ATOMIZING AIR CASE STUDY

6/28/2016

Delivering atomized air to eliminate the smoke

Compliance issues resolved

SITUATION

A small Caribbean power station generates and distributes electricity to approximately 55,000 customers throughout the territory. In recent years, the station has invested millions of dollars in upgrading its generating and distribution systems to improve reliability.

The unit:

- GE Frame 5 LA
- Rated Output approx. 15 MW
- Fuel: distillate oil

CHALLENGE

The oldest GE Frame 5 gas turbine on the plant still operated using the original mechanically atomized liquid fuel system. This mechanical atomization fuel nozzle design had ultimately been abandoned by GE because of poor startup reliability and excessive exhaust smoke during operation. As local emission compliance rules became stricter, the issue of smoke in the exhaust had become more problematic for the station to a point that a solution had to be found. In addition, since this is a “black start” unit, starting reliability is an important consideration.

The solution is to replace the mechanically atomized fuel nozzles with atomized air nozzles and the provide a suitable atomizing air delivery system to allow the unit to start reliably and run smoothly across its full load. These systems are generally expensive and in this case the challenge was to design a cost effective solution that improved reliability and combustion, bringing the unit into compliance and increasing its value to the grid.

SOLUTION

Turbine Technology Services (TTS) was very familiar with the issues associated with Frame 5 atomizing air upgrades having dealt with many such upgrades in it 30 years of operation. Traditional atomizing air upgrades require modification of the accessory gearbox to accommodate a mechanically driven atomizing air compressor; a mechanically driven booster compressor; new fuel nozzles and liners and all the associated additional piping.

This is an expensive approach and requires an extended outage to make all the on-base mechanical modifications, neither of which were acceptable to the station's management. An alternative solution is to provide a self-contained off-base AA skid to deliver the atomizing air. This solution has been refined by TTS to a point where it provides the dual advantages of much lower hardware cost and minimal unit down time for installation. This is the solution provided to the station.

EXECUTION

TTS reviewed component and operational information to ensure a full understanding of the unit configuration and capability prior to initiating design of the off-base atomizing air system. Once a full understanding of the unit fuel flow and air flow capabilities and installed fuel nozzle and liner configurations was established, TTS initiated design of the system. The major components required for the upgrade were:

- AA-Style Fuel Nozzles
- Combustion Liners
- Motor Driven Air Compressor Package
- Air Storage Tank
- AA Control Valve and Associated Instrumentation
- Interconnecting Piping

In addition, A Micro PLC controller was provided to control and protect the AA system and the unit and to provide an interface with the existing Mark IV control system.

TTS provided one Mechanical Engineer to support on-site Installation Supervision, Commissioning and Startup activities. TTS also provided a Controls Engineer to commission the Micro PLC and to program the Speedtronic Mark IV Control system.

All of the off-base components were installed prior to taking the unit out of service The unit was then out of service for just over a week to allow for the installation of the fuel nozzles, liners and on-base piping.

The unit was then commissioned and tested. During testing each start was trouble free and repeatable and the unit had smoke free exhaust at all points from ignition to full load.

RESOLUTION

"TTS brought our system into compliance timely and in budget. We don't have any more smoke, problem solved!", Operations Manager.