

Florida Power & Light

FPL's Riviera Plant improved overall operations by introducing the HOGEN® onsite hydrogen generator and the StableFlow™ hydrogen control system.



Background

Florida Power and Light (FPL) is one of the largest and fastest growing utilities in the nation. In 2005, the utility had a generating capacity of 24,000 megawatts and anticipated 80,000 new customers annually. Its Riviera Power Plant has two active generating units that burn natural gas or fuel oil and utilizes hydrogen as a cooling gas in the generator cylinder. The plant, capable of generating up to 580 megawatts of electricity and serving more than 136,000 customers, was using about 15 cylinders of hydrogen per week for daily usage requirements. This required storing 60-100 gas cylinders on site (to provide purity purge gas when needed and refill the unit after an outage) at a cost of \$4 - \$8 per 100 cf. The majority of hydrogen costs are associated with the filling, transportation, and rental of the cylinders themselves. A technology evaluation program was initiated by FPL engineers to determine if onsite hydrogen generation and control systems could improve overall efficiency at the Riviera Plant.

Equipment Installation

In September 2006, Distributed Energy Systems installed a HOGEN proton exchange membrane (PEM) onsite hydrogen generator and a StableFlow monitoring and active control system at one of the two generating units at the Riviera Plant. The HOGEN unit utilizes plant demineralized water and standard single phase 240 VAC power to generate ultra-high purity (UHP) hydrogen on demand as it is needed to maintain pressure, purity, and dew point within the electric power generator casing.



StableFlow hydrogen control system at FPL's Riviera Plant

Both systems were installed easily and did not require a plant outage to integrate the equipment into the existing plant infrastructure.

Test Results

A baseline was established by monitoring typical generator conditions under normal plant operations. Data collected during this week-long period showed that the pressure within the generator casing fluctuated by as much as 5 psig due to "batch hydrogen feed." Hydrogen purity was consistently above 98.5% and hydrogen dew point ranged from 16°F – 24°F. The next test phase

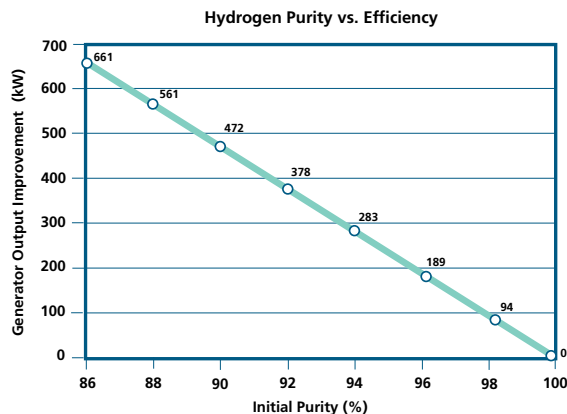
At A Glance...

- 60-90% reduction in hydrogen operating costs
- Dramatically improved safety resulting from reduced hydrogen inventory and handling
- When combined with our StableFlow hydrogen control system, most power plants can save \$1,000 / year / megawatt of capacity in fuel costs
- 750 HOGEN systems in 50 countries around the world

introduced a continuous supply of UHP hydrogen generated from the HOGEN onsite unit. A gas sample was collected and analyzed in a laboratory using gas chromatography. The results showed hydrogen purity in excess of 99.8%. CO₂ gas was then introduced to lower the purity of hydrogen gas in the electric power generator. Monitoring showed that hydrogen purity steadily improved over a 10-day period while casing pressure remained stable and consistently within specification.

The final test involved lowering hydrogen gas pressure to 35 psig for one week in the electric power generator to determine if gas pressure has an affect on cooling efficiency. The data collected did show possible improvements to fuel flow, but due to the many variables that affect fuel flow in a steam plant it is impossible to determine what percentage is related to improved hydrogen purity.

The graph below, based on data provided by the OEM, shows that there is a 280kW loss with a hydrogen gas purity of 94% within the generator casing. If operated at this sub-optimum level, the annual impact to Riviera Plant could be as much as 2,480 MWh lost. It is important to understand that every electric power generator model has a specific purity vs loss curve. The generator OEM should be consulted to understand how hydrogen gas purity affects the efficiency of the specific electric power generator under consideration.



Summary

FPL improved overall operations at its Riviera Plant by introducing the HOGEN onsite hydrogen generator and the StableFlow hydrogen control systems. Plant operators recognized the benefits of owning their own source of hydrogen to provide a reliable source of cooling gas for generators at a low cost. A typical HOGEN unit will consume less than 20 gallons of demineralized water each day and consume approximately 17kWh of electricity for every 100 cubic feet of hydrogen produced. The StableFlow unit has proven to be a valuable piece of hardware at the Riviera Plant by continuously monitoring and controlling the hydrogen gas within the generator casing. The effects on generator efficiency and capacity are measurable in most cases.

Acknowledgements

John Speranza, VP Sales, Distributed Energy Systems
 Ken Stenroos, Manager Generator Fleet, and Eric Else, Engineer, FPL
 Bill Bailey & Angelo Morson, Sr. Product Engineers, Distributed Energy Systems

Distributed Energy Systems provides our global customers with superior energy choices in a dynamic and changing landscape.

The Hydrogen Generation group designs and manufactures proton exchange membrane (PEM) electrochemical systems to make pure hydrogen from deionized water for a wide range of commercial applications

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