NTPC BEYOND POWER AND PROFIT

A Maharatna Company

RAMAGUNDAM

ABSTRACT

NTPC Ramagundam Stage- 1 Boilers are B&W design, natural circulation, front fired Boilers Commissioned in 80'S. Since then Front fired Burners technology has taken a big leap and also in new design, various problems associated with older burners have been addressed. This has resulted in very good boiler flame stability, low NOX emissions, uniformity of temperatures throughout the furnace zone. This has given a thick edge to front fired boilers over corner fired design and new units are springing up with front fired design.

Now a day's NTPC is going for UMPP's where Boiler capacities are in range of 660 MW to 800 MW. It is interesting to note that these boilers are equipped with front and rear fired technology, which is an enhancement over its older design of front fired one. Also burner design in these boilers has been changed quite significantly to cater the needs of today's continuously changing grid conditions. Many a time's units are running at partial loads where limiting factor is none other than Boiler flame stability.

Older units with front fired design are not that safe in terms of Boiler flame stability when operating at low loads. Due to this, these units are running at 70 % of load whenever backing down is demanded from GRID. But now keeping in view of present grid conditions and rising of UMPP's, CERC has decided to go for 55 % of load to all thermal generating stations irrespective of their age and size, when backing down situations are arising. This is going to prove an oppressive decision putting older unit's boiler flame stability in Jeopardy at lower loads.

Moreover NTPC is targeting for 100% ash utilization. This has also become a major challenge for projects with higher installed capacities. Research works are going on fly ash utilization and major breakthrough in this is converting fly ash into non flyable form which can be later dumped in coal mines for void filling. This is really a win win situation for power plants and coal mines as scarcity of sand for filling mine voids has already started troubling mines and they are also in search of an alternate arrangement.

"**NTPC beyond power and profit"**, with this theme, this paper focuses on burning issues of current time which are environmental hazards related with fly ash and NOX emissions and making older units able to compete in changing grid scenario.

INTRODUCTION:

THERMAL generating stations have always been bedrock among electricity generating sectors in both conventional and non conventional ones. From past some time thermal sector is facing stiff competition from other sectors. This is a result of awareness among masses about deteriorating condition of environment, which has forced govts to almost gag thermal sector by making stringent environmental norms and at the same time giving boost to non- conventional energy sectors.

To keep thermal sector from getting uprooted with new sowing seeds of non conventional energy sources some changes are need of the hour and their implementation can help thermal stations to keep pace with time and changing power scenario.

FRONT FIRED boilers are giving low flame stability when operating at low loads. Environmental norms becoming more and more stringent for NOX emissions. This problem is becoming more prevalent for older units as frequent backing down situations are arising. With a payback period of just 2 years CCV burners are most promising solution to above mentioned problems.

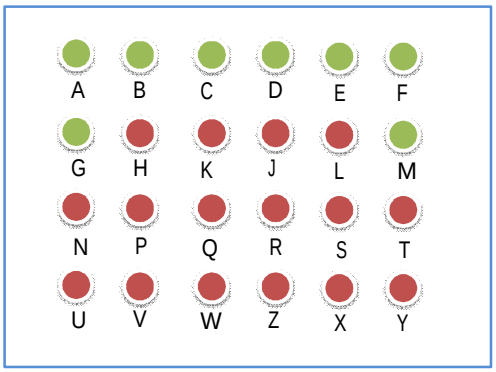
Ash which is a byproduct of thermal stations has also drawn attention of various authorities and its 100% utilization is one of the major target of NTPC. Rigorous research work is under progress to utilize flyash in different application and to some extent it is being implemented also, but huge amount of ash coming from stations is still being dumped in ash ponds. This needs immediate attention before it is getting too late.

Ramagundam Stage-1 Boiler burner's arrangement is shown in fig-1 which consists of total 24 burners arrangened in four elevations. Each mill discharge having two no of coal pipes which will again branch into further two nos, hence total 6 no of mills discharge pipes connected to all 24 nos burners. Each burners is equipped with a coal nozzle which houses impeller in it which can be advanced and retracted. Oil guns for initial light up and during low loads for flame stability are housed inside the impeller, secondary air for the combustion in supplied through air registers. UV and IR scanners are provided for flame sensing.

IMPROVEMENT IN EXISTING SYSTEM

Stage-1 Boiler Coal Burner Alignment

STAGE-1 UNITS : 200MW
BOILER : BABCOCK & WILCOX DESIGN
FIRING METHOD : FRONT FIRED



200MW BURNER FRONT

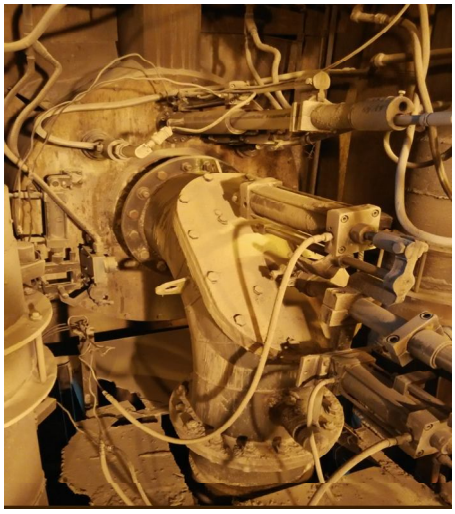


Fig-1

Rated MS and HRH temperature with allowable MMT conditions in boiler depends on proper combustion which in turn depends on 3 Ts time, temperature and turbulence. Out of this, the parameter which is affecting the combustion is turbulence, which solely depends on condition of impeller. In the present system, the impellers are getting eroded and are being periodically replaced, frequency of which was originally 3 months but as combustion problems are arising decision was taken to reschedule the replacement of impeller two and half months.

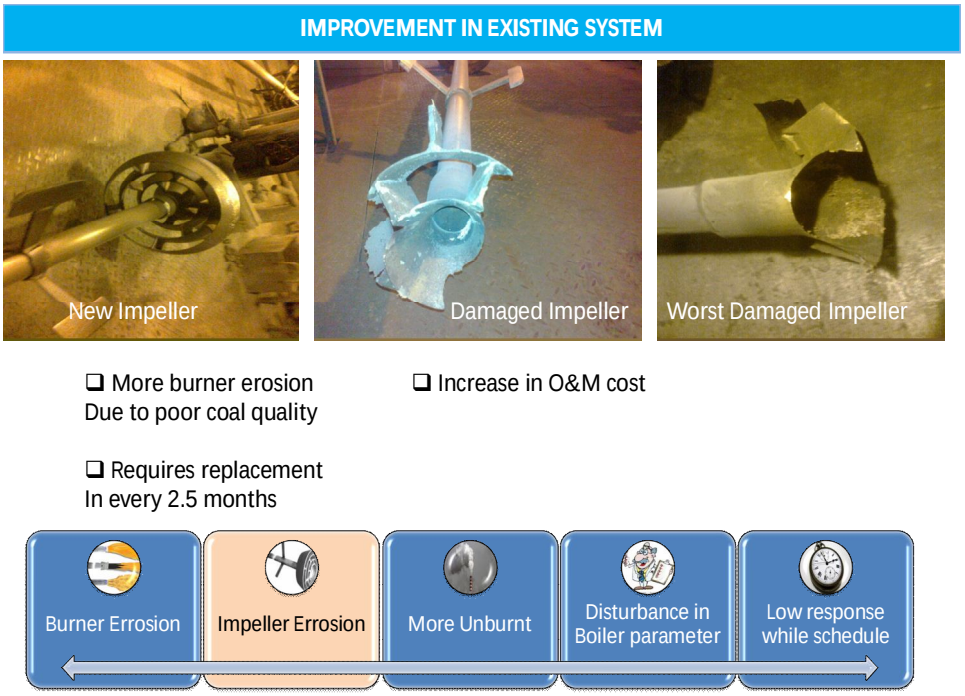


Fig-2

As this replacement frequency is also not giving desired results in all cases examples of which can be seen in the figs 2. Erosion of impellers causing metal temperature excursions and less O2 problems, MS & HRH mismatch between LHS and RHS temperatures. This is also leading to higher reheater spray affecting unit Heat Rate.

IMPROVEMENT IN EXISTING SYSTEM

Retrofitting Burners of stage 1 with Controlled Combustion Venturi burners

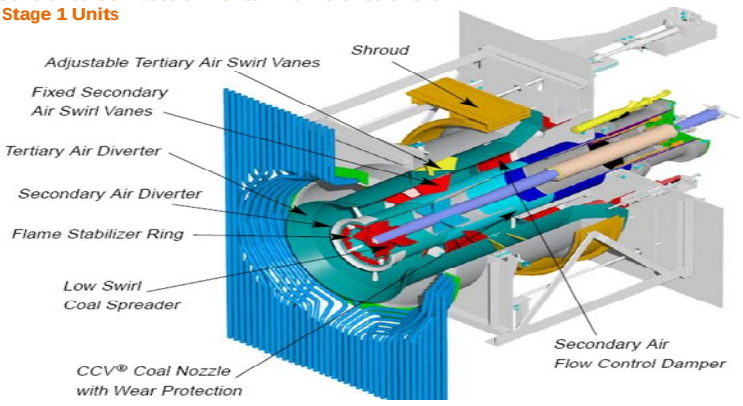
- EASY INSTALATION WITHOUT REPLACING BURNERS
- SIMPLE DESIGN, EXCELLENT MECHANICAL RELIABILITYLONG LIFE
- LOWER PRESSURE DROP ACROSS BURNER
- EXCELLENT AIR FLOW DISTRIBUTION
- EXCELLENT FLAME STABILITY

FRONT FIRED boilers are giving low flame stability when operating at low loads. Environmental norms becoming more and more stringent for NOX emissions. This problem is becoming more prevalent for older units as frequent backing down situations are arising. CCV burners seem to be promising solution to overcome these problems. Some of the salient features of CCV burners are as follows.

- Venturi type coal nozzle to concentrate the coal at the centre of the burner which gives the desired coal air distribution by a coal spreader.
- Vane type coal spreader at the centre for controlled mixing of coal and secondary air.
- Adjustment of spreader position for desired flame shape
- Secondary air diverter promotes rapid devolatilization of the coal in the reducing environment in Primary combustion zone which reduces the Nox formation.
- Flame stabilization Ring in the burner Nozzle creates local low pressure region near burner tip helps internal recirculation, enhance the flame attachment and flame stability at low loads.
- Register turning vanes in the secondary air which can be used for adjusting the secondary Swirl, flame turbulence and combustion completeness.
- Secondary air shroud to control the secondary air for improved burner turn down.
- Facilitates for equalizing fuel and air flow to each burner, for correct distribution of fuel and air.
- Burner air swirl direction alignment of adjacent burners in vertical and horizontal directions avoiding flame interference to ensure smooth combustion and uniform heat flux in the furnace.

IMPROVEMENT IN EXISTING SYSTEM

Controlled Combustion Venturi Burners retrofit for Stage 1 Units



As 660 & 800 MW boilers are already being provided with CCV burners in new units, cost – benefit analysis has been carried out against the O&M cost for older burner assemblies and payback period calculated.

NOX REDUCTION BY RETROFITTING LOW NOX BURNERS

NEW CCV BURNER TOTAL INSTALLATION COST (Rs 260/KWHR) **: 5.2 CRORES**

CURRENT COAL BURNERS COST (O&M COST) **: 19.8 LACS**

- TOTAL UNBURNT SAVED : 0.3%
- HEAT RATE IMPROVEMENT BY 13.5 KCAL

AMOUNT SAVED DUE TO UNBURNT AND HEAT RATE IN 2 YEARS **: 5.72 CRORES**

(Note : Cost excluding APC saved)

Payback Period : 2 years

Extra advantages
- ❑ APC cost save / year : 24 Lacs
- ❑ Nox reduction

100% utilization is one of the major target of NTPC. Rigorous research work is under progress to utilize fly ash in different application and to some extent it is being implemented also, but huge amount of ash coming from stations is still being dumped in ash ponds. Glimpse of the fly ash utilization target by MOEF is as follows.

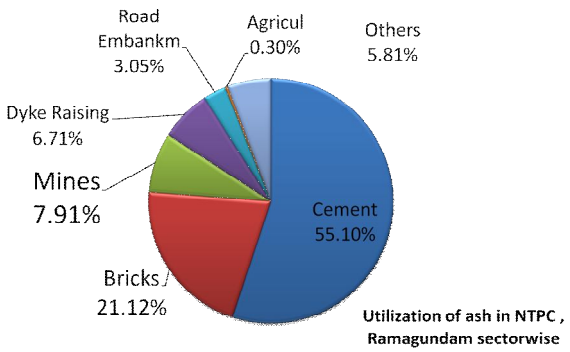
Targets set by the MoEF as per the notification

Reduction in Disposal of Ash

S.No	Target of Fly Ash Utilization	Target Date	To be achieved by the end of the year
1	At least 50% of Fly Ash generation	One year from the date of notification	2010
2	At least 60% of Fly Ash generation	Two years from the date of notification	2011
3	At least 75% of Fly Ash generation	Three years from the date of notification	2012
4	At least 90% of Fly Ash generation	Four years from the date of notification	2013
5	100% of Fly Ash generation	Five years from the date of notification	2014

Utilization of ash in Ramagundam is shown in fig. where Major part is being utilized by Cement industry, where as minor part being Agriculture industry.

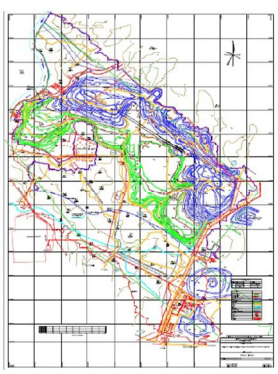
Utilization of ash in Ramagundam



Utilization of ash in NTPC , Ramagundam sectorwise

Out of total ash generated 80 % being fly ash and 20 % being Bottom ash. Coal mines which have used sand for void filling till date are facing acute shortage of the same due to stringent norms by the government. They are searching for an alternate source and bottom ash due to its sand like property has the potential in this arena, But this utilization by coal mines will only solve problem of 20% ash generated. Recent research by Indian scientists have shown very promising results in converting fly ash into non flyable form which gives it sand like property allowing it to be used in void filling of mines. This is the area, which is yet unexplored. This is a win-win situation for both the industries. If fly ash becomes alternate for sand in void filling days are not far when 100% fly ash utilization can be achieved. With proper planning and coordination with coal mines, collateral damage to environment can be minimized.

Use of Ash for open cast mines



Advantages of using fly ash with OB

Mixing the fly ash increases the mechanical strength of the dump as fly ash absorbs the moisture from clay and increases the overall strength of the mixture due its Pozzolanic properties.

As the specific gravity of fly ash is very low compared to that of the overburden this reduces the overall weight of the dump slope and increases the stability of the dumped slope.

CONCLUSION:

Changing grid conditions are demanding retrofitting of older units as and when necessary. To keep the promise of 100% fly ash utilization and meeting stringent environmental norms are mile's journey, that has to be started with small steps. This paper is focusing on small steps that can help NTPC in achieving its long term goals.

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