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Educating & Informing Stakeholders on Energy, Environment & Thermal Power Plants

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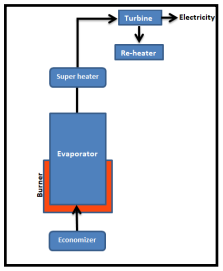
BOILER TECHNOLOGY: PART II
SUPER-CRITICAL TECHNOLOGY

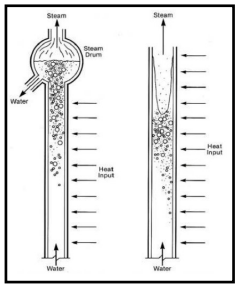


This article is a continuation on the topic Boiler Technology for thermal power plant discussed in the February 2018 issue of Stoppwatch. Super critical boilers operate at a pressure greater than the critical pressure than the sub-critical technologies. Unlike a sub-critical technology, the former does not require a drum to separate steam from water. The result because of the pressure exerted by the furnace, water gets directly converted to steam to rotate the turbine to produce electricity. This is known as drum-less technology because sub-critical technology requires a drum to collect and circulate the water. This type of boiler is also called as "once through boiler technology" due to the absence of drum (where steam is separated from liquid and re-circulated).

Major components of a super critical boiler:

- Economizer - Pre-heats the water entering the boiler to maintain uniform fluid conditions.
- Evaporator - a medium to make water evaporate into steam by absorbing the heat from the furnace area.
- Super heater - Heats the steam to super saturated level (steam with zero moisture)
- Re-heater - is used to capture residual steam after initial electricity production has commenced. It increases the temperature and pressure of the steam coming out of the High Pressure Turbine and directs it to the Low Pressure Turbine for further electricity production.

Advantages :



In figure, left side image represents drum type technology and the right side image represents once through technology.

- Once through technology is more suited for managing frequent variations in inputs to produce electricity i.e. coal and water than the drum type boiler technology. This leaves a difference of 2% in the input variations between these two technologies.
- Super critical boilers have faster rate of start-up which account to the structural and technology change of the boiler.
- Increasing the temperature and pressure above the critical point, not only reduces the fuel cost but also reduces the pollution load i.e. less CO_2 production and less SO_2 and NO_X production, which means reduced acid rain and Green House Gas effect.

Challenges:

- In order to overcome thermal heat stress effect, proper maintenance is required and highly heat resistant material needed, making this technology costly.
- Frequent turbine control valve wear and tear and the solid particle erosion problems in the turbine blades.
- High levels of purity is required for input water. Poor quality of water can result into carry over of impurities which will result in turbine blade deposits.

With growing concerns on global warming, power plants should move towards super-critical boiler technology in order to reduce emission. The efficiency of super critical technology ranges from 42% to 47% which is very much higher than sub-critical technology (36 - 37%). Adapting from drum less to once through boiler technology is more important in terms of environment as well as operation of the power plant. This can be easily achieved by adapting to super critical technology.

In India coal is expected to provide the major source of energy, accounting for 45 percent of the increase in energy demand. Over 70 percent of the increase in global coal consumption is to fuel India's power sector so that electricity is provided to more of India's population

GOVT RUSHING COAL TO POWER PLANTS TO PREPARE FOR SUMMER

The government has ramped up coal supply to ramp up buffer stock at thermal power stations in anticipation of electricity demand shooting in line with the weatherman's prediction of an early and hot summer this year.

Latest coal ministry data shows 16 power stations, or 14%, of the 112 coal-fired power plantsmonitored by the Central Electricity Authority have received fuel supplies in excess of their 100% requirement. Data shows the level of excess supply reaching as high as 200% in one case, while remaining between 104% and 163% for the remaining 13 stations under this group.

There are 28 other power stations, or a quarter of the monitored plants, that are getting supplies well in excess of their 'trigger level' - which ranges between 75% and 90% - of the annual contracted quantity of coal tied up from state-run Coal India Ltd The push for increased coal supply is aimed at avoiding a repeat of last year's situation when coal demand spiked as thermal plants raised output to bridge shortfall in generation from hydel, wind and nuclear sources.

In the August-September period of 2017, nuclear generation fell 36%, wind 14% and hydel 12%. Supplies from Bhutan also dropped. This supply gap was met by coal-fired plants, which saw generation rising by 17% as plants spun at 58% of capacity against 52% in August 2016.

This had led to coal demand rising by 20 million tonne. Coal India raised despatch by 21% but it still proved inadequate because power demand spiked with rising humidity and a prolonged dry spell.

Since then, the coal and railway minister Piyush Goyal has initiated several steps to ensure adequate coal stocks at power stations, some of which are still operating with low fuel stocks duw to various reasons. Coal India is despatching 8% more coal than it did a year ago, loading 308-310 rakes per day to wheel 1.8 million tonnes (mt) of the fuel daily. Coal India's production has also gone up to 2 million tonne a day and is set to increase further to 2.5 mt in the remaining days of March.

The Times of India March 14, 2018

NGT DIRECTS CPCB TO SUBMIT REPORT ON ANPARA POWER PLANT

The National Green Tribunal has directed the Central Pollution Control Board (CPCB) to submit report on the emission standards of the Anpara thermal power plant located at Sonbhadra district in Uttar Pradesh.

"We reiterate the directions of our order dated December 7, 2017 and call upon the CPCB to file its report and we again direct Chief General Manager of the said plant to be present. We make it clear that the report shall be filed by CPCB within one week after serving copy on the Ministry of Environment, Forest and Climate Change," the panel said.

The tribunal had earlier noted that Anpara thermal plant in Sonabhadra district of UP was found to be worst amongst all the other thermal power plants in the state in terms of emission standards.

It had earlier directed the CPCB to inspect sites where thermal power plants were discharging effluents in the Ganga basin or pay Rs one lakh as fine.

The tribunal had asked the counsel for the CPCB to physically examine the sites where thermal power plants are located in the first phase of Ganga cleansing project between Gomukh and Haridwar.

The tribunal was hearing a plea filed by NGO, Indian Council for Enviro Legal Action, seeking regulation of thermal power plants located in the Ganga river basin.

The plea had also sought directions to ensure that fly ash is not released into the Ganga river or its tributaries.

It had alleged that there were more than 25-year-old power plants, which were not technologically advanced and were polluting the river.

Business standard March 13, 2018

US COAL HASN'T SET ASIDE ENOUGH MONEY TO CLEAN UP ITS MINES

As the US coal industry winds down, does it have enough money set aside to clean up the vast pits, walls and broken mountains left behind?

A Climate Home News investigation has found the answer is no. Particularly in Appalachia, the land, water and health of mining communities have been put at risk by a critically underfunded system supposed to clean up after mines close.

According to national data compiled and published for the first time on Thursday, mining companies and state governments hold just $9.2 billion nationwide to ensure mining land is reclaimed if operators go bust. Experts told CHN that amount falls far short of what is needed to rehabilitate more than two million acres of mining permits the system is supposed to cover.

In the major coal states of Appalachia, coal production has halved in the past decade. But even as many mines slide toward closure, most states in the region rely on a system of pooled risk that lets companies put up just a fraction of the total costs of reclaiming their mines.

"There is not enough money in the bonds to truly remediate those problems if there were some large-scale walking away from those bonds," said Scott Simonton, coordinator of Marshall University's environmental science programme.

With the industry struggling to compete with cheap gas and renewable energy, mass bankruptcies could leave taxpayers with the bill for clean up. Left untreated, closed mines raise a range of environmental and community health risks, from sinkholes to acid contamination of water courses.

"It is one of the bigger public failures that has gone under the radar," said Patrick McGinley, a law professor at West Virginia University who has 40 years' experience in the industry. The data covers all 23 states that produce 99% of US coal and about 5,000 mining permits.* It was gathered from responses to dozens of records requests submitted to the state environmental and mining agencies in charge of each state's programme.

Due to greatly varying costs of reclamation from state to state and mine to mine, there is no precise way to estimate how much should be held nationally. But McGinley said the level of bonding in general was too low and in Appalachian states in particular was "preposterous, absolutely ridiculous".

The communal funds, known as 'bond pools' or 'alternative bonding systems', have left eastern states with less money per acre – an imperfect but useful measure of the strength of a state's bonding system – for environmental clean-up than most western states. CHN found Appalachian states hold between $2,373 per acre (Ohio) and $4,604 per acre (Maryland). Colorado, one of the best-protected mining states, holds $10,732 for every acre, and Texas bonds are $7,655 per acre.

Bond pools collect money from mining companies, and if one of them goes out of business, the pool guarantees to pay any costs that exceed other money they have set aside. But if market conditions get tough and several companies fail at once, the funds will not cover all their liabilities.

In 2015-16, companies accounting for nearly half of the coal production in the US went into some form of bankruptcy. They have since emerged from that nadir, but the massive, sudden collapse highlights the problem of sharing risk among companies that all produce the same atrophying commodity.

"It just seems to be a very fragile system. That's the problem. It's a system that's designed for small failures," Simonton said.

CHN spoke with regulators from all six states that currently rely on bond pools. Most pointed to the small number of recently-forfeited permits as evidence of the safety of the shared funds.

Lewis Halstead, deputy director of the Division of Mining and Reclamation in West Virginia's Department of Environmental Protection, said the bankruptcies guided where the state needed to shore up its bond pools. "

Peter Morgan is a senior attorney at the Sierra Club who has worked extensively on mine bonding. "One thing that is particularly clear in Appalachia is that these bonds are not being designed to capture the costs of water treatment," he said.

According to a 2017 actuarial report commissioned by the Ohio's Reclamation Forfeiture Fund Advisory Board, the $25.9m held in the fund would not be sufficient to withstand "shock loss," a term for unexpected forfeitures. The fund is replenished by taxes on coal production and by fees, so it gradually grows over time.

The report found that the fund is two years away from being able to withstand a single, average-sized mine forfeiting. It would take more than 150 years before the fund could handle the largest mining company it guarantees going under.

Climate Home News, March 14, 2018

In the steam drum, the main objective is to separate the steam from the steam-water mixture, which is coming through the riser tubes. It provides a point for chemical dosing in order to maintain the concentration of the impurities and the ph of the water

Citizen consumer and civic Action Group (CAG)

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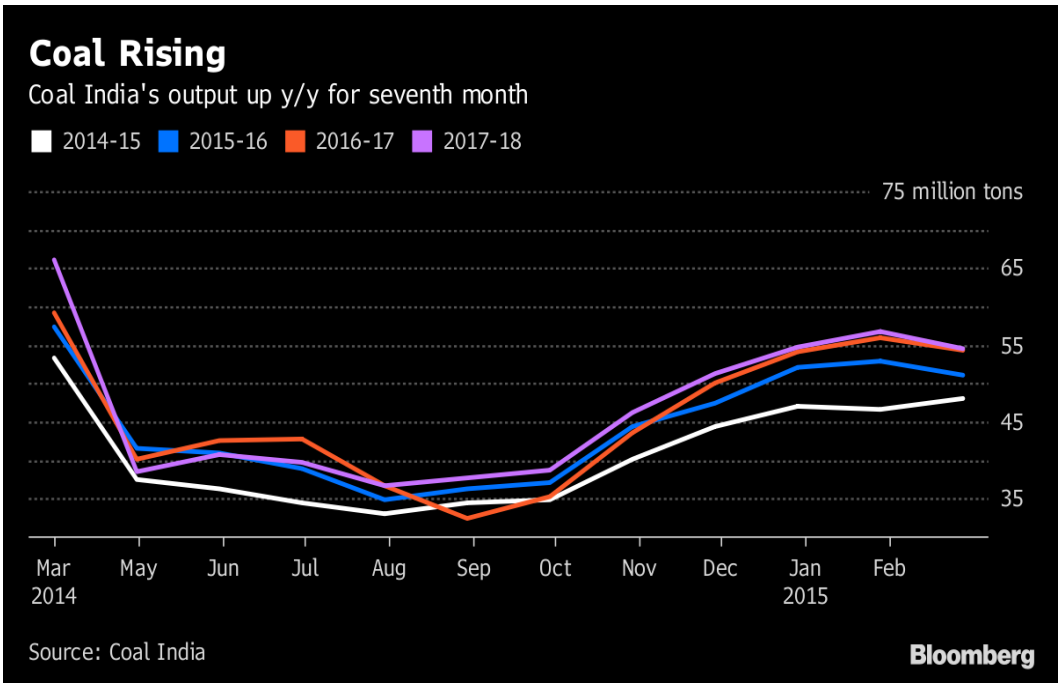
30 years of CAG
Citizen consumer and civic Action Group

Citizen consumer and civic Action Group (CAG) is a non-profit, non-political and professional organization that works towards protecting citizens' rights in consumer and environmental issues and promoting good governance processes including transparency, accountability and participatory decision making.

Coal India Output, Sales Rise as Power Plants Rebuild Stockpiles



Regulations and Cases

- Central Pollution Control Board (2018) *Compliance reporting protocols for online continuous emission & effluent monitoring system (OCEEMS).* New Delhi 7th March 2018 Click here
- Ministry of Environment Forest & Climate Change (2018) *Guidelines for Taking up Demonstration of New/Innovative Technologies for Air Pollution Control/ Abatement.* New Delhi 20th March 2018 Click here

Publications

- Firoz, F. et al (2018) 'Supplier selection criteria for sustainable supply chain management in thermal power plant' *IOP Conf series: Material Science and Engineering* 310 012016 Available at Click here [Accessed 31 Mar 2018]
- Pieta, Izabela. Et al. 2018 'Waste into fuel—Catalyst and process development for MSW Valorisation', *Catalysts* 2018, *8*(3), 113 Available at : Click here [Accessed 31 Mar 2018]

Miscellaneous

- The SNEC 12th (2018) International photovoltaic power generation conference& Exhibition, which will be held on 28th May, 2018 at Shanghai, China Click here
- NBQP Accredited Lead Auditor Training on Energy Management system (EnMS) Covering As per ISO 50001:2011, ISO 19011:2011 & ISO 17021, will be held on 7th May, 2018 at Haryana, India Click here