
Unbundling and Smart Grids

Conflicting Policies?

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Agenda

- unbundling
 - debate transmission
 - key issues
 - transferability to distribution
- defining „Smart Grids“
 - goal
 - definitions
 - characterization of different concepts
- analysis of interactions
 - central control approach
 - decentral control approach
- conclusion

Unbundling I

transmission network

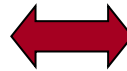
- transmission network debate

- report on sector inquiry 2007
- third legislative package 2009

- arguments

trading off cost and benefits

- discrimination incentives and ability of integrated firms
- strategic investment withholding (interconnector investment)



- coordination losses

Unbundling II

options

- full Ownership Unbundling
 - complete elimination of ties between firms
 - coordination problem
- (deep) Independent System Operators (deep-ISO)
 - solving coordination problem
 - eliminating discrimination incentives
 - strategic investment withholding
- Effective and Efficient Unbundling (EEU), third way, Independent Transmission Operator (ITO)
 - incomplete solution to discrimination problem

Unbundling III

distribution networks

- at the moment: legal unbundling
- smart grids transform distribution networks
 - more similarity to transmission
 - active management
 - increasing actor participation: generation and load
 - ▶ discrimination potential and possibility
- isolated networks - no interconnectors
 - no interregional linkages
 - ▶ strategic investment withholding probably not a problem

Smart Grids I

definition

- definition

an electricity network that can cost efficiently integrate the behaviour and actions of all users connected to it – generators, consumers and those that do both – in order to ensure **economically efficient, sustainable** power system with low losses and high levels of quality and **security of supply**.

(ERGEG 2009)

- ▶ triangle of energy policy: efficiency, reliability, sustainability

- tool to respond to new challenges

- integration of intermittent renewable energies
- expansion of demand flexibility, demand side management
- increasing storage
 - ▶ flexible network management necessary
 - ▶ intelligent management for system optimization (generation, storage, load, network)

Smart Grids II

functions: what is a „Smart Grid“?

- elements of smart grid definitions:
 - bi-directional communication
 - „self-healing“ (US Grid 2030)
 - self-controlled, automatic balancing of supply and demand (MeRegio)
 - online **information** for improved network management (E-DeMa)
 - **control** signals from a centralized control platform (MeRegio)
 - utilizing controllability potential / load shifting potential of large customers (eTelligence)
 - regional **market** for electricity bringing together generators, consumers, service providers, and network operators
- diverse functions and aspects
 - monitoring, information, control, market places

Smart Grids III

concepts: realizing the Smart Grid

- virtual power plants
- demand side management
- control of power flows
- smart metering
- flexible energy prices
- storage and buffering

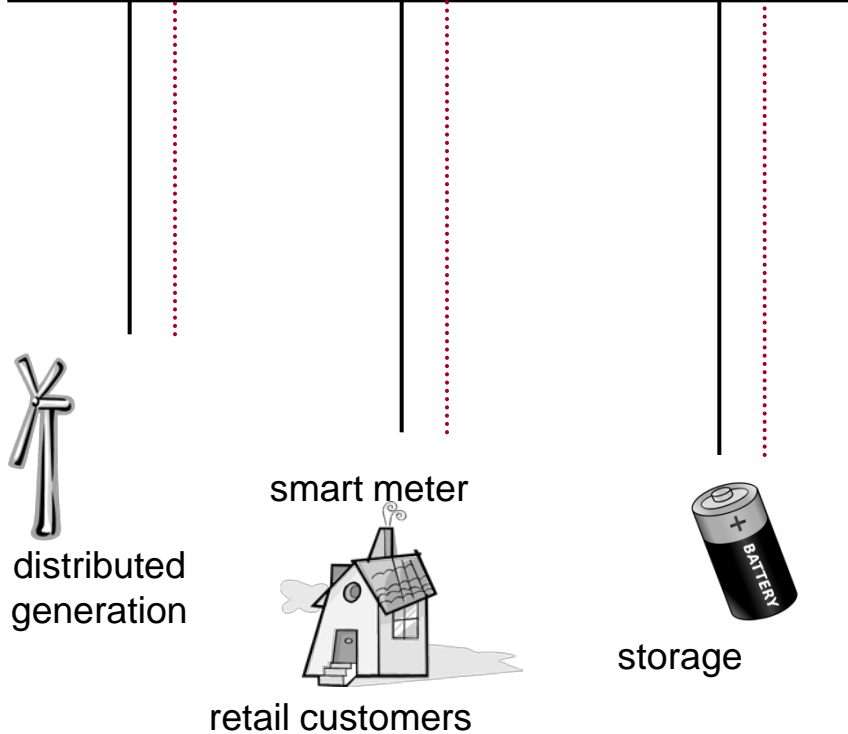
- question from unbundling perspective
 - allocation of control rights
 - access to information

 - roles and responsibilities (R&R)
 - system operation
 - reliability / control in emergencies
 - information processing

Smart Grids IV

centralized control rights I

monopolistic network part



central control via integrated firm:

- network firm
- own generation, storage facilities
- integrated with retail

responsible for

- system operation
- information handling

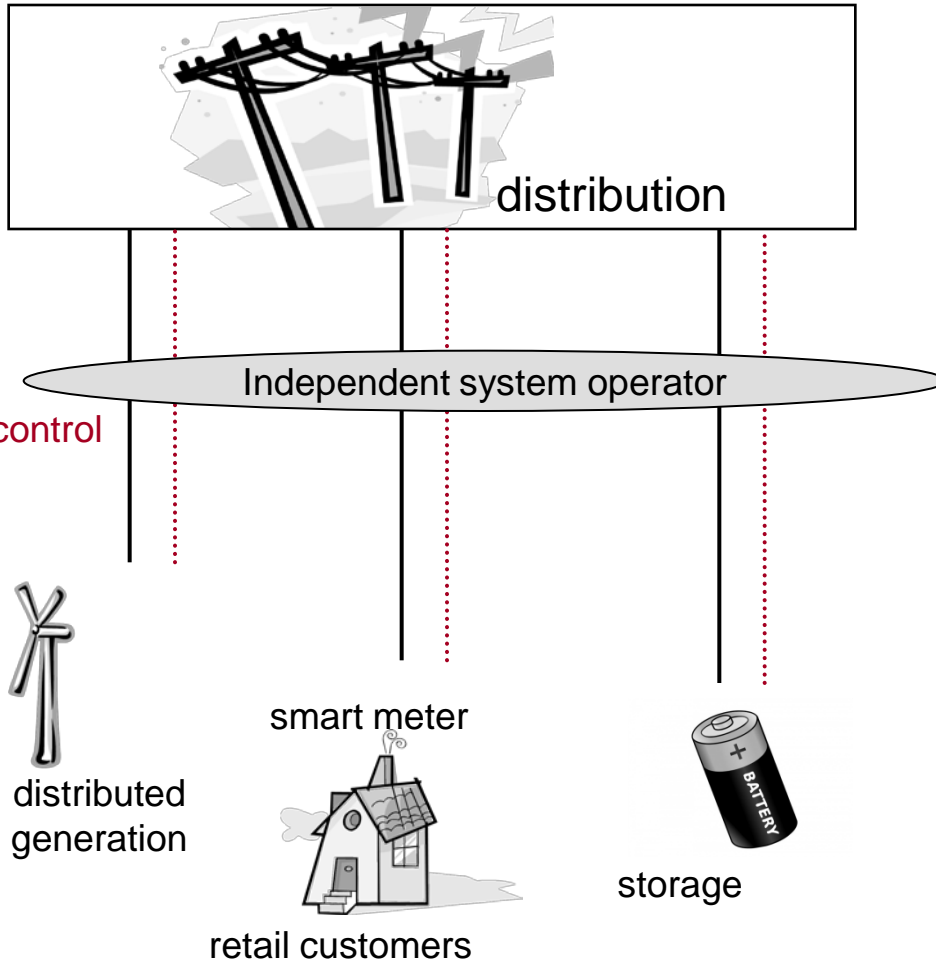
coordination as hierarchical system

information flow
physical flow ———

Smart Grids V

centralized control rights II

monopolistic network part



central control via system operator:

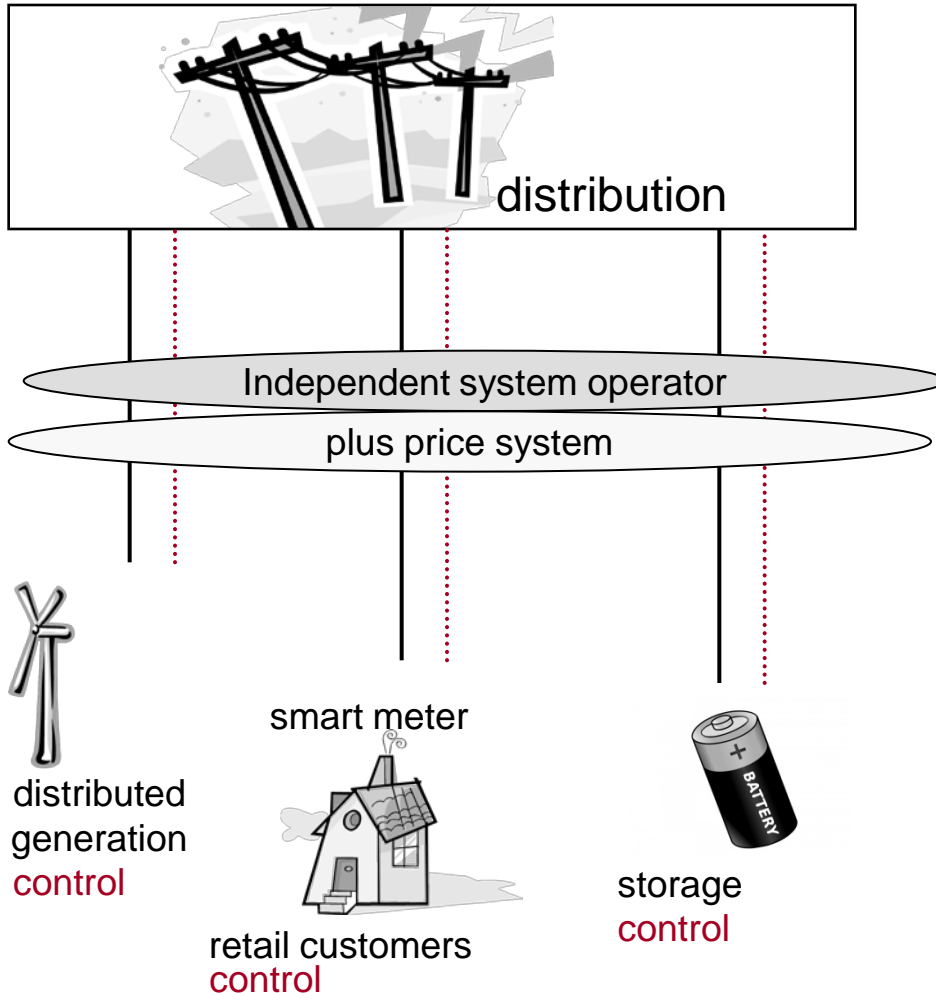
- independent system operator
 - responsible for system operation and information handling
- independent entity

information flow
physical flow ———

Smart Grids VI

decentralized control rights

monopolistic network part



decentral control:

- each actor retains control

coordination

- independent system operator
 - market place/ price signals
- fully reflective price = coordinating device
 prices must encompass all system conditions:
 → i.a. location, time, line capacity

responsibility for system operation

- network firm
- independent system operator

information handling

- independent entity
- network firm

information flow
 physical flow ———

Analysis

central control approach

- delegation of control necessary
 - integrated system operator / network company
 - + best informed actor
 - + efficient coordination / integrated planning of grid, generation
 - DG is increasing → more third party activity in any case
 - discrimination potential and incentive for load and generation (favouring own over competing generators or customers)
 - independent system operator
 - + neutral party → no discrimination incentives
 - has to receive all relevant information → information problems?
 - not „per-definition“ integrated planning → coordination necessary
- ➔ ISO can also serve in a market based solution

Analysis

decentral control approach

- control rights remain with actors
 - external coordination necessary
 - market coordination
 - + theoretically appealing
 - + no discrimination incentive or potential
 - + room for innovation, new concepts and market participants
 - difficult in practice, transaction cost, response/ activity by market participants
 - difficulty to design correct prices, might create unwanted discrimination
 - less coordination among network and suppliers
 - coordination via markets and aggregators
 - + easier to handle, less market participants
 - + aggregators can bundle and coordinate different actors
 - difficulty to design reflective prices
- ➔ market operator needed
- possibly combination with system operation to an ISO as market operator

Conclusions

- smart grids will trigger the unbundling debate at distribution level
 - discrimination issues arise in operation and connection
 - connection possibly good controllable
 - operation should be independent
- (non-deep) Independent System Operator as workable solution
 - in contrast to transmission no problem of investment withholding
 - counterargument to ISOs at transmission level is weakened
 - no interconnectors in distribution networks
 - advantages from ownership unbundling are smaller
 - no ownership unbundling necessary to guarantee non-discrimination
 - ISO addresses potential coordination problem
- allocation of rules and responsibilities still to be determined
 - take into account possible unbundling issues
 - proactive design of framework to support investment and innovation

Thank you for your attention.



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