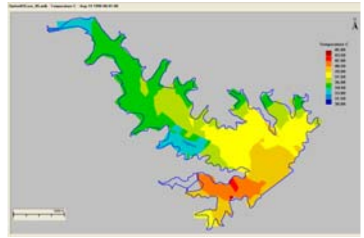
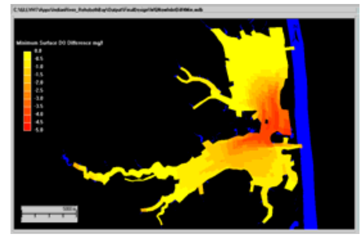
Intake Water Temperature Reduction Alternatives

TXU, Comanche Peak SES, Glen Rose, Texas





Situation

The purpose of this study was to present a performance and economic evaluation of several supplemental cooling options to decrease the cooling water intake temperature for Comanche Peak Steam Electric Station (CPSES). CPSES uses Squaw Creek Reservoir (SCR) to transfer waste heat to the atmosphere. The cooling water intake structure located near the western shore withdraws 2.2 million gpm of water at its peak capacity. This heated water is routed back in to the reservoir through a discharge pipe located at the southern end of the peninsula allowing it to cool naturally. Due condenser pressure limitations at high intake temperatures and inadequate natural cooling, a supplemental cooling options to reduce intake temperatures below 95 F were evaluated. In addition, cost benefit analyses of the options were performed.

Approach

A three dimensional hydrothermal model, GEMSS® (Generalized Environmental Modeling System for Surfacewaters) was used to model the SCR's response to the reduced waste heat loads. The modeling effort consisted of calibrating, then verifying computed temperatures against field data. The calibrated model was then used to predict the SCR response to full capacity operations. For the simulation year chosed, intake temperatures exceeded 95 F more than 80 days. Plant production decreases once the intake temperature goes above 95 F and ultimately needs to be shut down at 101 F when the condenser pressure reaches 5.0 in. HgA.

The supplemental cooling options that were analyzed for the study were: Oriented Spray Cooling Systems (OSCS), Mechanical Draft Cooling Towers (MDCT), and Water Garden Steps (WGS). The option of increasing the SCR surface area by 5% to enhance the surface heat exchange was also considered. These supplemental cooling systems were designed to cool 25% of the intake water. To increase the overall effectiveness of these systems, a dike enclosing the intake was designed to restrict the mixing of the cooled water and the hot reservoir water.

Results

The SCR's response to the designed supplemental cooling system was found to be favorable. On the other hand, the increased surface area did not contribute much to decrease the intake temperature. The supplemental cooling systems lowered the intake temperatures by up to 5F making the occurrence of the "greater than 95 F" event almost non-existent. While effective, these supplemental cooling systems increased the house load by a considerable amount. This increased house load alone rendered the MDCT and WGS systems ineffective in terms of capital and operational costs to benefit ratio. OSCS resulted in an increased power generation but was associated with high capital cost. A minimal return on investment of 2% was not justifiable economically and thus became the basis for subsequent rejection of the OSCS system.