent extraction
- b. The key role of the availability and structure of information about relevant performance indicia
- c. Pure once and for all fixed price contracts (or price caps) are never optimal
- d. Menu of cost-contingent contracts and sliding scale applications
- e. Learning, ratchets, resets, credibility; the tradeoffs
- f. Interactions between incentive mechanisms to reduce costs and incentives to alter service quality

4. Electricity distribution

- a. What is “distribution” and what are its major components?
- b. Distinguish between delivery services and “retail supply” services
- c. Overlaps between metering and billing services
- d. Where does distribution end and transmission start?
- e. Main features of traditional cost of service regulation (in practice) of distribution delivery services (which is also the foundation for more recent incentive regulation based on sliding scale mechanisms, ratchets and resets)

5. Applications of incentive regulation mechanisms to electricity distribution in practice

- a. Regulatory targets and benchmarks: costs, quality indicia, price structure
- b. RPI-x as an overlay to cost-of-service regulation
- c. What should “x” be in theory?
- d. Operating cost components
- e. Capital costs
- f. Ratchets and resets
- g. Use of benchmarking studies to set  $p_0$  and x in practice (yardstick regulation)
- h. Incentive mechanisms designed to improve/control quality of service
  - i. England and Wales
  - ii. Massachusetts
  - iii. Others
- j. Assessments of performance of alternative regulatory mechanisms

5. Unbundling retail supply services from distribution to support retail competition

- a. Distinctions between “mass market” and “large customer” segments

- b. Attributes of retail supply costs. What costs should be unbundled and how should they be unbundled?
  - i. Cross-subsidization, “sticky” customer, and other marketing issues and considerations
  - ii. Default service and other transition issues (including stranded cost recovery)
  
- e. Experience with retail competition in electricity and impacts of different unbundling and default service strategies, distinguishing between “mass market” and large consumers
  - i. E&W
  - ii. Norway
  - iii. U.S. states (Texas, PA, Massachusetts, Ohio and New Jersey will be the focus to illustrate effects of differences in the ways in which retail competition has been introduced)
  - iv. BGS auctions as an alternative for smaller customers
  - v. Municipal aggregation as an alternative for small customers (opt-in vs. opt-out)

## 6. Transmission Networks

- a. Why are transmission access and pricing issues important for the performance of competitive wholesale power markets in the short run and the long run? Why are they so challenging to deal with?
- b. Basic economics of transmission networks
  - i. Network operations to support economical and reliable physical wholesale power markets
  - ii. Loop flow and operating reliability considerations
  - iii. Congestion management
  - iv. Reliability of network components and associated O&M costs
  - v. Investment in new transmission facilities
- c. Organizational issues and models
  - i. Transmission (TO) and system operating (SO) functions
  - ii. Interdependencies between wholesale power markets, TO and SO operating activities
  - iii. Vertically integrated utilities governed by “open access” regulations (e.g. FERC order 888)
    - 1. functional separation rules
  - iv. Independent Transco model in various flavors (NGC, RedElectrica, Norway, Italy (soon), New Zealand, Australia)
  - v. ISO model (U.S.)
- d. Transmission tariff regulation in the UK
  - i. Interconnection cost and pricing philosophy
  - ii. Use of system charges
    - 1. Long run zonal pricing system for use of network from/to different locations
  - iii. Incentive regulation mechanisms

1. Direct operating costs
  2. Congestion, balancing and other network constraint costs
  3. Losses
  4. Network outages (costs of unserved energy)
- e. Transmission Tariff regulation in the U.S.
- i. Under FERC Order 888
  - ii. Under standard market design as implemented by PJM
- f. Transmission investment
- i. Economic models focus on congestion (and losses)
    1. Simple economics of investment to reduce congestion
    2. Transmission rights-based systems
    3. Market power considerations
  - ii. Engineering models focus on and use reliability rules
    1. Interdependencies between “reliability” investments and economic investments
    2. Examples from PJM and New England
  - iii. Diverse nature of transmission investment opportunities
    1. Lumpiness issues
    2. Complementarities with the existing network
    3. NIMBY and related constraints
  - iv. Regulatory frameworks for identifying and providing incentives for transmission investment
    1. UK model
    2. PJM Model
    3. New England model
  - v. Merchant transmission as a complement to regulated transmission investments
    1. Theoretical issues (Hogan, Joskow-Tirole)
    2. Experience in Australia
    3. Experience in the U.S.

## 7. Conclusions