

INTEGRAL ENERGY POWER QUALITY CENTRE NEWSLETTER

August 2000

No. 3

Funding Agreement with Integral Energy

It is now just over one year since Integral Energy committed itself to a further three years funding of the Integral Energy Power Quality Centre. The \$345,000 agreement was signed on the 28th June, 1999, by the Integral Energy Chairman at the time, Bill Hilzinger, and the University of Wollongong Vice Chancellor, Professor Gerard Sutton, in the presence of a mixed audience from industry and the University.

Professor Sutton stated that the University regarded its relationship with industry, and Integral Energy in particular, very highly and that such relationships were vital for the future health and vigor of both the University and industry. Mr Hilzinger said that Integral Energy was committed to research and training activities that led to improved system reliability and better service for customers. He emphasized the important contribution that the Power Quality Centre was making to the understanding and improvement of power quality problems.

The objectives of the Centre under the new agreement were expanded and are as follows:

- To foster and conduct R&D in power quality.
- To inform and promote to the electricity supply industry, customers and the community generally the outcomes of the R&D.
- To facilitate the commercialisation of the results of such R&D.
- To provide to the electricity supply industry, customers and the community generally training services ranging from general power quality awareness to the specialized technical requirements for engineers and technicians.
- To provide to the electricity supply industry, customers and the community generally, access to the resources of the Centre on a consultancy basis, to complement Integral's Quality of Supply Group.
- To provide informed and credible input to local and international power quality standards including standards issued by Standards Australia and the International Electrotechnical Commission.
- To provide documentation suitable for distribution to all categories of Integral Energy customers in order to keep them informed regarding power quality issues.

Voltage Sag Testing of Dairy Equipment

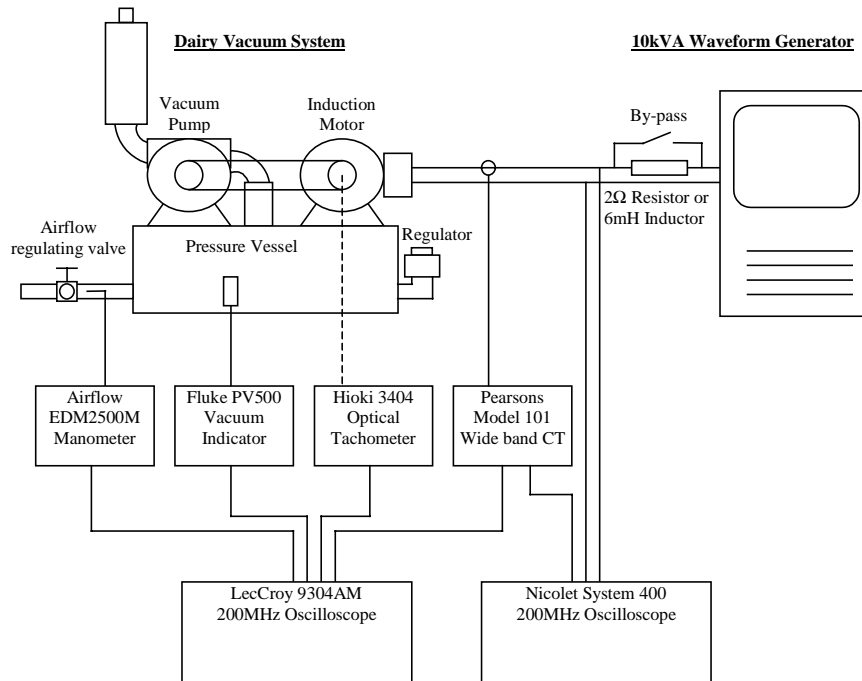
Sags are widely reported as being one of the worst power quality problems and are particularly common in rural areas. Automated milking equipment on dairy farms is a piece of equipment very susceptible to malfunction by sags. Each cow has 4 cups attached by suction from a vacuum reservoir, evacuated by a single phase induction motor driving a pump. It has been found that even brief sags can cause loss of vacuum and the detachment of all cups. The time to restart the vacuum equipment and connect up all the cups can be many times longer than the sag duration and be very inconvenient. In assessing the relative

cost/benefits of sag mitigation in the dairy or the supply network it is important to know the dairy equipment immunity level.

Recently the Power Quality Centre undertook a series of voltage sag tests on a dairy vacuum system to assess its ability to ride through sags. There was strong interest from both the supplier of the equipment and the local distributor in the farming area in identifying the weak link in the vacuum system with a view to developing a cost-effective improvement in the sag immunity.

The tests were performed with the 10 kVA waveform generator (described in Newsletter No. 2) developed at the University of Wollongong.

The test arrangement is shown in the diagram below.



Sags of 10-50% and duration 3 cycles to 10 seconds were applied for air flow rates of 0-1000 litres/minute. The air flow regulating valve allowed simulation of varying degrees of air leakage into the vacuum system. During these tests it was determined that the motor contactor was the component causing sag susceptibility. Sag tests were repeated with the contactor by-passed to test the limits of the remaining system. As well as sags, interruptions from 3 cycles to 3 seconds were applied for conditions of no air flow and air flow of 1000 litres/minute

As a result of the tests, some detailed observations can be made of the dairy vacuum system. The motor contactor is the first 'weak link' as it will not ride through a sag of 40% for longer than 0.5-0.6 seconds whereas the other tests suggest the rest of the equipment should withstand such a sag.

This finding is similar to what has been reported for several industrial processes elsewhere.

Small changes in motor speed produced by sags less than 30% do not affect the pressure or airflow. Sags of 40% cause an increase in vessel pressure but not significant enough to produce large variations in airflow suggesting that the system should withstand such sags. Sags of 50% with duration greater than one second may see the system fail as pressure rises significantly.

An interruption of duration greater than 0.5 seconds would probably cause the system to fail as the pressure rises dramatically. This means the system could not withstand a distribution system circuit breaker auto re-close operation in its current design if re-close times are more than 0.5 seconds.

Power Quality Survey Workshop

The Centre hosted a one day workshop in late February for Australian Electricity Distributors in preparation for a proposed national power quality survey. Seven utilities were able to attend and a number of others expressed interest in the project. Frank Zammit welcomed the audience on behalf of the Electricity Supply Association of Australia

(ESAA) and John Weidemier spoke about the Illawarra Technology Centre and its Australian Power Quality Service Centre which is managing the proposal. Four invited speakers then gave the background to the proposal.

Vic Gosbell's talk was entitled "Power Quality Surveys - Findings from the 1997 ESAA Scoping Study". In this he covered the reported overseas experience in power quality surveying, including the reasons for the survey, what quantities were measured and the benefits of a benchmark type survey. These include the acquisition of useful data relatively cheaply and the information needed to set realistic PQ targets.

Robert Barr of Electric Power Consulting spoke about the justification of the proposal. The survey would enable the provision of the level of PQ disturbance to customers with critical plant and satisfy the developing requirements of regulators. It would also help the utility itself, allowing realist PQ targets to be set and guide network augmentations and improvements. Some benefits which would arise include

- sites would be chosen in the different utilities with uniform criteria
- instrumentation would be certified
- survey performed by an independent body
- allow a "level playing field" comparison with other utilities with anonymity
- guide the development of future PQ standards

The details of project were covered by Vic Smith. It was proposed that 4 sites be monitored each for 2 weeks. Vic discussed the quantities which

would be measured, the monitor which would be used, and the transfer of data. Various options to the main proposal and their additional costings were presented.

The final presentation was by Greg Strain of CHK Engineering. Greg began by reviewing some recent overseas surveys, the quantities that had been recorded and how they were processed and displayed. He then discussed the specifications of CHK's PM30 power quality monitor, including range, accuracy, sample rate and quantities which could be recorded. He then covered the associated POWERview software which gives control of the PM30 configuration, logging, display and post-processing.

Robert Barr hosted a discussion session designed to cover people's concerns and adapt the proposal accordingly. The major outcome was the desire for more sites and a smaller monitoring period.

Following the workshop, a final proposal was circulated through ESAA to its member distributors. To date, eight distributors have committed themselves to the survey with two others considering doing so. The survey commenced in early August and it is anticipated that it will be completed early next year.

PowerCon 2000 Conference

Vic Gosbell is running a power quality session at Powercon 2000 to be held at the University of Western Australia in Perth in December. The Power quality session is expected to contain papers on sag testing, power quality indices, motor additional losses under distorted waveforms and power quality monitoring.

This conference is the fourth in a series on power systems technology jointly sponsored by IEEE Power Engineering Society and the Chinese Society of Electrical Engineers. The conference this year is the first outside China, the previous ones being held in Beijing. Keynote speakers will

include Dr David Jefferies, Former Chairman of National Grid Group, Professor Jos Arrillaga of University of Canterbury and Dr Keith Cornick of PowerGrid Ltd, Singapore.

As well as Power quality, there will be special sessions in Plant condition assessment using artificial intelligence, Renewable energy power systems, Intelligent systems applications to security control in power systems, Meta-heuristic applications to competitive power markets, New type power delivery systems and Distribution automation.

Sarath Perera – Overseas Study Leave

Hong Kong Polytechnic University, Nanyang Technological University of Singapore and the University of Moratuwa of Sri Lanka were visited by Sarath Perera as a part of study leave program.

In Hong Kong Sarath gave a public seminar titled 'Power Quality – A Subject of Increasing Interest' at the Department of Electrical Engineering which was then followed by the Part 2 of the seminar titled 'Integral Energy Power Quality Centre – An Industry Initiative'. The discussions held with the members of the staff and the visits to the

laboratory facilities has enabled to identify some common research areas. Among these were the harmonic state estimation which is now a hot topic in quite a few institutions around the world.

The visit to Singapore revealed that power systems is still a major topic of research. The laboratory facilities were found to be impressive and the research projects related to power quality included studies into the control of a DVR (dynamic voltage restorer).

In Sri Lanka, most of the time was spend on the developments and delivery of a Masters Course module in Power Quality. About 25 students participated in the course. The discussion with the practicing engineers who participated in the

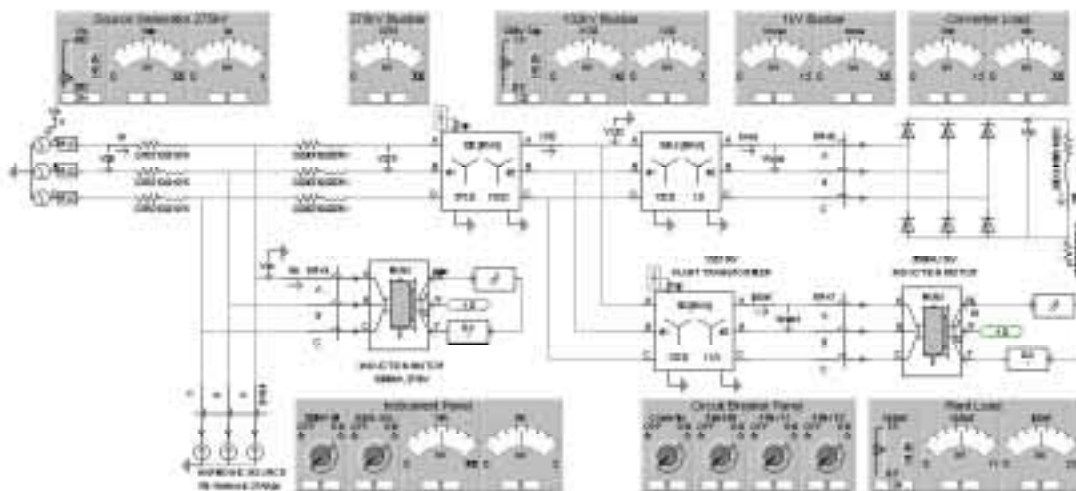
course mentioned that power quality is of increasing concern in addition to reliability.

Discussion were also held with the members of staff who have worked on various model development for electromagnetic transient studies. A visit was also made to Lanka Transformers Limited. In discussion with the engineers at the plant a very keen interest was shown towards the effect of harmonic currents on distribution transformers. At the Institution of Engineers of Sri Lanka a public lecture titled 'Power Quality – a Subject of Increasing Interest' was delivered where there were many professional engineers.

Power Quality Centre - Commercial Licence for PSCAD/EMTDC

The Power Quality Centre now possesses the capacity to study a wide variety of power quality problems (in addition to many other power systems problems) using the well known and powerful PSCAD®/EMTDC™ electromagnetic transients software package developed by the Manitoba HVDC Research Centre Inc. Version 3

of PSCAD/EMTDC now runs in the Windows environment and the Centre has already undertaken commercial work where the software has been extensively used. For details on the software you may refer to the website: <http://www.hvdc.ca>



Example of the PSCAD graphical user interface

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