DISTRIBUTED ENERGY RESOURCES

We help you plan, design, operate and optimize your DERs

We help you meet the world's changing electricity demands with the efficient use of Distributed Energy Resources (DER). Our expert consultants advise in planning, design, operation and optimization of DER so you can extract maximum benefit.

Introduction

Historically, the typical electricity consumer has imported power from the grid, switching appliances on and off as needed, while sometimes contracting with the distribution utility to control loads such as water heaters in return for a reduced tariff.

Innovations in the generation, storage, and control of energy are allowing electricity consumers to act increasingly as "prosumers" with the ability to generate, store, and control energy in their homes and work places, via:

Generation
- Photovoltaic (PV) arrays
- Wind turbines
- Combined Heat and Power (CHP) co-generation
- Standby gas or diesel generators

Energy storage
- Refrigeration
- Air conditioning chillers
- Hot water heaters
- Batteries
- Electric vehicles

Controls to enable response to market prices
- Demand reduction to mitigate the effect of utility outages
- Frequency control
- Voltage support

Key capabilities

PSC's DER service brings together skills from our Power Networks, Operational Technologies, Market Systems, and Strategic Advisory divisions. Combining these skills gives us capabilities in:

- Microgrids
- Network planning at distribution and transmission levels
- DER control space
- DER system studies
- Energy storage
- PV connections
- Metering
- Distribution network analysis
- Active distribution network management
- Demand response
- SCADA/DMS/EMS
- Distribution market systems
- Standards
- Research
- Telecommunications, IT, networking and cyber security
- Vendor management
- Regulatory processes

These smaller energy systems that can be aggregated to provide the power necessary to meet regular demand are known as 'Distributed Energy Resources' (DER). Taken individually, they can be very small schemes (typically 5kW for household rooftop PV) up to larger grid scale (of the order of 1MW to 100MW) and microgrids. DER when aggregated together are changing the way in which the overall power system operates:

- PV installations are reducing the need to build more centralized generation.
- Renewable DER is displacing fossil fuelled generation.
- The direction of power flow in distribution networks can reverse as consumers become net generators. This affects voltage profiles, protection, and power quality.
- Demand control has become an increasingly viable alternative to network augmentation.
- Microgrids are allowing communities to source their energy locally and become more resilient by islanding themselves in the event of a grid outage.

PSC projects

A selection of projects which demonstrate our extensive experience appears below.

Effect of PV Installations on Distribution Network Quality of Supply, Australia
An Australian distribution utility is required by grid codes to meet specific criteria relating to quality of supply (QoS). PSC carried out an assessment of the impact of increasing DER penetration on QoS for the utility's low voltage and single-wire earth return (SWER) systems. Steady-state voltage regulation, voltage fluctuations and unbalance were studied via PowerFactory models which PSC constructed for selected representative feeders. Particularly for older distribution feeders having higher impedances, PV penetrations of the order of 30% were found to yield steady state voltage regulation challenges.

Distribution Feeder Market-based DER Optimization Project - Microsoft - United States
PSC led a team that developed a cloud based optimization solution for a DER project. The solution improves dispatch of new energy resources, including device controls and predictive forecasting for situational awareness. The solution provides a market based dispatch for both constrained and unconstrained distribution feeder conditions. The market based solution developed for this project is consistent with the electricity industry direction for advancement of Distribution System Operations (DSOs) and Distribution System Platforms (DSPs).

Generator Interconnection Studies, USA
PSC has been supporting a number of RTOs in the United States with generator interconnection studies that will enhance the connectivity of distributed energy resources and microgrids with the larger grid.

Connection Studies for PV Schemes in Isolated Systems, Australia
In Australia's Northern Territory, PSC was engaged to provide electrical engineering services for the utility's Solar Energy Transformation Program at remote locations with existing diesel generation. PSC carried out analysis of system load flow, short circuit, feeder voltage profile and protection systems, before and after the addition of solar generation.

Research into Integration of PV and EV, New Zealand
PSC is undertaking its own research project into using distributed PV arrays to charge its own commuting electric vehicles. The scheme coordinates the power production of the solar arrays with the power supplied to the electric vehicles. Power delivery is transacted across the grid. The project aims to charge EV's with guaranteed renewable energy.

Regulatory Advice on DER Hosting, California
PSC is reviewing the Distribution Resources Plan (DRP) documents issued by California utilities in response to the California Public Utilities Commission Governance Document. PSC is reviewing the proposed methodologies from distribution utilities to calculate Distributed Energy Resource (DER) hosting capacity and locational benefits. The constraints on hosting capacity include thermal, voltage, power quality, protection, and safety. Locational benefits include localized voltage support and resilience to network outages.

Battery Storage Integration with SCADA, USA
PSC provided conceptual design and system integration services to support energy storage software vendor and a utility in Washington State with the deployment of a one-megawatt battery energy storage system based on Modular Energy Storage Architecture (MESA) and the vendor's proprietary storage technology. MESA is a set of non-proprietary design and connectivity standards developed by an industry consortium of electric utilities and technology suppliers that intends to provide a scalable approach for energy storage control system integration and optimization. The vendor software provides the user interface and resource optimization for the scheduling of the distributed resources.

Integration of PV and Batteries, USA
PSC was contracted by a North American utility to tune the AGC response to frequency instabilities caused by PV solar. PSC modeled the PV and batteries for AGC including reserve monitoring. Custom displays were developed to provide the operator with real time situational awareness of the state of the PV and batteries as well as the forecasted energy production. PSC provided on site operator training to assist the operators in familiarization of operations of the distributed energy resources.

Integration of Windfarms and Water Heating, USA
PSC assisted with implementing a pilot project involving a renewable generation-following scheme in Washington State, where hot water heating was controlled to follow the power output of a local windfarm. The solution provided generation following services to reduce the impact of variable renewable energy resources on the grid. By controlling the electric water heaters, the utility was able to increase load as wind energy increased as well as decrease load as wind energy declined. The scheme also reduced the peak demand of the distribution network from the transmission grid.

Microgrid Solution to Provide Robust Supply to Semiconductor FABs, New York, United States
PSC was contracted to investigate ways to provide a robust power supply to a semiconductor fabrication plant in New York. The supply from the local utility could not match the pace of the FAB's rapid growth and PSC identified how real-time network monitoring, and local fuel cell and PV generation could be used to improve the power quality and supply capacity to the FAB. The analysis by PSC determined the implementation of a Microgrid to be cost effective and plans are underway to implement the Microgrid.

Conservation Voltage Reduction and PV Penetration Studies, USA
PSC carried out Conservation Voltage Reduction (CVR) studies and PV Penetration studies for distribution utilities in the United States. The CVR studies analyzed the impact of reducing the voltage on distribution feeders to reduce demand. The studies were conducted using GridLAB-D, a distribution network analysis tool developed by PNNL.

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