

McBurney – Gaffney, South Carolina, USA

Calpine, Broad River Energy Center



Once Through Steam Generators (OTSG) were chosen by Calpine for installation in their first steam injected gas turbine (STIG) simple cycle peaking plant located in Gaffney South Carolina. The first phase of the project included the STIG retrofit and installation of OTSGs on units 1 through 3. The second phase of the project included the STIG retrofit and installation of OTSGs on units 4 and 5.



Project Description

The Broad River Energy Facility was constructed in phases during the late 1990's and early 2000's. The plant's simple cycle phase included five simple cycle GE Frame 7FA 190MW gas turbines. The first three gas turbines were retrofitted in 2001 to permit steam injection and three STIG OTSGs were installed in the turbine's exhaust path. The STIG cycle significantly increased the gas turbines' mass flow, which resulted in an increase in efficiency and power output plus a reduction in NOx emissions. The remaining two gas turbines were retrofitted with two more STIG OTSGs in 2004 which resulted in the same improvements of the previous units. STIG OTSG applications can reduce NOx emissions by 85% and increase the gas turbine output by more than 10%.

Each gas turbine was out of service for less than one week during the installation of the STIG OTSGs. The STIG OTSGs were also designed, fabricated and ready for shipment within less than 6 months. The STIG OTSGs have a full dry run capability permitting operation of the gas turbines while the steam process is out of service.



Innovative Steam Technologies
www.otsg.com
 An AECON Company

Head Office:
 549 Conestoga Blvd.
 Cambridge, ON
 Canada N1R 7P4

P: +1.519.740.0036
 F: +1.519.740.2051

European Office:
 Zurich Tower
 Muzenstraat 89
 2511 WB Den Haag
 The Netherlands

P: +31 (0)70 42 62 163
 F: +31 (0)70 42 62 111



STIG OTSG Process

This process consists of injecting steam or water into the head end of the combustor (for NO_x reduction) and into the compressor discharge, increasing mass flow and power output. Gas turbines generally are designed to allow up to 5% of the compressor airflow with flows as high as 10% allowed on some gas turbines. The injected steam must contain at least 50 °F (28 °C) superheat and be at pressures comparable to fuel gas pressures. A steam injection flow of 5% of total flow will increase power output by approximately 17.5% for all ambient conditions (independent of temperature, humidity etc.) and also reduce NO_x levels.

The main advantages of the steam injection process are:

- a) The power increase can be realized independent of ambient conditions (temperature or humidity). The power augmentation process will increase power in all climates and at all times of the year.
- b) Power augmentation results in greatly increased NO_x reductions. The injected steam reduces the flame temperature thereby reducing NO_x emissions.

CONTRACT SUMMARY

Gas Turbine	Turbine Output (MW)	Exhaust Weight (lbs/hr)	Fuel	Exhaust Temp. (°F)	Firing Temp. (°F)	Feedwater Temp. (°F)
Frame 7FA	+190	3,381,000	Natural Gas	1122	NA	190
Steam Flow (lbs/hr)	HP System Pressure (psia)	Temp. (°F)	Steam Flow (lbs/hr)	LP Steam Pressure (psia)	Temp. (°F)	OTSG Total Heating Surface (sq ft)
136,000	490	700	NA	NA	NA	21,073