Gutachten – Qualitätsregulierung

Berücksichtigung und Verwertung von Netzzuverlässigkeit und Versorgungsqualität in Anreizregulierungsverfahren, mögliche methodische Ansätze, empirische Datenermittlung und Erfahrung in der internationalen Anwendung

Präsentation vor dem Konsultationskreis

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Bonn, 21.03.2006

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1. Introduction and Scope of the Study
Background

- The New Energy Law provides that the Bundesnetzagentur (BNetzA) shall prepare a report on the cornerstones of an incentive regulation system by June 30th, 2006.
- The Energy Law provides with respect to quality regulation:
  - Efficiency targets must consider the quality of supply and respective quality targets
  - Quality targets must be based on reliability criteria, taking into account structural differences between the network operators
  - Violation of quality targets may lead to reduced network tariffs
  - The Ministry of Economics and Technology (former Ministry of Economics and Labour) may develop regulations with respect to
    - Setting minimum and maximum efficiency and quality targets, including the means to enforce these targets
    - Referential treatment of investments that serve the improvement of the security of supply
  - The Ministry of Economics and Technology shall monitor the security of supply with special consideration of the long-term adequacy of the system

Introduction and Scope of the Study

- Regulatory issues
  - How to define quality of supply?
  - How to monitor and regulate quality of supply?
  - How to get started in the absence of quality data and tested regulatory mechanisms?

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Cornerstones of Quality Regulation System
Different Dimensions of Quality

- Quality of network operators are usually divided into four dimensions:
  - Safety: “The ability to avoid damage to property or persons”
  - Reliability: “The ability of a system to transport energy to and from its connected network customers”
  - Product Quality: “The technical quality of electricity and gas”
  - Service Quality: “The quality of the interactions between network operators and their clients”

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Cornerstones of Quality Regulation System

- Are current quality standards adequate?
  - No apparent concerns that today's safety standards and product quality are not sufficient (gas and electricity)
  - Average reliability in electricity seems to belong to the best in Europe
  - Reliability levels in gas are not well known, neither in Germany nor internationally
  - Service quality in Germany is unknown

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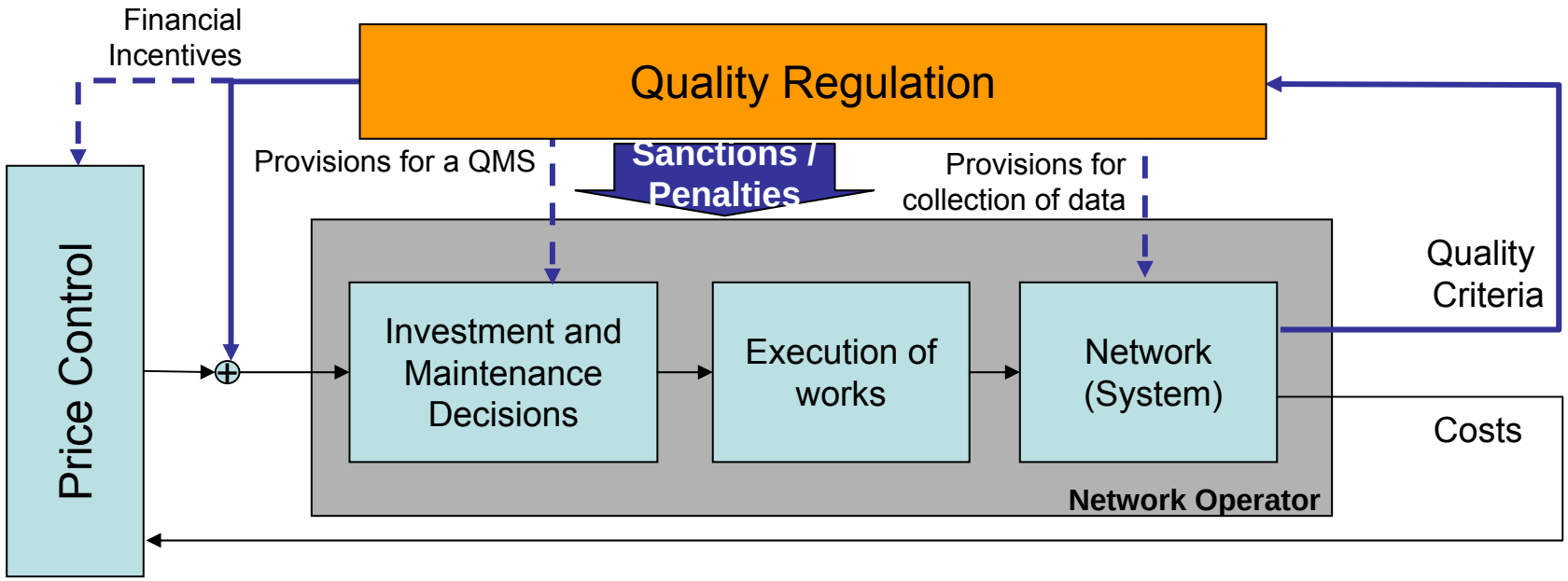
Cornerstones of Quality Regulation System

- The common regulatory structure



Cornerstones of Quality Regulation System

- Common criteria for average reliability
  - Interruption > 3 minutes
  - SAIFI – System Average Interruption Frequency Index
    - Cumulated interruption frequency per connected customer

$$SAIFI = \frac{Summe\ aller\ Kundenunterbrechungen}{Summe\ aller\ angeschlossenen\ Kunden}$$

  - CAIDI – Customer Average Interruption Duration Index
    - Average restoration time per interrupted customer

$$CAIDI = \frac{Kumulierte\ Dauer\ der\ Kundenunterbrechungen}{Summe\ aller\ Kundenunterbrechungen}$$

  - SAIDI – System Average Interruption Duration Index
    - Cumulated interruption duration per connected customer

$$SAIDI = \frac{Kumulierte\ Dauer\ aller\ Kundenunterbrechungen}{Summe\ aller\ versorgten\ Kunden}$$

  - ENS – Energy Not Supplied
    - Cumulated energy not supplied

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Cornerstones of Quality Regulation System

- Scope of quality regulation
  - Identify any potential dissatisfaction of clients with current quality levels
  - Ensure a proper efficiency analysis, as common benchmark approaches do not consider quality of supply
  - Protect customers from over-extensive cost savings
    - Protect vulnerable customers from degrading quality
    - Provide incentives to achieve a socio-economically justified quality level

International Experience
Electricity - UK

- Detailed system developed since 1990 including
  - Technical regulation (Grid Code and Distribution Code)
  - Requirements for audited quality data
  - Publication of reported data
  - Protection of worst-served clients
  - Incentive for average quality performance
- Incentive System
  - Based on Average reliability
    - Price of Quality, φ^{SAIDI} = 0,05 – 0,5 €/min, φ^{SAIFI} = 4,5 – 39 €/interruptions
    - Up to 3% of revenues at risk
- Guaranteed Standards for
  - Service Quality
  - Reliability (worst served customers)
    - Standards for normal and exceptional conditions
- Reporting and Auditing
  - Detailed reporting arrangements
  - Auditing performed annually

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International Experience

Electricity - Netherlands

- Detailed regulation system comprising of
  - Technical regulation (Grid Code and Distribution Code)
  - Requirements for audited quality data
  - Publication of reported data
  - Protection of vulnerable clients
  - Incentive for average quality performance
- Incentive System
  - Average reliability
    - Price of Quality, φ^{SAIDI} = 0,20-0,25 €/min (to be determined in 2006)
    - Up to 5% of revenues at risk
- Guaranteed Standards for Reliability (worst served customers)
    - Restoration time (more than 4 hours)
    - Household customers: € 35
    - Small commercial customers:: € 910
- Reporting and Auditing
  - Detailed reporting arrangements
  - Auditing performed annually

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International Experience
Electricity - Norway

- Incentive System
  - Energy Not Supplied (ENS)
  - 2001-06
    - Revenue cap increased or decreased depending on actual and expected cost of ENS
    - 2003-06 ENS cost €1,0-12,4/kWh
  - 2007-11 proposal
    - Incentive based revenue cap
    - Yearly efficiency calculations (DEA model)
    - Cost of short-term (<3min) outages included from 2008
    - Direct compensation for outages over 12hrs
- Reporting and Auditing
  - Detailed reporting arrangements to NVE
  - ENS differentiated between 27 customer groups

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International Experience
Gas - UK

- Gas industry regulation driven by safety considerations
  - Separate safety regulator (HSE)
  - Principal concerns are
    - Gas escapes
    - Explosion
    - Fire
    - Carbon monoxide poisoning
- Regulation of quality of service is much less sophisticated than for electricity
- Limited data reporting
  - Number and duration of interruptions
  - Mains replacement performance
  - Environmental outputs
- Guaranteed and Overall Standards introduced recently
- No immediate prospect of linking quality to revenue through incentives

International Experience
Gas - Netherlands

- DTe considerations of gas quality regulation
  - Safety
  - Quality (security) of transportation
  - Gas quality
    - composition and pressure of the transported gas,
  - Service quality
  - Environmental quality
- Reporting requirements
  - Number of accidents
  - Average duration of the time needed to cancel the safety risk
  - Number of leakages
- Possible future use of incentive regulation with minimum performance standards
- Improvement to legal framework for gas network design, construction, operation and maintenance required
  - Regulatory responsibility for safety compliance unclear

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International Experience - Summary

- Electricity
  - Several examples of sophisticated incentive regulation of quality
  - Average system performance drivers
    - SAIFI, CAIDI, ENS
  - Limited revenue exposure
    - Less than +/-5%
  - Often with extra protection for customers who get poor service
    - Penalty payments
  - Key requirement is good data
    - Detailed reporting protocols
    - Quality Management Systems and Auditing
- Gas
  - Safety is the over-riding consideration
  - Some monitoring introduced
  - Very few penalties and no financial quality incentive schemes

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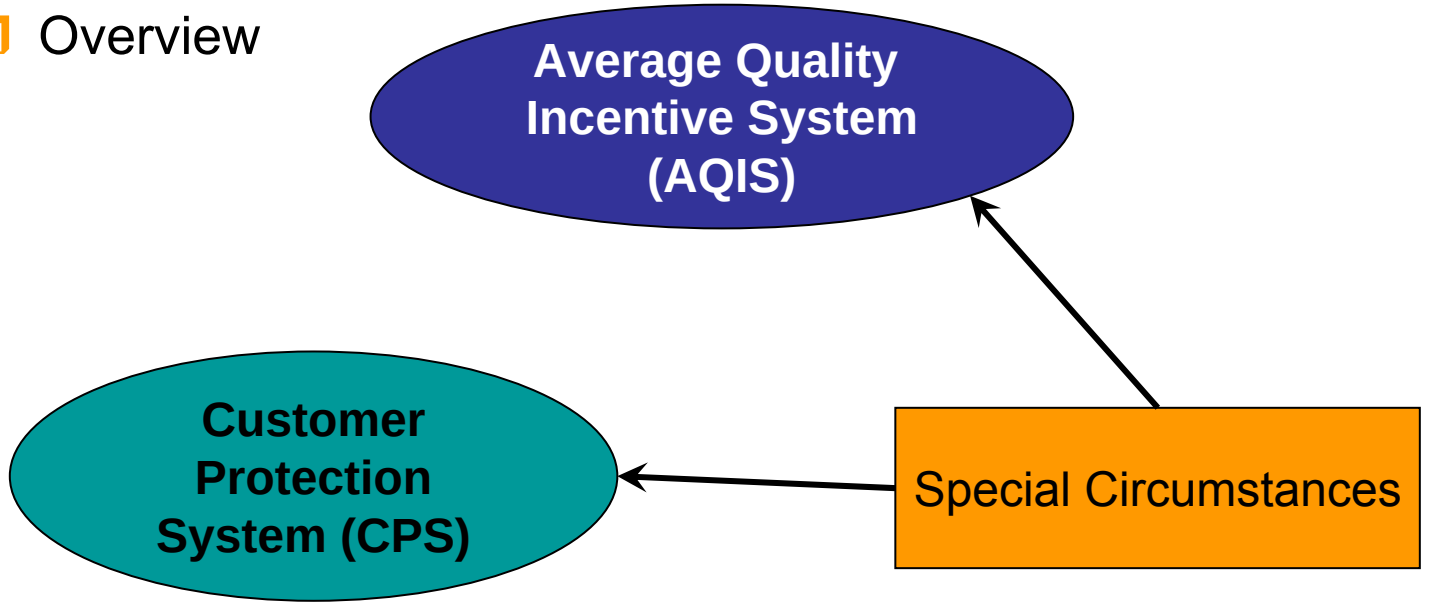
Status Quo of Quality Regulation in Germany

- The “Safety” and “Product Quality” of electricity and gas is ruled by special standards and rules. There is no immediate need to expand on these rules.
- General planning and operational standards exist only for 110kV-networks and above in form of an N-1 criteria. We do not see any reasons for modifying these planning rules.
- The “Reliability” of electricity is monitored since many years with the focus on components (since 2004 customer focussed). The existing data base from 2004 onward may serve as a basis to conduct initial trend analysis for medium and high voltage networks.
- The “Reliability” of the gas network is hardly monitored. Focus was always put on gas accidents. We suggest to expand the data base to include reliability data as well.
- The role of economic and safety regulators in approval of modification of these standards and rules should be further clarified and confirmed by respective regulations.

Recommendations
Reliability (Electricity)

- Overview



- Two focus areas of quality regulation
  - Incentive to adapt average quality to socio-economic values
  - Protection of worst-served customers

Recommendations
Reliability (Electricity)

Criteria

Criteria		CPS	AQIS
Type	**Duration**	*initially:* maximum duration per interruption *later:* several duration levels	CAIDI (average restoration time)
	Frequency	*initially:* number of long interruptions per affected customer *later:* more compex frequency function	SAIFI (average interruption frequency per connected customer)
Cause	**notified / not notified**	no differentiation	differentiation
	origin of interruption	Network operator of respective voltage level paid by network operator, who provides connnection settled among network operators	Network operator of respective voltage level
Structural Differences	**Customer Groups**	*initially:* no separation or mutually accepted differentiation *later:* possible differentiation by size of customer based on willingness to pay	*initially:* no differentiation or mutually accepted differentiation *later:* possible differentiation by size of customer based on willingness to pay
	Voltage level	no differentiation paid by network operator, who provides connnection settled among network operators	differentiation
	Geographical	initially: no later: possible differences to reflect local conditions	*initially:* no differentiation or mutually accepted differentiation *later:* as part of the efficiency assessment
Special Events	**Force Majeur**	included in data base, but explicitly described, excluded from calculation of criteria, no explicit definition	included in data base, but explicitly described, excluded from calculation of criteria, no explicit definition

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Recommendations
Reliability (Electricity)

- Determination of Criteria
  - Calculation of a company's SAIFI and CAIDI

$$SAIFI_i = SAIFI_i^{HV} + SAIFI_i^{MV} + SAIFI_i^{LV}$$

$$CAIDI_i = \frac{CAIDI_i^{HV} \cdot SAIFI_i^{HV} + CAIDI_i^{MV} \cdot SAIFI_i^{MV} + CAIDI_i^{LV} \cdot SAIFI_i^{LV}}{SAIFI_i}$$

  - For small networks
    - Averaging SAIFI – and probably CAIDI - over n years

$$SAIFI_{t=0} = \frac{\sum_{t=-1}^{-n} SAIFI_t}{n}$$

    - Until averaging time is reached, a reduced financial weight might be considered (1/n)
    - n needs to be determined based on a statistical analysis of the fluctuations of the number of interruptions
      - VDN-Störungsstatistik serves as a basis

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Recommendations
Reliability (Electricity)

- Customer Protection System (CPS)
  - Evaluation of interruptions:
    - Socially and politically not acceptable quality level
    - Costs should be related to “price” of service
  - Criteria (proposed criteria and penalties)
    - Maximum duration of an interruption
      - 18 hours
      - € 30 per interruption and interrupted customer
    - Multiple interruptions of a duration of 4 hours and more
      - 3 interruptions
      - € 30 per interrupted customer
    - Tuning target levels and penalty payments for Phase II
  - Settlement
    - Automatic payment by companies for exceeding maximum interruption time
    - Claims by customers for exceeding multiple interruption standard, burden of proof is with the network operators
    - Settlement procedure to be developed by network operators
    - Contracts to be modified accordingly

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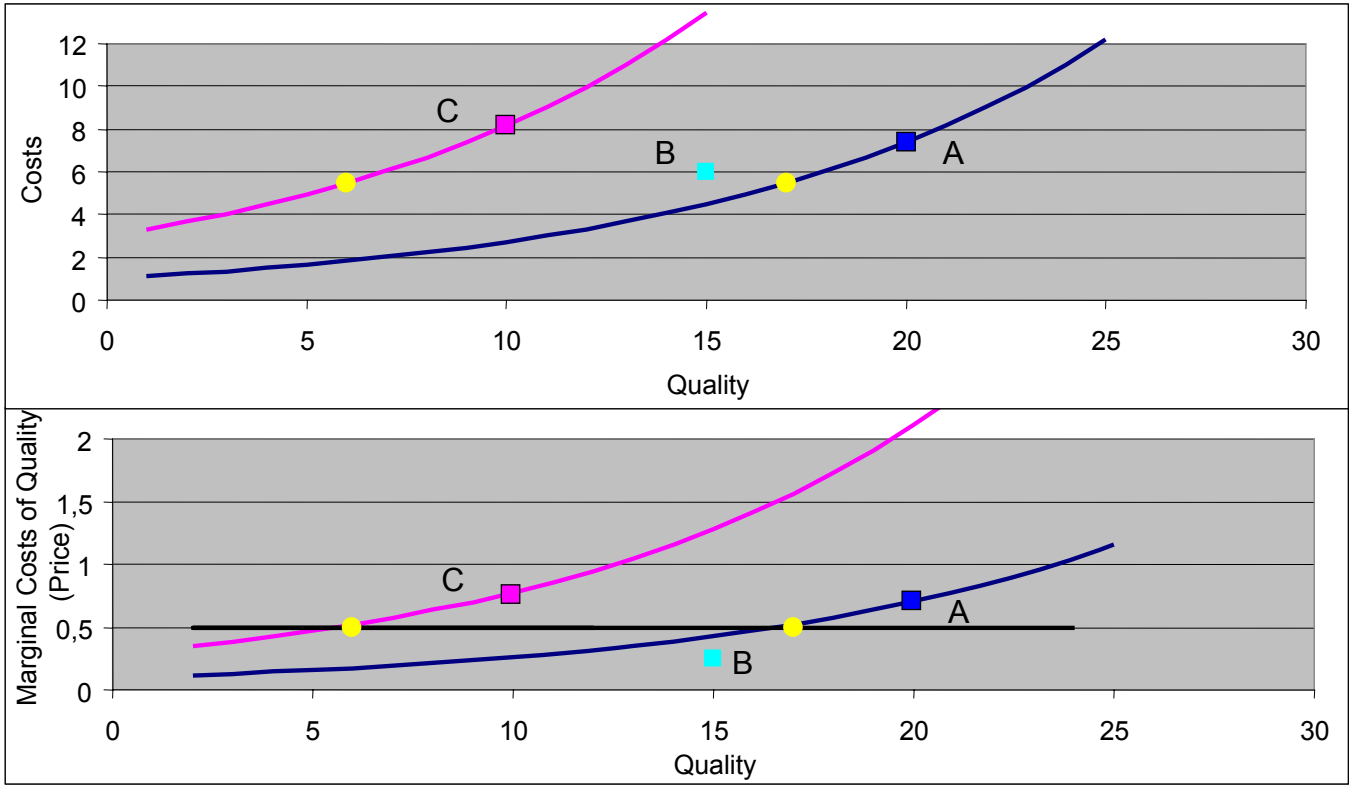
Recommendations
Reliability (Electricity)

- Average Quality Incentive System (AQIS)

- Interactions with the cost efficiency analysis requires differentiation of
  - Optimal cost/quality ratio
  - Optimal quality level



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Recommendations
Reliability (Electricity)

- Incentive system via AQIS
  - If the x-factor is determined without consideration of quality, the formula may be written as

$$Rev_{t+1} = Rev_t^{cost\ efficiency} + Rev_t^{Quality} \pm Z$$

$$Rev_t^{Quality} = Revenue\ due\ to\ quality$$

  - Quality is weighted average from unplanned and planned interruption
    - Proposed weighting factor planned / unplanned: 66% / 33%

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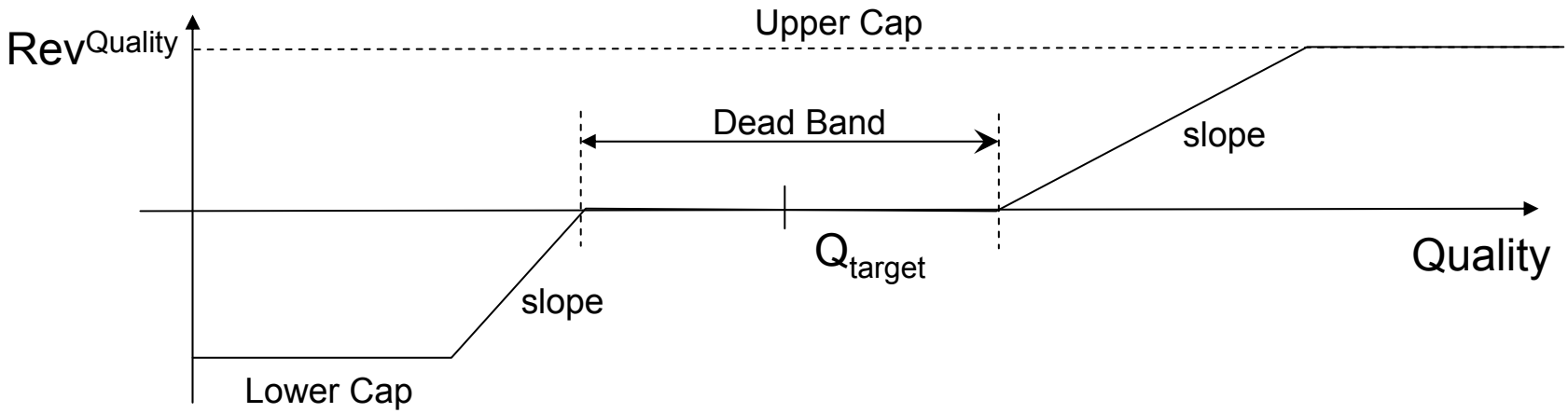
Recommendations
Reliability (Electricity)

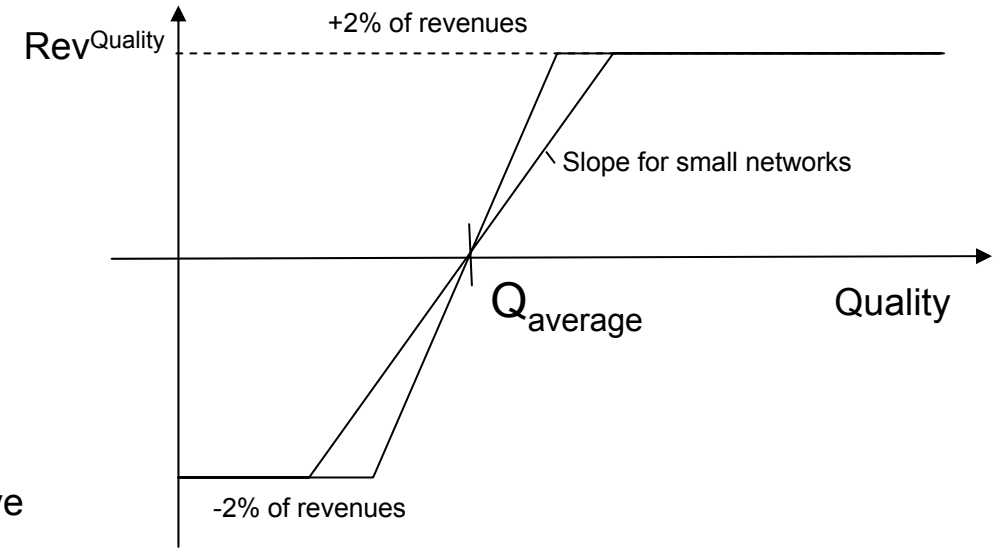
- General description of incentive system



- Quality target
  - Depends on cost/quality curve of individual network operator and customer willingness to pay
  - May vary across the country
- Dead Band reduces impact of small changes in quality
- Upper and Lower Caps limit the impact of quality on revenues
- Slopes mirrors the “willingness to pay” or the quality cost function of companies

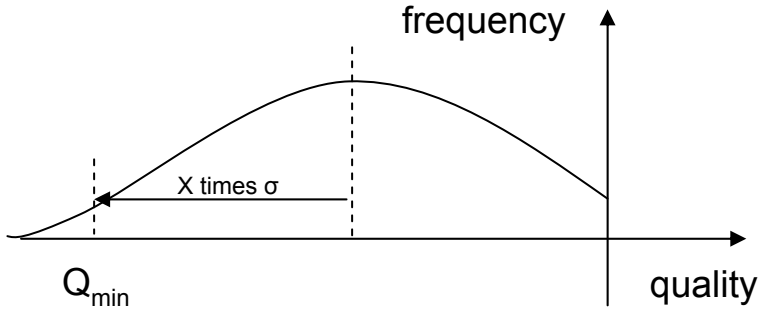
Recommendations
Reliability (Electricity)

- Option I (average quality standard)
  - Quality Target is set by average of comparable companies (definition of clusters)
  - Slope is symmetric as no further information available and follows “common sense”
  - Reduced slopes for companies with strong stochastical fluctuations
  - Cap is symmetric at 2% of revenues
  - No dead band
- Evaluation
  - Consideration of quality levels to improve efficiency targets
  - Companies of one cluster only comparable, if slope is set right
  - Slope must be harmonized with x-factor
  - Incentives to reach socio-economically justified quality level only if slope equals willingness to pay (WTP)

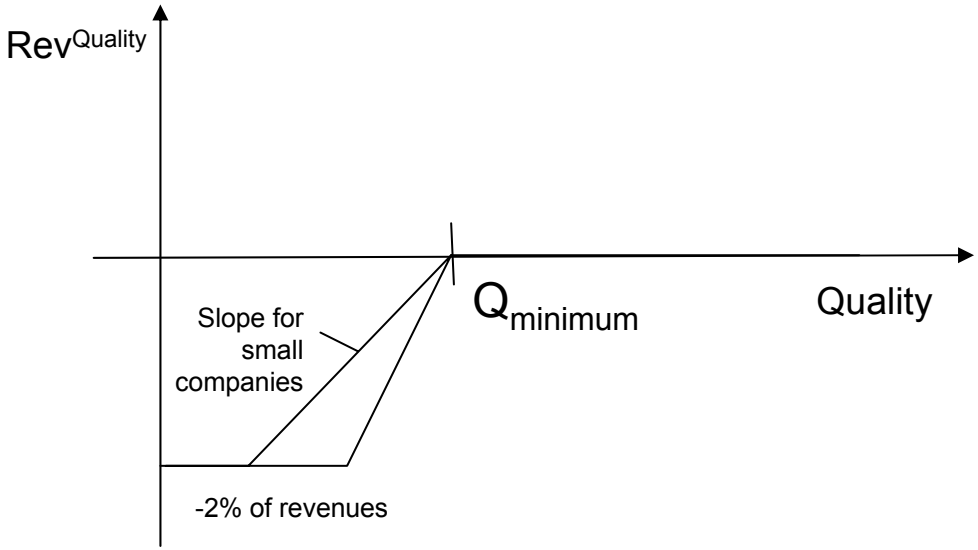


Recommendations
Reliability (Electricity)

- Option II (minimum quality standard)
  - Penalties, if quality is below a minimum limit
  - Minimum limit set based on the quality frequency distribution in one cluster

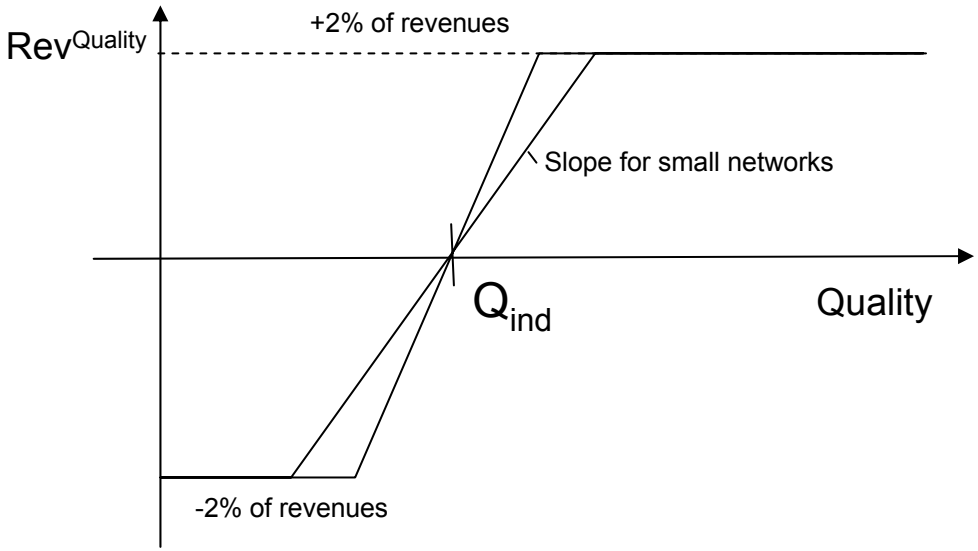


- Evaluation
  - Strong incentive to increase quality above minimum level
  - Incentives to reduce quality to minimum level



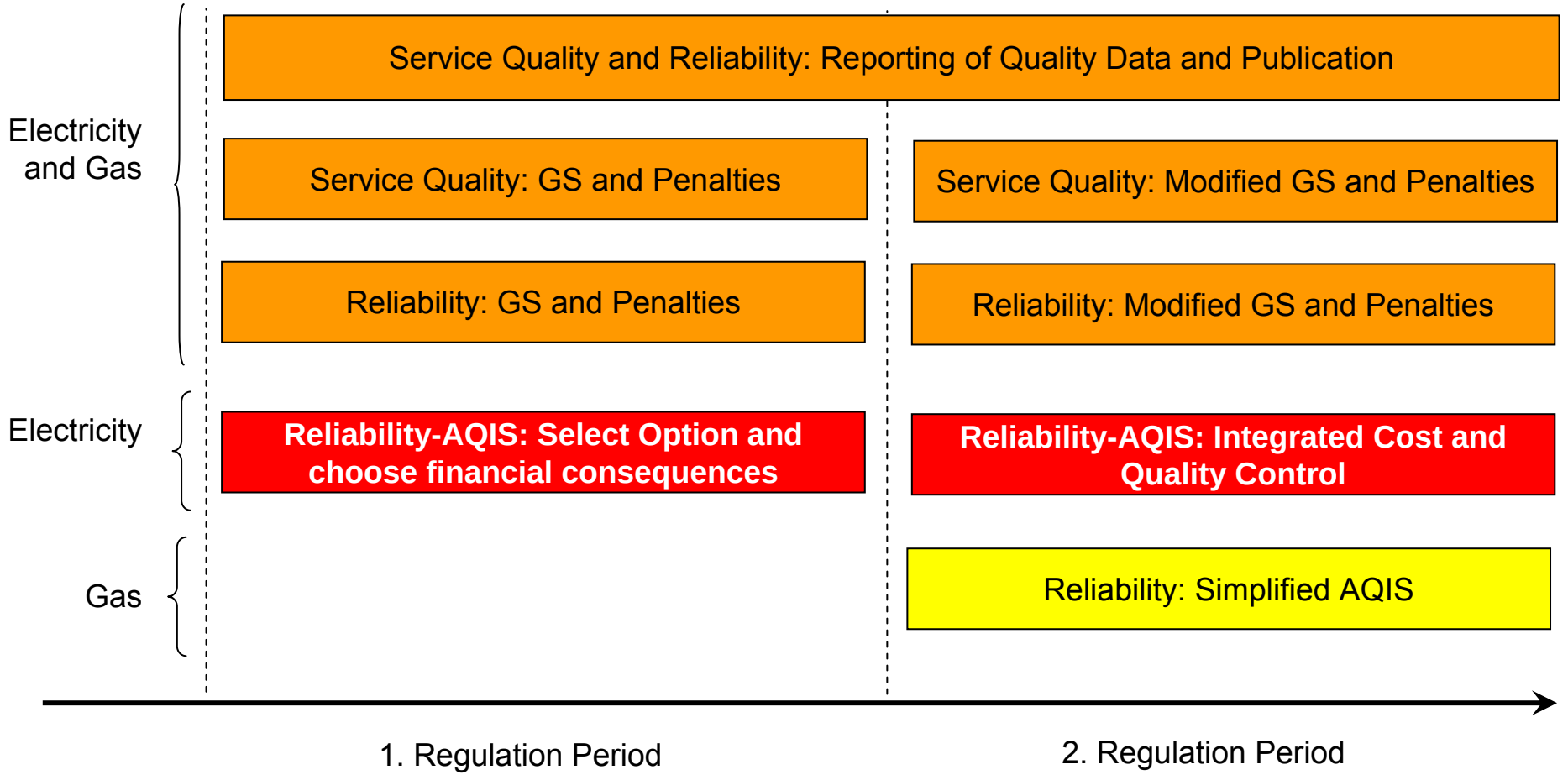
Recommendations
Reliability (Electricity)

- Option III (individual quality standard)
  - As Option I, but individual quality standard are set based on the efficiency analysis
- Evaluation
  - Individual quality targets set off the shortcomings of the cost efficiency analysis
  - No clustering required
  - Incentives to reach socio-economically justified quality level only if slope equals to willingness to pay (WTP)



Recommendations
Reliability (Electricity)

- Implementation Scenarios (General Overview)



Recommendations
Reliability (Gas)

- Measure Quality Criteria
  - SAIFI
  - CAIDI
  - Leakages?
- Same data as electricity, but explicit description of any safety-related interruption time
- Development of quality regulation management scheme requires time
  - CAIDI depends partly on strong safety requirements
- Proposed Guaranteed Standard for long supply interruptions
  - 18 hour target level, €30 penalty payment, with exceptions for safety-related time

Recommendations
Service Quality

- Service Quality targets may be set based on international experience
- Targets should be set to protect worst served customers
- Targets are independent of structural differences
- Penalties should be paid automatically
- Service standards 1 to 5 are for gas and electricity, standards 6 and 7 are for electricity only
- Proposed Standards:

	Guaranteed Standard	Target Performance Level	Penalty Payment	Automatic Payment
1	Providing cost estimate for works	20 working days	€10	Yes
2	Execution of works	15 working days	€30	Yes
3	Connection of new supply	8 working days	€25	Yes
4	Reconnection following non-payment	1 working day	€40	Yes
5	Timed appointments	Morning or afternoon	€ 30	Yes
6	Responding to supplier's fuse failure	5 hours	€25	Yes
7	Resolving* metering or voltage problems	10 working days	€30	Yes

*resolving = correction of problem or preparation of detailed action plan

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Recommendations
Safety and Product Quality

- Current rules are adequate
- The role of the energy regulators should be clarified
  - Energy regulators should have a formal role in initiating and approving changes to the existing rules
  - Formal procedures required to ensure that safety issues are appropriately considered in the price control mechanism
- No need to set up guaranteed standards for voltage quality, regulated by customer complaints
- As a result of the customer survey, BNetzA may consider to require additional monitoring of voltage quality in electricity networks

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Recommendations
Reporting and Quality Management System

- Quality criteria should be reported and published
  - Application of customer pressure through publication of information
  - Application of investor pressure through publication of data
  - Application of peer (competitive) pressure by publication of data and benchmarking
- Companies should be required or encouraged to set up a Quality Management System
  - Data
    - Unambiguous definition and format of quality indicators
    - Clear description of the data collection and registration process
  - Quality of Supply
    - Setting targets for the quality indicators
    - Procedure to estimate the future demand for network capacity and quality
    - Procedure for estimating the development of network quality
    - Contents and procedures for setting up investment and maintenance plans
    - Requirements for an emergency action plan
    - Responsibilities for maintaining an adequate asset register
- The role of regulatory authorities in defining the requirements for such a QMS needs to be determined

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Summary

- Quality in electricity and gas is divided into
  - Safety
  - Reliability
  - Product quality
  - Service quality
- “Safety” and “Product Quality” are determined by technical design, planning and operating standards
  - There is no apparent need to modify or expand today’s planning and operating rules, neither in electricity nor in gas
  - There is no apparent need to expand today's standards for the gas quality and voltage quality
  - There is a value in formalizing the role of the state agencies and BNetzA in monitoring and enforcing compliance with the norm and standards defining the product quality

Summary

- Two-leg system to regulate “Reliability” of electricity
  - No general planning and operating standards in medium and low voltage levels
  - Reliability of transmission networks require specific consideration of network characteristics
  - General Quality Regulation Mechanism required for customers of medium and low voltage networks
  - Regulation System should be stable and clearly defined, as it must provide long-term incentives
  - Customer Protection System (CPS)
    - Maximum interruption duration and maximum interruption frequency
  - Average Quality Incentive System (AQIS)
    - Based in SAIDI and CAIFI
    - Socio-economically justified quality level requires to determine customer’s willingness to pay
    - Quality data can be used immediately, price depend on network size
- Deferred system to regulated “Reliability” of gas
  - BNetzA should start to measure reliability criteria for gas networks
  - Customer protection System (CPS)
    - Maximum interruption duration with special consideration of gas safety
  - Consider a AQIS only as more information about the reliability data emerges

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Summary

- Introduce a guaranteed standards for “Service Quality”, even if an initial customer survey has not been undertaken
  - First recommendations for the GS and the respective penalty payments have been made and need to be discussed and modified according to the reactions of the network operators
- There is a value in requiring network companies to operate a Quality Management System, both for ensuring that data is delivered in adequate quality as well as in ensuring the quality is considered appropriately in the planning and operating decisions
  - Today’s TSM for gas and electricity need to be reviewed to check if they comply with these requirements
  - It is important to formalize the role of the regulatory agencies in initializing and approving changes to the current rules and in monitoring compliance
- There is a value in conducting regular customer survey’s in order to gain insight in the customer needs
  - Initial customer survey in order to understand the customer’s understanding of regulation, his rights and his needs for modifications
  - Regular survey’s to better understand his willingness to pay, particularly for quality
- All proposed data are subject to a careful review with today’s practice in Germany

Discussion

Thank you for your attention!

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