Council of European Energy Regulators

THIRD BENCHMARKING REPORT ON QUALITY OF ELECTRICITY SUPPLY 2005

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Electricity Working Group
Quality of Supply Task Force

THIRD BENCHMARKING REPORT ON QUALITY OF ELECTRICITY SUPPLY 2005

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INTRODUCTION

The Council of European Energy Regulators (CEER) Electricity Working Group on Quality of Supply published in September 2003 the “2nd Benchmarking Report on quality of supply”. The Report was presented on the occasion of the 2nd World Forum on Energy Regulation (Rome, October 2003) and was debated in several conferences, raising the interest of energy regulators, energy market operators and stakeholders.

In the meantime due to the enlargement of EU, the number of CEER members has significantly increased, thus a comparison of a much broader scale has become possible within the framework of this new analysis.

The General Assembly of CEER requested the Electricity Working Group to establish a Task Force for Quality of Supply (CEER QoS TF) and gave it the task of updating the previous data, widening the participation in the data collection and analysis, showing trends in various elements of Quality of Service, suggesting common indicators for the CEER members who are at the stage of introducting quality regulation and for those who would like to harmonize their existing practices with others. Practically all CEER members participated in the work of the CEER QoS TF to-date.

When starting to work on the 3rd Benchmarking Report CEER QoS TF members – in line with the request of the General Assembly – have extended the scope of collecting information. In addition to the two topics (Continuity of Supply and Commercial Quality) which were addressed in the previous report, information was asked on the use of standards and incentives for quality regulation, especially with regard to continuity of supply. Information/data asked regarding these three issues was grouped into three separate questionnaires. The questionnaires for data collection were voluntarily prepared by two members of the CEER QoS TF: Mr Luca Lo Schiavo (AEEG, questionnaires for Continuity of Supply, Incentive Regulation and Voltage Quality) and Mr Günter Pauritsch (E-Control, questionnaire for Commercial Quality). Concerning the questionnaire on Commercial Quality we need to mention that some issues of commercial quality standards were covered by a Questionnaire on Customer Protection, which was circulated in the first half of 2005 by the ERGEG Customer Focus Group. Nevertheless for the work of the QoS TF it was necessary to collect information on commercial quality standards in a more detailed form. The CEER QoS TF – based on the analysis of the information from the answers to the questionnaires – prepared one joint report in which the various methods of quality regulation were introduced. Intermediate results of the data analysis gave rise to the preparation of a separate (fourth) chapter on Voltage Quality.

The Report compares both actual levels and standards of several aspects of quality of service and various practices in terms of regulatory methods, and analyses the factors influencing the levels of service. This could be useful for those regulators, who would like to harmonise their activity with that of others, as well as for those who are in the stage of introducing new elements of quality regulation.

This Report is the result of the joint activity of all participants. James Hope (Ofgem) volunteered for the analysis of Continuity of Supply, Luca Lo Schiavo prepared the analysis for Voltage Quality chapter which benefited of the valuable comments of prof. Guido Carpinelli (IEEE, University of Naples "Federico II") and of prof. Maurizio Delfanti (Politecnico di Milano, Dept' of electrical engineering). Mr Lo Schiavo also prepared the second Chapter on Standards and Incentives in Quality Regulation with the vital contribution from Elena Fumagalli (Politecnico di Milano, researcher in the Department of Management, Economics and Industrial Engineering) while the Commercial Quality chapter was edited by Dr Gábor Szörényi (HEO) with the assistance of Dr Tibor Tersztyanszky and with the devoted work of Mr Zsolt Birinyi. The help of Florence Delestre (CRE) who prepared the preliminary analysis of the answers to the Continuity of Supply and Incentive Regulation questionnaires was very valuable. Finally, Una Shortall's grammar and language check as well as useful comments were huge contribution to better understanding.

Colleagues from Austria, Belgium, the Czech Republic, Estonia, Finland, France, Great Britain, Greece, Hungary, Italy, Ireland, Latvia, Lithuania, Norway, Poland, Portugal, Slovenia, Spain and Sweden actively participated in the work of the Task Force and supplied valuable information on their own country's quality levels and standards, so that the analysis in this Report was based on the information obtained from these nineteen countries.

The main chapters we focused on the introduction of the most important standards, the requirements, the indicators, the factors influencing the measured quality levels and on those incentive schemes, which are recommendable to be introduced in practice.

Regarding common statements, recommendations and proposals for those who intend to introduce quality regulation nowadays and for those who would like to harmonize the quality regulation elements, the Report does not contain targeted measurement methods and incentives, neither does it suggest levels of indicators which should be required by regulators. This would be too early taking into consideration the harmonization procedure. However, important messages to the industry and to the customers are incorporated into this Report.

We do suggest continuous discussions among the regulators, with customers on their expectations and satisfaction and with the energy industry on quality regulation matters.

Dr Gábor Szörényi
Chair of the CEER QoS TF

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CHAPTER 1 – Continuity of Supply

CONTENT

CONTINUITY OF SUPPLY

1.1 What is Continuity of Supply?

Continuity of supply is characterized by the number and duration of supply interruptions. It is widely accepted that it is neither technically nor economically feasible for a power system to ensure that electricity is continuously available on demand. Instead, the basic function of a power system is to supply power that satisfies the system load and energy requirement economically and also at acceptable levels of continuity and quality. “Quality of supply” is usually measured in terms of acceptable values of voltage and frequency, while “continuity of supply” refers to uninterrupted electricity service[1]. Reliability refers to the ability of a power system to provide an adequate[2] and secure supply of electrical energy at any point in time[3]. Supply interruptions regardless of their cause, mean a reduction in reliability.

Continuity of supply matters to all types of customers and for numerous reasons. For large industrial users interruptions of even a relatively short duration can lead to substantial financial losses, whilst for domestic users interruptions can leave people without heating, lighting and cooking facilities. The main things that customers expect to see in respect of electricity networks are:

- Reliability;
- Quick restoration; and
- Timely reliable information when there is a problem.

Chapter 2 of this report deals with the incentive regulations in place in many European countries, whilst chapter 3 looks at commercial quality and the standards of service in force throughout Europe. This chapter focuses on the key measures of continuity of supply that are commonly used in Europe. A supporting Annex provides additional tables and analysis of the wealth of information that was submitted.

The four main features of continuity of supply can be summarised as follows:

- **The type of interruption: planned or unplanned interruptions**. Planned interruptions are scheduled, for instance, to carry out necessary maintenance of the network. Planned interruptions which are not notified to customers should be recorded as unplanned interruptions.
- **The duration of each interruption: transient, short or long interruptions**. In accordance with European technical standards EN50160, interruptions that last more than 3 minutes are defined as “long interruptions”, interruptions that last more than 1 second and less than 3 min-

[1] Billinton, R. and Allan, R.N., « Reliability evaluation of power systems » (Plenum Press, 1984)
[2] Adequacy is the ability of a power system to supply the aggregate electrical demand and energy requirements of the customers at all times, taking into account scheduled and unscheduled outages of system facilities (definition from NARUC, the US National Association of Regulatory Utility Commissioners). Adequacy problems are not addressed in this report.
[3] Billinton, R. and Allan, R.N., « Reliability Assessment of large power systems » (Kluwer Press, 1988)

utes are defined as "short interruptions", and interruptions that last less than 1 second as "transient interruptions".

- **The voltage levels of faults and other causes of interruptions**: an interruption of supply to final customers can originate at any voltage level, low/medium/high voltage, in the system. At high voltage and extra high voltage levels there is typically greater security and most faults will not lead to customers being interrupted.
- **The type of continuity indicators: number or duration of outages.** The number of outages per customer in a year, termed Customer Interruption (CI) or System Average Interruption Frequency Index (SAIFI), indicates *how many times* in a year, energy is not supplied. The cumulative yearly duration of interruptions per customer, generally referred as Customer Minutes Lost (CML) or System Average Interruption Duration Index (SAIDI), indicates *how long*, in a given year, energy is not supplied[4] (average per customer). A small number of countries make use of the following continuity indicators; the time of equivalent interruption per power installed (TIEPI) and the number of equivalent interruptions per power installed (NIEPI). These indices (of frequency and duration) provide useful information to regulatory authorities on the performance of the network in terms of security and availability respectively.

1.2 Main Conclusions on Continuity of Supply Regulation – Drawn from the CEER's First and Second Benchmarking Reports

The main features of continuity of supply, across several surveyed countries, are described in the First (April 2001) and the Second (September 2003) Benchmarking Reports, hereafter referred to as "First Report" and "Second Report".

In brief, the First Report identified the two main features of continuity of supply regulation as (1) guaranteeing that each user can be provided with at least a minimum level of quality and (2) promoting quality improvement across the system. The comparative analysis of available measurement and continuity of supply regulation in the First Report shows that regulators have generally approached continuity issues starting from long interruptions affecting LV customers, treating planned and unplanned interruptions separately. In several countries both the number and the duration of outages are available for each indicator, but the choice of the indicator used varies by country and in many countries short interruptions (and sometimes, transient ones) are or will be recorded as well. Different approaches to continuity of supply regulation, and in particular the different continuity indicators and standards adopted, recording methodologies used, combined with different geographical, meteorological and network characteristics, makes benchmarking of actual levels of continuity of supply difficult.

Since publication of the First Report of the working group, there have been a number of improvements in comparisons of continuity of supply. This Third Report now includes information from 20

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[4] Energy Not Supplied (ENS) is linked to CML and is more sophisticated indicator because it takes into account the disconnected power.

countries compared with 6 in the First Report. Comparisons of performance are made for unplanned and planned outages, outages of short duration and an attempt has been made to investigate unplanned performance excluding exceptional events. As in the previous two reports data limitations have meant that detailed comparisons could not be carried out for all countries.

1.3 Main Conclusions on Continuity of Supply Regulation – Drawn from the CEER's Third Benchmarking Report

A number of encouraging trends have been observed in carrying out work on the Third Report:

- The duration of unplanned interruptions shows (for most countries) a significant downward trend;
- The number of unplanned interruptions shows (for most countries) a downward trend;
- Excluding exceptional events from unplanned performance figures highlights the significant improvements being made by many European countries in terms of both the duration and number of interruptions;
- Countries with previously low levels for duration and number of interruptions have been able to make further improvements; and
- Short interruptions have generally not been rising despite an increased move to automation and remote control techniques.

1.4 Continuity of Supply Questionnaire

1.4.1 Continuity Indicators Used

The continuity indicators which form the basis of the continuity analysis in this report[5] are:

- **"System Average Interruption Duration Index" (SAIDI)**, in some countries referred to as "Customer Minutes Lost per customer per year" (CMLs)
- **"System Average Interruption Frequency Index" (SAIFI),** in some countries also referred as "Customer Interruptions per 100 customers per year" (CIs)
- **"Momentary Average Interruption Frequency Index" (MAIFI).**
- **"Energy Not Supplied" (ENS)[6]**
- **"Average Interruption Time" (AIT)**[7].

SAIDI measures the average duration of outages for a power system. SAIFI and MAIFI measure the average frequency of outages for the power system, respectively for long and for short interruptions. ENS is generally based on long interruptions, as the energy not supplied during short

[5] For a comprehensive review of continuity indicators, please see the document : IEEE Standard 1366-2003. *IEEE Guide for Electric Power Distribution Reliability Indices*. IEEE, New York, NY, May 2004

[6] Norway uses ENS for all voltage levels greater than 1 kV.

[7] For some countries such as Italy (until 2004), the information relating to AIT and ENS includes outages occurring at distribution high voltage and may therefore result in higher values than those countries reporting solely outages on the transmission network.

interruptions is very small. AIT is normally used only for transmission networks, whilst the other 4 performance indicators are used both for transmission and distribution. These five performance indicators are typically reported annually in most countries and the first three are often split into planned (scheduled) and unplanned (unscheduled) interruptions.

1.4.2 Data availability

The analysis in this chapter is based on the information obtained from the following twenty[8] countries as set out in the table below.

TABLE 1.1 AVAILABLE DATA COUNTRY BY COUNTRY

Countries	Data for trend analysis	Data for responsibility and voltage analysis	Data for density analysis	Data for regional analysis	Data for worst-served customers analysis	System data
Austria	✓	✓				✓
Belgium_nat	✓					✓
Belgium_wall	✓					✓
Czech Republic	✓			✓		✓
Estonia	✓	✓				✓
Finland	✓					✓
France	✓		✓	✓		✓
Great Britain	✓	✓		✓		✓
Greece	✓	✓	✓			✓
Hungary	✓	✓		✓	✓	✓
Ireland	✓		✓			✓
Italy	✓	✓	✓	✓	✓	✓
Latvia	✓			✓		✓
Lithuania	✓	✓	✓	✓		✓
Netherlands	✓					✓
Norway	✓	✓	✓	✓	✓	✓
Poland	✓					✓
Portugal	✓	✓	✓	✓		✓
Slovenia						✓
Spain	✓			✓		✓
Sweden	✓		✓	✓		✓

✓ = available blank = not available

[8] Two sets of data were received for Belgium, one set contained Federal information and the other contained information for the Wallonia region. Due to differences in methodology and availability of data the analysis makes use of both Federal and Wallonia information.

1.5 Assumptions for benchmarking of actual levels of continuity of supply

Because of different measurement practices in European countries, available data on actual levels of continuity of supply are not always comparable. It is important to consider the country specific conditions detailed in the Annex to this chapter. In particular the following should be noted:

- First, whilst the scope of benchmarking interruptions has been extended to include short interruptions as well as long interruptions, not all countries separate their interruptions data into these two categories.
- Second, there are different ways of measuring supply interruptions. Continuity data may be collected at all voltage levels or may exclude some voltage levels, this will be identified later in the report. Furthermore, continuity indicators may refer to all customers or be split between customers at different voltage levels.
- The final and perhaps most important factor to take into consideration is that continuity indicators are not always defined in a comparable way. Continuity indicators can be weighted by three different methods; by customer, transformer or contracted power. This can give rise to differences depending on which weighting method is used.

Measurement practices have an important role in the definition of standards and in the design of incentive/penalty regimes. The relationship between continuity measurement systems and standards and/or incentive/penalty regimes will be discussed in depth.

This section contains comparative information about: the type of interruptions monitored, the statistical indicators calculated, the guidance rules for recording interruptions and the technology involved, as well as the audit procedures.

1.5.1 Interruption monitoring and communication

With very few exceptions, all the surveyed regulators monitor long (≥3') planned and unplanned interruptions arising from distribution. Interruptions at the distribution level are not currently monitored in Poland. In Slovenia some data are available, however, the recording is not yet systematic. In Latvia no distinction is made between planned and unplanned interruptions. In Ireland no distinction is made between short and long interruptions (all interruptions longer than 1 minute are registered).

It is clear from the survey that significant differences exist with regard to accuracy, as well as completeness in the measurement and registration of the data. In addition, monitoring of continuity data by the regulators is a fairly recent activity for numerous countries. Robust data would require at least three years of historical measurements, consistent with unambiguous recording rules. Consequently, even if most of the regulators indicated in the questionnaire that they register long interruptions, fewer countries met the requirements chosen for inclusion in the data comparison. Only a restricted number of countries register interruptions originating from all voltage levels, HV (high voltage), MV (medium voltage), and LV (low voltage)[9] (Czech Republic, Finland, France, Greece, Great Britain, Hungary, Italy, Lithuania, Norway, Portugal, and Sweden). In most cases recording is limited to HV and/or HV and MV (Austria, Estonia, Ireland, Latvia, Slovenia, and Spain). In this case, the number and duration of interruptions actually experienced by consumers will be higher than indicated (interruptions with origin on the LV network are not registered). In Belgium (Wallonia) interruption data are divided between HV and LV, but LV interruptions are recorded only if longer than 15 minutes. A number of monitoring systems are under development.

[9] Generally LV means below 1 kV, MV means between 1 and 35 (or 60) kV and for this report HV includes those voltages that are generally referred to as EHV. Voltage levels are not the same in all EU countries.

Interruptions shorter than three minutes are (separately) measured in only a few countries (Finland, France, Hungary, Great Britain, Italy). A group of countries is preparing to measure short interruptions, for instance Lithuania and Czech Republic. From 2005 Norway will also require companies to record short interruptions, albeit at a less detailed level than for long interruptions. From 2006 companies in Norway will be required to record and report short interruptions in the same scheme as long interruptions. It should be noted that as customers make increasing use of computers and other electronic equipment they are increasingly concerned about short interruptions. For this reason, both long and short interruptions should be measured.

Concerning the spatial scope of monitoring, large differences were found across countries. Estonia, Ireland, Latvia, and Slovenia collect data at country-level (note that in Ireland and Latvia there is only one distribution company). In all other countries continuity is monitored at a more detailed level: by distribution company, in Austria, Belgium (Wallonia), Czech Republic, Great Britain, Hungary, and Norway; by administrative region (and in the future by concession) in France by concession in Sweden. A good number of the countries use a classification of territorial areas in order to distinguish at least among urban and rural (and thus set differentiated standards). Such distinctions are meant to capture technical differences among networks (overhead lines vs. underground cable, and so on). The criteria used for territorial classification vary from one country to another:

- Per number of inhabitants, at municipality level (Italy and Lithuania) or at locality level (France);
- Per number of customers, at municipality level (Spain and Latvia) or at locality level (Portugal);
- Other criteria: Greece (based on the distance from the nearest service centre), Finland (based on the percentage of cable – 5 categories); Ireland (by network configuration); Sweden (on the basis of meters of line per customer).

Additional Information 1.1 – Comparing performance across companies

In Great Britain there is no territorial classification, but the regulator developed a methodology for benchmarking company performance that is used also to set targets for the interruption incentive scheme.

Ofgem collects physical characteristics and performance information for each MV circuit for each distribution company. These circuits are then divided into 22 circuit groups with physically similar characteristics. The groups are defined so that differences in the percentage of overhead line, circuit length and number of connected customers are minimised and that no group is dominated by a single company. Performance is compared and benchmarked within each circuit group. Ofgem then establishes an overall benchmark for each company based on its mix of circuits and compares actual performance with these benchmarks.

The vast majority of regulators require companies to submit information on continuity data on a yearly basis, with the exception of Portugal and Lithuania where data are collected quarterly, and Slovenia where they are collected at the request of the regulator. Usually regulators publish annual reports that include data on continuity (not in Belgium, Wallonia). Other forms of communications of these data include publication from Ministries and on the websites of the regulator or of the companies.

1.6 Background Information on Continuity Indicators

- Where possible countries should seek to measure continuity indicators, especially unplanned SAIDI and unplanned SAIFI.
- Weighting by user is the most common method for calculating continuity indicators. Therefore countries planning to introduce continuity indicators are recommended to adopt this method.
- Comparative analysis is facilitated where countries use the same method for calculating continuity indicators at all voltages.
- Exceptional events can significantly affect annual performance figures and countries should attempt to provide one set of figures including all interruptions and one set excluding such atypical events.

As far as the distribution network is concerned, continuity indicators on duration and frequency of unplanned interruptions are available from the majority of the surveyed countries. The level of confidence in these indicators reflect the confidence on the data measured, as explained in Subsection 1. Indicators are more commonly weighted on the number of customers served (SAIDI, SAIFI for long interruptions and MAIFI for short interruptions), but they can be weighted also on the contracted power (in Portugal both methods are adopted). Table 1.2 summarises the situation, noting the differences in voltage levels that are monitored.

TABLE 1.2 CONTINUITY INDICATORS FOR DISTRIBUTION: unplanned interruptions

SAIDI, SAIFI and MAIFI per voltage level (H, M, L)	GB, HU, IT, NO (from 2006)
SAIDI and SAIFI per voltage level (H, M, L)	CZ, GR, PT, FR, LT, NO (from 2006)
SAIDI and SAIFI per voltage level (H, M)	SI (some data only), BE_Wallonia
SAIDI and SAIFI all voltages	SE, EE, IE (SAIFI from 2006)
Average duration (D) and frequency (F) per contracted power or other	AT (average D and F weighted on MV power affected, MV/MV, MV/LV), ES (average D and F weighted on MV power affected: TIEPI, NIEPI) FI (Average D and F weighted on yearly energy consumption) FI (Interruptions are weighted by the yearly energy consumption of the distribution area that one distribution transformer feeds). PT (TIEPI, ENS, excluding LV) NO (ENS, excluding LV: ≤1kV)
Other/No indicators	LV (number of interruptions), PL (no indicators)

1.6.1 Weighting methods used for continuity indicators

There are a number of ways of calculating continuity indicators, Table 1.3 shows which countries use which method.

TABLE 1.3	WEIGHTING METHODS USED FOR CONTINUITY INDICATORS
USER	Belgium-Wallonia, Czech Republic (from January 2007) Estonia, France (LV and T networks), Great Britain, Hungary, Ireland, Italy, Lithuania, Portugal, Sweden,
TRANSFORMER	Finland[10] , Norway
POWER	Austria (MV-networks, MV/MV, MV/LV), Czech Republic (until January 2007), France (MV networks), Spain
None used/no answer	Belgium, Greece, Latvia, Netherlands, Slovenia, Poland

As can be seen from the table, user is the most common method for weighting continuity indicators. Each method has its merits and drawbacks some of which are illustrated in Table 1.4:

TABLE 1.4 MERITS AND DRAWBACKS OF ALTERNATIVE WEIGHTING METHODS

Method	Merits	Drawbacks
User	Places greater emphasis on domestic customers, who are less likely to be able to protect themselves Simpler to use More robust, as there is not the need to make assumptions about demand from different groups of customers	Does not take into account the costs of larger users, therefore more of the risk may fall on larger customers rather than on network operators. Network operators do not take such risks on board when making their investment decisions.
Transformer	Simplifies the reporting scheme and is compatible with the financial incentive regulation in place.	Does not describe the power quality very well and does not take account of the fact that transformer districts can be different (by energy consumption and by the number of customers connected).
Power	Takes into account the costs of larger users. Network operators in a position to take such risks on board when making their investment decisions.	Domestic customers carry a smaller weight and may therefore be exposed to more risk. Assumptions regarding the demand of different customer groups are required.

In some cases the regulator collects information about not only average values but also the distribution of customers per number of interruptions (see additional information 1.2.).

[10] In Finland the indicator is based on transformer district and is not weighted in any way.

Additional Information 1.2 – Data on Short interruptions

The frequency of short interruptions (between 1” and 3’) is not available to the French regulator for distribution networks. However, other data are available. The distribution company reports how many customers (in percentage) had between 0 and 5 short interruptions during the year, how many customers had between 6 and 10 short interruptions during the year, how many between 11 and 15, 16 and 20, 21 and 25, 26 and 30, and more than 30 short interruptions during the year. This information is collected for both MV and LV customers. Italy adopts a similar approach, as distribution companies are required to give the Regulator, each year, data on the worst-served customers in the following format (the thresholds for number of long and short interruptions vary according to the type of territory; the example refers to urban districts).

Example of format for worst-served analysis used in Italy (urban districts)

	Up to 1 long interr/year	2 long interr/year	3 long interr/year	4 long interr/year	5 or more long interr/year	Total
Up to 1 short interr/year						
2 or 3 short interr/year						
4 or 5 short interr/year						
6 or more short interr/year						
Total						

Continuity indicators regarding planned interruptions (annual frequency and duration per customer) are available from most of the countries surveyed, with the exception of Poland and Latvia. Indicators for the Czech Republic will be available beginning in 2007. In Estonia, although planned interruptions are recorded, indicators of average frequency and duration are not available. France has only an indicator of average duration per consumer, in Norway the information is on the ENS per MV transformer, and Spain uses TIEPI as an indicator for planned interruptions.
The regulators have established rules for the timing of the advance notice to be given for a planned interruption only in approximately half of the countries surveyed (Austria, Belgium (Wallonia), Czech Republic, Estonia, Hungary, Ireland, Italy, Portugal, Spain and Great Britain) (as set out in Annex 2, planned interruptions rules). This varies between 1 day (in Italy and Spain) and 15 days (in Czech Republic). In most of these countries the procedure for notification is not indicated: in Ireland the notification must be by mail, and in Spain by any verifiable means to customers above 1 kV, and by advertising posters placed in visible spots with regard to all other consumers and by means of two of the most widely circulated printed media in the province; in all other countries the procedure is only indicative or left to the companies (newspaper, websites, newsletters are all acceptable means of communication).
In the other half of the surveyed countries different situations are found: in Finland, Norway and Sweden the only rule is to give an advance warning that enable consumers to be prepared; in France the matter is regulated in detail by contractual agreements; in Hungary the regulator approves the procedures established by the companies; in Lithuania the matter is regulated by the Ministry of Economy; in Greece, Latvia, and Slovenia the regulators have not addressed the subject yet.

Additional Information 1.3 – Notice to consumers

In Italy the minimum time for notice is 24 hours in advance, otherwise the interruptions must be considered as unplanned. Should the planned interruption start before the notified timetable (more than 5 minutes in advance), it must be considered as unplanned. Should the planned interruption last longer than notified, the extra duration must be considered as unplanned.

In Portugal the Commercial Relations Code, published by ERSE, establishes rules about the notice to the customer according to the reasons of interruption:

- Interruptions for reasons of public interest: the entity responsible for the network must inform, whenever possible, and with a minimum prior notice of thirty-six hours, the customers which may be affected by the interruption.
- Interruptions for service reasons: the entity responsible for the network has the duty to minimise the impact of the interruptions among customers. For this purpose, distributors may agree with the clients that will be affected the best moment for the interruption. If the agreement is not possible, the interruptions must occur, preferentially, on Sundays, between 05:00 hours and 15:00 hours, with a maximum duration of eight hours per interruption and five Sundays per year, per customer affected. The entity responsible for the network must inform with a minimum prior notice of thirty-six hours.
- Interruptions due to customer responsibility: The supply interruption may only take place following 8 days' notice

Note that in Great Britain an interruption is treated as planned provided that the start of the interruption is within the period of interruption stated on the notice to the customers.

Most of the countries collect continuity indicators for the *transmission* system, with the exception of Austria, Estonia, Greece, Latvia, and Slovenia. The most common indicators used for transmission are listed in Table 1.5.

TABLE 1.5 CONTINUITY INDICATORS FOR TRANSMISSION

Energy not supplied (ENS)	FI, FR, HU, IE, IT, LT (from 2006), PL, PT, ES, SE, GB, NO
Average interr. time (AIT)	BE, FR, IT, LT (from 2006), PL, PT, ES, SE
SAIDI at T-level	CZ, FR, PT, NO (from 2006)
SAIFI at T-level	CZ, FR, PT, IT, NO (from 2006)
Other indicators	total time of interruption: CZ, HU MAIFI: FR, IT outage rate: HU numb. of incidents: IE, HU, SE, GB
None	AT, EE, GR, LV, SI

1.6.2 Rules for recording long interruptions

It clearly emerges from the survey that the majority of the regulators have not established or approved rules for recording interruptions. There are only eight countries out of 20 surveyed where recording protocols are in place (Italy, Czech Republic, Norway, Portugal, Spain, Hungary, Great Britain, Sweden). These protocols address issues such as identification of interruptions, technology employed, assessment of the number of consumers affected, and definition of interruption causes (in general including that of *force majeure*). In Italy, Spain, Great Britain, Hungary, and Portugal the recording protocol was set by the regulator. In Norway the protocol (FASIT) was developed by a branch organization and is referred to by the regulator. Sweden has guidelines for the calculation of SAIDI and SAIFI.

It is relevant to note that all the eight countries cited above have introduced standards and/or incentive/penalties regimes linked to the number and/or the duration of long interruptions and/or energy not supplied. The rules for recording long interruptions are, in fact, the basis of these regulatory provisions: they ensure that all interruptions are recorded, and that the recording methodology is homogeneous across the country. This enables a fair and correct implementation of the financial incentive schemes. Hence, it is of concern that Ireland, having adopted an incentive and penalty regime states that no recording protocol has been implemented.

Recording rules establish an obligation for all (or at least all the major) companies to register continuity data. Secondly, they indicate which data are required for a correct identification of an incident. Usually these include the time interval of the supply interruption, its cause, the network device where it originated, the affected installations and the number of consumers involved.

One of the most relevant issues is the logging of incidents. Depending on the available technology on the network an incident is logged when *i)* a customer (or other person) first contacts the company to advise of no-supply, an abnormality or suspected abnormality; *ii)* there is an alarm on SCADA indicating a loss of supply, abnormality or suspected abnormality; or *iii)* an employee or agent identified the existence of a loss of supply, abnormality or suspected abnormality. There is usually no obligation of automatic logging of the incidents, but, for instance, regulators in Italy and Portugal explicitly require companies to remotely control the whole HV and MV distribution networks (for each HV and MV feeder).

A second issue is the identification of the consumers affected by the interruption. Norway Portugal and Great Britain (see Additional Information 1.4) require companies to integrate the customer information database with the topology of the network (connectivity model). At the present time Italy (see Additional Information 1.5) and Spain have rules for estimating the number of LV consumers involved in an interruption; however, both countries are requiring companies to be able to identify single customers in a few years time (in Spain the process is expected to be completed by 2006

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[11] In Norway data recordings are referred to delivery points. A delivery point is a medium or high-voltage end-user or a distribution transformer. In total 121 600 points.

and in Italy the integration of the network information and the commercial systems has to be completed by the end of 2007). Sweden is also investigating the possibility of having companies report interruptions at the single customer-level in a few years time.

The real possibility to achieve full phase connectivity (so it will be possible to identify exactly which customers have been interrupted for say a single phase fault) by these dates relies on matching advanced metering information with network fault information.

Additional information 1.4 – Connectivity model

All distribution companies in GB were required to put in place a connectivity model associating customers to the outgoing LV feeder from the distribution substation from 1 April 2002. Companies are not required to have phase connectivity. The number of customers affected will therefore be based on actual customer numbers for MV faults and faults that affect all LV phases. The number of customers interrupted for single-phase and two-phase LV incidents is calculated on a pro rata basis, i.e. 1/3 or 2/3 of the total number of customers connected to the LV circuit, or part of circuit, affected. Customers with a three-phase LV supply (where these can be identified) are considered to be interrupted when supply is interrupted to one or more of the three phases.

Additional information 1.5 – Estimate the number of LV consumers

In Italy remote control device for automatic logging of interruptions (SCADA) is requested on every HV and MV line. Distribution companies must know and record the actual network configuration at the time of each long interruption. This allows companies and the regulator to know the exact list of MV customers and MV/LV transformers affected by each long interruption.

Only a few distribution companies are able to know exactly the LV customers affected by each interruption. In order to estimate of the number of LV users affected in each interruption, until 2007 an averaging method is permitted: a) for interruptions with origin in the HV or MV network: number of LV users affected = number of MV/LV transformer affected multiplied by the ratio LV users per MV/LV transformer (calculated at municipality level, taking account of different areas); b) For interruptions with origin in the LV network: number of LV users affected = number of LV lines affected multiplied by the ratio LV users per LV line (calculated at municipality level, taking account of different areas). The same rule is used by distribution companies in the Czech Republic.

Finally, with regard to the causes of interruptions three main approaches were found. In Sweden interruptions are not classified by cause and all incidents are included in the incentive/penalty regime (in Norway causes of interruptions are identified, but all incidents are included in the incentive penalty/regime). In Italy, Portugal, and Spain, the rules for classification aim to identify those interruptions that are not attributable to the distributor and to exclude them from the incentive/penalty regime. Exclusions typically include interruptions caused by the generation and transmission systems, by other distributors, by third parties, as well as interruptions due to force majeure (see Annex 2 – Force majeure). In Great Britain, interruptions are not separated by cause, however, Ofgem has defined a mechanism which allows companies to ask for the impact of a small number of exceptional events to be excluded from their performance (see Additional Information 1.6). Similarly, in Hungary and in the Czech Republic exceptional events can be recognized by a public authority.

Additional Information 1.6 – Identifying Exceptional events

In Great Britain distribution companies must make a claim within 14 days of the end of an exceptional event. For event to be eligible it must satisfy certain thresholds.

1.1 Severe weather conditions
A weather event is classed as exceptional if it causes 8 or more times the daily mean number of faults at higher voltage (i.e. at MV and above) in a 24 hour period. The full audited impact of the event is then excluded under the interruption incentive scheme.
The restoration performance is then separately incentivised under the guaranteed standard for supply restoration in severe weather.

1.2 Other events
Other types of event will only be eligible for adjustment if they are outside the companies' control and caused by some external factor. For example, this includes third-party damage such as vandalism or terrorism but would not include a failure of protection equipment or a fire at a substation. Only interruptions above the following absolute thresholds are excluded from the performance:

- 25,000 customers affected (approx 1.5 CI for an average company)
- 2 million customer minutes lost (approx 1 CML)

For other events Ofgem's auditors will review the extent to which the company has taken appropriate mitigating actions. If the company has performed appropriately the full impact above the threshold will be removed. Otherwise a reduced adjustment will be applied.

In addition to the eight countries mentioned above that have full recording protocols, there is another group of five countries (Belgium-Wallonia, Estonia, Finland, France, and Lithuania) where a definition is given in the regulations, of circumstances where the company is not considered responsible for the interruption (see Annex 2 – *Force Majeure*). It is important to note that these countries have all introduced continuity standards (at single customer level) and therefore need exclusions where an event is outside the company's control.

Finally it should be noted that in Belgium-Wallonia, Finland, Lithuania, and France interruptions are recorded with an indication of causes. In Lithuania, where the regulator had already planned, when defining the causes of interruption, to introduce an incentive/penalty scheme in the near future, the attribution of responsibility is taken into account; in the other countries of this latter group the list of causes is mostly technical and does not necessarily identify the responsible party.

1.6.3 Rules for recording short interruptions

As mentioned above, Finland, France, Great Britain, Hungary, Italy and Norway (since 2005) monitor short interruptions. Among them, only Hungary and Italy count separately transient and short interruptions and in France transients are not recorded.

Short interruptions derive from the presence on the network of reclosers, that generally are remotely controlled. A recloser attempts to clear a fault in a short time, or it is remotely activated by personnel. Hence, the number of short interruptions is calculated, where possible, from SCADA information. Where this is not available companies may use counter readings on reclosing devices. In the case of multi-shot reclosing schemes, only one short interruption is counted where the successful restoration is achieved by a sequence of multiple operations in less than three minutes.

France, Great Britain, and Italy addressed an important matter in the questionnaire: how the number of users affected by this type of interruptions is assessed. In France, for MV networks, short interruptions are automatically measured for each customer with remote control systems. For LV networks, operators estimate the number of users affected by measuring short interruptions at every interface between MV and LV networks (LV substation). When an interruption occurs at a certain LV substation, every customer connected to this substation may be affected. In Great Britain the number of customers interrupted is identified in the same way as for long interruptions (see Additional Information 1.4). If a company uses periodic counts of recloser operations to calculate the number of short interruptions, the number of customers interrupted will be based on an estimate of those customers who would have been interrupted if the circuit was configured normally. In Italy, distribution companies are required (by 2006) to know the exact list of MV users affected by each short interruption using the actual network configuration at the time of the interruption.

Such measurements are particularly important in France, the only country where a standard for the maximum yearly number of short unplanned interruptions applies (to MV consumers only).

Additional Information 1.7 – rules for Sequences of interruptions

Meaningful attention must be paid to interruption sequences, as different rules are used in EU countries. As regards short interruptions, for instance:

- in Great Britain it is required to record short interruptions which follow long interruptions only if the time between the end of the long interruption and the start of the short interruption lasts more than three hours; short interruptions occurring for some customers during a long interruption for other customers on the same circuit are not counted. Short interruptions which precede long interruptions must be recorded as separate interruptions,
- In Italy short interruptions are always recorded, if there are more than three minutes from the previous interruption (short or long). Interruptions occurring to different customers on the same circuit can have different duration and are classified as long or short using each single customer viewpoint.

- In France short interruptions occurring due to reconfiguration manoeuvres within 1 hour from the beginning of a long interruption are not counted; moreover, short interruptions resulting from protections and automatic mechanisms and preceding at maximum 2 minutes a long or short interruption are not counted.

It's evident that these rules do hinder a real comparison among EU countries as regards short interruptions.

1.6.4 Audits on data collected

The survey shows that fewer than half of the surveyed countries regularly conduct audits on continuity data provided by the companies (Italy, Hungary, Norway, Great Britain, Portugal, Spain, and France). It is worth noticing that countries where standards and/or incentive/penalty regimes are in place usually carry out audits on information provided by the companies (the only exceptions being Ireland and Sweden). France is the sole country where auditing of continuity data has been implemented even if there is no incentive/penalty regime.

As is shown in Table 1.3, a number of countries seem interested in implementing audit procedures (among them Belgium-Wallonia, Lithuania, and Poland).

Audits can be conducted by different authorities: by the regulator (Italy, Hungary, and Norway), by consultants on behalf of the regulator (Great Britain), by companies on the basis of an obligation set by the regulator (Portugal and Spain – but eventually the regulator himself can conduct audits), by owners of the concession (France). Implementation of the audits can vary significantly across these countries (see Additional Information 1.8).

TABLE 1.3 AUDITS ON DISTRIBUTION CONTINUITY DATA

By regulator	IT, HU, NO
By consultants on behalf of the regulator	GB
By companies	PT
By consultants on behalf of the companies	ES (could also be examined by the regulator)
By other subjects	FR (owners of the concession)
Interested in implementing auditing	BE, LT, PO
No audits	AT, CZ, EE, FI, GR, IE, LV, SI, SE

Additional Information 1.8 – Audits on Continuity Data

In Italy the regulator determines the measurement rules and checks measurement procedures by means of randomly selected inspections of interruptions (the sites to inspect are strategically selected). Audit results are used to validate data provided by the distributors. In case of inadequate recording of interruptions, continuity data are re-calculated and so are penalties and incentives; in particular, incentives, where still due, are halved. Administrative financial sanctions are foreseen for distributors that provide false data. All regulated companies are inspected at least once every four years. For Enel, that distributes to the 85% of final customers, controls are done separately for each of the 29 SCADA operating centres in the country.

In Hungary the regulator has defined a procedure for sampling data for audits and has been auditing the 6 distribution companies at least twice per year.

In Norway the regulator controls a sample of the data and the recording procedures. When errors are found in either of the two, companies are given a deadline by which the data must be corrected and if they fail to meet the deadline they pay a daily fee until they make the required corrections.

In Portugal the regulator can conduct audits whenever he considers it necessary. In parallel, the Quality of Service Code requires companies to audit their procedures related to the analysis of quality of service every two years (the main distribution company has carried out two audits, so far). The procedure is not standardised and penalties are not applied (however, results of the audits are published).

In Spain the procedure for audits has been developed and obliges all companies to have their data audited by specialized firms before submission to the relevant authority. As of now the regulator requires the company to design the process of measurement, transfer, analysis, and storage of continuity data in such a way that will enable the verification of the entire procedure by a third party. In particular, the Spanish regulator is concerned about the preservation of confidentiality, integrity and availability of the continuity data.

In Great Britain the regulator has introduced regulatory definitions and guidance for reporting interruptions and other quality of service data, including minimum levels of accuracy companies are required to achieve. Audits on companies are carried out by consultants on an annual basis to monitor whether the 14 distribution companies are applying the definitions and whether the accuracy levels have been met. For the procedure see Annex 2 (in progress). If companies fail to meet the accuracy levels Ofgem adjusts the data to correct for inaccuracy. Ofgem may also carry out an investigation and may impose financial penalties taking into account the circumstances and the nature of the breach.

In France the city, as owner of the concession, is entitled to carry out audits on company data, eventually employing consultants. There are no procedures set by the regulators on the matter, nor data available on the number of concessions audited nor on the results of the procedures.

Sweden is planning to conduct audits on continuity data provided by the companies in the near future.

1.7 Analysis

The number of countries providing information for the different measures varied from 15 to 4 depending on the measure in question. In order to provide for meaningful comparisons a rule of thumb was used whereby countries providing 2 or fewer years' worth of data were not included in the analysis in this chapter but are instead shown in the Annex to this chapter.

Care must be taken when comparing countries' figures not only because there are a number of methods employed for calculating the continuity indicators, but also because of differences in the scope of interruptions covered, the rules determining how interruptions are counted and the robustness of the data itself. The legends in the charts in this section attempt to spell out the voltage levels captured and the information in Table 1.3 sets out the different weighting methods employed by the respective countries.

Even where countries employ the same weighting method and their interruptions data covers the same voltage levels, differences can still occur. For instance, the Netherlands make no distinction between planned and unplanned interruptions, therefore when comparing their figures in charts 1.2 and 1.5 the reader should take this into account. In Ireland long interruptions are all interruptions greater than 1 minute, whereas most other countries have adopted the standard practice of classifying long interruptions as those being 3 minutes or longer.

The remainder of this chapter is set out as follows:

	Paragraph	Table(s) in Annex
SAIDI		
Unplanned not attributable to exceptional events	1.7.1	3.1
Unplanned	1.7.2	3.2
Planned	1.7.3	3.3
SAIFI		
Unplanned not attributable to exceptional events	1.7.4	3.4
Unplanned	1.7.5	3.5
Planned	1.7.6	3.6
MAIFI	1.7.7	3.7
Energy Not Supplied	1.7.8	3.8, 3.9, 3.10
Average Interruption Time	1.7.9	3.11

SAIDI

1.7.1 Unplanned SAIDI not attributable to exceptional events

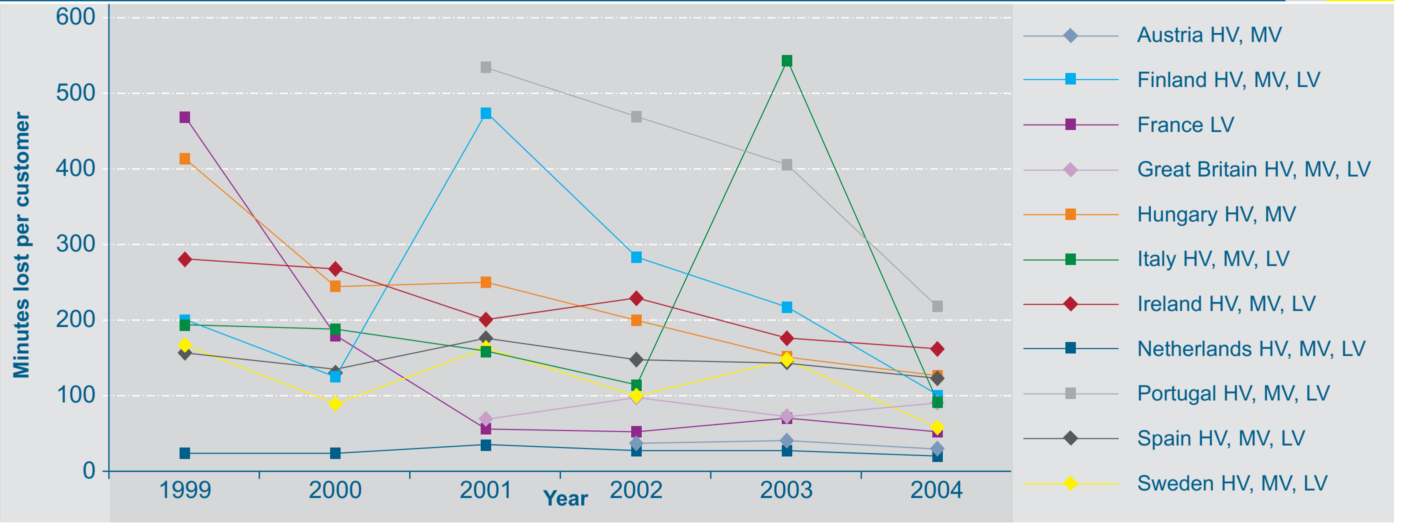
Significant care needs to be taken when comparing these figures as each country appears to have its own methodology for determining what constitutes an exceptional event. The data from Great Britain is relatively flat potentially indicating that the exclusion mechanism employed takes out nearly all the volatility from exceptional events, although the British data including exceptional events was far more stable to begin with. Overall the data indicates there have been very large improvements in the duration of interruptions. It appears that monitoring and incentivising interruptions performance is having a positive impact on performance across Europe, particularly on duration but also on the number of interruptions.

FIG 1.1 UNPLANNED INTERRUPTIONS EXCLUDING EXCEPTIONAL EVENTS
Minutes lost per customer per year (1999–2004)

1.7.2 Unplanned SAIDI

The duration of interruptions during the year is a key indicator of the quality of service that electricity customers receive. The length of an interruption can be influenced by a variety of factors such as, the level of interconnectivity on the network, the voltage at which the interruption occurred, the distance to the fault, the accessibility of the fault etc. Most countries calculate this measure based on users and the graph below shows performance from 1999 to 2004. For most countries there is a downward trend in the duration of interruptions. However for a small number of countries the data is too volatile to identify any clear trends. One potential reason for the significant volatility is the impact of exceptional events on performance.

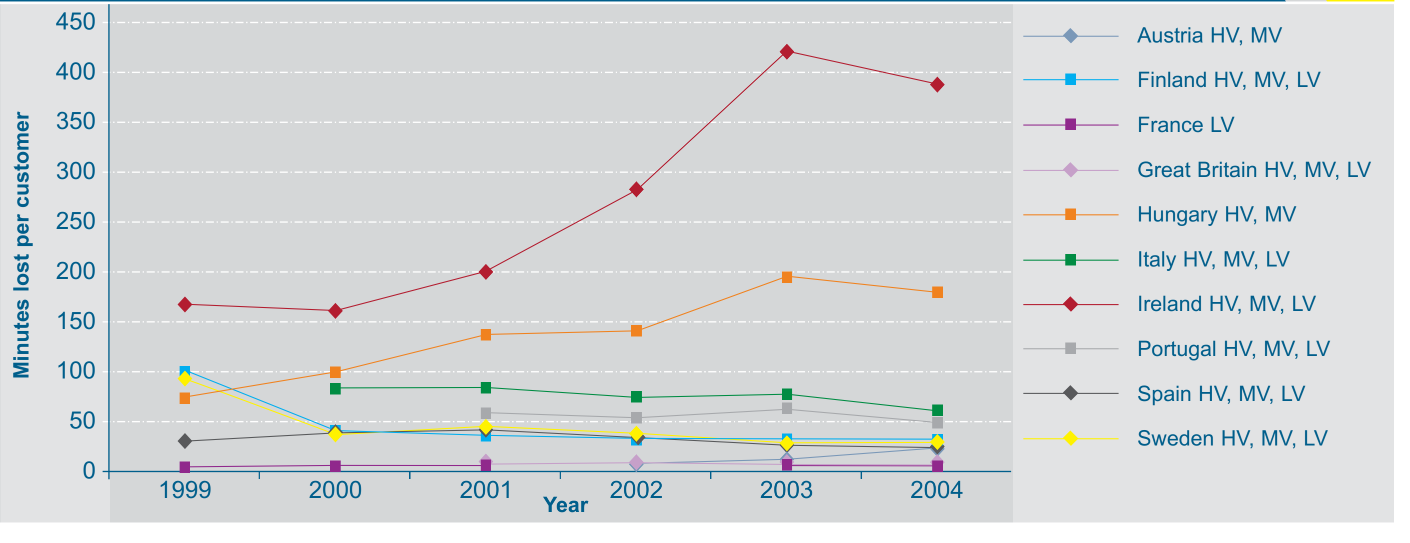
FIG 1.2 UNPLANNED INTERRUPTIONS Minutes lost per customer per year (1999–2004)



1.7.3 Planned SAIDI

Planned duration relates to those minutes off supply experienced by customers where they have been given prior forewarning that they would be going off supply. Countries have their own rules as to how much notice is required to give customers in advance of planned work, with some countries counting intended planned work not notified in the correct timeframe as being unplanned work. Planned work is undertaken for a variety of reasons such as, to make improvements to the network, to connect new customers to the network, to make permanent repairs to the network, to carry out tree-trimming activities etc. The graph below shows that a number of countries have seen major increases in the average duration off supply due to planned work. In the case of Hungary this is due to new constructions in order to replace old network elements to improve the supply quality.

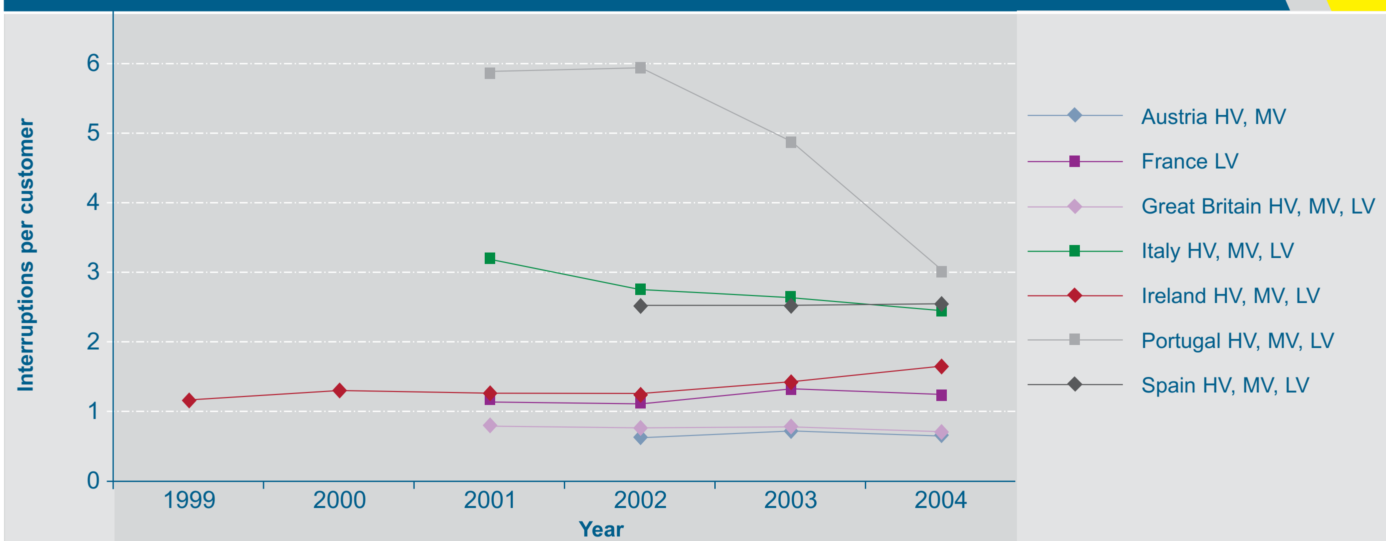
FIG 1.3 PLANNED INTERRUPTIONS Minutes lost per customer per year (1999–2004)



1.7.4 Unplanned SAIFI not attributable to exceptional events

For most countries there is a gradual decrease in the number of interruptions excluding exceptional events over the period. Being able to strip out the impact of exceptional events and focus on underlying performance is valuable to both regulators and the network operators themselves in that it allows them to understand what is happening on the networks and to identify any trends in performance. For those countries that have incentive schemes in place on the number and duration of interruptions it is essential that the incentive effects are not distorted by exceptional events. If exceptional events are left in when determining targets for annual performance there is a danger that those targets will be too easy to achieve in many years, in effect giving money to the network operators. Yet, in those years where there are exceptional events the converse may be true, with companies penalised for exceeding their targets. Given the marked differences in performance when comparing duration and interruptions data including and excluding exceptional events it is strongly recommended that countries give serious consideration to having a mechanism in place to exclude exceptional events and to introduce separate incentives or standards of performance relating to such events.

FIG 1.4 UNPLANNED INTERRUPTIONS NOT ATTRIBUTABLE TO EXCEPTIONAL EVENTS
Interruptions per customer per year (1999–2004)



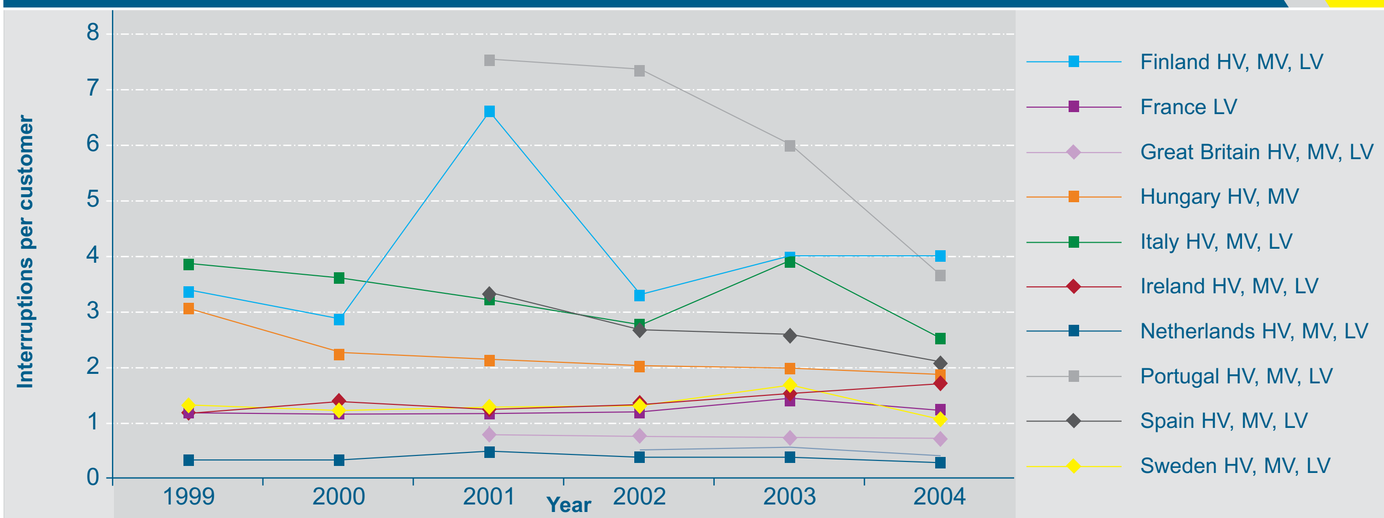
1.7.5 Unplanned SAIFI

The number of interruptions is a key indicator of the robustness of electricity networks and it is generally the case that the higher the voltage the more robust the network. However, when interruptions do occur at higher voltages they tend to impact on greater numbers of customers. Network operators have over time been seeking to reduce the number of interruptions experienced by customers and examples of ways to achieve this are, making the network more resilient, building in spare capacity known as redundancy and investing in network automation, which can result in result in customer interruptions moving from being classified as long interruptions (SAIFI) to short or momentary interruptions (MAIFI).

As can be seen in the graph below there is significantly less volatility in interruptions performance over the period than was observed in the duration graph. In most countries there appears to be a slight downwards trend in the average number of interruptions, which is understandable as once countries reach a certain level it is generally the case that further improvements in performance are likely to be incremental.

A number of countries have made significant strides in reducing the number of interruptions, with performance in Hungary and Italy dropping by over 1 interruption per customer in six years. Even some of those countries previously recording quite low levels of interruptions have been able to further reduce interruptions. Great Britain, the Netherlands and Spain have all seen significant percentage improvements in the number of interruptions. The impact of exceptional events is usually less pronounced for the number of interruptions compared to the impact on duration, although a number of specific atypical events in Italy in 2003 had a marked impact on the number as well as the duration of interruptions.

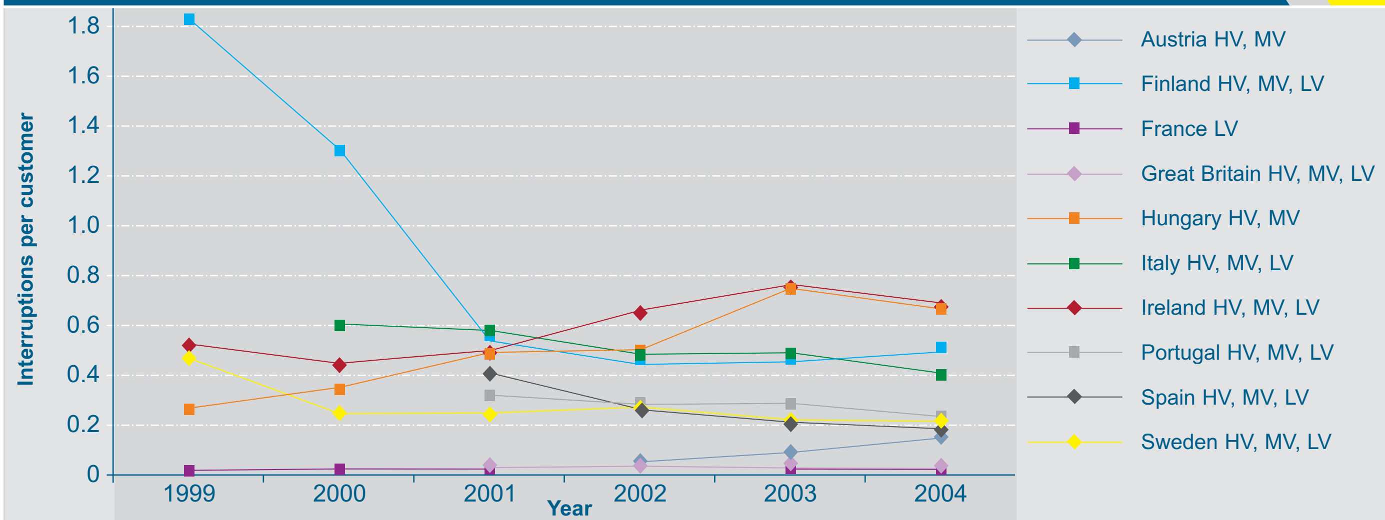
FIG 1.5 UNPLANNED INTERRUPTIONS Interruptions per customer per year (1999 – 2004)



1.7.6 Planned SAIFI

The number of interruptions due to planned work was somewhat volatile across the thirteen countries providing data. The two countries experiencing major increases in the duration of planned interruptions also recorded increases in the average number of planned interruptions. In some countries the amount of planned work carried out on the networks has a less significant impact on the planned duration and interruption figures, as many network operators now employ techniques which enable them to work on networks whilst they are still live, therefore avoiding interruptions and minutes lost.

FIG 1.6 PLANNED INTERRUPTIONS Interruptions per customer per year (1999 – 2004)



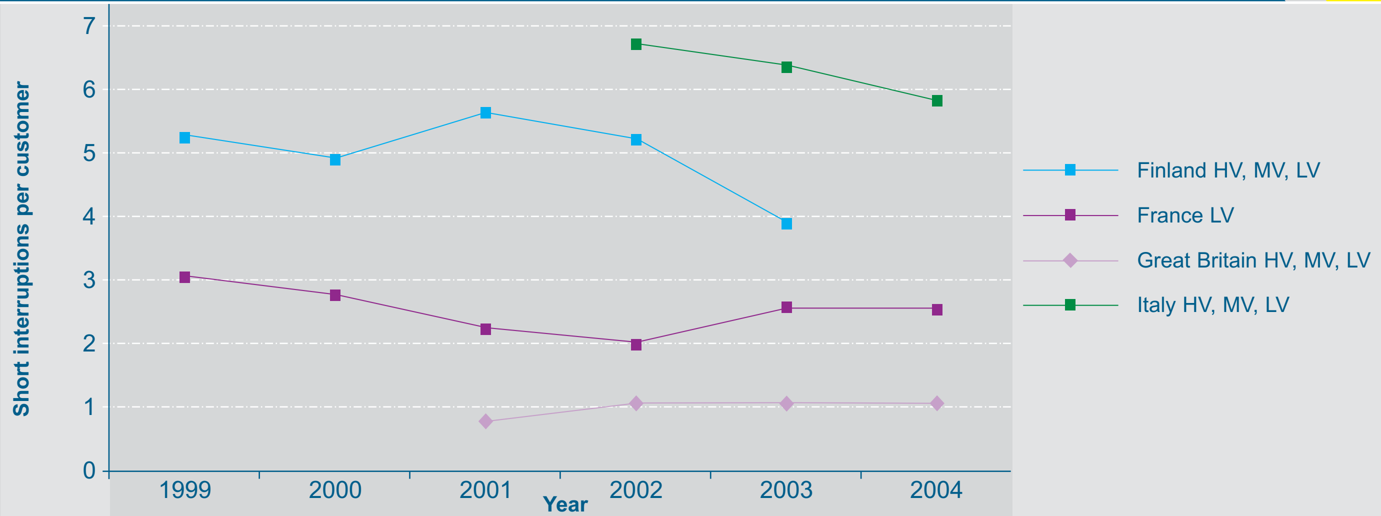
1.7.7 Unplanned MAIFI

Some countries make no distinction between long and short interruptions and others do not collect any information on interruptions lasting less than 3 minutes. Additionally, not all countries differentiate between interruptions lasting less than one second, known as transient interruptions, and those lasting longer than 1 second and less than 3 minutes. The number of short interruptions can in certain instances give network operators advanced warning of developing problems which they can then address before they turn into long interruptions. As network operators invest in more automation and remote control it is likely that the number of short interruptions will increase. It may be that in the future customers demand limits on the number of repeat short interruptions and a number of countries feel it is useful to keep track of this information at this time.

Hungarian data for 2003 and 2004 is shown in Table 3.7 in the Annex and this shows the total number of short interruptions per customer excluding exceptional events. Hungary splits short interruptions into transients (less than 1 second) and all other short interruptions (1 second to less than 3 minutes) but has found the data to be unreliable and has begun a project to ensure consistent short interruptions data from 2006.

As explained in additional information 1.7, the different rules for the sequences of interruptions used in the countries that report short interruptions make the comparison of such data hard to be meaningful.

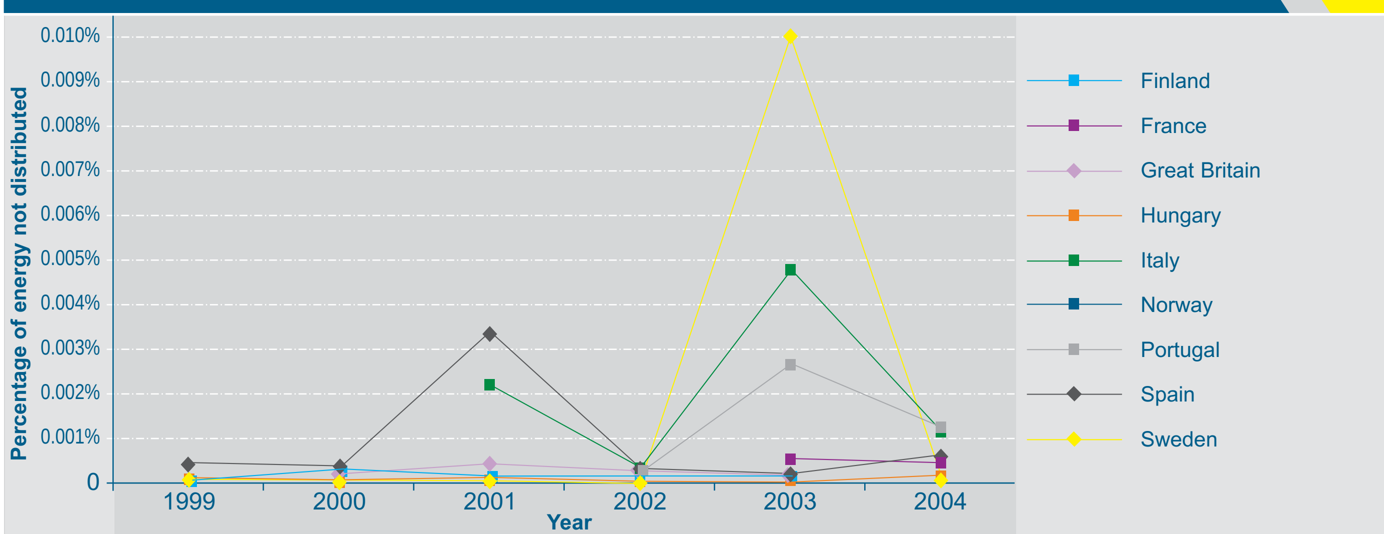
FIG 1.7 UNPLANNED INTERRUPTIONS Short interruptions per customer per year (1999 – 2004)



1.7.8 Electricity Not Supplied (ENS)

The level of electricity not supplied gives an indication of the overall robustness of a country's electricity networks. For most countries the information relates to transmission networks only, although there are some countries such as Italy, where the ENS and AIT information includes data from interruptions at distribution high voltage. Given that all other things being equal, a larger system would tend to record more energy not supplied than a smaller system, the information on ENS is presented as energy not supplied as a percentage of the total energy supplied by that system in a given year.

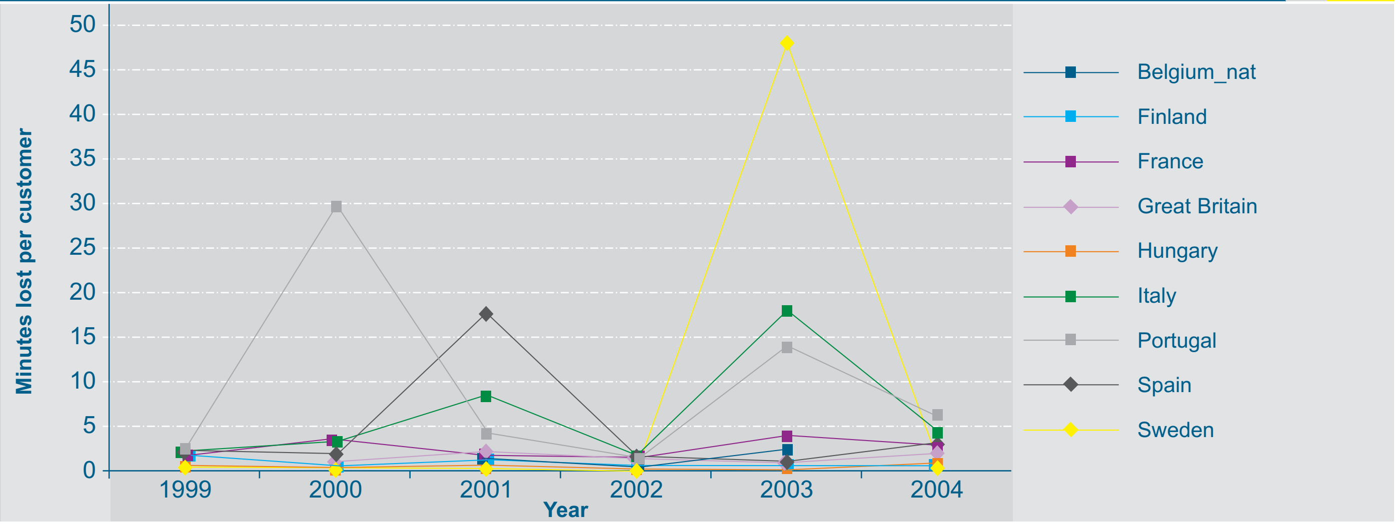
FIG 1.8 ENS AS A PERCENTAGE OF DISTRIBUTED ENERGY (1999 – 2004)



1.7.9 AIT (Transmission)

Transmission networks are generally designed to higher standards than distribution networks and as a result faults taking customers off supply are relatively infrequent. However, when there are interruptions on the transmission they tend to result in large numbers of customers being off supply and high values for energy not supplied. Figs 1.6 and 1.7 illustrate this clearly, with most countries showing average AIT below 10 minutes lost per year but a number of countries experiencing peaks two, three or even five times this level. Such peaks often make headline news internationally as well as nationally, as was the case in the transmission outages in London and Birmingham in Great Britain in 2003, the blackouts and load shedding in Italy in 2003 and the transmission outage in southern Sweden in 2003. The peaks in AIT are generally mirrored by those in ENS, although the percentage change generated in Portugal for AIT in 2000 was higher than that for ENS, whilst in Spain the percentage ENS in 2001 was greater than the percentage change in AIT.

FIG 1.9 AIT (1999 – 2004) AIT – Minutes lost per year – Transmission network – all interruptions



1.8 Further analysis of interruptions set out in the Annex to this chapter

A range of additional analysis has been carried out studying the relationship between the number and duration of interruptions and network and customer characteristics. The additional analysis is set out in the Annex to this chapter. The key findings are set out below:

- Excluding exceptional events from short interruptions data is not a common practice across Europe;
- As would be expected there is a strong positive correlation between the number of interruptions and the duration of interruptions;

- There is some evidence to support the view that denser networks *(having a higher ratio customer/km)* have fewer interruptions and fewer minutes lost per customer per year than less dense networks (although the R^2 values were very low);
- Urban, suburban and rural data supports this view, with performance in urban areas being far better than that in rural areas; and
- For most countries the majority of interruptions and customer minutes lost are as a result of faults on MV networks.

1.9 Conclusions: recommendations for future work on Continuity Indicators

1. **Common continuity indicators**: As interruptions occur at all voltage levels it is beneficial to use common continuity indicators across all voltage levels, in order to provide customers and companies with a complete and readily understandable picture of the quality of service delivered.
2. **Standard basis for continuity indicators**: The separation of short interruptions and long interruptions provides useful information to customers, companies and regulators and countries should attempt where possible to split their data in this way.
3. **Continuity indicators for planned and unplanned interruptions**: Splitting interruptions data between planned and unplanned interruptions can allow regulators to apply lower weighting to planned interruptions given that customers can make prior arrangements. Having a clear split can also give public visibility to programmes undertaken to improve long-term quality of service, but which may result in short-term decreases in quality of service. It also allows comparisons between volumes and types of planned work and the impact on customers.
4. **Publication of continuity data**: Making information on continuity performance public is a key way of ensuring that companies keep their focus on quality of service and also of encouraging customers to understand the performance they receive and it is recommended that countries make such information readily available in as timely and user friendly manner as possible.
5. **Weighting method**: The majority of countries included in this chapter base their weighting of continuity indicators on the number of customers, weighting by “user”. It is recommended that those countries seeking to introduce continuity indicators should give strong consideration to weighting by user.
6. **Force majeure**: It is strongly recommended that countries develop a set of rules regarding events which are outside of the control of the distribution companies and which can then be excluded from annual performance, be it as part of an incentive scheme or purely for comparative purposes. The ability to identify, monitor and possibly incentivise underlying performance is greatly aided by stripping out large scale events outside of the control of distribution companies.

CHAPTER 2 – The Use of Standards and Incentives in Quality Regulation

CONTENT

THE USE OF STANDARDS AND INCENTIVES IN QUALITY REGULATION

2.1 Introduction: what is quality regulation and why is it needed?

In recent years, a growing number of countries have adopted price-cap as the form of regulation for electricity distribution, and sometimes also transmission, services. Price-cap regulation without any quality standards or incentive/penalty regimes for quality may provide unintended and misleading incentives to reduce quality levels. Incentive regulation for quality can ensure that cost cuts required by price-cap regimes are not achieved at the expense of quality.

The increased attention to quality incentive regulation is rooted not only in the risk of deteriorating quality deriving from the pressure to reduce costs under price-cap, but also in the increasing demand for higher quality services on the part of consumers. For these reasons, a growing number of European regulators have adopted some form of quality incentive regulation over the last few years. Moreover, quality is multidimensional and some aspects of quality have a long recovery time after deterioration. Hence, quality of service is usually regulated over more than one regulatory period to address numerous issues, including continuous monitoring of actual levels of performance.

The objective of this chapter is to provide relevant and comparable information on the regulation of quality in the electricity distribution and transmission services, as enforced in CEER-member countries. This chapter deals with standards and incentive/penalty regimes related to continuity of supply[12]. It is the first time that the CEER's Quality of Electricity Supply Benchmarking report reviews existing incentive regulations for quality. Therefore, this chapter should be regarded as a first and general-purpose comparison, while more focused comparisons could be developed in future.

Incentive Regulation (IR) for quality comprises essentially three aspects:

- **measuring actual and perceived levels of quality –** a necessary and preliminary step, since setting continuity standards and/or incentive/penalty regimes requires robust and reliable data on the service actually provided and on customers' perception. The subject of continuity measurement was extensively discussed in Chapter 1 and is only briefly summarized in Section 2.2; the same section describes customer surveys, through which regulators can collect additional information on quality as perceived by customers, which is extremely valuable for regulatory decision-making;
- **promoting continuity improvement**, which means giving utilities signals and incentives to evaluate their investment and management decisions not only in light of their costs but also taking into account the effects on actual quality levels. Regulators can promote continuity improvement especially by introducing incentive/penalty schemes, generally based on system-level quality standards that refer to the average quality level in a geographical area. Section 2.3 describes such incentive/penalty regimes and, whenever possible, their effects;

[12] For commercial quality standards, please refer to Chapter 3. For voltage quality, please refer to Chapter 4.

- **ensuring good continuity levels to consumers**, especially worst-served ones; regulators can do this through guaranteed standards that refer to the quality level experienced by each single customer connected to the network. Single-customer guaranteed standards are associated with the payment of compensations to the affected customers where the company fails to meet the standard. Section 2.4 deals with continuity standards at single-customer level and customer compensations.

At the end of each section, a number of findings identified from the comparison are summarised. Some recommendations for future work, from the surveyed experience, are given as conclusions of the chapter. The findings and recommendations, together with this introduction, can be read as an executive summary of the chapter. Furthermore, space has been devoted to the more detailed description of some regulatory experiences of special interest, through boxes containing additional information. There are also some comparative tables that analyse the most substantive issues.
The survey is based on data provided by 19 countries: Austria (AT), Belgium (BE)[13], Czech Republic (CZ), Estonia (EE), Finland (FI), France (FR), Great Britain (GB), Greece (GR), Hungary (HU), Ireland (IE) Italy (IT), Latvia (LV), Lithuania (LT), Norway (NO), Poland (PL), Portugal (PT), Slovenia (SI), Spain (ES) and Sweden (SE).
Note that quality standards and incentive/penalty regimes might be issued by legal bodies different from regulatory authorities. In some countries regulators do not have the legal power to set quality standards, however, generally they can at least make proposals on the subject to the competent institution. More detailed information can be found in Annex 2 (Competencies of regulators with regard to quality regulation).
The data were collected through a questionnaire containing about one hundred open-answer questions and through a series of clarifications made by the single countries at the request of the authors of this chapter. The findings and final recommendations have been discussed and agreed by the CEER Member Authorities.

2.2 Quality measurement: a prerequisite for standards and incentives

Setting continuity standards and incentive/penalty regimes requires firstly robust and reliable data and secondly that the outputs to be regulated are relevant and important for consumers. This means that there are two main prerequisites for setting standards and incentives:
- continuity measurement systems;
- customer surveys on satisfaction, expectations and willingness to pay.

In the two following paragraphs these prerequisite are briefly illustrated; for a more comprehensive discussion of continuity measurement systems, see Chapter 1. A summary of the most relevant issues concludes the section (Findings I).

[13] Belgium has a federal organization for regulation activities. The national regulator (CREG) is only concerned with the national transmission network, while 3 regional regulators are concerned with local transmission and distribution networks. Only regional data from the regions Wallonia and Flanders are available and included in this report.

2.2.1 Continuity measurement systems

As described in Chapter 1, there is a widespread commitment by regulators to regularly monitor actual levels of continuity of supply, by collecting data from distribution and transmission companies, and to publish the data for benchmarking (Table 2.1). The most common indicators are SAIDI and SAIFI for long interruptions (duration > 3 minutes) for distribution and ENS and AIT for transmission. Usually both planned and unplanned interruptions are monitored separately. Concern for planned interruptions on the part of the regulator is motivated by the fact that even planned interruptions have a cost for consumers. As long as they are informed in advance, however, they will be able to reduce their outage costs and inconvenience.
At present, very few regulators have data on the number of short interruptions (duration < 3 minutes). However, it is clear that regulators are increasingly concerned about short interruptions as they become increasingly relevant to business customers. Monitoring short interruptions requires attention to technical details and is, naturally, the prerequisite for setting regulatory standards.
It was rather clear from the survey that significant differences exist with regard to accuracy and completeness in the measurement and registration of the data. This diversity makes it difficult, even today, to fairly compare numerical values. One example for all is the measurement of interruptions originated on LV circuits. Where these are not measured (more than half of the countries surveyed), the number and duration of interruptions actually experienced by consumers will be worse than indicated in the reported data.

TABLE 2.1 MONITORING AND COMMUNICATION OF CONTINUITY INDICATORS

	Measure long interruptions	Measure short int's	Measure separately planned/unplanned	Voltage level	Information to regulator	Publication
AT	✓		✓	HV, MV	Yearly	✓
BE	✓(>15' in LV)		✓	HV, LV	Yearly	
CZ	✓		✓	HV, MV, LV	Yearly	✓
EE	✓		✓	HV, MV	Yearly	✓
ES	✓		✓	HV, MV	Yearly	✓
FI	✓	✓	✓	HV, MV, LV	Yearly	✓
FR	✓	✓	✓	HV, MV, LV	Yearly	✓
GB	✓	✓	✓	HV, MV, LV	Yearly	✓
GR	✓		✓	HV, MV, LV	Yearly	✓
HU	✓	✓	✓	HV, MV, LV	Yearly	✓
IE	✓(>1')	✓(>1')	✓	HV, MV	Yearly	✓
IT	✓	✓	✓	HV, MV, LV	Yearly	✓
LT	✓		✓	HV, MV, LV	Quarterly	✓
LV	✓			HV, MV	Yearly	✓
NO	✓		✓	HV, MV	Yearly	✓
PO						
PT	✓		✓	HV, MV, LV	Quarterly	✓
SI	some data available	some data available	some data available	HV, MV	upon request	✓
SE	✓		✓	HV, MV	Yearly	✓

Comparison of data across countries is made inherently difficult by the fact that performances vary substantially even among companies and within the same company. As suggested by Ofgem, factors that influence performance can be grouped into three classes:

- **Inherent factors** such as weather conditions, geography and population density of a particular area;
- **Inherited factors** such as the design of the network at the starting moment of incentive regulation and/or privatisation (e.g. some companies or areas may have long, predominantly overhead circuits, whilst others may have more underground lines). It takes a long time and significant capital expenditure to fundamentally alter network design;
- **Incurred factors** such as managerial performance, how well assets are maintained, and how effectively resources are used.

Reliable and robust data is crucial for incentive regulation on continuity. On the one side, it clearly emerged from the survey that the majority of regulators have not established or approved rules for recording interruptions (see Table 2.2). On the other hand, measurement protocols are generally found in almost all of the eight countries where an incentive/penalty regime is implemented (not in all countries that have set continuity standards at system- or customer-level). These protocols require companies to measure and analyse data in a manner that is consistent with regulatory purposes, enable the regulator to control the registration process, and give credibility and fairness to financial incentive regimes. The most critical issues in measurement protocols that affect the implementation of incentive/penalty regimes are classification of causes (in particular force majeure: this is defined in the great majority of countries, see Annex 2.1), and identification of the number of consumers affected by the interruptions (or its estimate).

TABLE 2.2 RECORDING, AUDITS, AND QUALITY REGULATION

	Rules for recording long interruptions	Classify interruptions with causes	Definition of Force Majeure	Audits	Continuity standards*	Incentive/penalty regime
AT	✓	✓	✓			
BE		✓	✓		✓	
CZ	✓	✓	✓		✓	
EE			✓		✓	✓
ES	✓	✓	✓	✓	✓	
FI		✓			✓	
FR		✓	✓	✓	✓	
GB	✓		✓	✓	✓	✓
GR						
HU	✓	✓	✓	✓	✓	✓
IE		Not regularly			✓	✓
IT	✓	✓	✓	✓	✓	✓
LT		✓	✓		✓	
LV						
NO	✓			✓	Proposal	✓
PO						
PT	✓	✓	✓	✓	✓	✓
SI		✓				
SE	✓				✓	✓

* any type of standards, at system level or at single-customer level.

Almost all countries having adopted incentive/penalty schemes regularly audit data provided by companies. The variety of auditing systems (audits can be carried out by regulators themselves, by consultants, or even by the companies according to procedures set by the regulator) should facilitate the diffusion of such important measures in other countries, especially those interested in implementing a financial incentive scheme. It is important that audits be carried out more frequently when the incentive/penalty regime is first introduced. Frequency of audits can then be relaxed over time.

2.2.2 Customer surveys

Customer surveys are an additional, important form of "measuring" quality, complementary to continuity measurement systems. Even if customer surveys are not widely used by regulators, customer research can provide useful information on customer satisfaction, expectations and Willingness To Pay (WTP) for quality. This information is useful in regulatory decisions regarding the choice of quality factors and services to be monitored and given the presence of incentives. For this reason, regulators who do carry out customer research usually find them extremely important and use the results in various matters of regulation.
The most frequent issues explored through customer research are (see Table 2.3):

- **Customer satisfaction**: this is the typical subject of customer research, either occasionally (like in Portugal) or periodically (like in Hungary, Italy, Great Britain); acccording to the separation between network operator and energy supplier, the common quality factors on which customers are requested to express their satisfaction are:
  - regarding the network operator: continuity of supply, troubleshooting, voltage fluctuation, staff behaviour, information provided;
  - regarding the supplier: punctuality of bills, details of bills, complaints handling, information provided, billing adjustments in case of errors.
- **Customer expectations and importance of quality factors**: this is a more sophisticated matter that can provide regulators with useful information for standard setting and for identifying new areas of regulatory intervention. Often, continuity of supply is felt as the most important quality factor (for instance in Portugal and in Italy), but more focused research can uncover new areas of great interest to consumers. For instance, Ofgem's latest study, published on Ofgem's website in June 2004, suggests that British customers' main priorities are:
  - improving restoration times following storms;
  - receiving accurate information during power cuts;
  - reducing the number and frequency of power cuts;
  - carrying out some degree of undergrounding in national parks and areas of outstanding natural beauty.
- **Customer willingness to pay**: this type of quantitative research is done by many of the regulators that introduced incentive regulation for continuity of supply and is used by them, together with cost and performance information, to get information on incentive rates and cost allowances of the incentive schemes. This kind of research is based on "contingent valuation": this means that, in order to quantify the valuation of economic damage ensuing from interruptions, generally one or more "interruption scenarios" are proposed to the interviewee. WTP

research is the most difficult to carry out and can lead to results that are hard to interpret; for instance, both in Italy and in Great Britain, WTP studies have shown higher than expected willingness to pay, even if the vast majority of both household and business consumers feel that the price they pay to electricity suppliers is consistent with the value they receive (e.g., in Hungary 84.4 % of household customers and 77.8 % of business customers declare that the price they pay to electricity suppliers is perfect, mostly or fairly in harmony with its value).

TABLE 2.3 CUSTOMER SURVEYS CONDUCTED BY REGULATORS

Other specific matters	GB (quality of telephone response, monthly)
Customer surveys on willingness to pay (WTP)	NO (2001), IT (2003), GB (2004), SE (2003)
Customer surveys on expectations and importance of quality factors	HU (annually), IT (1998)
Customer surveys on satisfaction	HU (annually), IT (annually), GB (every 5 years), PT (occasionally)
Customer surveys under preparation	GR
None	AT, BE, CZ, EE, ES, FI, FR, IE, LV, LT, PL, SI

Additional Information 2.1 – Incentives for Quality of Telephone Response through Customer Surveys in Great Britain

The case of Great Britain is probably the most innovative as regards the use of customer surveys. Results from customer satisfaction become, in fact, an indicator in the incentive/penalty regime, even if with a weight that is largely lower than the continuity-based indicators. The regulator (Ofgem) carries out monthly surveys of the quality of telephone response. The regulator commissions market research consultants to call back customers who have contacted their distribution business in relation to an emergency or power cut. The customers are asked to rank the company from 1 to 5 where 1 is very dissatisfied and 5 is satisfied in four key areas:

- politeness of staff;
- willingness of staff to help;
- accuracy of information provided;
- usefulness of information provided.

Nine hundred customers are interviewed each year for each distribution company. Companies are then incentivised on the basis of their annual mean score. Companies are subject to a sliding-scale penalty if their annual mean performance deteriorates below 4.1. If their annual mean scores fall below 3.6, companies will be liable for the full penalty of 0.25 per cent of revenue. There will be a small reward of 0.05 per cent of revenue for those companies with annual mean scores greater than 4.5.

2.2.3 Findings I: Quality measurement as a prerequisite for standards and incentives

IR#1: *Quality performance depends on some country-specific conditions, related to inherent factors (such as geography and weather conditions), inherited factors (which can be changed only over a long period of time, such as network configurations) and incurred factors. Moreover, each regulator has different powers in quality standard-setting and in fixing customer compensation.*

IR#2: *Reliable and robust data is crucial for setting standards and introducing incentive regulation on continuity. Measurement protocols are generally found in almost all countries where an incentive/penalty regime is implemented. These protocols require companies to measure and analyse data in a manner that is consistent with regulatory purposes, enable the regulator to control the registration process, and give credibility and fairness to financial incentive regimes. Almost all countries that have adopted incentive/penalty schemes regularly audit data provided by companies.*

IR#3: *Customer satisfaction is the most frequent subject of market surveys; in some cases, regulators survey other issues that are relevant for their decision making, like willingness-to-pay and customer expectations for service levels (see Table 2.3). In a few cases, regulators make focused surveys, regarding satisfaction with specific services (e.g. quality of telephone response, see additional information 2.1).*

2.3 Continuity standards at system-level and incentive/penalty regimes

In the past five years regulators have developed incentive/penalty regimes for continuity that are linked to continuity standards at the system level. As far as the distribution service is concerned, incentive/penalty regimes are in place in eight countries out of 19 surveyed: Italy (from 2000), Norway and Ireland (from 2001), Great Britain (from 2002), Hungary and Portugal (from 2003), Sweden (from 2004), and Estonia (from 2005). Note that in Estonia the incentive/penalty regime, introduced on both distribution and transmission, is too recent to be described in the present report. Other countries expressed interest in introducing an incentive scheme in the future: Finland (from 2008), France, Lithuania (from 2008), Poland, Spain, and Slovenia (see Table 2.4).

TABLE 2.4 SYSTEM-LEVEL STANDARDS OF CONTINUITY: DISTRIBUTION

System-level continuity standards	GB (SAIDI, SAIFI), HU (Outage rate, faults/km, average repair time (MV), average number of grouped faults (LV), SAIDI, SAIFI, Percentage of interr. restored within 3 and 24 hrs). IE (SAIDI and losses until 2005; SAIDI, SAIFI and losses from 2006), IT (SAIDI), NO (ENS), PT (ENS), SE (SAIDI, SAIFI), ES (TIEPI-MV, NIEPI-MV, 80 percentile TIEPI-MV), EE (not available)
Special plans	ES, PT, SE
Incentive/penalty regime	EE, GB, HU, IE, IT, NO, PT, SE
Interest or intention	ES, FI, FR, LT, PL, SI

As for transmission systems, system-level continuity standards are not very common (see Table 2.5). They are set only by the regulators in Great Britain, Italy (from the end of 2005), and Hungary. Incentive/penalty regimes are applied in Great Britain, Hungary and Norway and will be applied in Ireland starting in 2006 (Italy, France and Spain are moving in this direction).

TABLE 2.5 SYSTEM-LEVEL STANDARDS OF CONTINUITY: TRANSMISSION

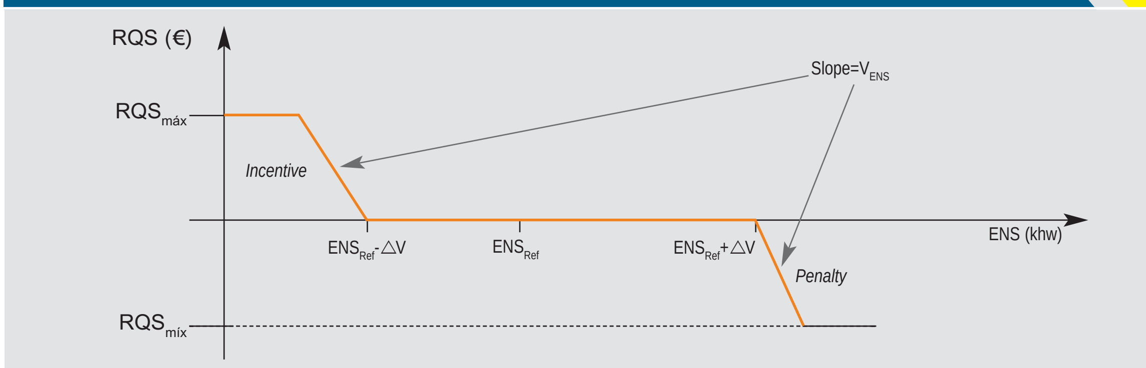
System level continuity standards	GB (ENS), HU (network availability, outage rate), IT (expected at the end of 2005), EE (not available)
Incentive/penalty regimes	GB [incentives and penalties in form of increase (1% max)/decrease (1.5% max) in allowed revenues], HU (only penalties in form of fines), IE (System Minutes Lost, at risk 0,4% of controllable costs from 2006), NO (same regime as for distribution), EE (not available)
Interest/intention in incentive regime	ES, FR, IT

This section illustrates the regulatory mechanisms adopted in the surveyed countries. The incentive schemes implemented are all based on the same principle: the revenues of the company are modified upward or downward depending on its performance in terms of continuity of supply, measured as the distance between actual system-level continuity standards and a predefined target. Although the principle is the same, the mechanisms adopted in European countries are quite different in numerous respects, as will be explained below. In order to facilitate understanding of the comparison the Portuguese mechanism, chosen for its simplicity, is described in detail (Additional Information 2.2).

Additional Information 2.2 – Portugal: incentive/penalty regime

The Tariff Code, published by the Portuguese regulator (ERSE) establishes an incentive scheme to improve continuity of service. The financial measures affect the annual adjustment of the allowed revenues for the activity of electricity distribution in MV and results in a penalty or a reward, depending on the results of continuity of service performance.
The continuity indicators considered in the incentive scheme is the Energy Not Supplied (ENS). The incentive scheme is represented in Figure 2.1.

FIGURE 2.1 PORTUGUESE INCENTIVE SCHEME



The incentive is symmetric and related to a reference value (target) of the Energy Not Supplied (ENS_{Ref}). A dead band applies.

- If the value of ENS in a given year is less than ENS_{Ref}-$\triangle$V, which means that the network had a good performance, the distributors' revenues are increased by an amount RQS (revenues for quality of supply), expressed in €. RQS is computed using a per-unit-value of the ENS, V_{ENS}, and is proportional to the difference between the actual ENS in the year and the target ENS_{Ref}-$\triangle$V:

$$RQS= V_{ENS} x[(ENS_{Ref}-\triangle V) - ENS]$$

- If the value of ENS in a given year is greater than ENS_{Ref}+DV, which means that the network had a bad performance, the distributors' revenues are decreased by an amount RQS, in €. RQS is computed using a per-unit-value of the ENS, V_{ENS}, and is proportional to the difference between the actual ENS in the year and the target ENS_{Ref}-$\triangle$V:

$$RQS= V_{ENS} x[ENS-(ENS_{Ref}+\triangle V)]$$

- If the value of ENS in a given year is near the ENS_{Ref} value, the distributor's revenues are not affected (if $ENS_{Ref}-\triangle V \leq ENS \leq ENS_{Ref} \pm \triangle V$, then RQS=0).

- The parameters used in 2005 are the following:
  - The reward and the penalty have the same maximum value: $|RQS_{min}|= |RQS_{max}|$ = 5 000 000 €
  - Target: ENS_{Ref} = 0,0004 x ES (ES=energy supplied in the year)
  - Dead band: ± $\triangle$V = 0,12 x ENS_{Ref}
  - Value of ENS: V_{ENS} = 1,5 €/kWh

- This incentive scheme is applied with a two-year delay: in 2005 for performance in 2003.

Incentive/penalty regimes are compared on the basis of a number of characteristics. Among these are the indicators included in the scheme, the baseline for standards, the form of financial incentives/penalties, the effectiveness of the scheme and the expected changes over time. A summary of the most relevant issues concludes the section (Findings II).

2.3.1 Incentive/penalty schemes adopted in European countries

Incentive/penalty schemes have been implemented in European countries with the general objective of improving/maintaining continuity levels at a socio-economically acceptable level, in particular under price- or revenue-cap types of regulation. In one case only (Italy) has the regulator designed the mechanism specifically around a country-specific objective: the convergence of continuity levels towards unique targets (for districts having the same territorial characteristics). Prior assessment of current continuity levels can, in fact, show the need to address specific issues (Table 2.6).

TABLE 2.6 TYPE OF INCENTIVE/PENALTY REGIMES ADOPTED IN EUROPEAN COUNTRIES

	Objectives	Incentive and/or penalty	Other schemes	Duration
GB	Improve continuity levels	both	Guaranteed Standards (GS) on maximum restoration time: GS on maximum yearly number of long unplanned interruptions	5 years (as price control period)
HU	Improve continuity levels Compensate drawbacks of price cap regulation	both	GS on maximum restoration time	No predetermined duration. From 1 January 2006 a new regime will be introduced for 3 years. No correlation with the price control period (4 years).
IE	Improve continuity levels	both	GS on maximum restoration time	5 years (as price control period)
IT	Improve continuity levels and reduce regional gaps in continuity through a "convergence" mechanism	both	GS on maximum yearly number of long unplanned interruptions per HV and MV customer GS on maximum restoration time under consultation	4 years (as price control period)
NO	Achieve a socio- economically acceptable level of continuity (rather than to improve it)	both	None	No predetermined duration until now. From 2007 there will be some small changes in the scheme.
PT	Improve continuity of service levels	both	GS on Maximum yearly cumulative duration of unplanned interruption (all voltage levels), GS on Maximum yearly number of long unplanned interrup-tions (all voltage levels), Special Plans for improving Quality of Supply	No predetermined duration
SE	Achieve a socio-economically acceptable level of continuity	both	GS on maximum restoration time under evaluationObservation of the worst performing areas	No predetermined duration (ex-post regulation, year by year)

In all cases surveyed, the scheme includes both penalties and rewards and, since it is designed to address system-average continuity levels, is or will be complemented by some form of protection for the worst-served consumers. In general this is done by introducing Guaranteed Standards (GS) on duration and number of long interruptions (maximum restoration time being the most common, see section 2.4). Sometimes this assumes the form of observation of the worst-performing areas (Sweden) or, as in Portugal and Spain, of a quality improvement plan financed through tariffs (See Additional information 2.3).

Additional Information 2.3 – Worst performing areas

In Portugal, a distributor experiencing difficulties in meeting quality standards can submit a temporary action program aimed at improving its performance in a specific location. The program, with a maximum duration of 2 years, must be approved by the Ministry after consultation with the regulator. Special plans are financed through tariffs.

In Sweden, a quality of supply index is calculated for every company using a network performance assessment model (see Additional Information 2.4). The regulator observes the change in this index from year to year and investigates any companies that present a persistently low quality of supply over a period of few years. Companies below the lower quality boundary can be checked for quality issues, regardless of the company's performance from a tariff regulation point of view.

Spain does not have an incentive/penalty regime yet, but it has set system-level continuity standards, which are not only evaluated as average levels in a given territory but aimed at identifying worst-served areas in that region. Standards are set on TIEPI, 80th percentile TIEPI, and NIEPI, and differentiated by density areas. Distribution companies experiencing difficulties in maintaining the quality required in certain areas are given the opportunity to submit, to the competent administration, a temporary action programme describing the problems that need to be corrected. Those programmes will be included in a quality improvement plan financed through the tariff. Special plans have been implemented since 2004 and the amount of expenses recovered through this mechanism has been quite large so far: for 2004 special plans received a budget of 50 million, increased to 80 million for 2005.

Incentive/penalty schemes have in most cases the same duration as the price control period (4 or 5 years) and in a few cases have no predetermined duration. All schemes are periodically reviewed: in the first case, with the same frequency as the tariff, in the second at the regulator's discretion. When the review is performed at the same time as the tariff adjustment it should be easier to separate the expected level of continuity (remunerated via the base tariff) from the improvements, financed via the incentive scheme.

2.3.2 Indicators used for incentive/penalty regimes

The indicators included in the incentive schemes are usually one or two (in some cases SAIDI only; in other cases both SAIDI and SAIFI; occasionally ENS, Energy Not Supplied) and concern long interruptions. Until 2005, Hungary monitored several indicators, but it is planning to use only three starting in 2006 (Table 2.7).

In some cases the indicator includes only unplanned interruptions, in others also planned ones. In the latter case, planned interruptions are usually not given the same weight as unplanned ones. In Great Britain, where the regulator found evidence from a customer survey that their impact is about half that of unplanned interruptions, they have been counted with a 0.5 discount factor since 2005. In Norway their reduced impact on consumers is taken into account in the incentive rate, which is lower than the incentive rate for unplanned outages (but more than half of it). Planned interruptions in Norway were evaluated using data from a customer survey (i.e. in the same manner as unplanned interruptions, see paragraph 2.3.4). In any case is important to be aware of the fact that a scheme that allows companies to gain higher revenues by reducing planned interruptions, on the one hand, can induce companies to adopt a more efficient maintenance program or, on the other hand, may create a long term risk due to insufficient maintenance of the network. This may be especially true if the company is close to its target halfway or three-quarters of the way through the year: the company may choose to defer planned work.

TABLE 2.7 INDICATORS USED FOR INCENTIVE/PENALTY SCHEMES

	Indicators	Planned	Exclusions	Rolling average
GB	CIs: number of customers interrupted per 100 customers, CML: average number of customer minutes lost per customer	Included in CML and CIs with 50% weighting from 2005	exceptional events; separate regulatory mechanism (see Additional information 2.6)	No
HU	Network Security (NS) indicators: *Outage rate,* Number of MV faults per grid length, Average repair time of MV network, Average number of LV grouped faults. Continuity of Supply (CS) indicators, *SAIDI, SAIFI,* Percentage of interruptions restored within 3 and within 24 hrs	Excluded	NS: no CS: yes	Yes: three year rolling average
IE	SAIDI and Losses (SAIFI being added from 2006)	Included	days with daily SAIDI with deviation larger than twice the standard deviation from the mean	No
IT	SAIDI	Excluded	force majeure and external causes; Statistical method	Yes: two year rolling average
NO	ENS Energy Not Supplied	Included in the incentive regulation (evaluated separately)	Yes (exceptional events can be evaluated upon request by the company)	No
PT	ENS Energy Not Supplied, which is determined on the basis of TIEPI (indicator of frequency of interruption weighted with the installed power in MV)	Excluded	force majeure, public interest, service reasons, safety reasons, agreements with the customer, facts attributable to the customer.	No
SE	SAIDI, SAIFI	Included in the incentive (evaluated separately)	Force majeure	No

As far as exclusions are concerned, all countries have a criterion for excluding events due to "*force majeure*", or exceptional events however defined. In Sweden the regulator used to include the events caused by faults on the transmission system. The interruptions due to the Swedish blackout of 2003 were removed on an exceptional basis. A law is currently under discussion that would eventually lead to exclusion of events due to the transmission system. In Norway, NVE may (based on applications from the network companies) find acceptable reasons for exemptions from the incentive regime (for instance, extremely bad weather), but this has not happened in the period 2001-2005. In Italy and Portugal, consumers' damages are excluded from the company's liability (although, in Italy, from 2005 distribution companies are free to choose to include them in the regulation and in this case targets are reviewed accordingly). It should be clear that all approaches are acceptable as long as the causes of interruptions that are included in the regulated indicator are included also in the calculation of the target chosen for the incentive scheme, otherwise there is a risk of misjudging the difference between actual quality levels and quality standards.

Regulators' concern with the volatility in company performance from one year to the next resulted in the cases of Italy and Hungary in the adoption of a two- or three-year rolling average value as a measure of the company's actual performance. This is not the case for the other countries, where the continuity indicators are used as actual values for the specific year. The use of a rolling average can reduce volatility, but on the other hand it can dilute incentives/penalties by the number of years considered in the rolling average.

2.3.3 Standards used for the incentive/penalty scheme

Five out of eight regulators require distribution companies to improve their performance over time. In other words, they set continuity targets that decrease with time (Table 2.8). In Sweden the continuity target can theoretically vary from year to year. Is important to notice that Sweden offers an implicit incentive to improve quality, since the benchmark used in the performance assessment model is based on 100% underground cables at LV and MV levels (see Additional Information 2.4). In Norway no improvement is required by the regulator, whose aim is to achieve a socio-economically acceptable level of continuity and not necessarily to improve it. The Norwegian regula-

TABLE 2.8 STANDARDS USED FOR INCENTIVE/PENALTY SCHEME

	Baseline	Scope (number of companies)	Dead band
GB	Flat or minimum level of improvement. Convergence mechanism.	Per distribution company (14 ex-PES), excluding the new smaller ones	No
HU	SAIDI decreases yearly. All other indicators are constant. Convergence mechanism.	Per distribution company (6)	Yes: 5% for penalties; 10% for incentives
IE	Yearly decreasing	Per distribution company (1)	No
IT	Yearly improvement required. Convergence mechanisms.	Per territorial district (more than 300). Each district is formed by all the municipalities of the same province with the same density (inhabitants) and served by the same distribution company (24 major companies).	Yes: ±5% from target
NO	Target can vary from year to year.	Per distribution company (137); the same incentive regime is applied to the transmission company.	No dead band but until 2006 regulator requires companies to adjust tariff changes only if long-lasting changes in continuity have been achieved
PT	Only one target, ENSRef = 0,0004 x ES (Energy supplied in the year), has been published by the regulator so far. The target can be recalculated every year	Per distribution company, only in MV (1)	Yes: ± 12% from target
SE	Target can vary from year to year. Implicitly decreasing.	Per distribution company (193)	No

tor calculates a benchmark for company performance using a regression model: this benchmark is adjusted in order to give companies incentives to provide a socio-economically optimal level of reliability; to this end, utilities are forced to internalise consumer interruption costs.
In Italy, Great Britain, and Hungary the worst performing companies have larger improvements to make: this choice enables a convergence of continuity levels for the entire country. Continuity targets are set in all cases by company. The only exception is Italy, where targets are given by territorial district. Historical performance and structural differences in network layouts must be taken into account when setting the standards, in order to set targets that are achievable for the company and valuable for consumers. Differentiating targets by density area, as in Italy, or by company, as in other countries, does just that.
Some regulators try to avoid tariff changes for performances that are “close enough” to the target. This reduces the administrative burden of regulation. To this end, Italy Hungary, and Portugal have defined dead bands around the target. The width of the dead band varies from a minimum of +/- 5% to a maximum of +/- 12%. Note that there is a risk of diluting incentives if the band is too wide. In Norway there is no dead band, but the regulator requires companies not to introduce changes in the tariff unless long-lasting changes in continuity have been achieved.

Additional Information 2.4 – Network performance assessment

Network performance assessment methodologies enable regulators to compare company performance in a objective and fair manner, taking into account differences in structural variables across distribution companies.

The Swedish regulator employs a network tariff regulation model, theso-called Network Performance Assessment Model (“PAM”). Long planned and unplanned SAIDI and SAIFI reported for a whole year by the companies, for every network concession, are converted to a total cost of interruptions for that particular concession. The calculation is based on a study of customers’ estimated interruption costs conducted by Swedenergy (the branch organization) in 1994 and updated in 2003, where both planned and unplanned interruptions were considered.
This amount, called the “reported total interruption cost”, is compared for every concession with the “expected total interruption cost” calculated from the PAM. If the company’s reported total interruption cost is higher than the calculated one, the difference between the reported and expected interruption cost will correspond to the penalty due to poor quality of supply for that concession.
Therefore, there is a target level of continuity that is defined, in terms of cost of interruption, by the “expected normal interruption cost” calculated by the PAM. There is also an implicit incentive to improve quality as costs computed from the performance assessment model are based on 100% underground cables at LV and MV levels.
The effect of quality performance on the tariff is limited by upper and lower “boundaries”. The upper boundary is the limit for over-quality and the lower boundary corresponds to the performance from a pure radial network.

In Norway a regression model is used to calculate “expected total interruption costs” for each company using historical data and various structural variables (energy supplied, network extension, number of transformers, wind, geographical dummies).

In Great Britain the regulator (Ofgem) collects physical characteristics and performance information for each MV circuit for each distribution company. These circuits are then divided into 22 circuit groups with physically similar characteristics. The groups are defined so that differences in the percentage of overhead line, circuit length and number of connected customers are minimised and that no group is dominated by a single company. Ofgem compares and benchmarks performance within each circuit group. A benchmark is then built for each company based on its mix of circuits.

2.3.4 Economic effects

Incentive/penalty schemes, in one form or another, affect revenues earned by distribution companies. With the exception of Hungary (and Great Britain from 2002 to 2004), such economic effects are directly proportional to the difference between the actual value of the regulated indicator(s) and the target and symmetry. Symmetry means that for the same deviation in absolute value (positive or negative) from the target there is the same amount of incentive (for positive deviation, i.e. actual quality better than standard) or penalty (for negative deviation, i.e. actual quality worse than standard). Indeed, the degree of symmetry of the whole incentive/penalty regime should be regarded not only in the light of the proportionality between deviation from the standard and economic effects, but also looking at the standard setting system, and in particular at the existence of a required minimum improvement (see Table 2.9).
Rewards are ultimately paid by consumers in all cases. In Great Britain, as well as in other countries, these costs are shared only among consumers of the company that earned incentives. Differentiating the distribution tariff across different areas of the same country can be an issue in some countries, where a higher-level principle prevents such tariff differentiation. In Italy, for instance, the constraint of the single distribution tariff across the national territory requires that all consumers in the country share the costs of quality improvements above the target: it is the single national tariff that increases. The problem does not apply to countries where there is only one distributor (for example Ireland and Portugal).

The most interesting aspects are the following:

- In the case of Great Britain and Ireland, respectively ±3% and ±2% of price control revenue is exposed to the continuity incentives (note that the amount of revenues exposed to the scheme is boundaried). In Ireland the percentage of revenues exposed will be increased to ±2.5% in 2006 and ±4% from 2007. There are four incentives, 3 of which refer to quality of supply and network performance (SAIDI, SAIFI and losses). In Great Britain 1.2% of this relates to SAIFI and 1.8% relates to SAIDI. Rewards (penalties) are proportional to the difference between the actual performance level and the target. Such difference is valued using a fixed incentive rate.
- In the case of Norway and Sweden the difference between expected interruption costs and actual interruption costs (using respectively actual ENS and actual SAIDI and SAIFI), is calculated annually for each company and added to the company's revenue cap if positive or subtracted if negative. In Sweden the tariff for each company is adjusted accordingly (network tariff and quality are evaluated *ex post* through a reference network model). Upper and lower boundaries are used, respectively corresponding to the quality of a totally undergrounded net-

work and a pure radial network. In Norway, so far the tariff is changed only if the company's expectations of future interruption costs deviates from the target (due to investments, changes in operation of the system and so on). From 2007 companies shall adjust tariffs according to the incentive/penalty result each year.

TABLE 2.9 ECONOMIC EFFECTS

	Incentive/penalty	Incentive rate	Symmetry
GB	±3% of price control revenue is exposed to the continuity incentives	Average value of energy not supplied implicitly used in the scheme: 4.18 €/kWh not served	Yes (but minimum improvement required)
HU	Tariff-related incentives and penalties apply to 3 indices out of NS & CS: outage rate; SAIDI, and SAIFI; Fines apply to all NS and CS indicators	Not applicable	No
IE	±2% of price control revenue is exposed to the incentives (2001-2005)±4% of price control revenue is exposed to the incentives (2006-2010)	Average value of energy not supplied used in the scheme: 7.2 €/kWh-not-supplied (year 2000)	Yes (but minimum improvement required)
IT	The price-cap formula contains a Q factor that funds the net difference between incentives and penalties.	Differentiated according to type of consumers (domestic and business); respectively 10.8 and 21.6 €/kWh-not-supplied	Yes (but minimum improvement required)
NO	The difference between expected interruption costs and actual interruption costs (using actual ENS) is calculated annually for each company and added to the company's revenue cap if positive and subtracted if negative. From 2007 companies will have to adjust tariffs yearly on the basis of the incentive/penalty effect	Costs of energy not supplied, differentiated according to type of consumers (unplanned - planned in €/kWh-not-supplied); Industrial: 7.90 - 5.51; Trade/Service: 11.86 - 8.14; Agricultural: 1.80 -1.20; Residential: 0.96 - 0.84; Public service 1.56 - 1.20; Wood processing/ energy intensive industry: 1.56 - 1.32	Yes
PT	Rewards (penalties) are proportional to the difference between the actual performance level and the target (excluding the dead band)	Fixed incentive rate for any deviation from the targetValue of energy not supplied used in the scheme: 1.5 €/kWh-not-supplied.	Yes
SE	The difference between "expected interruption costs" and actual interruption costs (using reported SAIDI and SAIFI) is calculated annually for each company. The tariff for the company is adjusted accordingly. An upper boundary (totally underground network) and a lower boundary (quality of a pure radial network) are used.	Costs of energy not supplied and cost of power interrupted, differentiated according to density of line, i.e., meter line per number of customers. €/kWh-not-supplied (unplanned/planned) Urban: 12 / 8.6; Suburban: 8.8 /6.3; Rural: 7.4 /5.2; €/kW-interrupted (unplanned/ planned); Urban 2.5 /0.4 Suburban 1.9 /0.3; Rural 1.6 / 0.2	Yes

- In Italy, distributors that do not reach (that exceed) their assigned target in each district and each year pay a penalty (gain a financial incentive) proportional to the difference between the actual level and the target. Due to the single national tariff, adjustments in the tariff are more indirect than in the previous cases: the price cap formula is adjusted via a Q factor that funds the net difference between incentives and penalties. In other words, penalties are used to fund the incentives and the rest is funded through tariffs (Q factor). The improvement targets are considered within the base tariff: incentives are limited to extra improvements over the targets.

A regime to avoid overquality is enforced through “reference levels” that are considered the “optimal” continuity levels for each type of territory.

- Hungary alone has adopted a totally asymmetric incentive regime. The scheme includes tariff-related incentives and penalties as well as sanctions. *Incentives* are in the form of a profit increase for the company. They apply to 3 indices out of Network Security (NS) and Continuity of Supply (CS) indicators (Table II.4): outage rate, SAIDI, and SAIFI. In case of improvement of any of these indices by more than 10% above target, and if both the others are above target, company profits can be increased by 10%. Tariff-related *penalties* apply to the same 3 indices. In case of underperformance in the 5-10% range, the distribution tariff decreases by 0.5% per indicator below target (maximum penalty: 1.5% decrease in tariff). In case of underperformance above 10%, the distribution tariff decreases by 1% per indicator below target (maximum penalty: 3% decrease in tariff). Sanctions apply to all NS and CS indicators: if the performance is worse than standard the company pays a fine to the regulator: a lower fine applies if the performance is worse than the standard by 0-5%, a higher fine applies if the performance is 5-10% worse than the target.
- The case of Portugal is illustrated in Additional Information 2.2. The incentive was determined for the first time for 2003 performance. The incentive value to be applied in 2005 was zero (the value of ENS in 2003 was within the “dead band”) and in 2006 will be the maximum value, RQS_{max} (the value of ENS in 2004 was lower than $ENS_{ref}-\triangle V-RQS_{max}/V_{ENS}$).

Financial incentives, in the simpler form of sanctions, or in the more complex form of adjustments in tariffs (or revenues), pose the question of choosing the amount to be paid. In particular, defining the incentive rate (amount paid per unit deviation from the target) is a challenge for the regulator. In Norway, Great Britain, Sweden and Italy the choice of the incentive rate was guided by customer valuation of the energy not supplied conducted through a WTP survey (the incentive rate is differentiated per consumer type).

2.3.5 Improvement effects and periodical review effects

In Great Britain, Italy, Ireland, Hungary and Norway, incentives schemes have been in place long enough to observe their effects on continuity levels. In all countries such results are quite remarkable in terms of improvements of the regulated indicators, and sometimes also of the unregulated ones. Effects of the incentive schemes include also a stronger focus on quality of service, both in terms of day to day management of the network and in longer-term investment decisions. In greater detail:

- In Great Britain the initial incentive scheme applied from 1 April 2002 to 31 March 2005. It was introduced partway through the price control period to allow for initial work on improving the accuracy of reporting. The main results of the first implementation period include a 15% improvement in CIs (SAIFI*100) and a 19% improvement in CML (SAIDI), between 2001/2 and 2004/5, as illustrated in Figure 2.2 (excluding the impact of exceptional events). It should be noted that only two companies per year paid penalties (for years 2002-2004 the UK had a penalty-only scheme). Note that the penalties were calculated annually but only applied as adjustments to revenue at the end of the price control period. In addition, quality of service regulation become widely accepted by companies – senior management now has a stronger focus on quality of service, both in terms of day to day management of the network and also in longer-term investment decisions.

- In Hungary, the incentive scheme has applied since 1 January 2003. Remarkable improvements in terms of continuity indicators have been achieved: SAIDI in 1999: 411, in 2004: 137 min/consumer (Figure 2.3). It was found that, as a side effect, in a few cases planned interruptions increased.
- In Ireland the incentive scheme has applied since 2001. Continuity has improved by an average of 5% per year.
- In Italy, an incentive scheme applied for a first regulatory period during the years 2000-2003. The main results include a significant reduction in the gap between the continuity level in Italy and best performing countries in Europe, and a dramatic reduction in regional gaps, especially between North and South of the country, while maintaining continuity levels achieved in some areas of outstanding service. The total SAIDI went down from 192 minutes lost in 1999 to 91 minutes lost in 2004 with an improvement rate of 53% in 5 years (Figure 2.4). The improvement in the total duration of interruptions per customer also led to a partial benefit in terms of reduction in the number of long interruptions per customer (SAIFI: -34% in 5 years). Short interruptions have also gone down slightly (MAIFI: 15% in 3 years). Finally, a general consensus on continuity regulation was achieved: according to an evaluation study conducted through interviews with network managers, the incentive scheme “polarized” investments in distribution companies towards the acknowledged goal of continuity improvement and territorial convergence, according to objectives set by the Authority.
- In Norway, the incentive scheme has applied since 2001. The main results include a reduction in ENS from 27000 MWh in 2000 to 16000 MWh in 2004 and a positive effect on operation, maintenance and investments in the system (Figure 2.5). Regarding planned interruptions: companies have changed their routines (work with power on, smaller areas are affected by maintenance work because of more precise disconnections, better planning of maintenance, etc.) and have reduced ENS with the same level of maintenance.

Great Britain, Italy, and Norway have entered a second regulatory period (Ireland is about to, in 2006, with new incentives now in place). Regulators carried out, also with the help of consultants, an evaluation of the incentive scheme in place and introduced some changes, including an update of the incentive rates. The beginning of a new regulatory period was taken as an opportunity for expanding the scope of the regulation, to introduce simplification, and to eliminate redundancies. In particular:

- In Great Britain, the new incentive scheme applies for the full price control period from 1 April 2005 to 31 March 2010. The main changes are the following: financial exposure to continuity went from 2% to 3%; higher incentive rates were applied; the incentive scheme, which was partially symmetric (due to uncertainties about the targets), become fully symmetric; planned interruptions were given a 50% weighting, instead of 100%; and the exceptional events mechanism was simplified.
- In Italy, the renewed incentive scheme applies for the current regulatory period (2004-2007). The main changes are the following: introduction of a GS on the number of interruptions; targets reviewed for SAIDI; introduction of a new method for calculating “tendential improvement tar-

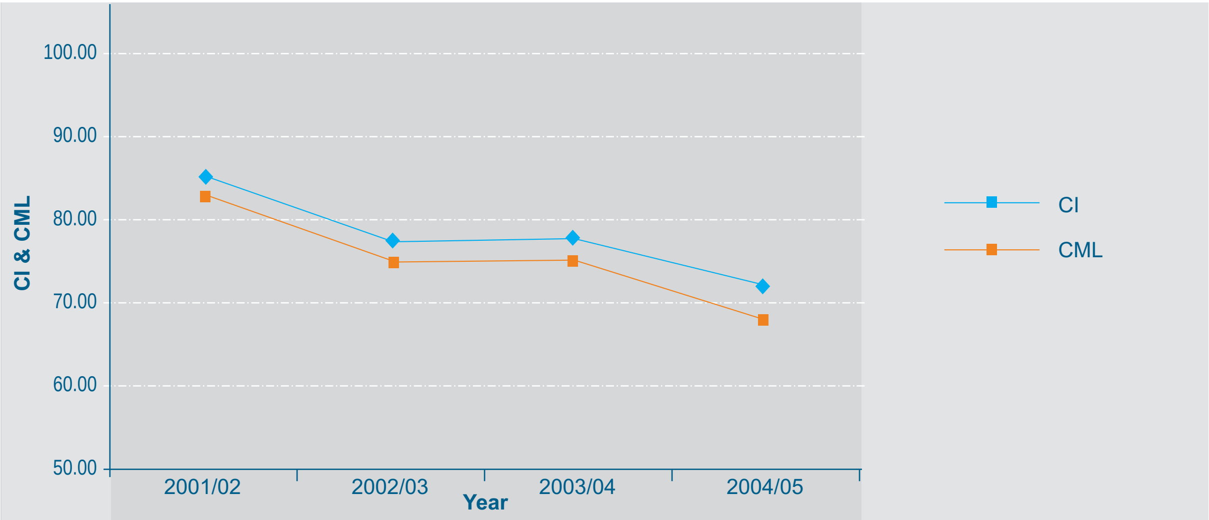
gets"; introduction of an upper boundary for both incentives and penalties; updating of the incentive rate differentiatiation according to final use of energy (domestic or non-domestic uses).

- In Norway, the incentive rates related to energy not supplied were changed in 2003 (based on a new customer survey). Also the differentiation changed from 2 customer groups to 6.
- In Ireland, global financial exposure was increased from 2% to 4% (with 2.5% in 2006 as an interim step). Each individual incentive is capped at 1.5%. The value of the incentive was updated to reflect the value of benefit based on actual information (e.g. value of lost load, end-user unit costs).

Additional Information 2.5 – Evaluation of costs and benefits

Ofgem carried out an impact assessment of the new incentive scheme as part of the November 2004 final proposals for the price control review.
The total costs that have been allowed to fund improvements in continuity of supply in the period 2005/6 to 2009/10 have been estimated at £225 million (excluding allowances for exceptional events). This amounts to an increase in charges of approximately £1.20 per annum per customer allowing for the fact that capital expenditure will be funded over the depreciation life of the assets.
The revised targets for quality of service assume that improvements in the national average performance of around 3 customer interruptions for every 100 customers and 10 minutes lost should be achievable over the next price control period.
The valuation of benefits of reducing interruptions depends on the weightings between domestic customers and different types of business customers and the form of analysis used. However, taking a reasonably conservative estimate of £10 for the weighted average cost of a one-hour interruption across customer groups would imply average benefits to customers of approximately £47m per annum or approximately £1.70 per customer across the price control period from distribution companies meeting the new targets. This suggests that it is worthwhile to tighten quality of service targets.

FIG 2.2 IMPROVEMENT EFFECTS OF THE INCENTIVE/PENALTY REGIME IN GREAT BRITAIN
CI and CML 2001/2 to 2004/5 (incentive penalty/regime started in 2002)



Note: CML=SAIDI; CI=SAIFI*100

FIG 2.3 IMPROVEMENT EFFECTS OF THE INCENTIVE/PENALTY REGIME IN HUNGARY
SAIFI 2004 TO 2004 (incentive penalty/regime started in 2003)

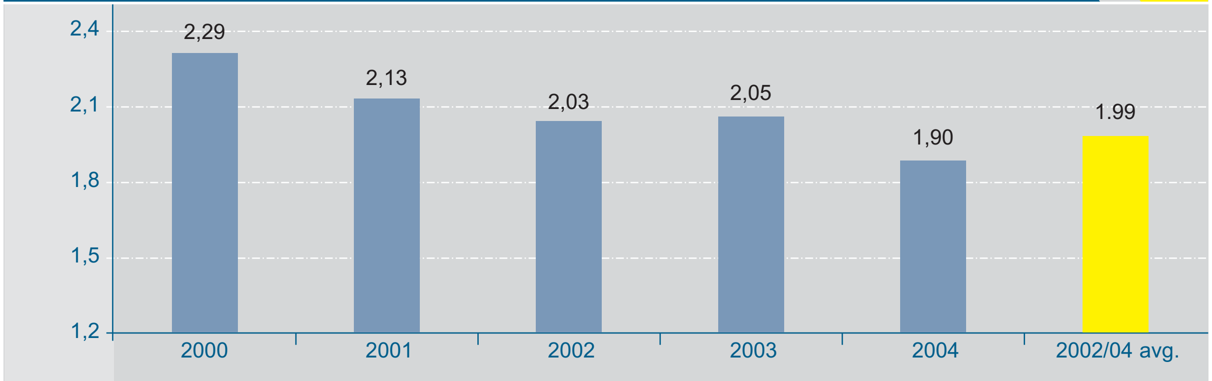


FIG 2.3 IMPROVEMENT EFFECTS OF THE INCENTIVE/PENALTY REGIME IN HUNGARY
SAIDI (expressed in hours) 2000 TO 2004 (incentive penalty/regime started in 2003)

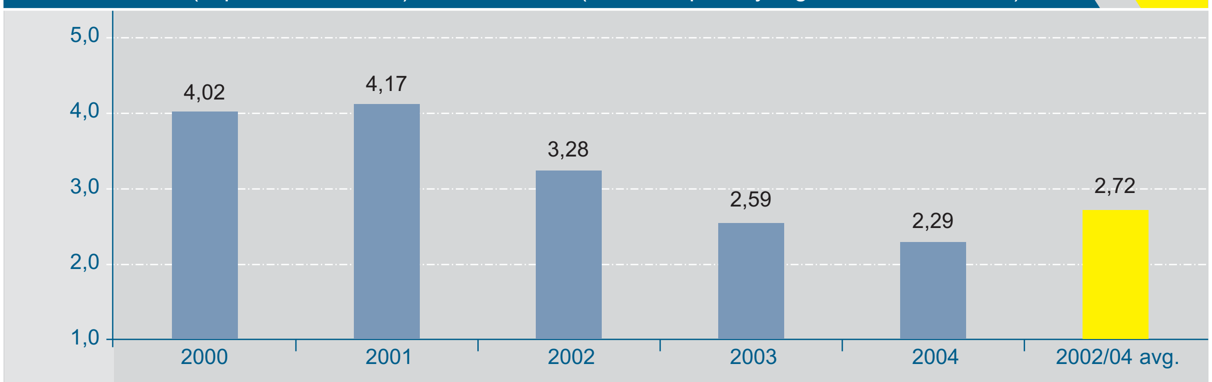


FIG 2.4/a IMPROVEMENT EFFECTS OF THE INCENTIVE/PENALTY REGIME IN ITALY
SAIDI 1998 TO 2003 (Incentive/penalty regime started in 2000)

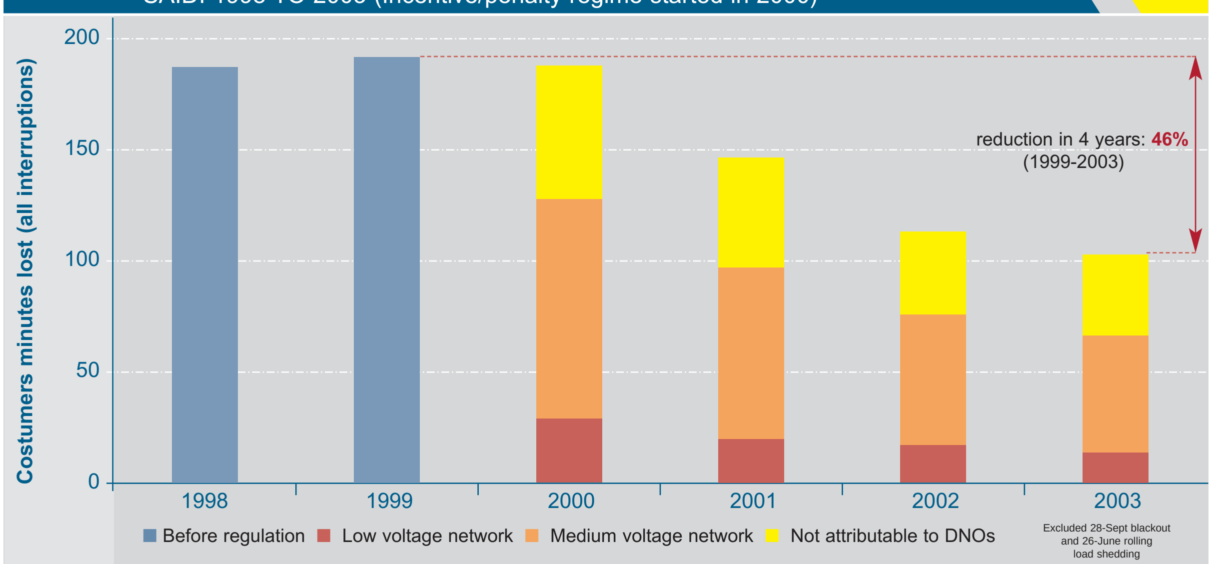


FIG 2.4/b CONVERGENCE EFFECT OF THE INCENTIVE/PENALTY REGIME IN ITALY
SAIDI-NET 1998 TO 2003 (Incentive/penalty regime started in 2000)

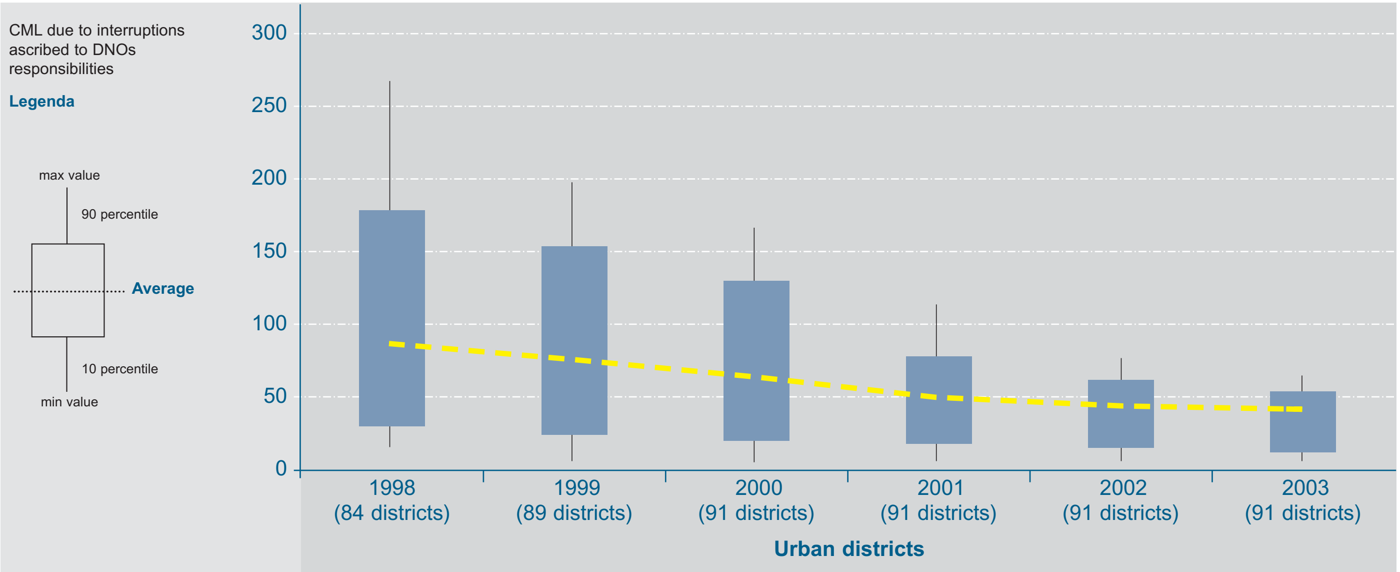
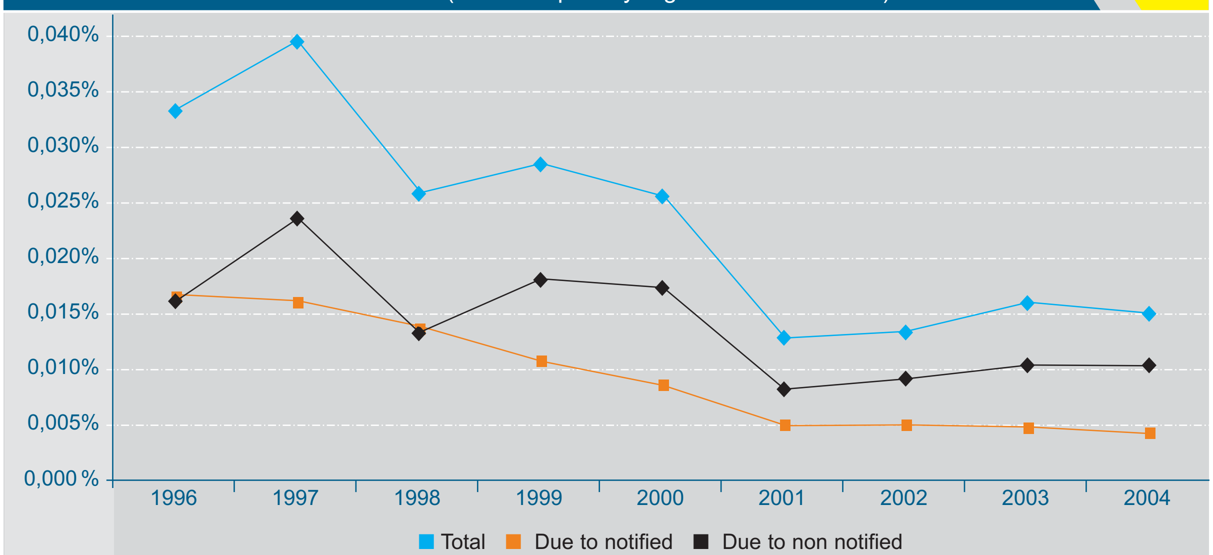


FIG 2.5 IMPROVEMENT EFFECTS OF THE INCENTIVE/PENALTY REGIME IN NORWAY
ENS/ENERGY 1996 TO 2004 (Incentive penalty regime started in 2001)



2.3.6 Findings II: Continuity standards at system-level and incentive/penalty regimes

IR#4: *The introduction of incentive/penalty regimes normally aims to improve continuity levels and avoid perverse incentives from price cap regulation that may lead to deteriorations in quality. Where an assessment of the current situation highlights country or regional weaknesses, specific objectives should be considered with at least the same attention as for general objectives (like special investment plans, reduction of regional gaps, and so on). In any case, it's extremely important to assure an overall consistency of the objectives with the allowed revenues of the companies.*

IR#5: *The first element in the design of an incentive/penalty scheme is the selection of the continuity indicators. The current practice shows that an efficient incentive scheme can include one (typically duration of interruption per customer or energy not supplied), two (typically duration and number of interruptions per customer) or more indicators. Periodic revisions of the incentive scheme allows the regulator to modify over time the number of indicators and fine-tune regulation to its objectives. Mechanisms to smooth volatility and to cope with exceptional events (exclusion of specific types of interruptions and/or use of rolling averages for the continuity indicators) have an impact on the financial results of the distribution companies; for this reason they should always be carefully considered.*

IR#6: *The second element is the definition of targets. Empirical evidence shows that both constant and decreasing baselines are used. A decision on the baseline can only be taken considering the current as well as the historical continuity level of the companies, observing such results in comparison with those of similar territories and network layouts, and after consultation with stakeholders. Targets are normally given for a set number of years in advance, usually for the duration of the regulatory period; in one case only the target is fixed year by year.*

IR#7: *Foreseeing economic effects is the third element in designing the incentive/penalty regulatory scheme. In general, schemes are symmetric around the baseline and financial incentives and penalties are proportional to the difference between the actual performance and the target; apart from this, incentive rates, amount of revenues exposed to the scheme, and upper and lower boundaries are significantly different among the surveyed countries (see Table 2.9). There is no simple solution to the task of setting financial incentives. It is advisable to take a decision after wide consultation and bearing in mind regulatory objectives. It was observed that in a number of countries incentive rates (that convert the difference between target and actual level into financial amounts) have been established after having surveyed the willingness-to-pay (or to accept compensations) of final customers.*

IR#8: *Regulators review incentive/penalty regimes at regular intervals, as it is usually done for the tariff. Periodical reviews allow regulators to introduce modifications, enlarge the scope of the regulation and even remove it in case market mechanisms seem to work efficiently for the same purpose. Continuous monitoring of all measured indicators are also extremely useful for observing the effects of the regime on those indicators that are not subject to financial incentives.*

2.4 Continuity standards at single-customer level and customer compensations

Single-customer continuity standards are thresholds applied to continuity indicators that have to be respected for every single customer connected to the network. Single-customer continuity standards are generally expressed as the maximum number of interruptions and/or a maximum duration of interruptions, but can also concern other continuity indicators.

They can differ depending on the type of customer (for instance a domestic or a non-domestic customer will not always have the same standard), but also depending on the voltage level of the network. Customers who do not receive the level of service set out in the standard are entitled to receive compensation payments from the operator; the compensation payment can be either automatic or upon request by the affected customer, and can vary according to the type (or size) of customer and, in some cases, according to the difference between the actual level of the indicator and the standard. Setting single-customer standards means it is necessary to have measurement systems at the single-customer level or for the customers themselves to claim compensation.

This section surveys different standards adopted by regulators, or imposed by laws, at the single-customer level, and the compensation payments to customers in case the operator fails to meet the single-customer standard. A summary of the most relevant issues concludes the section.

2.4.1 Very long interruption standards

There are fundamentally two groups of standards related to the maximum duration of interruptions per single customer (see Table 2.10):

- Maximum duration for each unplanned interruption: this kind of standard is enforced in a significant number of countries (and in two further countries the regulators have proposals under consideration), even if each country has its own definition and conditions for enforcement;
- Maximum yearly duration of unplanned interruptions for the same connection point: this kind of standard is applied in only a few countries.

TABLE 2.10 VERY LONG INTERRUPTION STANDARDS FOR SINGLE CUSTOMERS

Standards on maximum duration of each unplanned interruption	BE, CZ, EE, FI, FR, GB, HU, LT
Standards on maximum yearly duration of unplanned interruption for the same connection point	ES, PL, PT
Proposal stage	IT, SE
None	AT, GR, IE, LV

Both types of single-customer standards related to maximum duration of unplanned interruptions are generally linked to economic compensation for the affected customers, subject to some conditions. Tables 2.11 and 2.12 compare the different single-customer standards related to maximum duration of unplanned interruptions.

TABLE 2.11 CONTINUITY SINGLE-CUSTOMER STANDARDS: maximum duration of each unplanned interruption

Country	Standard	Conditions	Compensation	Amount
BE (Wall.)	4 hours	Exceptional events (force majeure) excluded	Economic compensation on request. After 4 hours provisional production has to be installed.	Damages only if interruptions are distributor's fault
CZ	LV cust: 18 hrs HV cust: 12 hrs	Exceptional events (force majeure) excluded	On request; must be claimed by the customer within 5 working days	10% from yearly payments for distribution, max. €150 for LV and €300 for HV
EE	20 hours (in the summertime) 24 hours (in the wintertime); stricter standards will apply from 2008	Exceptional events (force majeure) excluded	Automatic for the three biggest distribution companies; on request for the other companies	LV <63A: from 8€ (excess up to 48 hours) to 24 (excess more than 96 hours) MV: from 0.77 €/kW to 2,3 €/kW according to the excess time
FI	12 hours	Exceptional events excluded (see list in Annex 1); moreover, in case of risk for workers' safety, the distributor can delay the starting time for counting the duration	Customer has to ask for compensation, but the DSO should make it as easy as possible. Many companies pay compensation automatically	interruption 12-24 h: compensation 10% of customer's annual network charges; interruption 24-72 h: compensation 25% interruption 72-120 h: compensation 50%; beyond 120 h: 100% Max 350€/interruption
FR	6 hours	Exceptional events excluded (see list in Annex 1, Force majeure)	Automatic	For each range of 6 hours interruption, 2% of the fixed tariff component depending on the subscribed power (4% after 12 hours, …).
GB	18 hours (normal weather conditions) 24 up to 141 hours for exceptional events	Severe weather events excluded Severe weather events classification (see additional information 2.6). Some exceptional events excluded	On customer's request On customer's request	£50 domestic customers £100 non-domestic, plus £25 for each further 12 hours £25 (around €36) plus £25 for each further 12 hours up to maximum of £200 (all types of customers)
HU	12 hours (in case of single disturbance); 18 hours (in case of several disturbances)	Exceptional events excluded (see list in Annex 1)	Automatic in the case of 1 company out of 6, on customer's request for the other 5 companies	Household consumers: automatic payment around €8, on request €20. Non domestic consumers: from €12 (LV, automatic) up to €120 (MV on request).
LT	24 hours (stricter standards apply under specific contractual conditions only to some categories of customers)	Exceptional events excluded	On customer's request	Not defined

Observation suggests that there is great disparity among single-customer standards related to the maximum duration of unplanned interruptions. However, this disparity is not surprising, as many factors have to be considered:

- the compensation amounts are often linked to the "excess time", that is the difference between the actual duration of the interruption and the standard; thus, for instance, if there is large difference between the French standard (6 hours) and the British one (18 hours for normal weather events), one should also take into account the difference in the compensation: in France, it is 2% of the power-dependent part of the tariff – a few euros for a domestic customer – and around 36 in Great Britain for the same type of customer;
- in some countries the standards are differentiated according to voltage levels (Czech Republic, Spain and Portugal), type of territory (Spain and Portugal), season of the year (Estonia) and type of incident (Hungary); this hinders a simple comparison, but it must be considered that all these differentiations are reasonable and have been introduced considering a balance between simplification and a sense of reality;
- for approximately half of the countries, compensation is automatic; in the other half it is given at the customer's request. This is a difference that has a great impact on the effectiveness of this kind of regulation. In this regard one should consider the case of Great Britain where the regulator (Ofgem), as part of the new price control system starting 1 April 2005, has introduced a mechanism to encourage companies to be pro-active in making payments. The penalty to distribution companies, where there is a failure under the normal, severe weather standard or the Highlands and Islands standard, is the same whether or not the customer claims. Where a company does not make a payment to the customer, it will face an equivalent reduction in its price control revenue.

TABLE 2.12 CONTINUITY SINGLE-CUSTOMER STANDARDS:
maximum yearly duration of unplanned interruptions

Country	Standard	Conditions	Compensation	Amount
ES	MV CUST.: Urban: 4h/year; Suburban: 8h/yr; Conc. rural: 12h/yr; Scat. rural: 16h/yr; LV CUST.: Urban: 6h/year Suburban: 10h/yr; Conc. rural: 15h/yr; Scat. rural: 20h/yr HV (>36KV) CUST.: 6h/yr	Exceptional events excluded (see list in Annex 1)	Automatic	Discount=PW*DH*5*P PW = billed annual average power DH = difference between the number of consumer interruption hours and the hours fixed in the required standards; P = kWh price for non eligible customers, or P = pool kWh annual average hourly final price for eligibles
PL	LV customers: 60 hours/year	Only applicable to interruptions due to the transmission service; Exceptional events excluded (see list in Annex 1)	On customer's request	For each undelivered unit of electric energy, the customer shall be entitled to a discount equal to five times the electric energy price for the period of the interruption
PT	MV CUST.: Urban: 4h/year; Suburban: 8h/yr; Rural: 16h/yr; LV CUST.: Urban: 6h/year; Suburban: 10h/yr; Rural: 20h/yr HV (>36KV) CUST.: 4h/yr	Excluding all interruption due to fortuitous reasons or force majeure, public interest, service reasons, safety reasons, agreements with the customer and circumstances attributable to the customer.	Automatic	Compensation depends on the standard, the actual duration of the interruptions registered for each costumer, the voltage level and the contracted power

As shown in Tables 2.11 and 2.12, in all but one case standards related to the maximum duration of interruption are only applicable outside *force majeure* conditions. The only one case where a single-customer continuity standard applies even in case of exceptional events is Great Britain, as indicated in Additional information 2.6.

Additional Information 2.6 – severe weather standards in Great Britain

Ofgem has set different standards for the maximum duration of unplanned interruptions. These are related to normal and severe weather conditions respectively and apply to the whole of GB except for the Highlands and Islands of Scotland. These areas of Scotland are covered by a separate standard, which includes an exemption for paying compensation for severe weather, but customers may request a review if they feel that compensation was withheld unreasonably. To get a compensation, customers must claim compensation under each of these standards.
The following table explains how the exceptional events are classified and the different levels of standards. For very large events the standard depends upon the actual number of customers affected.

Category of weather	Definition	Standard
Normal weather	< 8 times daily mean faults at higher voltage.	Supply must be restored within 18 hours, subject to certain exemptions, otherwise a payment must be made
Category 1 (medium events)	Lightning events (≥8 times daily mean faults at higher voltage and less than 35% of exposed customers affected) Non-lightning events (≥8 times and < 13 daily mean faults at higher voltage and less than 35% of exposed customers affected)	Supply must be restored within 24 hours, subject to certain exemptions, otherwise a payment must be made
Category 2 (large events)	Non-lightning events (≥13 times daily mean faults at higher voltage and less than 35% of exposed customers affected)	Supply must be restored within 48 hours, subject to certain exemptions, otherwise a payment must be made
Category 3 (very large events)	Any severe weather events where ≥ 35% of exposed customers are affected	Supply must be restored within the period calculated using the following formula: $48 \times \left(\frac{\text{total number of customers interrupted}}{\text{category 3 threshold number of customers}}\right)^2$

Certain exemptions apply to these Guaranteed Standards. For example, all distribution operators affected by a category 3 (very large) severe weather event will be exempt from paying customers compensation for that event if any of the Distribution Network Operators (DNOs) affected by the event have more than 60 per cent of exposed customers off supply. Exposed customers are defined as customers supplied by mixed or overhead higher voltage circuits (i.e. those customers who may be affected by a severe weather event.) There are also a number of more general exemptions. For example, an exemption applies if the government has invoked emergency powers.

The importance of the subject of customer protection in case of very long interruptions is witnessed also by the fact that in both countries where regulators have recently submitted proposals (Italy and Sweden), the proposal is focused precisely on exceptional events.

2.4.2 Multiple interruption standards

There are fundamentally three groups of standards related to the maximum number of unplanned interruptions per single customer:

- Maximum yearly number of long interruptions per single customer;
- Maximum yearly number of short interruptions per single customer;
- Maximum yearly number of interruptions (long+short) per single customer.

The "multiple interruption standards" require a great effort for continuity measurement at the individual level, as the distributor must know for each customer the actual number of interruptions in order to verify the standard at the end of the year. This explains why not many countries have introduced this kind of standard and also why in some countries this type of standard is not applicable to LV customers, due to difficulties in precisely identifying affected customers at a low voltage level. Moreover, standards for short interruptions are still very rare, although the subject of short interruptions is of growing interest to regulators. So far, there are standards for short interruptions only in France. These multiple short interruption standards have not been set by the regulator but are contained in contracts between the distribution and transmission operators and their customers.
As is the case for "very long interruption standards" (see the previous paragraph), the "multiple interruption standards" show a great variety both in terms of thresholds and compensation; in all cases, there are restrictions on applicability. The most frequent restrictions are exclusion of interruptions due to force majeure and to the transmission network and special treatment for re-interruptions, i.e. interruptions that occur within a short time lag from the previous outage (generally due to actions on the network for restoring the first interruption).
Multiple interruption standard thresholds are in most cases differentiated according to the type of territory (urban/suburban/rural). On the one hand, this is rational as the number of yearly interruptions that affect a single customer depends a lot on the structure of the circuits to which the customer is connected, and therefore depends highly on the type of territory and the density of load. On the other hand, the different groups used to classify territories hinder a simple comparison (see Table 2.13).

The comparison shows large differences among the thresholds, ranging from 2 to 8 long interruptions per year for customers in urban contexts, and from 5 to more than 20 long interruptions per year for customers in rural contexts. The large differences among EU countries even for territories of relatively homogeneous density can be only partly explained by differences in the network structure, and are probably due to different regulatory approaches in setting standards. A possible approach for regulators setting multiple interruption standards could involve looking at a given percentage of worst-served customers: in Italy, for instance, multiple interruption standards have been set in consideration of customers above the 90^{th} percentile in terms of number of long unplanned interruptions during the year.
There is a wide range of possibilities for compensation in case multiple interruption standards are not met. Not only can compensation be either at the customer's request or automatic, but also the structure and amount of compensation varies a lot from one country to another.

In France, the customer claims for damages and the compensation can cover the actual damages incurred, subject to technical verification. In all other countries, except Great Britain, compensation depends on the applicable standard, the actual number of interruptions and the contracted power. From one country to the next, the unit value for interrupted kW is quite varied. In Great Britain the compensation is fixed, due to the fact that the regulator introduced the multiple interruption standard principally aiming at protecting domestic customers and smaller business customers, since large business customers have other means to limit the impact of single or multiple power cuts. In Italy, the right to compensation depends on the customer's compliance with technical requirements set by the regulator, which focus on the protection of customers' equipment in order to avoid faults leading to network interruptions that will affect other customers connected to the line.

TABLE 2.13 MULTIPLE INTERRUPTION STANDARDS

Country	Standard (interr/year)	Conditions	Compensation	Amount
ES	Long interruptions: MV CUST.: urban: 8; Suburban: 12; Concentrated rural: 15; Scatterd rural: 20; LV CUST: urban: 12; Suburban: 15; Conc. rural: 18; Scat. rural: 24; HV (>36kV): 8	Exceptional events excluded	Automatic	Discount=PW*H*P*DN/8; H = number of interruption hours; DN= difference between the actual number of interruptions and the applicable standard; PW: contractual power; P: see table.2.12
FR	Long interruptions: MV CUST: urban: 2; suburban: 3; rural: 3; rural scattered: 6; LV CUST: no standard Short interruptions: MV CUST.: urban: 2; suburban: 3; rural: 10; rural scattered: 30; LV CUST.: no standard; Long+short interruptions: MV CUST.: on request, customised standard	Exceptional events excluded	On request and only if there are damages	Amount of claimed damages
GB	Interruptions longer than 3 hours All customers: 3	Exceptional events excluded; interruptions with more than 0,5 Mill.; customers interrupted; transmission interr. excluded	On request	£50 (not differentiated)
IT	Long interruptions; HV CUST.: 1 interr./yr; MV CUST.: high density: 3; medium density 4; low density 5; LV CUST.: no standard	Exceptional events excluded;reinterruptions within 1 hour excluded; transmission interr. excluded	Automatic, subject to conditions (technical requirements for selectivity of customer's protections)	Compensation = 0,7*PW*DN*Vp;PW contractual power, DN difference between actual number of interruptions and standard; Vp= 2,5€/kW for MV up to 500 kW; 2€/kW over 500 kW
PT	Long interruptions; HV CUST.: 8; MV CUST.: zone A: 8; zone B: 18; zone C: 30; LV CUST.: zone A: 12; zone B: 23; zone C: 36	Same exclusion as for maximum yearly duration of unplanned interruptions (see table 2.12).	Automatic	Compensation depends on applicable standard, actual number of interruptions and contracted power

(*) Long interruptions: interruptions longer than 3 minutes. Short interruptions: interruptions longer than 1 second and less than 3 minutes.

2.4.3 Single-customer standards related to planned interruptions

In some countries there are single-customer standards associated with planned interruptions. These take two basic forms:

- Single-customer standards related to number and/or duration of planned interruptions;
- Single-customer standards related to advance notice for planned interruptions.

The most interesting cases are the following:

- In France, MV customers must not suffer more than 2 planned interruptions per year and each planned interruption cannot last more than 4 hours; both MV customers and LV customers with contracts for more than 36 kVA must receive, for each planned interruption, a notice at least 10 days in advance (with date, time and duration of works); for LV customers the maximum duration of planned interruptions is 10 hours/interruption. As for multiple interruption standards, if the company fails to meet the standard, compensation is paid upon request but only in the amount of actual damages incurred.
- In Great Britain, customers must be given at least 2 days notice; a compensation payment of £20 for domestic customers or £40 for non-domestic is foreseen in case this standard is not fulfilled (on customer's request).
- In Poland, in the event of a failure to individually notify customers supplied from a grid with a nominal voltage higher than 1 kV, in writing, by telephone or via other means of telecommunication, at least five days in advance, of the dates and duration of the planned interruptions in the supply of electricity, the charge will amount to 151,83 zlotys (around €38).
- In Belgium (Walloon) if the planned interruption lasts more than 4 hours, the distributor must provide temporary generation.

In some countries (like for instance Estonia), there are some overall standard on planned interruptions but no compensations are foreseen in case of standard breaching.

2.4.4 Single-customer standards for the transmission network

There are only a few countries with single-customer standards for transmission users (i.e. distributors, customers directly connected to the transmission grid and production plants):

- In France, the transmission operator sets standards for both short and long interruptions for each transmission user; the standards are based on historic performances, taking into account the actual performance in the last 4 years for each customer (see additional information 2.7 below);
- In Estonia, the yearly duration of unplanned interruptions per connection point to the transmission grid cannot exceed to 240 hours; this standard will be reduced to 200 hours from 2008 and to 150 hours from 2011. Furthermore, each interruption in the transmission grid must be eliminated within 12 hours (within 10 hours from 2008 and 8 hours from 2011). If the interruption time exceeds the standards, the network tariff will be reduced through a compensation of around 2,5 €/kW multiplied the greatest hourly power in the connection point in the previous year.

- In Portugal, for each client connected to the EHV grid (nominal voltage equal or higher than 230 kV), the yearly duration of unplanned interruptions is 45 minutes and the yearly number of interruptions is 3. The standard considers long interruptions and excludes interruptions due to fortuitous reasons or force majoure, public interest, service reasons, safety reasons, agreements with the customer and facts attributable to the customer.

Additional Information 2.7 – transmission contractual levels in France

In France, the transmission operator RTE calculates the continuity contractual level for each transmission user both for long and short interruptions; the maximum yearly number of both long and short unplanned interruptions depends on the historical performance of the site (over the 4 previous years) and is calculated as described below:
First, RTE calculates, for long interruptions, a value E_{LI}:

$$E_{LI} = \frac{(MaxLI\ over\ 4\ years)+(RealisedLI\ year\ n\text{-}1)+(RealisedLI\ year\ n\text{-}2)}{3}$$

where:
- (MaxLI over 4 years) is the maximum number of long interruptions (LI) recorded during the last 4 years;
- (RealisedLI year n-1) and (RealisedLI year n-2) are the numbers of long interruptions recorded respectively during the previous year and 2 years ago.

Depending on the value of ELI, RTE determines the contractual standard, which is the maximum number of long interruptions, as shown in the following table:

E_{LI}	Standard for long interruptions
$E_{LI} = 0$	1 long interruption over 3 years
$E_{LI} = 0{,}33$	2 long interruptions over 3 years
$E_{LI} \geq 0{,}66$	1 long interruption per year

The maximum yearly number of short unplanned interruptions depends on the historical performance of the site (over the 4 previous years) in a similar way, according to the parameter E_{SI}:

$$E_{SI} = \frac{(MaxSI\ over\ 4\ years)+(RealisedSI\ year\ n\text{-}1)+(RealisedSI\ year\ n\text{-}2)}{3}$$

Depending on the value of ESI, RTE determines the contractual standard, which is the maximum number of short interruptions, as shown in the following table:

E_{SI}	Standard for long interruptions
$E_{SI} = 0$	1 short interruption over 3 years
$E_{SI} = 0{,}33$	2 short interruptions over 3 years
$E_{SI} = 0{,}66$	1 short interruption per year
$1 \leq E_{SI} \leq 1{,}66$	2 short interruptions per year
$2 \leq E_{SI} \leq 2{,}66$	3 short interruptions per year
$3 \leq E_{SI} \leq 3{,}66$	4 short interruptions per year
$E_{SI} \geq 4$	5 short interruptions per year

If the previous rule (based on historical performance and giving the maximum number of long and short interruptions) gives the result of 1 long interruption over 3 years and 1 short interruption over 3 years, the contractual standard becomes 2 interruptions (long and/or short) over 3 years.
The customer can also ask RTE for an arrangement on short+long interruptions or other customized arrangements. This calculation method is the normal arrangement for transmission contracts; a customized arrangement is used for distribution contracts.

2.4.5 Findings III: single-customer continuity standards

IR#9: *A significant number of countries have introduced (or are going to introduce) continuity standards for the maximum duration of interruptions (see Table 2.10, 2.11 and 2.12) . This is an important form of customer protection, especially if there are automatic compensation payments when companies fail to meet standards.*

IR#10: *In some countries there are quality standards related to the maximum yearly number of unplanned interruptions per single customer (see Table 2.13). The standards have various conditions and some exclusions apply; moreover, in some countries this type of standard is not applicable to LV customers, due to difficulties in precisely identifying affected customers at low voltage levels.*

IR#11: *Although customer research suggests that the impact of interruptions where customers had been given advance notice is less than unplanned interruptions, standards regarding planned interruptions can be useful to compel distribution network operators to plan their maintenance work in a way that inconveniences consumers as little as possible.*

IR#12: *Transmission regulation is still at a very early stage of development. There are only contractual continuity standards for the transmission network's customers in one country (see Additional information 2.7). This should not be regarded as a priority area for regulators approaching quality regulation issues for the first time, as protection of consumers connected to distribution networks is a higher priority. In any case, the regulation of quality for transmission must be consistent with the transmission tariff system (in some cases transmission tariffs are not at all or not entirely subject to price caps).*

2.5 Conclusions: recommendations for future work on Quality Regulation

The following recommendations are made to regulators who want to introduce quality regulation with an incentive/penalty mechanism. It is important to consider that setting such a mechanism for distribution or transmission companies is delicate, for economic, technical and political reasons.
This advice comes from experienced countries which already have set up an incentive system for quality regulation and which know the consequences, advantages and disadvantages of such a mechanism. The following recommendations also take into account the different regulators' points of views toward electricity service quality, what they expect for the future and how they want to manage it, as collected through questionnaires.
Although this advice is important to follow in order to prevent unintended effects, the quality regulation system adopted in one specific country might not be applicable in others, because of many different conditions (electricity network features, meteorological conditions, economic situation, degree of companies' privatisation, customers' willingness to pay for better quality, customer satisfaction, and so on). Indeed, a quality regulation system needs to be set up by the country itself, considering all its country-specific factors.

1. **Continuity measurement rules:** It is absolutely necessary to collect reliable and robust data for due time before introducing any type of continuity standards or incentive regime. It is strongly recommended to set measurement rules that can assess *separately* the different types of interruptions, monitoring at least planned and unplanned interruptions, the latter at least divided between long and short ones. It is also highly recommended that regulators define their own guidelines for recording interruptions, or approve the procedures of the regulated companies, at least with respect to the definition of *force majeure* and the assessment of customers affected by each interruption. It is known that once recording protocols are introduced, the indicators can worsen due to the fact that all interruptions are taken into account.

2. **Audits on continuity data:** The guidance for recording interruptions should be regarded as a preliminary step towards more diffuse regulatory auditing on the continuity data provided by distribution and transmission companies. Measurement rules and audit procedures become more important when some kind of economic incentive or disincentive is used to promote continuity of supply enhancement. It is strongly recommended that regulators who introduce incentive/penalty regimes and/or guaranteed standards on continuity of supply set obligations for auditing and actually do audits in order to check that all interruptions are taken into account in continuity indicators and that there is no abuse of exclusions.

3. **Complete continuity indicators:** As interruptions can originate at all voltage levels, only continuity indicators that contain all voltage levels wholly represent the situation from the customer viewpoint. Regulators are advised to move towards continuity indicators where all voltage levels are included. In order to introduce incentives, it is necessary to include at least medium and higher voltage levels, even if LV interruptions can be a major issue in urban areas. In order to

introduce single-customer standards, it's strongly recommended to measure continuity of supply according to the customer's viewpoint, which means that interruptions at every voltage level should be recorded.

4. **Incentive/penalty regimes for continuity:** Regulators have a strong interest in introducing incentive/penalty regimes that counterbalance the cost cutting trend of price-cap regulation in order to avoid unintended effects on quality of service, especially continuity of supply. The examples of incentive/penalty regimes already enforced for several years show that extremely good results can be obtained. It is recommended that each country develop its own incentive/penalty regime taking into account its specific conditions as regards, for instance, network development, investment levels, regional differences and automation projects. It is highly advisable for incentive/penalty regimes to be subject to regular periodic review and for results to be evaluated in light of the benefits and costs for final consumers.

5. **Customer research:** The introduction of incentive/penalty regimes will require more customer research, especially on the customers' willingness to pay for continuity improvement. Country-specific issues are very relevant to customer research, but it would be best to follow common research methodologies or at least share ideas about how such research can be improved.

6. **Multiple interruption standards:** Standards related to the maximum yearly number of unplanned interruptions can be seen as a very useful regulatory signal for structural investment on the distribution networks, and can also have potential benefits for LV customers even if the standards apply only to MV customers, as the MV network is generally responsible for most interruptions per customer. This type of standard requires a measurement system with indicators evaluated for each customer subject to the standards; it is therefore advisable to adopt a gradual approach, for instance starting with HV and MV customers.

7. **Very long interruption standards and severe weather conditions:** As most of the "very long" interruptions are due to the impact of atmospheric phenomena on overhead circuits, it is strongly recommended that regulators establish a precise definition of "*force majeure*" or set up mechanisms (like the British one) for differentiating maximum duration standards according to the severity of weather conditions. It is worth mentioning that, due the different objectives of the two regulatory regimes, different approaches can be used for treating exceptional events for the incentive/penalty regimes and for Guaranteed Standards.

CHAPTER 3 – Standards in Commercial Quality Regulation

CONTENT

STANDARDS IN COMMERCIAL QUALITY REGULATION

3.1 What is Commercial Quality? Why regulate Commercial Quality?

Commercial quality relates to the nature and quality of customer service provided to electricity customers. In a liberalized electricity market this is more complex by the fact that supply and distribution are separated (the customer may not be served by a single integrated electricity utility but rather by separate distribution and supply companies). This is a distinction which is not always clear from the customers' perspective. This separation of activities will be more and more common with the application of the unbundling rules as the customer shall conclude either a single contract with the supplier or separate contracts with the supplier and the DSO. In both relations commercial quality is an important issue.

Commercial quality is directly associated with transactions between electricity companies (both DSOs and Suppliers) and customers. The transactions include not only the distribution/transmission and sale of electricity, but also the contacts established between electricity companies and customers. Before the beginning of supply several transactions occur between a potential customer and the DSO, such as connection and meter installation. These and later transactions during the contract can be made subject to a set of relevant quality factors which determine a network- and/or supplier company's commercial quality performance.

Commercial transactions between an electricity company and a customer may be classified as follows:

- **Transactions related to conditions of distribution and supply** for new connection such as information on connection to the network and prices associated with the supply. These transactions occur before the supply contract comes into force and incorporate transactions both with the DSO and the supplier. Generally, customer rights with regard to transactions related to these conditions are set out in Codes (such as Connection Agreements and the General Conditions of Supply Contracts) approved by the regulatory authority and /or other governmental authorities.

- **Transactions during the period of the contract,** such as billing, payment arrangements and responses to customers' queries, complaints and claims. These transactions are regular or occasional transactions. Regular transactions refer to those like billing and regular meter readings. Some transactions between the electricity company and the customer are necessary only occasionally, when the customer contacts the company with a query or a complaint. The quality of these transactions can be measured for example by the time span the company responds. These transactions could relate to the DSO and the supplier respectively and could be quality regulated according to the regulatory framework of the particular country.

Given the wide range of transactions between a supplier/DSO and a customer, the reality is that companies have substantial discretion over the services they provide and the way they provide them as well. It is often asked why is it necessary to measure performance, set incentives, regulate and prepare quality requirements for the electricity companies in a liberalised market where competition should force the companies to perform at or above a certain minimum level. The reality is not that simple. There are for example some fields where the DSOs have exclusive rights and do not compete with other participants. Regulation can introduce competition in contestable areas of network operation (e.g. metering), but this practice is not fully adopted across CEER members. Further at the beginning of this process competition is limited. Frequently there is competition in supply/trading activities with the possibility for new firms to enter the market, but often this does not involve all groups of consumers (e.g. household customers) and in the absence of efficient retail competition it does not give a good incentive to keep the commercial quality above a certain level or to raise it. It is therefore important to have in place elements of quality regulation for incumbent electricity companies.

Another aspect which is generally valid for all elements of quality regulation relates to the incentive regulation regarding network charges. This price-regulation method (price cap/price formula/pricing period) encourages network companies to reduce costs (and thus increase efficiency) during pricing period. The consequence of the reduction of operational expenditure may be that actual levels of network quality of service decline or do not improve in line with customers' expectations. This may easily be the case in countries, where the incentive regulation principle in network price regulation (price cap) is being developed and could be adopted in near future, while stipulations on service quality standards could be targeted later only. There is a question whether it is appropriate to keep some minimum standards even where the competition is fully developed so that there would be a minimum standard with regard to supply and companies may compete in providing standards which exceed these. On the other hand, some commercial quality aspects (for instance times for connections) are related to distribution networks and therefore given the monopoly element they should be regulated.

Important factors in analysing how a company interacts with and responds to the needs of customers include the presence or absence of a complaints procedure, how the matter was handled and if it was settled satisfactorily as well as the information the company itself collects regarding customer service. One of the most direct ways that quality regulation works to ensure good customer service is through commercial quality standards or requirements. The most important issues and the commonly used commercial quality indicators and standards are explained in the subchapter 3.3. A complete list of existing standards in each country is given in Annex 3A. It is necessary, in general terms, to identify which standards relate to distribution functions and which relate to supply functions because commercial quality is related to unbundled activities.

Commercial quality regulation attempts to ensure there is an appropriate level of commercial quality. This is achieved, to different extents in each country, through the use of regulations or codes, performance standards, the dissemination of information to promote quality of service as well as through strategies to encourage customer participation. The involvement of the customers and their representatives can make an important contribution to quality regulation because on the one hand customer surveys show the customers' own expectations (and not only those expected by the regulators), on the other hand the customers are the ones affected by inadequate service. The level of customer satisfaction when they contact a company is most important in this respect (e.g. call centres, costumer contact centres). Higher customer expectations and their effect on regulated network prices require a regulatory strategy which includes the customer perspective.

3.2 Commercial Quality Questionnaire

Although not explicitly stated, the questionnaire targeted LV household and small industry consumers (up to the large consumer limit, which limit varies from country to country). Where data refer to MV or HV customers it is marked accordingly.

3.2.1 Scope of the Questionnaire regarding Commercial Quality

The CEER QoS TF designed the questionnaire to examine:

1. Actual levels of commercial quality;
2. Standards (guaranteed and overall) in commercial quality;
3. Compensations if guaranteed standards are not met.

Country regulators were asked to answer seventeen questions on actual levels and a further twenty-four questions on standards of commercial quality. In addition, each country was requested to define in more detail the indicators of commercial quality in their country in order to aid the harmonisation of information received on actual levels of service. Information gathered on the actual service levels and the standards that are in place can be found in Annex 3.

Information was collected on the standards required from supply and distribution companies and on the penalty payments that are imposed in the event that companies fail to meet the required performance (where appropriate). A further approach that could be adopted is identifying the characteristics of commercial quality that are important to the customer. This survey did not research consumer protection policies and procedures across countries. Neither did it examine the customers' views on the characteristics on good service or attempt to measure customer attitudes and satisfaction.

3.2.2 Data Availability

The analysis in this Report is based on the information obtained from all (or some, as appropriate) of the following (nineteen) countries: Austria, Belgium, the Czech Republic, Estonia, Finland, France, Great Britain, Greece, Hungary, Italy, Ireland, Latvia, Lithuania, Norway, Poland, Portugal, Slovenia, Spain and Sweden.

It has to be remarked that without analysis of the detailed definitions of the respective commercial quality indicators one has to be very cautious when comparing data. The general experience of quality regulation can be used for analysis of existing trends and expectations.

Where the data in days referred to working days as distinct from calendar days, answers specified in working days have been converted into calendar days (5 working days = 7 calendar days, 7 working days = 9 calendar days, etc).

3.2.3 Answers to Questionnaire

Answers were received from 19 of the 26 CEER member authorities (See Table 3.1). Fifteen provided answeres to the questions concerning the actual levels of commercial quality (Questionnaire ref. No 1.1 and 1.2).

Finland has not given reasons for not supplying data. Austria and Germany do not have fully fledged experiences in the area of the regulation of commercial quality and this was the reason for not supplying data. Particularily in Germany, no incentive regulation principle in network price regulation has been adopted so far. An incentive based regulatory scheme is currently being developed. In the Czech Republic the amendment of the current regulation is expected by the end of 2005, thus the monitoring of the quality standards will start from January 1, 2006. The new Energy Law of Poland became effective on March 3, 2005. The Polish regulator does not yet have information on the current performance levels of the commercial quality, but this is rather common situation even among regulators that have set some commercial quality standards For instance, Great Britain has only supplied data for “The average speed of telephone response for distribution call centers” (Section 1.1.3 of the Questionnaire) because in general OFGEM does not collect data on actual levels of commercial quality but rather measures performance against the standards with the percentages of cases in which standards are met. Finland provided comments solely on Questionnaire sections 1.1.8 and 1.1.9. Sweden stated, that the general practice and the economic and market conditions have not made regulation of the commercial quality a necessity. The companies themselves are expected to provide standards in order to satisfy the expectations of their customers. Beside that, the Swedish Consumer Electricity Advice Bureau provides information, guidance and assistance to consumers in various matters concerning the electricity market. All information and guidance is free of charge. Usually, regional data are weighted by the number of customers in the specific region except for the Belgian and Slovenian regulators who supplied data only in relation to two regions. (Therefore there are two columns in the table under the names of these countries.)

The evaluation of the actual level of commercial quality for distribution networks and retail supply was based on data supplied by 12 countries (Belgium, Estonia, France, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Portugal, Slovenia, Britain), completed Table 1.1 of the questionnaire. The data refer to 2004.

TABLE 3.1 Commercial quality related answers to the distributed questioners

Involved regulators of countries	Commercial quality at distribution/supply level	
	Actual levels (facts) 1.1. Questionnaire	Standards 2.1. Questionnaire
Austria		✓✓
Belgium	✓✓	✓✓
Cyprus		
Czech Republic		✓✓
Denmark		
Estonia	✓✓	✓✓
Finland	✓	
France	✓✓	✓✓
Germany		
Greece	✓✓	✓✓
Hungary	✓✓	✓✓
Ireland	✓✓	✓✓
Italy	✓✓	✓✓
Latvia	✓✓	✓✓
Lithuania	✓✓	✓✓
Luxembourg		
Malta		
Norway		✓✓
Poland	✓	✓
Portugal	✓✓	✓✓
Slovakia		
Slovenia	✓̶	✓̶
Spain		✓✓
Sweden	✓	✓
The Netherlands		
UK	✓✓	✓✓

✓ = An evaluation (reply) in words ✓✓ = Numerical information rendering ✓̶ = Partial regional information rendering

Commercial Quality at transmission level

The answers to the questionnaire 1.2. about the existing/actual levels of measured commercial quality in connection with transmission network have returned only the regulators of Belgium, Estonia and France. To the questionnaire 2.2. about the Commercial Quality related standards of transmission networks replied the regulators of the same three countries and Slovenia.

3.2.4 Analysis

The evaluation of standards of performance was based on Table 2.1 of the questionnaire. 19 countries replying to the questionnaire provided detailed information. The questionnaire originally listed 24 standards and also allowed countries to specify any additional standards that are specific to them. A number of countries have made use of this option, therefore information is available on 23 additional standards. This Chapter focuses on the most common standards as it would be impractical to discuss all of the standards due to the large numbers, differing definitions and interpretations and circumstances in each of the countries. On the basis of replies further analyses were made the results of which are shown in **Tables 3.2, 3.3 and 3.4** (see in Annex 3B). In **Table 3.2** data are found on the 17 original indicators in questionnaire 1.1, **Table 3.3** shows the original 24 standards of the questionnaire 2.1 broken down by countries and licensees (distributor or supplier), while **Table 3.4** shows how the specific countries apply these standards: as guaranteed standards or overall ones. Each line of these latter two tables is repeated at the heading of the section where the standard is addressed in detail.

It is important to keep in mind that any comparison of data supplied may be misleading as the level of liberalization as well as extent of competition, rate of unbundling and market experience vary significantly by countries. One should take these factors into consideration during making comparisons and drawing conclusions. It seems generally to be the case that with market opening less standards of performance are applied on Suppliers while more ones are applied to address DSO quality of service issues. As the efficiency of energy markets grows there is less of a need for supply-related commercial quality indicators and for regulatory intervention. However, it is important to maintain commercial quality regulation in the initial phases of market opening, particularly where customers have difficulty switching supplier or changing tariffs with their existing supplier. Although general the in Report the word “standard” is used in the practice of some countries the word “requirement” would fit better (the regulatory authority sets “requirements” instead of “standards”).

The following table serves as a guide to the most popular and most frequently used standards.

TABLE 3.5 MOST FREQUENTLY USED COMMERCIAL QUALITY STANDARDS

Area	Standard	Number of countries where applied					
		OS	GS	Both	DSO	Supp.	Both
Connections of the customers	Estimating charge (simple work)	2	5	1	7	0	0
	Execution of simple works	2	4	0	6	0	0
	Execution of complex works	2	3	0	5	0	0
	Connection (supply and meter)	3	9	1	12	0	0
Restoration in case of fault related to single customer	Responding to failure of distributor's fuse	0	9	0	9	0	0
Solving problems related with voltage or meter	Voltage complaints	3	7	0	11	0	0
	Meter problems	3	8	0	11	1	0
Customer contact in person, in writing or by phone	Notice on interruption of supply	6	9	0	14	0	0
	Queries on charges and payments	2	9	0	5	5	1
	Response to customers letters	3	5	0	2	1	5
	Response to customers claims	4	5	0	3	1	5
	Appointments scheduling	0	8	0	7	0	1
Meter reading and billing	Number of meter readings within a year	9	3	0	10	0	0
	Reconnection following repayment of debts	4	8	0	10	1	0

(Note: In many cases the sum of figures DSO+ Supplier cells is not equal to that in GS+OS cells. The reason is the incomplete answer to the questionnaire, obviously, empty cells could not be analyzed. Further, in some cases - e.g. Italy in estimation charges - the same standard is a GS and OS depending on the category of the customers or on the voltage level. In other cases the same standard is applied both for DSO and Supplier.
The highly important standard on Restoring/reconnecting supply and its analysis are not included here, as they are addressed in details in Chapter 2, The use of Standard and Incentives in Quality Regulation.)

These 14 standards serve as the mainstream standards for trhe purposes of comparison and analysis while the other arguably less important standards are summarized in Annex 3A.

From the standards applied by at least 5 countries (see **Table 3.5**) it is clearly shown that the focus is on five different activities. The first one is connection to the network, the second one is the restoration of the supply, the third one is the settlement of problems associated with voltage and metering, the fourth one is maintaining relations with the customers (in writing, in person and over the phone) and handling of claims, and the fifth one is the activities relevant to meter-reading and billing. The analysis of these activities is presented in the following sections.

The most common five standards for suppliers (see **Table 3.5**) appear at most in 5 countries (note the figures in column "Both" too), whereas for distribution companies apply significant more standards. This is explained by a number of countries focusing on continuity and other quality of service issues relating to the DSO, while quality of service issues related to Suppliers is allowed to be driven by competitive market forces. This approach may justified in certain circumstances. However, considering the current situation of several CEER member states where competition is starting to be introduced and there is no established quality regulation in place it may be is useful to cover Commercial Quality issue both for DSOs and Suppliers.

3.2.5 Kinds of Standards of Commercial Quality

There are two kinds of Standards of Commercial Quality: guaranteed standards and overall standards.

- **Guaranteed Standards (GS)** set minimum service levels, which must be met in each individual case. If the company does not meet these standards compensation at fixed rates is payable to the customers concerned. The definition of Guaranteed Standards involves the following attributes:
    1. Service covered (e.g. estimating charges).
    2. Required performance level – usually stipulating a response time (e.g. 5 working days).
    3. Penalty/compensation payment the customer (e.g. € 20) in case of non-performance of standard level.

- **Overall Standards (OS)** cover areas of service where it may not be possible to provide guarantees but where customers are entitled to expect pre-determined levels of service. With overall standards the company is required to conduct its business in such a way as to be reasonably expected to deliver the standard. Overall Standards are defined as follows:
    1. Service covered (e.g. connecting new customers' premises to electricity distribution system).
    2. Minimum performance level (usually a percentage) to be achieved over a defined period (e.g. 90% of cases should be connected within 20 working days, over a one year period).

Overall standards do not imply penalty payments but are fundamental to monitor and promote quality of service. The institution of GS is a very effective means for the regulatory system to stimulate the continuous increase of the standard of supply. However, both types of standards are only effective if the consumers get sufficient information on them. Regular (annual) reports by the regulator on the performance of companies are effective means not only to measure performance and for the company to improve its image, but also to inform customers of the standard of service they can expect. The presence of standards and regular reporting on quality actual levels also confirms the improvement of the standard of customer service as a regulatory objective in several countries.

It is clearly shown (from Table 3.4 in Annex 3B and Table 3.5 above) that the regulators make more use of Guaranteed Standards (GS) than Overall Standards (OS). (The number of GS is more than the double of that of OS.) We think that this is useful as most standards are then a requirement that the company has to meet for each individual customer rather than an average target for performance. As Italian and English practice show the number of OS have been decreasing or disappearing while more and more GS come into force instead. This process is likely continues in other countries in the next future.

3.2.6 Layout methodology

After an introductory interpretation the commercial quality-related indicators applied by CEER member authorities are presented one by one. Where possible the actual performance as well as the standards relating to a particular service are given. The reference number of the question in the original questionnaire is given as well as the number of countries in which the standard has been applied for

- DSO or
- Supplier and
- whether it has been applied as a GS or OS.

In order to encourage the use and refinement of particular standards recommendations on their application (and their relative importance, marked by ☆s) is set out. These are based on practical experience of quality regulation and/or on the opinion of CEER members. (marked as Recomm.)

3.3 Standards and actual levels of Commercial Quality

3.3.1 Connection of the customer to the network

Quest. 2.1.4	Recomm. ☆☆☆
Supp. 0	DSO 7
OS 3	GS 6

3.3.1.1 Standards applied for the preparation of a cost estimate for simple works

The standards applied for preparation of a cost estimate for simple works in the case of household customers ranges between 6 and 20 working days. The rate of compensation payable in case of non-compliance varies between € 8 and € 60. The separation of the simple and complex works is not uniform across countries. Payment is automatic in the countries answering the questionnaire. In Spain the rate of compensation is influenced also by the amount of the bill of the customer (**Table 3.6** of Annex 3B.).

> ***CQ#1*** *For the harmonized use of a standard for preparation of a cost estimate for simple works first of all it is necessary, that "simple work" should be interpreted in the same way by all regulatory authorities. Time limist can be set subsequently. Efforts should be made to make the payment automatic where practicable.*

Quest. 2.1.20	Recomm. ☆☆☆
Supp. 0	DSO 4
OS 2	GS 3

3.3.1.2 Standards applied for the preparationos a cost estimate for complex works

The standards applied for preparation of a cost estimate for complex works varies between 21 and 90 days. It is characteristic that the timescale depends on the voltage level. (Higher voltage level = longer timescale for the provision of a connection quotation) In Italy 90% of the cases shall be arranged within the prescribed 40 working days. The rate of compensation in Ireland is € 130, and in Spain a minimum of € 30. (**Table 3.7** of Annex 3B.)

> ***CQ#2*** *For the harmonized use of the standard for preparation of a cost estimate for commplex works first of all it is necessary, that "complex work" sould be interpreted in the same way by all regulatory authorities. Time limist can be set subsequently. Efforts should be made to make the payment automatic where practicable.*

Quest. 2.1.17	Recomm. ☆☆☆☆
Supp. 0	DSO 6
OS 2	GS 4

3.3.1.3 Standards applied for the execution of simple works

If "simple works" refers to activities when the request of the customer can be realized without the extension of the existing network or without building a new network, the standards applied ranges between 3-20 working days. In Italy the standard is differentiated for voltage levels: 15 working days for LV customers, 30 working days for MV cases. In case of non-compliance the compensation payment is automatic in all cases, the rate of compensation in LV is between € 25 and € 65. This rate may vary depending on the category of the customer, the voltage level and the amount of the first complete bill. (**Table 3.8** of Annex 3B.)

> ***CQ#3*** *The definition and classification of activities referred to as"simple works" need further improvement. Introduction of harmonized standard is only possible subsequently.*

Quest. 2.1.21	Recomm. ☆☆☆
Supp. 0	DSO 5
OS 2	GS 3

3.3.1.4 Standards applied for the execution of complex works

According to the previous section, this group includes the activities when the works to be carried out are not of low voltage, and where it is necessary to extend the existing network, to build a new network or one or more transformer stations. The relevant standards specify 45-60-80 working days for the execution of these works. The rate of payable compensation – in case of non-compliance – is € 30-65 in case of household customers, in case of medium voltage customers the compensation is € 60-65. Compensation may be paid on request or automatically. (**Table 3.9** of Annex 3B.)

> ***CQ#4*** *The works in the category of "complex works"are so varied that a harmonized regulation does not seem possible. However, it is important that every country has a clear standard applicable for the execution of complex works in order that the customer can calculate in advance the completion time.*

Quest. 2.1.3	Recomm. ☆☆☆☆
Supp. 0	DSO 12
OS 4	GS 10

3.3.1.5 Standards applied for the start of supply

The most commonly applied standards for the start of supply are 2, 3 and 5 working days. A "loose" standard of 30 working days is applied in Greece, in case where the LV service is also to be rendered. The compensation is characteristically a lump sum predetermined by voltage levels, which varies between € 8 and € 150. In the Czech Republic the sum is influenced by the number of days of the delay, while in Spain it may be influenced by the amount of the bill of the customer with a minimum of € 30. In Lithuania and Slovenia there is no compensation payment. (**Table 3.10**. of Annex 3B.)

> ***CQ#5*** *The supply of the customer with energy is a question of outstanding importance.*
> *The Directives of the EU also priorities the issue of connection to the network and the issue of network access, and places these under the responsibility of the regulators. Therefore it is recommended that there should be harmonized standards in this area that set out within how much time the customer shall be connected to the network following the fulfilment of the conditions to be met by the customers, and the conclusion of the supply contract. The majority of the standards determine 2-5 working days. The compensation may increase depending on the duration of the delay.*
> *In this case also, efforts should be made to make the payment automatic.*

Quest. 2.1.19	Recomm. ☆☆☆☆☆
Supp. 1	DSO 10
OS 4	GS 8

3.3.1.6 Standards applied for the reconnection of the customer to the network after the payment of debt

Almost every regulator indicated a reconnection time of 1 day. The Greek standard is a bit more rigorous, in Greece the customer will be reconnected on the same day that the payment is made provided that this is within working hours. The standard which can be met most easily exists in Lithuania and Estonia, where the customer shall be reconnected to the network within 5 working days. The compensation rate varies between € 15 and € 120 depending on the voltage level and on the delay in making the reconnection, on the category of the customer, on the connection capacity and on the amount of the customer's bill. There are countries where no compensation is paid (Slovenia, Lithuania), while in some specific cases (Czech Republic, Hungary) compensation is paid only upon request. (**Table 3.11**. of Annex 3B.)

> ***CQ#6*** *Considering that the customer — even if he/she has not always paid on schedule — has fully paid its debt, and according to the practice of several countries, has paid a specific fee for the reconnection, it may request the restoration of the supply as soon as possible. Therefore CEER recommends that the maximum length of time for reconnection should be one working day. Any delay past the oneworking day reconnection time could increase the amount of compensation.*

Quest. 1.1.13	Recomm. ☆☆☆
Supp. 7	DSO 6

3.3.1.7 Actual levels for the average response time to demands for LV supply

The seven answers received showed response times between 0 and 30 days. The original data generally came from distributors, but in Hungary suppliers also delivered data, while in Estonia it was exclusively the sales agent who supplied data. The 5 working days indicated by Portugal has been taken to be equivalent to 7 calendar days. Estonia's figures are the average of the times between the receipt of an application for a connection and sending out the offer. The Slovenian data refers only to queries arriving by mail. (**Table 3.12** of Annex 3B.)

Quest. 1.1.14	Recomm. ☆☆☆☆
Supp. 1	DSO 9

3.3.1.8 Actual levels for the time of connection of a new customer to the network

The figures indicated by the nine countries answering the questionnaire were between 1 day and four months. In all cases the original data came from distributors, which was complemented by supplier data only in the case of Hungary. The working days for the Portuguese and Lithuanian standards have been converted into calendar days. Depending on the type of the work Greece indicated three standards, while Latvia and Italy indicated two standards. (**Table 3.13** of Annex 3B.)

Quest. 1.1.15	Recomm. ☆☆☆☆
Supp. 0	DSO 7

3.3.1.9 Actual levels for the time of starting the supply

In the countries answering the questionnaire this activity is performed within a period of time ranging between 1 and 7 days. The original data were supplied by distributors in all cases. All times in working days were converted into calendar days. In Italy the average time is 0 day in case of self-activation (i.e. by the customer, subsequent to activation permission from the supplier), while if Automatic meter Reading (AMR) is available activation is controlled remotely. In Hungary the signing of the contract takes place at the time of the connection, thus in the specific regions the time passing between the two steps can be measured as a few minutes. (**Table 3.14** of Annex 3B)

3.3.2 Restoration of supply

Quest. 2.1.1	Recomm. ☆☆☆☆☆
Supp. 0	DSO 9
OS 0	GS 9

3.3.2.1 Standards applied in the case of a distributor's fuse[14] failure

In some countries customers at their premises are equipped with a distributor's fuse and this standard refers exclusively to replacement of such fuse, while in other countries this standard refers to faults of meter or breaker or LV services in customers' premises too. In case of fuse failure the majority of standards prescribe 3 and 6 hours as the time of restoration. The restoration time is maximum 6 hours for Wallonia (in Belgium). In many countries the restoration time has been differentiated for example by customer category (household – non-household), density of customers (city, town, rural area), time of the occurrence of the error (working hours – out of working hours – weekend). Similarly to other standards this one is differently defined and interpreted by countries. In Italy a new standard is applied from 2005 to eliminate meter faults. Relevant data will be available from 2006.

The rate of compensation varies between € 8 and € 35, depending on the category and zone of the customer. In the majority of countries the electricity companies pay a sum of € 15-30 to the customers.

The payment is generally automatic. There is a small number of countries where payment depends on customer claiming (for example in the Czech Republic). In Portugal the customer shall be obliged to pay for the cost of the work if the fault is in the customer's installation. (**Table 3.15** of Annex 3B.)

CQ#7 *Due to its high importance the standard applied in the case of a distributor's fuse failure, should be applied within all CEER member countries. Most of the current standards specify 3-4 hours as restoration time and CEER thinks compensation be automatic if practicable. Differentiation among the regions and according to the density of customers (town-countryside) may depend on political considerations in some countries. When determining standards this question is to be handled by the national regulator; this cannot be harmonized among the CEER members.*

Quest. 1.1.16	Recomm. ☆☆☆☆☆
Supp. 0	DSO 10

3.3.2.2 Actual levels for the average time of restoration

Data received from nine countries ranged typically between 0,72 and 2 working days. The original data is supplied in all cases by the distributor. The comment made by Norway in connection with this point (it does not include the data of the delays occurring due to low voltage faults), and the individual quality indicator recommended by Lithuania (see section 3.3.10.6) suggests that this indicator has been applied differently by these two countries. (**Table 3.16** of Annex 3B.)

[14] (or breaker or meter)

3.3.3 Problems associated with voltage and metering

Quest. 2.1.6	Recomm. ☆☆☆☆
Supp. 0	DSO 11
OS 3	GS 7

3.3.3.1 Standards applied for voltage complaints

In several countries this activity has been separated into two steps. The first step is a check-up on the site, which is followed by a response to the complaint. Separate time limits are prescribed for both steps, 7-8 days for the check-up, and 5-8 days for the response to the complaint. Where such complaints are handled as one single procedure, the standard is 10-15 working days for the resolution of the problem. Many countries indicated Standard EN-50160:1999 as a norm relevant to the voltage. In Italy – depending on the voltage level – the adjustment time shall be respected in 90-95% of cases. In Norway one month is available for the survey and for the preparation of the progress schedule. In Portugal the customer shall pay to the supplier the cost of the monitoring (capped by the national regulator) if the complaint is not justified. In case of non-compliance by the electricity company the compensation rate to be paid varies between € 8 and € 75 depending on the voltage level and on the connection capacity. The payment of compensation – if any – is automatic. (**Table 3.17** of Annex 3B.)

CQ#8 *This standard applied for voltage complaints is a major issue with potentially significant implications. This may mean that some voltage discrepancies may be caused by the customer. CEER recommends further analysis in this area as part of its 2006 work programme.*

Quest. 2.1.7	Recomm. ☆☆☆☆
Supp. 1	DSO 11
OS 3	GS 8

3.3.3.2 Standards applied for the case of meter problems

Similar to the previous standard, in many countries the process for dealing with metering problems has been divided into two steps. The visit to the site and the check-up shall take place within 5-7 working days from the receipt of the customer's complaint. The most characteristic time limit for fully addressing such complaints is 15 days. In the Czech Republic and Slovenia the customer shall make a payment to the distributor for the verification, if the meter is found to be perfect. In Lithuania the reported problems of non-household customers shall be handled within 2 days. In Spain the standard is 5 working days below 15 kW connection capacity, over this it is 15 working days. The rate of compensation varies between € 15 and € 75. The sum may be influenced by the delay in responding, the category of the customer, the voltage level, the connection capacity and the amount of the customer's bills. The majority of the countries answering the questionnaire apply automatic compensation payments. (**Table 3.18** of Annex 3B.)

CQ#9 *In the case of standards to be applied for meter problems the provision that the customer shall pay the full or partial costs if the meter proves not to be foulty, can be a useful solution to reduce unjustified customer complaints which engage significant resources. However, when determining the sum to be paid, attention has to be paid that the payment shall not be a disproportionate burden on the customer.*

Quest. 2.1.12	Recomm. ☆☆☆
Supp. 0	DSO 4
OS 0	GS 4

3.3.3.3 Standards applied for the correction of voltage faults

Since several countries answered this question together with the indicators under section 3.4.3.1, only Hungary and Ireland answered to this specific question. In these countries in case of a voltage problem examined and found justified, the required actions on the network (construction, extension, modification of the section border) shall be carried out within a max. 0,25 – 1 year, as a result of which the prescribed voltage should be assured. Compensation is paid on the request of the customer. The rate of compensation is € 20 - 50 for household customers, while for medium-voltage customers € 120 shall be paid. (**Table 3.19** of Annex 3B.)

> ***CQ#10*** *It is useful to apply this standard (applied for the correction of voltage faults) together with the standard for voltage complaints (analyzed in section 3.3.3.1). While that standard includes provisions relevant to the handling of the complaints, this standard for the correction of voltage faults has provisions relevant to the actual time of the correction of voltage complaints, sometimes lasting for a long period.*

3.3.4 Customer contact in writing

Quest. 2.1.5	Recomm. ☆☆☆☆☆
Supp. 0	DSO 14
OS 6	GS 9

3.3.4.1 Standards applied for information (notice) on scheduled supply interruptions

Many countries have standards for notice to be given on scheduled supply interruptions. The most rigorous deadline exists in the Czech Republic, where the customer shall be informed 15 days prior to the scheduled interruption. However, in the majority of cases there is an obligation to inform the customers 24-36-48 hours prior to the scheduled interruption. In Norway there is no specific standard, only the condition, that the customers shall be informed in proper time and in a proper way. In France in case of emergency works “a.s.a.p.” notice is to be sent. With regard to the compensation fees there are significant differences among the countries. While in Poland the compensation fee is € 3,8 at LV, in the Czech Republic the fee may reach even € 300 at HV. The rate of the fee may be influenced by the amount of the bill, the voltage level and the category of the customer. In approximately 50 per cent of replies to the questionnaire compensation is paid automatically, in other cases upon request of the customer. (**Table 3.20** of Annex 3B.)

> ***CQ#11*** *The large number of countries where the standards for notice on scheduled interruption are applied clearly shows the importance that regulators attribute to inform the customers of all foreseeable interruptions. CEER recommends that providing information 24 hours prior to the interruption may not be sufficient for small industrial customers to take the appropriate preventive measures. Therefore some working day(s) for sending a prior notice is (are) recommended.*

Quest. 2.1.8	Recomm. ☆☆☆☆
Supp. 6	DSO 6
OS 2	GS 9

3.3.4.2 Standards applied for responding to queries for information associated with charges and payments

The standard (applied for responding to queries for information associated with the charges and payments) sets in three countries is 5, in one country is 7, in two country is 10 and in two further countries 15 and 20 working days, respectively. These periods relate to the requirements on electricity companies to respond to customer’s queries regarding charges and payment. The sum of the compensation paid by the electricity company in case of non-compliance varies between € 1,9 and € 30 for household customers. In the Czech Republic the sum is determined by the duration of the delay. In Hungary it is determined by the category of the customer and the voltage level, in Portugal it is determined by the connection capacity and the voltage level, while in Spain it is determined by the sum of the first complete bill of the customer with a minimum of € 30 compensation. (**Table 3.21** of Annex 3B.)

> ***CQ#12*** *Due to the very differing results it is recommended to harmonize this standard applied for responding to queries for information associated with the charges and payments across CEER member authorities. The payment of compensation should be automatic.*

Quest. 2.1.15	Recomm. ☆☆☆☆☆
Supp. 2	DSO 7
OS 3	GS 5

3.3.4.3 Standards applied for answering customer's letters

The regulators of the CEER member countries answering the questionnaire have a rather uniform standpoint in this question. The response time is 15 days in almost every case. The required response time is longer in Estonia (30 days), in Greece if there is a need to visit the site (15 working days), and in Italy (20 days), while in France it is shorter 8 days. In Italy this level does not have to be met in 100% of the cases, but in 90% for low voltage and in 95% of cases for medium voltage customers. In Latvia it is not the regulator who determines this standard, but it is included in the internal regulation prepared by the licensees. In case of non-compliance the rate of compensation to be paid is € 15-25 for household customers. In case of non-household customers it is between € 40 and € 120. In Poland the sum of the compensation is proportionate to the duration of the delay. (**Table 3.22** of Annex 3B.)

> ***CQ#13*** *The experience shows that the 15-day response time for answering customer's letters can be met by the licensees and it is also acceptable for the customers. However, considering the more complicated cases which occur from time to time, it is also reasonable, that this period should not be respected in 100% of the cases, in certain percentage when it is impossible to give appropriate answer within the deadline, a notice to the customer is to be sent disclosing the reasons and time of expected answer. As a condition of this, data management system should be established recording each and every customer contact, and which is able to reliably produce the required records. Furthermore, it is recommended to introduce an absolute time during which all matters should be settled. If regulator decides so data availability enables automatic compensation.*

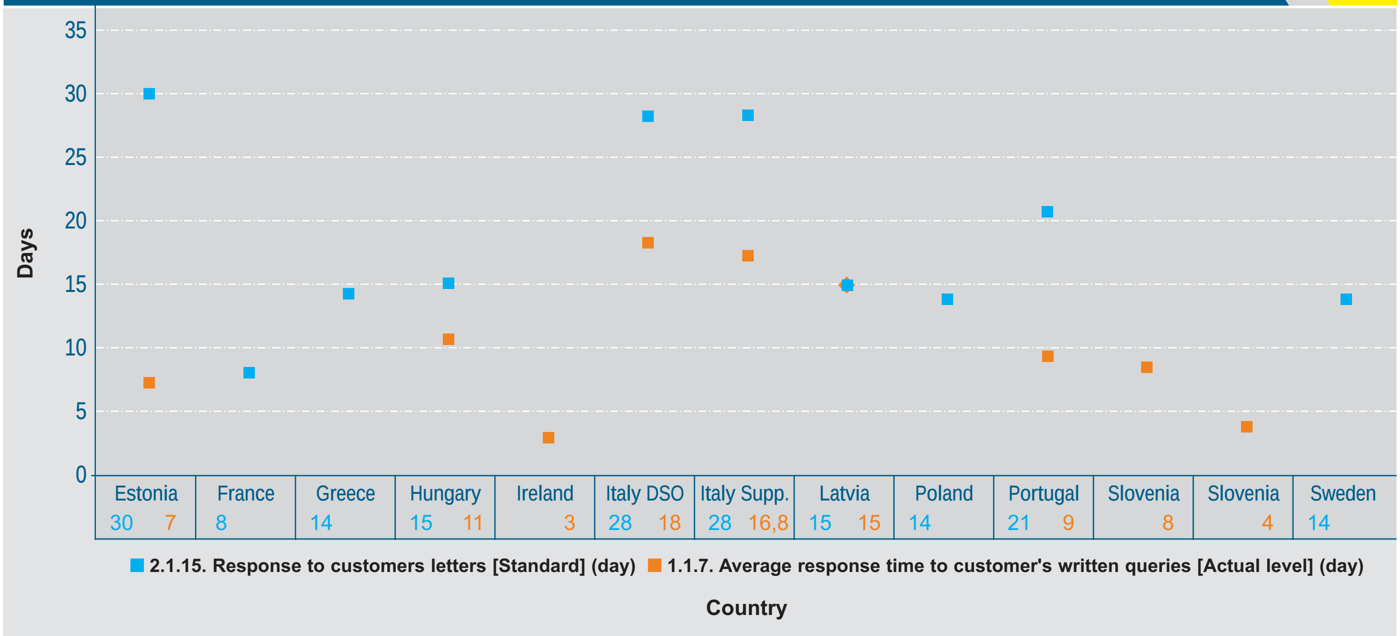
Quest. 1.1.7	Recomm. ☆☆☆☆☆
Supp. 2	DSO 5

3.3.4.4 Actual levels for the average response time of answering written queries

Answers were received from six regulators. The applied response times are between 3 and 18 days. The data have been supplied mostly by the distributors, while, in the case of Estonia and Italy the delivered data relates to the supplier. The Hungarian data include the response time of the answers related not only to the distributors, but also to the suppliers. (**Table 3.23** of Annex 3B.)

The following table shows expected and the actual values of the indices mentioned in this section. A more detailed table can be found in Annex 3B.

TABLE 3.24 RESPONSE TO CUSTOMER'S WRITTEN QUERIES



3.3.5 Customer contact in person

Quest. 2.1.9	Recomm. ☆☆☆☆☆
Supp. 1	DSO 8
OS 0	GS 8

3.3.5.1 Standards applied for keeping scheduled appointments

In the case of scheduled appointments 3 countries apply a window of 4-hour intervals, an other 3 countries a 3-hours, one country 2-hours, and there is also one country applying 1-hour interval. These appointments shall only be during the working hours of the licensees. In case of non-compliance the compensation rate payable to the customer varies between € 15 and € 40 for domestic consumers. Its higher for LV non-domestic consumers e.g. in Italy or in Hungary. The sum may be influenced by the category of the customer, the voltage level, and the connection capacity. In Portugal the customer also has to pay if it is not available at the time of the scheduled appointment. Both types of compensation payment are applied (automatic and upon request). (**Table 3.25** of Annex 3B.)

CQ#14 *The regulator should require a maximum of 4 hours intgerval for licensee to respect when scheduling appointments with customers. This means that it is not acceptable that the customer should wait for more than 4 hours for an action which often lasts only 10-15 minutes. CEER notes customer's expectation that compensation payments are of higher importance than in other cases, since by waiting at the site, actual costs may arise to the customer, which have to be compensated.*

Quest. 2.1.23	Recomm. ☆☆☆
Supp. 0	DSO 1
OS 1	GS 0

3.3.5.2 Standards applied for the attendance of customer centers[15]

In the first round of reduction of the operating costs (especially after privatization and/or after the introduction of incentives into the network charge regulation) in most cases it is often the traditional customer centers which have been reduced or closed. Distributors and suppliers favor up-to-date forms of administration which are more cost-effective: Call Centres or the Internet. However, for some customers these changes are too fast. They are used to the old practice: „I go there, I sit down, we discuss the problem and we arrange it", they prefer to go to the customer centres. It may be the case that as Call Centres develop customers may be reluctant to try this type of communication channel in which case Call Centres will have unused capacities, while due to the customer centre closures the existing customer centres suddenly have to face an increased attendance. In medium/longer term more and more customers using the customer centres, will switch to Call Centres or other new forms of communication. (**Table 3.26** of Annex 3B.)

Quest. 1.1.1	Recomm. ☆☆☆☆
Supp. 3	DSO 5

3.3.5.3 Actual levels applied for the average waiting time in the customer centres

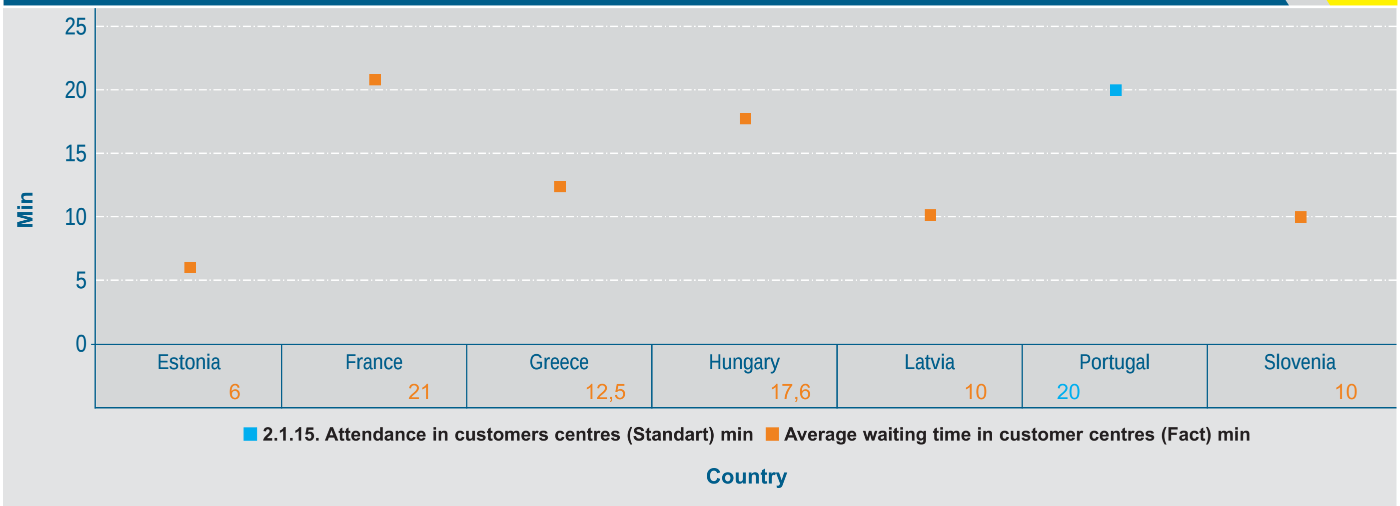
The actual levels of waiting time in the customer centres range between 6 and 20 minutes. In five countries the data refer to the distributor licensee, while in the case of three countries they refer to the supplier. Greek data refer to both DSOs and suppliers as sources of data. (The data provided to RAE by PPC – collectively as DSO and main supplier – correspond to 50 large customer centres, where an automated system is in operation, out of a total of 223 customer centres nationwide.) Almost every regulator has presented the data provided by the companies supplying the specific regions in a different way. The regulator of Greece calculated an average without weighting it by the number of customers while the regulator of Hungary weighted it by the number of customers. The regulator of Estonia calculated the targets from the waiting time in the customer centers operating in the cities with the number of customers living in the territory of the customer centers. (**Table 3.27** of Annex 3B.)

> ***CQ#15** Since in the majority of cases there are many other ways of communication (telephone, Internet) which are more and more popular, the harmonization of this indicator is not necessary. However,in the short term in smaller settlements (rural area), until modern communication means become widely used, the regulators could consider whether it is necessary to maintain appropriate number of customer centres to meet customer expectations and to comply with standards for waiting times.*

The following table shows the expected and the actual values of the indices mentioned in this section. A more detailed table can be found in Annex 3B.

[15] A distinction is made between traditional "customer centres" which are a phisical location and phone/internet "call" centres.

TABLE 3.28 WAITING TIME IN CUSTOMER CENTERS



3.3.6 Customer contact by phone

Quest. 2.1.24	Recomm. ☆☆☆☆☆
Supp. 2	DSO 2
OS 4	GS 0

3.3.6.1 Standards applied for the service level indicators of Call Centres

Unfortunately, despite the great importance attached to this form of contact by the licensees, the responses referred to surprisingly few standards, and not all responses referred to the same indicator. In France the relevant standard prescribes, that the number of abandoned calls should not be more than 5% of all incoming calls. The Hungarian and the Portuguese standards refer to the same parameter, but the expectations are different. In Hungary 80% of the calls shall be received within 30 seconds, while in Portugal within 60 seconds. In Ireland the standard is that 75% of the call shall be received within 20 seconds. The provision of an automatic message informing the customer on the expected waiting time or on the busyness of the administrator is not regarded as an actual answer in any of countries. As this is an average measure of performance, in case of non-compliance no compensation is payed to customers. (**Table 3.29** of Annex 3B.)

> ***CQ#16*** *From the answers to the questionnaires received it is not clear that the standards for the service level in Call Centres refer to the distributor licensee or the supplier licensee, therefore it is recommended to make clear first of all the interpretation of the standard.*

Quest. 1.1.3	Recomm. ☆☆☆☆
Supp. 3	DSO 5

3.3.6.2 Actual levels for the average waiting time measured in Call Centres

The data received on actual levels of performance for waiting times in call centres are typically between 15 and 70 seconds. In five cases the data suppliers were the distributors, in three cases they were the suppliers. The Italian data are based on the ENEL data-supply of the second half of 2004. The data of Great Britain refer to the period between April 2004 and March 2005. From the responses received it is clear that not every regulator measures the speed of response in the same way. Some of them measure the time from the arrival of the incoming call until the call is answered (for instance Portugal and Italy), others (like Hungary) measure the time after the selection from the menu until the start of the answer (**Table 3.30** of Annex 3B.)

> ***CQ#17*** *Instead of visiting the customer centres more and more customers call the companies by phone. Therefore this service is important for an ever growing number of customers. It is important for them, that they can start the conversation with the operator as soon as possible. Due to the significance of the indicator for the customers, it would be useful to measure the waiting time in a harmonized way. At the same time, it would be useful to establish set of customers' expectations and based on these stipulate requirements, as guidelines for the licensees when establishing and operating the Call Centers.*

3.3.7 Customer complaints

Quest. 2.1.16	Recomm. ☆☆☆☆☆
Supp. 6	DSO 8
OS 4	GS 5

3.3.7.1 Standards applied for responses to customers' complaints

In relation to written complaints the typical response time is 15 days. There is a differing standard in Estonia (for business customers) and in Lithuania, where the required response time is max. 30 days, as well as in Spain, where it is 7 days below 15 kW connection capacity, and in France, where the required response time is a max. of 8 days for every customer. The complaints must be answered in 21 days in Portugal, and in Spain for over 15 kW connection capacity. In Lithuania and Portugal the deadline shall be met in 95% of the cases. The compensation fee – in case of non-compliance – is between € 15 and € 30. The rate of compensation may be influenced by the category of the customer, the voltage level, the duration of the delay and the sum of the first complete bill. Compensation payment may be effected both automatically and on request. (**Table 3.31** of Annex 3B.)

> ***CQ#18*** *Regardless of whether "written queries" and "written complaints" are addressed jointly or separately, the regulators should in any case formulate expectations towards responding written claims. CEER recommends that one must not keep the customer in uncertainty for a long timein knowing whether or not his/her complaint has been accepted by the licensee. CEER thinks that the generally used 15-day deadline is acceptable standards for responding customers' complaints and that it can be met.*

Quest. 1.1.5	Recomm. ☆☆☆☆
Supp. 2	DSO 9

3.3.7.2 Actual levels applied for the number of complaints per 100 customers

Data were supplied by six distributors and in case of Greece and Italy by suppliers. The Greek data refer only to written complaints. The Hungarian data include not only the complaints arrived to the distributor, but also those received by the supplier. Figures of less than one are typical for this indicator. (**Table 3.32** of Annex 3B.)

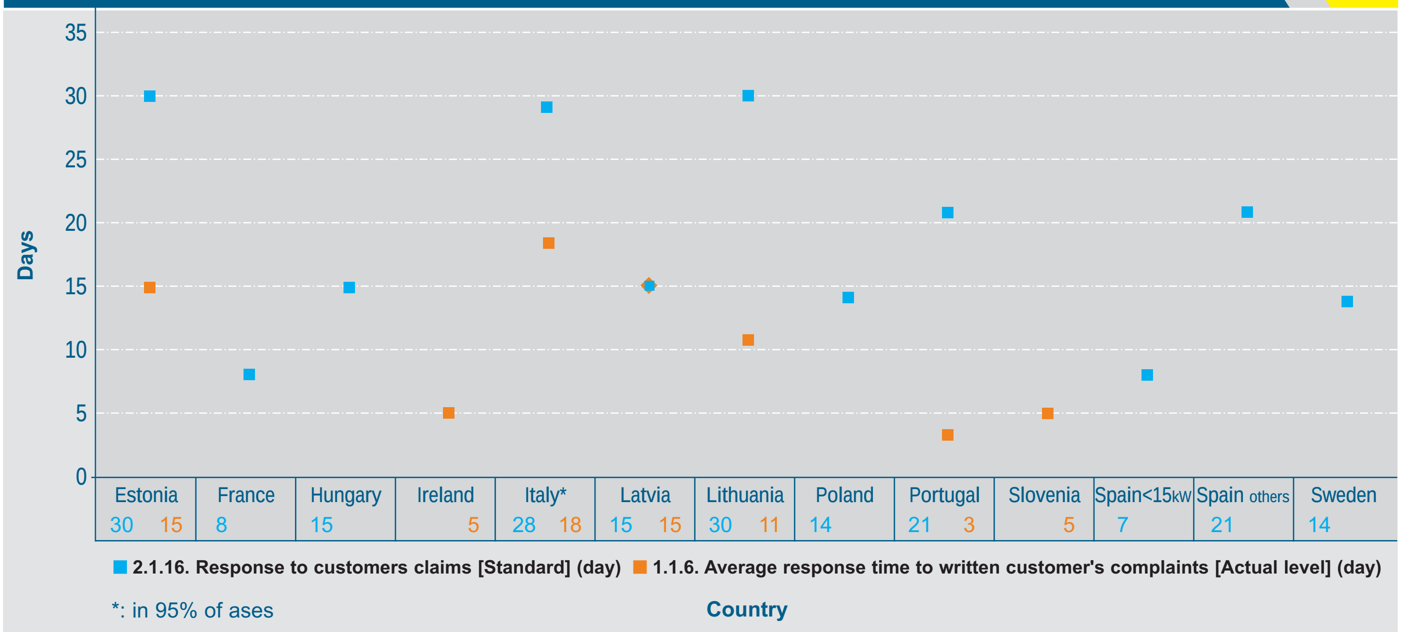
Quest. 1.1.6	Recomm. ☆☆☆☆
Supp. 2	DSO 6

3.3.7.3 Actual levels relevant to the average time of written responses to customers' complaints

The responses indicated that average time of written responses to customers' complaints ranged between 3 days and 15 days. The data referred to the distributor, but in the case of Estonia and Italy the supplier also delivered data. The latter, generally for this reason, indicated separately the data supplied by the distributor and the supplier. The number of working days have been converted into calendar days (2 working days = 3 calendar days) (**Table 3.33** of Annex 3B.)

The following table shows the expected and the actual values of the indices mentioned in this section. A more detailed table can be found in Annex 3B.

TABLE 3.34 RESPONSE TO CUSTOMER'S WRITTEN COMPLAINTS



3.3.8 Meter reading, billing

Quest. 2.1.14	Recomm. ☆☆☆☆☆
Supp. 0	DSO 10
OS 9	GS 3

3.3.8.1 Standards applied for the number of annual meter readings

In general, in the case of household customers one meter reading per year is typical. However, the way of reading can be different in every country. In Austria self-reading by customers is accepted, and it is sufficient if the distributor reads the meter every three years. In France the licensees should read the meter twice a year like in Spain, in Norway four, six or twelve times per year according to the category of customer (contractual power and yearly consumption level.). In Portugal there are further individual rules and the rules for meter reading shall be met only in 98% of the cases, not including the meters of weekend houses and those not accessible from outside of the building. In Italy the performance expectation is a single reading per year in 95% of the cases. In the case of large costumers (the definition of this category may vary across countries) in general monthly reading is applied, but it may be more frequent, like for those customers, who are required to have electronic meters, and whose consumption and settled price are calculated in relation to the continuously changing wholesale market price the more frequent meter-reading is required in harmony with the system operation rules (hourly or quarter hourly). None of the countries who supplied data have a practice of compensation payment in case of non-compliance of the meter-reading requirements. (**Table 3.35** of Annex 3B.)

CQ#19 *Meter readings and through it the accuracy of the bills cause the largest number of customer complaints. Customers often dislike flat rate payments calculated on the basis of one single reading per year, because of the eventually high sum year-end balance. They would like to know the precise consumption in a given period of time and they wish to pay accordingly. Regulators should discuss with the representative organizations of distributors the advantages/disadvantages and the options/costs of the meters suitable for automatic meter reading (AMR). Thus in the medium term it may become possible to read the meter of every customer in every month without his assistance and to issue a bill on this basis. CEER member authorities intend to further address this issue in 2006.*

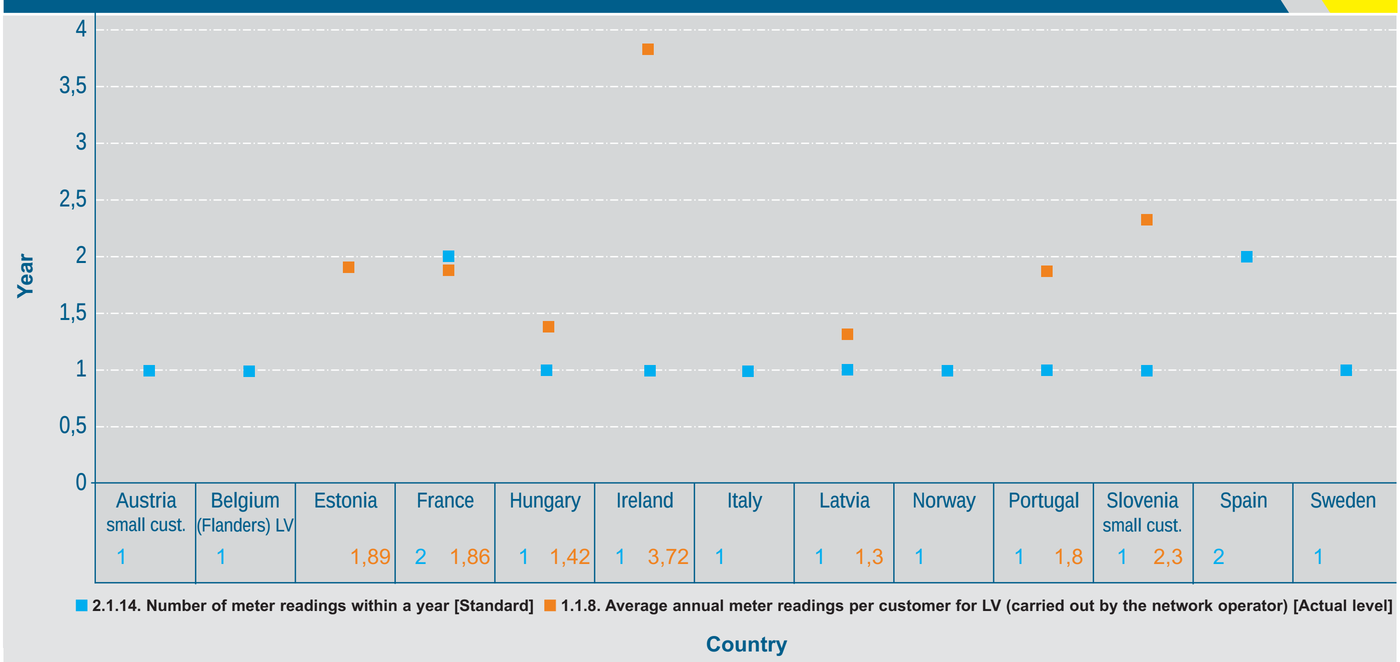
Quest. 1.1.8	Recomm. ☆☆☆☆
Supp. 0	DSO 8

3.3.8.2 Actual levels applied for the annual readings by the distributor licensee

The data from the six replies vary between 1.3 and 3.72 average meter-readings per customer per year. The data supplier was the distributor in all cases. In Portugal only low voltage customers have been taken into consideration up to a contracted capacity of 41.4 kVA. In Sweden the issue of annual readings are under revision by the regulator. According to the relevant legal regulations from 2009 all meters shall be read in every month, and the customers will pay for actual consumption. (**Table 3.36** of Annex 3B.)

The following table shows the expected and the actual values of the indices mentioned in this section. A more detailed table can be found in Annex 3B.

TABLE 3.37 NUMBER OF METER READINGS



3.4. Standards and actual levels of Commercial Quality related to transmission

3.4.1 Applied standards

Four countries supplied data to these questions on the actual levels of commercial standards related to transmission (Table 2.2 of questionnaire). Every country supplied information regarding standards in accordance with its own regulations. The low number of replies can be explained by two reasons: the quality regulation of the operator of the transmission network does not belong to the scope of activity of the regulator of the given country, or, due to the low number of problems in the transmission network (TSO) this area is not considered as primarily critical from the point of view of the service level of customers. It has to be noted, that in case of non-compliance with the standards listed below the TSO is not obliged to pay compensation in any of the indicated cases.

3.4.1.1 Belgium

During the preliminary examination of the connection to the grid the examination of the completeness of the application must take place within 10 working days. If the application proves to be complete, the quotation which includes the technical information will be prepared within 40 working days. The final analysis of the connection to the grid starts again with the examination of the completeness of the application. This is performed within 10 working days. This is followed by the examination of the technical solutions together with the petitioner within 40 working days. At the end the conclusion of the technical agreement will follow within 60 working days. The TSO will send a proposal to the customer relevant to the connection agreement within 30 working days. For the conclusion of the contract there are a further 30 working days available. A change of supplier must be arranged within 5 working days. The TSO will provide authenticated data for every supplier in each month, at least relevant to the previous month.

3.4.1.2 Estonia

Complaints associated with the meter device are investigated within five working days. The information relevant to the planned modifications to be carried out on the meter device shall be sent to the customer a minimum of 5 days before starting the work. The notice on the scheduled interruptions shall be sent to the customer until the 15th day of the previous month. The offer for connection of a new customer shall be answered within 90 days. The maximum duration of non-scheduled interruptions may be 12 hours, and may not exceed 240 hours in total on annual level.

3.4.1.3 France

Supply interruptions are scheduled in cooperation with the customer. Five days of scheduled interruption are permissible over three years. Scheduling shall be done a minimum of 15 days prior to the planned interruption. In case of connecting a new customer to the grid 90 days are available for preparing the cost estimate of the works. According to the Guaranteed Standards customers' queries shall be answered within 30 days, while the response time according to the General Standards is 15 days. Contact will be established automatically in the case of voltage problems, metering problems, customer's queries relevant to charges and payments, appointment scheduling, relocation and replacement of the meter, carrying out on-site works.

3.4.1.4 Slovenia

The customer shall be informed of the scheduled interruption at least 48 hours in advance. During a possible breakdown rectification shall be commenced within 2 hours, and the fault shall be eliminated within 4 hours. Voltage complaints shall be investigated within 8 days and within another 8 days shall be answered. In case of problems associated with charges and payments the customer will inform TSO about the problem within 8 days, and TSO shall answer within another 8 days.

3.4.2 Actual levels of the commercial quality indicators (transmission)

Three countries supplied data relevant to this table (1.2) of the questionnaire.

3.4.2.1 Belgium

In Belgium the customers supplied on a voltage level between 150 kV and 380 kV belong to this category. In their case no complaint has been lodged due to non-compliance with the time given for the specific steps of connection to the grid.

3.4.2.2 Estonia

In Estonia the number of customers connecting to the grids of a voltage level of 110 kV and above is 13 in total. Only one of them had made a complaint in 2004. In case of written complaint the average response time was 15 days (in the above mentioned single case). The average response time in case of a written customer's query is 10 days. The proportion of estimated bills and corrected bills is 2% in both categories.

3.4.2.3 France

In France for customers connecting to a network of a voltage level between 63 kV and 400 kV the total number of complaints in 2004 was 142 and 65 in the first five months of 2005.

3.5. Conclusions and recommendations

1. **Content of standards and indicators:** The results of the analysis of standards of commercial quality show that the regulating authorities closely follow the level of the services provided to customers. However, it is also clear from the received data/information that in the member states there are significantly different sets of standards with different contents and implementation levels. Before the next benchmarking analysis is conducted the CEER shall clarify precisely all specific indicators used in each country, since otherwise the analysis of the received results may lead to false conclusions. (For example: unique definition of waiting time in the Call Centers; what kinds of calls are counted into the number of calls arriving to the Call Center; what kinds of complaints count as telephone complaint; how waiting times are calculated; etc.)

2. **Level of unbundling:** The situation is made even more complicated by the fact, that the scope of activities and responsibilities of the supplier, the distributor and the public utility (regulated tariff) supplier are not always clearly separated. From the data provided and from the indication of the licensee responsible for data supply it seems that in the countries where liberalization has fully been realized and competition is efficient, the data supplier is almost exclusively the distributor, and the regulatory authority deals solely with the supervision of the activity of the distributor. However, in case of countries where the supplier has not yet been legally separated from the distributor, the regulatory authorities supervise all electricity companies performing both distribution and commercial tasks. This duality also appears in the supplied data, since the indicated values are generally higher in these countries than the data of the countries having realized the unbundling of activities and effective competition.

3. **Ways of quality regulations:** Regarding the type of quality regulation the realization of two different concepts can be shown.

   On the one side, and this is more general, regulatory authorities prescribe objective requirements, and they measure the compliance, and in case of non-compliance they impose a kind of sanction. Thus the licensees are expected to comply with the level set by the authority. In this case the regulator is largely responsible for establishing indicators and requirements (standards), in order to assure an appropriate service level for the customer.

   Another possibility is the analysis of the subjective elements, where by collecting the opinion and expectation of the customers continuously or temporarily, the electricity companies are qualified and ranked on the basis of the customer's opinion. In this case it is not the expectations of the regulator that will be the driving force of quality improvement, but the ranking of companies according to customers' views, which will stimulate the electricity companies to make all possible efforts to improve. Obviously, the combination of the two above options is the most desirable.

   The method of ranking of suppliers publicly can be the simplest way in countries where there are the social and cultural bases in place and economy is in such a condition that the competition on the market has a forcing effect on the electricity companies without any special regulatory interference. This type of market regulation may also result in a situation where there are no requirements expressed in figures, or there are only a few of them which are of a general character (Sweden, Norway). However, for this it is necessary that the companies have a service level accepted by the society, and where it is enough to focus solely to the prevention of worsening performance.

4. **Regulations by standards:** In countries where the regulator chooses the objective indicator option there could be at least two ways to sanction. First, the regulator can establish overall standards (OS) and failure in performance results in imposition of penalty or in application of price reduction. Second, a more customer-friendly way is the application of guaranteed standards (GS), by which affected customers can be directly compensated if non-performance is evident. The tendency is for regulators to move from OS towards GS like in Great Britain where no OS are in force anymore and in Italy where the number of OS have been reduced step by

step. CEER recommends that member states put in place guaranteed standards together with automatic compensation directly to the customer, where appropriate.

5. **One goal – more solutions:** This Report shows that the same goal can be achieved in different ways, depending on the circumstances. Any of the different regulation methods can result in equally high commercial quality. A perspective for future research is evaluating how effective is the regulation of the commercial quality across countries. CEER should focus its attention on the effects following the introduction of the specific indicators: how the service quality has improved, how easily the expected value (required service level) can be complied with or indeed whether the penalties paid for non-compliance have an appropriate effect. Even if it is not known, so far, the effects of commercial quality regulation, one thing is sure that the national regulatory authorities have had reasons to establish their regulation system as it was, since in their consideration that was the most effective means in the given economical, political and cultural environment.

6. **Automatic Meter Reading as target:** From the information received it is apparent, that the accuracy of the issued bills and the real values of the billed consumption have an ever greater importance both for the customers and the licensees. Developments have been started in several countries the aim of which was to acquire monthly (or more frequent) meter readings without "disturbing" the customers. To this end in some countries automatic metering systems (AMS) will be established, which can make possible the (remote-controlled) reading of the meters with optional frequency, without the necessity of the assistance of the customer. In Italy the system is under construction and for all ENEL customers it will be completed by the end of 2006, while in Sweden monthly reading and billing shall be resolved in case of all LV customers by 2009.

7. **Appointments scheduling:** It can be problematic for distributors to schedule appointments with customers. In general, the time which is good for one party is not good for the other, and vice versa. Remote control systems offer solution to this problem. Moreover, in case of the change of customer AMS enables the DSO to start the billing process by remote control. With the overall establishment of such systems customer's queries can significantly be reduced, the reading and billing process can be made more simple, and in specific cases the execution time can be less. On customer's side, the use of option of recording multiple readings in the bill will result in tougher competition in the retail sector (switch to another supplier).

8. **New means of communication:** The new communication forms were made possible by the technical development and the problem of their handling is worth mentioning. The option of e-mail communication and perhaps mobile phone SMS are an ever growing requirement from the part of the customers, and the electricity companies endeavour to create the possibility. However, customers sometimes have unreasonable expectations. Except for the reports on events or a breakdown endangering the safety of life or property, the changes in the (communication) form of the reports do not justify prompt arrangement, all the more, since this would impose disadvantage to those customers who continue to submit queries in the traditional way.

Thus it is recommended to handle the e-mail and SMS communication according to the rules relevant to written reports.

9. **Dialog with partners:** Finally, it worth to state, that the continuous consultation with the customer organizations on their expectation regarding commercial quality and with the license holders on feasibility of fulfilment of such expectations, on planned actions and on the method of data gathering is extremely important for the national regulators.

CHAPTER 4 – Voltage Quality Monitoring Systems, Standards and Market Mechanisms

CONTENT

VOLTAGE QUALITY MONITORING SYSTEMS, STANDARDS AND MARKET MECHANISMS

4.1 Introduction: what is Voltage Quality and why are Regulators interested in it?

The term voltage quality (VQ) covers a variety of disturbances in power systems. For the purpose of this report, the definition of voltage quality is "the characteristics of the supply voltage concerning magnitude, waveform and symmetry of the phases".

The voltage quality parameters are listed and defined in the European standard EN 50160 (1999, Corrigendum Sept. 2004; hereinafter "EN 50160"), which is applicable in all EU countries for low and medium voltage networks (up to 35 kV). For the purpose of this work, we refer to the following VQ parameters:

- supply voltage variations;
- rapid voltage changes;
- flicker severity;
- supply voltage dips;
- temporary (power frequency) and transient (impulsive) overvoltages;
- voltage unbalance;
- harmonic distortion of voltage waveform;
- interharmonic voltage;
- mains signalling voltage.

Generally power quality covers a range of factors including interruptions, but in this report interruptions are considered separately under the heading "continuity of supply".[16] This is why here the term "voltage quality" is used to refer to every disturbance of voltage except interruptions. Furthermore, in this report, we do not draw attention to frequency variation limits, as they are monitored and managed by the interconnected European power system operators. Frequency variations are of concern for isolated networks, typically on islands not synchronously connected to the main grid.

In all 19 countries surveyed, EN 50160 is translated and/or applied (it is not yet translated into Latvian but is applied as a national standard), and may or may not be obligatory.

EN 50160 refers to low and medium voltage networks; it does not apply to voltage levels higher than 35 kV. It sets mandatory values of compliance, which are stated for only a few voltage quality parameters, under normal operating conditions and for 95% of the time (generally valued as the 95th percentile of the 10 minutes average rms values):

- supply voltage variations;
- flicker severity;
- harmonic distortion of voltage waveform;
- mains signalling voltage.

[16] Please refer to Chapter 1 (continuity measurement systems and actual levels) and to Chapter 2 (continuity standards and incentive regimes).

For the rest of the voltage quality parameters, only indicative values are given in EN 50160; this is especially true for events like voltage dips, which however are the disturbances generally perceived as annoying by the largest share of business customers.

Indeed, voltage quality is becoming an important issue in many countries, because of the sensitivity of end-user equipment and the increasing concern of both distributors and customers. In particular the wide use of electronic devices in homes and small businesses has increased the sensitivity of a greater number of users for voltage quality, making it no longer an issue for big customers only.
In most of the EU countries, the regulator is interested in monitoring actual voltage quality levels and in some cases the regulators have set different, more restrictive voltage quality standards than those indicated in EN 50160. In only a few EU countries is a body other than the regulator responsible for voltage quality. For instance, in Lithuania, a function of the State Energy Inspectorate is to assure technical parameters of electricity. In Great Britain it is the responsibility of the Department of Trade and Industry (DTI) Engineering Inspectorate.

This chapter contains comparative information about voltage quality monitoring systems, individual voltage quality verification, voltage quality standards (in particular those different from EN 50160) and experience of market mechanisms deployed to cope with voltage quality problems (such as power quality contracts). The most relevant issues are summarised in findings, and final recommendations conclude the chapter.

4.2 Voltage quality monitoring systems

Unlike continuity of supply, monitoring voltage quality disturbances requires installing specific voltage quality recorders and cannot be obtained through ordinary SCADA systems (as in the case of interruptions).
Nonetheless, a growing number of European countries have monitoring systems installed or plan to install them in the near future (see table 4.1, where ordinary systems for voltage regulation in transmission are not considered as voltage quality monitoring systems).

TABLE 4.1	VOLTAGE QUALITY MONITORING SYSTEMS
Monitoring at both transmission and distribution level	IT*, NO, PT, SL
Monitoring only at transmission level	CZ*
Monitoring only at distribution level	HU
Proposal stage	ES, SE
None	AT, BE, EE, FI, FR, GB, GR, IE, LV, LT, PL

(*) Voltage quality monitoring system currently under commissioning

Even if these monitoring systems are different from each other in many respects, a common point is that at least short and long interruptions, voltage magnitude, voltage dips and harmonic distortion of the voltage waveform are monitored. The number and location of voltage recorders is quite different from one country to another. The most interesting cases are the following:

- In Norway, a monitoring system has been applied for several years. From 2006, mandatory voltage quality monitoring will enter into force. Each network company (even the smallest one) will be obliged to monitor quality parameters continuously in different characteristic parts of its MV, HV and EHV power system. At least the following parameters have to be monitored: long (duration > 3 min.) and short (duration between 1 sec. and 3 min.) interruptions, voltage dips, temporary overvoltages and rapid voltage changes (>3%). If customers are facing problems because of other parameters (harmonics, voltage unbalance, supply voltage variations, flicker severity), companies will be obliged to measure these parameters too.
- In Hungary, the regulator owns 400 voltage quality recorders that are installed each semester in one of the six distribution companies, at low voltage level only (around 0.007% related to LV consumers). The cost of monitoring the system is shared between the regulator and the utilities, the former having paid the cost of VQ recorders, the latter bearing the cost of installation and removal. The regulator chooses the network points randomly, in a way that does not depend on previous events or complaints. The VQ recorder is compliant with all EN 61000-4-30 (Class B); the system uses GSM for automatic remote reading. The measurements are actually in a test phase, because of the need to improve the recorder. At the end of the test, the measurement results are made public.
- In Portugal, there are 61 points monitored on the transmission grid (40 for 4 weeks and the rest all year long); in distribution, all substations (423) in MV and 1270 power transformation stations in LV have been monitored for 3 years. The companies pay the cost of the monitoring system, which monitors not only the above mentioned voltage characteristics but also the flicker and the unbalance of three-phase voltages.
- In Slovenia, distribution and transmission companies are obliged to measure voltage quality parameters: voltage quality monitoring is implemented in high voltage covering all the substations (8) and about 10% (160) of medium voltage systems; all the voltage quality parameters are monitored according to EN 50160.
- In Italy, at the end of 2004 the regulator asked the transmission company to install about one hundred voltage quality recorders; as for distribution, a voltage quality monitoring system of 400 points (10% of MV bus-bars in HV/MV transformers) is under commissioning. All the voltage quality parameters (except transient overvoltage, interharmonics and mains signalling voltage) will be monitored from 2006 both on transmission and distribution networks. The transmission monitoring system is paid for by the TSO; for distribution, the system is financed through a tariff component funding non-competitive R&D projects, in place since liberalisation started. Both systems involve customer participation, with participating customers paying the cost of their own voltage quality recorder: in distribution, for example, a further 200 points could be measured at MV customers' delivery points at their request.
- In Spain, the distribution companies and the regulator have been working on a procedure for controlling and measuring voltage quality; in the near future, 10% of the busbars in MV of each province will be involved (costs will be sustained by the distribution companies).

- In Czech Republic a monitoring system is going to be installed at the interconnection points between transmission and distribution networks.

The availability, in coming years, of voltage quality data on both transmission and distribution grids will not only allow a deeper knowledge of actual voltage quality levels, but is also likely to enable regulators to define focused actions plans to improve voltage quality and to set standards in the interests of consumer protection.

4.3 Individual voltage quality verification

Although voltage quality monitoring systems are very useful for getting a general picture of actual average voltage quality, for a single customer it is more important to have a specific measurement of voltage quality levels on its own connection point. The reason is that voltage quality levels (for instance, the depth of voltage dips) change for the same perturbation from one point to another even along the same circuit.

In most countries, customers who experience voltage quality problems can ask for individual voltage quality verification on their connection point, although the distribution companies are not legally required in all countries to install a voltage quality recorder for a given time period (see table 4.2). Generally costs are paid for by the requesting customer. Sometimes costs are paid by the customer if parameters comply with standards, and by the company if they don't (see also additional information 4.1).

In a few countries, customers have the right to install their own voltage quality recorder instead of asking for it from the distribution company. Generally, the voltage quality recorder owned by the customer must comply with technical standards to be accepted by the distribution company. In some countries the voltage quality recorder owned by the customer has to comply with several technical criteria, defined by the operator.

TABLE 4.2 INDIVIDUAL VERIFICATION OF VOLTAGE QUALITY

Distribution companies compelled to provide voltage quality individual verification when requested by the customer	AT, BE, CZ, EE, FR, HU, IT, LV, NO, PL
No duty for installing a voltage quality recorder but for providing information to the customer	FI, PT
Proposal stage	SW
No legal obligation	ES, GB, GR, LT, SL

ADDITIONAL INFORMATION 4.1 – INDIVIDUAL VERIFICATION OF VOLTAGE QUALITY IN PORTUGAL

When a client complains about voltage quality and the distribution operator does not have enough information to typify the waveform in the client delivery point, the operator has to make additional measurements. After the monitoring, the distributor has to give the client the following information:

- Monitoring period
- Type of equipment that was used in the monitoring.
- Type of perturbations that have been registered.
- Analysis of the regulated values or limits fulfilment.
- Entity responsible for the perturbations.
- Deadline to solve the detected problem in case code levels are not met.

The limits for voltage characteristics at the delivery point are established in NP EN 50160 (translation of the European Standard EN 50160) for LV and MV networks, and in the Complementary Instructions published by the Ministry (DGGE) in accordance with Quality of Service Code for HV and EHV networks. If actual results reveal that waveform characteristics are in accordance with the code values, or if they are not in accordance with the code values for reasons attributable to the client, then the client has to pay the costs related to the extra measurements. The amount that the client has to pay in this situation is limited to a figure established and published each year by the regulator (ERSE). The following table presents the amount published by ERSE for 2005.

Client (voltage level)	Amount (€)*
LVN (low voltage with contract power up to 41,4 kVA)	20,00
LVS (low voltage with contract power higher than 41,4 kVA)	160,00
MV	1.350,00
HV	4.650,00
VHV	4.650,00

The client can install equipment to measure installation voltage quality. If the equipment is installed and sealed after a written agreement with the distribution operator, its measured values are valid as proved in a claim.

As for individual voltage quality measurement, one case deserves special attention. In France, both the Transmission System Operator (RTE) and the main distribution company (EdF) offer their customers customized contracts with assigned voltage quality levels ("*engagements*" or contractual levels). If the customer claims for better contractual levels than the normal ones, he can ask the operator for customized contractual levels in his contract, paying an extra charge. Customers who have customized contractual levels must have a monitoring recorder installed (it can be owned by the customers themselves or by the network operator). The existence of voltage quality contracts has led to a high diffusion of voltage quality recorders installed on the connection point of single customers: in distribution networks, about 16% of MV customers have a voltage quality recorder installed; in the transmission network, the figure is about 12% of EHV-HV customers.

4.4 Voltage quality standards

In recent years, some regulators have introduced voltage quality standards different from those indicated in EN 50160. Table 4.3 lists, for each voltage quality parameter (excluding interruptions and frequency variations for the reasons explained at the beginning of this chapter), the countries where voltage quality standards differ from those set in EN 50160, although in some cases these standards have not been set by the regulator. More details can be found in Annex 4.

As for voltage variation limits, with respect to MV customers (1-35 kV), the European standard EN 50160 states that "under normal operating conditions, during each period of one week, 95% of the 10 minutes rms values of the supply voltage shall be within the range of U_c ± 10%", where U_c is defined as "declared supply voltage" and "is normally the nominal voltage U_n of the system", but "if by agreement between the supplier and the customer a voltage different from the nominal voltage is applied to the terminal, then this voltage is the declared supply voltage U_c".

Although the above-mentioned voltage variation limit is among the few enforceable ones set by EN 50160, some countries have introduced different, more restrictive limits for voltage variations. The restrictions affect both the "95% of time intervals" clause foreseen by EN 50160 for voltage supply variation for MV customers and the width of the allowed variation band.

TABLE 4.3	VOLTAGE QUALITY STANDARDS DIFFERENT FROM EN 50160
Supply voltage variations	ES, FR*, HU, NO, PT (only for EHV-HV customers)
Rapid voltage changes	NO
Flicker severity	NO, PT (only for EHV-HV customers)
Voltage dips	FR* (customised engagement on request only for MV and HV customers)
Temporary or transient overvoltages	FR*
Voltage unbalance	FR*, NO
Harmonic distortion of voltage waveform	FR*, NO, PT
Interharmonic voltage	None
Mains signalling voltage	None

(*) In France the voltage quality limits are set in the contracts between the customer and the distribution/transmission operator; the regulator surveys the contracts but does not set standards.

In greater detail:

- in France, for MV customers the supply contracts contain the voltage variation limit U_c ± 5% for 100% of the time, where U_c must be in the range ±5 % around U_n;
- in Hungary, the limit is U_n ± 7,5%, with a maximum of 115% for 1 minute, for both LV and MV networks;
- in Portugal, the EN 50160 (1999) standard is applied for MV and LV. For EHV and HV the Quality of Service Code establishes that the value of U_c shall be within the range of U_n ±7%. Under normal operating conditions, during each period of one week, 95% of the 10 min average rms values of the supply voltage shall be within the range of U_c ±5%.
- in Norway, the distribution companies shall ensure that variations in the stationary voltage rms value are within an interval of U_n ± 10 % for 100% of the time intervals, measured as a mean value over one minute, at the points of connection to the LV network;
- in Spain, the maximum variation limit for the supply voltage to final consumers is Uc ± 7%.

Other voltage quality standards regarding rapid voltage changes (including flicker), voltage dips and harmonics are listed in detail in Annex 4.

In only few countries penalties are foreseen in case the voltage limit standards are not met. In France, through contract conditions, customers can receive compensation payments on request if voltage quality contractual levels are not met. For instance, a customer with a customized contractual level on voltage dips can receive compensation if the operator does not respect this standard. This is also valid for EN 50160 standards, when referenced in contracts. In other countries (like Hungary), if the voltage quality standards are not met, a financial penalty may be applied by the regulator. In others still, the distribution company must take appropriate steps to rectify the causes of the inadequate voltage quality within a given time (in Spain and in Great Britain the period is six months for voltage variations out of prescribed limits).

In no country is there an economic incentive regime aimed at general voltage quality improvement, even if the guaranteed standards for the customer requesting for voltage quality problem solving, which are enforced in some countries (like for instance Hungary and Great Britain), are a key regulatory measure in order to assure timeliness for restoring normal voltage quality levels on a local basis.

The most interesting case for voltage quality regulation is Norway, where the regulator recently introduced regulation with some stricter requirements than EN 50160 (see additional information 4.2). The regulator decided to set limits for voltage quality parameters after becoming very familiar with the subject (thanks to the several years of continuous monitoring), and for which it is possible to prevent disturbances. Through cooperation with Norwegian distributions companies for more than 12 years organized through research projects, the regulator obtained a good knowledge about actual VQ levels in Norway.

Additional Information 4.2 – Power quality directive in norway ([17])

The Norwegian regulator NVE has put into force a new Directive on quality of supply from January 1st 2005. As a rationale for the new Directive, NVE states "to ensure a satisfactory quality of supply in the Norwegian power system and a rational operation, development and construction of the power system". NVE have also stated a goal to keep the voltage quality close to the present and acceptable level

NVE draws attention to the importance of compatibility between immunity levels for electric equipment (limits for damage in particular) and the power quality level.

The Directive defines requirements for:

- A minimum acceptable level of power quality at customers terminals
- Continuous measurements of power quality
- Information to customers about what power quality is to be expected
- Time limits for handling and solving customers' complaints related to power quality

For some phenomena NVE has chosen to not introduce minimum limits:

- Supply voltage dips
- Short interruptions
- Long interruptions
- Temporary overvoltages live/earth
- Transient overvoltages
- Interharmonic voltages
- Mains signalling voltage on the supply voltage.

The reason for not introducing limits for these phenomena is partly due to difficulties in setting limits and monitoring them. Another aspect was the socio-economic importance or weight of some phenomena.

Both utilities and customers are subject to the Directive and might be economically responsible for insufficient power quality and hence may have to finance mitigation. The Directive puts the responsibility on the legal entity/person owning or using electrical equipment or plants that causes violation of the limits. Procedures to determine whether the supply system is too weak or emissions from the load are too high are however not yet given. It is pointed out in the regulation that power quality shall be a part of the network contract between DSOs and customers. Such a contract is an important instrument to limit emissions from customers so that the power quality requirements at all supply terminals can be managed.

There are some significant differences between EN50160 and the new Directive, where the latter goes beyond the former. A comparison is given in the table below.

[17] Excerpt from H. Seljeseth, K. Sand, K. Samdal, "Quality of supply regulation in Norway: Going beyond EN 50160". CEER TF QoS thanks the authors – who are with SINTEF Energy Research, Trondheim (NO) – for permission to publish this excerpt.

COMPARISON BETWEEN EN 50160 AND THE NEW NORWEGIAN DIRECTIVE ON VOLTAGE QUALITY

Quality aspects	EN 50160	The new Norwegian directive on voltage quality
Main evaluation period for most phenomena	95%	100%
RMS-variation averaging time period	10 min	1 min
Flicker levels	95% value for Plt ≤ 1	100% value of Plt ≤ 1 and a 95% value for Pst ≤ 1,2
Voltage steps LV	Normally 5% and in special situation up to 10% a few times per day	Once per day for voltage steps up to 10%, 24 steps per day up to 5% and for steps that occur more than 24 times per day the change shall not exceed 3%.
THD (low and medium voltage)	8% for the 10 minute average	8% for the 10 minute average, and 5% weekly average
Higher order harmonics	No limits for harmonics above 25th order	General limits for higher order harmonics
HV/EHV	No limits for HV/EHV as customers connected to these voltage levels are expected to be covered by special contracts	Introducing some limits for HV and EHV: Rapid voltage changes, flicker, harmonics, voltage unbalance

In general, there is a growing number of countries whose regulator is not satisfied with EN 50160 standards, especially for the following reasons:

- EN 50160 does not take into account abnormal exploitation situations and sets standards only for 95% of the time; this weakens the limits prescribed by that standard;
- EN 50160 does not set standards for higher voltage levels than 35 kV and does not take into account that in some countries MV is defined up to a higher level than 35 kV;
- as regards harmonic distortion, harmonic currents are not mentioned, nor are there standards for customers connected to the network: but, distribution companies can meet standards only if customers meet some as well.

In coming years, therefore, we can expect regulators to pay increasing attention to voltage quality issues. For instance, some regulators think that stricter voltage quality standards are required or are actually engaged to prepare more constraining standards because they are not happy with EN 50160. Setting more restrictive standards than those stated in EN 50160 can entail higher costs for network investments: hence, regulators should be aware of both costs and benefits for the customers deriving from tighter voltage quality standards.

Voltage quality regulation might also do well to consider the problem of disturbing customers' plants. In Portugal, for instance, the Quality of Service Code imposes maximum levels of disturbance concerning voltage quality for installations connected or having applied for connection to the networks. If one installation connected to the network has levels of disturbance greater than the limit, the network operator must notify the party in charge of the installation. The network oper-

ator must advise clients connected to its network on the best way to mitigate the pollution caused by their installations. But if the pollution due to a client damages voltage quality, the network operator has to contact the client and agree on a deadline to solve the problem. If they fail to agree, the decision is submitted to the regulator (ERSE). If at the end of that time the problems remain or are causing serious damage, for instance related to the safety of other customers' equipment, the entity responsible for the network can disconnect the polluting installation. This situation must be communicated both to the regulator (ERSE) and to governmental offices (DGGE).
Similar solutions are adopted in Spain and in France to assure that consumers establish a set of measures to minimise the risks stemming from lack of quality. For these purposes, the distribution companies must inform the consumer in writing of the steps to be taken to achieve this risk minimisation. Defining allowed emissions to customers is a very complex matter that still needs to be studied profoundly, as it involves both the customer installations and the network characteristics, in terms of short circuit power at the connection point.

4.5 Market mechanisms for improving quality

In some countries, the customer can negotiate with the distributor to get a higher level of quality (both voltage quality and interruptions); this is generally called a "power quality contract". In most cases, this is possible through the connection contracts: for example, it may involve having a dual connection with automatic changeover.
Power quality contracts are rarely monitored by the regulator. In the majority of cases where contracts are foreseen, the regulator has no role in market mechanisms for quality (see table 4.4, where "interruptible" contracts, more widespread than power quality contracts, are not considered).

TABLE 4.4 POWER QUALITY CONTRACTS

Power quality contracts with some ex-ante intervention of Regulator	FR, IT
Power quality contracts with only ex-post intervention of Regulator	SI
Power quality contracts with no intervention of Regulator	CZ, ES, GB, LV, PT
None (or simply special connections on customer request)	AT, BE, EE, FI, GR, HU, IE, LT, NO, PL, SE

In only two cases the regulator has a specific role *ex-ante* in the setting of power quality contracts.

- In France, both the transmission and distribution companies offer all customers the possibility to contract for extra quality requirements. If the customer needs better standards than the normal ones in his contract, he can ask the operator for customized contractual levels. The customer will have to pay for them, depending on the necessary works to reach these new standards. The regulator has to receive a copy of every new contract. Even if it has no real power, the regulator has a great influence on contract models. Its comments on those models are usually taken into account by the operator. When a customer wants customized contractual levels in his contract, the operator makes a technical and financial proposal, which describes the necessary works on the network to reach the levels of quality wanted by the customer, and their costs. If the customer accepts, the works will be at the customer's expense. With customized contractual levels, the operator has to provide an annual or biannual report to the customer describing the quality performance of the site. The report should especially focus on the customized contractual levels. This situation, which existed before the regulator was formed, has led to a wide usage of power quality contracts in France: in MV networks, in 2003, around one thousand MV customers (out of more 100,000) had customized contractual levels for continuity of supply (maximum number of unplanned interruptions per year), and 92 customers had customized contractual levels on continuity and quality of supply (voltage dips or other voltage quality factors). Moreover, around 12% of the customers directly connected to the transmission network have customized contractual levels (see also additional information 4.3).

- In Italy, the regulator explicitly provides for power quality contracts and sets some minimum criteria for these. Each power quality contract must contain at least 3 elements: contractual level of quality, yearly premium, and penalty for non-compliance. Exclusions are possible if agreed by the parties. AEEG deemed it preferable not to require that power quality contracts be submitted for preliminary approval and to limit regulatory activity to establishing a few general rules to be observed by the distribution company in offering power quality contracts: (i) the contractual level of quality shall be expressed as a threshold applied to one or more indicators of continuity of supply or voltage quality; (ii) the duration of the contract may be no less than one year and no more than four years; (iii) contracts can be differentiated according to the level of voltage and every other electrical parameter relating to supply, including the actual level of quality recorded at the delivery point. Contracts are totally voluntary, both for customers and for distribution companies (or the transmission system operator). For the network operators, the additional revenues coming from power quality contracts are treated as a service excluded from the company's revenue control. Suppliers can be involved, especially to "federate" more than one consumer interested in quality improvement in the same distribution area; the cost (and the benefits) of power quality contract can be shared among several customers. Beyond the *ex-ante* criteria, distribution companies are supposed to communicate to the regulator (AEEG) the number and contents of power quality contracts. The rules for power quality contracts were issued in 2004 and no such contracts have been signed so far.

Power quality contracts are still at a starting phase but they can be seen as an efficient solution for improving voltage quality without imposing excessive costs on general tariffs. Anyway, these contracts require that customers requiring better voltage quality have a clear willingness to pay for it.

Additional Information 4.3 – Customised voltage dip arrangements in France

Voltage quality standards defined as in the EN 50160 document are respected in France for distribution networks, even if this norm is not obligatory. Moreover, distribution and transmission grid access contracts contain voltage quality *engagements* (arranged contractual levels). These *engagements* are more severe than standards set in EN 50160 and concern fluctuations of voltage magnitude, frequency, temporary or transient over-voltages and unbalance of the three phase voltage. They concern only customers connected to distribution networks at MV level and to the transmission network. For LV customers, such contractual conditions are not established yet.

Nowadays, customers connected to distribution networks at MV level or to the transmission network can ask for customized *engagements* on the maximum number of voltage dips they might suffer per year.

At transmission level (63 kV and above), the arrangement is 5 voltage dips per year. Only voltage dips deeper than 30% and longer than 600 ms are counted by the operator. It does not take into account voltage dips occurring less than one second after an interruption (short or long). Voltage dips due to a fault in the customer's installation are likewise not taken into account. If the site is supplied in 225 or 400 kV, only the duration of fault elimination is counted as a voltage dip when the origin of the voltage dip is a default on one phase of the main feeder. In this case, the automatic reclosure operating time (single phase operation of circuit breakers) is not taken into account.

At MV level, this *engagement* is determined depending on the local conditions of the site's alimentation. Since the *engagement* at transmission level is automatically 5 voltage dips per year, the distribution operator can not take a better one. Thus, a customer connected at MV level can not have an engagement of less than 5 voltage dips per year. As well as for transmission, only voltage dips deeper than 30% and longer than 600 ms are taken into account by the operator.

At the transmission level, the customer can ask the operator for other customized arrangements concerning voltage quality. The operator answers that request with either a motivated rejection, or a technical and financial proposal. If the customer accepts this proposal, the cost of the necessary studies and works on the network are at the customer's expense. When customers ask for customized arrangements, they pay an annual fee to operators.

4.6 Main findings from the survey on voltage quality

VQ#1: *Voltage quality is a complex issue as it is composed of several parameters, each of them with its own characteristics. A good knowledge of the real situation is a preliminary step towards any kind of regulatory intervention. A significant number of EU countries have installed or will soon install a monitoring system (see Table 4.1). All these are based on a sampling either of transmission-distribution interface points or customer connection points. Different solutions have been adopted in order to finance the monitoring systems; in some countries distribution companies have been imposed with duties for voltage quality regular measurements; in other countries the monitoring system is partly financed with public resources.*

VQ#2: *Customers requiring a verification of actual voltage quality levels on their own connection point are generally entitled to have their request satisfied (see Table 4.2). The regulator can either put an obligation on distribution companies or regulate the customer's right to measure voltage quality with its own voltage quality recorder; in the latter case, in order to assure that measurements are valid for the distribution company, the voltage quality recorder must comply with technical standards or technical criteria set by the operator.*

VQ#3: *In some countries, voltage quality standards differ from the limits prescribed by EN 50160 (see Table 4.3 and Annex 4); this means that in an increasing number of EU countries the EN 50160 (1999) reference levels are not found to be satisfactory both by regulators and customers, for a number of reasons among which the following are the most important:*

- *EN 50160 does not take abnormal operations into account and sets standards only for 95% of the time; this weakens the limits prescribed by that standard;*
- *EN 50160 does not set standards for higher voltage levels than 35 kV and does not take into account that in some countries MV is defined up to a higher level than 35 kV;*
- *as regards harmonic distortion, harmonic currents are not mentioned, nor are there standards for customers connected to the network: distribution companies can meet standards only if customers meet some as well.*

This is especially true for supply voltage variations, rapid voltage changes and voltage dips, and to a lesser extent for harmonic distortion and flicker severity. Setting quality standards different than EN 50160 requires the regulator to have not only a good knowledge of the actual situation, but also an idea about the cost/benefit ratio of the new standards in order to avoid excessive costs on the network.

VQ#4: *In some countries customers and distribution companies have the possibility to agree upon a special contract with contractual quality levels and extra-revenue for the distribution companies; only in a few countries do regulators have scope to intervene in this market mechanism (see Table 4.4). Where the regulator intervenes in power quality contracts, his role can be either ex-ante, determining the general form of the contracts, or ex-post, monitoring the diffusion and actual application of power quality contracts.*

4.7 Conclusions: recommendations for the future work on Voltage Quality

Voltage quality is still a largely new issue for regulators. The following recommendations arise from the survey on existing experiences of measuring and regulating aspects of voltage quality in some European countries. Setting tighter standards than EN 50160 could involve major costs for network investments, especially for those VQ parameters for which mandatory values have been set; hence, regulators should be aware of both the costs and benefits for the customers deriving from the new standards. Nonetheless, standards more constraining than the indicative values reported by EN 50160 are necessary to protect customers from VQ disturbances, as customers' applications are becoming ever more sensible over time, especially to voltage dips.

1. **Voltage quality parameters and standards:** European regulators are concerned about the voltage quality standards indicated by EN 50160 (1999). This standard determines limits for voltage quality parameters that in most cases are only indicative, and even when they are

mandatory such values are applicable only for 95% of the time (leaving no limits for approx. 8 hours every week). Following that standard, many disturbances are not constrained at all. These standards are not restrictive enough and do not constitute a good reference for voltage quality in European networks. Generally, network performance in Europe is already better than EN 50160 values, which are actually recommended, rather than compulsory, in some countries. For this reason, some regulators would like to react to this problem, especially at a time of electric company privatisation. They want to set more restrictive standards, especially looking at voltage supply variations, rapid voltage changes and voltage dips, and to a lesser extent at harmonic distortion and flicker severity. Even though some international standards (for example in IEC community) deal with VQ measurement, several problems are still open and under discussion. Then, efforts for technical standardisation are needed also in this field, with reference to accuracy not only of the measuring instrument, but of the whole measurement chain, including frequency and phase response characterization of the transducers and other technical aspects. The aim is to have robust and comparable VQ data throughout all Europe (not only for voltage analysis but also for currents, in order to better identify responsibilities in introducing disturbances).

It is highly recommended that EN 50160 be revised by CENELEC in cooperation with CEER and other stakeholders, taking into account both the actual levels of voltage quality in European transmission and distribution networks, the evolution of customers' needs and the VQ measurement issues.

2. **Actual levels of voltage quality:** Knowledge of performances in terms of voltage quality over several years is necessary. Monitoring of voltage quality parameters is difficult and costly, but the number of voltage quality measurement systems in Europe is increasing and regulators show increasing concern for the technical aspects of quality. From this initial overview of voltage quality, regulators will be able to determine objectives for companies, taking into account the costs and benefits of new voltage quality standards for customers and for network companies.

It is strongly recommended that at least the most critical voltage quality parameters be monitored and that results be published, in order to determine, in a first stage, the actual performance of networks. This has to be done over several years (at least 3), in order to draw significant trends.

3. **Power quality contracts:** Even if quality contracts are not yet widespread, they can be useful for revealing customer preferences for quality, especially for customers with the greatest need for continuity and voltage quality.

It is highly advisable to undertake further research and information on this market-like tool, which can result in an efficient way to satisfy special quality needs without increasing general tariffs.

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ANNEXES – ANNEX TO CHAPTER 1.

Section 1 – Comparative table on force majeure

SECTION 1 – FORCE MAJEURE	
AUSTRIA	No explicit regulatory definition. Force majeure intended as events that are more severe than the design network requirements; order by public authority; strikes; transmission blackouts; generation inadequacy. Data from 2002 are given without flood In Austria there were serious floods especially on the danube river in August 2002. The interruptions which were caused by these rare flood events (acts of god) were removed from the statistics, because they were not representative for the situation in the networks
BELGIUM (national, transmission)	Definition in Royal Decree of 19/12/2002**.** Force majeure intended as events that are more severe than the design network requirements; order by public authority; strikes; transmission blackouts, due to other TSO-zones; generation inadequacy (multiple generators out)
BELGIUM (Wallonia, distribution and local transmission)	Force majeure intended as events that are more severe than the design network requirements; order by public authority; strikes (only for LTSO, not for DSO); *see for detail the legal text below*
CZECH REPUBLIC	Events "*Acts of God*" have to be recognized by the Energy Regulatory Office
ESTONIA	Force majeure: when interruption is caused by a long time event (natural disaster, heavy winds or glazed frost that exceeds design norm) that network operator could not foresee, the interruption must be eliminated within 3 days after the end of this event.
FINLAND	if all the three following conditions are meet 1) the interruption is out of the control of the distribution company (storm, snow, animals does not qualify to this "out of control" definition) 2) the interruption is such that it is not reasonable for the distribution company that it could have been taking it into account in its operation 3) the distribution company could not have avoid the interruption even when operating very carefully
FRANCE	Regulator: no definition. Definition of "*Exceptional events*" in article 11 of the decree of 1995 (copied out in contracts). Voluntary destruction (in case of war, riots, terrorism…); Incidental and uncontrollable 3rd parties damages (fire, explosion, plane crash…); Natural disaster; Irresistible atmospheric phenomenon, involving outage for more than 100.000 customers; Load-shedding in case of general strike; Outage asked by public authorities (for security or national defence reasons); Unbalance between generation and consumption (lack of power generation). *This last condition is not written in the decree but operators added it in contracts.* Force majeure intended as events that are more severe than the design network requirements, in the meaning of the law n°82-600 from the 13th July 1982; order by public authority; strikes; transmission blackouts; generation inadequacy; wars, terrorist actions, thieving

(CONTINUE) SECTION 1 – FORCE MAJEURE

GREAT BRITAIN	Ofgem has defined a mechanism under its quality of service incentive scheme, which allows companies to ask for the impact of a small number of exceptional events to be excluded from their performance. This has been updated from 1 April 2005 as part of the new price control on the electricity distribution businesses in GB. *See for detail Additional Information n. … and n. … in the body of Chapter 2*
GREECE	No classification of data made by DSO as regards circumstances that various interruptions are attributed to.
HUNGARY	"*Extraordinary event*" defined by independent authority but applied only for guaranteed standards. Regarding the 3 years average the specifications must be match
IRELAND	Force majeure intended as events that are more severe than the design network requirements; order by public authority; strikes. For the incentive regime, those days with daily SAIDI larger than yearly average plus two standard deviations are excluded
ITALY	"*Force majeure*" intended as events that are more severe than the design network requirements; order by public authority; strikes; transmission blackouts; generation inadequacy (load shedding), public calamities, only if there is an act of calamity declared by a public authority (e.g. natural disaster central authority or local authorities). The distributor must prove that the technical design requirements have been overpassed. There are technical design requirements for wind (120km/h) and for ice on the overhead lines (12mm in some parts of Italy). In order to simplify the registration there is also a statistical method to define "*major event days*" and distribution companies can choose to apply this statistical methodology (called "*EPR*") that is based on a statistical analysis in two steps of the daily value of continuity indicators and excludes automatically the day in which indicators present an abnormally high value. The interruptions starting in "*major event days*" are excluded from incentive regulation. 14 distributors on 23 subject to incentive regulation have chosen this methodology.
LATVIA	"*Force Majeure*" defined
LITHUANIA	Force majeure: War and terrorist actions, actions or directions of competent state bodies, natural disasters or other exceptional events, which cause announcement of the emergency situation; significant climate changes, which cause exceeding of permitted technical norms.
NORWAY	No regulatory definition. Force majeure intended as events that are more severe than the design network requirements; generation inadequacy if there is energy shortage
POLAND	Definition included in Transmission Grid Code. No statistical method. Force majeure intended as events that are more severe than the design network requirements; order by public authority; strikes (in some cases only); transmission blackouts; generation inadequacy.
PORTUGAL	The Quality of Service Code considers the following situations as force majeure: general strike, public order altercation, fire (if its origin is not in the network), earthquake, flood, wind of intensity superior to the values considered in the design of the network, direct lightning strikes (if damages on equipments proved), sabotage, malefaction, proven third party intervention. An act of god is any situation that is simultaneously unpredictable, irresistible and external to the network.
SLOVENIA	No regulatory definition. Force majeure intended as events that are more severe than the design network requirements; order by public authority; strikes; transmission blackouts; generation inadequacy.
SPAIN	Force majeure: incidents accepted as such by the competent administration, including governmental decisions or civil protection service decisions and extraordinary atmospheric phenomena that go beyond the limits set in the regulations on extraordinary risks for people and property. Atmospheric phenomena that are deemed usual and normal in each geographical area according to the statistical data available may not be cited as reasons of force majeure
SWEDEN	Not taken into account by the regulator. Force majeure defined as war, terror attack and natural disaster like earthquakes or ice storms and strikes.

1. According to technical rules for DSO: those cases are foreseen:

Art. 20. In these technical rules, is regarded as an emergency

1. the situation which follows a case of «force majeure» and in which exceptional and temporary measurements must be taken to face the consequences of a case of «force majeure» in order to be able to guarantee or restore the reliable operation and reliable distribution network;
2. a situation which follows upon an event which, although it cannot be described as a case of «force majeure» depending on the current state of jurisprudence and the legal studies, require, according to the evaluation of the DSO or the user of the distribution network, an urgent and adapted intervention of the DSO in order to be able to guarantee or restore the reliable operation and reliable distribution network, or to prevent other damage …

Art. 21. Following situations, if they are irresistible and unforeseeable, are regarded as cases of «force majeure» for the DSO

1. natural disasters, including the earthquakes, floods, storms, cyclones or other exceptional climatologic circumstances;
2. a nuclear or chemical explosion and its consequences;
3. the sudden unavailability of the installations for other reasons than the outdatedness, lack of maintenance or the qualification of the operators; including a collapse of the information processing system, caused or not by a virus, whereas all the preventive measures had been taken, according to the state of technology;
4. technical impossibility, temporary or permanent, for the distribution network to provide electricity because of a brutal lack of injection of energy coming from the transmission network or local transmission network and not compensable by other means;
5. the fire, the explosion, the sabotage, the acts of terrorism, the act of vandalism, the damage caused by criminal acts and the threats of same nature;
6. the war declared or not, the threat of war, the invasion, the war, embargo, the revolution, the revolt;
7. the "government fiat", in which, in particular situations, the authority makes reference to an urgency and imposes exceptional and temporary measurements to the DSO or to the users of the distribution network in order to be able to maintain or restore the reliable operation and reliable of the whole of the networks.

2. According to technical rules for LTSO: those cases are foreseen:

Art. 16 §1. In these technical rules, are regarded as emergencies

a) the situations which follow a case of «force majeure» and in which exceptional and temporary measurements must be taken to face the consequences of a case of «force majeure» in order to be able to maintain or restore the reliable operation and reliable local transmission network, during time strictly necessary to reconfigure the local transmission network with safe equipments;

b) the situations which follow upon an event which, although it cannot be described as a case of «force majeure» depending on the current state of jurisprudence and the legal studies, require, according to the evaluation of the LTSO or the user of the local transmission network, an intervention urgent and directed of the LTSO in order to be able to maintain or restore the reliable operation and reliable local transmission network, or to prevent other damage …

Art. 16 §2. Following situations, if they are irresistible and unforeseeable, are regarded as cases of «force majeure» for the LTSO

1. natural disaster following earthquakes, floods, storms, cyclones or other exceptional climatologic circumstances;
2. a nuclear or chemical explosion and its consequences;
3. the sudden unavailability of the installations for other reasons than the outdatedness, lack of maintenance or the qualification of the operators; including a collapse of the information processing system, caused or not by a virus, whereas all the preventive measures had been taken, according to the state of technology;
4. technical impossibility, temporary or permanent, for the local transmission network to transport electricity because of disturbances within the zone of adjustment caused by flows of electricity which result from energy exchanges within another zone of adjustment or between two or several other zones of adjustment and whose identity of the actors of the market concerned with these energy exchanges is not known from the LTSO and cannot reasonably be known;
5. impossibility of operating on the local transmission network or the installations which functionally form of its part, because of a collective conflict and which gives place to a unilateral measurement of employees (or groups of employees) or any other social conflict;
6. the fire, the explosion, the sabotage, the acts of terrorism, the act of vandalism, the damage caused by criminal acts, the constraint of criminal nature and threats of same nature;
7. the war declared or not, the threat of war, the invasion, the war, embargo, the revolution, the revolt;

8. the “government fiat”, in which, in particular situations, the authority makes reference to an urgency and imposes exceptional and temporary measurements to the LTSO or to the users of the local transmission network in order to be able to maintain or restore the reliable operation and reliable local transmission network.

Section 2 – Comparative table on planned interruptions

SECTION 2 – PLANNED INTERRUPTIONS

	Advance notice	Procedure
AT	48 hrs	No rule
BE(W)	10 days	No rule
CZ	15 days	No rule
EE	2 days	Suggested: web site/large companies by newsletter
ES	24 hrs	a) By means of individualised notification using a method whereby there is a record (consumers at voltages higher than 1 kV and essential services).b) By means of advertising posters placed in visible spots with regard to all other consumers and by means of two of the most widely circulated printed media in the province.
FI	No rule	No rule

(CONTINUE) SECTION 2 – PLANNED INTERRUPTIONS

	Advance notice	Procedure
FR	The regulator didn't issue any rules about the notice to the users, but there are some contractual rules (in contracts between the distributor and the customer): ▪ for MV customers: – for not emergency works, the distributor contacts the customer to decide when the works will be held; – for emergency works, the distributor has to inform the customer as soon as possible. ▪ for LV customers: – the distributor has to inform the customer (by letter or public information) for works without emergency; – for works with emergency, the distributor has to inform the customer as soon as he can; – each interruption cannot last more than 10 hours.	
GB	48 hrs (or shorter period where this has been agreed with the customer)	No rule
GR	n.a.	n.a.
HU	for household consumer: in the case of less than 4 hours planned interruption the minimum time-lag is 4 days, in the case of more than 4 hours it is 8 days.	The regulator approves procedure established by distribution companies
IE	2 day (MV and LV customers)	Compulsory: by mail
IT	24 hrs	Using appropriate means of communication, like individualized notification for MV customers and advertising posters placed in visible spots for LV customers.
LV	No rule	No rule
LT	No rule	Rules set by Ministry of Economy
NO	Give consumers sufficient time to prepare	Suggested: newspaper adds, mail (postcard)
PO	No rule	No rule
PT	The Commercial Relations Code, published by ERSE, establishes rules about the notice to the customer according to the reasons of interruption: ▪ Interruptions for reasons of public interest: the entity responsible for the network must inform, whenever possible, and with a minimum prior notice of thirty-six hours, the customers which may be affected by the interruption. ▪ Interruptions for service reasons: the entity responsible for the network has the duty to minimize the impact of the interruptions among costumers. For this purpose, distributors may agree with the clients that will be affected the best moment for the interruption. If the agreement is not possible, the interruptions must occur, preferentially, on Sundays, between 05:00 hours and 15:00 hours, with a maximum duration of eight hours per interruption and five Sundays per year, per costumer affected. The entity responsible for the network must inform with a minimum prior notice of thirty-six hours. ▪ Interruptions due to a fact from the costumer responsibility: The supply interruption may only take place following a prior notice of interruption, with a minimum advance warning of 8 days relative to the date when it will occur. If the costumer installation emits perturbations to the network, the operator establishes, in accordance with the costumer, a time period for solving the problem.	
SI	No rule	No rule
SE	Give sufficient advance warning	No rule

Section 3 – Tables on continuity indicators

TABLE 3.1 – UNPLANNED INTERRUPTIONS EXCLUDING EXCEPTIONAL EVENTS
Minutes lost per customer per year (1999 – 2004)

Country	1999	2000	2001	2002	2003	2004
Austria				35.23	38.43	30.33
France	52.00	46.00	45.00	44.00	51.00	51.00
Great Britain			73.80	72.24	68.16	61.43
Italy			138.57	108.88	96.82	75.85
Ireland	227.60	187.60	183.00	183.00	162.00	156.50
Portugal			412.86	334.54	303.75	148.81
Spain	137.40	125.40	149.40	132.00	130.80	118.20
Greece					108.00	
Lithuania						32.3

TABLE 3.2 – UNPLANNED INTERRUPTIONS
Minutes lost per customer per year (1999 – 2004)

Country	1999	2000	2001	2002	2003	2004
Finland	198.00	129.60	468.00	284.40	212.40	103.00
France	459.00	176.00	59.00	52.00	69.30	57.10
Great Britain			75.84	101.33	72.68	87.33
Hungary	411.00	241.20	250.20	196.80	155.40	137.40
Italy	191.77	187.40	149.09	114.74	546.08	90.53
Ireland	273.60	257.90	199.30	230.20	171.90	162.80
Netherlands	26.00	27.00	34.00	28.00	30.00	24.00
Portugal			530.74	467.98	406.18	217.79
Spain	156.37	145.41	179.69	142.56	141.91	123.60
Sweden	165.77	89.17	162.90	101.84	148.05	59.73
Latvia					14.00	8.50
Lithuania						190.00

Note: France 1999, 2000 and 2001 are MV and LV, 2002 onwards is only LV

TABLE 3.3 – PLANNED INTERRUPTIONS
Minutes lost per customer per year (1999 – 2004)

Country	1999	2000	2001	2002	2003	2004
Austria				7.40	12.79	20.69
Finland	103.20	38.00	33.00	32.00	32.00	30.00
France	4.00	6.00	6.00		5.30	6.60
Great Britain			7.85	9.04	8.43	6.95
Hungary	75.00	99.60	139.80	142.80	199.80	178.80
Italy		82.62	84.82	77.97	80.67	62.62
Ireland	172.00	164.70	202.00	284.10	422.30	390.70
Portugal			57.37	52.21	62.39	49.16
Spain	31.96	37.05	36.57	30.66	24.79	22.80
Sweden	90.07	34.53	42.28	37.12	25.41	29.59
Estonia					24.38	
Greece					87.00	
Lithuania						122.45

TABLE 3.4 – UNPLANNED INTERRUPTIONS EXCLUDING EXCEPTIONAL EVENTS

Interruptions per customer per year (1999–2004)

Country	1999	2000	2001	2002	2003	2004
Austria				0.59	0.67	0.61
France			1.20	1.15	1.40	1.30
Great Britain			0.83	0.75	0.77	0.69
Italy			3.19	2.74	2.68	2.39
Ireland	1.03	1.30	1.26	1.24	1.47	1.68
Portugal			5.90	5.93	4.81	2.95
Spain				2.51	2.51	2.47
Greece					1.18	
Lithuania						0.26

TABLE 3.5 – UNPLANNED INTERRUPTIONS

Interruptions per customer per year (1999–2004)

Country	1999	2000	2001	2002	2003	2004
Finland	3.32	2.89	6.61	3.34	3.97	4.00
France	1.22	1.20	1.20	1.20	1.43	1.30
Great Britain			0.84	0.82	0.79	0.75
Hungary	3.09	2.29	2.13	2.03	2.05	1.90
Italy	3.81	3.59	3.29	2.76	3.96	2.48
Ireland	1.15	1.49	1.31	1.37	1.50	1.70
Netherlands	0.40	0.40	0.40	0.30	0.40	0.30
Portugal			7.51	7.35	5.96	3.66
Spain			3.30	2.65	2.60	2.06
Sweden	1.38	1.23	1.34	1.32	1.64	1.05
Latvia					0.04	0.04
Lithuania						1.58

TABLE 3.6 – PLANNED INTERRUPTIONS

Interruptions per customer per year (1999–2004)

Country	1999	2000	2001	2002	2003	2004
Austria				0.07	0.13	0.17
Finland	1.83	1.30	0.55	0.46	0.47	0.50
France	0.03	0.04	0.04		0.04	0.05
Great Britain			0.04	0.04	0.04	0.03
Hungary	0.29	0.34	0.50	0.52	0.75	0.68
Italy		0.61	0.59	0.49	0.49	0.40
Ireland	0.51	0.43	0.49	0.66	0.76	0.67
Portugal			0.32	0.29	0.30	0.23
Spain			0.42	0.26	0.20	0.19
Sweden	0.45	0.25	0.23	0.26	0.22	0.22
Estonia					0.49	
Greece					0.44	
Lithuania						0.40

TABLE 3.7 – SHORT INTERRUPTIONS
Number of short interruptions per customer per year (1999 – 2004)

Country	1999	2000	2001	2002	2003	2004
Finland	5.31	5.00	5.58	5.00	4.00	
France	3.10	2.80	2.30	2.00	2.60	2.60
Great Britain			0.75	1.01	2.02	1.03
Hungary					10.98	10.31
Italy				6.68	6.43	5.83
Estonia					0.10	
Lithuania						0.52

TABLE 3.8 – ENERGY NOT SUPPLIED
MWh not supplied per year (1999 – 2004)

Country	1999	2000	2001	2002	2003	2004
Finland	413	0	240	62	67	67
France					3263.1	2948
Great Britain		586	1404	698	415	1329
Hungary	18.7	13.4	3.2	1.0	16.5	52.7
Italy	2007.5	2485.1	6377.3	1387.0	14546.4	3626.3
Norway	30824	26984	20222	19780	21858	15996
Portugal	311.9	2016.8	254.4	91.4	976.2	496.0
Spain	676	779	6990	803	466	1250
Sweden	96	91	23.1	49.2	10416.7	25.2

TABLE 3.9 – DISTRIBUTED ENERGY
TWh distributed per year (1999 – 2004)

Country	1999	2000	2001	2002	2003	2004
Finland	77.8	79.2	81.2	83.5	85.2	86.8
France					521.6	546.6
Great Britain		305.892	309.84	315.32	319.92	
Hungary	30.45	31.15	32.20	32.46	34.33	34.75
Italy			285	290	299	299
Norway	103.86	107.42	108.37	107.61	105.11	109.31
Portugal				36.15	37.86	40.12
Spain	184.28	195.80	205.41	210.70	216.00	216.14
Sweden	100	99	103	102	104	108

TABLE 3.10 – ENERGY NOT SUPPLIED AS A PERCENTAGE OF ENERGY DISTRIBUTED

Percentage Not Supplied per year (1999 – 2004)

Country	1999	2000	2001	2002	2003	2004
Finland	0.0005%	0.0000%	0.0003%	0.0001%	0.0001%	0.0001%
France					0.0006%	0.0005%
Great Britain		0.0002%	0.0005%	0.0002%	0.0001%	
Hungary	0.0001%	0.0000%	0.0000%	0.0000%	0.0000%	0.0002%
Italy			0.0022%	0.0005%	0.0049%	0.0012%
Norway	0.0297%	0.0251%	0.0187%	0.0184%	0.0208%	0.0146%
Portugal				0.0003%	0.0026%	0.0012%
Spain	0.0004%	0.0004%	0.0034%	0.0004%	0.0002%	0.0006%
Sweden	0.0001%	0.0001%	0.0000%	0.0000%	0.0100%	0.0000%

TABLE 3.11 – AIT

Country	1999	2000	2001	2002	2003	2004
Belgium – national	3.32		0.98	0.62	2.32	
Belgium – Wallonia	1.22				20.5	9.96
Finland		0	1.55	0.39	0.41	0.41
France	3.09	3.62	2.46	2.40	4.21	3.77
Great Britain	3.81	0.79	1.87	0.93	0.54	1.71
Hungary	1.15	0.23	0.05	0.16	0.13	0.79
Italy	0.40	3.53	8.05	1.72	17.95	4.42
Latvia						0.28
Poland		3170	2929	2578	2615	2846
Portugal	1.38	29.54	3.82	1.35	13.93	6.68
Spain		2.11	17.87	2.01	1.1	2.8
Sweden		0.417	0.1	0.217	47.52	0.12

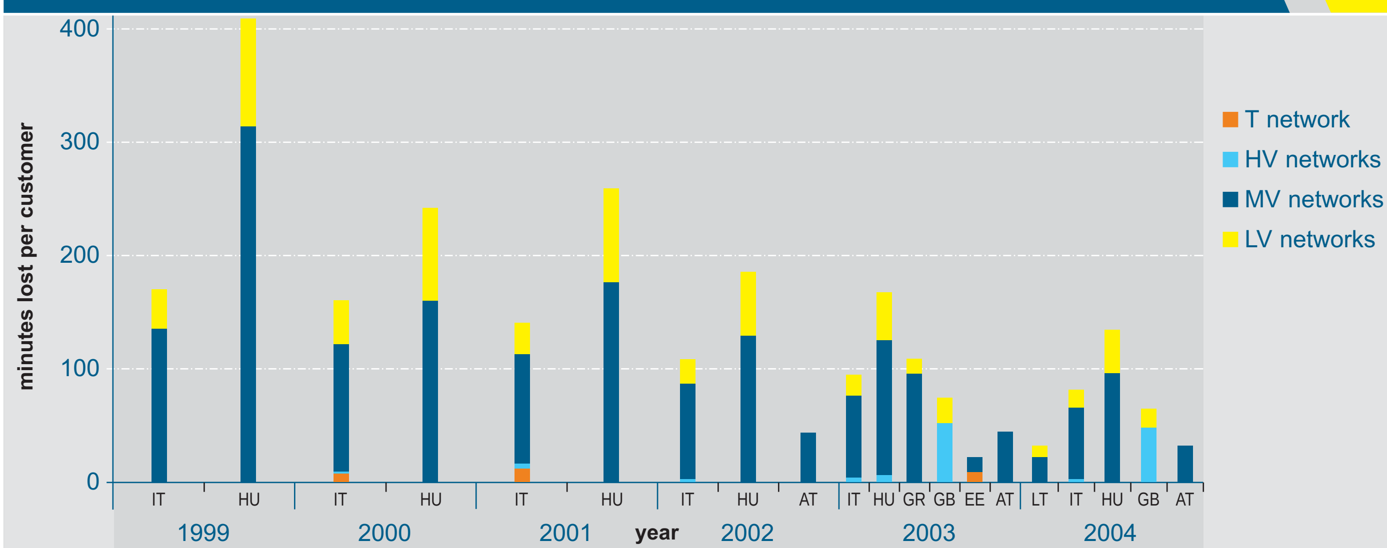
TABLE 4.1 – VOLTAGE ANALYSIS UNPLANNED MINUTES LOST PER CUSTOMER EXCLUDING EXCEPTIONAL EVENTS

Country		1999	2000	2001	2002	2003	2004
Austria	MV				35.23	38.43	30.33
Estonia	T					5.88	
	HV, MV, LV					12.31	
Great Britain	MV, HV, T					50.63	44.58
	LV					17.53	16.85
Greece	MV					95	
	LV					13	
Hungary	HV					4.2	1.8
	MV	316.2	165	174	130.8	123	95.4
	LV	94.8	76.8	76.2	51.6	40.2	40.2
Italy	T	0.68	2.72	8	0.82	0.94	1.68
	HV	1.15	2.63	2.12	1.46	1.66	2.81
	MV	136.25	124.31	102.63	80.59	73.85	55.87
	LV	26.44	29.56	25.82	26.01	20.38	15.5
Lithuania	MV						23
	LV						9

Note: A number of countries did not provide data split by voltage level, therefore the number of countries included in this table does not match those represented in the corresponding figure in Chapter 1.

VOLTAGE ANALYSIS SAIDI – EXCLUDING EXCEPTIONAL EVENTS

Minutes lost per customer per year due to unplanned interruptions



For most countries the majority of customer minutes lost occur due to faults on the MV networks. The data for Great Britain records all interruptions occurring on MV, HV and T networks under the HV networks category. Over time it is generally the case that the duration of interruptions at all voltage levels has been declining.

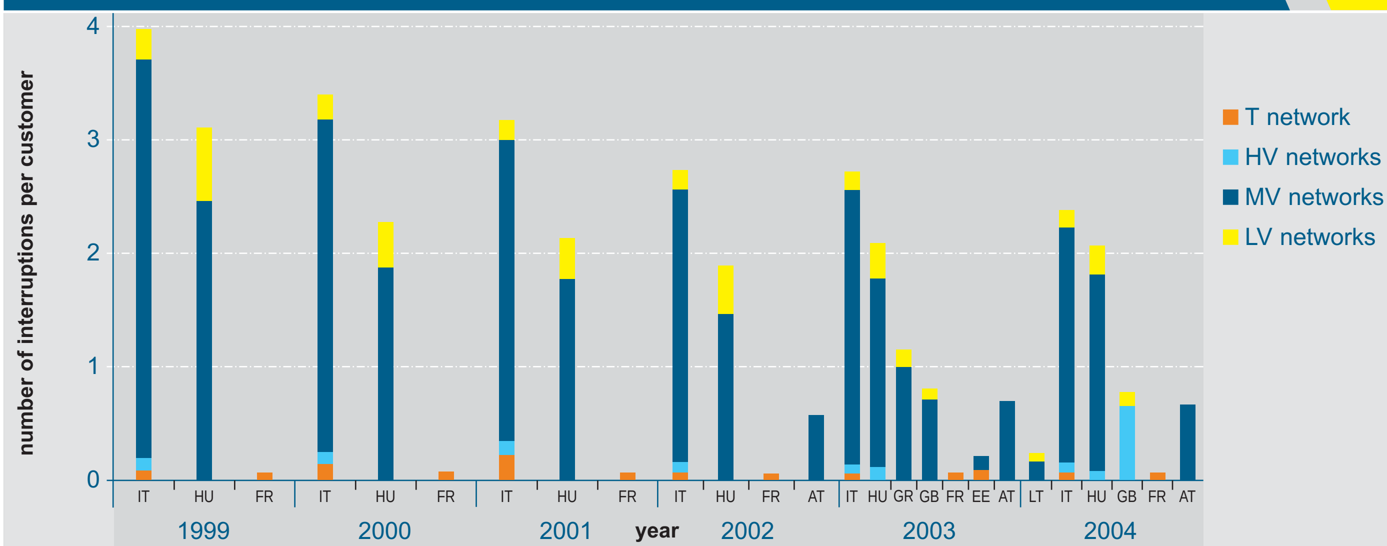
TABLE 4.2 – VOLTAGE LEVEL ANALYSIS UNPLANNED INTERRUPTIONS PER CUSTOMER EXCLUDING EXCEPTIONAL EVENTS

Country		1999	2000	2001	2002	2003	2004
Austria	MV				0.59	0.67	0.61
Estonia	T					0.14	
	HV, MV, LV					0.09	
France	T	0.09	0.09	0.09	0.07	0.14	0.09
Great Britain	MV, HV, T					0.67	0.60
	LV					0.09	0.09
Greece	MV					1.0	
	LV					0.18	
Hungary	HV					0.11	0.09
	MV	2.5	1.83	1.7	1.55	1.65	1.62
	LV	0.59	0.46	0.42	0.40	0.37	0.35
Italy	T	0.09	0.13	0.18	0.07	0.07	0.09
	HV	0.1	0.12	0.14	1.1	0.09	0.11
	MV	3.56	2.97	2.69	2.41	2.35	2.05
	LV	0.23	0.24	0.18	0.16	0.17	0.14
Lithuania	MV						0.2
	LV						0.07

Note: A number of countries did not provide data split by voltage level, therefore the number of countries included in this table does not match those represented in the corresponding figure in Chapter 1.

VOLTAGE LEVEL ANALYSIS SAIFI – EXCLUDING EXCEPTIONAL EVENTS

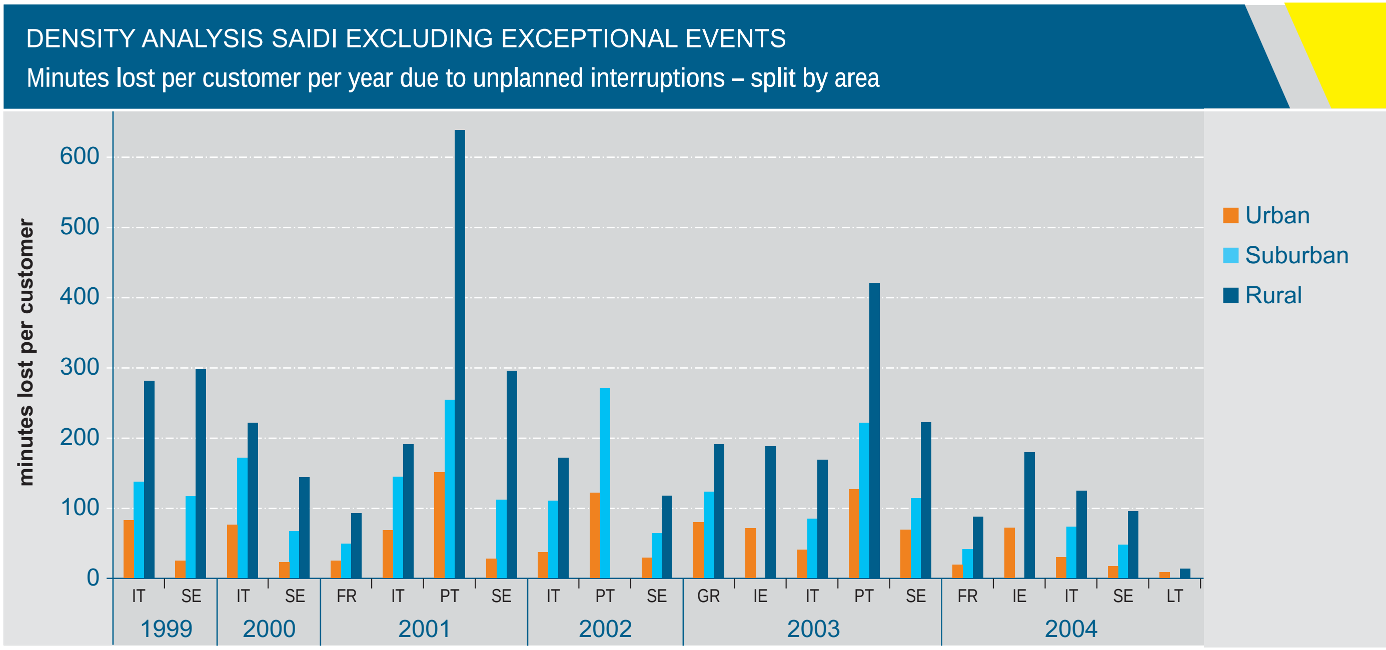
Customer interruptions per customer per year due to unplanned interruptions

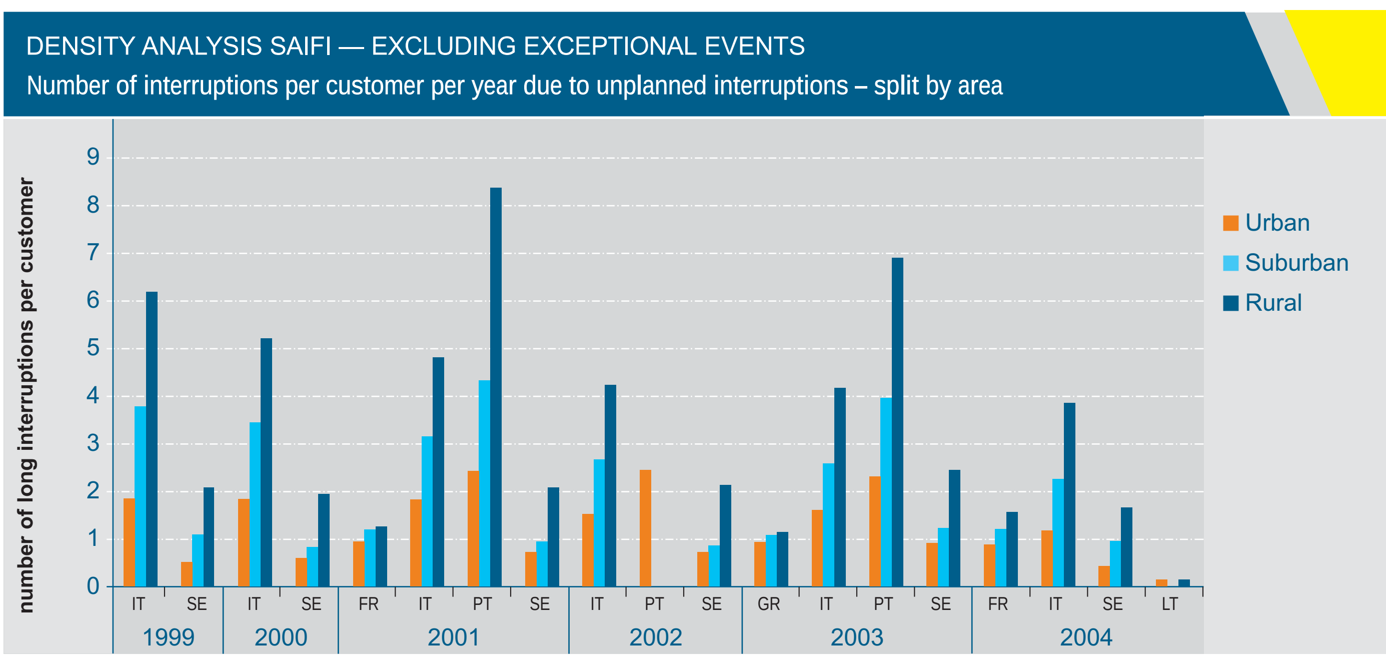


Again it can be seen that the majority of interruptions are due to faults on MV networks.

Section 5 — Density analysis

Regulators were asked to provide a density level analysis of nationwide continuity levels for unplanned interruptions from the year 1999 to the year 2004.





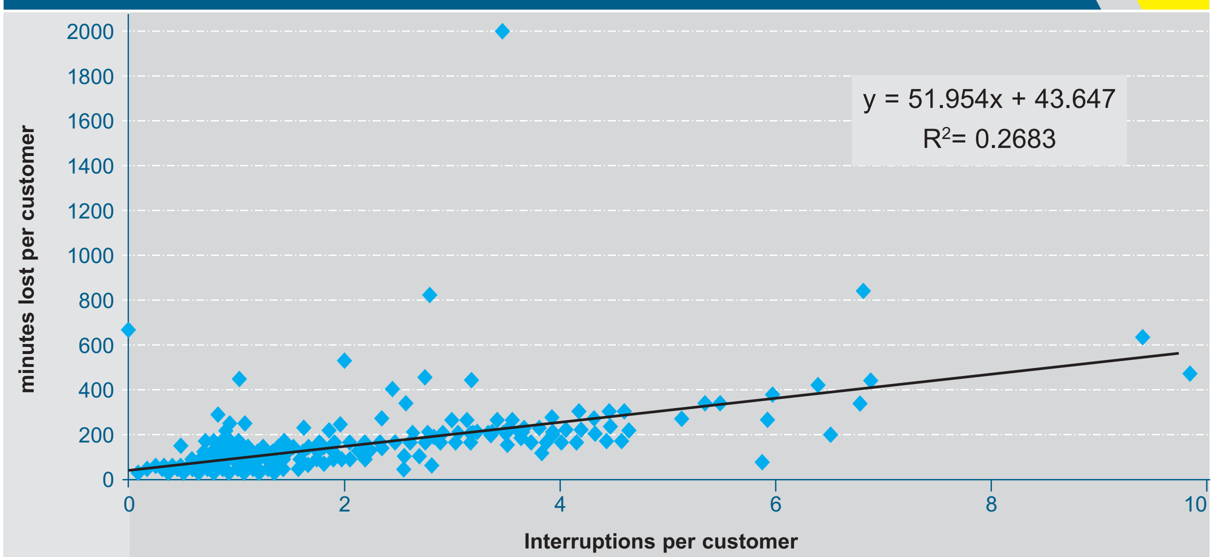
The classification of continuity data on the basis of density level is a useful way, within a country, for a regulatory authority to monitor network performance in rural and urban areas. However, cross-country comparisons are complicated for the following reasons:
Not all countries adopt a classification for density analysis. For example, Austria, Estonia, Great Britain, Hungary, Latvia, Poland and Slovenia do not use territorial classification for disaggregated analysis. Figures below show the survey results for Italy, Sweden, France and Greece, on the basis of "urban", "semi-urban" and "rural" classification.

As would be expected both the duration and number of interruptions rise the less dense the area, with urban areas showing the best performance, followed by suburban areas and then the rural areas.

Section 6 — Regression analysis

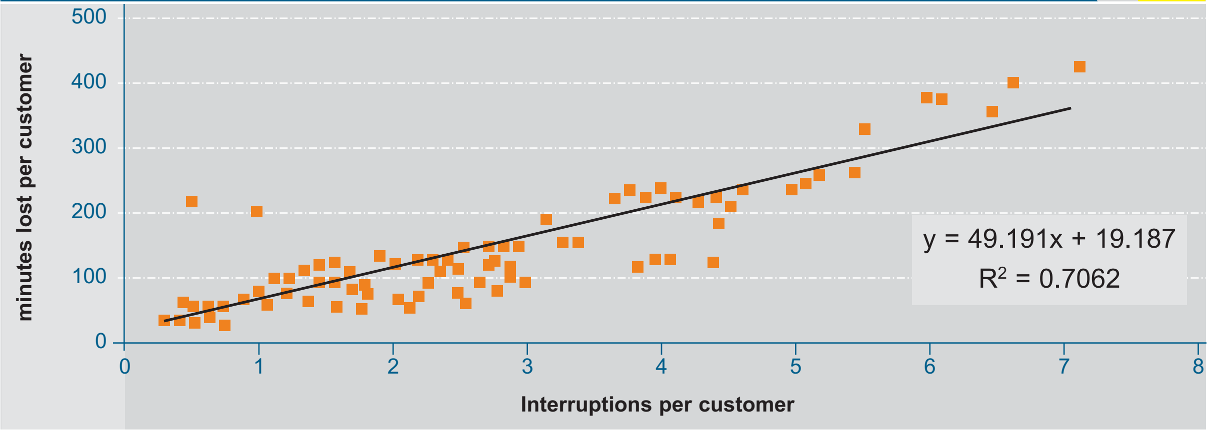
Regression analysis of duration and frequency of unplanned interruptions using regional data

REGRESSION OF THE DURATION AND FREQUENCY OF UNPLANNED INTERRUPTIONS USING REGIONAL DATA (2004)



There should be a positive correlation between the number and duration of interruptions as displayed by the graph, however, the R^2 is very low and on inspection of the data it was felt that one country's information was distorting the analysis. The following graph shows the same analysis but excluding that country. It can be seen that the R^2 value increases significantly.

REGRESSION ANALYSIS OF THE DURATION AND FREQUENCY OF UNPLANNED INTERRUPTIONS USING REGIONAL DATA (2004)

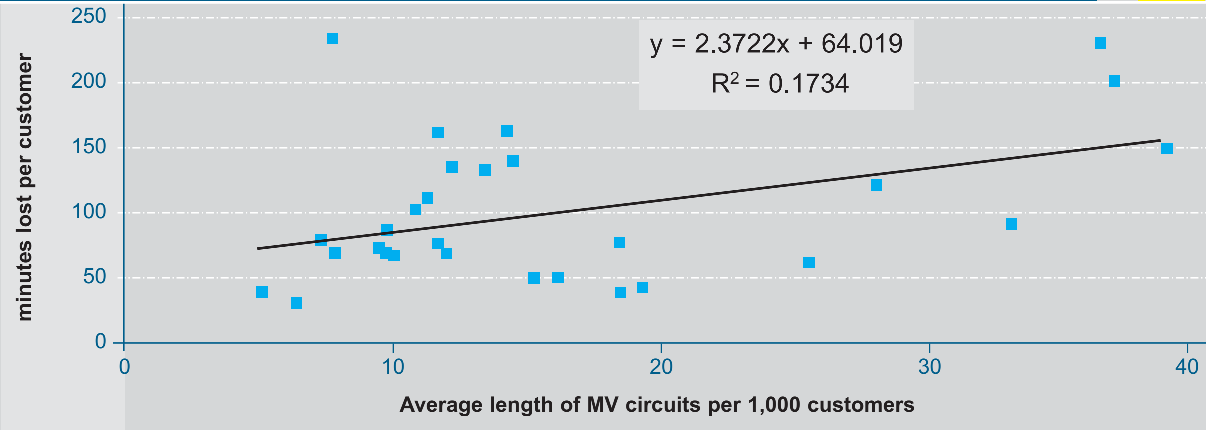


Correlation between quality of supply and density

The number of supply interruptions is to a large extent dependent on whether a consumer is connected to an urban or rural network. This is because urban customers are generally supplied by underground cables whereas rural customers are supplied by overhead lines. One would expect high density levels (urban customers) to experience high levels of quality of supply (low number of interruptions for short periods). Work carried out in Great Britain has indicated that the performance of completely overhead circuits is similar to that of entirely underground cables and that it is mixed circuits, those containing both overhead and underground sections, which have the worst performance.

Using all the available information for this analysis resulted in a very low R^2 and a negligible relationship between the density represented by the average length of MV circuits and the duration of interruptions. Removing countries whose data appeared to be skewing the results improved the R^2 and the relationship although the relationship shown is still weak.

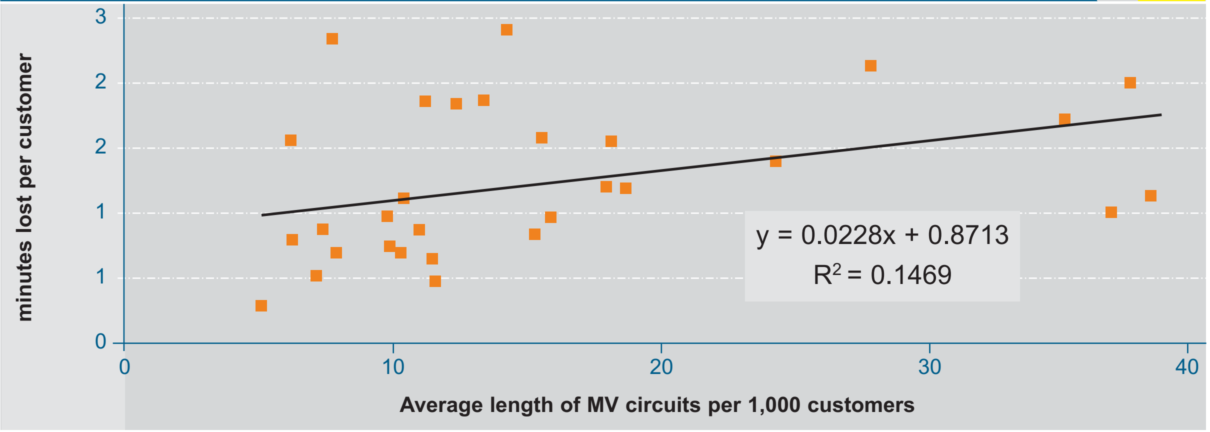
SAIDI AND DENSITY (AVERAGE LENGTH OF MV CIRCUITS PER CUSTOMER) USING UNPLANNED INTERRUPTIONS REGIONAL DATA (2004)



The same pattern emerges with the interruptions data when correlated with the average length of MV circuits. The R^2 is very low and the relationship very weak when looking at all the available data but improves somewhat when a smaller number of countries are evaluated.

Based on subset of information received.

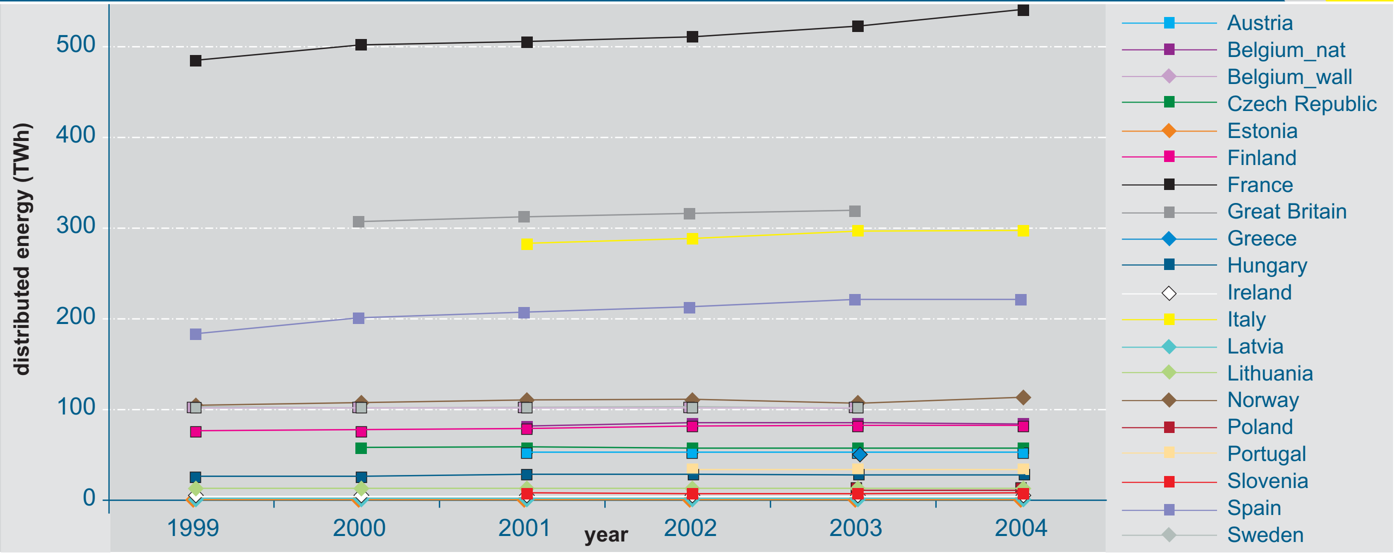
NUMBER OF INTERRUPTIONS AND DENSITY (AVERAGE LENGTH OF MV CIRCUITS PER CUSTOMER) USING UNPLANNED INTERRUPTIONS REGIONAL DATA (2004)



Using the number of customers per Km^2 as the proxy for density resulted in low R^2 even when certain data was excluded. As expected, quality appears to decrease with lower levels of density, as indicated by the slopes in the graphs.

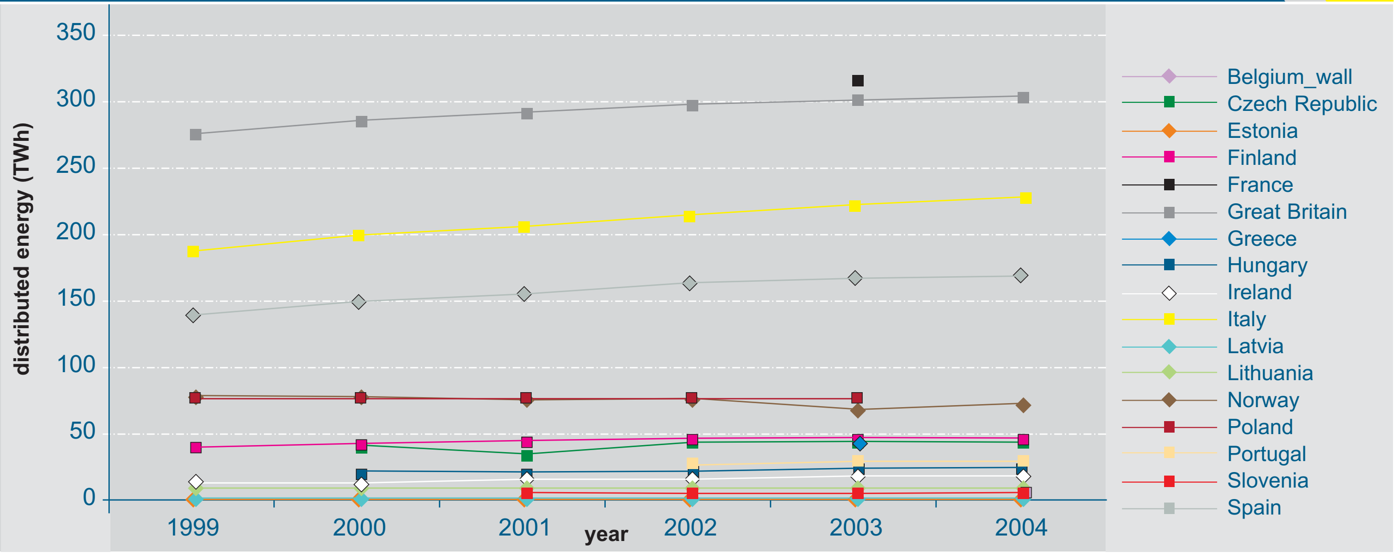
Distributed energy

DISTRIBUTED ENERGY – ALL CUSTOMERS



France distributes the most energy across all customers with Great Britain generally distributing the most energy to MV and LV customers. The growth in total energy distributed appears to have been driven by growth at the MV and LV level, as can be seen in the graph below.

DISTRIBUTED ENERGY – MV AND LV CUSTOMERS



ANNEX TO CHAPTER 2.

Annex 2.1 – Competencies of Regulatory Authorities on the Subject of Quality Regulation

Country	Can set quality standards	Can set compensation to customers	Can set incentive/ penalty regimes	Cannot set quality regulation / can make proposals to the Government	Other
Austria	No	No	No	Yes	The implementation of a system for quality regulation will be discussed in the near future. It will be necessary to legislate responsibilities and competencies with regard to quality regulation.
Belgium					
Czech Rep.	Yes	Yes	Yes		
Estonia	No	Yes	No	Yes	
Finland	Yes (if it is under the "obligation to devel-op the network")	No No	Yes		
France	No	Yes: if the customer complains to the regu-lator, the regulator can set compensation, but in particular cases only	Not yet	Yes	A law was just published on 13 July about energey policies and orientations. This law provides for quality standards and thresholds that have to be respected by distribution and transmission companies. A decree will set these thresholds, and if they are not respected, the operator (transmission or distribution) will have to pay penalties. The regulator will be consulted on this decree, and will give advice and comments about it before its publication.
Great Britain	Yes	Yes	Yes		
Greece	No	No	No	Yes	
Hungary	Yes	Yes		Yes	
Ireland			Yes		
Italy	Yes	Yes	Yes		
Latvia	Yes	No	No		
Lithuania	No	No	No		Regulator's legal power is limited: it supervises how licensed companies follow the quality requirements established by the Ministry of Economy
Norway	Yes	Yes	Yes		
Poland	No	Not yet	Not yet	Yes	Regulator will be consulted on the new law regarding quality standards and i ncentive/penalty regimes
Portugal	Yes, in collaboration with DGGE	Yes	Yes		
Spain	No	No	No	Yes	
Sweden	No	Yes	Yes	Yes	

[18] DGGE: General Directorate for Geology and Energy: responsible for the publication of the Quality of Service Code, while the regulator ERSE is responsible for presenting to DGGE a proposal for commercial regulations and for supervising enforcement of the Code.

ANNEX TO CHAPTER 3.

Annex 3A

As mentioned in the chapter "Commercial quality", some standards and facts are analyzed here. The structure is similar to the chapter's body and the numbering is continuous.

3.3.3. Problems associated with voltage and metering

Quest.	Recomm.
2.1.11	☆☆
Supp. 1	DSO 2
OS 1	GS 2

3.3.3.4. Standards applied for prepayment meter faults

Only two countries indicated standards relevant to this case. The reason can possibly be the low number of prepayment meters. However, there is a significant deviation between the standards of the two countries. In Spain the timescale is 5 working days below 15 kW connection capacity, while it is 15 working days over this capacity. In contrast, in Britain the fault shall be eliminated within 3 hours in working days, and within 4 hours in other days. Elimination of the fault may mean the repair or the replacement of the meter. In case of non-compliance the payment of compensation is automatic in both cases, the rate of compensation is € 30. In Spain this sum may be greater if 15% of the first complete bill is less than the this sum. (**Table 3.38** of Annex 3B.)

Currently this standard is applied only in a few countries. We do not recommend its harmonized introduction within CEER.

Customer contact in Person

Quest.	Recomm.
2.1.13	☆☆☆
Supp. 0	DSO 3
OS 2	GS 1

3.3.5.4. Standards applied for the visits necessary for the replacement of the meter

In most countries this is part of the simple works described under section 3.3.1.3, thus no separate standard has been established for this activity. Only three substantial answers where received. In Estonia, where 7 working days are available following the receipt of the notice of the customer for the adjustment or the replacement of the meter, and the customer shall pay for the activity. In Italy same figure is 15 working days while compesation is € 30-60. (**Table 3.39** of Annex 3B.)

If the meter is owned by the distributor or the supplier, we do not consider it justified, that the customer shall pay for the adjustment or the replacement of the meter, except in the case when the meter has been damaged by the customer, or the customer has caused the replacement necessary.

Quest. 2.1.18	Recomm. ☆☆
Supp. 0	DSO 5
OS 2	GS 4

3.3.5.5. Standards applied for the case of deactivation on customer's request

In Belgium (Flanders), Greece and France the DSO has 2 (working) days for deactivation based on customers' requests. The Italian standard is longer (5 working days for low voltage, 7 working days for medium voltage), but the compensation payment is higher. (In France the compensation is € 25, in Greece: € 15, in Italy: € 30 (household customers), € 60 (non-household customers), € 120 (medium voltage.) (**Table 3.40** of Annex 3B.)

> *From the low number of countries applying this standard the conclusion can be drawn, that this indicator is not significant from the point of view of commercial quality, therefore we think, its harmonized introduction and application within CEER is not necessary.*

Quest. 1.1.2	Recomm. ☆☆☆
Supp. 1	DSO 4

3.3.5.6. Actual levels applied for the number of visits to the customer centers per 100 customers

The indicated actual levels are between 2.6 and 116. Except Estonia the data were supplied in all cases by the distributor. Portugal's data are based on the data measured in the three largest customer centers. The calculation method applied by Estonia corresponds to the method described under section 3.3.5.3. (**Table 3.41** of Annex 3B.)

> *The responses given in relation with this indicator also confirm that the expectations and the practice of the customers are different by the region, the national characteristics, and the town/countryside requirements, and these expectations are continuously changing. Therefore it is not necessary to strive for the establishment of uniform indicators, respectively for a harmonization of indicators within CEER.*

3.3.6 Customer contact by phone

Quest. 1.1.4	Recomm. ☆☆☆
Supp. 4	DSO 6

3.3.6.3. Actual levels applied for the phone calls per 100 customers

The data received regarding actual levels of phone calls per 100 customers are between 1,8 and 137. The original data were supplied by the distributors, except Estonia, Hungary and Italy. The regulator of Greece indicated both licensees as data suppliers. Italy's are based on the ENEL data supply referring to the second half of 2004. In the case of Hungary the data include the reports on meter readings, reports on interruptions, billing complaints and all other changes in technical or billing parameters. However, it is possible that in the other countries only a part of these are included in the statements. (**Table 3.42** of Annex 3B.)

The low level of phone calls maybe the result of a number of factors, like:

- in case of new Call Centers the customers still prefer the personal contact,
- high level of customer satisfaction (they have only a few complaints),
- meter readings "must not" be reported or are measured separately.

The high level of phone calls maybe the result customer satisfaction with the operation of Call Center, however complaints on interruptions or billing may also result in high number of phone calls.

When evaluating service quality, it is important to use the indicator only in its own national, regional and historical environment. International comparison may be misleading. However, in a national environment it allows us to evaluate, how the Call Centers are "loaded".

3.3.7 Customer complaints

Quest. 1.1.11	Recomm. ☆☆☆
Supp. 3	DSO 5

3.3.7.4. Actual levels relevant to the number of corrected bills per 100 customers

The data received from five countries are between 0.01 and 5.2. The data were supplied by the distributor, except in Ireland, Italy and Estonia. It seems to be, that 5 mistakes (corrected bills) in every 100 issued bills are rather high! (**Table 3.43** of Annex 3B.)

Quest. 1.1.17	Recomm. ☆☆☆
Supp. 4	DSO 4

3.3.7.5. Actual levels relevant to billing complaints per 100 customers

Only four countries supplied data which are between 0.0004 and 3.6. The original data were delivered by the suppliers, except in Ireland, in Latvia and in Portugal. The data of Greece refer only to written complaints. In Hungary in the regulated tariff segment only the public supplier issues bills which combine the distribution fee and the supply fee. In the free market segment there are separate network related and energy related bills. The indicated data show the number of complaints relevant to these bills. (**Table 3.44** of Annex 3B.)

3.3.8 Meter reading, billing

Quest. 2.1.22	Recomm. ☆☆
Supp. 0	DSO 1
OS 0	GS 1

3.3.8.3. Standards applied for the accuracy of the bills of estimated consumption

We have received answer to this question only from Spain. According to the standard effective in that country customers with supply tariffs 1.0 and 2.0 may be billed by historical averages. However, the distributor must make an adjustment every six months in order to base the bill on the actual consumption. There was no mention by the regulators of the countries whether the customers have expectations with regard to the rate of difference between the consumption billed by the mid-year estimated bills and the consumption billed by the final bill issued at the end of the year. Namely, it may occur, that the licensees – estimating the expected increase of consumption – issue estimated bills during the year in which they account for consumption higher than the realistically expected volume, thus forcing the customers to overpay. (**Table 3.45** of Annex 3B.)

If we take into consideration the above suggestion, namely that the solution of the current problems would be the more frequent meter-reading in the future, this also means that the problem of the accuracy of the estimated bills will cease, since the estimated bills themselves will also cease within a few years. Therefore, we think that there is no need for a harmonized regulation in this matter within the framework of CEER.

Quest.	Recomm.
1.1.9	☆☆☆
Supp.	DSO
0	5

3.3.8.4. Actual levels relevant to the annual readings by the customers

Four countries supplied data which are between 0.03 and 8.7 average self meter-readings per year. The data supplier was the distributor in all cases. In Portugal only low voltage customers have been taken into consideration up to a contracted capacity of 41.1 kVA. In Italy the meters are read only once in a year. 95% of these readings are self-readings by customers. Therefore this value is included in the previous indicator. (**Table 3.46** of Annex 3B.)

Quest.	Recomm.
1.1.10	☆☆☆
Supp.	DSO
2	5

3.3.8.5. Actual levels relevant to the proportion of estimated bills

The data supplies varied between 0,58% and 94%. In five countries the data supplier was the distributor licensee, in two countries the data were supplied by the supplier. In Portugal only low voltage customers have been taken into consideration up to a contracted capacity of 41.1 kVA. In Italy the automatic meter reading project will result soon in the elimination of estimated bills. In Estonia there is meter reading once in a year which is generally performed by the customer. Further bills are based on estimation. (**Table 3.47** of Annex 3B.)

3.3.9 Individual (special) standards (applied only in one country)

Country	Standard	Expected value	OS/GS	DSO/ Supp.	Compensation payments	Recom-mendation
Austria	Response to the application for new connection to the grid	14 days	OS	DSO		☆☆☆
Belgium (Wallonia)	Transmission of meter reading data to the suppliers	Before 4. or 10. working day after the subject months	GS	DSO		☆☆
	Change of supplier and/or ARP	at least a months in advance	GS	Supp.		☆☆
Czech Republic	Answer to supply quality complaints	30 days	GS	DSO	€ 30/days, max. € 800	☆☆☆
	Elimination of reasons of non-quality supply	30, 60 days 2 years	GS	DSO	€ 30/days, max. € 1600	☆☆☆
	Response to the application for new network connection	30 days	GS	DSO	€ 15 /days	☆☆☆
Estonia	Response to the application for a new connection to the grid	30 days	OS	DSO		☆☆☆
Greece	Feasibility study associated with a new connection	15 or 25 working days	GS		€ 15	☆☆☆
Hungary	Reimbursement after wrong billing	8 days	GS	Sup.	HH € 8, Non HH € 24, MV € 60	☆☆☆
	Unjustified disconnection		GS	DSO/Sup.	HH € 40, Non HH € 80, MV € 240	☆☆
	Number of justified complaints received by the regulator	differing per region	GS	DSO/Sup.		☆☆☆
Ireland	Meter works requested by Supplier on behalf of customer	95% 5 w.day, 100% 10 w.day	OS			☆☆☆
	Refund Guarantee	within 5 working day	GS	DSO	€ 35	☆☆☆☆
	Independent Complaints Arbitrator	within 10 working day	GS	DSO	€ 130	☆☆

(CONTINUE)

Country	Standard	Expected value	OS/GS	DSO/ Supp.	Compensation payments	Recom-mendation
Spain	Disconnection of the eligible customer due to lack of payment	5 days	GS	DSO		☆☆
	Disconnection following lack of payment for Public Entities	4 months	GS	DSO		☆☆
	Disconnection following lack of payment for integral tariffs customers non Public Entities	2 months	GS	DSO		☆☆
	Notifying anomalies or errors in application of access to the distribution network	10 days	GS	DSO		☆☆☆
	Rejection of application of access to the distribution network	15 days	GS	DSO		☆☆☆
	Notification of finalization of power purchase contracts at low voltage between customer and supplier (LV)	15 working days	GS	DSO/Sup.		☆☆☆
	Reply to applications of eligible customers to modify the contract	5 working days	GS	DSO		☆☆

3.3.10 Individual (special) facts (measured only by one country)

At the end of Table 1.1 of the questionnaire the regulators were asked to add further indicators in addition to the predetermined 17 standard indicators. Six countries made use of this option, thus, in total 19 new indicators were specified.

3.3.10.1 Belgium (Flanders)

Number of complaints per 100 customers voltage quality: Change of voltage magnitude 0.1143, Flicker 0.0092, Harmonic voltage 0.0002, Voltage dips 0.006. Number of complaints per 100 customers: Quality of service by DSO (realization of connections, timely reactions on interruptions, supplying information about interruptions, repairing malfunctioning meter)

3.3.10.2 Estonia

Number of letters per 100 customers: 2.5. Average response time to the letters: 23.3 days.
Number of e-mails per 100 customers: 3.5. Average response time to the e-mails: 12.1 hours.

3.3.10.3 Greece

Average time of attendance in the customer centers. 2003: 5.3 minutes, 2004: 6.15 minutes. Number of front office staff per 1000 customers. 2003: 0.08. Number of back office staff per 1000 customers. 2003: 0.18. Number of cashiers per 1000 customers. 2003: 0.05. Number of collectors per 1000 customers. 2003: 0.23. Total number of customer service positions (own employees & billing subcontractors) per 1000 customers in 2003 is 0.36. Number of customer centers per 1000 customers is 0.003 in 2003. Number of service position in the customer centers is 9.47 in 2003.

3.3.10.4 Hungary

Supply level in the Call Centers. The proportion of calls received by the operators within a given period of time: 2004: 81.1%. (Expectation: 80% within 30 seconds). Number of complaints per 1000 customers arriving to the regulator. Fact: 2004: 0.0563.

3.3.10.5 Italy

Average adjustment time of billing complaints, if the customer paid a wrong sum: 47.73 days.

3.3.10.6 Lithuania

Time of restoration of the supply following disconnection due to unpaid bills: 2 days for household customers, 1 day for other customers. (This indicator corresponds to the indicator under question 1.1.16.). Notice before scheduled interruption: 14 days in case of household customers, 10 days in case of other customers. Time between the receipt of meter complaints and the visit to the site: 4 days in case of household customers, 3 days in case of other customers.

3.3.10.7 Portugal

Proportion of customers waiting less than 20 minutes in the customer centers (data from the three largest customer centers with the highest number of customers: 96%. Proportion of customers supplied with energy within four hours after a breakdown: 97%.

ANNEX 3B

TABLE 3.2

INDICATORS	Bg Flanders		Czech Rep.		Estonia		France		Greece		Hungary		Ireland		Italy		Latvia		Lithuania		Portugal		Slovenia		UK		Sum.			
	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	Both.	Sum.
1.1.1. Average waiting time in customer centres						X	X		X	X		X					X				X		X				4	2	1	7
1.1.2. Number of visits per 100 customers in customer centres						X	X										X				X		X				4	1	0	5
1.1.3. Average waiting time in call centres						X						X	X			X	X				X		X		X		5	3	0	8
1.1.4. Number of calls per 100 customers in call centres						X	X		X	X		X	X			X	X				X		X				5	3	1	9
1.1.5. Number of complaints per 100 customers			X						X	X	X		X		X	X	X		X		X		X				7	0	2	9
1.1.6. Average response time to written customer's complaints			X		X	X									X	X			X		X		X				4	0	2	6
1.1.7. Average response time to customer's written queries			X		X	X					X	X					X						X				3	0	2	5
1.1.8. Average annual meter readings per customer for LV (carried out by the network operator)					X		X				X		X		X		X				X		X				8	0	0	8
1.1.9. Average annual self meter readings per customer for LV (carried out by the customer)							X						X				X				X		X				5	0	0	5
1.1.10. Percentage of estimated bills						X	X					X	X				X				X		X				5	2	0	7
1.1.11. Number of revised bills per 100 customers			X			X	X							X		X	X				X		X				5	3	0	8
1.1.12. Average response time of repair service					X						X		X		X		X				X						6	0	0	6
1.1.13. Average response time for LV supply quotations						X					X	X	X		X		X				X		X				5	1	1	7
1.1.14. Average time to connect a new LV customer to the network					X				X		X	X	X		X		X		X		X		X				8	0	1	9
1.1.15. Average time to provide meter and supply after supply contract			X								X		X		X		X				X		X				7	0	0	7
1.1.16. Average time to restore supply to a customer after disconnection	X		X		X						X		X		X		X		X		X		X				10	0	0	10
1.1.17. Number of billing complaints per 100 customers						X			X	X		X	X			X	X				X						3	3	1	7
1.1.18. Average service time in customer centres									X	X																	0	0	1	1
1.1.19. Number of front office service positions per 1000 customers									X	X																	0	0	1	1
1.1.20. Number of back office service positions per 1000 customers									X	X																	0	0	1	1
1.1.21. Number of cashier positions per 1000 customers									X	X																	0	0	1	1
1.1.22. Number of subcontractors for collection of bills per 1000 customers									X	X																	0	0	1	1
1.1.23. Total number of customer service positions (PPC&billing subcontractors) per 1000 customers									X	X																	0	0	1	1
1.1.24. Number of customer service centres per 1000 customers (PPC only)									X	X																	0	0	1	1

(CONTINUE) TABLE 3.2

INDICATORS	Bg Flanders		Czech Rep.		Estonia		France		Greece		Hungary		Ireland		Italy		Latvia		Lithuania		Portugal		Slovenia		UK		Sum.			
	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	Both.	Sum.
1.1.25. Number of service positions per customer service centres (PPC only)									X	X																	0	0	1	1
1.1.26. Percentage of customers with waiting time in customer centres lower than 20 minutes																					X						1	0	0	1
1.1.27. Percentage of customers with a time to restore supply after a fault lower than 4 hours																					X						1	0	0	1
1.1.28. Number of letters per 100 customers																														1
1.1.29. Average response time for letters of clients																														1
1.1.30.Number of e-letters per 100 customers																														1
1.1.31. Average response time for e-letters of clients																														1
1.1.32. 80/30 call centre quality											X	X															0	0	1	1
1.1.33. Average time to fix billing problems (in case the customer has already paid the wrong sum)																X											0	1	0	1
1.1.34. Average time to execution of simple works															X												1	0	0	1
1.1.35. Average time to execution of complex works															X												1	0	0	1
1.1.36. Appointment scheduling															X												1	0	0	1
1.1.37. Period of time restoring of electricity supply after disconnection for debts																			X		X						2	0	0	2
1.1.38. Period of time from notification to the planned interruption																			X								1	0	0	1
1.1.39. Period of time during which the supplier came to the consumer by his request due to problems in metering																			X								1	0	0	1
1.1.40. Rightful complaints received by the regulator																											0	0	1	1
1.1.41. Number of complaints per 100 customers voltage quality	X																										1	0	0	1
1.1.42. Number of complaints per 100 customers: Quality of service by DSO	X																										1	0	0	1
Sum.	3	0	6	0	6	10	7	0	13	12	9	9	12	1	11	7	16	0	7	0	19	0	15	0	1	0	105	19	21	149

Yellow: doesn't specify an informant

Green: The regulator gather the information

TABLE 3.3.A

INDICATORS	Austria		Bg Flanders		Bg Wallonia		Czech Rep.		Estonia		France		Greece		Hungary		Ireland		Italy		Latvia	
	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.
2.1.1. Responding to failure of supplier's fuse					X		X				X		X		X		X				X	
2.1.2. Restoring/ reconnecting supply			X		X		X		X		X		X		X		X				X	
2.1.3. Connection (supply and meter)			X		X		X				X		X		X		X		X		X	
2.1.4. Estimating Charges											X				X		X		X			
2.1.5. Notice of supply interruption	X		X		X		X		X						X		X				X	
2.1.6. Voltage complaints			X		X				X						X		X		X		X	
2.1.7. Meter problems			X		X		X		X						X		X		X		X	
2.1.8. Queries on charges and payments						X	X			X						X				X	X	
2.1.9. Appointments scheduling							X				X		X		X		X		X			
2.1.10. Payments notice under standards						X			X								X				X	
2.1.11. Prepayment meter fault			X																			
2.1.12. Correction of voltage faults					X										X		X					
2.1.13. Visits to customers who required a meter move			X						X										X			
2.1.14. Number of meter readings within a year	X		X								X				X				X		X	
2.1.15. Response to customers letters									X	X	X		X	X	X	X			X	X	X	
2.1.16. Response to customers claims									X	X	X				X	X			X	X	X	
2.1.17. Execution of simple works			X								X						X		X			
2.1.18. Deactivation on customer's request			X		X						X		X						X			
2.1.19. Reconnection following lack of payment						X	X		X		X		X		X				X			
2.1.20. Estimating charges for complex works			X														X		X			
2.1.21. Execution of complex works			X		X												X		X			
2.1.22. Accuracy of bills made on estimations																						
2.1.23. Attendance in customers centres																						
2.1.24. Attendance in telephone service											X					X						

TABLE 3.3.C

INDICATORS	Austria		Bg Flanders		Bg Wallonia		Czech Rep.		Estonia		France		Greece		Hungary		Ireland		Italy		Latvia	
	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.
2.1.25. Response to customers application for a new connection to the grid	X																					
2.1.26. Feasibility study & design for new connections													X	X								
2.1.27. Disconnection following lack of payment for integral tariffs customers non Public Entities																						
2.1.28. Disconnection following lack of payment for eligible customers, demanded by supplier																						
2.1.29. Disconnection following lack of payment for Public Entities																						
2.1.30. Notifying anomalies or errors in application of access to the distribution network																						
2.1.31. Rejection of application of access to the distribution network																						
2.1.32. Notification of finalisation of power purchase contracts at low voltage between customer and supplier																						
2.1.33. Reply to applications to modify the contracting method from eligible consumers																						
2.1.34. Quality supplies complaints							X															
2.1.35. Remove cases of non-quality supplies							X															
2.1.36. Formulation to requests for customer's networking							X															
2.1.37. Offer for connection									X													
2.1.38. Max time of unplanned interruption on the connection point									X													
2.1.39. Max summary of times of interruptions per year									X													
2.1.40. Max time of planned interruption									X													
2.1.41. Refund because of false billing																X						
2.1.42. Unjustifiable disconnection															X	X						
2.1.43. Number of justifed complaints per 1000 customers (different for every supplier)																X						
2.1.44. Transmission of meter reading data to the suppliers					X																	
2.1.45. Change of supplier and/or ARP						X																
2.1.46. Meter works																	X					
2.1.47. Refund Guarantee																	X					
2.1.48. Independent Complaints Arbitrator																	X					
Sum.	3	0	12	0	10	4	11	0	13	3	12	0	8	2	14	7	16	0	14	3	11	0

TABLE 3.3.B

INDICATORS	Lithuania		Norway		Poland		Portugal		Slovenia		Spain		UK		Sum.			
	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	Both	Sum.
2.1.1.Responding to failure of supplier's fuse							X						X		9	0	0	9
2.1.2.Restoring/ reconnecting supply	X		X		X		X		X		X		X		16	0	0	16
2.1.3.Connection (supply and meter)	X						X				X				12	0	0	12
2.1.4.Estimating Charges							X				X		X		7	0	0	7
2.1.5.Notice of supply interruption	X		X		X				X		X		X		14	0	0	14
2.1.6.Voltage complaints			X				X		X				X		11	0	0	11
2.1.7.Meter problems	X						X				X			X	11	1	0	12
2.1.8.Queries on charges and payments					X	X	X		X		X			X	5	5	1	11
2.1.9.Appointments scheduling							X						X	X	7	0	1	8
2.1.10.Payments notice under standards											X		X	X	4	1	1	6
2.1.11.Prepayment meter fault											X			X	2	1	0	3
2.1.12.Correction of voltage faults			X												4	0	0	4
2.1.13.Visits to customers who required a meter move															3	0	0	3
2.1.14.Number of meter readings within a year			X				X		X		X				10	0	0	10
2.1.15.Response to customers letters					X	X		X							2	1	5	8
2.1.16.Response to customers claims	X	X			X	X		X			X				3	1	5	9
2.1.17.Execution of simple works							X				X				6	0	0	6
2.1.18.Deactivation on customer's request															5	0	0	5
2.1.19.Reconnection following lack of payment	X						X		X		X				10	1	0	11
2.1.20.Estimating charges for complex works											X				4	0	0	4
2.1.21.Execution of complex works											X				5	0	0	5
2.1.22.Accuracy of bills made on estimations											X				1	0	0	1
2.1.23.Attendance in customers centres								X							0	1	0	1
2.1.24.Attendance in telephone service							X	X							1	1	1	3

TABLE 3.3.D

INDICATORS	Lithuania		Norway		Poland		Portugal		Slovenia		Spain		UK		Sum.			
	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	DSO	Sp.	Both.	Sum..
2.1.25. Response to customers application for a new connection to the grid															1	0	0	1
2.1.26. Feasibility study & design for new connections															0	0	1	1
2.1.27. Disconnection following lack of payment for integral tariffs customers non Public Entities											X				1	0	0	1
2.1.28. Disconnection following lack of payment for eligible customers, demanded by supplier											X				1	0	0	1
2.1.29. Disconnection following lack of payment for Public Entities											X				1	0	0	1
2.1.30. Notifying anomalies or errors in application of access to the distribution network											X				1	0	0	1
2.1.31. Rejection of application of access to the distribution network											X				1	0	0	1
2.1.32. Notification of finalisation of power purchase contracts at low voltage between customer and supplier											X	X			0	0	1	1
2.1.33. Reply to applications to modify the contracting method from eligible consumers											X				1	0	0	1
2.1.34. Quality supplies complaints															1	0	0	1
2.1.35. Remove cases of non-quality supplies															1	0	0	1
2.1.36. Formulation to requests for customer's networking															1	0	0	1
2.1.37. Offer for connection															1	0	0	1
2.1.38. Max time of unplanned interruption on the connection point															1	0	0	1
2.1.39. Max summary of times of interruptions per year															1	0	0	1
2.1.40. Max time of planned interruption															1	0	0	1
2.1.41. Refund because of false billing															0	1	0	1
2.1.42. Unjustifiable disconnection															0	0	1	1
2.1.43. Number of justifed complaints per 1000 customers (different for every supplier)															0	1	0	1
2.1.44. Transmission of meter reading data to the suppliers															1	0	0	1
2.1.45. Change of supplier and/or ARP															0	1	0	1
2.1.46. Meter works															1	0	0	1
2.1.47. Refund Guarantee															1	0	0	1
2.1.48. Independent Complaints Arbitrator															1	0	0	1
Sum.	6	1	5	0	5	3	12	4	6	0	22	1	7	5	170	16	17	203

TABLE 3.4

INDICATORS	Austria		Bg Flanders		Bg Wallonia		Czech Rep.		Estonia		France		Greece		Hungary		Ireland	
	OS	GS	OS	GS	OS	GS	OS	GS	OS	GS	OS	GS	OS	GS	OS	GS	OS	GS
2.1.1. Responding to failure of supplier's fuse						X		X				X		X		X		X
2.1.2. Restoring/ reconnecting supply			X			X		X	X			X		X		X		X
2.1.3. Connection (supply and meter)			X			X		X			X	X		X		X		X
2.1.4. Estimating Charges			X									X				X		X
2.1.5. Notice of supply interruption	X		X			X		X	X							X		X
2.1.6. Voltage complaints			X			X										X		X
2.1.7. Meter problems						X		X	X							X	X	
2.1.8. Queries on charges and payments						X		X	X							X		
2.1.9. Appointments scheduling								X				X		X		X		X
2.1.10. Payments notice under standards						X			X									X
2.1.11. Prepayment meter fault			X															
2.1.12. Correction of voltage faults						X										X		X
2.1.13. Visits to customers who required a meter move			X						X									
2.1.14. Number of meter readings within a year	X		X								X				X		X	
2.1.15. Response to customers letters									X			X		X		X		
2.1.16. Response to customers claims									X			X				X		
2.1.17. Execution of simple works			X									X						X
2.1.18. Deactivation on customer's request			X			X						X		X			X	
2.1.19. Reconnection following lack of payment						X		X	X		X			X		X	X	
2.1.20. Estimating charges for complex works			X															X
2.1.21. Execution of complex works			X			X												X
2.1.22. Accuracy of bills made on estimations																		
2.1.23. Attendance in customers centres																		
2.1.24. Attendance in telephone service											X				X		X	
	2	0	12	0	0	12	0	8	9	0	4	9	0	7	2	13	5	12
Sum.	**2**		**12**		**12**		**8**		**9**		**13**		**7**		**15**		**17**	

Italy		Latvia		Lithuania		Norway		Poland		Portugal		Slovenia		Spain		Sweden		UK		Sum.			
OS	GS	OS	GS	OS	GS	OS	GS	OS	GS	OS	GS	OS	GS	OS	GS	OS	GS	OS	GS	OS	GS	Both.	Sum..
			X								X								X	0	9	0	9
			X		X	X			X	X		X			X				X	5	11	0	16
	X		X		X					X		X			X					3	9	1	13
X (MV)	X (LV)									X					X				X	2	5	1	8
			X		X	X			X	X		X			X				X	6	9	0	15
X			X				X				X	X							X	3	7	0	10
X			X		X						X				X				X	3	8	0	11
	X		X						X		X	X			X				X	2	9	0	11
	X										X								X	0	8	0	8
			X												X				X	1	5	0	6
															X				X	1	2	0	3
							X													0	4	0	4
	X																			2	1	0	3
X			X				X			X		X			X	X				9	3	0	12
X			X						X	X										3	5	0	8
X			X	X					X	X					X					4	5	0	9
	X									X					X					2	4	0	6
	X																			2	4	0	6
	X				X						X	X			X					4	8	0	12
X (MV)	X (MV)														X					1	2	1	4
X															X					2	3	0	5
															X					0	1	0	1
										X										1	0	0	1
										X										4	0	0	4
8	9	0	11	1	5	2	3	0	5	10	6	7	0	0	15	1	0	0	10				
17		**11**		**6**		**5**		**5**		**16**		**7**		**15**		**1**		**10**		**60**	**122**	**3**	**185**

TABLE 3.6 ESTIMATING CHARGES (WORKING DAY)

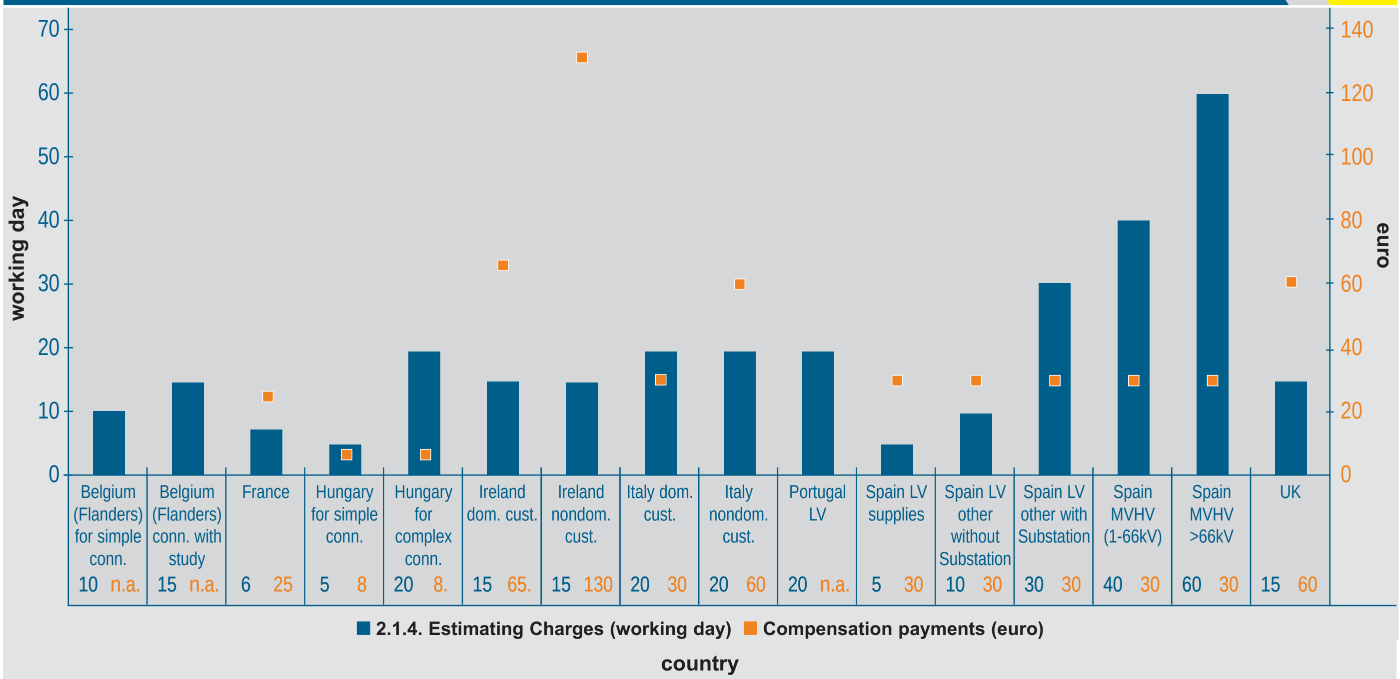
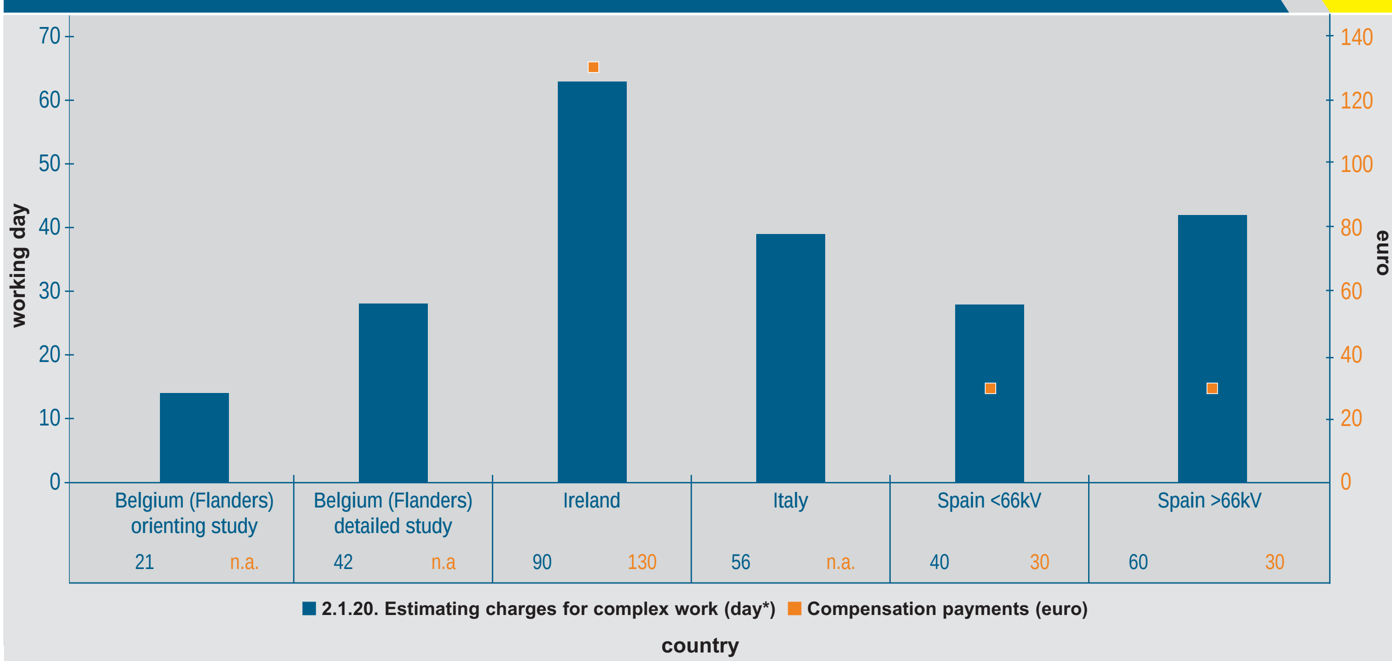
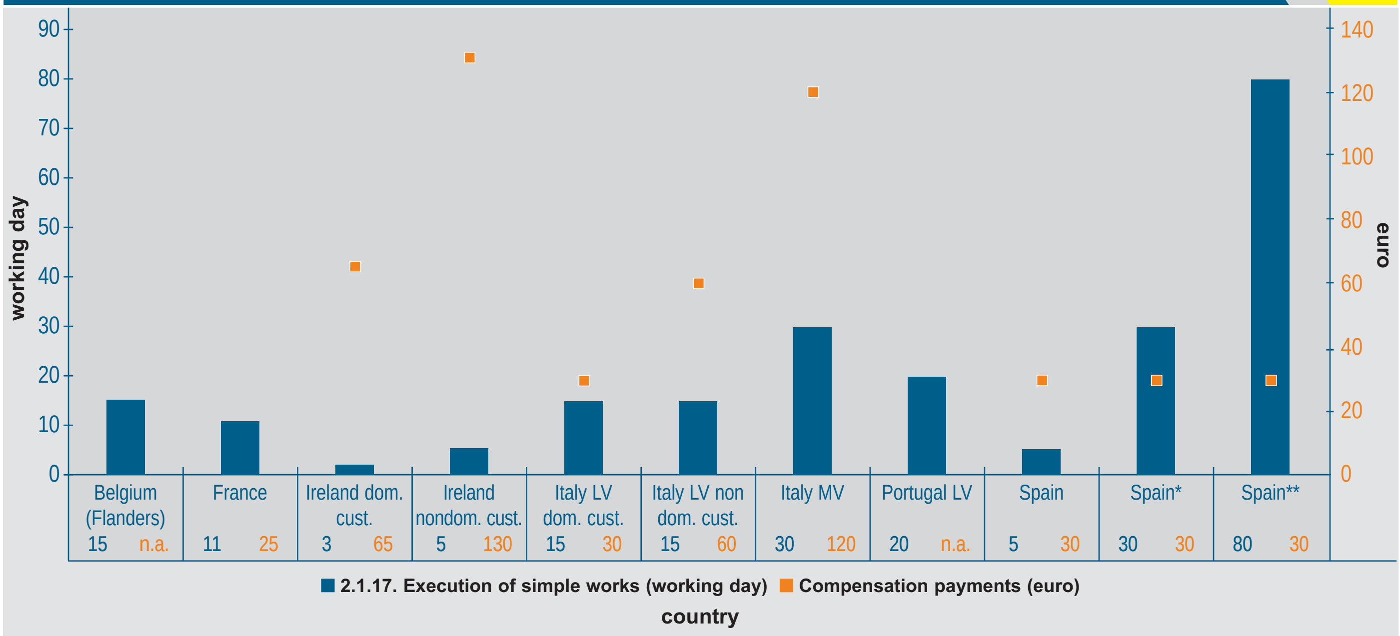


TABLE 3.7 ESTIMATING CHARGES FOR COMPLEX WORK (DAY)



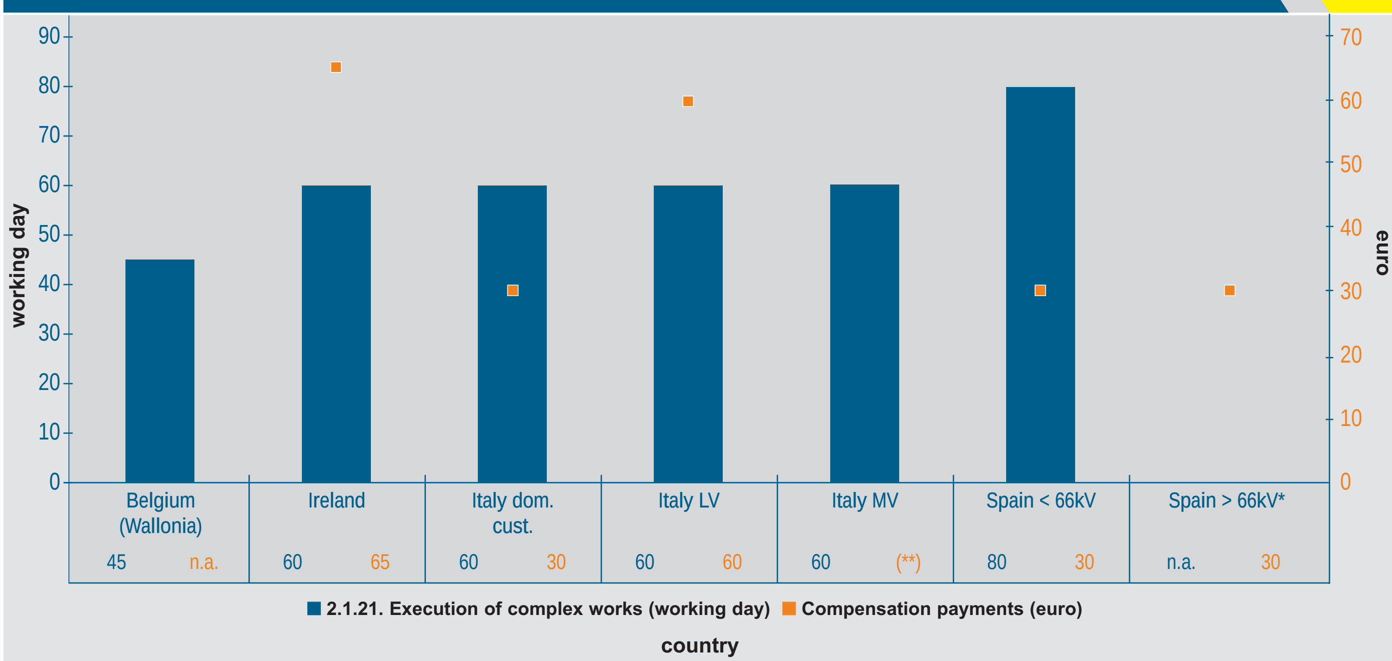
* Calculated where figures were supplied in working days

TABLE 3.8 EXECUTION OF SIMPLE WORKS (WORKING DAY)



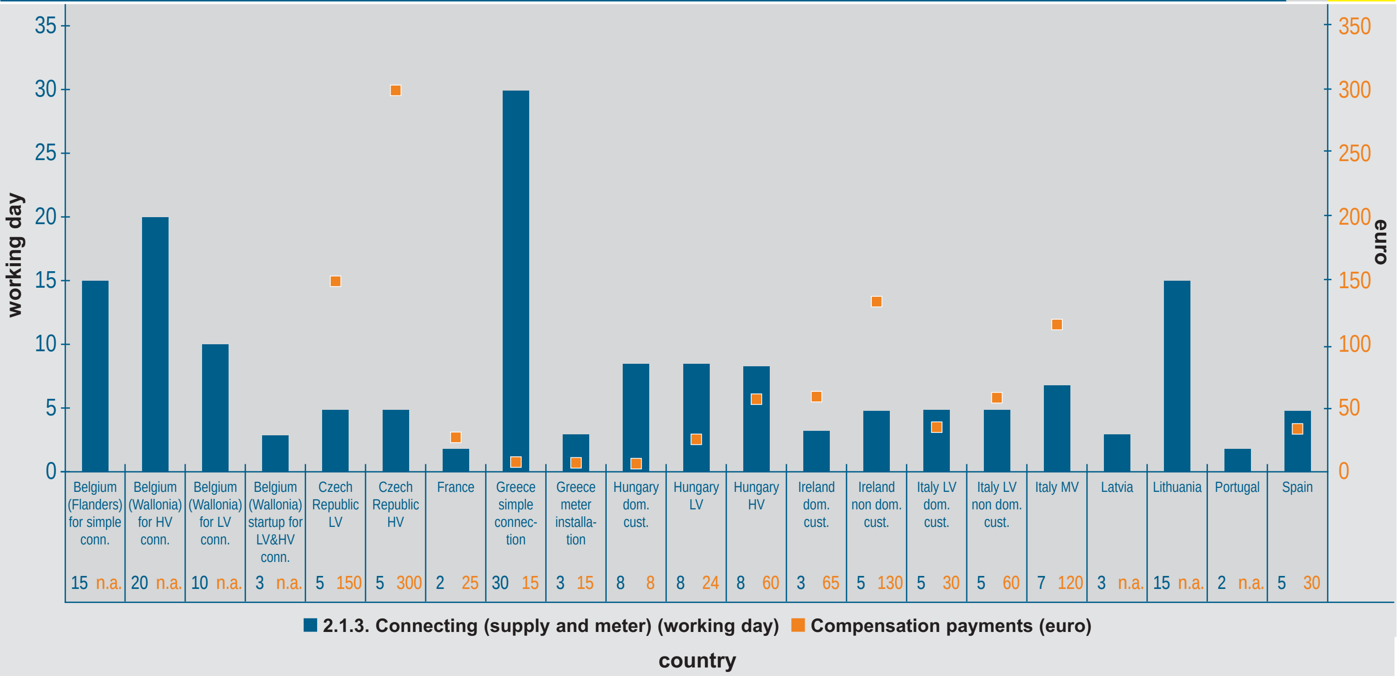
Spain* with LV network expansion
Spain** with several transformator centre

TABLE 3.9 EXECUTION OF COMPLEX WORKS (WORKING DAY)



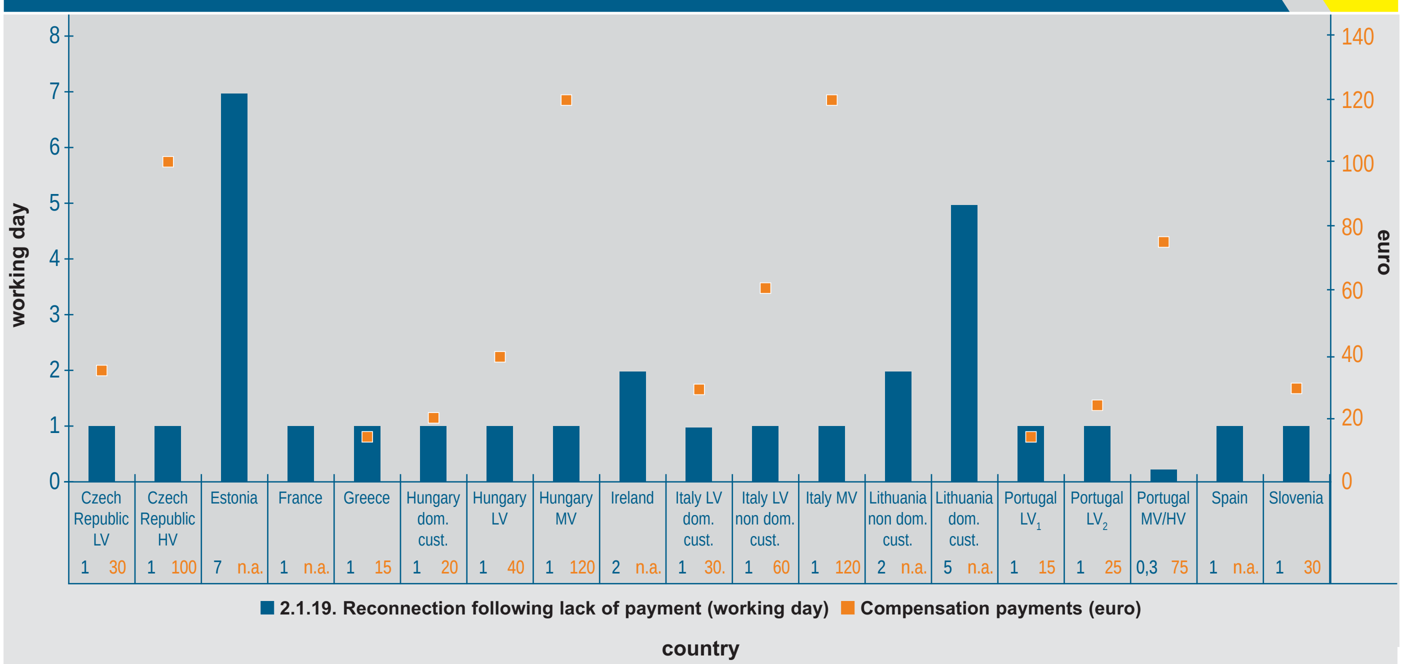
* deadlines determine in each case in line with importance of the work
** For MV customers the standard is always OS

TABLE 3.10 CONNECTING (SUPPLY AND METER) (WORKING DAY)



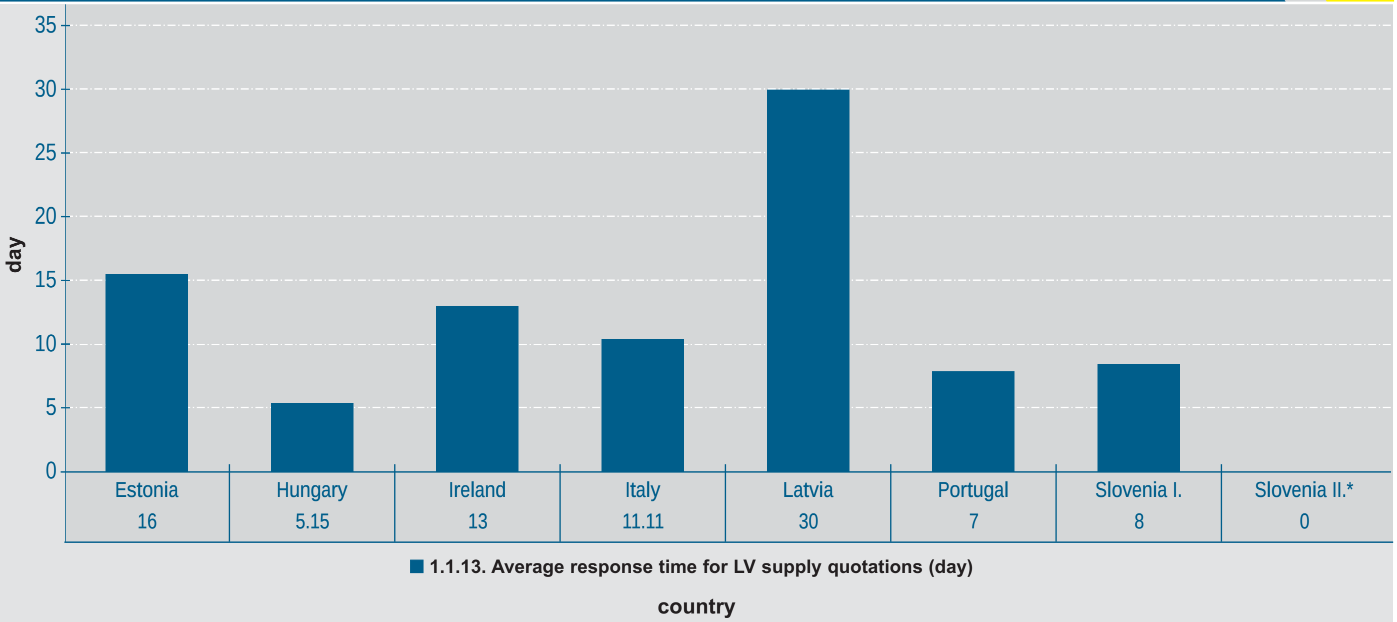
Slovenia: connection time is defined in connection contract

TABLE 3.11 RECONNECTION FOLLOWING LACK OF PAYMENT (WORKING DAY)



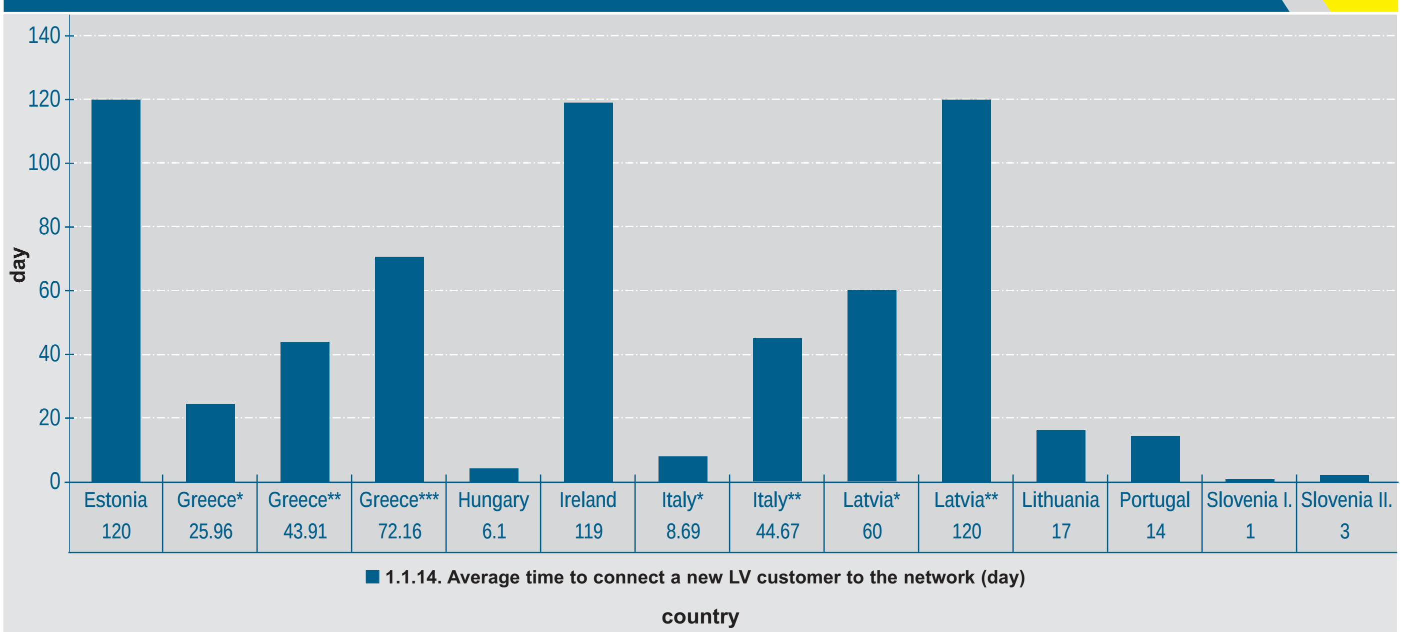
Belgium (Wallonia): n.a., n.a.

TABLE 3.12 AVERAGE RESPONSE TIME FOR LV SUPPLY QUOTATIONS (DAY)



* 0 means answer is given on the same day

TABLE 3.13 AVERAGE TIME TO CONNECT A NEW LV CUSTOMER TO THE NETWORK (DAY)



Greece * Simple overhead connection (2003)
Greece ** Simple underground connection (2003)
Greece *** Connection involving expansion on distribution network (2003)

Italy * simple connection
Italy ** complex connection
Latvia * simple connection
Latvia ** Connection involving expansion on distribution network

TABLE 3.14 AVERAGE TIME TO PROVIDE METER AND SUPPLY AFTER SUPPLY CONTRACT (DAY)

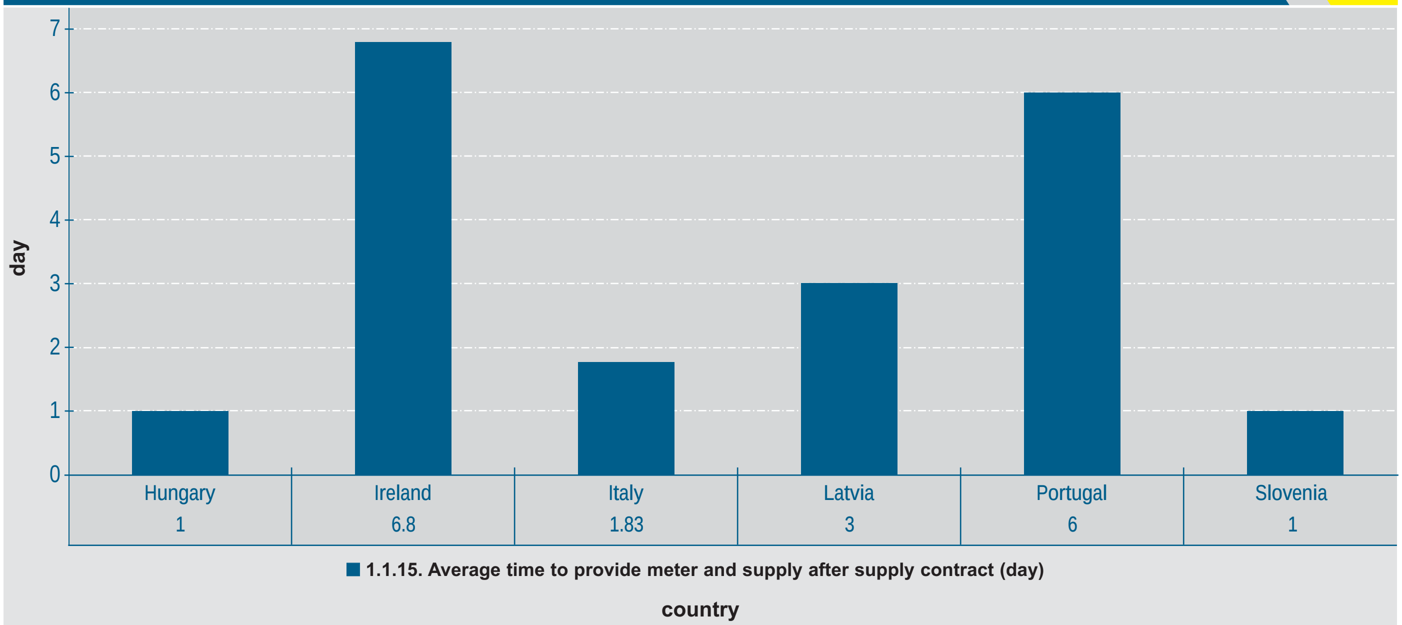
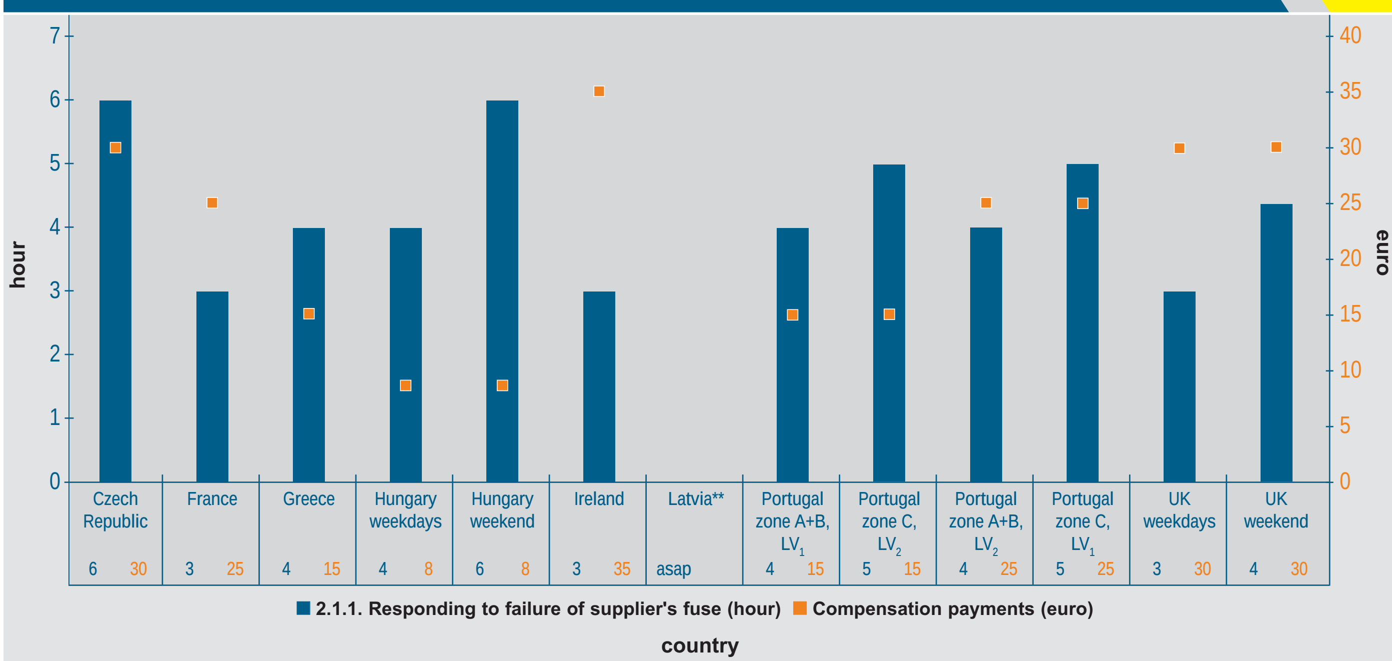


TABLE 3.15 RESPONDING TO FAILURE OF SUPPLIER'S FUSE (HOUR)



Belgium (Wallonia): n.a./n.a.
* area quality standards with authomatical penalties MV and HV figures are different
** "ASAP" can not be put in the diagramm

TABLE 3.16 AVERAGE TIME TO RESTORE SUPPLY TO A CUSTOMER AFTER DISCONNECTION (DAY)

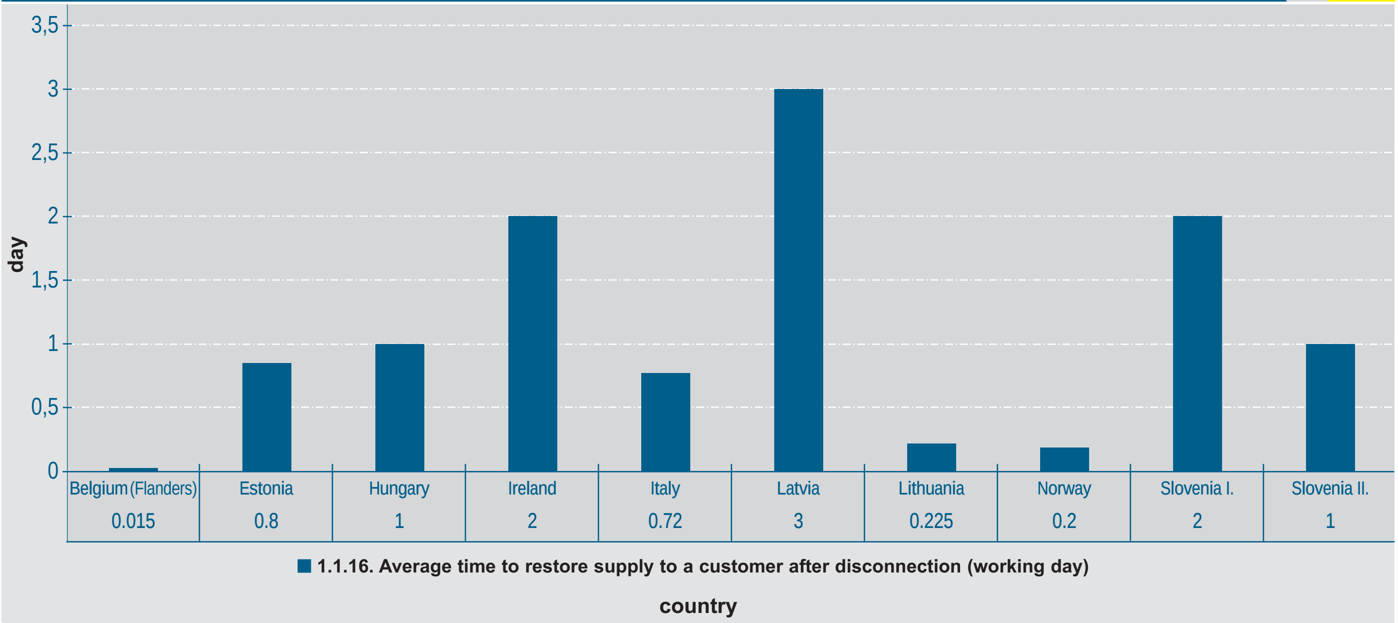
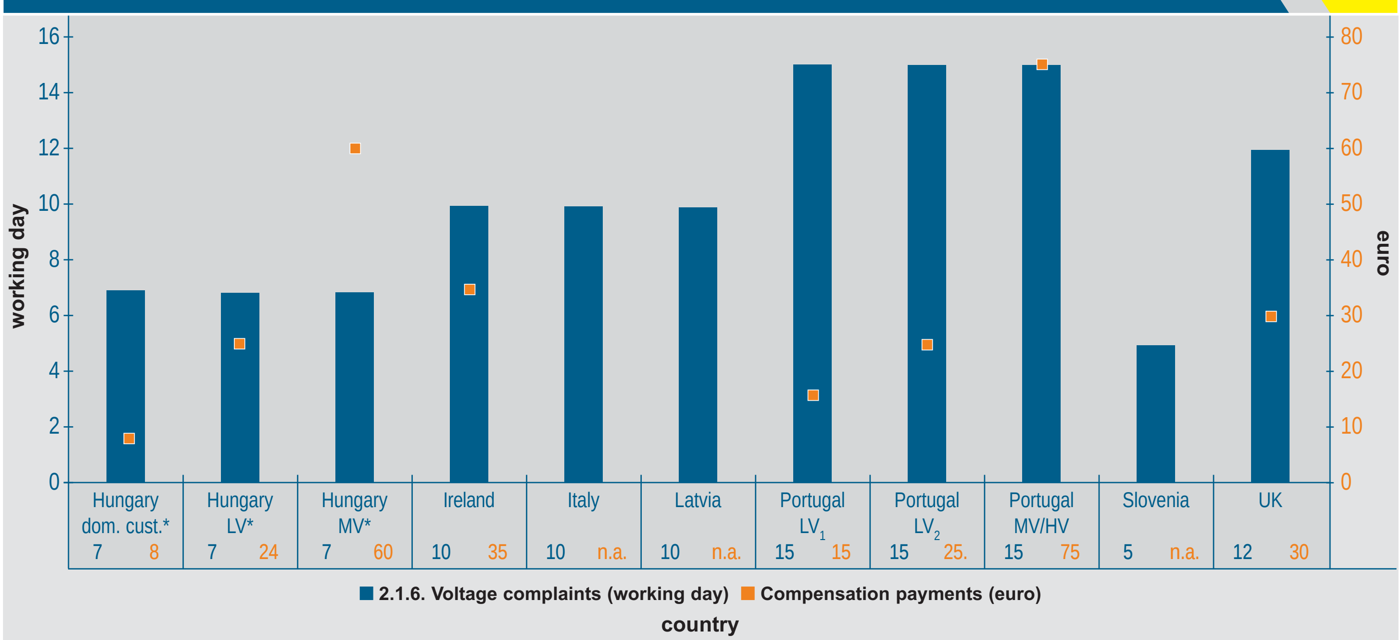
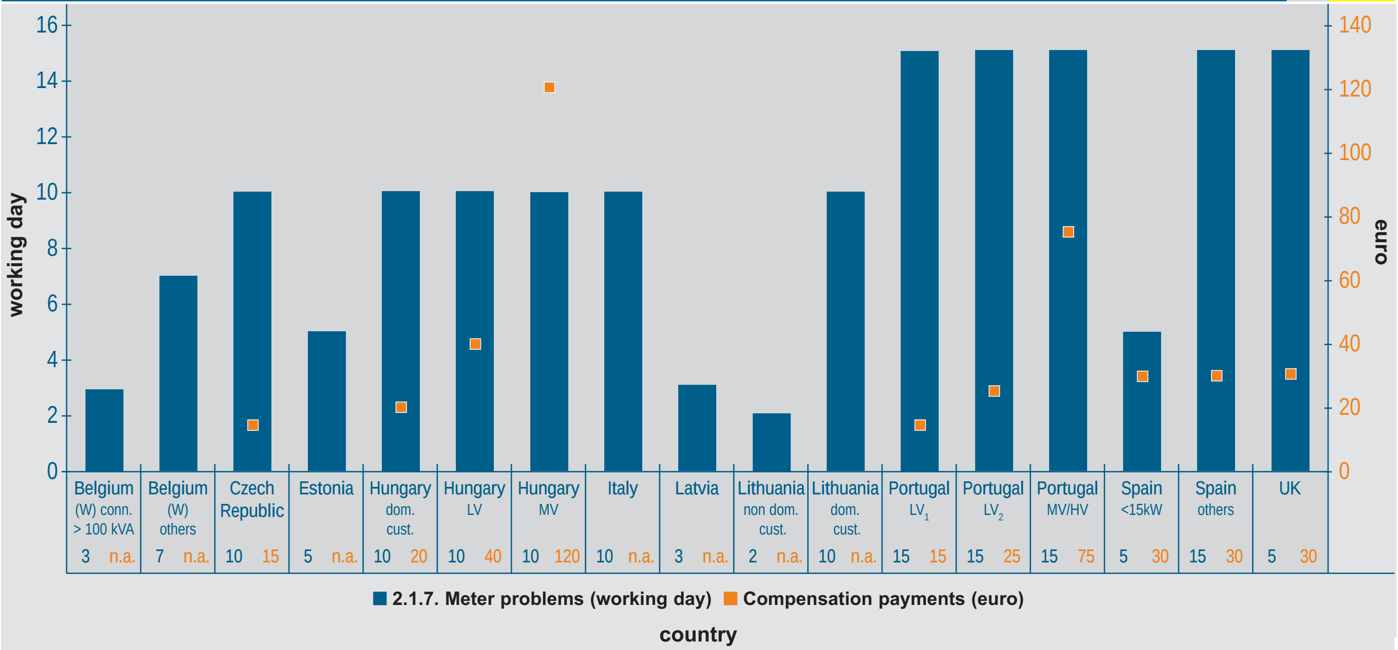


TABLE 3.17 VOLTAGE COMPLAINTS (WORKING DAY)



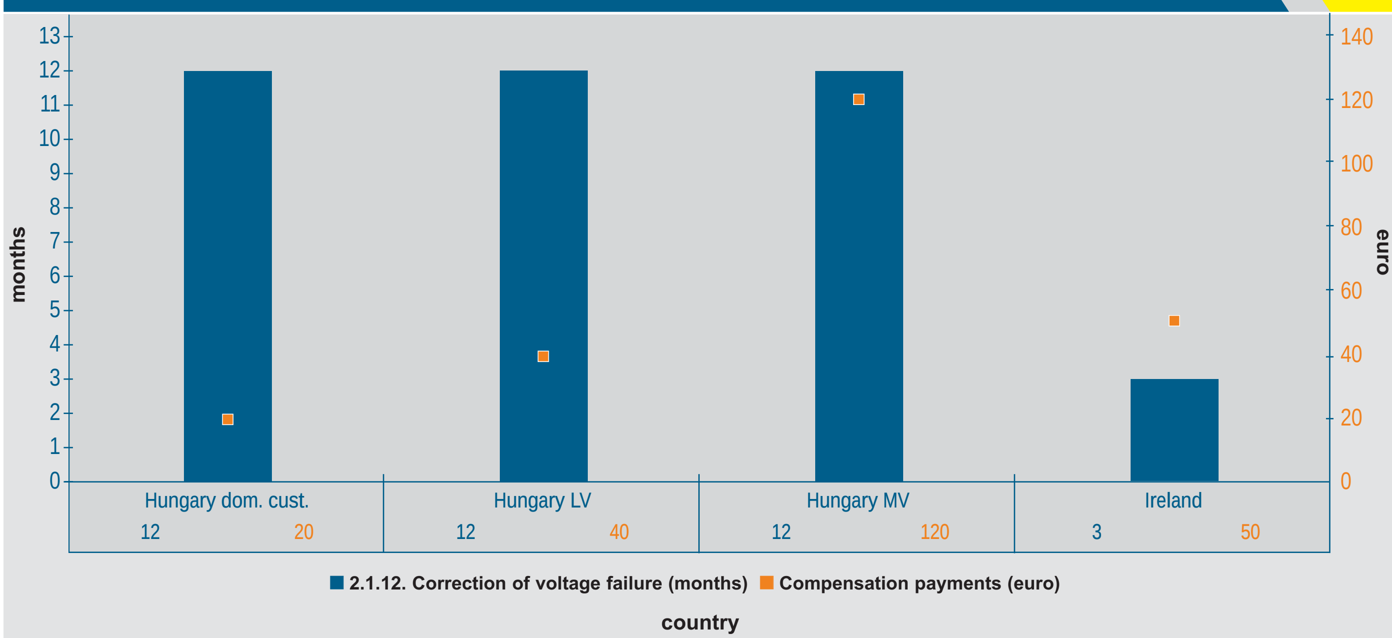
Belgium: n.a./n.a.
Norway: n.a./n.a.
* A total of 20 w. day is provided for contacting, site supervison and response.

TABLE 3.18 METER PROBLEMS (WORKING DAY)



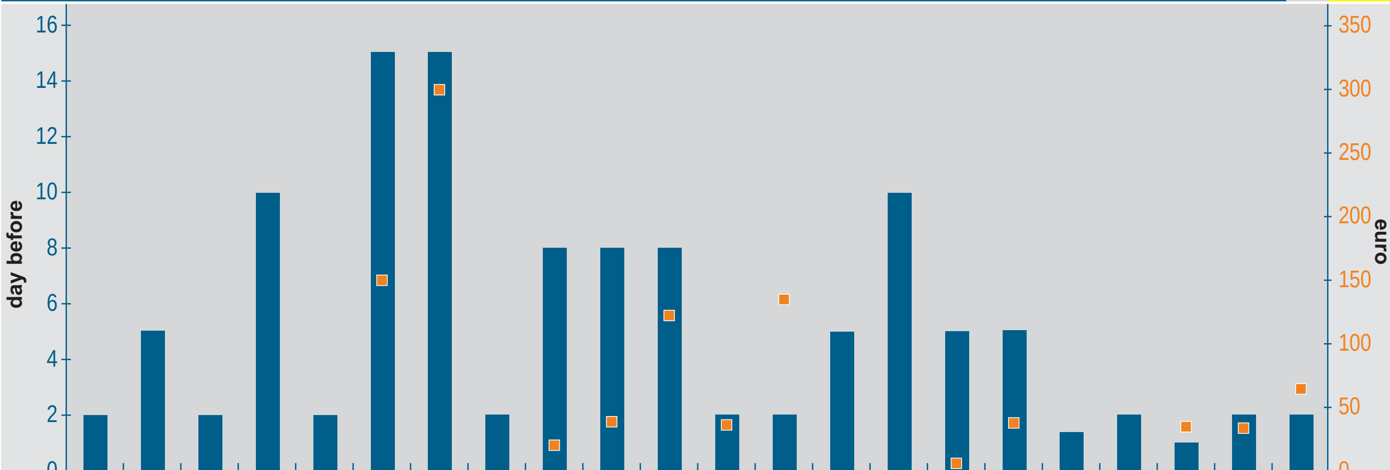
Ireland: n.a./n.a.

TABLE 3.19 CORRECTIONAL OF VOLTAGE FAILURE (MONTHS)



Belgium (Wallonia): n.a./n.a.
Norway: n.a./n.a.

TABLE 3.20 NOTICE OF SUPPLY INTERRUPTION (DAY BEFORE)



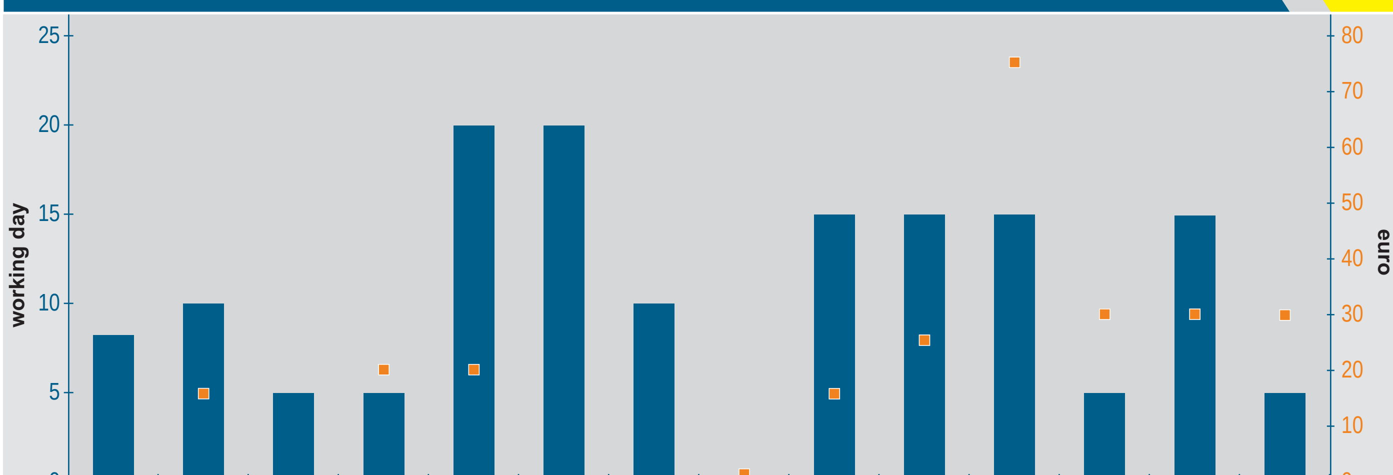
country	2.1.5. Notice of supply interruption (day before)	Compensation payments (euro)
Austria	2	n.a.
Belgium (Flanders) HV	5	n.a.
Belgium (Flanders) LV	2	n.a.
Belgium (Wallonia) HV	10	n.a.
Belgium (Wallonia) LV	2	n.a.
Czech Republic LV	15	150
Czech Republic HV	15	300
Estonia	2	n.a.
Hungary dom. cust.*	8	20
Hungary LV*	8	40
Hungary MV*	8	120
Ireland dom. cust.*	2	35
Ireland non dom. cust.*	2	130
Latvia	5	n.a.
Lithuania	10	0
Poland LV	5	3.8
Poland MV	5	38
Portugal	1.5	n.a.
Slovenia	2	n.a.
Spain	1	30
UK dom. cust.	2	30
UK non dom. cust.	2	60

■ 2.1.5. Notice of supply interruption (day before) ■ Compensation payments (euro)

country

*If expected duration of interruption is less than 4 hours a 4 days prior notice is to be sent.
Norway: n.a./n.a.

TABLE 3.21 QUERIES ON CHARGES AND PAYMENTS (WORKING DAY)



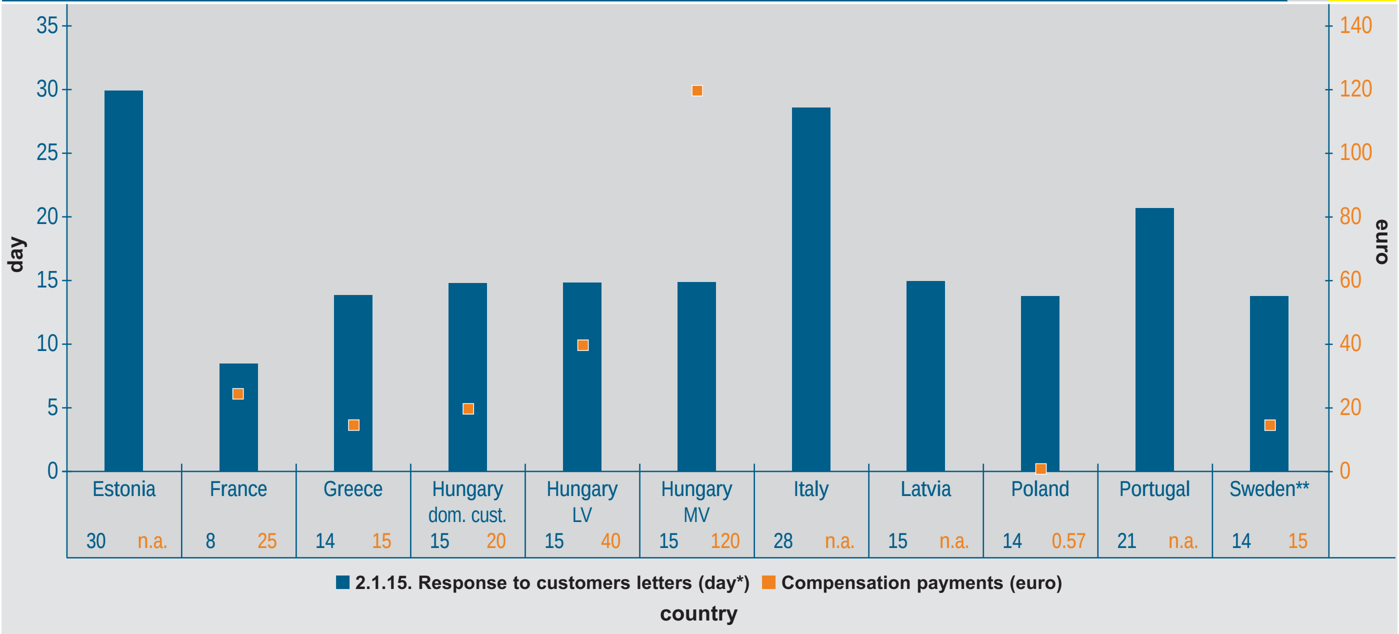
country	2.1.8. Queries on charges and payments (working day)	Compensation payments (euro)
Belgium (Wallonia)	7	n.a.
Czech Republic	10	15
Estonia	5	n.a.
Hungary for simple conn.	5	20
Hungary for complex conn.	20	20
Italy	20	n.a.
Latvia	10	n.a.
Poland	n.a.	1.9
Portugal LV_1	15	15
Portugal LV_2	15	25
Portugal MV/HV	15	75
Spain <15kW	5	30
Spain others	15	30
UK	5	30

■ 2.1.8. Queries on charges and payments (working day) ■ Compensation payments (euro)

country

Slovenia: n.a./n.a.

TABLE 3.22 RESPONSE TO CUSTOMER LETTERS (DAY)



* Calculated where figures were supplied in working days
**Example of response time guaranteed by one company

TABLE 3.23 AVERAGE RESPONSE TIME TO CUSTOMER'S WRITTEN QUERIES (DAY)

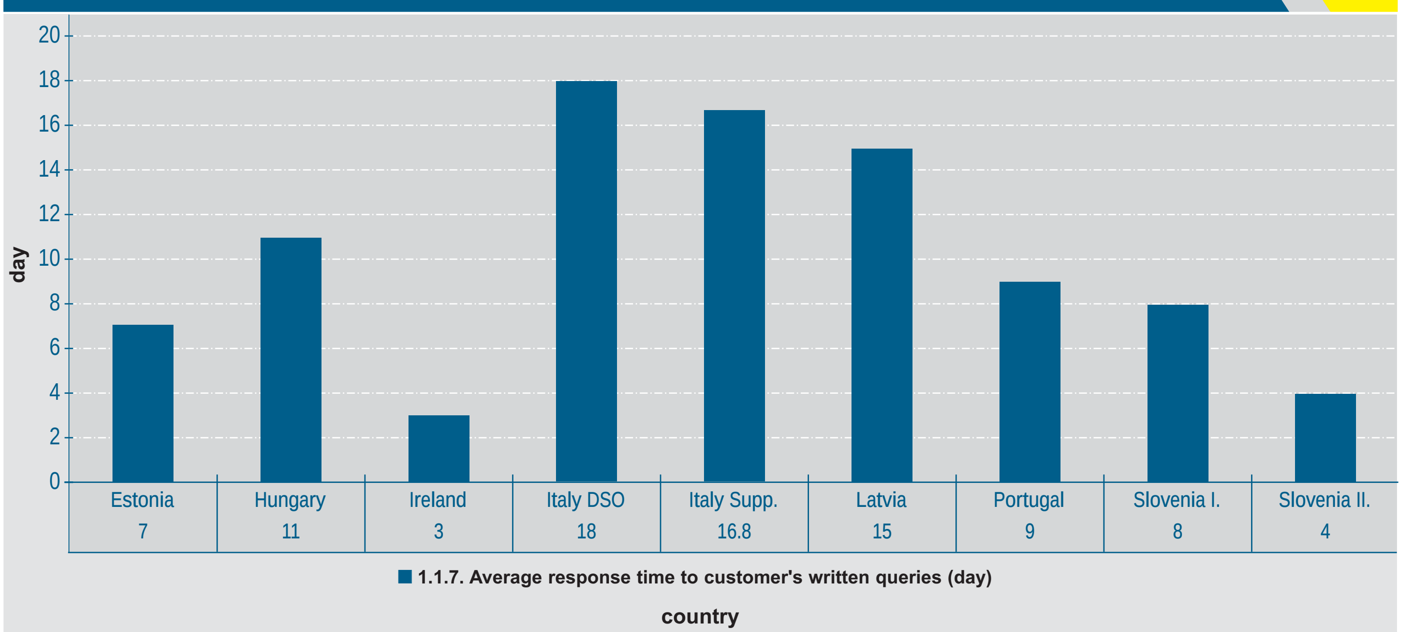


TABLE 3.25 APPOINTMENTS SCHEDULING (HOUR)

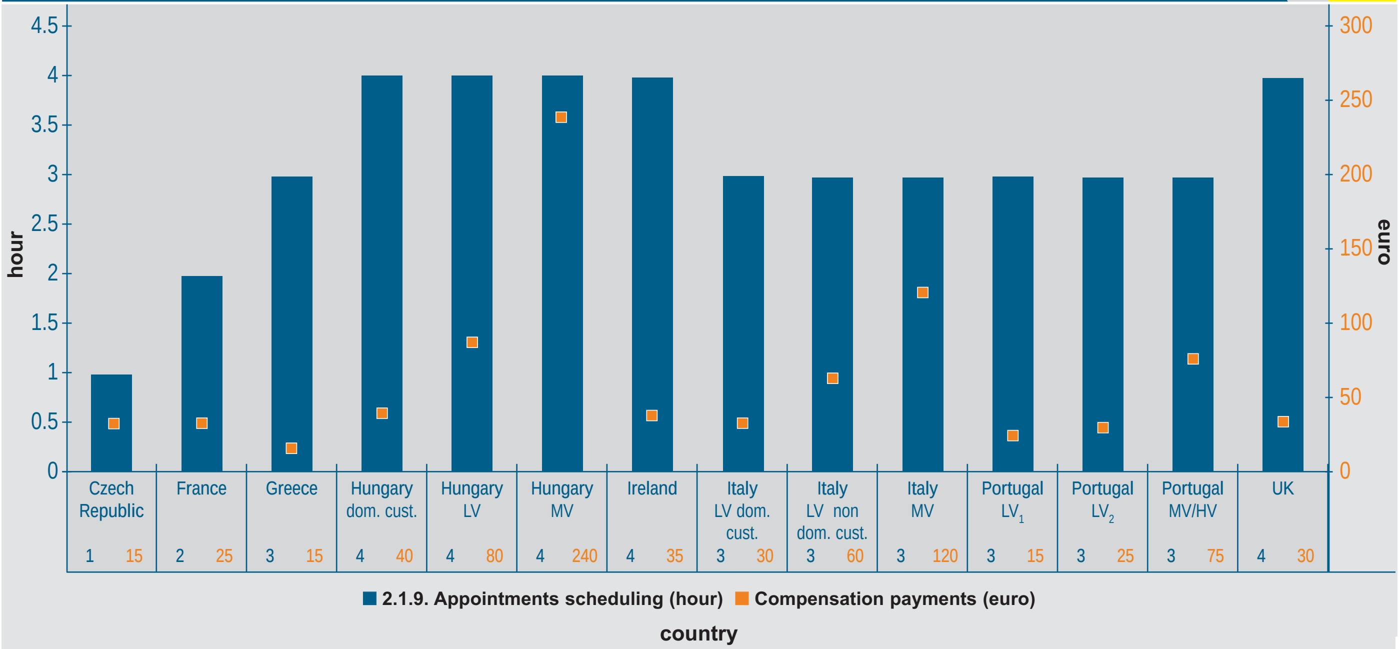
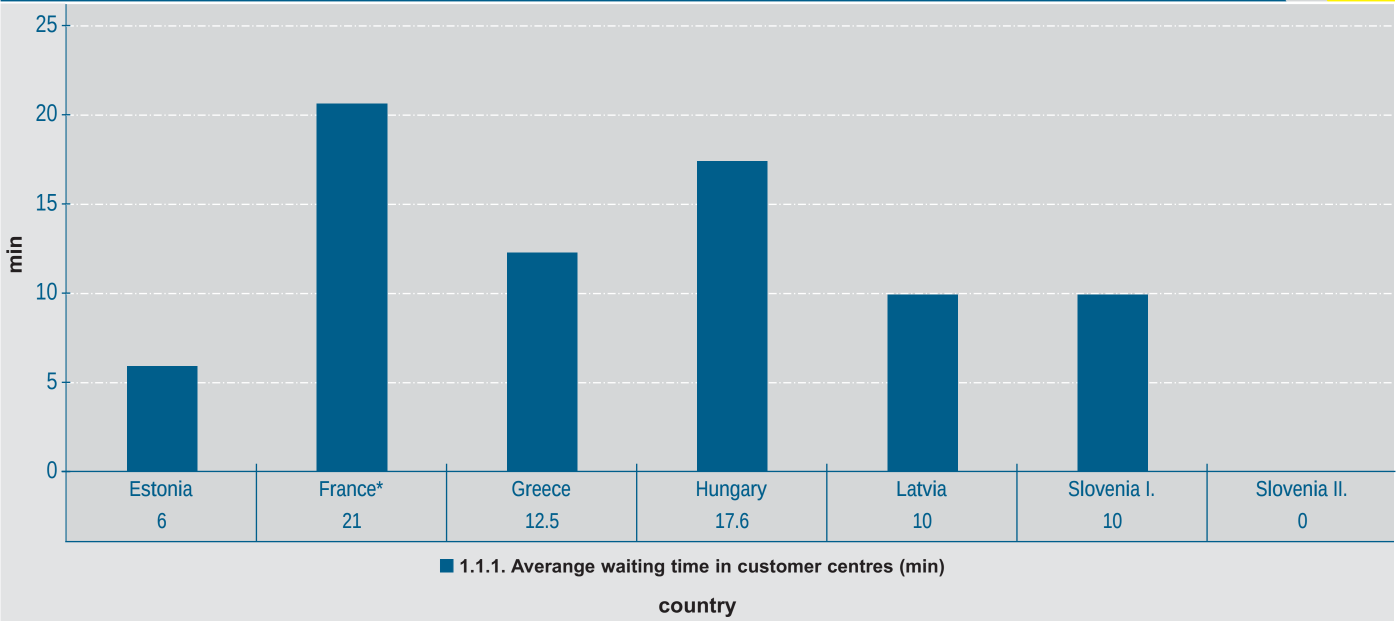


TABLE 3.26 ATTENDANCE IN CUSTOMERS CENTRES (MIN)

Country	2.1.23. Attendance in customers centres (min)	Compensation payments (euro)
Portugal	20*	

* 90% of cases

TABLE 3.27 AVERAGE WAITING TIME IN CUSTOMERS CENTRES (MIN)



France* In Questionnaire >20 min included

TABLE 3.29 ATTENDANCE IN TELEPHONE CENTRES (SEC)

Country	2.1.24. Attendance in telephone centres (sec)	Compensation payments (euro)
France*	n.a.	
Hungary*	30	
**Ireland ** **	20	
Portugal*	60	

* in Hungary and in Portugal 80% of calls must be answered in this time interval
** in Ireland 75 % of calls must be answered in this time time interval
*** 95% must get a personal call (not recorded)

TABLE 3.30 AVERAGE WAITING TIME IN CALL CENTRES (SEC)

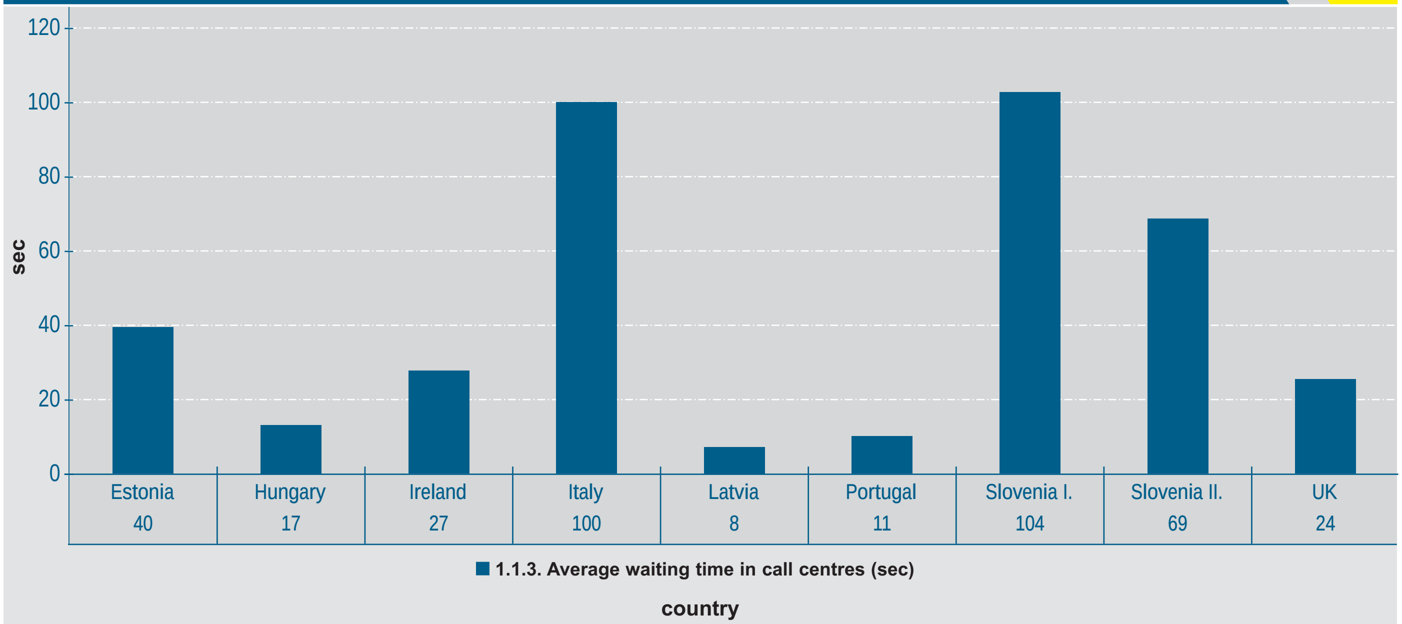
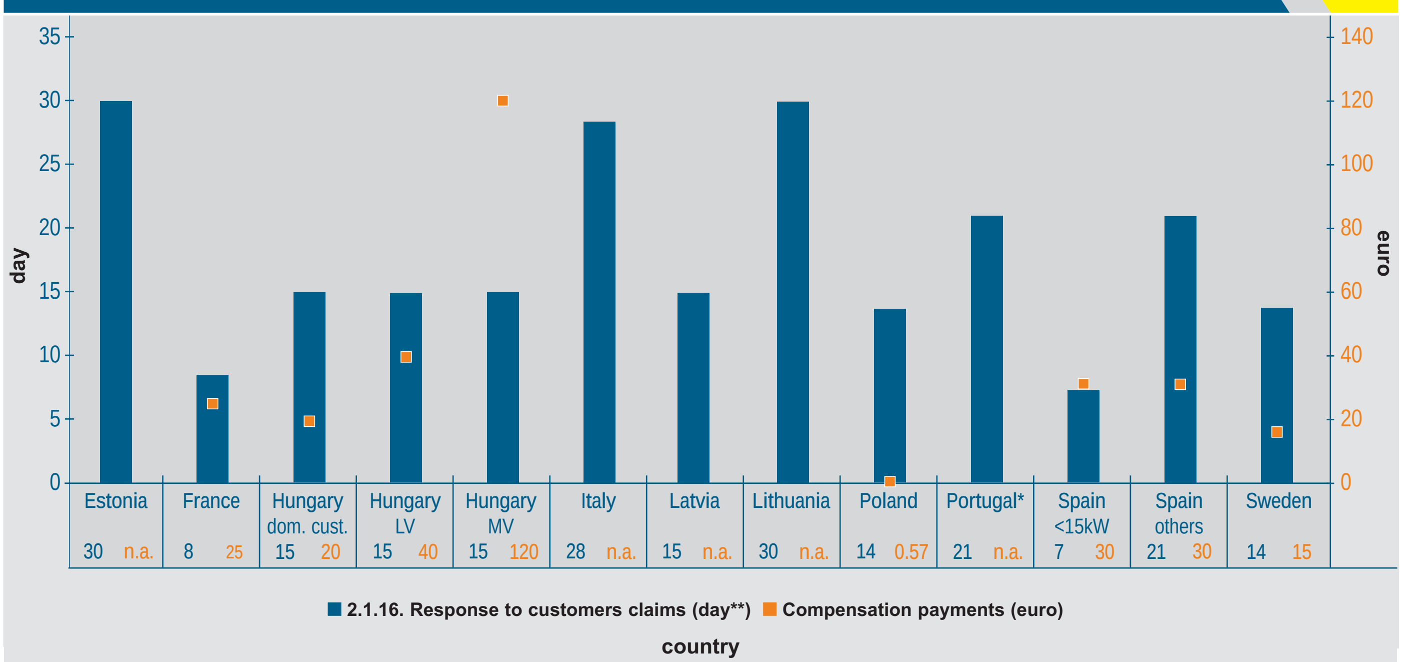


TABLE 3.31 RESPONSE TO CUSTOMERS CLAIMS (DAY)



* 95% of cases

** Calculated where figures were supplied in working days

TABLE 3.32 NUMBER OF COMPLAINTS PER 100 CUSTOMERS

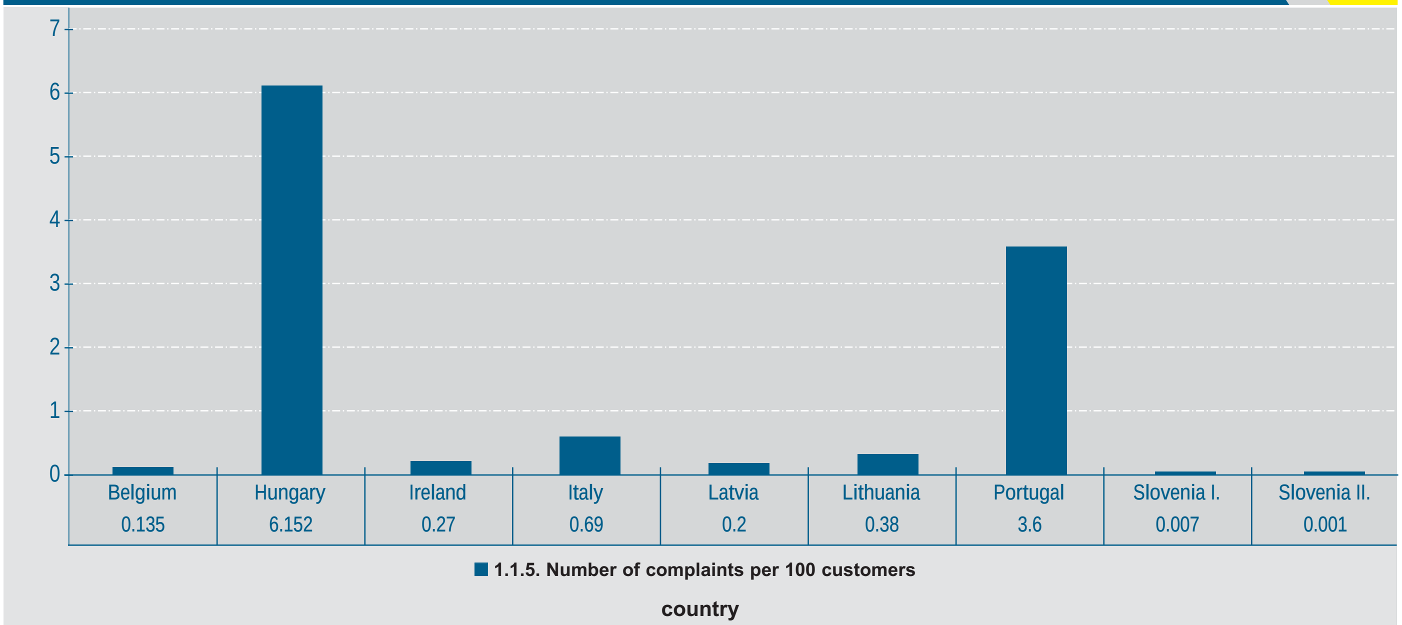


TABLE 3.33 AVERAGE RESPONSE TIME TO CUSTOMER'S COMPLAINTS (DAY)

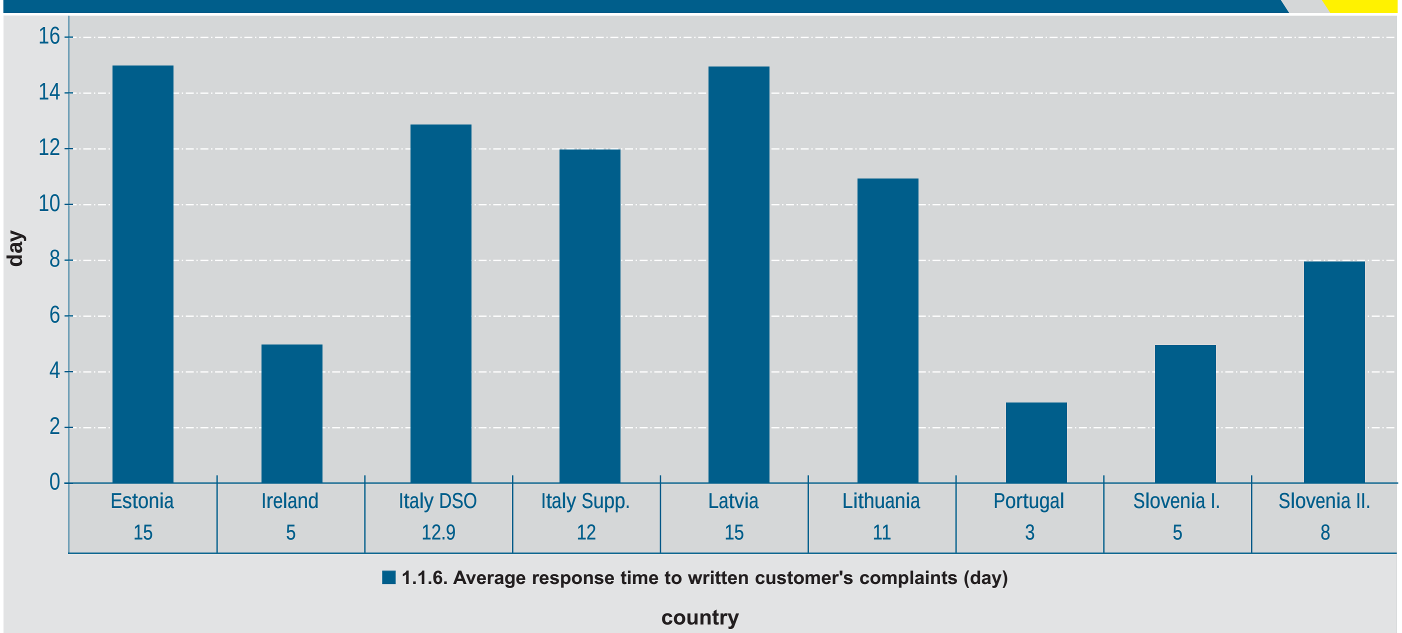
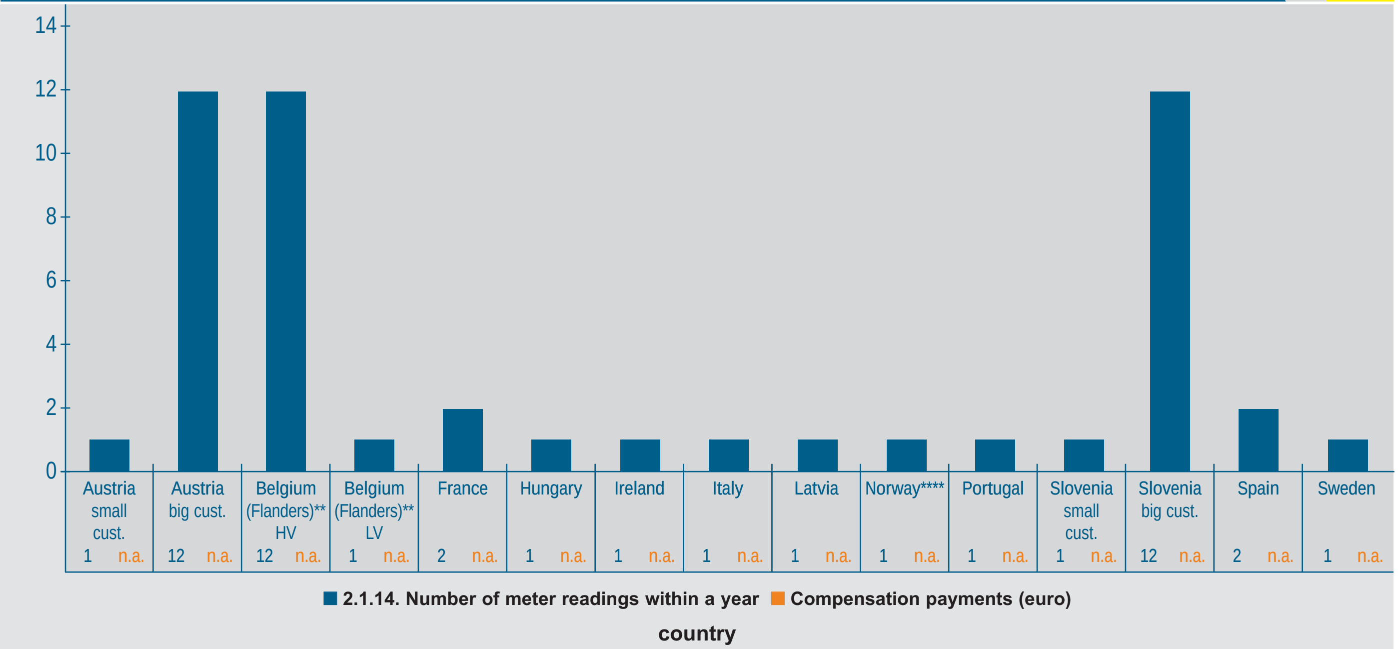


TABLE 3.35 NUMBER OF METER READINGS WITHIN A YEAR



Austria big cust.* >50 kW and >100.000 kWh
Belgium (Flanders)** connection >100 kVA continuously (every 15 minutes)
Belgium (Flanders)*** physically by DSO in every two years
Norway****: 4, 6 or 12 times if >8000 kWh, hourly if >100000 kWh

TABLE 3.36 AVERAGE ANNUAL METER READINGS PER CUSTOMER FOR LV
(carried out by the network operator)

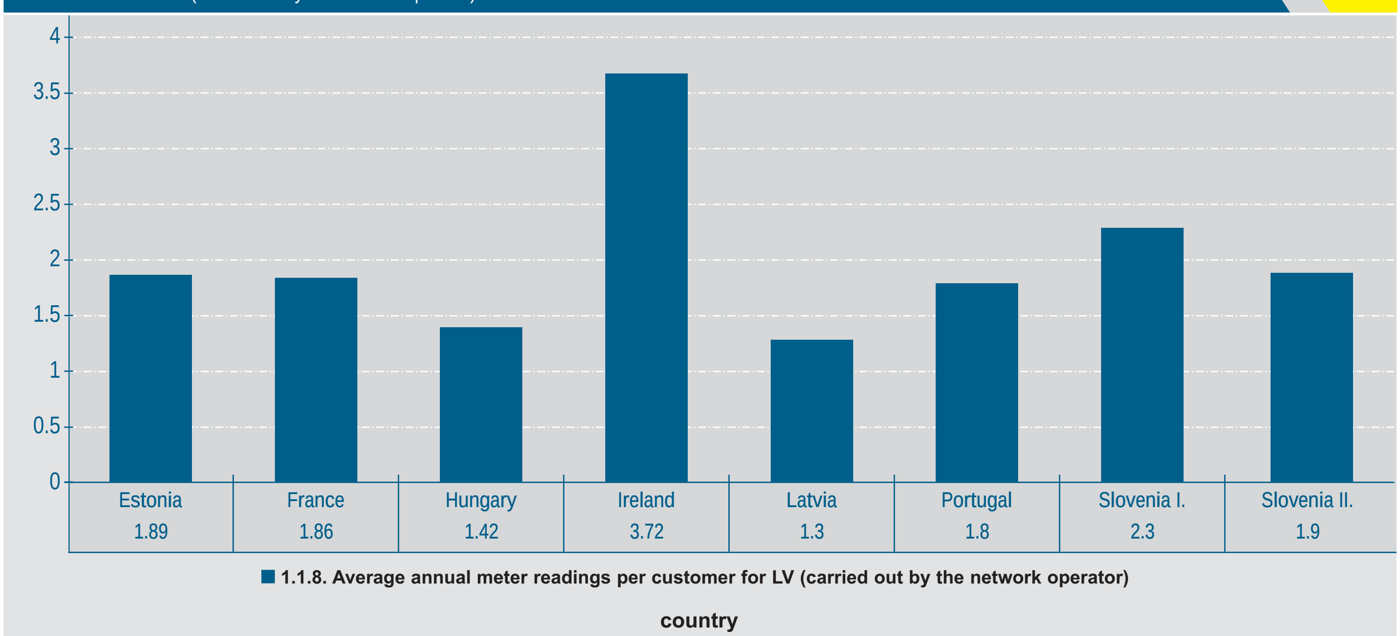


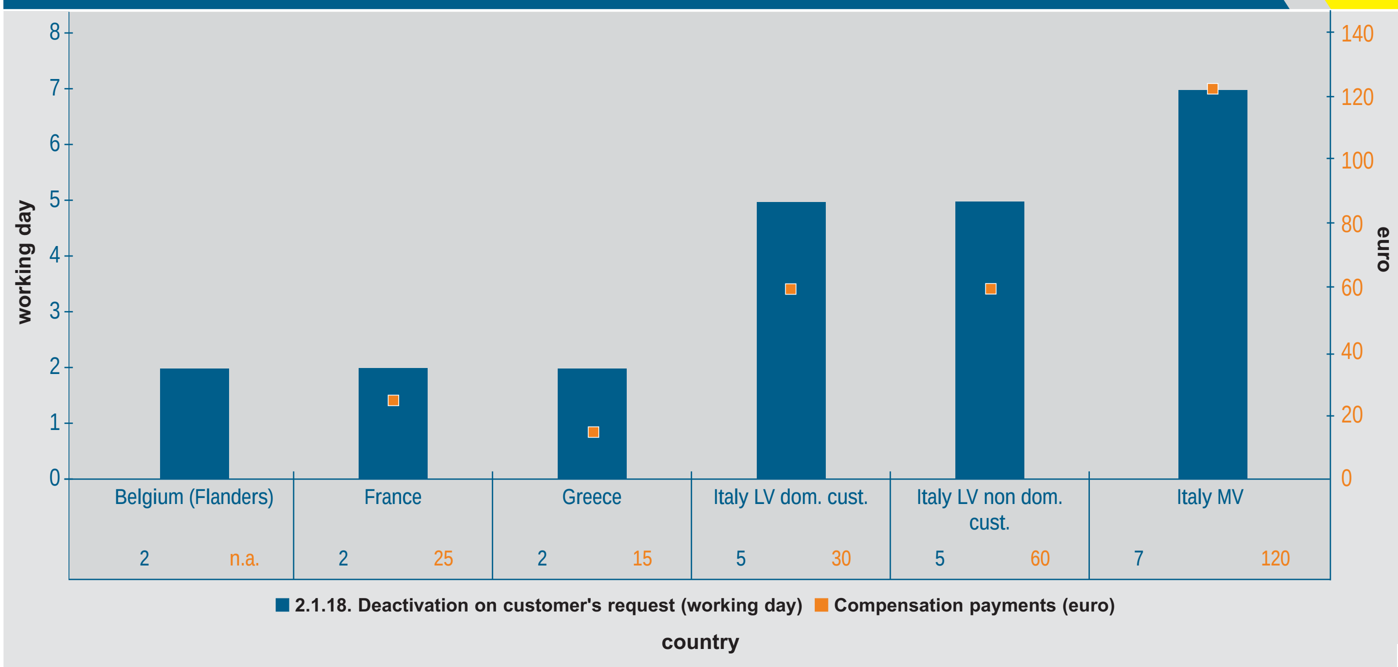
TABLE 3.38 PREPAYMENT METER FAULT (WORKING DAY)

Country	2.1.11. Prepayment meter fault (working day)	Compensation payments (euro)
Belgium (Flanders)	7	n.a.
Spain <15kW	5	30
Spain others	15	30
UK on workday	0,375	30
UK on other day	0,5	30

TABLE 3.39 VISITS TO CUSTOMERS WHO REQUIRED A METER MOVE (DAY)

Country	2.1.13. Visits to customers who required a meter move (working day)	Compensation payments (euro)
Belgium (Falnders)	15	n.a.
Estonia	7	n.a.
Italy	15	30-60

TABLE 3.40 DEACTIVATION OC CUSTOMER'S REQUEST (WORKING DAY)



Ireland: n.a./n.a.

TABLE 3.41 NUMBER OF VISITS PER 100 CUSTOMERS IN CUSTOMERS CENTRES

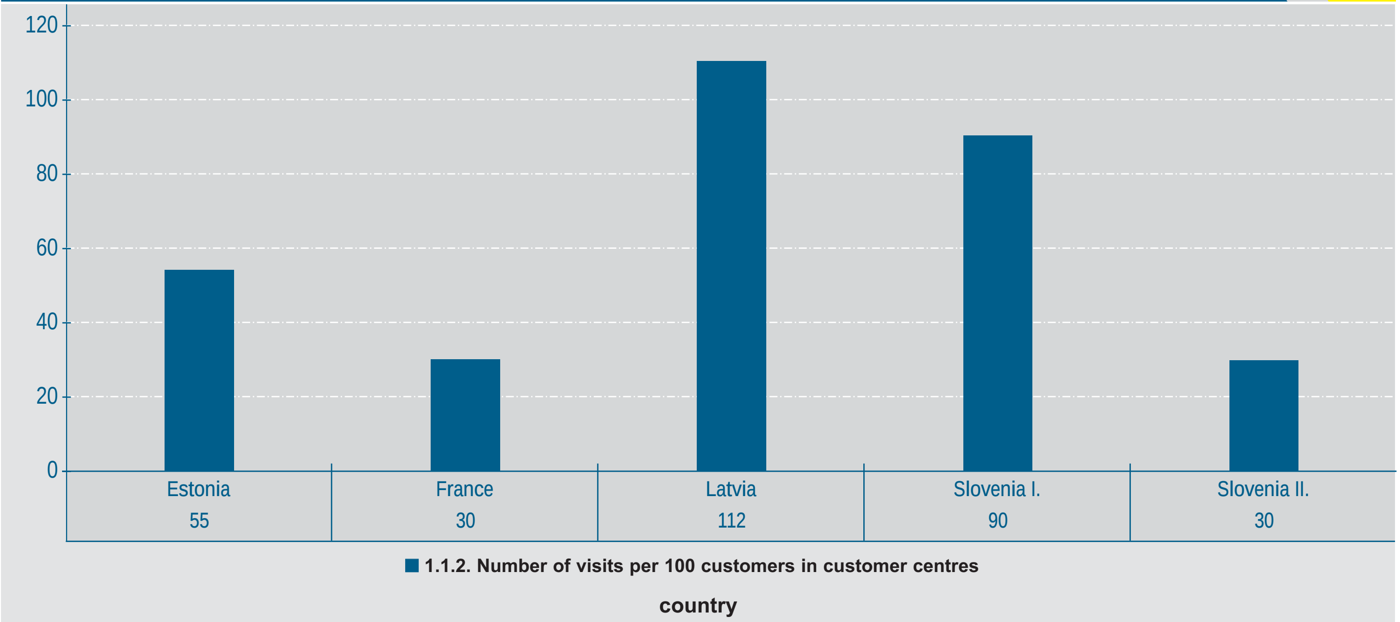


TABLE 3.42 NUMBER OF CALLS PER 100 CUSTOMERS IN CALL CENTRES

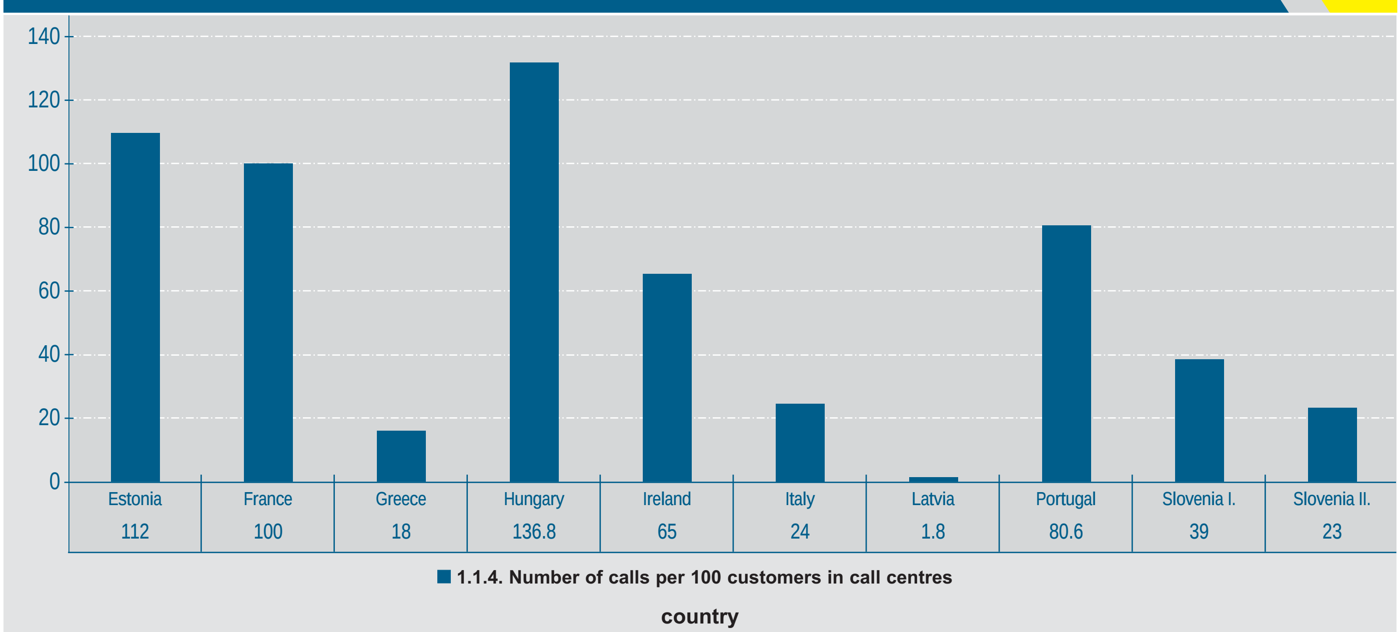


TABLE 3.43 NUMBER OF REVISED BILLS PER 100 CUSTOMERS

Country	1.1.11. Number of revised bills per 100 customers
Estonia	0,49
France	0,8
Italy	0,1
Portugal	5,2
Slovenia I.	1,2
Slovenia II.	0,01

TABLE 3.44 NUMBER OF BILLING COMPLAINTS PER 100 CUSTOMERS

Country	1.1.17. Number of billing complaints per 100 customers
Estonia	0,16
Greece	0,00428
Hungary	3,6
Ireland	0,05
Italy	0,12
Portugal	2,8

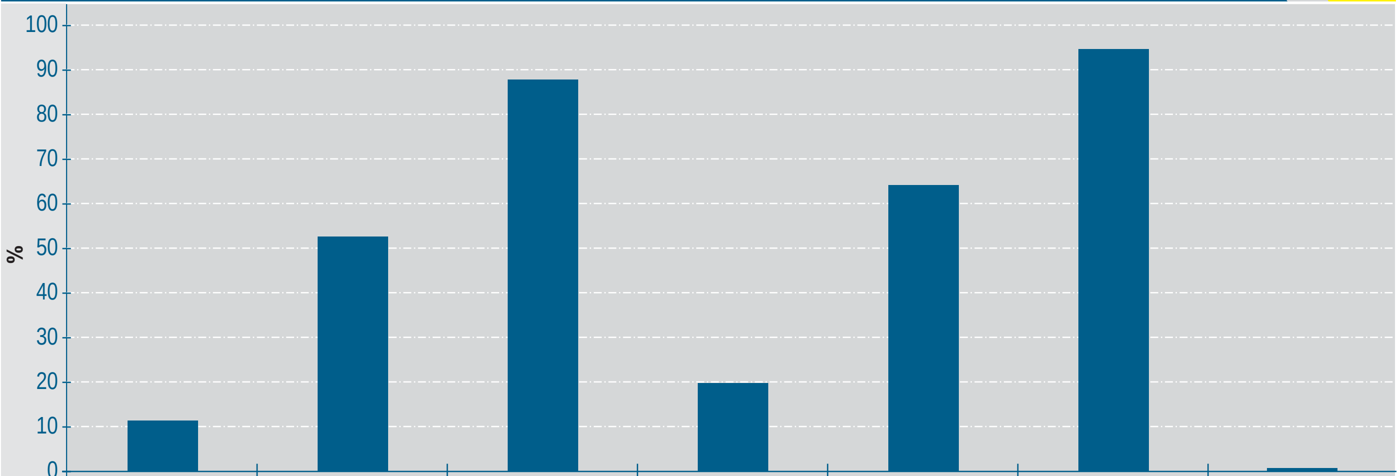
TABLE 3.45 ACCURACY OF BILLS MADE ON ESTIMATIONS (MONTHS)

Country	2.1.22. Accuracy of bills made on estimations (month)	Compensation payments (euro)
Spain	6	n.a.

TABLE 3.46 AVERAGE ANNUAL SELF METER READINGS PER CUSTOMER FOR LV (CARRIED OUT BY THE CUSTOMER)

Country	1.1.9. Average annual self meter readings per customer for LV (carried out by the customer)
France	0,03
Latvia	8,7
Portugal	0,8
Slovenia I.	0,16
Slovenia II.	0,1

TABLE 3.47 PERCENTAGE OF ESTIMATED BILLS (%)



Estonia	France	Hungary	Ireland	Portugal	Slovenia I.	Slovenia II.
12.3	53.4	88.1	20	64.5	94	0.58

ANNEX 4.1 Voltage quality standards different from EN 50160 applied in various European countries

Country	Fluctuations of voltage magnitude	Rapid voltage changes and flicker	Voltage dips	Temporary or transient overvoltages	Voltage unbalance	Harmonic distortion of the voltage waveform	Interharmonic voltages	Mains signalling voltage	Cd components
France[19]	LV: +6/-10 % (decree) MV: U_c=±5 % U_n, U_f=±5 % U_c T: 63, 90 kV: U_c=U_n±6 % U_f=U_c±8 % 150 kV: U_c=U_n±7 % U_f=U_c±10 % 225 kV: U_c=200/245 kV U_f=200/245 kV 400 kV: U_c=380/420 kV U_f=380/430 kV	EN50160	Only voltage dips deeper than 30% and longer than 600 ms are taken into account MV: customized contractual levels depending on the local conditions on the site (cannot be less than 5 vd/y) T: customized contractual levels (5vd/y	LV, MV, T: $P_{lt} \leq 1$ (long term flicker)	LV, MV, T: $t_{vm} \leq 2$ % (average value of unbalance)	MV: Rates of harmonic voltages t_h in % of U_f and THD do not rise above the thresholds of *table 1* T: Rates of harmonic voltages *table 1*	LV, MV, T: none	LV, MV, T: none	LV, MV, T: none
Great Britain[20]	+10% and -6%	EN50160	EN50160	EN50160	EN50160	EN50160	EN50160	EN50160	EN50160
Hungary	±7.5 %, max 115 % for 1 minute.	EN50160	EN50160	EN50160	EN50160	EN50160	EN50160	EN50160	EN50160
Norway	RMS value in the range ±10% of U_n. (mean value over 1 min, in connection points in LV net)	Limits to the number of rapid voltage changes *table 2* and limit to flicker severity on both Pst and Plt *table 3*	The Norwegian Water Resources and Energy Directorate may order to reduce voltage dips	NVE may order to reduce temporary or transient overvoltages	2 % in points connection at all voltage levels, measured as a mean value over ten minutes	Limits for individual harmonics and THD; use of mean values over ten minutes, in connection points; *table 4*	The Norwegian Water Resources and Energy Directorate may stipulate limit values	The Norwegian Water Resources and Energy Directorate may stipulate limit values	No limit are set at present
Portugal	EN50160 (LV and MV). VHV, HV: Quality of service Code: U_c=U_n ±7%U_n U_f = U_c ±5%U_c [21]	Flicker severity: - EN50160 for MV and LV. - Pst<1 for EHV and HV:	Na (monitoring obliged in every voltage level)	EN50160	EN50160 to all voltage levels included HV and EHV	EN50160 for LV and MV. For VHV and HV, *table 5*	na	na	na
Spain	Max variation limits in the supply voltage to final customers shall be +/-7% of the declared supply voltage	EN50160	EN50160	EN50160	EN50160	EN50160	EN50160	EN50160	EN50160

[19] U_c: contractual voltage; Un: nominal voltage; Uf: supply voltage

[20] EN 50160 and EN 61000 generally cover voltage quality standards. Specifically they are implemented by Engineering Recommendations prepared by the network companies:
- ER P28 - planning limits for voltage fluctuations caused by industrial, commercial and domestic equipment in the United Kingdom (e.g. flicker)
- ER P29 - Planning limits for voltage imbalance in the United Kingdom
- ER G5/4 - Harmonics limits and regulations (BS EN 61000-4-7)

[21] Uc: contractual voltage; Un: nominal voltage; Uf: supply voltage
Under normal operating conditions, during each period of one week, 95% of the 10 min mean rms values of the supply voltage shall be within this range.

TABLE 1: FRANCE: Rates of harmonic voltages

MV NETWORKS					
Odd harmonics				Even harmonics	
Not multiples of 3		Multiples of 3			
Rank	Thresholds (%)	Rank	Thresholds (%)	Rank	Thresholds (%)
5	6	3	5	2	2
7	5	9	1,5	4	1
11	3,5	15 and 21	0,5	6 to 24	0,5
13	3				
17	2				
19, 23, 25	1,5				
THD ≤ 8%					

HV NETWORKS					
Odd harmonics				Even harmonics	
Not multiples of 3		Multiples of 3			
Rank	Thresholds (%)	Rank	Thresholds (%)	Rank	Thresholds (%)
5 and 7	2	3	2	2	1,5
11 and 13	1,5	9	1	4	1
17 and 19	1	15 and 21	0,5	6 to 24	0,5
23 and 25	0,7				
THD ≤ 3%					

TABLE 2: NORWAY: Flicker severity limits: network companies shall ensure that flicker severity does not exceed the following values in points of connection with the respective nominal voltage value, for the respective time intervals:

Flicker severity index	$0{,}23 \leq U_N \leq 35$ kV	35 kV < UN	Time interval
Short-term flicker severity, P_{st} [pu]	1,2	1,0	95% of the week
Long-term flicker severity, P_{lt} [pu]	1,0	0,8	100% of the time

TABLE 3: NORWAY: rapid voltage changes: network companies shall ensure that rapid voltage changes do not exceed the following values in points of connection with the respective nominal voltage value, for the respective frequency:

Frequency of rapid voltage changes	Rapid voltage changes [%]	
	$0{,}23 \leq U_N \leq 35$ kV	1 kV < U_N
1 change per 24hour period	10	6
Up to 24 changes per 24 hour period	5	4
More than 24 changes per 24 hour period	3	3

TABLE 4: NORWAY: Rates of individual harmonic voltages (for both individual har monics and THD, the mean value over ten minutes has to be used in order to verify the respect of limits)

NOMINAL VOLTAGE FROM AND INCLUDING 230 V UP TO AND INCLUDING 35 KV

Odd harmonics				Even harmonics	
Not multiples of 3		Multiples of 3			
Order h	U_h	Order h	U_h	Order h	U_h
5	6.0 %	3	5.0 %	2	2.0 %
7	5.0 %	9	1.5 %	4	1.0 %
11	3.5 %	> 9	0.5 %	> 4	0.5 %
13	3.0 %				
17	2.0 %				
19, 23, 25	1.5 %				
> 25	1.0 %				
THD ≤ 8% over ten minutes; **THD** ≤ 5% over one week					

NOMINAL VOLTAGE FROM 35 KV UP TO AND INCLUDING 245 KV

Odd harmonics				Even harmonics	
Not multiples of 3		Multiples of 3			
Order h	U_h	Order h	U_h	Order h	U_h
5	3.0 %	3	3.0 %	2	1.5 %
7, 11	2.5 %	9	1.5 %	4	1.0 %
13, 17	2.0 %	15, 21	0.5 %	6	0.5 %
19, 23	1.5 %	> 21	0.3 %	> 6	0.3 %
25	1.0 %				
> 25	0.5 %				
THD ≤ 3 % over ten minutes					

NOMINAL VOLTAGE ABOVE 245 KV

Odd harmonics				Even harmonics	
Not multiples of 3		Multiples of 3			
Order h	U_h	Order h	U_h	Order h	U_h
5, 7	2.0 %	3	2.0 %	2	1.0 %
11, 13, 17, 19	1.5 %	9	1.0 %	4, 6	0.5 %
23, 25	1.0 %	15, 21	0.5 %	> 6	0.3 %
> 25	0.5 %	> 21	0.3 %		
THD ≤ 3 % over ten minutes					

TABLE 5: PORTUGAL: for EHV and HV, under normal conditions, during each period of one week, 95% of the 10 min mean rms values of each individual harmonic voltage shall be less than or equal to the following values:

EHV AND HV NETWORKS								
Odd harmonics						Even harmonics		
Not multiples of 3			Multiples of 3					
h	Uh (%)		h	Uh (%)		h	Uh (%)	
	HV	HV		HV	HV		HV	HV
5	4,5	3,0	3	3,0	2,0	2	1,6	1,5
7	3,0	2,0	9	1,1	1,0	4	1,0	1,0
11	2,5	1,5	15	0,3	0,3	6	0,5	0,5
13	2,0	1,5	21	0,2	0,2	8	0,4	0,4
17	1,3	1,0	>21	0,2	0,2	10	0,4	0,4
19	1,1	1,0				12	0,2	0,2
23	1,0	0,7				>12	0,2	0,2
25	1,0	0,7						
>25	0,2+12,5/h	0,2+25/h						
$THD_{HV} \leq 8\%$; $THD_{EHV} \leq 4\%$								

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