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Council of European
Energy Regulators



Quality of Supply: The EU view

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Fostering energy markets,
empowering **consumers**.



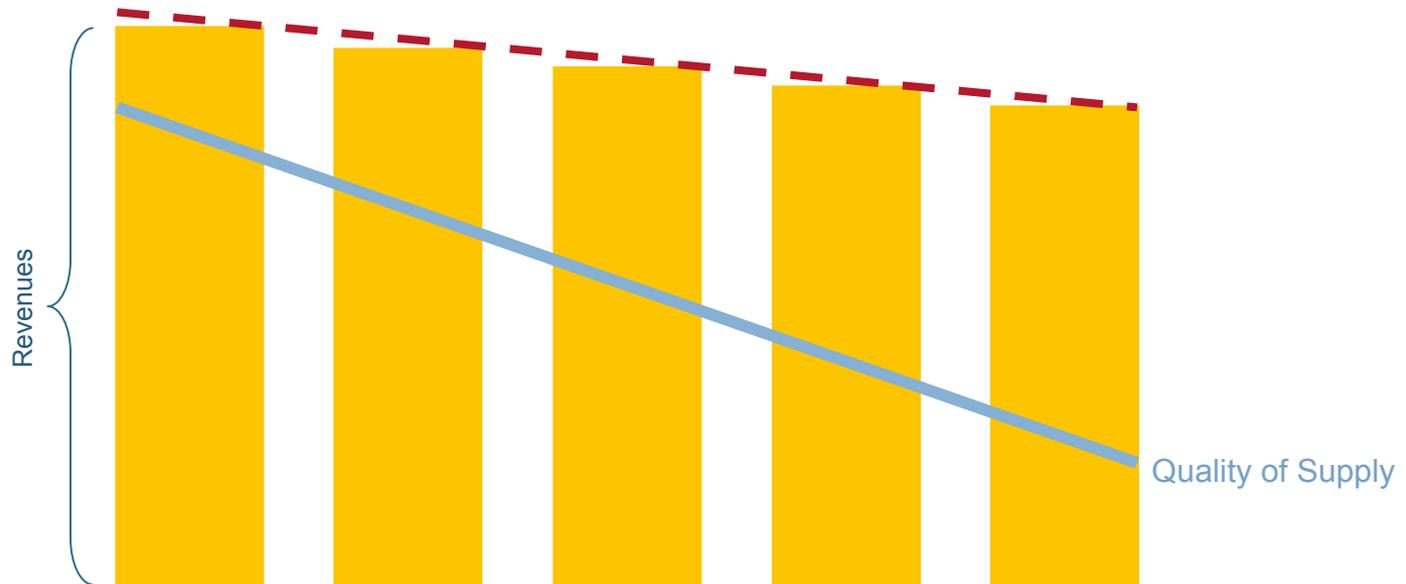
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Quality regulation in the EU

Why do we need quality regulation within an incentive regulation framework?



Quality regulation in the EU

Continuity of Supply

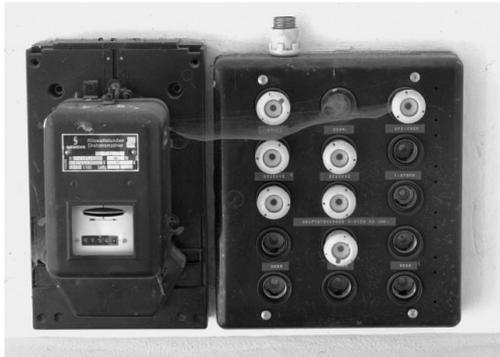
Product Quality

Commercial Quality

Quality regulation in the EU

How to measure Continuity of Supply?

➔ Supply interruptions



Planned



Unplanned

Quality regulation in the EU

Unplanned

- Atmospheric influences
- Influences by third parties
- Responsibility Network operator/unknown reason
- Faults in upstream or downstream networks
- Force Majeure

Planned

- Meter replacement
- All other notified interruptions

Quality regulation in the EU

Examples for the definition of short and long interruptions in the EU

Country	Short interruption	Long interruption
Hungary	$1 \text{ sec} < T \leq 3 \text{ min}$	$T > 3 \text{ min}$
Great Britain	$T < 3 \text{ min}$	$T \geq 3 \text{ min}$
Sweden	$100\text{msec} < T \leq 3 \text{ min}$	$T > 3 \text{ min}$
The Netherlands	No separate definition	No distinction. An interruption has a duration of at least 5 seconds

Quality regulation in the EU

Indices used in different countries to quantify long interruptions

	Great Britain	The Netherlands
Continuity of Supply	CI (Customer Interruptions), CML (Customer Minutes Lost)	SAIDI, SAIFI, CAIDI
Reference value calculation	Individual quality-goals based on historical DSO data	Check against the average quality of all DSO's (Yardstick-Quality regulation)
Consideration of characteristics	Consideration of planned interruptions by 50 %	<ul style="list-style-type: none"> - No consideration of planned interruptions - Exclusion of Force Majeure

Quality regulation in the EU

Calculation of the most important indices

- ▶ System Average Interruption Duration Index (SAIDI)

SAIDI = Cumulative length of all customer interruptions / Sum of all customers connected

- ▶ System Average Frequency Index (SAIFI)

SAIFI = Sum of all customer interruptions / Sum of all customers connected

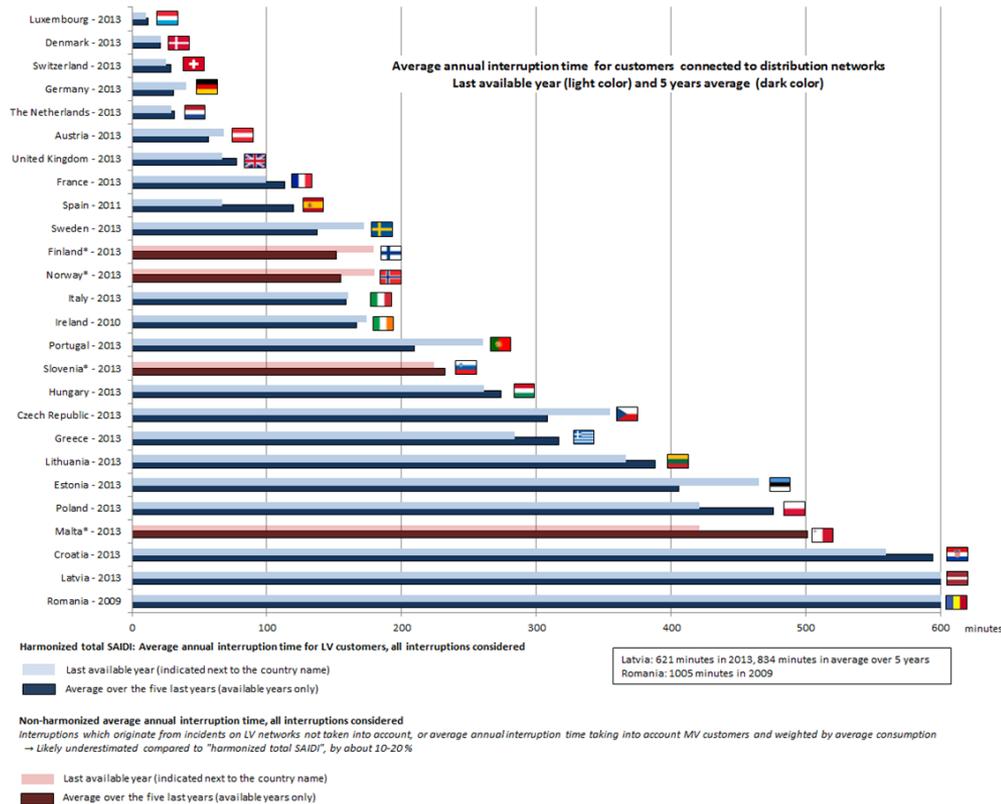
- ▶ Energy Not Supplied (ENS)

ENS = Cumulated energy not supplied

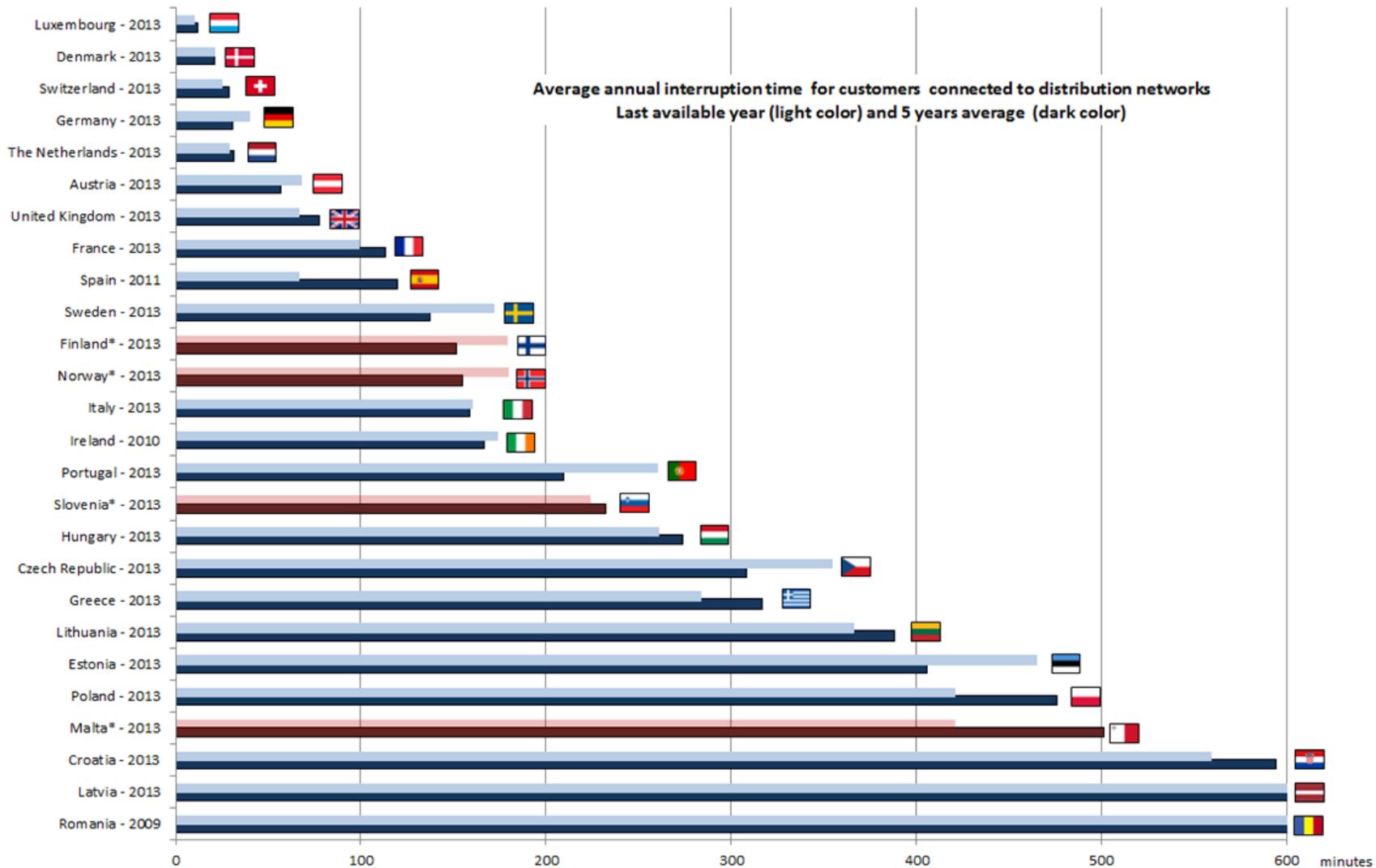


Quality regulation in the EU

Average annual interruption time for customers to distribution networks in 2013



Average annual interruption time for customers connected to distribution networks
 Last available year (light color) and 5 years average (dark color)



Harmonized total SAIDI: Average annual interruption time for LV customers, all interruptions considered

Light blue bar: Last available year (indicated next to the country name)
 Dark blue bar: Average over the five last years (available years only)

Latvia: 621 minutes in 2013, 834 minutes in average over 5 years
 Romania: 1005 minutes in 2009

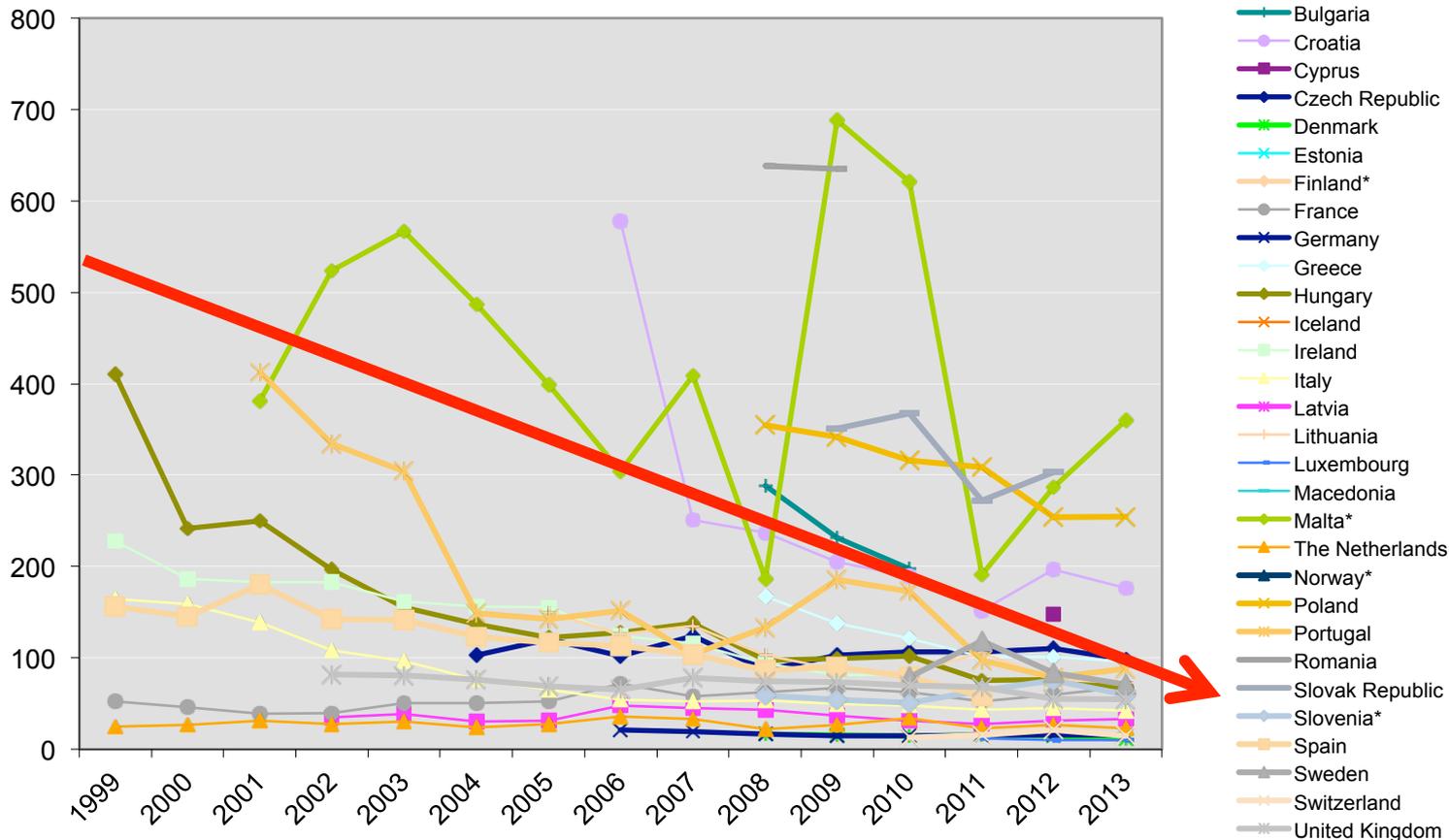
Non-harmonized average annual interruption time, all interruptions considered

*Interruptions which originate from incidents on LV networks not taken into account, or average annual interruption time taking into account MV customers and weighted by average consumption
 → Likely underestimated compared to "harmonized total SAIDI", by about 10-20%*

Light red bar: Last available year (indicated next to the country name)
 Dark red bar: Average over the five last years (available years only)

Quality regulation in the EU

UNPLANNED SAIDI - without exceptional events
Average annual time of interruption (minutes)



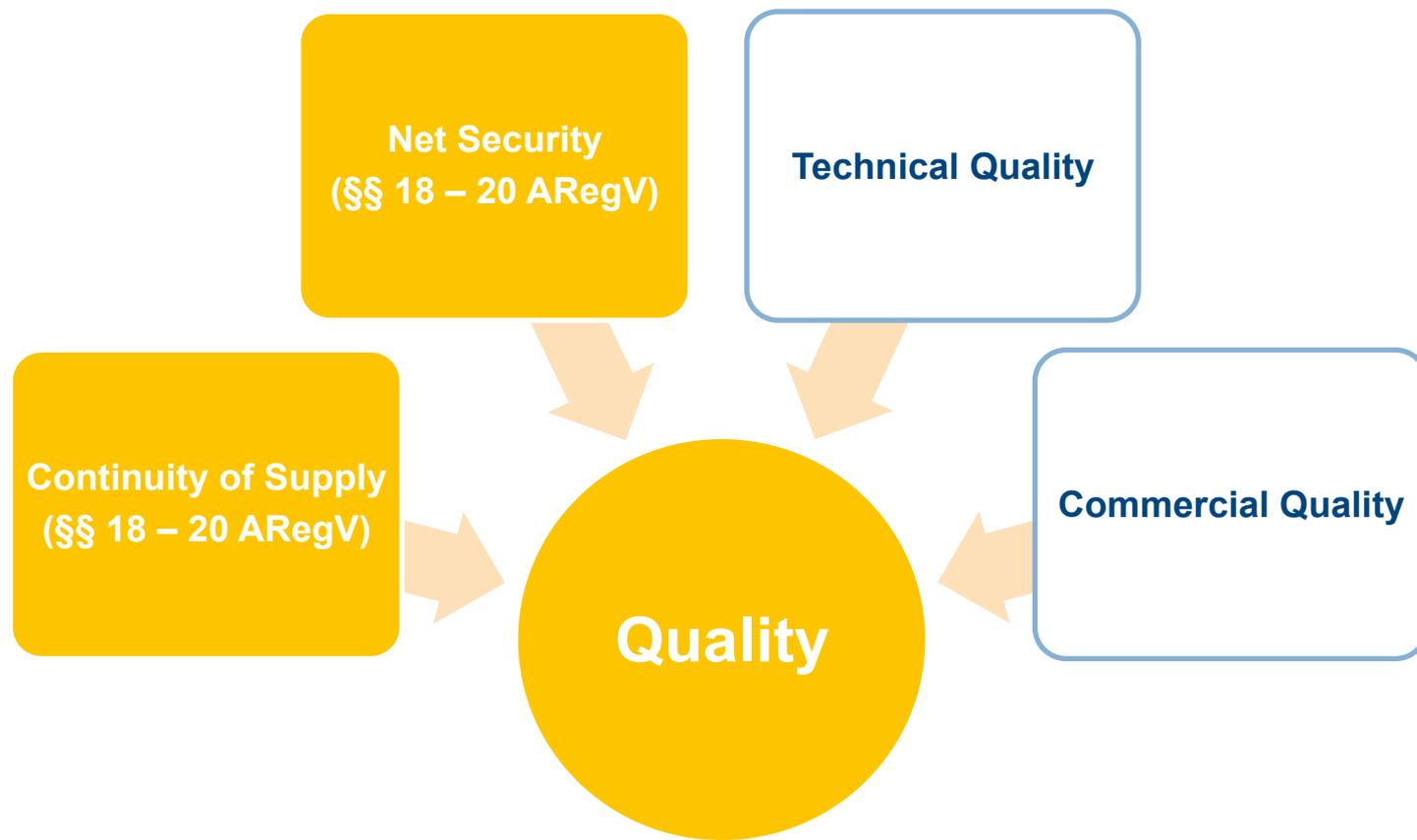


Quality regulation in Germany

- Quality regulation in Germany
 - ▶ Terms of quality
 - ▶ How it works
 - Used indices
 - Valuation of interruptions
 - Incentive to increase quality
 - ▶ Index calculation
 - Reference value calculation
 - Bonus/Malus determination
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Quality regulation in Germany



Quality regulation in Germany

Continuity of Supply

Supply without interruptions

Net Security

Transport of energy at any time

Technical Quality

- Voltage quality (electricity)
- Technical/operational quality (gas)

Commercial Quality

- Grid connection
- Information management → planned interruptions

Quality regulation in Germany

Guidelines in sections 18 to 20 of the Incentive Regulation Ordinance (ARegV) concerning Electricity Quality of Supply

► Specifications

- Integration into Revenue Cap via bonus-malus-system for quality higher/lower than average quality of supply
- Benchmarking to evaluate quality of supply
 - Quantity and length of the interruptions

► Indicators: Frequency and duration of interruptions (SAIDI/ASIDI)

- Reference values have to be calculated as weighted means of indicators of all network operators
- Structural differences have to be considered
- Using data of DSOs all over Germany



Quality regulation in Germany

Guidelines in sections 18 to 20 of the Incentive Regulation Ordinance (ARegV) concerning Electricity Quality of Supply

▶ Weighted mean of interruption

- Low Voltage → SAIDI (System Average Interruption Duration Index)

$$\text{SAIDI} = \frac{\sum (\text{Duration} \times \text{customers interrupted})}{\text{overall customers}}$$

- Medium Voltage → ASIDI (Average System Interruption Duration Index)

$$\text{ASIDI} = \frac{\sum (\text{Duration} \times \text{installed Power of interrupted Transformers})}{\text{installed Power of overall Transformers}}$$



Quality regulation in Germany

Database for calculating SAIDI and ASIDI

- ▶ Monitoring data § 52 EnWG: Interruptions longer than 3 min
- ▶ Some interruptions are excluded (e.g. Force Majeure)

Unplanned interruptions

Atmospheric influences	Influences by third parties	Responsibility Network operator/ unknown reason	Faults in upstream or downstream networks	Exceptional events (Force Majeure)
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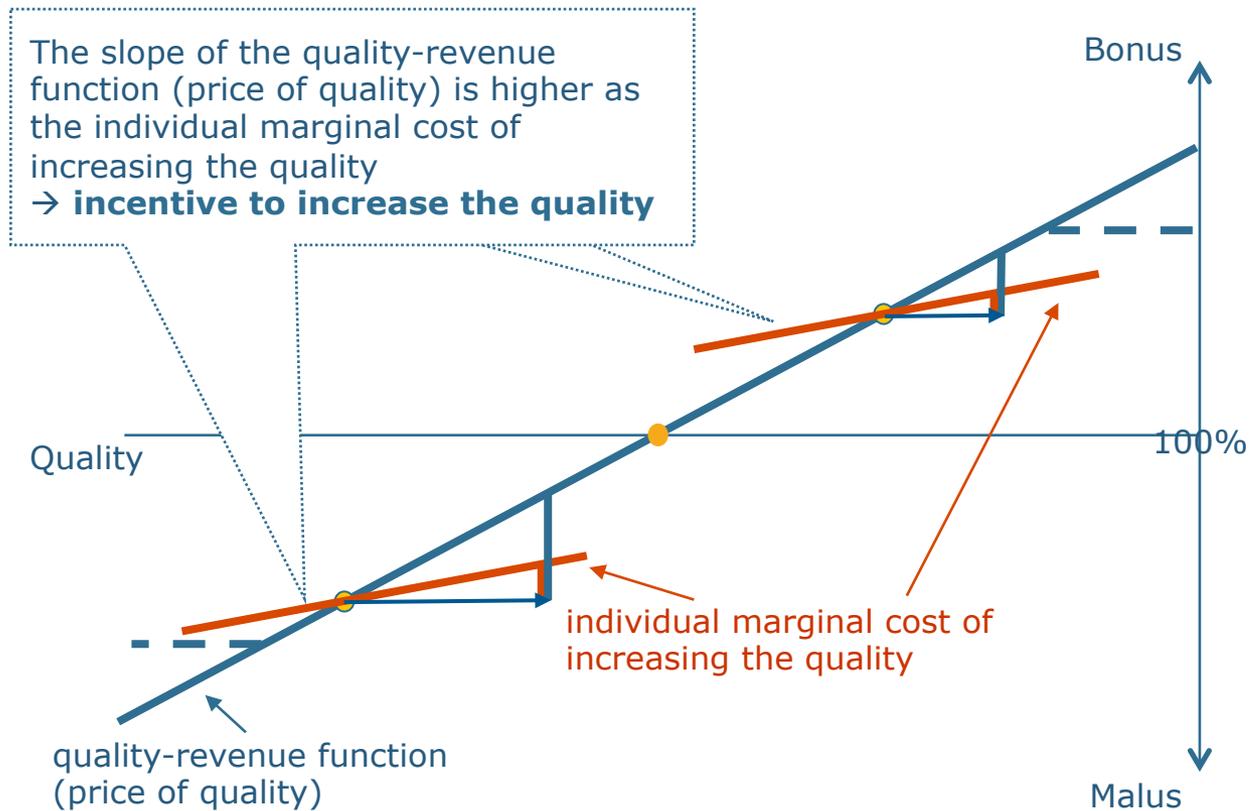
Planned interruptions

Others (weight of 50%)

Meter replacement

Quality regulation in Germany

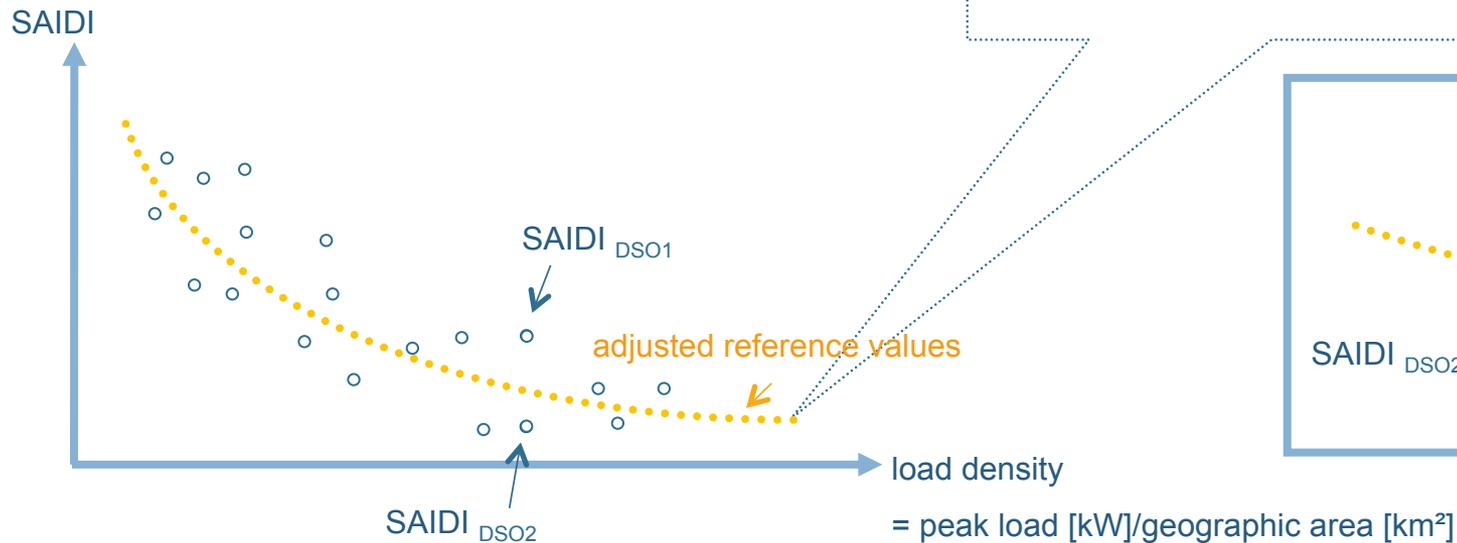
Basics of quality regulation



Quality regulation in Germany

Calculation of SAIDI_{Reference}

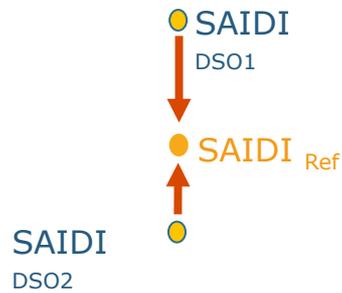
$$\text{SAIDI}_{\text{Reference}} = \frac{\sum (\text{SAIDI}_{\text{DSO}} \cdot \text{Customer}_{\text{DSO}})}{\sum \text{Customer}}$$



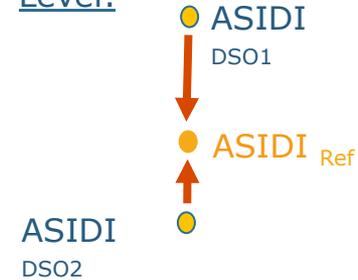
Quality regulation in Germany

Calculating the quality element

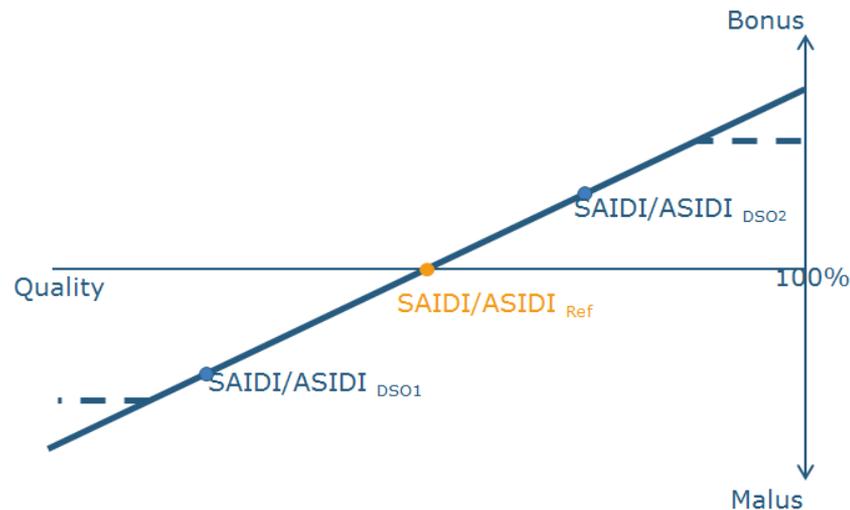
Low Voltage Level:



Medium Voltage Level:



$$\text{Bonus/Malus} = (Q_{\text{Ref}} - Q_i) * \text{Customers}_i * \text{price of quality in €/min/customers/a}$$



Quality regulation in Germany

Methods of monetization

Cost analytic methods to determine the consumers willingness to pay/willingness to accept interruptions

- ▶ Macroeconomic approach (value of KWh for the economy/customers)
- ▶ Alternative: customer survey

What is the price for one minute of interruption in Germany? (Macroeconomic approach)

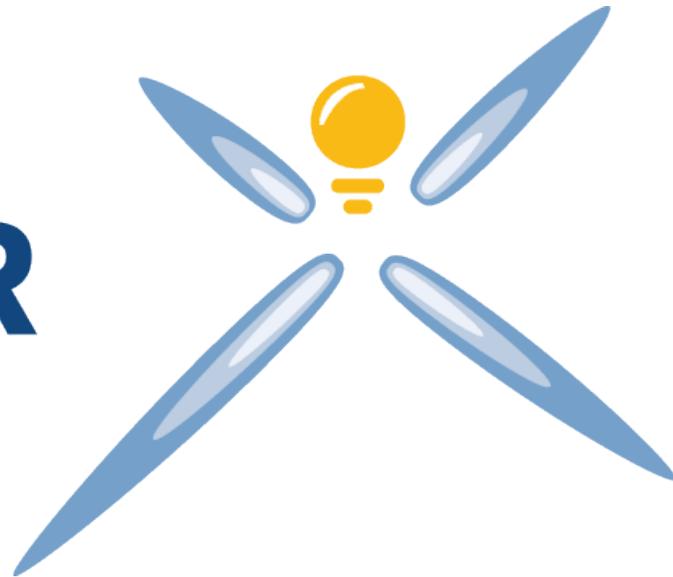
~ 19ct/min/customer/year



Thank you for your attention!

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