UNION OF THE ELECTRICITY INDUSTRY
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EURELECTRIC response to the ERGEG Consultation Paper on Voltage Quality Regulation

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INTRODUCTION

EURELECTRIC recognises the vital importance of service quality and in particular power quality for its customers. Voltage quality is one important aspect in this. For many years experts from EURELECTRIC member organisations have participated with equipment manufactures and other parties in the development of international standards. Customers have benefited from this harmonisation process through lower equipment costs. EURELECTRIC recognises the need for continuous improvement and the specific role that regulators have in representing the interests of customers, while ensuring the financial sustainability of network operators.

EURELECTRIC believes that European regulators were correct in deciding to address concerns relating to power quality through dialogue with CENELEC. It is highly desirable that the maximum feasible level of harmonisation is achieved and this is more likely to be achieved through working with CENELEC. EURELECTRIC is pleased to note that a process has been initiated by CENELEC TC8X in which CEER/ERGEG are actively participating.

EURELECTRIC acknowledges the efforts that CEER/ERGEG have already made in opening questions on EN 50160. The consultation document "Towards Voltage Quality Regulation in Europe – An ERGEG Consultation Paper" has many interesting observations and suggestions for improvements which will prove helpful in the process initiated by CENELEC. Replies by stakeholders will further contribute to the process.

EURELECTRIC strongly agrees that great care is required in making changes to EN 50160, and that there is a need to find the right balance between technical requirements and costs. EURELECTRIC also agrees that is it is insufficient to look at network design and operations only. Equipment manufactures and customers have a role in the drive towards cost effective improvement in the functioning of electrical equipment.

Ultimately the industry can support changes to EN 50160, if the resulting costs are demonstrated to be justified and on the understanding that regulators will allow efficient costs of implementation to be recovered by network operators. Additional operating costs could arise if stricter maintenance and monitoring regimes are necessary. Capital costs will arise due to additional reinforcement requirements if limits are changed. It is important to be mindful that reinforcements will take time to implement.

SOME FURTHER CONSIDERATIONS ON POWER QUALITY

<u>The grid as a "mediator"</u>

Two basic types of customers can be identified in electrical grids. The first type is characterised by a need of a non-sinusoidal electrical current which at the end reduces voltage quality in the electrical grid. Degeneration of voltage quality always leads to a deviation from the sinusoidal shape of voltage.

The second type of consumers is characterized by the demand of a sinusoidal shape of voltage in order to guarantee an undisturbed functioning of the process. It is up to the electrical grid to balance between those two contradicting requirements. Therefore three standards have to be defined:

- maximum emission of voltage deformation by type 1 consumers
- voltage quality in networks
- maximum acceptable voltage deformation for type 2 consumers

Limits of network-based voltage quality

Electrical networks cannot provide a perfect voltage quality, as failures and outages always occur. Electrical networks have automated protection schemes, with reaction times in the range of some hundreds of milliseconds. Therefore voltage deformation in this time period is an inherent characteristic in electrical grids. Here either the consumer has to be robust enough or customer-specific decentralised power quality tools have to be used.

Cost for network-based voltage quality

In many cases the network assets are dimensioned not according to the load that has to be distributed, but according to the voltage quality that has to be achieved. Having enough installed capacity in order to supply the electricity is one criteria, and having enough installed capacity in order to stabilise voltage is a second one. The more capacity is installed in order to guarantee voltage quality at a given value for distributed energy, the higher are the specific cost for distributed energy, i.e. the network tariffs.

COST-BENEFIT CONSIDERATIONS

The EN 50160 standard characterises the product “electricity”, representing the state of the art agreed by parties concerned, and its main purpose is to explain the range of characteristics of real networks across Europe. It must be recognised that in some countries there is significant expenditure already required to improve voltage quality to conform to the existing EN 50160 standard. Tightening of the standard risks increasing the level of expenditure required.

In general, the ERGEG paper suggests that limits in EN 50160 could be tightened and indeed have already been tightened in some countries. However there is a need to bear in mind the existing capability of electrical equipment and in particular the immunity of equipment to perturbations as set out in the relevant EMC standards. It is also important to bear in mind that there are ideas on new ways of utilising the electric network and in particular distributed generation which need to be taken into account. Tighter limits are only desirable if they yield a real benefit to customers. The fundamental keystone to any justification for changing existing power quality standards is that the customer must be shown to benefit from the changes introduced.

While there is some information on costs of perturbations in power quality in the consultation document, the costs of providing a more stable supply are in general not presented. EURELECTRIC recognises that the consultation paper is seeking information on both costs and benefits. EURELECTRIC believes that CENELEC should undertake a rigorous cost-benefit analysis of any change before proposing amendments to the standard.

It is not clear where the balance lies between specifying a uniformly higher power quality, much higher than many appliances or customers require, and the particular needs of specific appliances or applications. It appears unfair that the general user should bear the costs of supporting specific users, for which other options exist in terms of mitigation or re-design of specific appliances.

The network design, especially the low voltage network design, is based on stochastic concepts related to the behaviour of loads. Any low voltage customer is allowed to switch on each equipment at any time he wants.

There is a need for care in specifying a requirement for general, permanent, and exhaustive quality monitoring. Any requirement for extensive monitoring of power/voltage quality would trigger the need for investment into sophisticated measurement systems and for their continuous maintenance.

KEY QUESTIONS TO CONSIDER

Is there a worthwhile benefit from the change? Good Europe-wide experience exists over several decades of the existing power quality situation. It must be noted that CENELEC member countries continue to show satisfaction with the current EN 50160 standard, which the third revision voting result shows. Tighter standards could also result in an increase in the cost of the appliances. One way in which to provide confirmation would be to measure the number of complaints in areas where disturbance recorders are present, so that the relationship between disturbances and the impact on the customer could be assessed.

Who pays for the change? - Are those who pay for the change the same users who benefit? Networks generally serve customers indiscriminately: it is very difficult to provide one customer with a higher level of service than another when they are served by the same network. It is not possible to distinguish between customer groups on a detailed basis. It can therefore be expected that the costs resulting from quality improvements will be directly allocated to consumption, and that normal domestic customers will effectively cross-subsidise wealthier customers.

How long would the changes take to introduce? Adapting networks to adhere to a new voltage quality standard would involve a combination of extra measures (e.g. replacement of overhead lines by covered conductors) or the use of more expensive network configurations e.g. split networks. It would be expected that changes to meet new requirements would take a considerable time (several decades).

Could the benefits from improved voltage quality be provided directly by those customers who would benefit from tighter voltage control? As only a small proportion of customer equipment might be affected, it would be expected that mitigation measures on the equipment itself would in many cases be more cost-effective.

MEASUREMENT CONSIDERATIONS

Power Quality indices are useful for specific users in determining where to connect to a network or not, but they have little utility once the customer gets connected. The general user will see no benefit and a large commitment to monitoring equipment would be required by the distribution network operator. There would be additional costs involved due to additional continuous monitoring and evaluation of power quality.

Power quality monitoring is a long-term activity if we want to be sure of the results. It will not be practically feasible to perform measurements at the point-of-connection for all individual customers. It is also important to consider that almost all domestic customers and most commercial customers are not adversely affected by existing voltage disturbances.

SPECIFIC RECOMMENDATIONS IN CHAPTER 4 OF ERGEG PAPER

4.1 Improve definitions and measurement rules.

We agree in principle with the need of improvement, but it should be done after extensive discussion, step-by-step, preferably under EN 50160, ensuring participation of all involved parties (regulators, standardization organisations, distribution network operators etc.).

With respect to short and long interruptions, we do not recommend harmonisation of operational rules for calculating main continuity indices for both short and long interruptions. These are two different concepts: one is of continuity (interruptions higher than 3 min) requiring manual recovery in order to repair (permanent) faults; the other is of voltage quality, i.e. short interruptions that are automatically recovered due to transient or semi-permanent faults.

We have to clearly distinguish between continuity and power quality. We do not see the need to change the definition of short interruptions.

4.2 Limits for voltage variations - avoid “95%-of-time” clause and avoid long time intervals for averaging measured values.

Network design, especially for low-voltage networks, is based on stochastic concepts related to the behaviour of loads. Any low voltage customer is allowed to switch on any combination of equipment at any time they want. A probability of less than 100% is necessary, especially in low voltage networks. Otherwise the network must be designed to meet conditions which would only arise very occasionally. This would not be cost-effective and would not be in the overall best interests of customers. 95% seems to be a reasonable basis against which the standard of the supply can be evaluated.

The 95%-rule is the present basis for measurement and setting of limits for supply voltage, flicker and harmonics. Any adjustment in these values would require amendments to planning, statutory and EMC standard limits - there would be higher maximum and lower minimum measurements that wouldn't work with the present planning and EMC limits.

The average of 10 minutes is needed with respect to the realised technical system. Use of an average of less than 10 minutes without having considered the time required for tap changers to operate is unwise. Changing for short load changes cannot be realised in periods of 1 minute.

Moving from 10 to a 1-minute average would have significant impacts:

a) Customer loads would now need to be defined on a 1-minute basis also; e.g. almost any vacuum cleaner will fail;
b) In order to avoid breaching the 1 minute limit, the design of the network and operating criteria (e.g. limits on customers) would have to be designed for wider excursions – this would add significantly to cost.

4.3 Enlarge the scope of EN 50160 to high and extra-high voltage systems.

The EN 50160 philosophy cannot be directly copied to extra-high voltage, due to significant technical differences. We do agree however to introduce HV specifications. For high-voltage grids, there is a chance to develop an additional chapter within EN 50160.

4.4 Avoid ambiguous indicative values for voltage events.

Some of the mentioned phenomena are partly out of the network operators' control, so that only indicative values are possible. Today there are no bigger problems with the description within EN 50160. Nevertheless we see a certain chance to have more concrete values for voltage events, step by step.

4.5 Consider duties and rights of all parties involved.

Power quality seen from the customer's viewpoint depends on: a) interruptions, short circuit power and network capacity; b) the sum and the behaviour of equipment in all the customers' installations; c) situations of *force majeure*.

In consequence, the distribution system operator can only be responsible for that part of power quality that is under his control.

4.6 Introduce limits for voltage events according to network characteristics.

For events, limits are difficult as they are rather unpredictable and mainly out of DSOs' control. Nevertheless, we see a necessity to describe events whilst having in mind the different regional characteristics of the structure of supply and the existing networks.

4.7 Develop the concept of power quality contracts.

Additional higher power quality can also be negotiated, resulting in individual contracts responding to the specific network situation and the specific customer's needs. Several technical solutions are available, with expenses for the specific power quality requirements borne by the customer.

In some countries there are several contract models depending on the customer requirements and network limits. The customer could apply for the basic contract, or for further requirements with extra payment.

ISSUES FOR CONSULTATION IN CHAPTER 7 OF THE ERGEG PAPER

Specific questions on the recommendations to CENELEC for revising EN 50160

What is an appropriate responsibility-sharing curve between equipment and grid in the voltage-duration plan (both for voltage dips and swells)?

A reasonable balance must be achieved, but furthermore it is questionable if the term "responsibility" can be implemented in a standard, particularly in the case of EN 50160.

What is an appropriate way of protecting equipment against damage or failure due to short-duration over-voltages (voltage swells): limits for voltage swells (as events) or a shorter time interval (than the today's 10-min in EN 50160) for averaging continuously measured values (related to supply voltage variations)?

We feel this is an issue essentially for equipment manufacturers (EMC immunity).

How to consider random year-by-year variations in setting limits especially for voltage dips and other events correlated to weather influence?

By their very nature voltage dips are random. It is not viable to define Europe-wide limits on number of events. The random year-to-year variations in number of voltage dips should further be considered when setting limits on number of voltage dips.

Questions on the future of voltage regulation

Which are pros and cons of introducing national VQ limits and requirements by the national regulators? Do you believe that a "two level" option (definitions and measurement rules set homogeneously at EU level; limits set country by country by relevant authorities) can be a more effective way for improving or at least not deteriorating voltage quality?

National diversification of power quality standards would be contrary to any harmonisation efforts by the EU and the manufacturing industry. Having an EU-level standard and then various national standards in each country would be counter-productive. Equipment manufacturers will not be able to manufacture a 'one size fits all' product, and will therefore gain no benefit.

OTHER STATEMENTS AND COMMENTS

Some CIGRE WGs are also dealing with the issue of power quality regulation, but they are still perhaps two to three years away from any final conclusions and recommendations.

Furthermore, the impact of more stringent standards could be severe for some renewable power generation, as renewable production has a significant impact on both steady-state voltage and harmonics. This could mean that the introduction of photovoltaics (for example) would be seriously delayed.

CONCLUSION

A good start has been made by the European Regulators in the approach taken by addressing power quality through working with CENELEC and in seeking further information from interested parties at an early stage in the process.

EURELECTRIC's main concern is that CENELEC should undertake very careful cost-benefit analysis before proposing changes to EN 50160. If it is ultimately decided that changes are appropriate, then it is important that regulators give due considerations to the costs implications for electricity network operators.