Cooling Tower Optimization

Increased Power through Enhanced Performance

AREVA's patented comprehensive solution for a power increase up to 5 MWe without impact on normal plant operation.

The Challenge

In a power plant, the function of a cooling tower is to remove the heat absorbed in circulating cooling water systems via evaporation. Its efficiency depends on the air flow entering the inlet of the tower.

In existing cooling towers, the aerodynamics are suboptimal: turbulent air flow conditions in the air inlet reduce the cooling tower performance. The turbulence causes a limitation of power output, especially during hot summer periods.

The Solution

Promoting optimum and laminar air flow conditions of the cooling tower can result in a significant increase in plant power output. By minimizing cooling tower inefficiency due to turbulent flow conditions in the air inlets, one international nuclear plant's cooling tower optimization project resulted in a 4-5 MWe electric gain.

The cooling tower optimization works by reducing physical flow resistance for air flow. This higher air flow results in better cooling of the circulating water system, which increases the heat removal from the main condenser to improve overall plant efficiency and power output.

The concept modifies the cooling tower's lower edge and ground surface. Spoilers and baffles at the upper and lower edge of the inlet zone permit the smooth, laminar air flow needed for optimum performance.

Features and Benefits

- Maximum power output by promoting optimum flow conditions in the inlet zone to improve ultimate heat sink efficiency
- May result in increased power output of up to 5 MWe
- Minimize cooling tower inefficiency due to turbulent flow conditions in the air inlets
- No adverse impact to plant operations
- No regulatory issues
- Very low investment cost
- Cost/benefit study determines the return-on-investment
- AREVA offers a turnkey project including calculations, specifications, drawings, fabrication and installation of spoilers
- Receive verification and proven efficiency of the improvements

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AREVA Cooling Tower Optimization Approach

To provide cooling tower optimization, AREVA recommends a two-step approach. The first step is a technical study that estimates the power increase that can be achieved by modifying the cooling tower lower edge and ground surface area to promote laminar air flows. After the investment costs are evaluated against the benefits of higher power output, the second step is a turnkey project to implement the recommendations and document the improved efficiency and increased power output.

The technical study includes an evaluation of the present cooling tower condition through data acquisition and measurement, and a calculation of the improved efficiency realized by the recommended upgrades.

In order to realize the improvements, AREVA can provide a turnkey project including:

- CAD and construction drawings for spoilers and support structures
- Fabrication and installation of spoilers and baffles at the lower edge and ground level
- Verification and proven efficiency of the improvements

Ideal candidates for cooling tower optimization include thermal high loaded cooling towers with >2,000 MWth or plants that operate mostly in base-load close to 100% capacity.

Application sample:

- Cooling tower thermal power ≈ 2,400 MWt
- Spoiler at lower edge:
  Decrease of cooling temp. ≈ 0.97°F
- Ground level modification:
  Decrease of cooling temp. ≈ 0.72°F
- Power gain power electric:
  Total decrease of cooling temp. ≈ 1.8°F
  Power electric ≈ 4 – 5 MWe

Patented technology for increased power input by promoting optimum flow conditions in cooling tower inlet zone and maximizing ultimate heat sink efficiency

Before

After

Before

After

Better air flow → Better cooling → More MWe

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