



Specialist Consultants
to the Electricity Industry

PSC NEWS

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Detailed Testing, Modelling and Compliance in the Snowy River Mountains

Snowy Hydro is a dynamic energy company supplying electricity to more than one million homes and businesses. Since the days of their pioneering past, Snowy Hydro has grown into the fourth largest player in the Australian energy market.

Snowy Hydro not only operates the mighty Snowy Scheme (nine power stations including pumped storage at Tumut 3 Power Station and Jindabyne Pumping Station), it also operates gas and diesel peaking assets in New South Wales, Victoria and South Australia. They have a total generation capacity of 5,500 megawatts (MW) and offer energy insurance and other products that provide supply security and price certainty to customers in the energy market.

Snowy Hydro also owns the electricity and gas retail companies Red Energy and Lumo Energy, and the utility connections business, Direct Connect.

PSC has supported Snowy Hydro for more than three years, delivering a mixture of detailed testing, modelling and compliance reporting for 24 generators across eight stations in their portfolio. PSC's Genassure generator testing service and PSS®E modelling team have helped Snowy Hydro obtain a detailed understanding of the generator control systems' capabilities and characteristics, update their models and complete the compliance requirements necessary for the National Electricity Market (NEM).

PSC worked closely with Snowy Hydro to deliver this detailed programme of work. Each station was assessed separately with test plans, and other documentation prepared for testing the Governor and Automatic Voltage Regulator (AVR) control systems. Snowy Hydro's engineering team, and test services team were involved in this process as the companies worked together to ensure the minimum impact on Snowy Hydro's operations. *(continued on page 2)*



Snowy Hydro Project Manager Brian Williams (L) and Genassure Manager Peter Brown (R) at Tumut 3 Station

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Detailed Testing, Modelling and Compliance in the Snowy River Mountains (continued)

PSC reviewed Generator Performance Standards, the relevant National Energy Regulations (NER) and Snowy Hydro requirements before preparing Test Plans and other documentation for review. Once onsite testing was complete we managed the delivery of compliance, performance and modelling documentation.



Genassure Test Engineer Geoffrey Callander at Tumut 2 Station

Services provided by PSC included:

- ▶ Project Scoping and Management
- ▶ Specialist test services (Governor, AVR, Power System Stabilisation)
- ▶ Specialist modelling services (Complex waterways, model development and validation)
- ▶ Compliance assessment
- ▶ Generator performance assessment
- ▶ Planning and delivery flexibility in the dynamic Generation environment

Snowy Hydro now benefits from a comprehensive and detailed set of compliance and performance reports. PSC has completed the necessary generator model updates and validations necessary for Snowy Hydro to comply with the NERs as a member of NEM.

Connecting at DistribuTECH 2018

Utilities, power companies, and technology vendors flock to DistribuTECH for its reputation as a leading venue for showcasing the major technologies and trends in the electricity industry. Thought leaders from around the world arrived in San Antonio, TX, this January to share knowledge, demo technology, and connect with each other.

"Connections" were a common theme this year, too. At the Internet of Things / Smart Cities track, representatives of utilities and consulting firms discussed the role utilities will play at the center of the "smart city" revolution, providing the electric and communications infrastructure that makes so much connectivity and interoperability of devices possible.

Developing customer-focused technologies and strategies was another major topic this year. With the increased availability of renewables and home energy storage solutions, customers are beginning to expect more from their energy providers. Utilities must connect with their customers to understand their needs and develop new services.

The electricity industry has been slow to adopt social media as a primary method of communicating with customers, but that is rapidly changing. Some utilities have been using social media to alert customers of outages for some time, and several of those success stories were shared at DistribuTECH. However, utilities are beginning to realize more frequent engagement with their customers can also improve attitudes about customer service.

It wasn't just utilities that were struck by the rising value of social media. PSC CEO Alex Boyd thinks leveraging social media will help consulting firms improve their services, as well.

"As an engineering services firm, connecting to our customers at a personal level is critical to PSC. Our business relies on sharing stories, understanding our clients' points of pain, and having the knowledge and experience to offer a winning solution," said Alex.

"We are all familiar with the benefits of social media in our personal lives. After hearing several stories at DistribuTECH about

the ways social media is benefitting utilities and their customers, it's clear that the electricity industry is no exception. Our clients are online and they are using the same platforms as everyone else. It's up to us to find more effective ways to engage our audience and deliver solutions using these platforms and that is an exciting takeaway from this year's event."

PSC will be at DistribuTECH 2019 in New Orleans, LA, February 5-7, 2019.



Automatic Generation Control: - Is it time for a tune up?

Automatic Generation Control (AGC), on an Energy Management System (EMS), is critical for responding to frequency deviations on the system network. AGC also balances the Net Actual Interchange to the Net Scheduled Interchange. A properly tuned AGC system ensures unit control requests are effective (accurately sized controls) and efficient (minimal number of controls to reducing oscillations). Most, if not all, AGC systems require periodic tuning to achieve these goals.

Tuning of AGC controls can improve market system compliance by minimizing uninstructed deviation changes. A well-tuned AGC system is also key to integrating renewables. Tuning enables the AGC system to be highly responsive when reacting to unplanned changes in the output of the as-available generation.

Conversely, a poorly tuned AGC system can result in numerous undesirable outcomes, including higher O&M costs, increased unit wear and tear from excessive controls, and decreased unit responsiveness from ineffective controls. These unwanted outcomes can result in tens of thousands of dollars a month in excess costs.

What to watch for

Your AGC system may benefit from tuning if:

- ▶ Changes have been made to the local RTU or unit controller that effect how controls are implemented at the generating plant. It is common for these changes to not be coordinated with the EMS support staff responsible for the AGC system.
- ▶ A generating unit has problems maintaining a particular MW output or overshoots the desired changes in control direction (Raise controls vs lower controls, i.e., hunting).
- ▶ Under AGC control, a generating unit is not able to respond at the ramp rate that the generating plant staff knows the unit is capable of.
- ▶ During a frequency deviation event, the subsequent unit controls fight against the local governor action, i.e., controls are not frequency coordinated.
- ▶ ACE is crossing zero frequently.
- ▶ The AGC system has been upgraded to a newer product version which may or may not include new features.
- ▶ It has been more than five years since the AGC system was tuned even if there have not been identifiable changes to the unit controls at the generating plant, i.e., unit control response drifts over time.

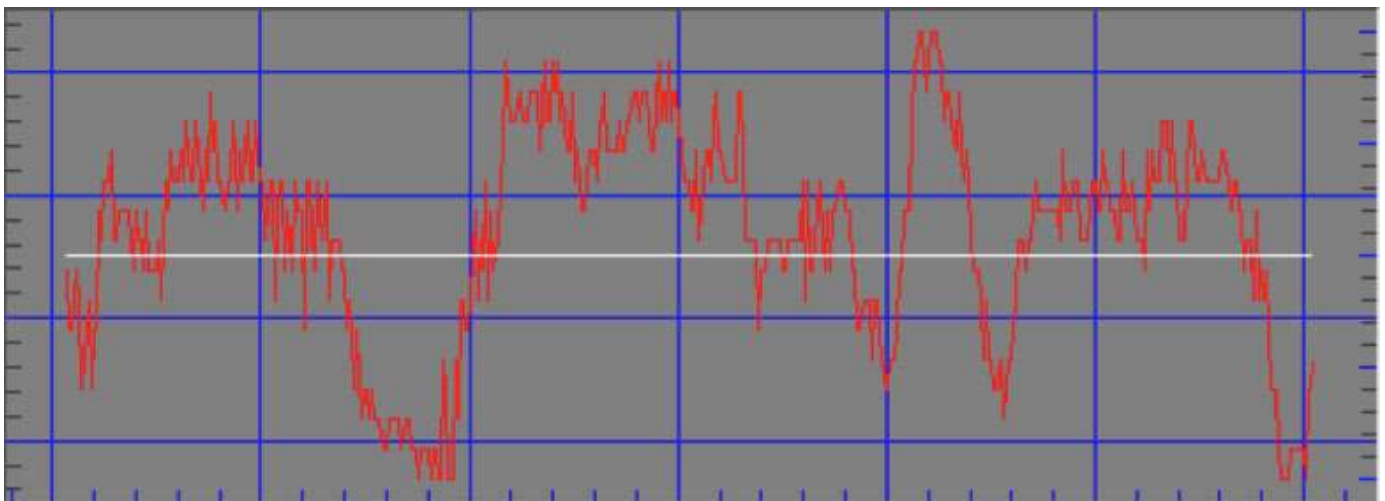


Figure 1 Unit output over a 20-minute window. Unit output in red; desired generation in white

Are there other reasons AGC can fall out of tune? According to PSC Principal AGC Consultant Bradley Nelson, age of the generating units is a factor. "More than half of all generating units in the United States are over 30 years old. Older generating units are more likely to drift from ideal response characteristics, so the need for routine tuning becomes more common."

Brad has helped customers work through a variety of AGC/Unit control issues. Sometimes, control problems can be avoided by improving communications. "In one case," says Brad, "[the customer's] AGC/Unit controls were tuned to a satisfactory level, and only one year later the customer requested another

tuning, due to problems with control. The follow-up tuning found that over half of unit controls needed to be retuned due to changes to the unit controller by plant personnel that were not communicated to operations staff."

In another case, the customer's AGC system had not been tuned for approximately 10 years. This resulted in significant oscillations in the unit controls as well as the ACE Regulation controls. For many systems in need of tuning, says Brad, the savings can be significant. "After completing the tuning, and comparing the before and after operations, conservative estimates of savings was in the range of \$100,000 per month."



Automatic Generation Control: - Is it time for a tune up? (continued)

AGC Evaluation

Some sites may benefit from an outside review of their AGC performance, including observation of how AGC features are being used and analysis of how they might be better leveraged. PSC offers customers an onsite review by an AGC subject matter expert to assess the overall state of AGC "health" and discuss of possible areas for improvement. This assessment culminates in a written report that may include recommendation for AGC tuning, as well as discussion of other AGC features that could benefit your operation.

How It's Done

PSC supports customers with routine tuning of their AGC system. This tuning is focused on the controls to the generating units as well as the ACE Regulation requests for the Balancing Area. Local staff are encouraged to participate as a training activity. This can include technical staff from the generating plants. This service includes a report discussing the problems found, the changes made, and recommendations for future improvements (most of which can be addressed internal to your organization).

PSC experts like Brad Nelson perform AGC/Unit tuning on site. Overall observations are made and notes are taken to describe the "starting point" of the system.

As generating units are made available for testing/tuning, open-loop controls are issued and their response to those controls is analyzed. This provides a starting point for setting the Tuning parameters. Tuning parameters are further adjusted and confirmed/refined using closed-loop controls.

As needed, observed issues are discussed with local generating plant technical support staff where such issues cannot be fully compensated for by unit control tuning parameters. In some cases, these local generating plant controls can be addressed within the timeframe of the unit control tuning exercise.

In a recent example, the senior plant technician was participating in the unit tuning. When the unit response significantly over-shot its target and then pulled back much more than expected, the plant technician knew exactly what the problem was. He called another technician at the plant who adjusted a setting in the local unit controller/governor which significantly improved the unit response. Overall, the tuning activity was much more successful with his participation.

Throughout the AGC/Unit tuning process, the system response to ACE Regulation is observed with corresponding BA level parameters adjusted.

If any of the control problems described above apply to your system, please contact us to discuss improving your system's performance. We may be able to do an initial evaluation via video conference.

Questions about your AGC system? Please contact us!

Kevin Cheung

Director of Operational Technology
PSC North America
+1 425 578 1451

Kevin.Cheung@pscconsulting.com

2017 PSC Scholarship Recipient



Thomas Galbraith (L) receives his certificate from PSC's Control and Automation Manager Barry Ireland (R) in our Christchurch office

PSC has for over 12 years provided support to the University of Canterbury. The PSC Scholarship was established in 2005 with the support of the Electric Power Engineering (EPE) Centre to recognise academic achievement by students pursuing courses in electric power engineering. The Scholarship is open to students in their 3rd professional year.

Congratulations goes to 2017 PSC Scholarship recipient Thomas Galbraith, selected from a field of high calibre candidates with his excellent academic performance and a strong focus on practical experience. With a background in power distribution, Thomas has a strong interest in the electronics and control systems associated with electric vehicles and was a member of the University of Canterbury motorsport team. He was also the IEEE University Student Branch Chairman where he promoted the IEEE and worked with industry sponsors.



Edward Hall Celebrates 20 years of Excellent Service with PSC

In February we congratulated Edward Hall who has achieved a significant milestone in completing 20 years of excellent service with PSC. Edward initially joined PSC as a Project Manager & Consultant, and has had several roles including Operations Manager and IT, Quality & Safety Manager. He currently is the Group IT Manager for the PSC Group of Companies and is responsible for the delivery of PSC's internal IT services, as well as delivering a number of specialist client projects.

As an experienced project manager, Edward has successfully delivered projects including IT infrastructure, information security, cloud systems, telecommunication networks, safety systems and quality improvements. He is also a technical specialist in the areas of fibre optic cable systems and aerial laser survey (ALS) using LiDAR. He has worked with our aerial laser survey partner OPTEN to deliver ALS projects for our clients throughout Australia and New Zealand.

The PSC management team would like to thank Edward for his commitment and excellent service over the past 20 years, and a small social event was held to celebrate his achievement.



Edward Hall (L) celebrates 20 years with PSC Co-founder Tony Armstrong

PSC STAFF CELEBRATE 10 YEARS OF EXCELLENT SERVICE WITH PSC

Recently two PSC staff in Australia and New Zealand celebrated 10 years of excellent service with PSC. The PSC management team congratulates Tanya Edgar and Kevin Hart on reaching this important milestone – well done.

Tanya Edgar is a Software Developer and Database Administrator with extensive experience in the development and support of applications and databases used in the electricity industry. As a member of the PSC IT Group, she provides support to our internal IT applications. Tanya has also been a team member for the upgrades for the Electricity Market System in Western Australia and most recently working with a team developing a prototype market trading portal.



PSC IT Group Manager Edward Hall (L) and Tanya Edgar

Kevin Hart is a SCADA Engineer in our Adelaide SCADA team for the ElectraNet SCADA support contract that includes SCADA development, database and display maintenance, systems administration, on-call response and support for specific applications. Kevin also has extensive experience in EMS upgrades including display and database migration, integration and configuration of specialised applications, functional testing and commissioning.



PSC Asia Pacific Managing Director Warwick Glendenning (L) & Kevin Hart



PSC WELCOMES NEW STAFF

SHANE KERR

PSC is pleased to welcome Shane Kerr as the Electrical Engineering Manager for Australia, within the Asia Pacific Power Networks team. Based in Brisbane, Shane joins us following a wide-ranging career at Energex. Most recently he was their Network Control Manager, where he was responsible for a team focused on the operation of the electricity distribution network in South East Queensland. As an experienced leader and manager, Shane also has experience in network operations planning, protection engineering and substation design and construction.



ROLF HOLMSEN

PSC welcomes Rolf Holmsen as a Senior Control Systems Engineer with electrical engineering experience in the electricity industry and industrial design specialising in PLC systems, HMI, SCADA and other control systems. Most recently he has been working on the maintenance, operations and development of Advanced Distribution Management Systems (ADMS) and has extensive GE PowerOn Fusion experience where he led system upgrades including testing, system integration, database and server upgrades. Rolf will be based in our Christchurch office in New Zealand.



THOMAS ADDISON

PSC welcomes Thomas Addison to our North American team. Tom has extensive expertise in delivering SCADA, EMS, and DMS software systems to global utility and government customers. He is recognized as a Subject Matter Expert who understands both Electrical and Oil & Gas systems from the ground up. Tom uses his investigative skills to analyze critical data, identify root causes of defects, and anticipate problems, combining technical expertise and breadth and depth of experience with intuition. As a strong customer advocate, Tom develops partnering relationships which ensures customer retention through understanding and advocating for the priorities of key stakeholders.



ALI DARGAHI

PSC welcomes Ali Dargahi to PSC Australia. Ali joined PSC as a Senior Civil/Structural Design Drafter in the Melbourne office, and has nine years of experience in the Power and Water Infrastructure, Commercial, Industrial and Residential sectors. Within the Power Industry, Ali's main focus has been Primary Civil and Structural design and drafting of outdoor and indoor substations and structural design and drafting of footings, poles and towers for transmission lines across Australia for various clients such as; ElectraNet, AusNet, SAPN (now Enerven), Powerlink and Ergon.



ARUN RAMALINGAM

PSC is pleased to welcome Arun who has 7 years of Australian SCADA systems experience and is a qualified and certified Software Engineer with a strong understanding and background in the energy utilities and associated communications industry. Arun has significant technical skills in SCADA, Distribution Management Systems (DMS) and Outage Management Systems (OMS), Asset Management, GIS, Microgrid/Distributed Energy Systems, Web application design and Mobile GIS application product development and solutions. Arun will be working in our Operational Technologies group based in Melbourne, Australia.



NOLAN CALIAO

PSC welcomes Nolan Caliao to PSC Australia as a Senior Power Systems Engineer. He completed his PhD in electrical energy and power systems at the University of Manchester in the United Kingdom and has strong experience in renewable energy and power systems for both distribution and transmission systems. Nolan has worked on a number of grid connection related activities such as due diligence as an Owner's engineer and interface with manufacturers in solar and wind technology. He will be working in the PSC Power Network's group based in Adelaide.



SYED RIZVI

PSC is pleased to welcome Syed Rizvi as a Senior Power Systems Engineer to PSC Australia. He has over 15 years of global experience in power systems, substation testing/commissioning, power system analysis and planning, grid interconnection studies, regulatory affairs and project/team management. Syed's professional experience has been acquired by working for global multinational organisations, along with academic qualifications achieved from the United States of America. Syed is highly conversant with the latest technologies and power systems analysis software. He is a passionate researcher as well and is pursuing his PhD (part time by research) from Curtin University Australia.



PSC NEW ZEALAND

PO Box 51098, Tawa
Wellington 5249
New Zealand
Phone: +64 4 232 7680
Fax: +64 4 232 7682

PSC AUSTRALIA

PO Box 2102,
Fortitude Valley, QLD 4006
Australia
Phone: +61 1300 933 632
Fax: +61 7 3252 8640

PSC NORTH AMERICA

PO Box 878,
Kirkland, WA 98083
United States of America
Phone: +1 425 822 8489
Fax: +1 425 822 3520

PSC ASIA

#16-01 The Amara
Corporate Tower
100 Tras Street
Singapore 079027
Phone: +65 9128 1830

PSC EUROPE

Suite 57, Pure Offices
Lakeview House, Wilton Drive
Warwick CV34 6RG
United Kingdom
Phone: +44 1926 675851



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