



HPI, LLC

Gas Turbine Control Efficiency

HPI continues to fulfill its role as a leader in the controls and instrumentation industry. HPI was recently prompted to secure a Funding Grant from the Department of Energy. This research grant assists HPI's ongoing efficiency studies and bolsters its list of publications and patents. The reason behind the initiative is the strong advocacy received from HPI customers concerning the increased efficiency created by HPI's Programmable Logic Control (PLC) control system packages. The evidence indicates that HPI's systems have saved a significant amount of fuel during key phases of turbine operation, namely the during startup sequencing and through load changes which occur during the 80-100% load range.

As an example, clients who operate certain aero-derivative turbines experience a reduction in liquid fuel consumption ranging from 4 - 7% by quickly achieving full-speed no-load load conditions during startup, a critical metric for peaking generators. The improvement is measured using the current generation of PLC controllers as compared to the various vintages of Hamilton Standard, GE Mark-series, Woodward, and similar vintage systems. When legacy controllers are replaced with an HPI-configured PLC system produced within the last five years, overall fuel efficiency increases of 8-12% have been reported, regardless of whether modern field devices such as valves or actuators were installed simultaneously.

The basic premise is that the responsiveness and consistent performance provided by the digital controller and associated software yields a dramatic improvement over vintage systems. This results not only from the updated technology itself, but by virtue of the fact that during the system retrofit, today's engineers implement certain control algorithm modifications which are allowable within the mechanical constraints of the package, thereby preserving safety and reliability while advancing the efficiencies related to fuel consumption and power output. These engineered modifications are driven by knowledge gathered by observing the turbine's operational characteristics 20-30+ years into their lifespan as well as applying new features that were not developed or envisioned when the packages were originally commissioned. These performance processes have been discovered and improved throughout the intervening years. The tuning performed during re-commissioning, and in some cases the complete redesign of control schemes leveraging current control theory best-practices, remain as other factors responsible for the benefits realized during control system upgrades with modern equipment.

One of HPI's clients, whose peaking fleet includes dozens of Pratt & Whitney Turbo Generator Sets, exemplify the performance improvements realized across the enterprise when new control systems are installed. Historically, their failure-to-start rate remained 1-in-5 (20%) attempts while the failure-to-sync rate registered at 1-in-12 (8%) attempts. Digital controls upgrades have reduced failure-to-starts to 1-in-20 (5%), and failure-to-syncs to 1-in-25 (4%), indicating that the new PLC (i.e. digitally integrated sequencer & fuel governor) and associated generator control panel also significantly increase availability while reducing costs and increasing grid network stability. The evidence indicates that further performance improvements are being limited by operating practices, maintenance issues, and/or electro-mechanical settings outside of the control panel retrofit scope.

How these operational improvements translate into specific dollar savings depends largely on other factors such as the fuel cost and type used, each company's operating procedures, and other site specific factors. Turbine users can utilize the preliminary figures to estimate the potential cost savings associated with new PLC-based controls configured and installed by HPI.

HPI plans to continue to actively gather raw field data with a plan to use the grant allotment to complete a study which can be shared publicly in the form of a clear report that will have been validated by a third party. This efficiency study is one of the many ways in which HPI proudly performs its role as a full service power solutions provider.