Quality regulation in electricity and gas networks

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Incentive regulation in the German electricity and gas sector – efficiency and reliability to set the yardstick

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BI

Contents

Regulation of networks – main issues

- Price structure
  - Large fixed cost – low marginal costs
- Price level
  - Controlling monopoly rents – distributional and efficiency concerns
- Cost efficiency
  - Motivating efficient operation and investment
- Quality of network service

Quality of network service

- **Safety (gas):**
  - Observable and verifiable outcome: “catastrophe or not”
  - Unobservable/unverifiable internal safety standards
  - Penalty scheme – problems of limited liability
- **Reliability (electricity):**
  - Observable and verifiable (continuous scale): Interruptions (duration and frequency)
  - Unobservable (matter of degree): Voltage quality
- **Service**
  - Unobservable (matter of degree): Customer support

Quality of network service

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  - Penalty scheme – but problems of limited liability
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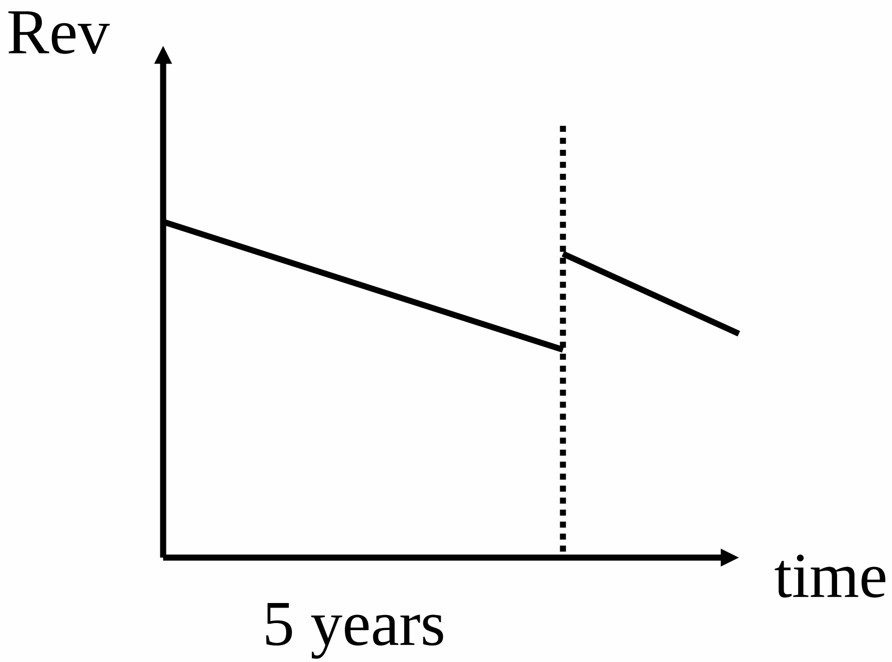
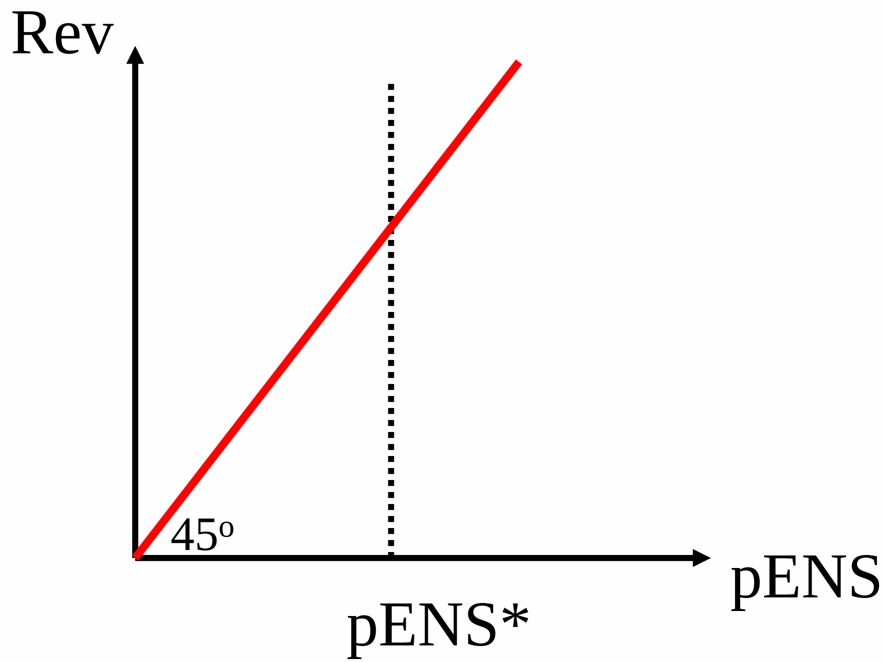
Norwegian Quality Scheme –
- 2006:

$Rev\ cap_t = K_0 - X - Eff.requirement + [pENS^* - pENS_t]$, $t=1,..,5$



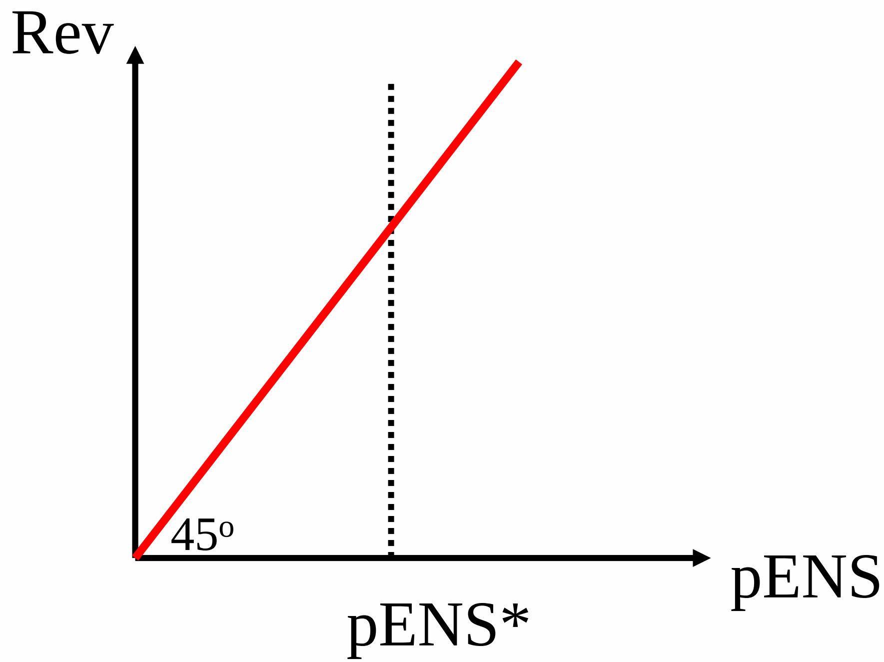


Norwegian Quality Scheme – - 2006:

Rev cap$_t$ = K$_0$ – X –Eff.requirement + [pENS*-pENS$_t$], t=1,..,5

If *p* reflects customers' costs of interruption (intention) :

Customers' benefits (of less interruptions) balanced against network cost of quality



Norwegian Quality Scheme – from 2007:

Details wrt ENS not yet settled

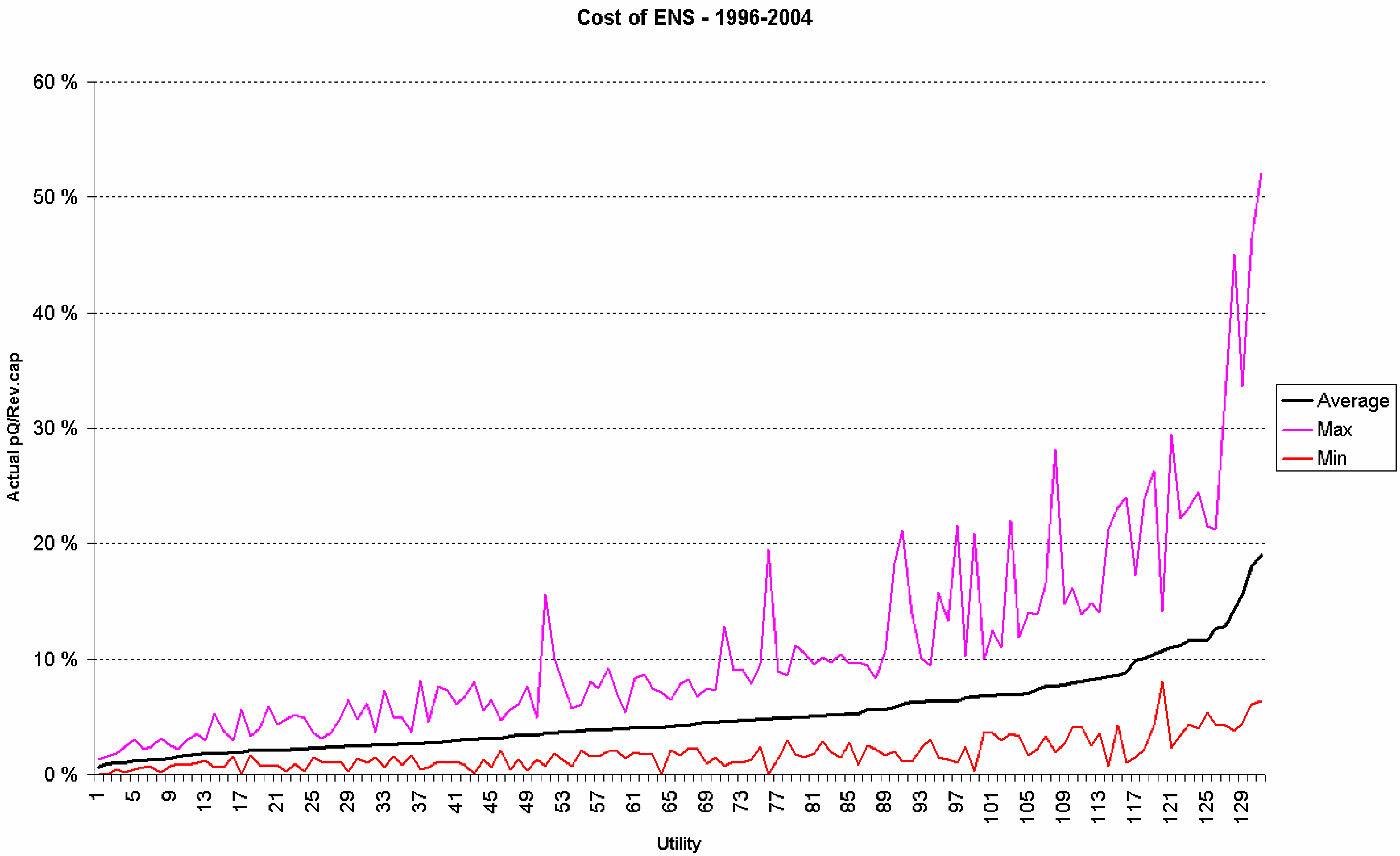
Rev cap$_t$ = 0.4K$_{t-2}$ +0.6K$^*_{t-2}$ + [pENS*-pENS$_t$]

Yearly efficiency measurement – DEA cost model

Quality targets– ENS*

Should reflect a balance between network costs and customers' benefits

- ❑ **Utilities' direct costs should reflect customers' costs of interruptions**
- ❑ **Utilities should be exposed to risk of interruption – no need to insure the companies**
- ❑ **Upper cap on quality costs – reflecting extreme events (limited liability)**
- ❑ **No Dead Band**


Cost of ENS - 1996-2004
60 %
50 %
40 %
30 %
20 %
10 %
0 %
Actual pQ/Rev.cap
Utility
1
5
9
13
17
21
25
29
33
37
41
45
49
53
57
61
65
69
73
77
81
85
89
93
97
101
105
109
113
117
121
125
129
Average
Max
Min

Quality targets– ENS*

Where do the optimal quality target come from?

Non-separability between network operation decisions and quality targets:

Balance between network costs and customers' benefits

Leave it to the utilities themselves to identify quality targets

Network utilities have different types of costs, and operate under different conditions:

1. **Labor costs: wL**
2. **Capital costs: qC**
3. **Costs of interruption: pENS**

Should minimize total costs:

$$TC = TC(w, q, p, D, CL, Y, CU)$$

1. **Network density and size: D**
2. **Climate: CL**

1. **Energy distributed: Y**
2. **# customers: CU**

Integrated benchmarking model

If benchmarking (DEA-cost) is used to set revenue - ENS should be included in the benchmark model:

$$\text{Rev cap}_t = 0.4(K+pENS)_{t-2} + 0.6(K+pENS)^*_{t-2}$$

$$\text{Profit}_t = 0.4(K+pENS)_{t-2} + 0.6(K+pENS)^*_{t-2} - (K+pENS)_t$$

- No need for regulators to regulate quality – decentralized to the utilities
- Regulators should instead regulate monopoly rents and give them incentives to operate efficiently
- Importance of p – customers' willingness to pay to avoid interruptions
- Average ENS (for several years) needed for DEA-cost model – if not extreme values would always define the frontier costs
- "Shadow accounts" can be used to smooth effects of extreme ENS.
- Controllability of ENS – events might be exogenous to company, but outcome (e.g. length of interruption) might be endogenous.

Conclusions

- Quality concerns (interruptions) should be an integral part of the incentive regulation approach
- Identifying customers' cost of interruptions
- Benchmarking models – such as DEA – should include cost of interruption
- Hard to ”filter out” exogenous ENS
- Incentive schemes relay on profit motives – Do some type of utilities have intrinsic costs of ENS?