Water Efficiency in Thermal Power Sector

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About CESC Limited & RP-SG Group...

- CESC Ltd, a 115 year old fully integrated power utility
- 567 sq. km distribution license area
- 2.9 million consumer base
- 3 Thermal plants - 1,125 MW capacity
- 20,400 circuit Km T&D network
- 2X300 MW TPP – Haldia & Chandrapur
- 40 MW AFBC plant at Asansol
- 9 MW Solar power project in Gujarat
- 50 MW Wind Power Plant in Rajasthan & Gujarat
Budge Budge Generating Station

Basic Overview of Power Generation Processes
Budge Budge Generating Station

Challenges before us in Design Stage in 1995:

In CESC Power Generation sector existing plants were having once through condenser cooling system, but for BBGS, MOEF came up with following norms:

- The temperature rise of the cooling water to be restricted by 5 Deg C.
- Any Power plant by the side of river Ganges should come up with Cooling Tower
- Cooling Tower blow down water heavy metal contents should be limited within prescribed limits.
Basic Features of Water Management in BBGS

Technology adoption and Initiatives towards Zero Effluent Discharge Power Station

- Zero Discharge System of Bottom Ash Handling
- Dry fly ash evacuation through dense phase system
- Emergency fly ash disposal by HCSD system
- All Volatile Treatment of Boiler water
- Control of Effluent discharge from Raw/DM water treatment Plant
- Use of CT-CW blow-down as service water
- Closed cycle cooling tower with a COC of 6
- Holding Pond for storage, settlement and recycling of Plant Effluent
Bottom Ash is transported as a slurry by mixing water to it. The water is recycled for re-use with only make up water being added to account for the system losses.
Fly ash evacuation done through pneumatic dense phase system.

HCSD System: An area has been demarcated for ash disposal in case of exigency by means of High Concentration Slurry disposal system. HCSD system is very effective for ash conveying as very little amount of water (40:60) is being added to make the high concentrated slurry which reduces the water consumption to a considerable extent. The slurry is transported by pumps through pipelines. The rated flow is 55.5 cubic meter per hour. Other benefits of HCSD system includes no leaching of ash water as the ash instantly forms mounds and does not have any fugitive emission.
All Volatile Treatment of Boiler water

Requirement:

To produce and maintain a stable protective oxide film on Boiler drum and tube surfaces. This can be achieved through: Controlled level of Alkali, Very low level of Oxygen, Low level of potential acid forming impurities such as Cl⁻ (Less than 0.02 ppm)

Previous System:

a) Conventional congruent Phosphate-ph control system by dosing Tri-Sodium & Di-Sodium Phosphate (in the ratio 2.6 : 1) and pH maintained between 9.5 to 10.
b) A considerable degree of “Phosphate hide out” often occurs when pressure exceeds 102 kg/cm² in high heat flux zone
c) This increases soluble silicates in Boiler water & this has to be taken care by blowing down Drum water
d) It entails massive energy loss

Present System:

a) Application of “All Volatile Chemicals” (Zero solid treatment)
b) pH is maintained between 9.4 & 9.7 by dozing Ammonia.
c) Hydrazine-hydrate is also dozed as an Oxygen scavenger.
d) The reaction is very slow. Residual hydrazine of more than 40 ppb to 200 ppb max is maintained at Economiser inlet & Ammonia 1-2 ppm in steam circuit.
Benefits:

Significant savings in:

a) D.M. water
b) Associated chemicals
c) Thermal energy by discontinuing Boiler blowdown
d) Electrical energy because boiler feed Pump handles less water

Replacing existing HP Dosing by 'All Volatile Chemical Treatment' resulting in reduction of boiler efficiency loss due to blowdown

Baseline Emissions Reduced = 3091 t of CO2 equivalent.

BBGS is the Globally FIRST Thermal Power plant to register 2 of its Energy saving projects with UNFCCC as CDM projects and earned 30042 CER’s till 2012.
Other water Saving Initiatives

Control of Inclined Surface settler de-sludging in RWTP
ISS de-sludging procedural change from continuous to intermittent have made considerable water savings. The sludge is pumped by sludge pump to sludge pond from where, after settlement the water is recycled back to the system through holding pond.

Control of DM chain Regeneration Effluent
1. ACF regeneration effluent directed towards holding pond.
2. Acid & Alkali effluents during chain regeneration is neutralized & then directed to a fish pond where we have Pisciculture.

Increase of COC of cooling water
Dosing of specialty chemicals, biocides, sulphuric acid and sodium hypochlorite in CT-CW water maintaining Ca++ ion concentration as high as 600 ppm. Online monitoring of critical parameters are in place.
CT-CW blow-down water is used in plant for re-use in the following purposes:

1. Road Washing
2. Bottom ash system make-up
3. High Concentration Slurry System
4. Sprinkling water in coal stack
5. Dry fog system for abating fugitive emission
Effluents – How discharge to river is controlled?

River Hoogli

Raw Water Treatment Plant → Sludge Pit → Fish Pond → Holding Pond

DM Plant → Station Services

Turbine

Condenser:
- Hot Water → CT Blowdown
- Cold Water

Cooling Water Forebay

Cooling Tower

CT Make-up

Discharge outside Plant
Modifications done

Revised Scheme

Municipal Drain

Pump House

Canteen
Water Consumption Trend

Sp. Water Consumption (Ltr/Kwh)
A study conducted by Centre for Science and environment (Green Rating Project) on 47 coal based thermal power plants in India revealed some interesting facts.