NEWS AND VIEWS FROM PSC

Specialist Consultants
to the Electricity Industry

PSC NEWS

Helping our clients power the world

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PSC Distributed Energy Resources (DER)

PSC is pleased to introduce PSC DER. Distributed Energy Resources (DER) is about the aggregation and control of distributed energy generation, demand and storage.
This includes:

- Generation: solar (PV), wind, fuel cell, co-gen, diesel
- Energy storage and efficiency
- Electric vehicles
- Demand response
- Local management Micro grids

PSC will help you to design, operate, and optimise the effectiveness and efficiency of your DER. We offer clients access to the full spectrum of specialist skills needed to meet and surpass the challenges that DER poses and deliver the benefits these new assets promise.

PSC's breadth of capability and experience is based on DER projects delivered in Australia, New Zealand, North America and Europe. PSC also offers a track record of performance in the electricity industry that spans decades, countries, and specialist services. We recognise that investing in know-how and skills is crucial and we have taken a hands-on approach to DER to reflect that.

From power networks, operational technologies and complete grid consulting solutions to generation source, load, control systems and system security, PSC works across and beyond the entire DER value chain. This means we underpin our DER capabilities with the diversity of engineering expertise you require.

PSC clients facing a DER challenge enjoy the confidence of having the full range of expertise on the job with PSC DER global knowledge, experience and full spectrum capabilities.

For more information, please contact:
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What is FERC Order 1000?

FERC Order 1000 seeks to further improve transparency, competition and cost-effectiveness in transmission expansion by using the levers of planning requirements, cost allocation and incumbency. Without stating any explicit public policy objectives, Order 1000 requires that transmission planning consider needs driven by public policy – at both the state and federal level – rather than only reliability and economic efficiency.

This means that the planning process will have to expand to consider state and federal laws, and that planning regions will have to work together to get more renewables online more quickly.

Why?

One outcome of the spike in alternative energy resource and policy development has been the exposure of gaps between areas with the most robust renewable resources and areas with the highest demand. The result is a need for more strategically located transmission, including longer transmission lines that can meet energy at the point of generation and carry it to points of demand, while linking it to the larger grid. FERC Order 1000 seeks to assist transmission providers in planning for the increased transmission necessary to meet growing renewable energy requirements and goals.

At the same time, regional transmission planners will have to factor in energy efficiency and demand response policies, which have the potential to reduce or even negate the need for new or enhanced transmission in certain areas. In this way, Order 1000 may also mitigate the risk of overdevelopment of transmission.

Removal of ROFR

The FERC-ordered removal of Right of First Refusal (ROFR) means that incumbent transmission providers are no longer given preference on competitive transmission projects in their existing territories. However, they may maintain advantages due to factors like long-held relationships with regulators, existing rights of way, proven track records, and knowledge of the network.

Large transmission owners are anticipated to leverage a number of business strategies to penetrate this newly competitive market space, meaning ISOs and RTOs will be challenged to evaluate an influx of proposals for transmission solutions from transmission developers, including incumbent and non-incumbent utilities as well as independent investment groups.

How PSC Can Help

With new directives from FERC Order 1000 driving the need for cost effective transmission solutions, transmission owners are faced with the challenge of planning successful, compliant projects. PSC personnel have hands-on experience in the development and evaluation of electric power transmission solutions for generator and load interconnections and network expansion within regulated utilities and for private transmission developers in the USA and internationally.

As an organization that is deeply rooted in the global utility industry, PSC brings more than technical expertise to our clients. Our customers benefit from PSC's qualified history of delivery and strategic insight into the many aspects of the project lifecycle, from planning through to commissioning and operation – bringing the added assurance of success that only comes from real experience.

Project Overview

PSC's network planning group regularly performs a variety of studies that require the definition of reliability needs as well as the evaluation of reinforcements against NERC and Transmission Owner specific reliability criteria.

Timetable and scheduling

As a consulting organization with extensive experience in transmission project development and project management, PSC also reviews Milestone Schedules, Outage Requirements and Work Plans.

Basis of Cost

Comparing competing estimates on an equal footing will present difficulty because of potentially different methodologies and assumptions used in preparing cost estimates for bids.

PSC develops independent shadow estimates to serve as a baseline for the review of detailed cost estimates.

In forming these shadow estimates, PSC obtains cost information from a variety of sources including recent client projects, publically available documents, estimating guides (e.g. RS Means, Handy-Whitman), requests for cost information from vendors and contractors, and by leveraging PSC's "Global Knowledge Network" to share experience and lessons learned from recently completed cost studies.

Project Engineering

In reviewing system and substation one-line diagrams, PSC planning and operations engineers consider such questions as:

- Are new or unusual contingencies brought about by changes to network topology being appropriately considered as part of the interconnection analysis?
- Do any of the new protection requirements incur prospective telecoms and protection issues that have not yet been identified?
- Do proposed breaker configurations comply with all criteria?

For greenfield projects, PSC transmission line designers and project engineers have the capability to review all transmission and substation drawings to determine completeness and highlight potential problems.

Brownfield projects, substations in particular, can often present logistical and construction complexities caused by clearance requirements, site access, extent of outages during construction, and a host of other factors. To ensure that these complexities have been

considered in the planning of a project, PSC begins by examining before-and-after engineering and transmission drawings as well as any photo or video evidence of the existing site to determine whether a site visit is warranted. PSC personnel experienced in project construction management visit the site if warranted, provided all health & safety requirements are met, to assess the constructability of the project. This is generally done in tandem with the existing asset owner, a representative from the project developer, and a representative from the project sponsor.

Permitting and Approvals

PSC engineers have coordinated and participated in several route and site selection projects on behalf of developers in the northeastern US and internationally. This involves acquiring Right-of-Way and property rights, complying with approvals processes for environmental requirements, and acquiring all permits for construction. These project engineers determine whether the information provided in support of the proposed project's siting and route requirements demonstrates that the process is sufficiently well advanced for the project to be given permission to proceed.

Contractual, Financial, and Prudency

PSC can assess the status of developer contracts having to do with procurement, design, construction and O&M to name a few. The assessment would determine whether all the services requiring consultants or contractors that were identified in the Work Plan are contractually provided for with agreements that are appropriately well advanced and cover sufficient scope to ensure successful commissioning of the project.

PSC AT DISTRIBUTECH 2016

Held in sun-soaked Orlando, Florida, DistribuTECH 2016 set new records for attendance and exhibitor turnout. The largest transmission and distribution conference in North America, DistribuTECH attracted more than 500 exhibitors and over 12,000 attendees from around the world.

PSC North America took advantage of the giant stage to unveil a new service offering, PSC DER. The rapid growth of distributed energy resources (and the technology to support and sustain them) is presenting new challenges to grid operators, as they look to integrate these new technologies with the grid. PSC's specialized team of DER engineers are developing innovative solutions for implementing renewable energy projects like wind, solar, energy storage, demand response, and micro grids around the world.

The theme of DistribuTECH 2016 was "Focusing on the Future." As it is PSC's commitment to help our clients power the world, DistribuTECH was the ideal place to share our vision for a smarter, more reliable grid with electricity operators and industry leaders from every major market. PSC would like to extend a special thanks to PennWell Corporation for organizing a seamless and influential convention.

PSC's Randy Berry (L) and Alex Boyd at the PSC booth during DistribuTECH 2016

DIRECTLINK HVDC PROJECT - AUSTRALIA

PSC has recently achieved a significant milestone as the Owners Engineer, on behalf of APA/ EII, following the commissioning of the 60MW converter station of Directlink, System 1, Mullumbimby, late 2015. Directlink System 1 is now in trial operation.

Directlink is a 180MW, High Voltage Direct Current (HVDC) facility that connects the power networks at Mullumbimby (NSW) and Bungalora (NSW) via High Voltage DC cables. Directlink was the first interconnector between the electricity networks of New South Wales and Queensland, commissioned in the year 2000.

The facility consists of the converter stations at Mullumbimby and Bungalora and a 60km route length DC cable easement between each converter station. Directlink utilises Voltage Source Converter (VSC) technology, and comprises three independent VSC "links" operating in parallel (System 1, System 2 and System 3). In 2012 a fire at Mullumbimby System 1 converter building resulted in the complete destruction of the System 1 converter.

PSC was engaged by the asset owner Energy Infrastructure Investments (EII) and the operator APA to provide key support in the rebuild of system 1. The converter building of System 1, was rebuilt by the EPC Contractor ABB, who was the original equipment manufacturer (OEM) for Directlink.

PSC undertook significant roles in the rebuild, which required close integration with the APA project and operations teams, including:

- Owners Engineer – On behalf of EII, PSC assisted in the development of EPC specifications, tendering support, owners engineer support and project management during the execution of the EPC Contract. PSC engaged in the daily management and supervision of the design, manufacture, site installation and commissioning by ABB.
- Site Supervisor – PSC supervised the site installation within a constrained live HVDC facility and adjacent a live Essential Energy substation. PSC managed the interfaces with the APA operations team, the adjacent utility Essential Energy and other stakeholders., PSC also backfilled the APA operations team providing trained and certified switching operators at each end (Bungalora and Mullumbimby) for the commissioning phase of the project.
- Commissioning Manager/Engineer – PSC undertook the key roles of Commissioning Manager and Commissioning Engineer for the re-commissioning of the Bungalora converter and commissioning of the rebuilt Mullumbimby converter. PSC developed and implemented commissioning plans and managed the interface with market stakeholders of AEMO, Essential Energy, Transgrid and Powerlink.

  Working closely with ABB and the asset owner PSC facilitated improvements in design and construction for a safer, more reliable and maintainable building. PSC is also currently performing the Owners Engineer role for the installation of fire services across both sites, which involves the installation of sprinkler systems within the HVDC converter indoor AIS yards, gas suppression systems within IGBT enclosures and control rooms; and VESDA smoke detection and alarm equipment. The fire services retrofit project is due for completion by the end of May 2016. PSC is proud to be an integral part of the team delivering both projects.

A view inside the new system 1 converter building

GCCIA CAPACITY BUILDING IN PSSE

Gulf Cooperation Council Interconnection Authority (GCCIA) is based in Saudi Arabia and their vision is to serve the GCC countries and beyond, by leading the development of an efficient power market, and providing knowledge excellence in power systems integration.

PSC recently completed a 5 day training course in capacity building in PSSE for a team of GCCIA and member states engineers. The training was completed by PSC Asia Principal Engineer Dr. Kee Han Chan who travelled to Damman on the eastern coast of Saudi Arabia. This is the major oil producing region in Saudi Arabia.

The training completed by PSC was well received and Kee Han received a certificate of appreciation for his valuable contribution to the training course. This training will assist in the day-to-day work of the engineers and PSC looks forward to working with GCCIA on future opportunities.

هيئة الربط الكهربائي لدول مجلس التعاون لدول الخليج العربية
GCC INTERCONNECTIION AUTHORITY

Certificate of Appreciation

To:
Dr. Kee Han Chan

Gulf Cooperation Council Interconnection Authority hereby honors you with this certificate for your excellent instruction in delivering the 5-days training course in:

Capacity Building in PSS/E Dynamics for GCCIA and the Member States

Conducted at: GCCIA H.Q, Dammam, Saudi Arabia
On the period from 27 to 31 December 2015

This certificate has been issued in valuable recognition to the advanced level of knowledge delivered in power systems dynamics analysis during the course.

GCCIA

SARAWAK ENERGY BERHAD – POWER SYSTEM PERFORMANCE IMPROVEMENT

Sarawak Energy Berhad (Sarawak Energy) is both an energy development company and a vertically integrated electricity utility in the State of Sarawak in Malaysia.

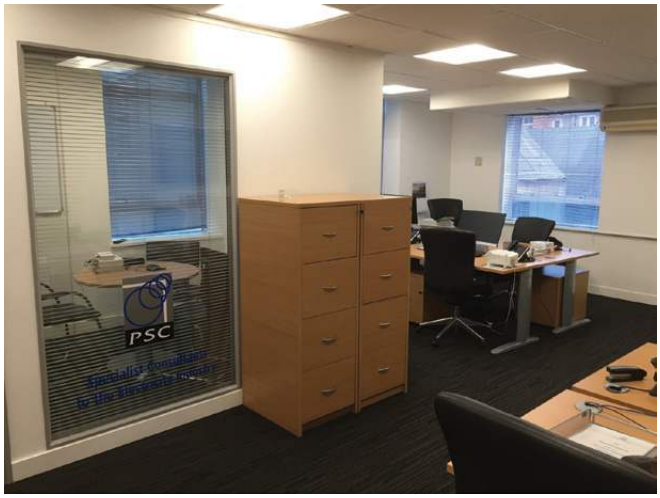
PSC Asia recently completed a review and assessment to improve the performance and reliability of the distribution network for Sarawak Energy. This work culminated in the development of a detailed reliability improvement roadmap for Sarawak Energy, which was presented to their operation and management committee.

Sarawak Energy is one of our new clients for PSC Asia and we are happy to have delivered this first successful project. We are currently working with them on another ongoing project and look forward to assisting them on future project requirements.

PSC UK MOVES TO NEW OFFICE IN READING TOWN CENTRE

To meet the growing work load in the UK and Europe, PSC UK has moved to a new office in Reading town centre. The office is located in Soane Point, 6 – 8 Market Pace which is ideally located to major road links like the M4 motorway and the Reading railway station is just a 5 minute walk and offers frequent high-speed trains to London. The office also has good access to the Heathrow and Gatwick airports. The Soane Point office complex is set over three floors and includes conference rooms, offices services and an on-site gym.

This new office will house PSC's core group of engineers based in the United Kingdom which includes a unique combination of engineering knowledge and experience in HVDC, power networks and Operational Technologies, and who are available to assist clients with project, operations and maintenance requirements. For more information, please contact PSC Europe's CEO Warwick Glendenning at warwick.glendenning@pscconsulting.com



PSC STAFF CELEBRATE 10 YEARS OF EXCELLENT SERVICE WITH PSC

Recently four PSC staff in Australia and New Zealand celebrated 10 years of excellent service with PSC. The PSC management team congratulates Arthur Panggabean, Gary Jennings, John McLean and Rick Wellington on reaching this important milestone – Well done.

ARTHUR PANGGABEAN

Arthur Panggabean (L) and PSC Group Chairman & Co-founder Tony Armstrong. Arthur is a Market Systems Engineer and has worked on electricity market system projects for PSC clients in Singapore, New Zealand and Australia. He is currently providing technical support and development services for the wholesale electricity market system in Western Australia.

GARY JENNINGS

Gary Jennings (L) and PSC Group Chairman & Co-founder Tony Armstrong. Gary initially joined PSC New Zealand as a SCADA engineer before moving to Australia and completing SCADA support and commissioning for a client in Brisbane. Most recently Gary has provided project management for the RTU and EMS work for two new substation projects for PSC's client Power and Water Corporation in Darwin Australia.

JOHN MCLEAN

John McLean (L) and PSC Group Chairman & Co-founder Tony Armstrong. John joined PSC and worked on electricity market projects for our clients in Singapore and New Zealand. John then moved to PSC Australia where he worked on a number of electricity market systems projects for our clients in New South Wales and Western Australia. John is the PSC Market Systems Manager for Western Australia and manages a team of market system engineers based in Perth Australia.

RICK WELLINGTON

Rick Wellington (L) and PSC Group Chairman & Co-founder Tony Armstrong. Rick is a Market Systems Engineer for PSC New Zealand and is based in Wellington. Since joining PSC, he has worked on a major upgrade of the New Zealand wholesale electricity market system and is currently providing a support role for this market system primarily in IT applications support and development.

DAVID MONK CELEBRATES 20 YEARS OF EXCELLENT SERVICE WITH PSC

David Monk has achieved a significant achievement in completing 20 years of excellent service with PSC. David has experience in all facets of high voltage transmission systems, including both classic and voltage source converter HVDC transmission technology. This work has included commissioning and maintenance of primary plant as well as control, protection and supervisory equipment and systems.

David's more recent work has included lead engineer for the Borwin 1 offshore HVDC wind connection project. Prior to this he has worked on numerous HVDC projects involving design close out of numerous platform auxiliary systems, operations and maintenance support, technical customer training, and interfaces to client systems.

David is the Technical Director – HVDC for PSC Europe, and is responsible for managing PSC's HVDC staff and developing the business. He is also providing his technical and engineering expertise for international HVDC projects.

The PSC Management team congratulates David on 20 years of excellent service with PSC and thanks him for his dedication and commitment to all of the projects he has been involved in.

PSC Group Chairman & Co-founder Tony Armstrong (L) congratulates David Monk

PSC WELCOMES NEW STAFF

GAURAV AGARWAL

PSC Australia welcomes Gaurav Agarwal as a software development and integration consultant. Gaurav has over 10 years of experience in the utilities industry with a focus in the areas of GIS, OMS and DMS. He has strong technical skills in the GE product suite including PowerOn Classic and PowerOn Fusion and is very experienced in the enhancement and development of these systems in the electricity and gas domains. Gaurav will be based with the PSC Operational Technologies team in Melbourne.

ANDREW NEEDS

PSC Europe welcomes Andrew Needs who joins the group as an Electrical Engineer. With a background in the high voltage power industry in New Zealand, Australia and the United Kingdom, he has experience across the full project lifecycle from specification to design, construction, installation, commissioning, and handover. Andrew will be based with the PSC UK team as a Commissioning Engineer on the ABB built Dolwin 2 HVDC platform off the coast of Germany.

HAMISH LAW

We welcome Hamish Law who joins PSC Europe as an HVDC engineer with five years' experience in the high voltage electricity industry. After completing a Bachelor of Engineering degree from the University of Canterbury, Hamish joined Transpower New Zealand and has worked on a wide range of HVDC equipment including control and protection testing for the new Transpower Pole 3 project, and the existing Pole 2 control system upgrade. Hamish will be based with the PSC HVDC team in Sweden.

NOEL TRIMBLE

Noel Trimble, who joins PSC North America from Minneapolis, Minnesota, is seasoned in performing a wide range of roles including project and team leadership, technical hands on support, data modeling, technical and contractual documentation preparation and quality assurance testing and monitoring. As a meticulous and detail-oriented engineer, Noel joined PSC with a wealth of core project management strengths in collecting, structuring and communicating information, problem solving, integrating cross-functional groups and technologies, and establishing strong partner relationships.

YIGAL RACHMAN

Yigal Rachman joins PSC Canada as a Senior EMS consultant. He has performed lead developer and / or technical architect roles for at least ten major automation projects including several Oil and Gas SCADA and measurement systems and an ocean observatory data acquisition and archiving subsystem. Yigal has extensive experience in application development, system installation, system configuration, and support. His technical skills include RDBMS programming, data interfaces, and system engineering for high performance, high availability computing in the energy industry. Yigal has strong analytic skills in developing requirements, design, and test documentation.

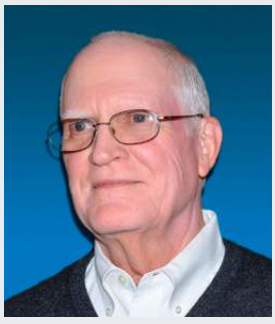
JON RESH

PSC welcomes Jon Resh, who brings an extensive Power Systems Applications background to the team. Jon, who hails from Kirkland, Washington, has experience in managing multiple software development process improvements, enterprise wide configuration management and multisite - distributed IT data centers. He has led and managed the transition to agile based / scrum development, integration, and testing activities, as well as managing projects involving traditional IT solutions and advanced cloud based solutions. Jon also has detailed Software Quality Control, Quality Assurance Management, and Risk Management experience as a strategic member involving corporate quality control and assurance programs.

JIM PANSCH

PSC North America is pleased to be joined by Jim Pansch, an all-round technical leader for SCADA / EMS systems who has also provided security services for both small and large EMS systems. Jim started his career as a software developer for AGC / ITS packages in large EMS systems and over time transitioned through various highly technical leadership roles in SCADA / EMS / DMS and Market Systems – most recently including technical vulnerability assessments, intrusion detection and complex system wide performance simulations and evaluations. In addition, Jim has also provided expert Oracle services in the areas of backup and recovery for all system types.

REED THORNTON



PSC is pleased to welcome Reed Thornton to the team. Reed brings 32 years of technical management experience covering all aspects of software development, from requirements solicitation through programming/implementation to production support. Throughout this time, Reed was responsible for establishing effective technical teams with appropriate processes to produce successful results. Prior to joining PSC, Reed was Director of IT Applications at Southwest Power Pool, Inc. (SPP), where he was responsible for all aspects of application development and support. Reed worked for two other highly successful IT companies prior to SPP and his experience with all sizes of teams and types of projects will bring great value to the growing North America team.

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