

# Some economics of monitoring and sensing in transmission networks

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# Overview

- Occasion
- Some economics of transmission networks
- M&S in liberalized electricity markets
- Design criteria for innovations in M&S
- Illustrative examples
- Conclusions

# Occasion (1)

- The need for transmission capacity
  - Market integration
  - Mitigation of market power
  - Enhancing security of supply
  - Economy
- Possibilities to resolve this challenge

# Occasion (2)

- Investment in new capacity
  - Technology is assumed to be given
  - Economic challenges: investment incentives, profitability, risk
  - Regulatory issues: incentives, property rights, credibility
- Non-investment solutions:
  - Traditional economists: Improved pricing signals
  - Political economists: Appropriate regulation, especially between states or countries
  - Engineers: Innovative technologies: <- *Focus of this conference*

# Some economics of transmission networks (1)

- Transmission networks inhibit fundamental market failures:
  - Public good features: non rival, non excludable services (example: auxiliary services)
  - External effects (loop flows)
  - Network externalities: increasing consumer benefits with an increasing degree of interconnectedness
  - Merit wants: electricity as an essential facility with universal service.
- => Structural impossibility to establish markets under each of these conditions

# Some economics of transmission networks (2)

- Traditional resolution of market failures:
  - Public provision of services (European approach)
  - Strict regulation of private enterprise (USA approach)
- Need for new approaches in liberalized electricity markets, including
  - Unbundling
  - Tariff and access regulation
  - Safeguarding public services (security of supply, reliability, environmental objectives)
- => Regulation as a second best option to mimic market conditions

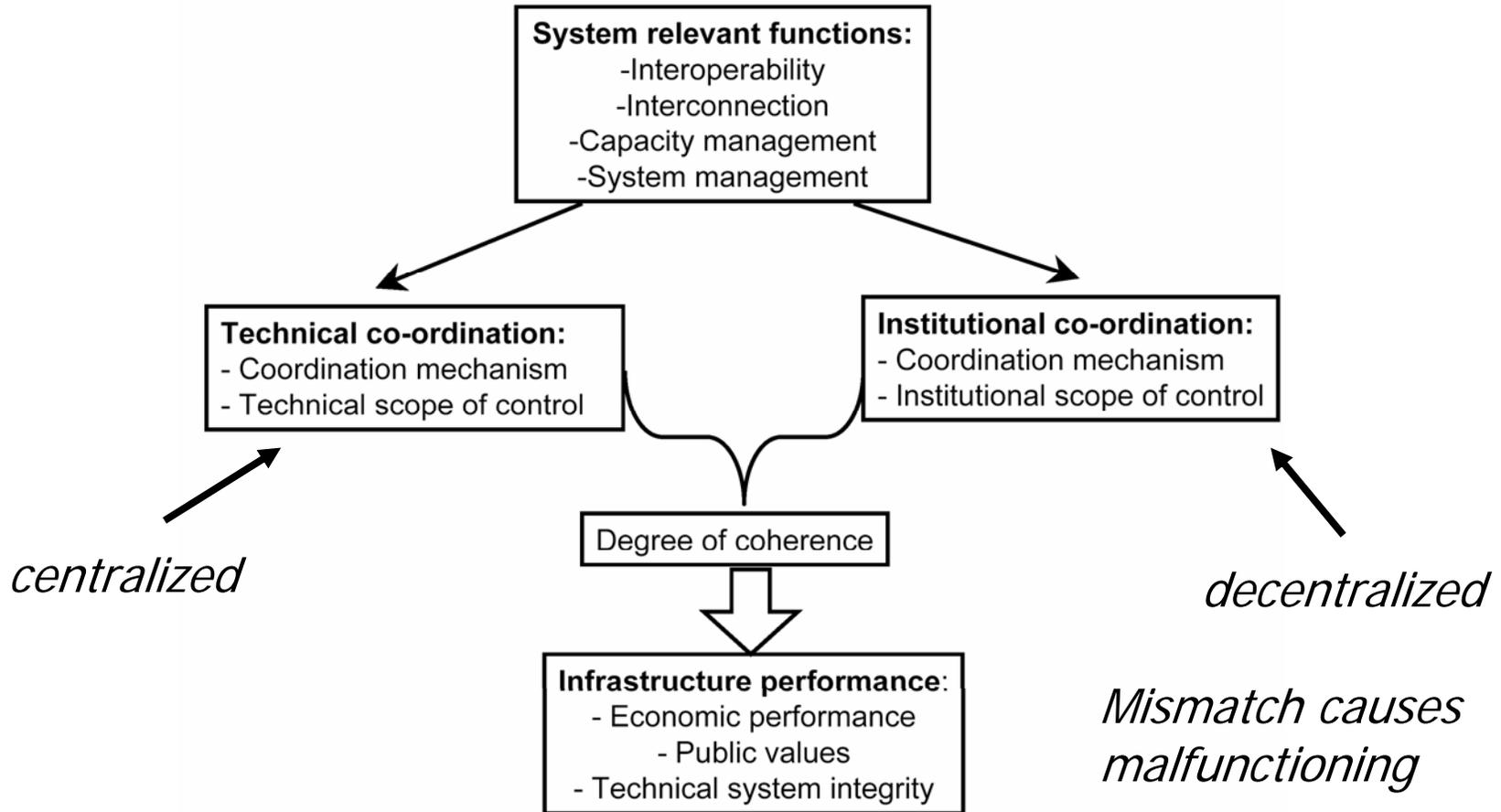
# Some economics of transmission networks (3)

- Economists approach is primarily focused on incentives and behavior of individual actors.
- => Assumption: by optimizing individual objectives social welfare will be maximized
- Problem with respect to the electricity system:
  - This does not recognize the fundamental technical and economic complementarities in electricity systems.
- => Economists treat the electricity system as an atomistic market, whereas a system approach is needed.

# M&S in liberalized electricity markets

- Essential technical functions:
  - Interoperability
  - Interconnection
  - Capacity management
  - System management
- These functions need to be supported by technology and institutional arrangements
- In liberalized markets institutional arrangements changed fundamentally, whereas technology is a constant.

# The mismatch between technical and institutional coordination



# Technical innovation and coordination

- Sustainability of liberalized electricity market institutions vis-a-vis the path dependence of the current technological system
- Bridging or enhancing the gap between technical and institutional coordination?
- Monitoring and sensing stimulates market functioning by:
  - Technically resolving market failures
  - Allowing for decentralized technical coordination of the electricity system ('electricity web')
- Provision of information is essential in decentralized systems:
  - Information on the technical conditions of the system
  - Information on the availability of capacity
  - Information about the current utilization of the system.

# Design criteria for innovations in M&S

- Does monitoring and sensing
  - resolve economic market failures?
  - contribute to a decentralized technical coordination?
- Performance criteria:
  - Enhancement of system efficiency
  - Contribution to safeguarding essential system services

# Example (1)

- FACTS:
  - avoiding external effects
  - allows for correct economic prices
  - Other market failures remain
  - Still a need for centralized coordination
  - => Only part of the economic problem is solved
  - => increasing system efficiency

## Example (2)

- DTCR (Dynamic thermal circuit rating):
  - Allows for a better utilization of system capacity
  - But does not resolve market failures.
  - Centralized technical coordination is still needed.
  - => Enhances system efficiency

# Conclusions

- Liberalization creates a need for transmission capacity
- Improved monitoring and sensing offers opportunities for 'non investment solutions' by:
  - Technically resolving fundamental market failures
  - Bridging the gap between technical and institutional coordination by allowing for decentralized technical coordination.
- Monitoring and sensing stimulates market functioning by providing essential information on system capacity and utilization
- It is to be expected that only part of the M&S innovations will meet these requirements.