

## genassure<sup>®</sup> at Roxburgh & Clyde Stations

### Governor and Automatic Voltage Regulator Testing



#### Introduction

Contact Energy Ltd. is one of New Zealand's leading energy generators and retailers, providing electricity, as well as natural gas and LPG to about 600,000 customers nationwide. Contact has two sources of hydro power which together account for 10% of the nation's electricity: the Clyde Dam on Lake Dunstan, which is the largest concrete gravity dam in the country, capable of producing 432 megawatts (MW) of power from four turbine generator units, and Roxburgh with eight generators and a capacity of 320 MW (enough to power about 200,000 homes).

Contact, like all energy providers in New Zealand, is subject to the asset testing requirements of the Electricity Authority. Established in 2010, the Electricity Authority and its contractor the System Operator, are responsible for consistent delivery and security of electricity supply. They established the Electricity Industry Participation Codes which require periodic testing of all electricity generation equipment (referred to as "assets") at every hydro power station to guarantee a high standard of maintenance and accuracy of reporting. It was mandated that initial rounds of testing was to be completed by June 2013, and thereafter on 4-10 year cycles.

Governors and Automatic Voltage Regulators (AVRs) are two types of electrical regulators that control the output of the hydro plant – Governors maintain constant frequency or speed, and AVRs maintain voltage levels. The engineers from Contact were interested in seeing how the genassure system compared to previous in-house Governor testing, but they had never done AVR testing before.



Figure 1 Contact Energy's Roxburgh Power Station, Roxburgh, New Zealand.

#### The Challenge

Asset testing is time and resource intensive. Skilled staff must be brought in from other tasks to take the asset offline, a limited number of highly specialised technicians are available to perform the testing, and throughout the outage no electricity revenue can be generated. There can also be variation in results if technicians differ in the way that they use equipment. Finally, delays of weeks or even months can occur with the processing of the results as technicians and engineers need to collate and assemble data from multiple sources before performing myriad calculations and finally carrying out the analysis.

Contact Energy was interested in learning more about how it could streamline and simplify the asset testing process as the Electricity Authority 2013 deadline loomed. Neil MacTaggart, Generation Engineer at Contact Energy said, "We were invited to a demonstration of the genassure solution at Meridian's Manipouri station and were impressed with the capabilities and speed of the system. We decided to bring Nightside in for a trial of the similar AVRs at Roxburgh power station."

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## Solution

Nightside's genassure solution provides a flexible, efficient means of testing Governor and AVR asset performance and meeting test obligations. The solution expedites the testing process, and provides reliable and consistent results immediately without the need for asset testing specialists.

The genassure system is a turn-key system fully contained in a couple of small cases and set up in less than an hour. It is built on a National Instruments cRIO control and acquisition platform which connects to the external field wiring, plus a Windows-based laptop. The software contains all of the expert knowledge required for asset testing, so any competent technician can carry out the tests by initiating procedures, following prompts in the graphical user interface, and processing test feedback.

genassure automatically carries out four standardised Governor tests: Step and Stability tests (which are required by the Electricity Industry Participation Codes to ensure the accuracy of modelling carried out by the System Operator), a Deadband test for condition monitoring, and a Reserve test, which checks ancillary service performance. For AVRs, genassure again conducts the required Step and Stability (Frequency Response) tests as well as a Power System Stabiliser Signature test, and Over- and Under-Excitation Limiter tests which establish reactive capability if there is too much or too little current.

"With the introduction of the Electricity Industry Participation Codes, all of New Zealand's power suppliers are going to be competing for the same limited pool of testing resources ahead of the 2013 deadline and beyond," said Peter Brown, Managing Director of Nightside Test Design. "genassure has made the entire testing process faster, easier, more convenient and more consistent – minimising the asset downtime and the burden of the new regulations."



Figure 2 The Machine Floor at Clyde Power Station

Once set up was complete at Contact's Roxburgh power station, the team was able to conduct testing on two generation assets per day, completing both Governor and AVR Testing on six generators within a week. The Contact engineers had allowed for two days of set up and one testing day per asset, and were quite pleased with the 50% efficiency savings.

"With the Roxburgh station testing completed so quickly, we were able to move on and test at Clyde station as well," said Neil MacTaggart. "This allowed us to get everything done at once while the personnel were in place, and send all the information through to System Operations at the same time."

Electricity Industry Participation Codes stipulate that "Representative Testing" of one or two assets is sufficient as long as the generators are sufficiently similar and consistently managed. However, with no previous testing data on the four AVRs at Clyde, MacTaggart saw the opportunity to quickly and easily conduct benchmark, or footprint testing across all the units, which would not only provide baseline performance data for future comparison on the same units, but also enable comparisons with other sites around the country.

"After testing all of the Governors at Roxburgh station we found an unknown fault with one of the generators – we wouldn't have found it if we hadn't accelerated the testing programme," said MacTaggart. "With genassure's instant results, we have been able to investigate the causes more quickly and easily."

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“The instant access to results is extraordinary in this industry, and quite powerful,” says Brown. “It gives the engineers the ability to evaluate test results on the spot, with the possibility of making changes to the generation controls and then immediately performing re-tests to compare results – all while the crews and equipment are still in place. That allows for problem diagnosis and fine-tuning to maximise resource output and efficiency like never before.”



**Figure 3** Contact Energy’s Clyde Power Station, Clyde, NZ.

## Results

For Contact Energy, the main advantages of the genassure solution were speed of testing and the instant availability of standardised reports. In total Contact Energy were able to test both the Governors and AVR’s on 12 generators over a two week period.

“The genassure solution offered fast testing and faster results. Previously we have sent the data away to experts and they compile spreadsheets and do the calculations. Now we have an immediate, standardised report with all the graphs and charts ready to analyse,” continued MacTaggart. “To have a system specifically designed for AVR and Governor testing with nearly everything in the one box ready to plug in and go, was beneficial. We will likely look at using genassure again for testing after our scheduled major outages.”

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