

CLEANING THE COAL

B.P. Singh, ED (CM&CW), NTPC Ltd.,

Presentation Outline

- Coal Scenario
 - Global
 - India
- Indian Coal Quality – An Overview
- Coal Quality – Power Sector Concerns
- Cleaning Coal - The Need
- Cleaning The Coal
 - Options.
 - Current Status
- Issues Faced by Industry
- Enablers to Set Up Washeries
- To Sum Up

Coal Scenario - Global

World coal reserves stand at about 850 Billion Tonnes.

About 92% of the reserves are concentrated in Asia Pacific, Europe and North America.

Globally both coal production and consumption have grown at CAGR of 3% over the decade and all through its availability has been in deficit situation.

Hard Coal Consumption

Year	1986	1996	2006
World (MT)	3232	3773	5339
% Increase over 1986		16.7%	65.2%
Selected Regional Aggregate Estimates			
Europe	17%	11%	7%
Former Soviet Union	17%	8%	6%
North America	21%	23%	18%
Asia Pacific	39%	53%	65%

There is notable increase in Rate of consumption of the Hard coal in the Asia Pacific Region

Coal Scenario - India

- ❖ India is endowed with 253 billion Tera-tonnes of Coal Reserves.
- ❖ The proven reserves stand at about 98 billion tonnes, corresponding to 10% of world's total proven reserves.
- ❖ 84% of the country's coal production is from Open Cast Mines.
- ❖ 75% of the total Coal produced in the country is consumed by the Power Sector.
- ❖ While the Good thing about Indian Coals is that they are low in sulphur, however, they have very high Ash Content.
- ❖ Indian coals have high Ash (30% to 45%, compared to Ash in coal at Developed countries (15 to 20%).
- ❖ When compared on energy terms, it may be misnomer to state these reserves as huge.

Cleaning of Coal (Coal beneficiation) assumes importance from environment & long distance transportation point of view

Indian Coal Quality – An Overview

- Indian coal has high Ash as it is supposed to have been formed by virtue of drift theory.
- Added to the inherent Ash, there is dilution in quality of coal due to mining and related activities.
 - In 1970-71, OC mining constituted only 20% of production
 - Currently about 85% of coal is produced through OC mining
 - Due to dilution the quality of coal (GCV) has been deteriorating
 - Early 60's around 5900 K Cals/Kg
 - By 70's around 5250 K Cals/Kg
 - By 80's around 4200 K Cals/Kg
 - By 90's around 4000 K Cals/Kg
 - Presently around 3500 K Cals/Kg

Coal Quality - Power Sector Concerns

- ❖ Power Plants are designed for a particular Coal Quality range and deviation in quality adversely affects the performance and efficiency of the Plant.
- ❖ The key area of concern are:
 - ❖ Ash in coal - As high as 45%.
 - ❖ Inconsistency in Quality of Coal.
 - ❖ Chemical Quality
 - ❖ Physical Quality.

Cleaning Coal – The Need

- Presence of mineral matter in coal has detrimental impact on Power Plant equipments and would cause high wear & tear on Coal and Ash flow paths, combustion chambers, Mills, Crushers etc.
- High Ash also impacts plant's thermal efficiency.
 - ❖ Calls for higher coal consumption, which may Generate higher CO₂ and other Green House Gases
 - ❖ May generate high Particulate Matter Emissions.
 - ❖ Higher Particulate matter in turn may:
 - Impair lung functions
 - Constrictions in respiratory passage
 - Damages to lung tissue.
 - Certain particles are suspected to cause cancer.

By using Clean Coal we get – Improvement in plant availability, increased equipment life, economy in long distance transport, better environment and so forth – Thus the Need to Clean Coal.

Cleaning The Coal

❖ There are various options for removing of impurities / reduction of Ash from the coal.

➤ **Coal Extraction Stage:**

- ✓ Judicious Mining – Removal of dirt bands separately.
- ✓ In Situ Gasification – Still at Infancy stage

➤ **Post Coal Extraction Stage:**

- ✓ Washing / Processing the Coal
- ✓ Blending high Ash Indian Coal with Low Ash Imported Coal
- ✓ On Surface Gasification – adoption of IGCC – Attempts are underway

Cleaning of Coal – Current Status

- ❖ Indian Coal Washeries committee (ICWC), in 1925, concluded that Indian coals are difficult to wash.
- ❖ Over the period, there have been technological developments and coal washing is getting matured for Indian Coals.
- ❖ Currently India has:
 - 20 coal washeries (32.37 MTPA) for Coking Coal
 - 28 coal washeries (70.35 MTPA) for Thermal coal & three more (Approx 21 MTPA) under various stages of construction/approvals.

Cleaning the Coal

..... contd

At Mining Stage-Selective Mining

- o Eliminate stone bands, to the extent possible, during mining.
- o Currently in India Inter Seam Stone bands upto 1 m thick are mined along with coal.
- o The Method aims at eliminating stone bands upto as low as 150 – 200 mm.
- o Can be done by mining the coal in thinner slices – would call for deploying smaller sized equipments.

Key Concern/Limitations

- o Productivity - Small sized equipment
- o Larger fleet - Safety
- o Economics

- NTPC plans to introduce this practice at all of its coal blocks.
- Simulated model for a particular mine depicts reduction in Ash% by 3 to 4 % without loosing much of combustible contents

Cleaning the Coal

..... contd

Coal Beneficiation

Involves mechanical separation of Inert matter from mined coal.

Steps Involved:

❖ Raw coal Pre-Treatment

- ✓ Successive Crushing and Screening - Inert material is hard & difficult to crush – Gets retained as oversize and removed at successive crushing/screening stages

NTPC had introduced Rotary Breaker at one of its power plants
Key Concern/Limitations of the system are

- Low Throughput – Not conducive for large scale coal handling
- Efficacy of separation is Poor
- Lot of coal may go as waste and need Re-segregation.

Cleaning the Coal

..... contd

Coal Washing

Pre-dominant separating principles:

- ✓ Separation based on differences in Relative Density (RD) between coal and associated mineral matter; pure coal has an RD of ~1.3 and associated mineral matter commonly has an RD of >2.2.
- ✓ Separation based on differences in surface properties between coal and associated mineral matter; coal is hydrophobic, whilst associated mineral matter is generally hydrophilic.

Pre-dominant Processes:

- ✓ Heavy/Dense Media Separation – Based on simulating the effect of using a liquid of appropriate density to effect a float/sink separation of coal from associated mineral matter.
- ✓ Jig Washing – A process that relies on pulsation of water through the particle bed to stratify particles of different density. Higher-RD shale particles, form the lower layers, and separated from clean coal using a shale discharge system.

Coal Washeries in India

Existing Coking Coal Washeries		Number	Capacity (MTPA)
1	CIL	12	20
2	Others	8	12
3	Total	20	32
Existing Non Coking Coal Washeries			
1	CIL	7	20
2	Others	21	50
3	Total	28	70
Non Coking Coal Washeries under construction			
1	Others	3	20
GRAND TOTAL		51	122

Development of Coal Washeries in India is not keeping pace with the growing demand for washed coal.

Broad Issues of Concern are:

- i. Assurance on supply of requisite quantity & desired quality of raw coal (both physical & Chemical from the linked source(s);
- ii. Availability of land for setting-up washery
- iii. Availability of land for disposal of washery waste i.e., rejects;
- iii. Access to associated infrastructure such as Power, Water, Railway Siding etc.

Sourcing of coal from one company and getting it washed through another agency has series of inherent risks, which may add to the cost of washing

- Issues faced by the industry

1. Availability of Basic Infrastructure – Land, Water, Power
2. Disposal of Rejects – For every 1% reduction in Ash, Yield drops by about 4% i.e. Quantity of rejects is thus far in excess of Ash%.
3. Maintaining Clean Coal Quality – No Control on Input Coal Quality.
4. Development of reliable and accurate sensors for coal quality monitoring.
5. Cleaning and dewatering of Ultra fine coal.
6. Desulphurization of High- sulphur coal. Application of Dry coal beneficiation processes for arid regions.

Enablers for Setting-up of Washery

Parameters that need to be ensured for washery project to become viable are:

- Firm source of coal supply.
 - Commitment on supply of evenly spread and defined quantity of coal over a reasonably long period say 15 to 20 years.
 - Commitment on quality of raw coal feed (Size, Ash, Moisture etc).
 - Providing Land for setting-up of washery
 - Allowing backfilling of rejects into the mine.
 - Sharing of infrastructural facilities such as Power, Water, siding etc.
-
- ✓ Developing coal washery in a cost effective manner, is possible, only if the coal washery is set-up by the coal Producer itself, wherein, he can make best usage of sharing of the common facilities.
 - ✓ This will also eliminate risks associated with achieving above stated parameters through contractual arrangement with washery developer

To Sum-Up

- Cleaning of Coal is necessary for
 - Reduction of Inert content in coal & Bringing in consistency in Quality of Coal. This will inter-alia result in -
 - Improved combustion – efficient plant operation
 - Reduction in plant size - Economy
 - Reduced emissions - improvement in environment.
- The process of coal cleaning will have to be tailor made depending on nature of seams and size of inter-bands, quality of coal, type of bonding of inert material with carbon content and the end use.
- The Choice of Technological developments both for coal beneficiation and end use plants will need to be evaluated for drawing a balance on extent of beneficiation required and the overall economic gains.

*Thank
You*