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Council of European Energy Regulators

# 6th Workshop of Eastern Partnership Energy Regulatory Bodies

## Quality of Supply in Europe

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Kiev, 16 May 2017

Fostering energy markets, empowering **consumers**.

# Agenda

I. Introduction to Quality of Supply
   1) What is it?
   2) Dimensions of quality
   3) Regulatory approaches (why & how)

II. CEER Benchmarking Report on the Quality of Electricity Supply
   1) History
   2) Participating countries
   3) Development and structure of the report

III. 6th Benchmarking Report on the Quality of Electricity and Gas Supply
   1) Continuity of Supply
   2) Commercial Quality
   3) Voltage Quality
   4) Gas

# INTRODUCTION TO QUALITY OF SUPPLY

# Introduction – Importance of Quality of Supply Regulation (1)

- Network operators are a natural monopoly, therefore regulation
- Economic regulation of utilities usually focuses on price regulation, with relatively less attention to (technical) performance standards
- On the other hand, technical rules are not generally concerned with economic aspects and cost-efficiency
- Thus, the linkage of economic and technical regulation presents a challenge for regulators
- Different types of regulation involve different incentives for quality of supply

# Introduction – Importance of Quality of Supply Regulation (2)

- In rate-of-return- or cost-plus-regulation, companies usually define their own investment and quality levels
- According to economic theory, this should create an implicit incentive to over-invest in quality and no incentive towards cost-efficiency
- Simple price- or revenue-cap regimes could incentivize a regulated company to reduce its quality of supply by cutting investments, maintenance, or personnel with the aim of increasing its profits
- Both rate-of-return- and cap-regulation have therefore to be accompanied by some kind of regulation of quality of supply, with the aim of avoiding distorted or excessive investment in the former case, and to prevent a decrease of quality in the latter

# Introduction – Importance of Quality of Supply Regulation (3)

- Quality incentives can ensure that cost cuts are not achieved at the expense of lower quality
- This is particularly important as some aspects of quality have a long recovery time after deterioration
- For this reason, quality regulation should be introduced as a counterpart to any kind of cap-regulation to avoid unexpected quality reductions

# Introduction – Importance of Quality of Supply Regulation (4)

- The general goal of the quality of supply regulation is to guarantee a good level of continuity of supply, voltage quality, gas quality and good services for consumers across Europe

- Monitoring the quality of electricity and gas supply constitutes an essential tool in the overall supervision of well-functioning energy markets

# Introduction – What is Quality of Supply?

**Quality of Supply?**

# Introduction – What is Quality of Supply?

## Technical

| Voltage Quality | Continuity of Supply |
| --- | --- |
| Covers deviations from optimum values in voltage magnitude or waveform | Covers the availability of electricity and is characterized by the number and duration of interruptions |

# Introduction – What is Quality of Supply?

| Technical | | Non-technical |
|---|---|---|
| **Voltage Quality** | **Continuity of Supply** | **Commercial Quality** |
| Covers deviations from optimum values in voltage magnitude or waveform | Covers the availability of electricity and is characterized by the number and duration of interruptions | Covers many aspects of the relationship between a supplier and a user, some of them can be measured and regulated through standards or other instruments |

# CEER BENCHMARKING REPORT ON THE QUALITY OF ELECTRICITY SUPPLY

# The Council of European Energy Regulators (CEER)

- CEER is the voice of Europe's national regulators of electricity and gas at EU and international level
- Members and Observers are from 33 European countries
- Based in Brussels, CEER deals with a broad range of energy issues including retail markets and consumers, distribution networks, smart grids, flexibility, sustainability, and international cooperation
- Through CEER, the National Regulatory Agencies (NRAs) cooperate and develop common position papers, advice and forward-thinking recommendations to improve the electricity and gas markets for the benefit of consumers and businesses

# CEER Benchmarking Report on the Quality of Electricity Supply (1)

- CEER periodically surveys and analyses the quality of electricity supply in its member and observer countries. These surveys and analyses take the form of CEER Benchmarking Reports on Quality of Electricity Supply

- The latest (6th) Benchmarking Report also examines and analyses the quality of gas supply

# CEER Benchmarking Report on the Quality of Electricity Supply (2)

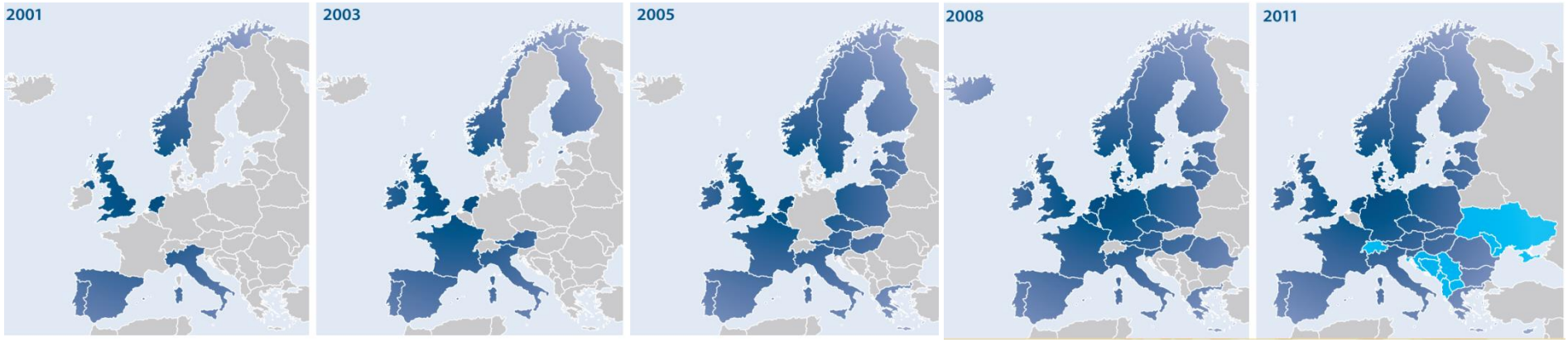
- The Electricity Quality Of Supply Task Force (EQS TF) is tasked with preparing the Report
- Reports are based on answers to detailed questionnaires put together by the task force
- Each chapter illustrates status quo of a different component of quality of supply across Europe
- Main findings are summarized at the end of chapters and are presented with recommendations for the future

# CEER Benchmarking Report on the Quality of Electricity Supply (3)

- 1st CEER Benchmarking Report – 2001
- 2nd CEER Benchmarking Report – 2003
- 3rd CEER Benchmarking Report – 2005
- 4th CEER Benchmarking Report – 2008
- 5th CEER Benchmarking Report – 2011
  - CEER Benchmarking Report 5.1 – 2014 (Continuity of Supply)
  - CEER Benchmarking Report 5.2 – 2015 (Continuity of Supply)
- 6th CEER Benchmarking Report – 2016

# CEER Benchmarking Report on the Quality of Electricity Supply

- Active contribution to the CEER Benchmarking Reports over its previous 5 editions (2001 – 2011)




- Countries part of the Benchmarking Report
- Countries part of the ECRB Annex

# 6th CEER Benchmarking Report on the Quality of Electricity and Gas Supply

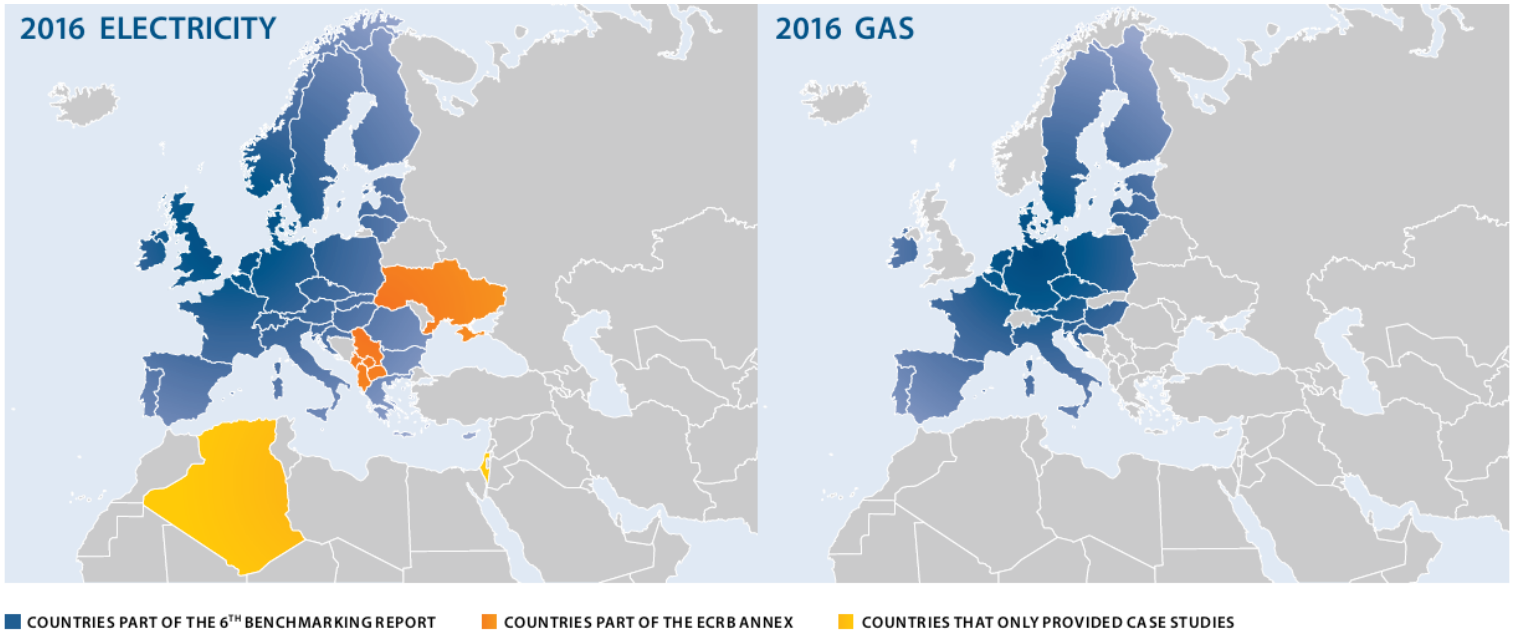
- The main body of the 6th Benchmarking Report includes data from 30 countries: 28 European Member States as well as Norway and Switzerland

- In addition, a total of 7 countries from the Energy Community Regulatory Board (ECRB) - Albania, Bosnia and Herzegovina, Former Yugoslav Republic of Macedonia, Kosovo, Montenegro, Serbia and Ukraine - have also completed the benchmarking exercise

- Lastly, to widen the geographical scope of the Report, case studies from the members of the Mediterranean Energy Regulators (MedReg), Algeria and Israel, are part of the Report

# 6th CEER Benchmarking Report on the Quality of Electricity and Gas Supply

- Active contribution to the 6th Benchmarking Report



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# Electricity – Continuity of Supply

## 6TH BENCHMARKING REPORT ON THE QUALITY OF ELECTRICITY AND GAS SUPPLY

# Continuity of Supply

- In short, it is the availability of electricity
- Continuity of supply (CoS) concerns interruptions in electricity supply
- In other words: CoS focuses on the events during which the voltage at the supply terminals of a network user drops to zero or nearly (practically) zero
- Continuity of supply is usually described with indicators depicting the number of interruptions, unavailability (duration) and energy not supplied per year
- Data collected for the period 2002-2014

# Interruptions

- Interruptions can be divided into:

- Planned and unplanned
- Long and short (and transient)
- Those that include exceptional events and those that exclude them

# Planned vs. Unplanned Interruptions

- Planned interruptions (prearranged interruptions) are those of which network users are informed in advance
- The requirement for advanced notice varies between 24 hours and 50 days
- Typically occur due to scheduled work on the electricity grid
- Countries with lower share of planned interruptions often employ portable generators or reconfigure networks so that there are no interruptions even during maintenance

# Interruption Duration

- Common definition: long interruption > 3 min, 1 sec < short < 3 min, transient < 1 sec
- Some countries do not define transient interruptions while others consider them to be included in short interruptions
- Long interruptions are monitored in all countries
- Short and transient interruptions are not monitored as widely – less than half the countries monitor them

# Exceptional Events

- Each country has a different regulatory definition of exceptional events
- Causes can be natural (strong winds, snowstorms, floods, earthquakes…) and non-natural (wars, sabotage, embargos…)
- Interruption statistics are not standardized: some countries include exceptional events while others exclude them (5 exclude, 9 include, 13 have statistics with and without)
- This results in difficulties comparing values across Europe

# Voltage Levels Monitored

- Definitions of voltage levels are quite different across Europe
- Interruptions not monitored on all voltage levels in every country
- Interruptions on low voltage level not monitored in 5 Member States
- Interruptions on extra high voltage level not monitored in 7 Member States

# Indicators (1)

- The choice of which indicators to use varies by country
- A wide range of indicators is implemented across the EU
- The use of multiple indicators has resulted in a greater availability of information

# Indicators (2)

- The two most common indicators:
  - SAIDI (system average interruption duration index) – average amount of time per year that the supply to a customer is interrupted (minutes per customer per year)
  - SAIFI (system average interruption frequency index) – average number of times per year that the supply to a customer is interrupted (interruptions per customer per year)
- They are reported in almost all the countries and are typically weighted by the number of affected customer
- SAIFI not always easily comparable among countries due to differences in aggregation rules – in some countries, all interruptions occurring during a specific defined time period are considered as a single interruption

# Indicators (3)

- Examples of other indicators:
  - AIT (average interruption time) – the amount of time that the supply is interrupted (minutes per year)
  - ENS (energy not supplied) – total amount of energy that would have been supplied to customers had there been no interruption
- Are mostly used for transmission grids

# Indicators (4)

- The method of weighting impacts the value of an indicator
- When weighting is based on the number of network users, users are treated equally regardless of their size and consumption levels
- When weighting is based on interrupted power or energy not supplied, large users (or period of higher consumption) get a different rating than small users

# Overall Planned and Unplanned Long Interruptions

- These interruptions include both planned and unplanned interruptions as well as exceptional events
- Range of values between 15 and 1,300 minutes per year
- No trends are visible
- Countries which do not exceed 50 minutes lost per year (Denmark, Germany, Luxembourg, the Netherlands, Switzerland) have high proportion of cable circuits at medium voltage

# Unplanned Long Interruptions, All Events

- Includes exceptional events
- Range of values between 10 and 1,100 minutes per year
- Year-to-year variation in the number of interruptions is less than the variation in the minutes lost
- This is because extreme events often result in lower number of longer interruptions than higher number of shorter interruptions

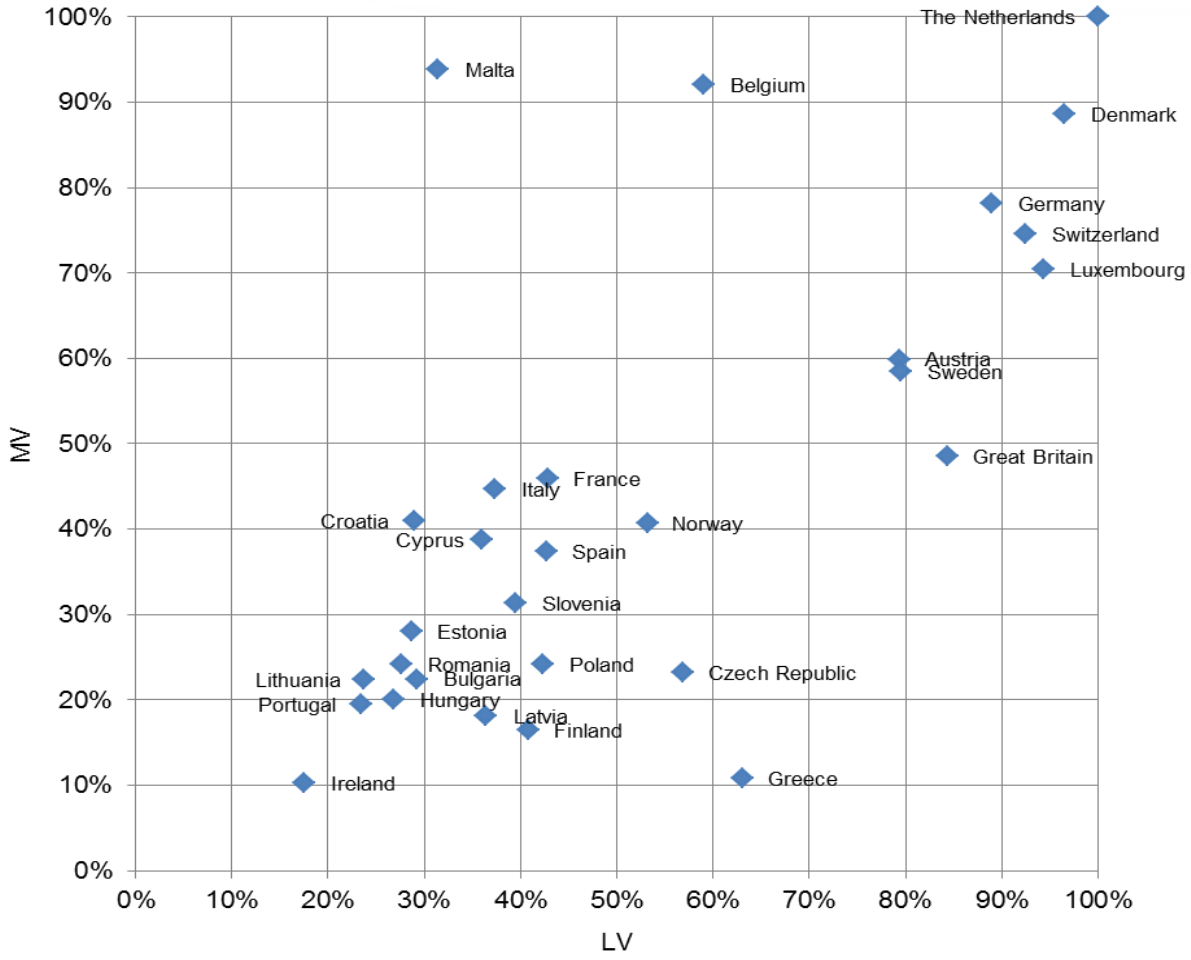
# Unplanned Long Interruptions, Excluding Exceptional Events

- Countries have different definitions of what constitutes an exceptional event, making direct comparison more difficult
- Less year-to-year variations than when exceptional events are included
- Some countries have high and variable values
- Those with better values show decreasing trend in interruption duration

# Planned (Notified) Interruptions

- Interruptions experienced by network users who were given prior notice about the interruption
- Range of values between 10 and 500 minutes per year
- The differences may be due to variations in design of the distribution network (with or without redundant supply paths) and the amount of maintenance and building in the distribution network
- A temporary high level of planned interruptions may be a sign of high investment aiming at reducing the number of unplanned interruptions in the future
- Not all countries include interruptions due to planned maintenance at LV. This may significantly underestimate the SAIDI and SAIFI values

# Rate of LV and MV Underground Cables



# Standards and Incentives

- Continuity measurement is a prerequisite for setting standards and reward/penalty regimes
- Maintenance and improvement of continuity levels: current status should be either maintained (in countries with good levels of CoS) or improved (in countries where CoS is not yet satisfactory)
- If the quality level is already very high, a further improvement might be very costly for the consumer

# Regulation at System Level

- 26 countries provided feedback, 17 of them employ reward or penalty schemes
- Penalties / rewards apply to system operators
- Most countries that have not yet implemented a continuity of supply scheme either consider or plan to introduce such a regime
- Combination of penalties and rewards is typically used
- This can be applied to distribution or transmission system or both

# Regulation at Single-user Level

- 18 countries offer economic compensation
- Rewards apply to individual users
- In most cases, customers have to ask for reimbursement, but sometimes the reimbursement is automatic
- Economic compensation is based on individual interruption duration, total interruption duration in a year or total number of interruptions in a year
- Compensation depends on voltage level, connected capacity and even weather conditions (in severe weather, interruption would have to be longer)
- Minimum duration of an interruption eligible for compensation varies from 1 hour (in the Netherlands, depends on capacity and voltage level) to 24 hours (in Ireland)
- Estonia and Romania offer compensation for planned interruptions if they exceed certain threshold

# Findings and Recommendations (1)

- Continuity of supply is monitored in all responding countries
- Monitoring usually covers long interruptions and differentiates between planned and unplanned outages
- Short interruptions are monitored by a minority of countries
- It is recommended to include incidents on all voltage levels in interruptions statistics
- Monitoring of short interruptions should be implemented in more countries

# Findings and Recommendations (2)

- Various indicators are employed when evaluating interruptions
- Even the use of the same indicator does not guarantee straightforward comparison (different aggregation rules for short interruptions, inclusion/exclusion of exceptional events…)
- Continuity of supply indicators and data collecting procedures should be harmonized to facilitate easy benchmarking (common weighting methods, common rules for aggregation of short interruptions, common approach to exceptional events…)

# Findings and Recommendations (3)

- Reward/penalty schemes on system level and compensation schemes on individual user level are used in more than half the countries

- Regulators should implement adequate incentive schemes in order to maintain continuity of supply levels or improve them if economically viable

- Payments to individual customers should be standardized across Europe

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# Electricity – Voltage Quality

## 6TH BENCHMARKING REPORT ON THE QUALITY OF ELECTRICITY AND GAS SUPPLY

# Voltage Quality (1)

- Covers deviations from optimum values in voltage magnitude or waveform
- Is the most technically complex part of the quality of electricity supply
- In this Benchmarking Report, voltage quality refers to all disturbances in the supply of electricity except interruptions
- Input from 27 Member States

# Voltage Quality (2)

- Examples of voltage quality disturbances: supply voltage variations (due to large load changes), voltage dips (due to short-circuits in the grid), voltage swells, flicker, harmonic voltage…

- Everyone connected to the power grid could influence the quality of the voltage at their or other connection points

- Voltage disturbances are becoming an increasingly important issue due to the increasing susceptibility of end-user equipment and industrial installations

# Voltage Quality (3)

- CEER began addressing voltage quality in 2005 (3rd Benchmarking Report)
- European Standard EN 50160 gives an overview of all voltage quality disturbances and sets limits for many of them
- Some national requirements are even stricter than EN 50160
- It is expected that the need for proper regulation of voltage quality will increase with distributed generation

# Voltage Quality (4)

- Voltage quality is monitored in 18 out of 27 responding countries
- Monitored voltage levels differ across Europe
- Additional countries monitor VQ occasionally, mostly due to customer complaints
- In about half the responding countries, NRA has powers/duties to define voltage quality regulation
- In 16 countries, there are penalties for customers in case of violation of disturbance limits

# Findings and Recommendations

- Regulating voltage quality includes setting standards and minimum requirements, implementing rewards/penalties, publishing and setting obligations
- Monitored voltage quality data mostly available to NRAs, in some cases to end-users as well
- Only a few countries publish statistics based on voltage quality. More countries should do so
- It is recommended to do further investigation on the way voltage quality is influenced by distributed generation and prosumers

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# Electricity – Commercial Quality

## 6TH BENCHMARKING REPORT ON THE QUALITY OF ELECTRICITY AND GAS SUPPLY

# Commercial Quality (1)

- Commercial quality covers many aspects of the relationship between a supplier and a user
- But only some of them can be measured and regulated through standards or other instruments
- Network operators are natural monopolies
- Commercial quality indicators therefore help to ensure a sufficient level of quality of services provided by them
  - In short, it is the speed and accuracy with which customer requests are handled
- Input from 23 Member states

# Commercial Quality (2)

- Distinction between *Indicator* and *Standard*
  - Indicators define a way to measure dimensions of service quality
  - Standards refer to the minimum level of quality, as defined by the NRAs
  - NRAs can define standards for indicators or define indicators without standards

# Commercial Quality (3)

- 3 different types of indicators
  - Guaranteed indicators (GI) refer to quality levels that must be met in each individual case
  - Overall indicators (OI) refer to a given set of cases and must be met with respect to the whole population in that set
  - Other requirements (OR) are additional requirements issued by the NRAs to achieve a certain level of quality
- Indicators focus on different areas where customers and network operators interact, all of which are part of a comprehensive list that was included in the survey

I. Connection (5 Indicators)
II. Customer care (13 Indicators)
III. Technical service (4 Indicators)
IV. Metering and billing (5 Indicators)

# Commercial Quality (4)

- Main results:
  - Input from 23 Member states
  - The most common indicators are the ones concerning connection (Group I) and customer care (Group II) issues
  - 16 countries apply at least some type of indicators regarding the time for response to the customer's claim for network connection and the time for connecting customers to the network
  - A total of 12 countries applies 10 or more indicators

# Commercial Quality (5)

- Example: Group I – Connection
  - Only applicable to DSO, since connection is mainly related to distribution

**TABLE 4.6** COMMERCIAL AND QUALITY INDICATORS FOR CONNECTION-RELATED ACTIVITIES RELATED TO LV CUSTOMERS

| Quality indicators (Group I) | Countries grouped by types of indicators | | | Time limit (median value and range) | Compensation (median value and range) | Company involved |
|---|---|---|---|---|---|---|
| | OI | GI | OR | | | |
| I.1 Time for response to customer claim for network connection | AT, EE, HR, IT, LT, LU, MT, PT, SI | CZ, HU, IT, MT, NL | BE, HU, LV, NO | 15 days (range 8-30) | €20 (range 16-25) | DSO |
| I.2 Time for cost estimation for simple works | AT, FR, LU | EL, HU, IT, SI | HU, LV | 14 days (range 8-30) | €20 (range 15-70)* | DSO |
| I.3 Time for connecting new customers to the network | AT, HR, LT, LU, PT, SI | CZ, EL, HU, NL | BE, FI, FR, HU, SE | 11 days (range 2 working days – 18 weeks) | €16 (range 15-250) | DSO |
| I.4 Time for disconnection upon customer's request | EE | EL | BE, FR, LV | 5 working days (range 3-5) | €15 Only one country | DSO |
| I.5 Time for a switching of supplier | AT, EE, HU, LT | - | BE, CZ, EL, FI, FR, HR, LU, NO | 21 days (range 2-42) | - | DSO |

* including LV non-domestic customer (Italy).

# Commercial Quality (6)

- Example: Group I – Connection
  - From the point of empowering competition, two types of indicators are of great importance
    - "time to connect": is monitored by 15 countries through all types of indicators
    - "time for a switching of supplier": is monitored in almost every country, mostly as OR
  - Time limits often have a complex structure due to complexity of the related work. Therefore sometimes agreements between customer and network operator are used
  - Compensation in case of non-compliance is also complex and often differs between voltage levels, and the types of customers (private or business)
  - Comparison is quite difficult

# Commercial Quality (7)

- Actual levels of Commercial Quality
  - Monitoring of the **average value of the indicator**
    - Does not depend on the standards
    - Is therefore comparable between countries
  - Monitoring of the **compliance percentages**
    - Only meaningful for comparison if time limits are the same (even if the standards are not)
  - A larger amount of information became available for the current 6th Benchmarking Report, possibly due to NRAs' growing attention to commercial quality standards
  - However, not all countries responded to the questionnaire
    - Indicators are not monitored
    - Indicators do not correspond to the indicator's definition in the CEER questionnaire

# Commercial Quality (8)

- Actual levels of Commercial Quality
  - **Connection** performance indicators are the most monitored commercial quality indicators
    - Most countries made noticeable progress in the past few years
    - Though on different levels
  - The reported non-compliance indicators related to **customer care** for most countries are relatively low and homogeneous on the 2010-2014 period
  - The indicators of **technical service** remained either about the same or improved slightly during the period of 2010-2014 many countries. With two exceptions all results are below the overall average percentage of non-compliance (9.22%) in 2014
  - 6 countries provided their performance indicators for **metering and billing** for the current Benchmarking Report, which were the least monitored commercial quality indicators in the 5th edition. All countries registered non-compliance percentages lower than 8% on the 2010-2014 period

# Commercial Quality (9)

- Summary of Results

  - There are 58 indicators for **connection** activities. The average number of indicators specified is 12, which shows that connection to the network in the countries surveyed is of primary importance
    - The most monitored indicators are time for response to customer claim for network connection, the time for connecting new customers to the network, and the time for a switching of supplier.

  - **Customer care** is the lowest group of indicators, with an average value of 6 indicators/activity

  - **Technical service** with an average value of 9 indicators and **metering and billing** with an average value of 10 indicators are more or less regulated to the same extent
    - Much attention is paid to the quickest possible restoration of supply, irrespective of its causes. This confirms the priority in energy regulation to ensuring the availability of supply

  - Differences in the average number of indicators per activity group are observed
    - ORs are the most frequently applied for all groups of activities
    - In some cases GIs, OIs and ORs are used in parallel
    - OI are frequently applied for connection group activities

# Commercial Quality (10)

- (Some) Findings and recommendations
  - Increased focus by the NRAs on the quality of the service provided to customers
  - A broad, but increasingly harmonised range of commercial quality indicators are monitored
    - Requirements and compensations vary a lot depending on the customer type
  - Commercial quality is mainly focused on the DSO's relationship with customers
    - But the focus needs to be wider than the DSO's written responses to customers
  - It is recommended to pursue the harmonisation of commercial quality indicators to make comparisons more reliable in the future
  - Furthermore a greater protection through guaranteed indicators with automatic compensation for customers should be ensured

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## Gas

# 6TH BENCHMARKING REPORT ON THE QUALITY OF ELECTRICITY AND GAS SUPPLY

# General Remarks (1)

- For the first time, the current edition of the CEER Benchmarking Report also covers the gas sector
- Although in general the quality of supply regulation of gas networks does not differ from that used for electricity networks, the underlying objective is entirely different
  - Since gas is a natural resource its quality and composition is of particular importance
  - Moreover, technical safety is of much higher importance than in the electricity since an interruption of gas delivery may give rise to physical danger and in the worst case with fatalities
  - Quality of supply in general is high, due to the ability of gas to be stored
- An extensive set of gas technical standards and rules have been established for gas internationally

# General Remarks (2)

- The Gas section covers the dimensions *Technical operational quality*, *Natural gas quality*, and *Commercial quality*

- A total of 19 countries participated in the survey that builds the basis for the analysis

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## Gas – Commercial Quality

# 6TH BENCHMARKING REPORT ON THE QUALITY OF ELECTRICITY AND GAS SUPPLY

# Commercial Quality (1)

- The same principles like in electricity, that means
  - 3 different types of indicators (Guaranteed Indicators [GI], Overall indicators [OI], and Other requirements [OR])
  - Classification of indicators into 6 groups which focus on different activities where customers and network operators interact
    I. Customer information (8 indicators)
    II. Customer care (11 indicators)
    III. Grid access (5 indicators)
    IV. Activation, Deactivation, and Reactivation of supply (8 indicators)
    V. Metering (12 indicators)
    VI. Invoices (7 indicators)

# Commercial Quality (2)

- Main results
  - Input from 19 Member states
  - The most common indicators among the reporting countries are the ones concerning **customer information** and **metering** issues
  - In total 13 of the responding countries apply some types of indicator regarding the time for response to customer request and/or complaints and the number of customer requests and/or complaints
  - A total of 10 countries apply more than 10 indicators

# Commercial Quality (3)

- Summary of Results
  - The most monitored indicator is the time for response to customer claim for network connection
  - The average number of indicators specified is 6 in the **Customer information** group. This figure is one of the highest among the other groups, meaning that customer information and the time to response to complaints in the CEER countries is of primary importance
  - **Customer care** indicators are the largest group of indicators. In this group the punctuality of market participants regarding appointments with customers and the punctuality of customers regarding appointments with market participants are the most monitored indicators

# Commercial Quality (4)

- Summary of Results
  - **Grid access** and **Activation and Deactivation of supply** have an average value of approximately 6 indicators. A key issue is access to the grid as quickly as possible: the average response time to customer requests for grid access and the time for execution of connecting customers to the network are the 2 most monitored indicators of that group
  - **Metering and invoicing** are regulated to the same extent, with an average value of approximately 6 indicators
  - Differences in the average number of indicators per activity group are observed
    - OIs are the most frequently applied indicators for regulation of customer information, customer care, grid access and invoicing issues
    - In some important cases GIs, OIs and ORs are used in parallel in CEER countries
    - GIs are frequently applied for activation and deactivation of supply and metering activities

# Findings and Recommendations (1)

- A high focus by the NRAs on the quality of the service provided to customers can be observed
- A broad range of commercial quality indicators are monitored
  - Requirements and compensations vary a lot depending on the customer type
- Commercial quality is mainly focused on the DSO's relationship with customers
  - But the focus needs to be wider than the DSO's written responses to customers
- A significant number of OIs and GIs are monitored in the regulation of gas commercial quality
- Customer information, customer care and activations to the network are key considerations

# Findings and Recommendations (2)

- For the future it is recommended to perform regular reviews of national regulations
- It is recommended to pursue the harmonisation of commercial quality indicators to make comparisons more reliable in the future
- Furthermore a greater protection through guaranteed indicators with automatic compensation for customers should be ensured

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## Gas – Technical Operational Quality

# 6TH BENCHMARKING REPORT ON THE QUALITY OF ELECTRICITY AND GAS SUPPLY

# Technical Operational Quality (1)

- The chapter is based on input from 19 countries
- Technical safety is of higher importance than in electricity since an interruption of gas can result in physical danger
- Variations in pressure levels allowed in some countries
- Gas can be stored easily which results in a very high quality of supply regarding continuity

# Technical Operational Quality (2)

- Continuity of supply focuses on events during which there is no gas at the supply terminal of a network user or the pressure drops below a specific level

- Indicators are generally the same as in electricity, but they cannot be interpreted the same way because of the possibility of storage

- Causes of interruptions are also monitored in most countries

# Technical Operational Quality (3)

- Continuity of supply in gas is not only expressed by indicators, but also by events that precede an interruption. These are:
  - Incidents: can happen in every system but may not necessarily lead to interruptions
  - Leaks: gas unwantedly leaves due to corrosion or a pipe burst. Not every leak results in interruptions
  - Accidents (damage): gas is inflamed and physical damage occurs

# Technical Operational Quality (4)

- A total of 10 countries use indicators to monitor both frequency and duration of continuity of supply for planned and unplanned interruptions

- SAIDI and SAIFI are used in most countries

- As in electricity: when weighting is based on the number of network users, each user is treated equally regardless of their size. When weighting is based on interrupted or contracted power, an interruption gets a higher weighting when the total interrupted power is higher

# Technical Operational Quality (5)

- One single interruption in gas can lead to a high risk of safety so the effort of network operators to avoid such interruption might be greater than in electricity

- Most pipelines are underground and are therefore less vulnerable than overhead power lines

- Most gas interruptions last much longer than electricity

# Technical Operational Quality (6)

- Indicator values for planned interruptions are higher than those of unplanned interruptions

- A total of 15 reporting countries have obligations to give advance notice of planned interruptions

- The requirement for advance notice varies between 36 hours and nearly an entire year (January 15 until the year's end)

# Technical Operational Quality (7)

- Compared to electricity, less countries use incentives for quality of supply in gas
- Financial compensation in situations when technical supply standards are not met is offered in only 4 reporting countries
- Half the responding countries have implemented regulation aimed at reducing losses (for example, if losses are below a certain limit, system operators can keep a portion of the value of saved gas)

# Findings and Recommendations

- Availability of indicators for continuity of supply and safety is not uniform across Europe

- Monitoring should be extended to more countries so that broader comparison is possible

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## Gas – Natural Gas Quality

# 6TH BENCHMARKING REPORT ON THE QUALITY OF ELECTRICITY AND GAS SUPPLY

# Natural Gas Quality (1)

- In short, it is the quality and composition of gas
- Composition can be different depending on the origin (indigenous production, imports from neighboring countries through interconnection points, LNG imports)
- As a result of this, each country has developed its own gas quality standards
- Interoperability Network Code was implemented in 2016 to facilitate efficient gas trading and transmission within the EU, but chemical composition has not been harmonized

# Natural Gas Quality (2)

- The chapter is based on input from 17 countries and compares the standards related to technical parameters
- Most European Member States monitor at least 10 technical parameters, some even 20
- In Austria and Germany, parameters are not monitored by NRAs but defined by technical associations which set binding guidelines and technical rules

# Natural Gas Quality (3)

- Main parameters:

- **Gross calorific value**: total energy released as heat by complete combustion of gas

- **Relative density**: density of gas in relation to density of air

- **Wobbe index**: calculated from gross calorific value and relative density and is used to compare the combustion energy output of gases with different composition

    - Wobbe index is the main indicator of the interchangeability of fuel gas

# Natural Gas Quality (4)

- Monitoring of Wobbe index (WI) is performed with different frequency across Europe
- Frequency varies between monitoring in real time and monthly monitoring
- Each Member State has set a minimum and maximum for their Wobbe index
- Allowed difference between min and max WI is between 1 kWh/$m^3$ and 3 kWh/$m^3$
- Even neighboring countries can have significant differences in allowed ranges

# Natural Gas Quality (5)

- CEN (European Committee for Standardization) has proposed standards for harmonization of several parameters related to gas quality
- A common Wobbe index range could not be defined
- Reasons: different regulations in CEN Member States and limited knowledge of the influence of broadening of Wobbe index range on efficiency and safe use of appliances

# Findings and Observations

- Number of parameters in use across Europe are outside of what is allowed by CEN standards
- Making CEN standards binding might contribute to reducing restrictions in cross-border gas flows, but it might prove costly
- TSOs might need to invest in treatment processes in order to accept gas that would be outside of specification
- The alternative would be to refuse gas that does not meet CEN standards, thus potentially creating future security of supply issues
- Any attempts to harmonize gas quality should take this into account

# Thank you for your attention!

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