Cost-Efficient Power At One Of N. America’s Most Advanced Combined Cycle Generating Plants

C-B Nebraska Boiler, an operating company of Cleaver-Brooks, provides critical auxiliary energy production for Lincoln Energy System’s (LES) Salt Valley Generating Station in Lincoln, Nebraska, USA.

As a public utility, LES’s charter is to provide the most cost-effective energy available for its customers in the Lincoln, Nebraska metropolitan area. To accomplish this, LES employs three distinct power generating combinations, including the use of its base load coal resources, purchased power and peaking plants. The peaking plants are employed to provide adequate power at the desired cost when this is optimal either for cost reasons or simply because of heightened demand caused by factors such as extreme weather.

LES’s Salt Valley plant is unique in the fact it is the first combined cycle generating plant in the State of Nebraska, consisting of three General Electric LM6000 aeroderivative fuel-fired turbines that can burn either natural gas or #2 diesel fuel, providing maximum flexibility for Salt Valley. These aeroderivative engines are essentially the same engines that have proven themselves for decades in aircraft such as the Boeing 747 and Airbus A300. In its power-generating configuration, the LM6000 is the industry’s most efficient, small-capacity turbine

The waste heat from 2 of the 3 LM6000 turbines is directed to a Heat Recovery Steam Generator (HRSG) producing steam that is used to drive a Nuovo Pignone (General Electric) steam turbine. In this combined cycle configuration in conjunction with the fuel fired turbine generators, Salt Valley can operate at 175 Megawatts and at efficiencies approaching 46 percent.

One of the keys to Salt Valley’s efficiency is the temperature of the intake air. At 48 degrees Fahrenheit — the maximum optimal intake air temperature — each LM6000 can generate 45 Megawatts. To achieve this level of efficiency with hot ambient air — say 90 degrees — Salt Valley employs chillers that circulate a 36-degree glycol solution through the combustion turbines’ air inlet housings. This chills warm ambient air (warmer than 48 degrees) down to the optimal 48-degree combustion air temperature. While there is input energy needed for the chilling process, it is nominal compared to the energy output ensured — 10-12 Megawatts per combustion turbine — from optimally efficient combustion.

When ambient air is cool — below 40 degrees — it becomes critical to warm inlet air for the combustion turbines because pressure differentials can quickly cause icing in the air inlet housing. If any ice were to form, then break free, it could seriously damage the turbine blades and take the unit offline. Again, while input energy is required to warm the inlet air, it is an infinitesimal investment compared to the cost of taking a combustion turbine off line.

To solve the icing problem, LES installed two Nebraska Boiler Model NS-L-46, 36,000 PPH Delta Watertube packages operating at 60 psig. The boiler(s) output is used in conjunction with heat exchangers to heat a glycol mixture that is circulated though coils in the air intake when ambient air falls below 40 degrees. This eliminates icing, protects the turbine and helps ensure that Salt Valley remains at full capacity.

The C-B Nebraska watertube boilers are also heating sufficient glycol mixture to provide comfort heat for offices and other buildings throughout the Salt Valley facility. And — since Salt Valley is a peaking plant — getting online efficiently and at full capacity is critically important.

C-B Nebraska Boiler plays a key role here too.

To operate in combined cycle, the Nuovo Pignone steam turbine must be fully sealed in order to accept steam from the HRSG that is driven by the waste heat from the LM6000 fuel-fired turbines. The Nebraska boilers, therefore, deliver steam to the steam turbine, sealing it, making it ready to accept the HRSG steam as soon as Salt Valley is called into action. This allows Salt Valley to operate at full, combined-cycle efficiency in very short order.

LES's Salt Valley Generating Station's efficiency and innovation have won the plant accolades including being named one of the top 12 plants in the world in 2005 by POWER magazine.

C-B Nebraska Boiler is proud of its role in helping Lincoln Electric System provide reliable and cost-efficient power for its residential and business customers throughout the Lincoln metropolitan area.

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