Regulating and pricing network access

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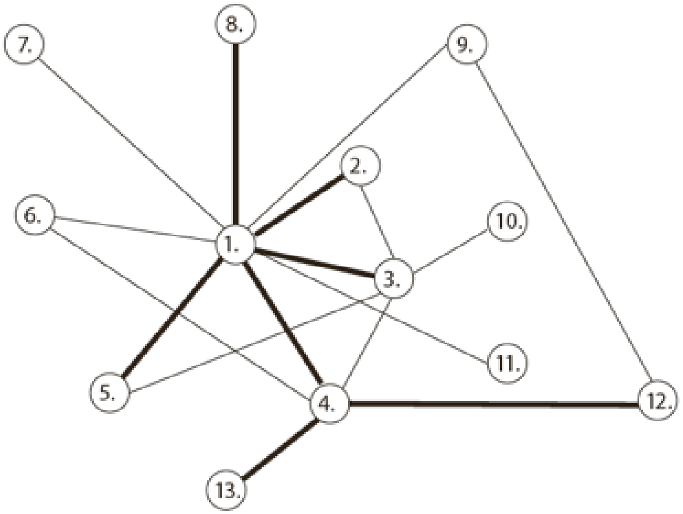
Lecture outline

- 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…)



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 × 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

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- 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)

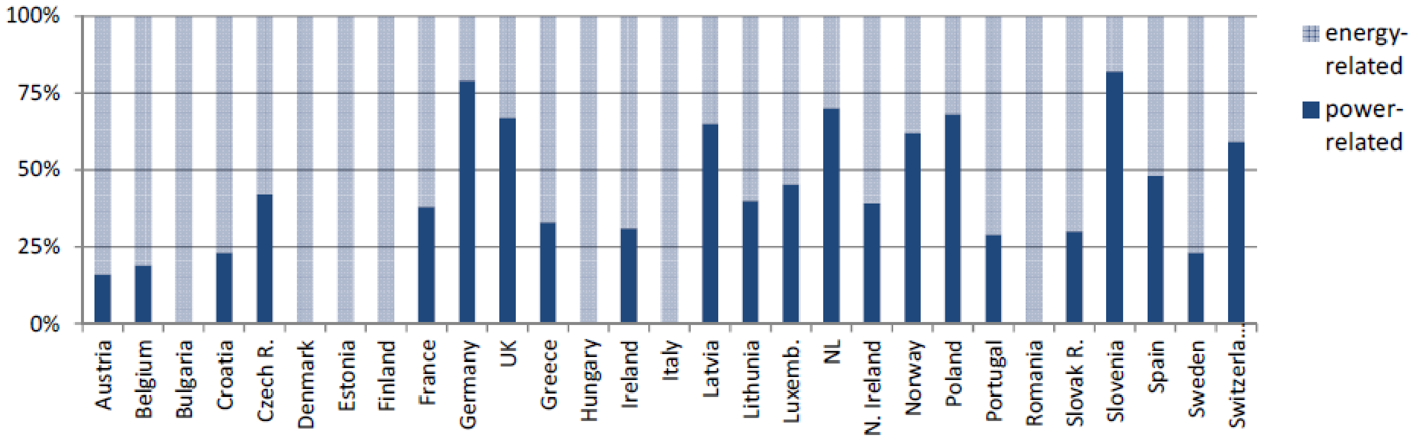
Tariff design questions - incentives

- 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

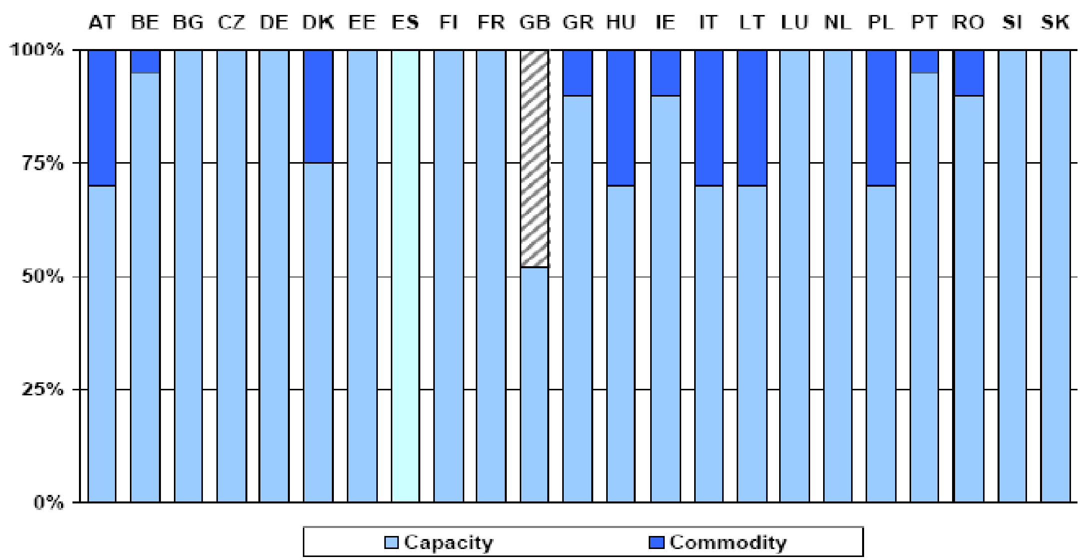
The share of capacity and energy related tariff components in European transmission tariffs



electricity

Data source: ENTSO-E (2011)

gas



Source: Kema/Rekk (2009)

	Sharing of network operator charges		Price signal	
	Generation	Load	Time	Locational
Austria	5%	85%	-	-
Bosnia Herzegovina	0%	100%	-	-
Belgium	0%	100%	Yes	
Bulgaria	0%	100%	-	-
Croatia	0%	100%	Yes	-
Czech Republic	0%	100%	-	-
Denmark	4%	96%	-	-
Estonia	0%	100%	Yes	-
Finland	11%	89%	Yes	-
France	2%	98%	-	-
Germany	0%	100%	-	-
Great Britain	27%	50%	Yes	Yes
Greece	0%	100%	Yes	-
Hungary	0%	100%	-	-
Ireland	25%	75%	-	Yes
Italy	0%	100%	-	-
Latvia	0%	100%	-	-
Lithuania	0%	100%	-	-
Luxembourg	0%	100%	-	-
Northern Ireland	25%	75%	Yes -	-
Norway	35%	65%	Yes -	Yes
Poland	0.6%	99.4%	-	-
Portugal	0%	100%	Yes	-
Romania*	0%	100%	-	Yes
Serbia	0%	100%	Yes	-
Slovak Rep.	0%	100%	-	-
Slovenia	0%	100%	Yes	-
Spain	6%	94%	Yes	-
Sweden	25%	75%	-	Yes
Switzerland	0%	100%	-	-

Source: ENTSO-E (2011) [*refers to system services]

Comparison of the structure of EU electricity transmission tariffs, Euro/MWh

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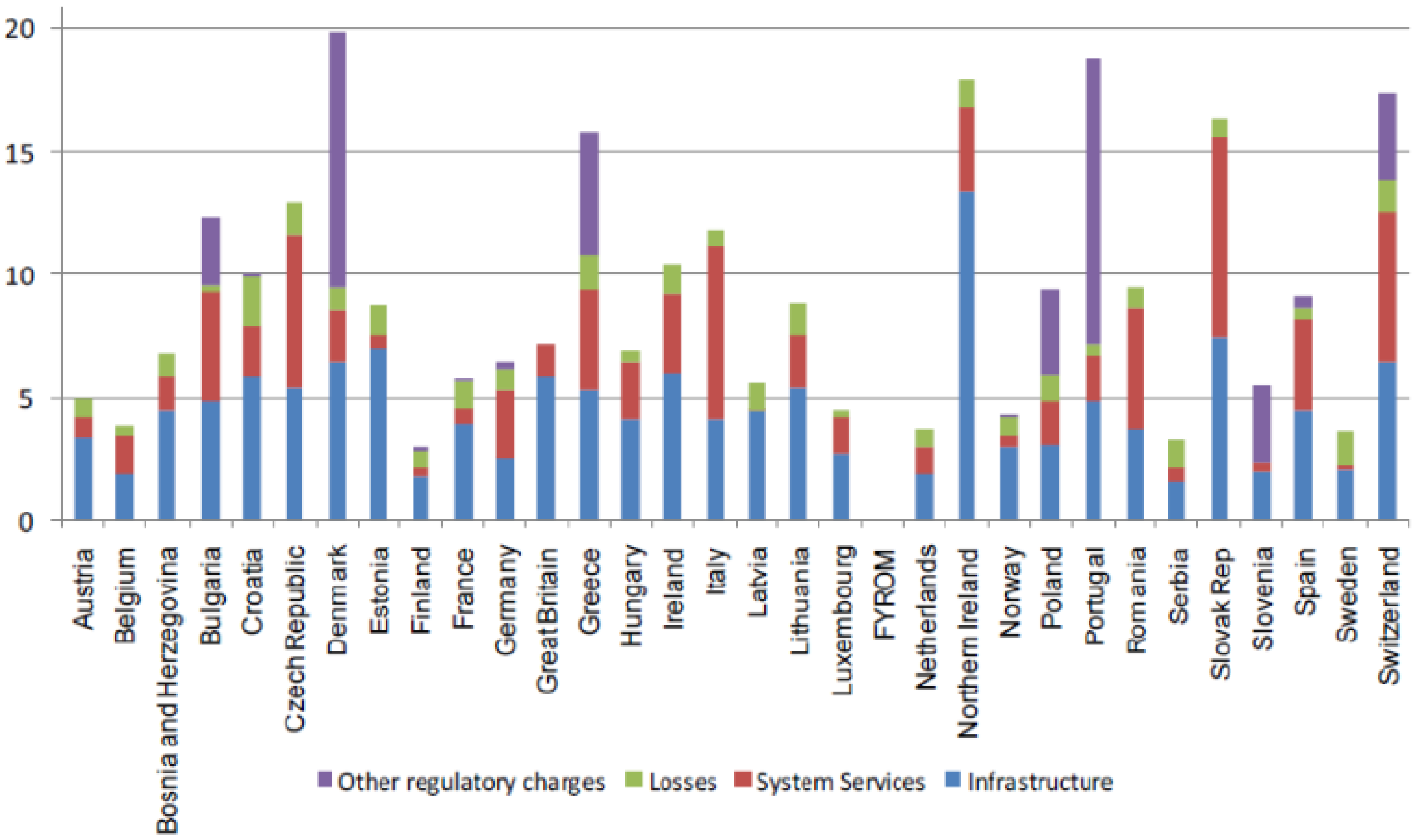

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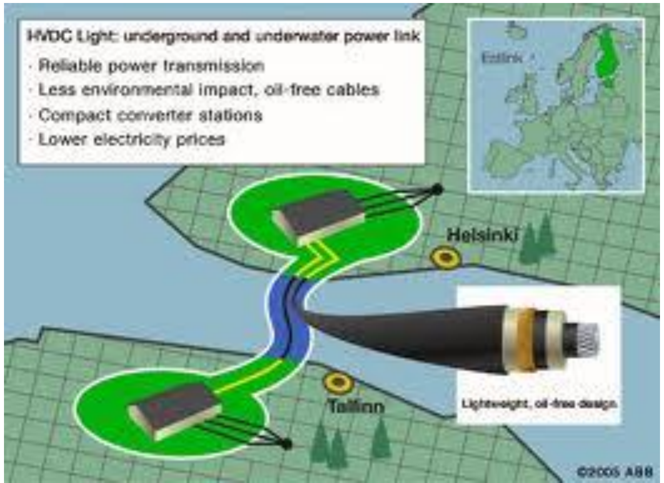
Financing new major lines – Model 1

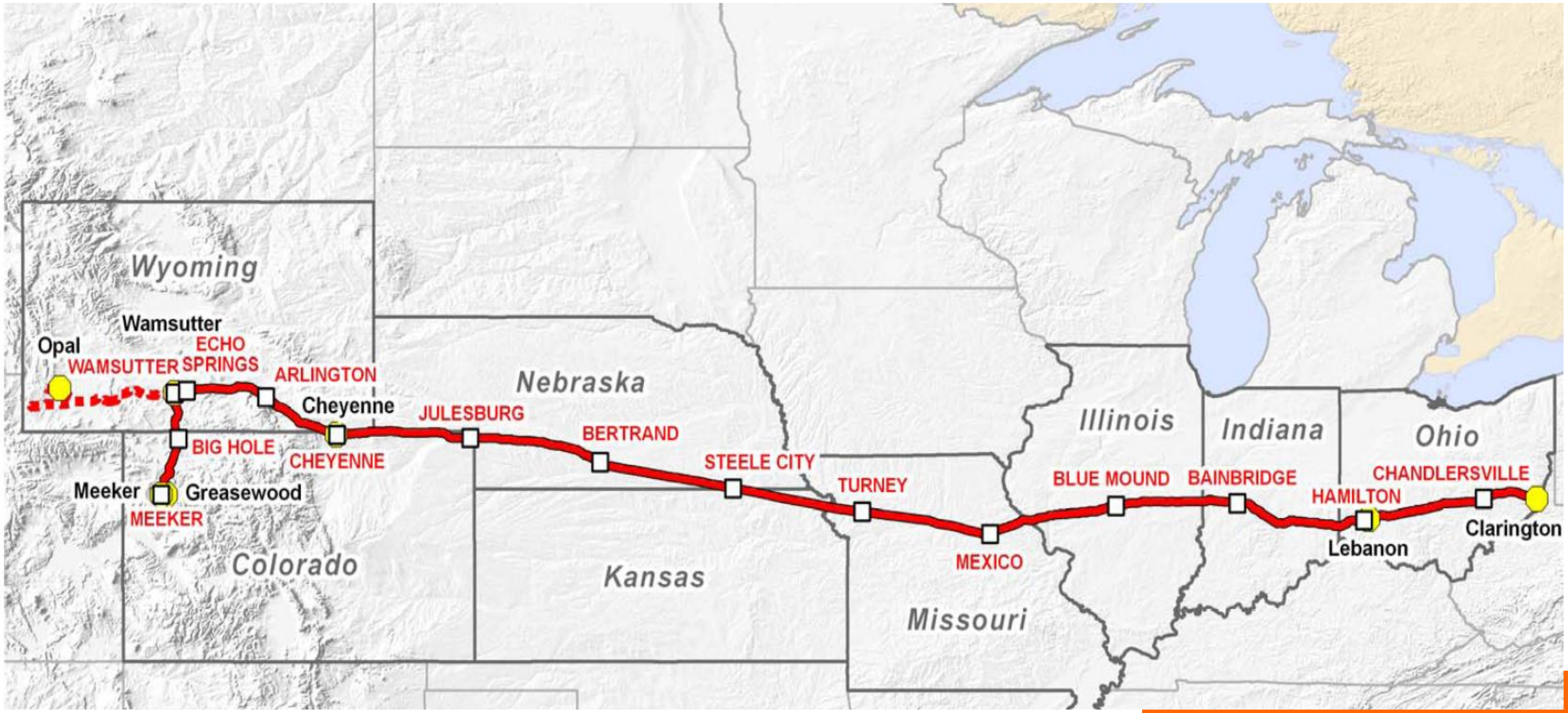
- Merchant or private line
  - Exclusive use of capacity by developers
  - No (or negotiated) third party access - no regulated access tariff
  - Line pays back from the price difference between the markets it connects



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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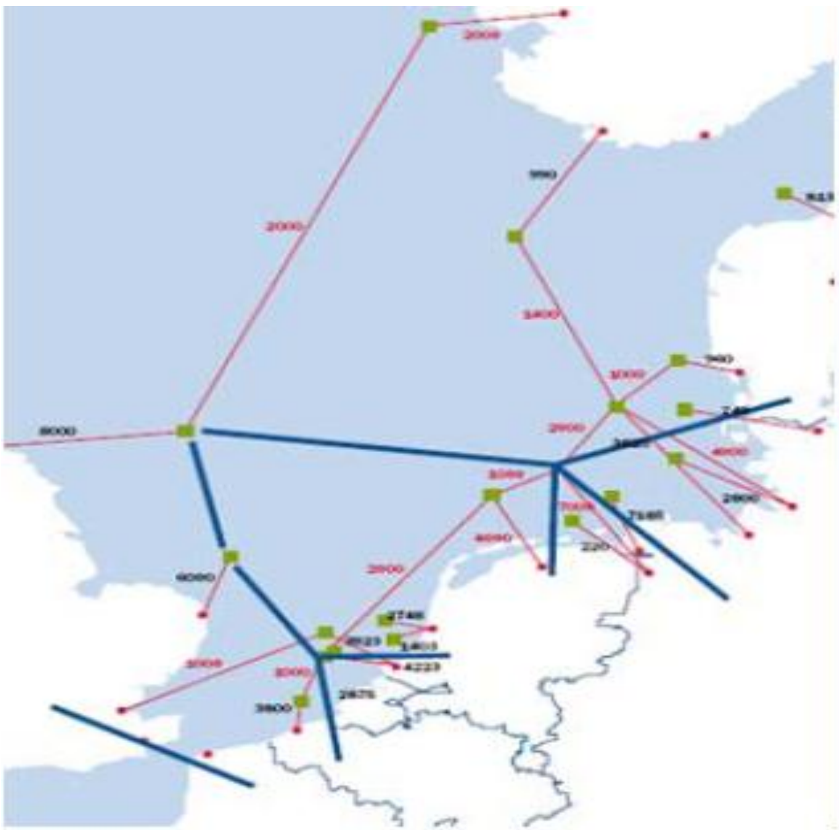
RES-E challenge to network regulation and pricing

- 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



Integrate offshore wind generation

Integrate RES-e from EU and non-EU countries

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!

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