FRONTERA ENERGY CENTER

Turbine Inlet Air Chilling with Thermal Energy Storage

QUICK FACTS

Market:	Power Generation & Utilities
Design:	Modular
Scope:	Turnkey/EPC
Owner:	Direct Energy
Location:	Mission, Texas, USA
Project Schedule:	July 2012 – May 2013
Original Plant Capacity:	529 MW Combined Cycle
Augmentation:	53 MW
Tonnage:	6,800 TR
Gas Turbines:	2 – GE 7FA 2x1
Thermal Energy Storage:	3 million gallons

Located in Mission, Texas, Frontera Energy Center is subject to temperatures in excess of 80°F more than 3,500 hours annually, resulting in turbine performance degradation. Even with its existing evaporative cooling system, the plant was limited to approximately 497 MW 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.

Stellar Energy designed, procured, manufactured, installed and commissioned a custom **turbine inlet air chilling (TIAC)** solution with **thermal energy storage (TES)** for Frontera Energy Center to boost plant capacity when ambient conditions degrade turbine performance. The system design features a 3 million-gallon thermal energy storage tank, one nominal 6,780 TR water-cooled modular chiller plant to serve the two GE 7FA turbines, a unique coil design that simplified the filter house modification and an innovative freeze protection system for the coils that allows the system to remain in use during warm days in the winter.

In consideration of the site's conditions and the client's objectives, Stellar Energy proposed N+1 redundancy configuration on both the chilled water and condenser pumps utilizing water-cooled mechanical chillers. The chillers were designed in a parallel configuration combined with the TES tank to deliver 12 hours of partial storage with a two-hour superpeak capability. The tank is charged during low-cost, low-demand hours and discharged during high-demand, high-cost consumption. In superpeak mode, the plant can run for two hours using only the chilled water from the TES tank,

KEY BENEFITS

- Increased output by **11%**
- Increased **operational flexibility**
- Reduced auxiliary load by **50%**
- Reduced **capital costs**
- Reduced **operating expenses**
- **Two-hour** superpeak capability
- Increased **reliability**

20+ years in the industry • **130+** projects in **14** countries • **1.2 million+** tons of refrigeration delivered
3,000+ megawatts recovered • **475+** modules fabricated • **100%** performance tests passed

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TURBINE INLET AIR CHILLING | DISTRICT COOLING | CENTRAL UTILITY PLANTS | COMBINED HEAT & POWER
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thereby eliminating the parasitic load of the chiller plant and increasing the available power.

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 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."

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- **Tim Kennedy**
  Director, Upstream Power
  Direct Energy

Stellar Energy is a global leader in the design, fabrication, installation and operation of a range of energy systems including turbine inlet air chilling, district cooling, central utility plants and combined heat and power. Learn more at **www.stellar-energy.net**.

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