Benchmarking of Electricity Distribution Networks in Austria and Germany

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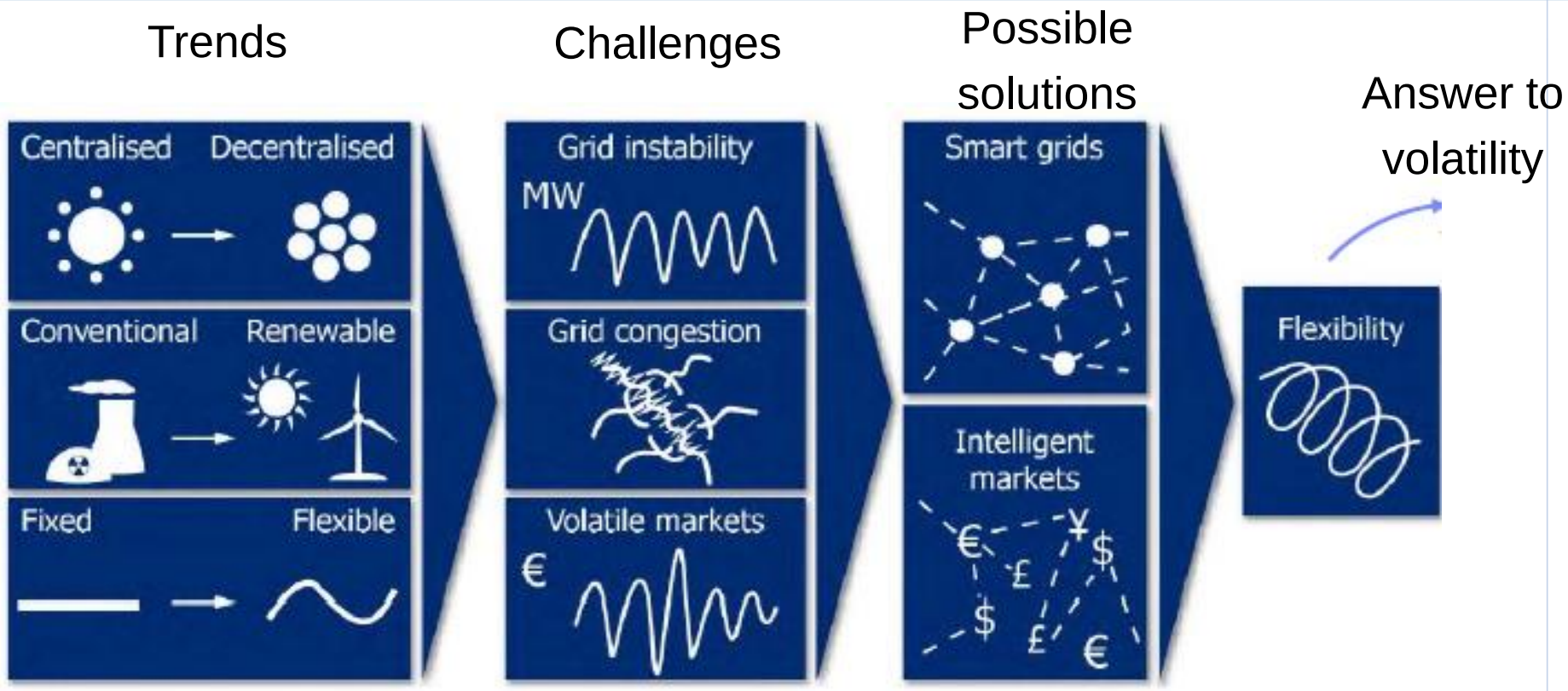
Overview

- Background
- History of Network Regulation
- General Approach
- Benchmarking
- Lessons

Background
Energy Policy

- National policies embedded in an EU-wide framework
  - 2010: 20-20-20 targets for 2020
  - 2014: 40-27-27 targets for 2030
- EU emissions trading scheme with low CO_2-prices (< 8 €/t_{CO2})
- Promotion for renewable energy sources
  - AUT: price-based
  - GER: transition from price-based to quantity-based (auctioning from 2017)
- EU internal energy market for electricity and gas
  - AUT and GER with one common price zone for electricity
  - But: increasing congestion at the border due to renewables in Germany → increasing necessity for re-dispatch measures

Background
Transition of the Energy Sector



- Framework conditions revised quite frequently (regulatory risk) → investment security jeopardized
- Continuation of old (brown) coal fired plants and shut-down of new gas fired plants
- Process of searching for the right answers

History of Network Regulation
Overview

Austria

- Network costs significantly cut by the regulator during cost plus as a basis for the introduction of incentive regulation

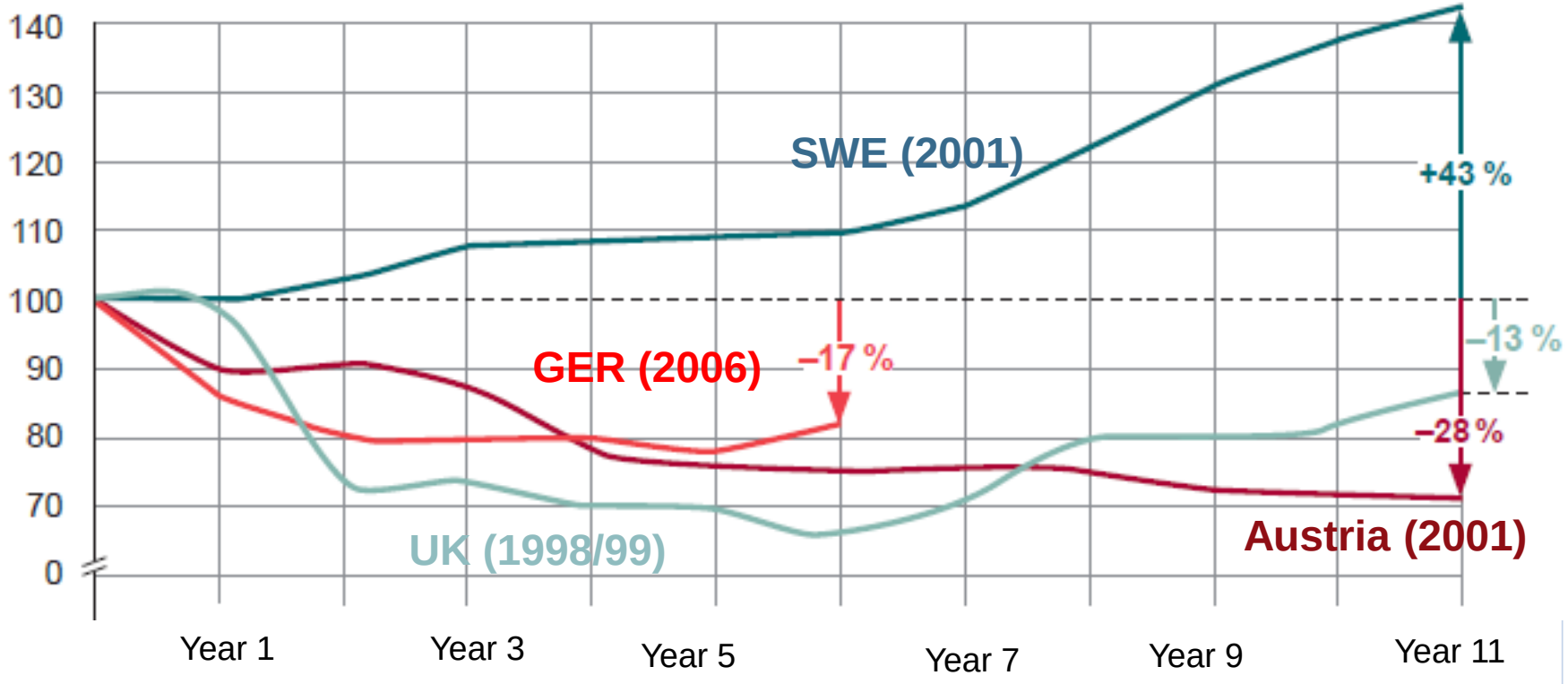
Germany

- Laggard regarding energy market liberalization in Europe with strong industry associations

*TPA: Third Party Access

History of Network Regulation
Effect on Network Tariffs

Index of network tariffs



Source: E-Control (2012)
Year 1: 1st year after introduction of regulated third party access (i.e. binding regulation of network operators)

General Approach
Overview

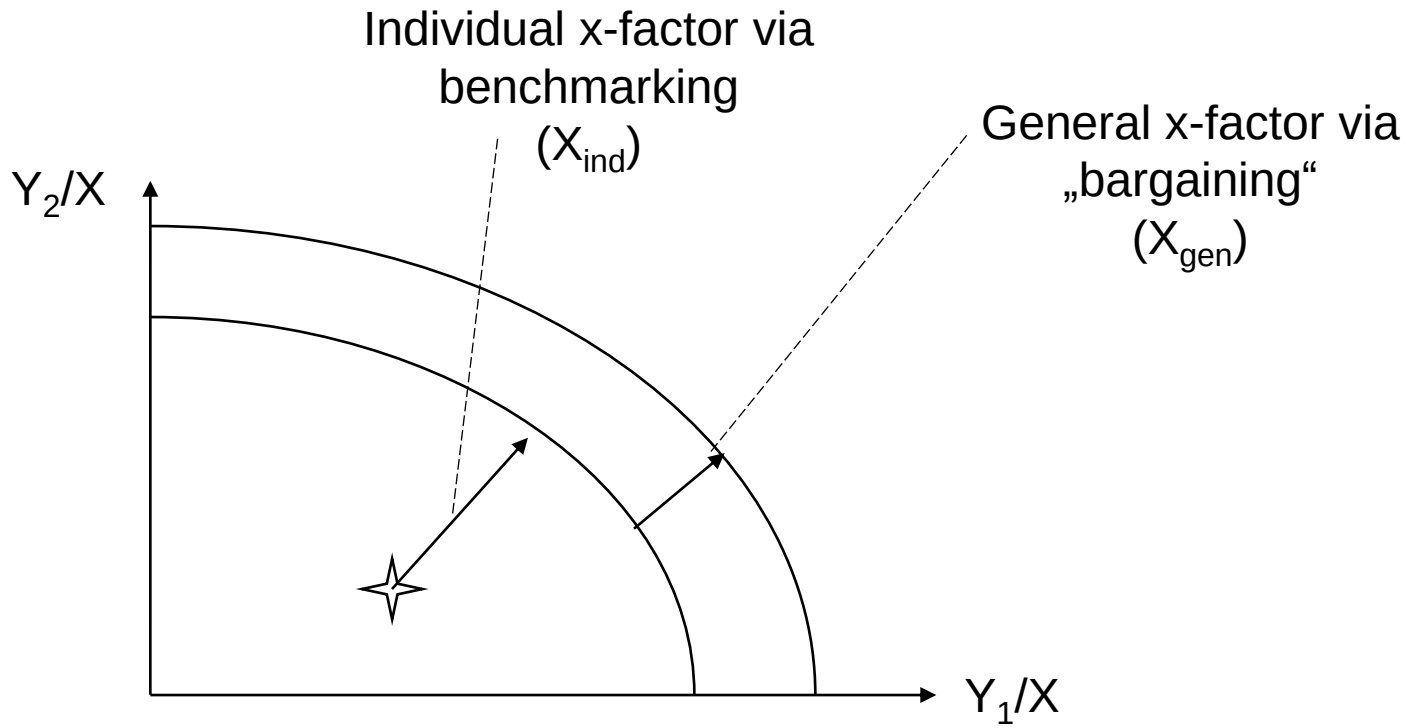
Regulatory Design Issue	Austria	Germany
No. of distribution network operators	Ca. 120	Ca. 900
Vertical separation	Legal	Legal
Regulation	Revenue cap since 2006	Revenue cap since 2009
Regulatory period	5 years	5 years
Benchmarking	TOTEX	TOTEX
Cutback of inefficiencies	2 regulatory periods	2 regulatory periods
Change in service provision	2 expansion factors • CAPEX (book values) • OPEX (cost driver)	Expansion factor (cost driver) or investment budget (planned costs)
Accounting for time lags	Yes (inflation)	no
Quality regulation	No	Bonus/penalty since 2012 (SAIDI)
Small operators	Cost plus (< 50 GWh throughput)	Simplified procedure (< 30.000 customers)
Possibility to appeal	yes	yes

General Approach
Revenue Cap

$$R_{i,t} = C^{B}{}_{i,t0} * (1 + RPI - x) + C_{i,t}$$

- R: Revenue of operator i in year t
- C^B: benchmarked costs of operator i in base year t0 (OPEX and CAPEX)
- x: x-factor
  x_{gen}: general x-factor (frontier shift)
  x_{ind}: individual x-factor of operator i (determined via benchmarking)
- RPI: Retail price index
  → Xgen = Differential of productivity and input prices between sector and economy
  AUT: input-price-based rate (e.g. wage index, construction cost index)
  → Xgen = sectoral productivity index
- C: cost regulated cost share (not benchmarked)
  e.g. investment budget, taxes, concession fees, several (OPEX-like) costs associated with embedded generation (e.g. congestion management)
  → has increased significantly over the last years in Germany

General Approach
X-Factors



- Benchmarking before the beginning of a new regulatory period → point estimate with regard to a certain year (static)
- “bargaining”: agreement between the regulator and industry based on differing calculations based on national accounting data and issue linkage
  e.g. AUT: industry accepted a higher x_{gen} with the regulator refraining from the introduction of a quality regulation

Benchmarking
Overview

Design issues	Austria	Germany
Threshold	> 50 GWh	> 100.000 customers
Method	Two different DEAs (I+II) + MOLS (Modified Ordinary Least Squares)	DEA + SFA
Returns to scale	Constant (CRS) (optimal firm size is within management's control)	Non-decreasing (NDRS) (protection of small operators)
Outlier detection	• yes	• yes
Input	TOTEX • Actual • Standardized (annuities)	TOTEX • Actual • Standardized (annuities)
Efficiency score	2 steps • 0,45*MOLS+0,15*DEA I + 0,4*DEA II • Best of two	Best of 4
Minimum efficiency	72,5%	60%

- TOTEX: substitutability between OPEX and CAPEX

Benchmarking
Germany

Regulatory Period	I. (2009 – 2013)	II. (2014 – 2018)
Parameters	Connections	Connections
	Netlength (LV)	Netlength (LV)
	Cables (MV)	Cables (MV)
	Lines (MV)	Lines (MV)
	Cables (HV)	Cables (HV)
	Lines (HV)	Lines (HV)
	Area (LV)	Area (LV)
	Peakload (HV/MV)	Peakload (HV/MV)
	Peakload (MV/LV)	Peakload (MV/LV)
	Transformers	Meters
	Installed dec. Power	Installed dec. Power
# Operators	198	195
Mean	92.2%	94.7%

Benchmarking
Austria

- DEA I + MOLS
  - peak load of the medium voltage level (PL_{med})
  - peak load of the low voltage level (PL_{low})
  - transformed area-weighted network lengths for high, medium and low voltage levels as single weighted parameter (wNL)
- DEA II
  - peak load of the medium voltage level
  - peak load of the low voltage level
  - transformed area-weighted network lengths for high voltage level (wNL_{high})
  - transformed area-weighted network lengths for medium voltage level (wNL_{med})
  - transformed area-weighted network lengths low voltage level (wNL_{low})

- Usage of combined outputs due to the low number of operators (38) → „curse of dimensionality" → otherwise loss of discriminatory power ("all with 100% efficiency")
- Transformation of data before it enters the actual benchmarking

Benchmarking
Austria

	MOLS		DEA I		DEA II	
Input	TOTEX	TOTEX stand.	TOTEX	TOTEX stand.	TOTEX	TOTEX stand.
Outputs	PL_{med} PL_{low} wNL	PL_{med} PL_{low} wNL	PL_{med} PL_{low} wNL	PL_{med} PL_{low} wNL	PL_{med} PL_{low} wNL_{low} wNL_{med} wNL_{high}	PL_{med} PL_{low} wNL_{low} wNL_{med} wNL_{high}
Ø-efficiency score	89.44 %	88.85 %	85.80 %	90.28 %	89.26 %	82.48 %
Min. efficiency score	69.03 %	74.23 %	62.83 %	70.14 %	63.07 %	54.05 %
Number of efficient op.	6	9	6	9	13	10

Benchmarking
Outcomes

- Benchmarking as a core element of network regulation
- Benchmarking mechanistically applied
- Several appeals and court hearings → full confirmation by the Supreme Courts
- Austria
  - Too few network operators for SFA (degrees of freedom)
  - Usage of combined outputs
- Germany
  - No. of network operators has risen rather than declined (as originally intended)
  - Strange investment behaviour observable (cost inflation in the base year)
- Exogeneity of some output parameters questionable (e.g. network length)
- Parameters cover more the traditional network structure and network planning process (missing parameters for network flexibility via usage of information and communication technologies → “smart grids parameters”)

Benchmarking
Current Discussions

- Austria
  - Revision of output parameters to better cope with upcoming network structures and planning procedures
  - Substitute network length by something like a spanning tree
  - 3 parallel research projects → results expected mid 2016
  - Shift to yardsticking in 2019?
- Germany
  - January 2015: release of a report evaluating the current regime
  - Main result: current regime works well regarding investment incentives with some drawbacks regarding innovation incentives
  - 4 models suggested to improve the current regime
  - Benchmarking: more flexibility in choosing output parameters

Lessons

- Trade-off
  - Stable framework conditions as a value in its own (investment security)
  - Adapt system to new information and findings
- Renewable energy sources
  - Proper output parameters (cost drivers) → real exogeneity of parameters
  - Smart grid parameters
- Static benchmarking vs. dynamic investment incentives → Norwegian approach
- Benchmarking should have discriminatory power
- All distribution network operators with nearly 100% efficiency scores makes no sense → weak efficiency incentives

Contact Information

Thank you!

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