Waste Coal Utilization in India

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Situation Analysis

- Policy decision to supply washed coal to all consumers by 2011-12 except pit head consumers.
- Coal India, Ltd., (CIL) currently owns/operates 17 washeries (30 MTY Capacity).
- Plans to add 19 more on a BOM basis to increase existing capacity by 100.6 MTY.
- Predominantly high ash content (~30-40%), low calorific value (~4,000 Kcal/Kg) coal, but lower sulfur (~0.5%) compared to U.S. coal
- Existing boiler designs and highly dispersed mineral matter in Indian coal makes washing to below 25% ash unnecessary/impractical.

The New Challenges

- Increased generation of waste coal or reject coal.
- FBC combustion of waste coal.
- Need for sound waste coal utilization strategies/adoption of best practices.

Current Project and Expected Benefit

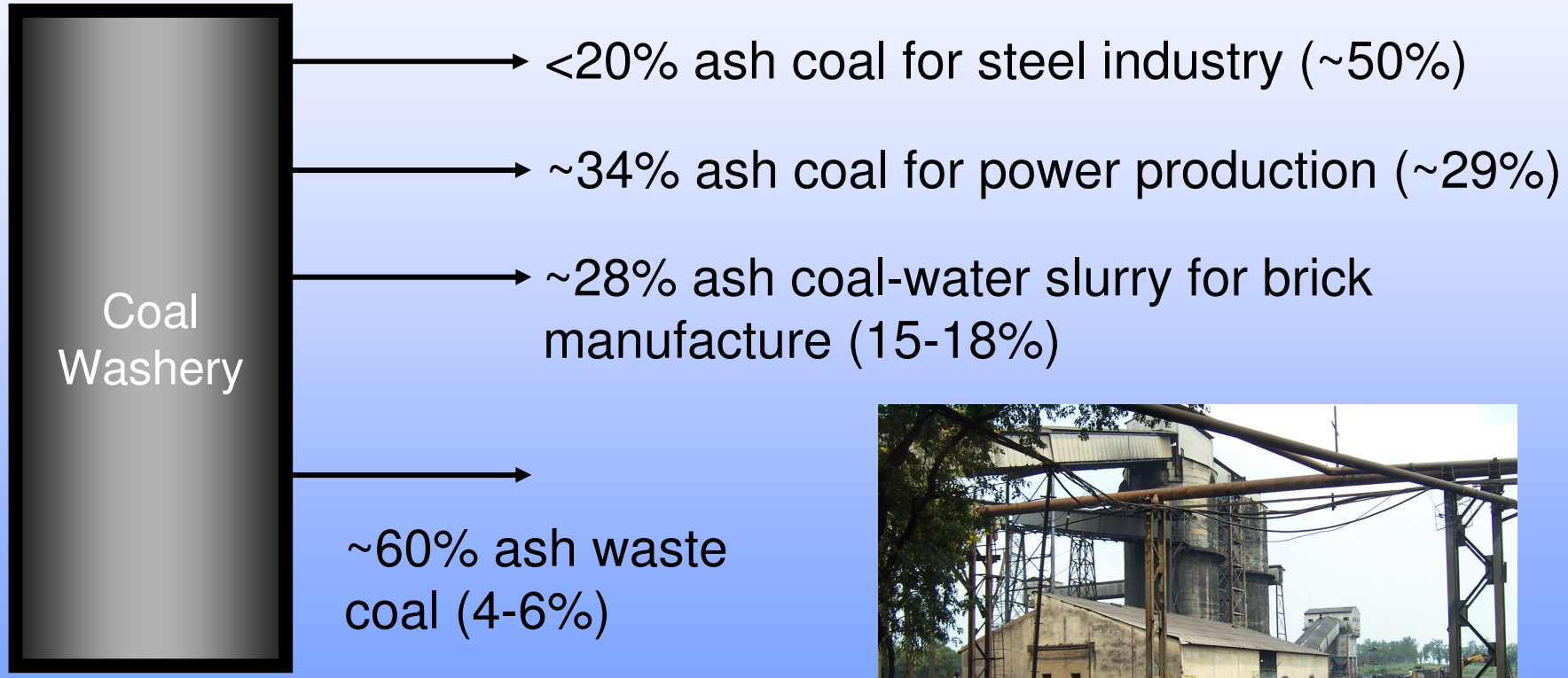
Assist with the development of a strategic planning document in conjunction with the Indian organizations involved.

(Mid-November, 2009)

Planned Approach

1. Evaluate existing coal washeries and current waste coal handling methods.
   - *A preliminary information list has been sent to CMPDI requesting information on this subject (completed).*
2. A visit to India to meet with officials of:
   - *The Ministry of Coal, Government of India*
   - *The Central Mine Planning & Design Institute Limited (CMPDI) (completed).*
3. Arrange a site visit for Indian delegates at the CWG Sep. 2009 meeting to a U.S. waste coal processing/power plant.
4. Assist in developing a strategic planning document for efficient burning and utilization of waste coal in India.

Indian Coal Washery Products



Waste Coal Utilization Options

- Fluidized Bed Combustion (current focus).

•Dewatering/drying for landfills, reforestation, mine reclamation.

Fluidized Bed Combustion

Advantages

- Currently practiced in 6 of CIL's 17 washeries
- Established technology (30 year plus).
- Equipment manufacture in India.
- Converts unsightly waste coal piles into electric power and porous aggregate-type ash particles.
- Existing demand for FBC ash for the building industry (bricks, cinder blocks) and road construction.

Fluidized Bed Combustion

Disadvantages

- Poor conversion of coal to power (btu/lb or kcal/kg; tons/kWh).
  - *Rs/kWh - Capital cost justification?*
- Produces a porous ash with increased potential for leaching of toxic elements during storage.
- Lower operating temperatures and excess air used in FBCs produce high NOx emissions and hazardous PAH emissions.
- Material flow problems, pulverizer and feeder wear
- Waste coal combustion sites in Pennsylvania suspected (but not proven) with increase in the incidence of Polycythemia Vera and other health issues.

Others Areas for Evaluation

1. Assess the potential and benefit of **reducing** waste coal generation and increasing **clean coal** output from Indian washeries using Dry Coal Cleaning Technologies:
   i. *All-air Jigs*
   ii. *Air Dense Medium Fluidized Bed Separator*
   iii. *Dual Density Fluidized Bed Separator*
   iv. *Electrostatic and Magnetic Separators**

2. Assess the cost-benefit of using waste coal in land fills, mine remediation, and re-forestation, including the cost of preventing toxic drainage.

Other Areas for Evaluation – cont.

3. Perform a comprehensive cost-benefit analysis that compares the following for application in India:
   a) *Dry coal cleaning technologies*
   b) *Waste coal for landfill applications and site remediation*
   c) *FBC combustion*

4. Host a team from India to visit modern coal preparation plants that incorporate fine coal cleaning, mined land reclamation operations, and FBC-based power producers.

Other Areas for Evaluation – cont.

5. Provide assistance to develop a list of best practices appropriate for Indian mines and washeries.

6. Assist with attracting U.S. technology providers and investors to implement these best practices in India as a demonstration or a BOM protocol.

7. Introduce and facilitate formation of JV agreements with U.S. partners to expand the model established in (6) above.

Thank You!