Quality regulation in electricity and gas networks

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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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Norwegian Quality Scheme – 2006:

Rev \( \text{cap}_t = K_0 - X - \text{Eff. requirement} + [p\text{ENS}^* - p\text{ENS}_t], \quad t = 1, \ldots, 5 \)
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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

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

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
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: \( w_L \)
2. Capital costs: \( q_C \)
3. Costs of interruption: \( p_{ENS} \)

1. Network density and size: \( D \)
2. Climate: \( CL \)

1. Energy distributed: \( Y \)
2. # customers: \( CU \)

\[
\text{Should minimize total costs:} \\
TC = TC(w, q, p, D, CL, Y, CU)
\]
Integrated benchmarking model

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

\[
\text{Rev cap}_t = 0.4(K+p\text{ENS})_{t-2} + 0.6(K+p\text{ENS})^*_t - 2
\]

\[
\text{Profit}_t = 0.4(K+p\text{ENS})_{t-2} + 0.6(K+p\text{ENS})^*_t - (K+p\text{ENS})_t
\]

- 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?