

genassure™ Asset Testing Platform

For power generation control systems

Introduction

Meridian Energy Ltd is a State Owned Enterprise and New Zealand's largest renewable electricity generator. Currently Meridian operates nine hydro stations in the South Island, the Te Apiti wind farm in the Manawatu, the White Hill Wind Farm in Southland which was commissioned in 2007, and a wind turbine in Wellington. It is currently constructing the West Wind wind farm in Wellington. Meridian supplies electricity to around 182,000 residential and business customers throughout New Zealand. Meridian's electricity generation is entirely from renewable resources and is a certified carbonZero generator.



New Zealand's electricity industry consists of the Electricity Commission, Generating companies, an Energy Transporting company, Distributing companies and Retailing companies.. The Electricity Commission is the industry regulator whilst Generators, Transporters and Distributors are known as Asset Owners. The security of New Zealand's power system (e.g. matching generation to load demand) is known as System Operations and is a Electricity Commission contracted service provided by Transpower. To enable the System Operator to manage its Principle Performance Obligations (e.g. grid security), Asset Owners are required to provide the System Operator with data sets and control system models that accurately represent the dynamic performance of their assets. To ensure the accuracy of those models, Asset Owners are required by law (i.e. Electricity Governance Regulations) to periodically test their assets and prove the accuracy of their control system models (e.g. frequency governor control, voltage governing control etc).

Control system testing is a specialist task which has traditionally required the use of a small pool of specialist technicians using specialist pieces of equipment to run tests and capture the asset performance data to be assessed. This test data was then taken away for assessment before being finally presented to the Asset Owner for review and action.

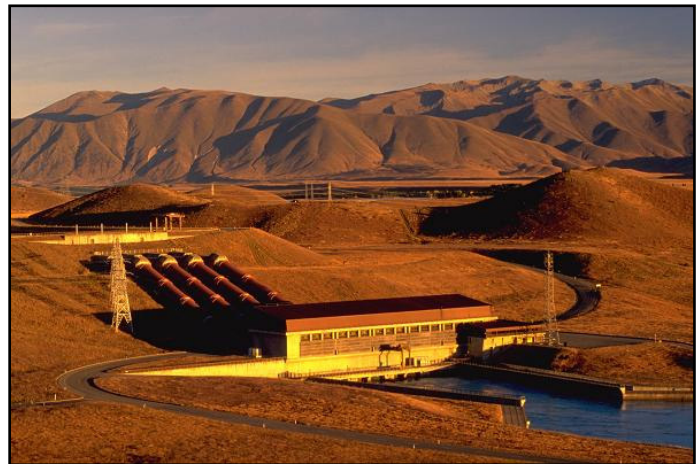


Figure 1: Meridian's OHAU B Power Station in Twizel, New Zealand

The Challenge

Nightside's challenge was to develop an automated system capable of effectively and efficiently testing assets used for the generation of hydro-power electricity. The system needed to capture the intellectual property required to perform tests, reduce the time needed to carry out these tests, analyse the test data in a timely fashion and present the assessed data in a format suitable for assessment by the Asset Owner and the System Operator (as required).

With Meridian's generation fleet, Asset Testing has been carried out in a rather adhoc fashion using the nations limited pool of highly skilled test technicians and engineers. In respect of recent EGR rule changes, the number of assets required to be tested on a periodic basis and the limited pool of technical resource able to run these tests, Meridian became concerned as to whether it would be able to meet its compliance obligations. These concerns were exclusive of the cost

Head office
Nightside Test Design Ltd.
P.O. Box 9040
Christchurch 8024
New Zealand

Phone (+64) 3 338 0034
Fax (+64) 3 338 2034
Email info@nightside.co.nz
Web www.nightside.co.nz

Auckland Office
Phone (+64) 9 265 1652
Fax (+64) 9 265 1653

impacts associated to long assets outages (e.g. 8 hours testing), slow data assessment turnaround (e.g weeks) and the financial impacts of using external resources. In response Meridian investigated the development of its own Test System and as a result engaged the services of Nightside

Peter Brown, Managing Director at Nightside, explains: “The challenge for Meridian, and other major power providers, is that there is a shortage of suitably skilled technicians in New Zealand able to satisfactorily carry out such tests and with new rule requirements it is likely this will not be just a problem for Meridian. The time required for testing, the resulting downtime and the shortage of resource combine to make meeting the rules laid down by the Electricity Commission a significant financial and commercial burden”.

“Technically this project presented us with a number of challenges; the system would have to ensure test consistency, ensure the continuous protection of plant under test, capture the intellectual property required to effectively carry out the test, and be small and compact enough to be easily packed, transported and set up for testing generating assets at power stations across the country.”

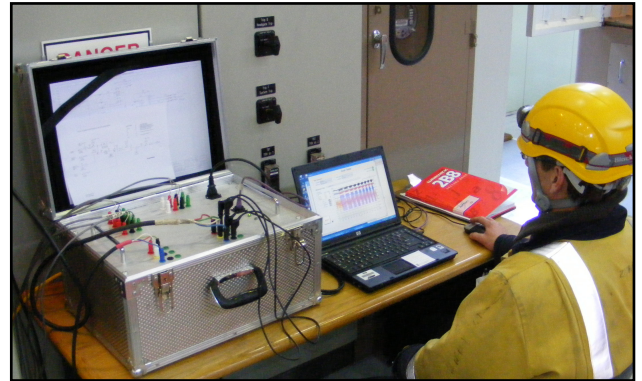


Figure 2: A Meridian Technician working with the test system

Technical Background

Historically Meridian outsourced asset testing to a very small pool of available and qualified technicians, which was costly and compounded by scheduling conflicts with other power generators chasing the same resource.

Asset testing required different pieces of kit to perform a suite of tests and technicians would often differ in the way that they used equipment which often created result anomalies. This made results difficult for engineers to interpret and use in a meaningful way.

Processing the results would also take a long time as technicians and engineers had to collate and assemble data from multiple sources, before carrying out analysis to gain useful insights.

Technical Solution

Working closely with Meridians engineers and technicians, Nightside helped develop an flexible test system named genassure™, to automatically carry out a suite of tests on a hydro Governor and generate immediate results. Meridian intends to continue with the development of genassure™ so as to extend its asset testing capabilities. Immediate plans include the testing of Automatic Voltage Regulators and Thermal Governors.

genassure™’s hydro governor test functionality is based on IEC 60308 and the System Operator Asset Testing Companion Guide, ensuring all requirements for asset testing are met. The expert knowledge required to carry out asset testing was harnessed and programmed into the software. The system then prompts the user to carry out the appropriate steps to perform an effective test.

Brown comments: “We built genassure™ using National Instruments Compact RIO technology, which is a reconfigurable control and acquisition system designed specifically for applications that require high performance and reliability. Testers simply connect the Compact RIO to the asset using the external field wiring. Any generation technician competent of being able to read circuit diagrams and connecting field devices to the test set can run the test. Test set up times are short (less than ½ an hour) and a complete set of tests can be run and results

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assessed in times typically less than 3 hours. I believe this is a significant improvement to what was traditionally experienced”

The user interface runs on a Windows based personal computer, which the technician uses to initiate tests and receive test feedback. The PC transfers test requirements to the Compact RIO Real Time Controller, which then coordinates the control and logging requirements, making use of the Field Programmable Gate Array (FPGA) of the Compact RIO chassis. The FPGA provides a hardware platform for running safety routines, and ensuring accurate timing for signal generation and data capture. The safety routines are used to return the Governor to normal operation, for example, if the grid experiences an under-frequency event.



Figure 3: The CompactRIO system

genassure™ automatically carries out four standardised tests. The first two, a Step and Stability test, are required by the Electricity Governance Rules and are used to ensure the accuracy of modeling carried out by the System Operator. The second two - a Deadband test, which is a condition monitoring test, and a Reserve test, which checks ancillary service performance - are not required by law but provide Meridian with a greater understanding of how assets are performing.

Results

genassure™ has been used to carry out asset testing on Governors at Meridian’s Ohau A, Benmore, and Aviemore stations. In comparison of how it used to achieve it has introduced some significant time efficiencies with manual testing, it has reduced the time taken to perform an asset test on a Governor down to 4 hours, inclusive of processing and displaying results.

Commenting on the project, Greg Falconer, Strategic Electrical Engineer for Meridian, said: “The ability for genassure™ to process results instantaneously is of huge value to Meridian; dramatically cutting down on man hours and critically, giving immediate access to meaningful data that can be used to accurately assess the performance of the assets and conclude model accuracy, a huge benefit to both Meridian and the System Operator”

As an effective test that can be carried out by a competent generation technician, genassure™ reduces the dependance on a small labour pool of highly specialised technicians. Meridian can now conduct Governor asset testing in-house, significantly reducing the cost and scheduling difficulties that it previously entailed.

The relative ease of asset testing using genassure™ also allows Meridian to take advantage of machine outages, instead of having to shut equipment down specifically for an asset test, a very costly and time consuming exercise. It also enables opportunistic testing, which allows Meridian to take further proactive steps for machine maintenance.

Falconer concludes: “This has been an extremely successful project and we have enjoyed a fantastic working relationship with the Nightside team. They were able to quickly interpret the scope and specification requirements, grasp our challenges, and introduce their own innovations that helped us to ultimately build a better solution.”

“We have now completed a number of commissioning tests, and we are confident that genassure™ gives us the answer to what we perceived as a very real challenge for Meridian.”

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