

Case Study

Frontera Energy Center

Solution: Turbine Inlet Air Chilling with Thermal Energy Storage

Market: Power Generation & Utilities

Design: Modular

Scope: Turnkey/EPC



CHALLENGE

Frontera Energy Center is located in Mission, Texas, an area with prolonged hot conditions where temperatures are typically in excess of 80F more than 3,500 hours annually. Even with its existing evaporative cooling system, the plant was limited to approximately 497MW during the high demand summer season. The site's weather conditions as well as a trend indicating a sharp rise in forward market heat rates made a mechanical chilling solution the smart investment.

SOLUTION

Stellar Energy designed, procured, manufactured, installed and commissioned a custom Turbine Inlet Air Chilling (TIAC) solution for Frontera Energy Center that included a water-cooled chiller plant, thermal energy storage tank with stratified chilled water design, a unique coil design that simplified the filter house modification, and an innovative freeze protection system for the coils that allows the TIAC system to remain in use during warm days in the winter. The system features a 3,000,000-gallon thermal energy storage tank, two (2) inlet filter house retrofits including cooling coils, and one (1) nominal 6,780 TR water cooled modular chilled-water plant to serve two GE 7FA Turbines at the Guarantee Case.

In consideration of the site's conditions and the client's objectives, Stellar proposed N+1 redundancy configuration on both the chilled water and condenser pumps utilizing water-cooled mechanical chillers in a parallel configuration combined with a 3-million-gallon Thermal Energy Storage (TES) tank to deliver 12 hours of partial storage with a two-hour superpeak capability.

The parallel chiller design provides added system reliability – in the case of a single chiller loss, the entire plant capacity is not shutdown. “The extra redundancy provided in the Stellar Energy design is one of the value-added benefits that

QUICK FACTS

Owner:	Direct Energy
Location:	Mission, Texas
Plant capacity:	500-MW Combined Cycle
Project schedule:	Design and procurement began July 2012; Project completion was May 2013
Ambient Design Conditions:	100°F Dry Bulb 75°F Wet Bulb 31.5 Relative Humidity
Gas Turbine:	(2) GE 7FA Turbines
TES:	3 million-gallon Thermal Energy Storage (TES) tank

RESULTS

53
MW

- Output Improvement: Increased output by 53MW on a 100F
- Cut auxiliary load in half during the day by storing energy overnight
- Reduced capital costs
- Superpeak: Enabled the plant to run for 2 hours (superpeak mode) on chilled water from the TES tank without the chillers operating

differentiated them and factored into our decision to select the Stellar Energy team for the Frontera project,” said Tim Kennedy, Director, Upstream Power, Direct Energy.

Combined Cycle Journal reported “Innovation is evident in the inlet-air house arrangement.... Frontera wanted its new inlet system to fit on the existing structural steel to avoid disturbing the inlet bleed heat system and silencers. Another cost-saving goal was to avoid reconfiguring ductwork.” The solution included a design whereby cooler air is produced by the upper coils and the inlet features an optimal number of fins per inch on each coil so that chilled air is produced at a uniform temperature on the downstream of the chiller.

“Stellar Energy delivered a smart, custom and economical solution for Frontera Energy Center,” said Kennedy. “This was an aggressively scheduled project with critical requirements and budgetary parameters. Stellar Energy’s experience, technical expertise, flexibility and frequent open and honest communication were keys to the success of this project.”



Stellar Energy is a global leader in the design, fabrication, installation and operations of a range of energy systems, including Turbine Inlet Air Chilling, District Cooling, Central Utility Plants and Combined Heat & Power. Learn more at www.stellar-energy.net.

