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LTNPQS NEWSLETTER

Issue 2 March 2010

LTNPQS Reports Issued

The 2007/2008 and 2008/2009 individual participant LTNPQS reports were issued to most participants in late 2009 and early 2010 with the remaining reports to follow soon. Data for the 2008/2009 reports was supplied by 10 participants monitored at some 500 plus sites.

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The reports issued follow the new report format and contain only participant data. Power Quality Australia made a presentation to the ENA of 2007/2008 and 2008/2009 national results at the March ENA meeting. National reports and utility comparisons will be issued to participants in the near future. Arrangements will also be made for presentation of results to participants at this time.

PQA Goes Global

Power Quality Australia will present results of a first foray in the United States during a video conference with a west coast DNSP scheduled for April 2010. Expansion into international markets presents a number of exciting opportunities and challenges. PQA is committed to growing the LTNPQS project in order to gain a better understanding of power quality performance not just in Australia but around the world. In the future opportunities may exist to compare PQ performance not only across Australia but across multiple countries. This has immediate benefits related to the way in which power quality standards are developed and applied in this country.

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PQA Staff Secure Funding to Develop 230 V ITIC (CBEMA) Curve

Power Quality Australia staff were recently successful in a grant application to the ASTP (Australia Strategic Technology Program) to begin preliminary development of a CBEMA curve based on the performance of 230V equipment used in Australia.

The ITIC, formerly CBEMA, curve was developed by the Information Technology Industry Council of the United Sates of America. The curve describes an AC input voltage envelope which typically can be tolerated by most Information Technology (IT) Equipment.

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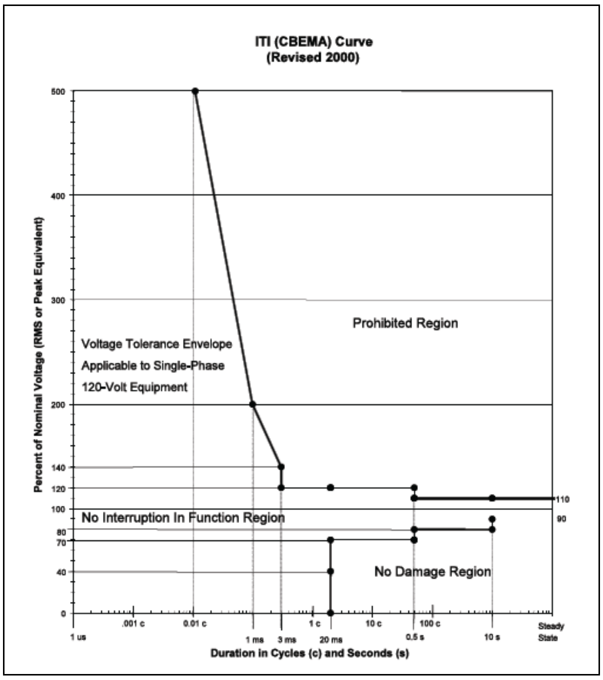

ITIC (CBEMA Curve)

Although the curve ostensibly applies only to IT equipment it is often used throughout the industry to provide an indication of the input voltage tolerance of a wide range of equipment not limited to IT equipment. It is specifically noted that the curve is applicable to 120V 60Hz nominal voltages. However, the curve is widely used in Australia which has a 230V 50Hz nominal voltage system.

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The purpose of the study is to begin development of an ITIC or CBEMA type curve(s) applicable to the Australian 230V 50Hz system. In the first instance, the curve(s) will be developed to describe AC input voltage tolerances for a range of the most common domestic and industrial equipment not limited to IT equipment. If this initial project is successful, a larger range of equipment may be analysed in future projects.

Allocation of Harmonic Planning Levels – The Harmonic Droop Approach

One of our biggest challenges at the University of Wollongong and PQA is to develop new processes to simplify the management of harmonics in our power systems for both electricity distributors and customers. AS/NZS 61000.3.6 "Limits – Assessment of Emission Limits for Distorting Loads in MV and HV Power Systems" is a rather complex and difficult standard to apply. Prof. Vic Gosbell has simplified 61000.3.6 for radial distribution networks by producing handbook HB264 which is in use by most electricity distributors in Australia.

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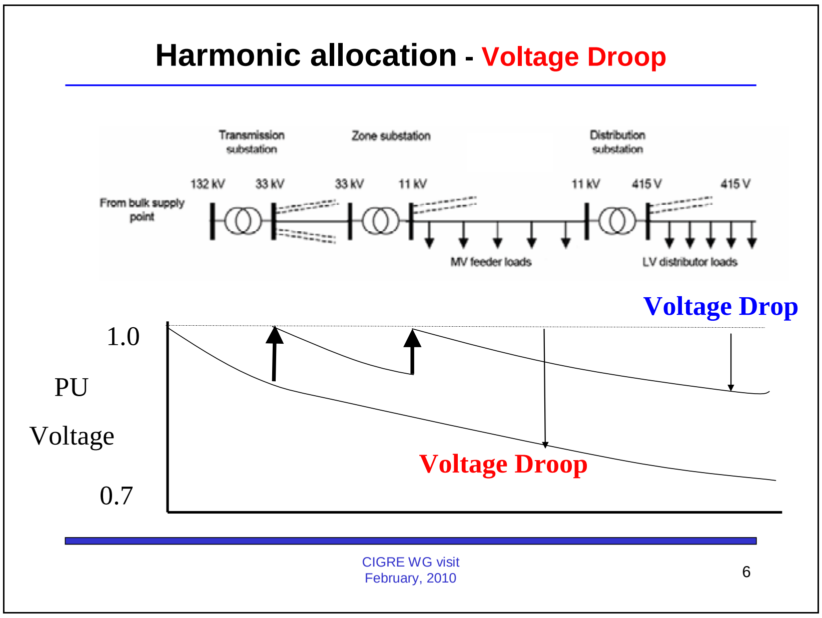
In an effort to further simplify the harmonics allocation process, Dr Robert Barr, Prof. Vic Gosbell and the PQA team have undertaken more research work. The new approach uses what we term "voltage droop". The voltage droop concept is illustrated below in graphical form.

All distributors are familiar with the concept of voltage drop and voltage regulation. In general terms, voltage drop needs to be restricted to no more than 6-10% between the last regulated MV busbar (11kV in the example) and the LV customers at the end of the system. This is necessary to achieve LV steady state voltage performance of 230 V +10% -2% (i.e. a 12% range). Voltage drops further up in the MV and HV systems also need to be restricted to keep within the



Voltage Droop Concept

tapping range of OLTC transformers.

Typically, voltage drop in these parts of the system need to be restricted to about 15-20% at each voltage level under (N-1) conditions and hence less under normal conditions.

So what is the relationship between voltage drop and voltage droop? Voltage droop is effectively the summation of all the individual voltage drops in the distribution network between the transmission system and a network point being considered. Total voltage droop is the sum of voltage drops between the transmission system and the end LV customer.

Why is voltage droop of interest to us when we study harmonics? Voltage droop can be readily defined mathematically and is a quantity that is naturally capped in all power systems. Growing power systems have new and increasing customer loads dispersed throughout their length. They also have continuing network additions and reinforcement to cater for the growth. The process of new loads and network augmentation is a natural process of power system development that occurs all around the world.

In mathematical terms, the process of network augmentation chasing customer load growth is simply a process of keeping voltage droop to manageable levels. When a distributor augments a transformer from 20 MVA to 40 MVA to cater for load growth, the voltage droop at the extremities of the network is being reduced.

When voltage droop is very large, it is indicative of the network lacking capacity to supply the load. If voltage droop is very small, it is indicative of the network having excess capacity. Our experience is that voltage droop levels of 30% are indicative of a network where the loads are generally in balance with the network capacity.

How can voltage droop assist with harmonic allocation? Voltage Droop is a fundamental frequency measure (50/60Hz) characteristic that can be assessed at any part of the network. Voltage droop is in fact a scarce resource that needs to be allocated carefully and sparingly to customers. Under our methodology, the contribution of a load to voltage droop is used to make an assessment of the customer’s use of the available network capacity and its harmonic allocation.

Assessing a customer's contribution to voltage droop is quite simple. The voltage droop contribution of a load to the network can be assessed by simply dividing the MVA load by the Fault Level at the point of common coupling. It is this simplicity that makes the proposed methodology attractive.

In many respects, voltage droop can be thought of as a harmonic of the fundamental frequency. The only difference between voltage droop and other harmonics is that it can be "tuned out" by a voltage regulator or OLTC transformer. Capacitor banks impact on voltage droop in similar ways to the effect of harmonic filters on harmonic voltages.

Knowing that total voltage droop from all customers is limited to about 30% on any network, we can use a customer's voltage droop contribution to make a fair allocation for maximum allowable customer harmonic currents. The natural voltage droop cap can be used to set customer harmonic current limits that will keep harmonic voltages below predetermined levels as set out in the standards.

The voltage droop concept and methodology has been the source of a number of presentations to the ENA Reliability and Power Quality working group and to a CIGRE working group. We are gaining increasing acceptance of the concept. We look forwarding to crystallising our thoughts and ideas further to simplify the harmonic allocation process and publishing our findings at the International Conference on Harmonics and Quality of Power (ICHQP) later this year in Italy.