Market-Based Investment in Electricity Transmission Networks: Controllable Flow

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Overview

• Introduction and background:
  • What is market-based transmission investment?
  • Congestion pricing: Europe versus USA
  • Why unregulated market-based interconnectors?
  • EU regulation

• Problems & Prospects (DC vs AC):
  • Economies of scale
  • Market power
  • “Profitable modification can be bad”
  • Risk

• Conclusions: in Europe, DC merchants only
  • Pros likely to offset cons
  • Sharp line between regulated and unregulated
What is MBTI?

- **Definition** [ACCC, 2001, p. 126]:
  
  line "operating between two connection points assigned to different regional reference nodes, [...] supported by the revenue stream generated by trading electricity between the two interconnected regions, [and] not eligible to earn regulated revenue."

- **Note:**
  - Unregulated price differences of two ends of line
  - Not eligible to regulated revenues
  - Others than designated TSO allowed
  - Interconnector ("link") based (Europe & Australia)
    - USA more refined
Congestion pricing: Europe vs. USA

- **In the USA:** *nodal* spot pricing
  - Zone contains many nodes with different prices
  - Allows LMP plus point-to-point incremental FTRs capturing network effects
- **In Europe (and Australia):** *zonal* (spot) pricing
  - Market-splitting / auctions
  - Single price in zone / “copper plate”
  - BritNed trades between APX-UKPX region
  - Network effects not captured / link-based
    - no merchant network deepening investment
- **Should Europe move to nodal pricing?**
Controllable flow

- **AC meshed networks: non-controllable**
  - Kirchhof’s laws
  - Power flows according to inverse of line resistances
  - Direct control of power flows not possible
  - Loopflows

- **DC lines: controllable**
  - Power flow on DC line can be controlled directly
  - By-passes loopflows
  - Applies to some extent also to FACTS
  - Disadvantage: expensive due to AC/DC convertors
Loopflows

Loopflows in three-node AC network

Constraint on line G1-G2 (AC network)
Why unregulated MBTI?

• Fear of under-investment (in T-capacity):
• Vertically integrated utilities have weak incentives to connect different systems
• Regulatory uncertainty for risky projects
  • Regulators may be tempted to strengthen rate regulation if ex-ante uncertain world turns out to be good ex post, while no adjustment for bad case
  • “Regulation holiday”: commitment not to regulate
• Public choice
  • Region which loses from interconnection may try to stop investment
EU Regulation on Cross-border Exchanges

• Regulation 26 June 2003 (1228/2003) (1/7/04)
• Art.7: new interconn. can be exempted from:
  • art.6(6): regulation of revenues from the allocation of interconnection
  • and directive arts. 20 (TPA) and 23(2, 3, 4) (regulation)
• ... provided the investment:
  • enhances competition
  • is risky
  • is legally (not ownership) separated from SO’s
  • is DC (in exceptional cases also AC)
EU Regulation on Cross-border Exchanges

• However, exemption does not seem to cover
  • art. 6(3): “must offer” maximum capacity
  • art. 6(4): “use it or lose it” provision for interconnector users
  • art. 6(5): netting

• Notes:
  • these arts. aim at existing lines, but seem to carry over to new lines. Was this intended?
  • Note: “must offer” and “uioli” can possibly be bypassed by prohibitively high pricing
P&P: Economies of scale

- Suboptimal capacity
  - With economies of scale (in line construction) revenues based on price differentials cannot recover (fixed) costs with long-run optimal capacity
  - “30% rule
  - ” Cost recovery: capacity “too” small

- Economies of scale may be “near” exhausted for bulky, large-scale interconnectors
  - > 750 MW
  - Typically DC technology
Economies of scale in transmission investment.

Source: Brunekreeft, 2003, Market-Based Investment in Electricity Transmission Networks: Controllable Flow, University of Cambridge; figure 2.
P&P: Economies of scale

• Ways out:
  • Ramsey pricing (uniform mark-ups)
    • Deviation from optimum may be small
  • User-specific two-part pricing: tricky
    • Allocation of fixed costs problematic
    • Pass-through to traders possibly not stable
  • All costs and benefits considered and included?
    • Increased system reliability and network upgrades: deep connection charges
    • Capacity payments
    • Environmental effects
P&P: Market power of interconnector

• Suboptimal capacity due to market power of line
  • Market may not facilitate “many” lines

• Problem, but counterarguments:
  • Race for investment speeds up investment
  • Pre-emption requires bigger than monopoly size
  • MES relative to market: interconnectors’ MES relatively small
  • Controllable (DC) lines allow lines to compete (in contrast to AC lines)

• If still problem, then perhaps organize tender
P&P: “Profitable modification can be bad”

- Loopflows cause network effects
- Profitable investment may have detrimental effects
- In *nodal* pricing scheme (USA):
  - Point-to-point incremental FTRs internalize network effects
    - Cf. Bushnell/Stoft and Hogan
  - Introduced in several US regions
  - However: incremental FTRs requires centralized decisions
    - Is a move away from market-based invisible hand
    - Cf. Joskow/Tirole
P&P: “Profitable modification can be bad”

Line G1-G2 (100 MW) has detrimental effect (AC network)

Must-accept Incremental FTRs:

\[ \Delta R_{12} = -100 \cdot (30-50) = +2000, \]

\[ \Delta R_{13} = +400 \cdot (40-50) = -4000, \]

\[ \Delta R_{23} = -400 \cdot (40-30) = -4000, \]

Total: -6000
P&P: “Profitable modification can be bad”

- In *zonal* pricing scheme (Europe) not possible:
  - Link-based payment
  - Network effects not internalized
  - Deep connection charges may relieve
    - Should be manageable, objective and transparent

- Conclusion: For *zonal* pricing regions restrict to controllable lines only
  - DC: no direct loopflows
P&P: Risk

- Different payment methods for line investors, but ultimately depends on price differences and (contracted) flow on line
  - Uncertain and risky
  - Hedges possible, but not perfect
- Whether prohibitively high is empirical question, but in any case:
  - In DC line flow is under control of owner,
  - In AC “under control” of Kirchhof’s laws
Conclusions

• For *zonal* pricing in Europe:
  • Policy recommendation: Restrict market-based transmission investment to HVDC interconnectors,
  • .. but these can well be market based and unregulated:
    • Pros likely to offset cons
    • Sharp line between regulated and merchant
  • Regulators should carefully think about *additional* regulatory measures
    • EU Regulation may be a problem!
Outlook

• **Additional regulatory issues**
  
  • **Ownership**
    
    • Should SOs be allowed? Power to manipulate dispatch and investment
    
    • BritNed legally separated subsidiary of TenneT and NGC
  
  • **Must-offer and/or use-it-or-lose-it**
    
    • For risky investment convincing arguments **not** to have such provisions; Detrimental effects on *new* investment decision!
    
    • Contradiction to EU Regulation?

• **Third-party access?**
  
  • Decision of line owner?
  
  • Open-season auction
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