Electricity sector introduction

History of liberalization
Market design

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PART 1: THE CHALLENGE
Policy goals

AAA:
• Available
• Affordable
• Acceptable
Challenges to availability

• reliability – international cooperation between EC, national governments, regulators, TSOs, market operators, companies…
• security of supply
  • sufficient investment in generation, transmission, distribution, metering, innovation
  • Where will the gas be coming from?
    • Where to invest?
    • (Total volumes of fossil fuels are not a restriction yet.)
• How fast can renewable energy be developed?
• Transition technologies: necessary, or undesired path dependence?
Challenges to affordability

- Competition is not effective everywhere → market power
- Restructuring → decentralization → coordination problems, transaction costs
- Rising fuel prices
- Limited investment during past decades → limited capacity for certain kinds of investment (nuclear, wind)
- Limited optimization across national borders
Challenges to acceptability

- Greenhouse gas emissions need to be reduced quickly
  - European Climate Foundation
    - 80% CO₂ reduction in 2050 only possible with *zero-carbon power supply*
    - long-run costs not so high?
  - but who pays the large upfront investments?
- Nuclear power, CCS
Massive transmission investments needed

Source: European Climate Foundation, Roadmap 2050
PART II: RECENT HISTORY
Timeline

- Reforms in Chile and Argentina in the 1980s showed that competition in electricity was possible
- Telecom reforms in the UK (1983) demonstrated the possibility of competition in a network sector
- UK: The Gas Act (1986) and the Electricity Act (1989) intended to create competitive markets
- 1988 “The Internal Energy Market” (European Commission)
- These developments lead to Directive 96/92/EC (electricity) and Directive 98/30/EC.
  → liberalization of European electricity and gas markets
Why liberalize: to improve economic performance?

- Ideology: To increase efficiency by introducing competition where possible

- Specific motivations vary:
  - Overinvestment in many Western countries (especially in Europe)
  - In NL: to stop excess investment, which resulted from a combination of central planning and stimulation of small-scale CHP
  - Less than optimal reliability (e.g. California)
  - Insufficient investment/low quality (in developing countries)
... Or for other reasons?

- In Europe: also to improve cohesion between countries by creating a single internal market
- In the UK: to break the coal unions (Thatcher)
- To qualify for loans (e.g. World Bank or IMF requirements)
- To attract private investment (developing countries)
Principles of liberalization

- ‘Unbundling’ of competitive and monopoly functions
- ‘Level playing field’ between competitors
- Regulation of residual natural monopolies
Expectations

- State ownership/private monopolies → poor incentives
  - attempts to improve efficiency had failed
- Introducing competition appeared possible and effective, why not in electricity and gas?
  - static efficiency: competition would drive down prices to cost level
  - dynamic efficiency: competition would lead to
    - an optimal generation mix
    - innovation
EU: legal instruments

• Regulation: general application, binding

• Directive: addressed to member states, needs implementation

• Decision: addressed to specific case, binding
EU: Co-decision procedure

- **Initiative**: European Commission
- **'Parliamentary' reading(s)**: European Parliament
- **Consensus?**: Yes/No
- **Adopted legislation**: Council of Ministers

The diagram illustrates the flow of decisions through the EU institutions, leading to a consensus or not, which affects whether legislation is adopted.

Basic outline of market: competitive activities should be free, networks regulated, but:
- Choice between nTPA/rTPA
- Government tendering of capacity allowed
- Gradual phasing in of competition
- No regulator required
- No detailed market design decisions (no harmonization!)
1998 Electricity Act

- Implementation of the Directive
- Affected only monopoly tasks: networks
- CPI-X regulation of network tariffs
- Permit requirement for supply to small customers (rule added later)
Gas Act (2000)

- Implementation of the Directive
- Focus on networks and supply: production is regulated by the Mining Act
- Initially nTPA, recently changed to rTPA

- Sunk costs
  - Demkolec
  - Import contracts
  - District heating projects
- TenneT to the state
The Electricity Directive
2003/54/EC

(Successor of 96/92/EC)
Principles:
• networks regulated monopoly, rest free market activity
• network and system managers independent
  • juridical unbundling, separate bookkeeping
• regulated access to the networks (rTPA)
• generation free, but license may be required
• supply: free after July 1st, 2007
• public service obligation for small consumers
The Gas Directive 2003/55/EC (Successor of 98/30/EC)

Principles:
- networks, storage and LNG: regulated monopolies
- free market: production and supply
- network and system managers independent
- juridical unbundling, separate bookkeeping
- regulated access to the networks (rTPA)
- storage: regulated or negotiated access
- supply: free after July 1st, 2007

No single energy price in the SEM

Domestic electricity prices 2008

Source: ERGEG (2009) Status Review
The EU’s Third Package

- Replacements for Directives 2003/54/EC
- New regulations replacing nos. 1228/2003
- Creation of European-level agencies:
  - ACER (Ljubljana)
  - ENTSO-E and ENTO-G
- Adopted in 2009
Third Package: Unbundling
transmission network operators

Compromise: three options
• Ownership unbundling
• Independent system operator (ISO)
  • operation is independent, transmission vertically integrated
• “Independent transmission operator” (ITO)
  • networks remain vertically integrated
  • but subject to stricter regulation, a.o. with respect to investment
Third Package: Requirements for regulators

- Independent from other public agencies and politics
- Full budgetary autonomy
- Extension of powers of national regulators
- Harmonisation of powers of national regulators
Third Package: Creation of ENTSO

- European Network of Transmission System Operators
- Annual plan
- European net code
- Every two years:
  - 10-year plan for network development (not binding)
  - annual forecast of summer and winter generation adequacy
- Coordination of research
- If requested: recommendations regarding binding guidelines
Third Package: Creation of ACER

- EU Agency for the Co-operation of Energy Regulators

- Advisory, monitoring and reporting roles
- Involved with preparing European net code and regulating ENTSO
- Replaces ERGEG as platform for the cooperation among national regulators
- Discretionary power with respect to cross-border transmission capacity \textit{in case involved countries cannot agree}

- Staff: +/– 40-50 persons
Third Package: Consumer protection

- Consumers need to receive all relevant consumption data (➔ smart meters!)
- Customer service requirements (switching, billing, contracts)
- Member states need to create independent agents for handling complaints (e.g. ombudsman, consumer authority)
- Protection of vulnerable consumers against being disconnected
PART III: CONCEPTUAL FRAMEWORK
Learning goal

• to learn a framework for understanding the relations between the physical value chain, the actors in the sector and regulation.

• ‘Market design’: how regulation of the market affects system performance.
  • Ideology: the market can be ‘made’ to lead to a specific performance.
System description

Principle: division between
- physical system (technical)
- economic system (actors, institutions)
Electricity - physical layer

- Producers
- System operator
- Transmission network managers
- Distribution network managers
- Generation
- Transmission network
- Distribution networks
- Load
- Consumers
Electricity sector introduction

Electricity – actor layer

- producer
- producer
- producer
- producer

power exchange

bilateral market

wholesale market

im/export capacity allocation

balancing mechanism

system operator

transmission network managers

distribution network managers

TSO

large consumers

retail companies

small consumers

large consumers
Conceptual framework

physical layer

institutional layer

electricity producers

TSO

bilateral market

power exchange

im/export capacity allocation

balancing mechanism

system operator

transmission network managers

distribution network managers

TSO

generation

transmission network

distribution networks

load

large consumers

small consumers

retail market

retail companies

Integrated market

- Combination of a spot market and the former central optimization algorithm.
- Main feature: mandatory *power pool*
  - the pool operator knows all supply and demand bids
  - there is no need to clear the market in advance
  - possibility to incorporate congestion management as *nodal pricing*

Q: using the same framework, what would an integrated market look like?
THIS CLASS
The challenges vs. class topics

- investment
  - theory vs. practice: risk of under investment
  - capacity mechanisms
  - impact of low-carbon technologies on the market
- renewable and carbon policy
- network congestion management
- gas system
  - how does it work
  - historic development
  - investment: dilemmas for regulation and for the industry
- energy system: the interrelations between policy, external factors and system development