CASE STUDY

Loughborough University

WHEN RESEARCHING GRID BALANCING, LOUGHBOROUGH UNIVERSITY REQUIRED A STABLE POWER SUPPLY TO GENERATE RESULTS.

The UK's transmission operator (National Grid) has a legal obligation to the maintain the frequency within statutory (49.5Hz - 50.5Hz) and operational limits (49.8Hz - 50.2Hz), while the distribution network operator needs to control the voltage at 230V +6% -10%.

Many manufacturers now design their systems to operate at both 50Hz and 60Hz so that equipment is transferable between the American and UK grid systems. Power electronic drives are a common feature in many industrial motor based processes and this has provided an interface between the grid and the machine removing the need for a tight 50Hz frequency. In addition, satellite based timing signals have resulted in less reliance on the grid system for timing.

Loughborough University's Centre for Renewable Energy Systems Technology (CREST) wanted to identify whether the National Grid would have to maintain their obligated 1% frequency tolerance, or if this tolerance is now outdated.

CREST were provided with a programmable AC source by ETPS, featuring the ability to set current limits and specify voltage/ frequency. Reader, Dr. Dani Strickland stated that "the AC source provided us with an immense amount of control over the output, allowing for accurate emulation of a variety of grid conditions."

"Without the simplicity and flexibility of the power system ETPS provided, research would have proved much more difficult."

> "THE AC SOURCE PROVIDED US WITH AN IMMENSE AMOUNT OF CONTROL OVER THE OUTPUT, ALLOWING FOR ACCURATE EMULATION OF A VARIETY OF GRID CONDITIONS."

ETPS
ELECTRONIC TEST & POWER SYSTEMS

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BALANCING THE GRID

The National Grid currently spends millions of pounds every year purchasing balancing services, such as Firm Frequency Response (FFR). It is forecasted that the instability of the grid will continue to increase in coming years.

CREST's research focus was to discover how the power consumed in domestic appliances and their operation would be impacted, if the statutory limits were changed to save balancing market costs.

Dr. Strickland added "the AC source allowed us to emulate the electricity grid's frequency and voltage deviations that domestic appliances can be subject to during normal household operation."

"A comparison could then be made against performance of the domestic appliances if the standards were allowed to loosen."

"The easy and intuitive user interface makes set-up very simple. The display allowed us to monitor 4 different output parameters simultaneously, meaning data could be recorded efficiently."

"A particularly useful feature is the local standby. This allows us to isolate the output voltage, so we don't need to turn off the PSU (consequently losing all the settings) as a means of isolation."

CREST has been involved in the research and development of Renewable Energy Systems Technologies for over 20 years. Informed by the latest research by world leading experts, it is the largest UK sustainable energy research centre and a leading European academic group.

The group's primary research focuses are: wind power, solar, energy in buildings, grid connection, integration and energy storage.

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ABOUT ETPS AC SOURCES

Programmable AC sources from ETPS can create virtually any grid condition. This allows users to investigate how changes to the mains voltage affect a power system's behaviour.

Distinct line disturbances such as brown outs and ripple control signals can be recreated in a repeatable laboratory environment. Adjustable frequency allows grid conditions for different countries to be precisely simulated.

Linear power supplies such as the single phase EAC-S and three phase EAC-3S contain EN 61000-4-11 sequences for pre-compliance testing. The standard tests for investigating behaviour during changes to the AC mains voltage are: short interruptions, voltage dips and voltage variation immunity tests.

A host of measurement functions are provided for the EAC-S and EAC-3S including true, apparent and reactive power, alongside average, effective and peak values for both voltage and current.

Besides unidirectional sources, ETPS also provide AC systems which operate as both a source and a load. All three of the four quadrant EAC-ACS-4Q's phases can be individually programmed voltage, frequency, phase angle and superimposed harmonics. Current control is also possible.

Advanced GUIs are available for the EAC-ACS-4Q to simulate a variety of grid and impedance conditions. An optional Fourier tool can create virtually any conceivable periodic waveform, with superimposed and inter-harmonic voltages up to 5000Hz.

Besides new power systems, our rental range also includes a selection of AC sources and electronic loads. A variety of nominal voltage, current and power models are available. The hire option makes perfect sense for temporary requirements where the capital cost of a professional instrument would normally be prohibitive.