Successful Demonstration Project @ a Large U.S. Aerospace Manufacturer

Integrated, Renewable Distributed Generation for Demand Response

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ABSTRACT

This paper is a case study of a U.S. Department of Energy Funded project to reduce peak demand at a large aerospace manufacturing facility using renewable distributed generation resources, energy storage, control systems, and innovative utility gateways for real-time and/or day ahead demand management.

1 PROJECT OVERVIEW

The project is a U.S. D.o.E. Multi-year grant funded project with contributions from participants, and is located at ATK Space System's plant in Promontory, UT.

ATK's Promontory plant in Utah is a 590 + building, industrial facility on 15,000+ acres. The site has an annual energy bill of over $15M, over half of which are in the form of demand charges. The project goal is to reduce peak demand by 15% and develop real-time interfaces with the load serving electric utility company.

Figure 1.

The project consists of integrated on-site renewable energy, distributed generation encompassing multiple renewable and control systems technologies. Project is demand management oriented and contains utility company interfaces.

2 PROJECT REQUIREMENTS

Reduce electricity demand at plant by 15%:

- Currently, demand charges are 50% of the plant's electric bill

Simple payback on generation installed on site:

- < 2 years
- Additional savings in net-metering and utility incentives
- Additional tax credit benefits

Ongoing Operational Savings

- Purchased electricity from the grid will continue to get more expensive
- Produce a verifiable, 15% on-demand reduction
- Reduce plant labor expenses

Ongoing Risk-mitigation

- The load serving electric utility (RMP) supply to the plant is projected get more constrained, putting plant power supply & power quality increasingly at risk, which presents risks to plant operations.
- Nearby new construction (70 MW new load on the existing radial feed) is causing power quality issues for the plant
- The project increases Plant's Back-up/emergency power capabilities and will minimize future disruption(s) of facility operations due to grid power supply issues.

Figure 2.

Clean Technology 2010, www.ct-si.org, ISBN 978-1-4398-3419-0

3 PROJECT PARTNERS

ATK Space Systems

- Project Management
- Host Site
- Liaison & Prime contractor w/ D.o.E. NETL Reporting

U.S. DOE – NETL

- Grant Funding

P&E Automation, Inc.

- Technology/Experience
- Project/Construction Management
- DG Automation
- Utility Gateway Integration

Rocky Mountain Power
(Div. of PacifiCorp) – the local utility

- Rebates & Incentives
- Utility Gateway Support

4 PROJECT STRATEGIES

The principal strategy was to install and test a mix of customer owned DG renewable generation resources, combined with energy storage, utilized for plant electric load demand reduction:

- No single renewable resource is reliable 24/7
- Wind doesn't blow and the sun doesn't shine all the time at the project site
- No single renewable generation technology is the 'perfect' solution at every micro-climate across this particular large facility site.
- Project developed an operational model to take advantage of periodic renewable resource availability

The Project demonstrates that "inside the fence" distributed/renewable resources can provide meaningful benefits to both customers/end-users and the utility interconnected grid.

4.1 Energy Storage Aspects of the Project

The project utilizes water and compressed air systems for energy storage and recapture of energy at peak load times.

The project's automation and control systems are managing the systems to:

- Pump water when renewables are available or:
- Pump water at night w/ "off peak" utility rates

The stored water is then run through an "on-site" hydro-turbine generator during peak rate periods and/or demand reduction periods.

- Compress air when renewables are available or:
- Compress air at night, or when excess capacity is available

The stored or waste compressed air is then run through an "on-site" compressed air power electricity generator during peak rate periods and/or demand reduction periods.

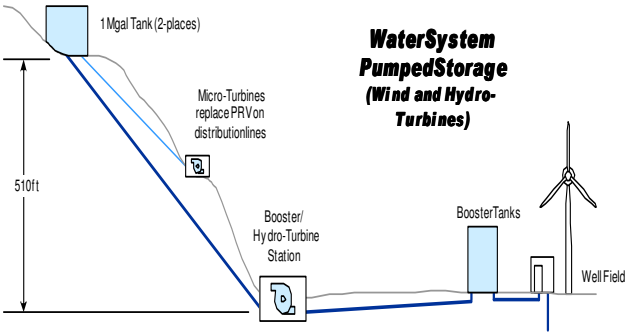

Figure 3.

4.2 Innovative Control Systems

The project includes "smart micro-grid" functions with the project's new and innovative DG control system which provides the project and plant operators with:

- Load aggregation & net-metering
- Monitoring, fault detection, & diagnostics
- Measurement & Verification for both customer use and the utility company's state commission reporting purposes
- Black Start of generation assets
- Historical trending and reports
- Real-time operator interface
- Two way communication with the utility' customer and operations systems

The new innovative control systems installed in the project for distributed generation system management were designed to current IT standards.

- Most industrial sites have IT expertise
- Approach Simplifies development process
- Provides Reduced Capital & Operating Cost
- Is Based on the EPRI Intelligrid platform

The project's control system architecture utilizes the plant's existing Ethernet TCP-IP lan system

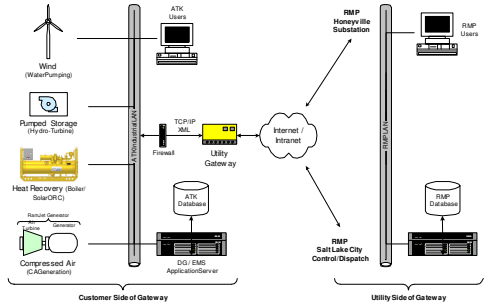

Figure 4.

4.3 Financial Aspects of the Project

The project was primarily funded in a cost sharing approach with both the U.S. Department of Energy and the host site division providing capital dollars and "in-kind" services. To reduce project capital costs and improve paybacks, the project also utilized:

- Utility incentives (rebates, tariff modifications)
- Accelerated depreciation per U.S. Tax code
- Investment Tax Credits
- Production Tax Credits

5 WHAT MAKES THIS DEMONSTRATION PROJECT UNIQUE?

The project integrates new "on-site" renewable generation resources and new energy storage systems, with existing plant management systems, the existing plant energy efficiency initiatives and provides two-way utility interfaces that benefit both utility and customer operations.

- Customer Driven, not utility driven
- Integrates Peak Demand Control with Renewable/Distributed Generation
- Integration with the Existing Facility Control/SCADA Systems & the local Utility's customer & operations information systems
- Dispatch of renewable distributed generation resources to address:
  - Facility Peak Demand, and
  - Utility/Grid System Peak
  - Demand, Demand Response initiatives and Grid Reliability
- Limitations due to the facility's Micro-Climates
- Limitations on DG resource site restrictions due to plant production activities

The project is being implemented and funded in a phased approach:

5.1 Phase I

The initial project phase demonstrated "proof of concept" which included the design, installation & testing of reliable and effective pilot project that included both the new DG systems & control systems. The initial phase installed:

- 2 Wind Turbines @ 2.4 kW each

- 1 Micro-Hydro Turbine @ 7.5 kW

- 1 Compressed Air Generator w/ Storage Device @ 20 kW

5.2 Phase II

The second project phase extends the renewable distributed generation systems to 2.5 MW installed on the ATK plant site. This second project phase will include the design, installation & testing of reliable and effective larger renewable DG systems & extensions of the control systems. Key components of Phase II:

- 4 Heat Recovery Systems @ ~ 200 kW each
  The systems will include stack exhaust heat recovery
- 1 Wind Turbine @ 1.5 MW
- 2 Hydro-Turbines @ 50 kW
- 4 Hydro Turbines @ 10 kW ea.
- 1 Compressed Air Generation w/Storage @ 20 kW

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The Phase II of the project will install an extended automation and control system which will provide the following:

- Utility Co. gateway 2-way communications
- Automated Measurement & Verification
- Automated optimization of DG resource usage (providing the 15% demand reduction)
- RMP system peak reductions
- Validation of site operational savings

Phase II of the project will also provide Commercialized technologies such that similar installations can be provided to other RMP customers and/or RMP sites.

6 PROJECT BENEFITS

This project demonstrates that distributed renewable resources can provide meaningful benefits to both end-user customers and the utility grid operators.

The project provides the tax payers, the local utility, its rate-payers, and customers the following direct and in-direct benefits:

- Expanded use of energy storage concepts
- Promotion of advanced Micro-grid automation for 2 way communication between Utility/Grid and Customers to facilitate both real-time and day/hour ahead notifications
- Dispatch of customer renewable generation resources for both customer site and utility company grid peak load management
- Dispatch of customer renewable generation resources for System Reliability/Stability
- Interfaces customer owned renewable resources availability with utility demand response requirements
- Reduces power quality risks, which do impact plant production and operations
- A reduction of CO2 emissions by more than 10,000 metric tones per year
- Fast payback of invested capital