ABSTRACT

Using Steam Turbine Warming Blankets to Reduce Startup Time and Rotor Stress

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A cold steam turbine was limiting our ability to start up quickly and capture real-time market prices. Warming the cold turbine was also adding serious fuel costs prior to ramping to target load. When we started up after 24 hours offline, it required some warming time. If we were offline for 48 hours, the plant would enter a cold startup phase requiring even more warming. Steam turbines have to be warmed slowly to avoid differential expansion of components, which can cause rotor stress and reduce service life. The 30-foot rotor in our GE A10 expands by 1¼ inches in length as it reaches operating temperature, while the 4-inch-thick turbine shell takes longer to warm and expand. If the rotor and shell don’t expand at a uniform rate, it can cause rubbing of these components.

We installed insulated electric blankets to heat the turbine shell for startup as well as keep it warm while in standby mode. Each zone has redundant surface thermocouples installed to monitor and control the blanket heaters; each turbine has its own control cabinet for each zone. The control logic monitors local shell temperatures using a combination of newly installed zone thermocouples as well as the turbines’ deep-base thermocouples. The controls also monitor turbine differential expansion, turning off the heaters to prevent exceeding differential expansion limits.

We now have the ability to enter set points and ramp rates on graphic screens in the control room. We used detailed graphical interfaces to integrate the heater control cabinets with the DCS. These allow optimal monitoring and control of the entire system either from the control room or the cabinet. The blankets have eliminated cold starts altogether, reduced warm startup times by 50% and helped us realize substantial fuel savings. They’ve also increased our chances of being dispatched in real time.