Regulating and pricing network access

László Szabó

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Lecture outline

• Network: an essential infrastructure
• Getting connected
• Pricing the use of existing electricity networks
• Regulatory models of network upgrade and expansion
• RES-E challenge to network regulation and pricing
The significance of networks – network externalities

- A new network user increases consumer benefit for those already using it
- The more people use the network, the more valuable the network service is (mobile phones, Facebook)
- Positive social externalities of electrification (economic development, education…)

![Diagram showing network interconnectedness](image)
The significance of networks – essential facility

- **Essential facility**: without access to such a facility, it is impossible to serve a given market (the only port on an island; the single airport of a country; the electricity network of a region…)

- **Major characteristics:**
  - Access to it is critical to serve end customers
  - Traditionally it is owned by a vertically integrated company
  - Access can only be granted by the vertically integrated company or can be enforced by regulation
  - Natural monopoly; it does not worth to duplicate it
Special characteristics of networks

• High fixed costs, almost negligible marginal costs (~network losses)
  ‣ MC-pricing certainly not enough to cover all costs of the firm
  ‣ Hungary (2005): $AC = 5 \times MC$ (electricity distribution)
  ‣ AC-pricing likely to result in significant efficiency loss

• „Essential facility”
  ‣ all market actors need access to the network
  ‣ vertically integrated network operators have an incentive to distort competition

• Capacity constraints
  ‣ certain network elements are prone to congestion, especially cross-border interconnectors

• Physical laws
  ‣ additional rules that define the flow of gas or electricity on the network (e.g. Kirchoff laws)
  ‣ especially important if congestion is present

• Investment incentives
  ‣ short term efficient pricing may not induce efficient network investment
Regulatory consequences from network characteristics

• The benefit from new connection is not only enjoyed by the new user but by the formers as well
  ‣ Public purpose line
  ‣ Part of connection cost is legitimate to 'socialize’

• If competition is introduced on an energy market, essential facilities have to be identified
  ‣ E.g. electricity network – including distribution and transmission parts
  ‣ In the case of non-natural monopolies, market analysis might be needed (e.g. natural gas storage)

• Third party access should be granted to essential facilities
  ‣ Main rule: regulated access
  ‣ Negotiated access: when can it be useful?
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Getting connected - questions

• Who can initiate a new connection?
• Benefits? Costs?
• Who should pay for the costs?
• Should the cost of connection depend on the location of the connection point?
• Is there any reason to socialize (include into transmission tariff) 100% of connection cost for some new market participants?
• What to do with excess demand for connection at a connection point (substation)?
• How to establish priorities for new connection?
• How to plan for the expansion of the grid?
• Regulator might be in charge to get involved in giving answers!
Connection cost allocation regimes

• **Total cost of connection**: direct cost of connection to a network substation and the potential additional costs of network upgrade and/or expansion that the new connection might make necessary
  ‣ *Super shallow connection charge*: developer/customer only pays for the direct cost of connection to a substation
  ‣ *Shallow connection charge*: developer/customer has to pay for the direct cost of connection and also for the necessary upgrade of the existing grid
  ‣ *Deep connection charge*: developer/customer has to pay for the total cost of connection

• Advantages, disadvantages?
• Who should establish the cost of connection?
• Should the allocation of connection cost be regulated or left to the parties?
EU regulators about renewable electricity (RES-E) grid integration

• ‘Charges for connecting to and using the [electricity] system should, in principle, be transparent, cost-reflective and not dependent on the source of the electricity.' (Regulatory aspects of the integration of wind generation in European electricity markets. A CEER Conclusions Paper, Ref: C10-SDE-16-03. 7 July 2010, pp. 20-22.)

• Issues with RES-E integration:
  ▸ Should the connection cost of high quality but distant RES resources into the grid be socialized?
  ▸ To handle excess demand for connection – queue management
Hungarian regime

- Small customers pay a regulated charge depending on the capacity of connection
- Shallow connection charge regime:
  - High voltage customers and generators pay 70% and 100% of the investment cost, respectively
  - Network upgrade cost is socialized
- Network company becomes the owner of network assets, even if the new user paid for it
- Asset value financed by network user deducted from regulatory asset base (RAB) for tariff calculation
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Network access and usage - questions

• Once connected…
• … can network operator deny access to the grid?
  ▶ Only according to pre-defined rules, mostly due to system security causes
  ▶ Network company has to explain; financial liability
• Network access in case of congestion?
• Can priority access to the grid be justified?
  ▶ In Europe, a usual mode of RES-E support
Congestion management methods

- Non-market oriented
  - first-come first-served
  - proportional reduction of demand
  - non-transparent methods (favoritism)
- Market oriented
  - auctions
    - one-sided, two-sided, common, coordinated
  - nodal pricing
  - zonal pricing
    - market splitting, market coupling
- Real-time
  - redispatching, counter-trading
Nodal pricing

- Network access charges are calculated for each node of injection and/or load separately.
- These charges reflect the marginal cost of using a specific network node (Locational Marginal Pricing).
- Differences in nodal charges are related to network losses and congestion at the nodes.
- Advantages:
  - Price signal for future network users where to connect to the grid.
  - Helps to manage network congestion by affecting future choices for new connections/developments.
- Not simple, but implementable: applied in New Zealand, PJM, New York…
Market oriented methods

• Coordinated auction:
  ▶ First, the transmission market „clears”
  ▶ After the closure of the transmission market, the energy market opens and clears
  ▶ Efficient working of the transmission market requires perfect foresight from traders regarding the energy market

• In zonal pricing:
  ▶ Market coupling:
    • Joint allocation methods of two markets
    • Two markets are joined in a zone, if no congestion is present between them
  ▶ Market splitting:
    • First, compute a single system electricity price as if no congestion existed
    • If line capacities are exceeded, then split the market into submarkets until a solution can be found
Financing the network in case of a regulated access system

- Cost assessment, establishment of annual revenue requirement
- Design of network tariffs
  - Customer groups
  - Single- or multi part tariffs
  - Recovery of network loss / non-payment
- Rules to change network tariffs (price regulation)
Tariff design questions - incentives

- Access charge is location-dependent (entry – exit) or 'post stamp' kind?
- The role of capacity and electricity based tariff components in network tariffs
- Country-wise uniform or regionally differentiated network tariffs?
- Who should pay the network tariffs: load (L), generation (G) or both?
- Network tariff as a mean to collect revenue for special purposes (e.g. subsidy for the poor)
- Network CAPEX to become part of RAB *ex ante* or *ex post*?
- Major considerations: location of load / generation; stability and predictability of network service remuneration; fairness in cost allocation
‘Post stamp’ pricing

• Does not recognize that users cause different costs to the network operator
• AC-pricing in general
  › it means uniform pricing, but can be differentiated by time use.
  › inefficient in itself, but can be combined with non-linear schemes to increase efficiency
• Cost of congestion management (redispatch) distributed evenly among system users
• Creates incentives to „free-ride” on the system
• Not necessarily bad, if
  › congestion is a rare problem in the network
  › cost differences in service provision are small
• Cross-subsidization is present
The share of capacity and energy related tariff components in European transmission tariffs

Data source: ENTSO-E (2011)

Source: Kema/Rekk (2009)
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Source: ENTSO-E (2011) [*refers to system services*]
Comparison of the structure of EU electricity transmission tariffs, Euro/MWh

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Financing new major lines – Model 1

- Merchant or private line
  - Exclusive use of capacity by developers
  - No (or negotiated) third party access - no regulated access tariff
  - Line pays back from the price difference between the markets it connects

Estlink
Financing new major lines – Model 2

- USA: market based development - Rockies Express Gas Pipeline
- Completed in 3 years
- Regulated rate of return: 10.2% (before crisis; new projects: 12%)
Financing new major lines – Model 3

- Government financed investment: Kazakhstan – China gas pipeline
- Sufficient government funding needed
Financing new major lines – Model 4

• European Union
  ▶ Main rule: regulated third party access (rTPA)
  ▶ Line pays back from regulated tariff set by national regulator(s)
  ▶ In case of new major infrastructure development: Commission / ACER might provide exemption from rTPA
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RES-E challenge to network regulation and pricing

• Ambitious targets for all EU Member States
• Not only a financing problem, but also reaches the limits of the network capacities in many countries
• New challenges: distributed production
• New tools: smart grids helping to detect price signals
Challenges for the EU

integrating massive renewable electricity generation and completing internal electricity and gas markets
Various country approaches of RES-E connection

• Italy:
  ▶ Semi-shallow cost charging, according to a well defined formula
  ▶ Mapping the network elements for connection capacities
  ▶ TSO/DSO have grid connection and grid reinforcement obligations as well
  ▶ TSO/DSOs are incentivised to connect RES-E, they have binding deadline for connection (with penalty)
  ▶ Intensive smart grid developments helps to detect price signals
Various country approaches of RES-E connection

• Denmark:
  ▶ Shallow cost charging – cheapest in Europe – cost are born by consumers
  ▶ TSO/DSO have grid connection and grid reinforcement obligations as well
  ▶ Network is developed till the last sub-station (even in the case of offshore wind parks)
  ▶ TSO has no deadline on decision
  ▶ Intensive smart grid developments, one of the most advanced in Europe
Various country approaches of RES-E connection

• The Czech Republic:
  ▶ Hybrid cost charging, according to a pre-set level (Euro/MW connected)
  ▶ Significant speculative demand for connection appeared in the system – later solved by deposit obligations
  ▶ TSO/DSOs are dis-incentivised to connect RES-E
  ▶ Lagging smart grid developments
THANK YOU FOR YOUR ATTENTION!

lszabo@uni-corvinus.hu
www.rekk.eu