

Why Indian Coals Need to be Washed ?

— R K Sachdev*

Preamble

Due to their very generic nature (formation by Drift process), Indian coals contain are high ash content. The quality of Run of Mine (ROM) coal gets deteriorated further due to predominance of opencast mining because of mixing of extraneous OB debris.

Therefore, Indian thermal coals require washing for the following reasons:

- Due to higher ash content in coal, transport costs increase particularly for power plants.
- Due to inconsistent and poor quality of coal, burning is not uniform which adversely impacts the boiler efficiency, emissions and increases maintenance costs.
- Larger area for ash dumps is required, and,
- SPM, SO_x and NO_x emission are higher.

Coking coals need washing to bring down the ash content from prevailing 25 to 40% (some time more) to 15 - 16 % (now SAIL is demanding 13 % ash coals) to meet their technological specifications.

Benefits of using washed coal

Washing of coal is a simple physical process using various gravity based techniques by which ash contents can be reduced to a desired level. Washed coal has lower ash content, higher heat value, uniform size and consistent quality. By using washed coal following benefits accrue to the power plants:

- Reduction in transportation costs.
- Lower ash content in coal reduces SPM and SO_x emissions.
- Significant improvement in thermal efficiency of boilers.
- Studies have shown that for each percentage point increase in thermal efficiency, the CO₂ emissions reduce by 2-3 percentage points.

- High quality coals improve efficiency by avoiding fouling / slagging problems in the boiler, which tends to raise flue gas temperature, increase heat loss, can cause accidents.
- IEA estimates that the coal-fired power plants in India can increase thermal efficiency up to 10% by switching from unwashed to washed coal.
- One can estimate the extent of reduction which can be achieved in greenhouse emissions by increasing thermal efficiency (approx. 20% on 10% increase in efficiency).
- Using low ash coal in power plants can reduce the cost of ash handling, reduce fly ash generation, and extend ash disposal landfill site life by 12-20%.

Field trials carried out at power stations using washed coal

- Starting from D V Kapoor committee (1978-79), number of committees have recommended that all power grade coals should be washed before dispatch.
- In mid eighties actual trials using washed coal at Satpura TPS were jointly conducted by Planning Commission, CEA, and CIL etc under the supervision of an independent agency (NPC). Subsequently, CEA and MSEB conducted trials at Koradi and Khaperkheda power stations.
- Results of these trails clearly indentified and quantified the benefits of burning washed coal by the power plants.
- International Energy Agency (IEA) has also carried out analysis and highlighted the advantages accruing from use of washed domestic coal in Indian power stations.

Paper written by Shri D N Prasad, Former Adviser (Projects), Ministry of Coal can be referred to for more details on various studies in CPSI Magazine Volume - VIII; Number - 21; August, 2016.

*President, Coal Preparation Society of India.

Mandate of MoEFCC:

- MoEF's original notification of September 19, 1997 had stipulated that power plants which are more than 1000 km away from the pit-head and those situated in urban and environmentally sensitive locations, have to use coal having less than 34 per cent ash content.
- Vide notification dated 2nd January, 2014 (effective from January 2016) Government reduced the mandated distance to 500 km and also brought under its ambit, both Supply and Use of Coal with ash content not exceeding 34% for the coal based Thermal Power Plants.

Background of 1000 KM distance mandate

- In late eighties, an inter-ministerial committee was constituted by Planning Commission with members from MoC, MoP, MoEF, Railways CEA, Coal India, NTPC etc. This committee after discussions concluded on the basis data available that due to reduced quantity of washed coal to be transported, in case of power plants located more than 1000 KM from supply source, the saving in freight alone would cover the additional cost of washing. This exercise was based on study of data pertaining to Dadri and Kayamkulam power plants, which were in active consideration of the government.
- Based on the recommendations of the above mentioned committee, Piperwar coal mine and Washery integrated project was sanctioned by government for supply of washed coal to Dadri power station of NTPC. (Kayamkulam Project that was originally based on coal was dropped).
- Mandate of reduced distance of 500 KM came into effect from June 2016 vide notification dated 2nd January, 2014, when the Government reduced the mandated distance to 500 km and also brought under its ambit, both Supply and Use of Coal with ash content not exceeding 34% for the coal based Thermal Power Plants. This was done to have coal washeries closer to the mines so as to reduce the avoidable cost of transportation of carrying ashes and minimise the fly ash pollution threat in the periphery of the plant site.

- Background of reducing the distance was that the MoEF's efforts were focused on gradually making of washing of all coal mandatory so that pollution levels in and around coal based power plants is reduced to minimum.

Why adequate washing capacity has not been created so far?

- It is fact that while stakeholders are convinced of the benefits of using washed coal, adequate washing capacity has not been set up by CIL. Reasons for this situation are:
 - i. Unfortunately both the washery operators and the government over emphasized on the need to use washery rejects. The washery operators found more profitable to sell rejects and more often ROM coal in the name of rejects. The whole process became reject centric and keenness on getting washed and superior coal diminished. It is this 'reject' centric approach that has been largely responsible for holding up large scale introduction of coal washing facilities.
 - ii. World over washery rejects are being dumped/ backfilled in the mines. Going by convention and international best practices coal companies must shed this mind set - Reject Centric approach.
 - iii. Where, rejects can be used for alternative uses like brick burning, these can be disposed off under a well articulated policy making siphoning off good coal in garb of rejects difficult.
 - iv. Internationally coal production and sale is computed on the basis of 'Saleable Coal' of a given set of standard parameters like - GCV, Moisture, Volatile Matter and Sulphur content etc.
 - v. In India, 85% of coal is produced by CIL and in a situation of perpetual shortage CIL finds that washing may reflect a substantial reduction in their output and hence does not support washing and improving the quality of coal.

- vi. Power plants, for reasons best known to them, are also responsible to a great extent for not insisting for supply of coal of right quality. They have been made to understand that washing will substantially increase the cost of fuel which is not a fact. Mere washing activity is known to cost only Rs.80 to Rs.120.
- vii. In some responsible quarters, there is a perception that power plants can use coal with high ash content without any problem. No doubt that power house boiler can burn coal with high ash content also but at what cost to the economy and the environment? If this was possible without any damage / cost then why other major coal producing countries, despite of the fact that their coals have much lower ash content, are washing their coals at the mine mouth?

Cost impact of coal washing

- Economics of coal production & usage is more sensitive to coal transportation than any other factor. Landed price includes freight which today is around Rs. 1.60/tkm. For a power plant located at 500 km, taking clean coal yield as ~ 80%, saving in freight alone is $1.60 \times 500 \times 20 = \text{Rs. } 160$. Other benefits are additional.
- Reduction in ash content or increase in clean coal yield lowers the transportation cost based on the equivalent thermal value of coal.
- Increase in CAPEX and OPEX of Coal Washing Plant has only minor impact on revenue. The higher yield offsets the higher CAPEX and has a net positive effect on overall revenue.
- Transportation of coal in India is becoming a challenge. Railways get additional carrying capacity of ~ 20% at zero capital cost.
- Coal washing can reduce this problem by reducing the amount of coal transported by delivering the same total thermal value of coal in lower tonnage to the power plants.
- It is the coal company fixes the grade of coal and also the price of coal. Since this is a commercial

matter the coal company is fully competent to change the price schedule.

Why power stations are reluctant in accepting washed coal?

- Power plants are always happy if coal of better and consistent quality is supplied. Problem is as follows:
 - i. In the name of washed coal power plants get mixed quality of coal from multiple sources.
 - ii. In absence of adequate coal washing capacity, power plants pay more but get coal of inferior than stated quality.
 - iii. Power stations receiving washed coal from merchant washeries set up by private parties, have to pay higher transport cost due to multiple transshipments (ROM coal to washery and washed coal to railway siding)
 - iv. If CIL puts up coal washeries at the pit head this problem gets automatically solved.

Benefits accruing to plants by using washed coal:

- Reduction in transportation costs.
- Lower ash content in coal reduces SPM and SO_x emissions.
- Significant improvement in thermal efficiency of boilers.
- Studies have shown that for each percentage point increase in thermal efficiency, the CO₂ emissions reduce by 2-3 percentage points.
- High quality coals improve efficiency by avoiding fouling/slugging problems in the boiler, which tends to raise flue gas temperature, increase heat loss, can cause accidents.
- IEA estimates that the coal-fired power plants in India can increase thermal efficiency up to 10% by switching from unwashed to washed coal.
- We can just imagine how much % points (20-30 % points) reduction can we expect in greenhouse emissions.

- Using low ash coal in power plants can reduce the cost of ash handling, reduce fly ash generation, and extend ash disposal landfill site life by 12-20%.
- Last but not the least, a new power plant designed on lower ash content saves on capital cost of around +/- 10%.

Way forward

- In recent past Coal India has revived its plan to set up coal washeries for a capacity of about 150 - 200 mtpa in next couple of years. Tendering process is underway. But looking at past record of Coal India, unless the company takes the implementation in a sincere and committed manner, it is very unlikely that new washeries will at all get established.
- With regard to ash and distance limit, Government must mandate that all coals must be washed irrespective of distance / location of consumers.
- The ash limit of 34% should be done away with and heat value in terms of Gross Calorific Value (GCV) of 4500 kcal/kg should be adopted as mandated heat value for coal to be dispatched from coal mine lease area, whether by public sector or private ones.
- Since it will take some time before coal companies to have adequate washing capacity, government should allow about three years time to CIL / coal companies to set up adequate washing facilities at pit heads. This, of course, would necessarily

require taking up a large number of coal washery projects in different coalfields. In order to realise this objective, and to make it happen Coal India must adopt more rational tendering system and conditions attached to the tenders. Such conditions should be in line with accepted commercial practices as being followed by other major PSEs like NTPC, SAIL etc.

- a. NITI Aayog or MoEF&CC can consider constituting an expert committee of members drawn from CPCB, CIMFR, IIT (ISM), CPSI etc, and have the issue studied to help the Ministry to fix a threshold for GCV and other related parameters.
- b. As the use of washed coal would also be beneficial to the power plants to comply with the new emission norms to great extent, it is in the interest of all stakeholders to accept the use of washed coal, which is in the overall interest of the Nation as it will also help in meeting some of NDCs for meeting CO₂ emissions targets agreed at the Paris Climate Treaty.

In the backdrop of various economic as well as environmental benefits accruing from use of washed coal, Government must adopt a holistic approach and formulate a policy for use of washed coal. While formulating the policy we should not ignore the fact that in view of scarcity and near 90% import dependence of oil and natural gas resources, India will continue to be heavily coal dependent for many years to come, may be forever, albeit in reduced volumes.