

# **COAL CLEANING PLANT SIMULATOR DISCUSSION**

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# LEVELS OF COAL CLEANING

- The implementation of coal washing has been categorized into levels of cleaning.
  - Level 1
    - Rough Scalping and Crushing
  - Level 2
    - Coarse Coal (+1/2 inch) Cleaning only
  - Level 3
    - Coarse and Fine Coal Cleaning
  - Level 4
    - Coarse, Fine, and Ultra Fine Coal Cleaning
  - Level 5
    - Level 4 Cleaning plus middlings crushing



# SAMPLING

- Technical evaluation of the target coals to determine the inherent characteristics (washability testing) will provide the initial critical data needed to achieve simulated computer modelling. Accurate sampling is critical. Sampling methods must be developed and standardized for use by the model.



# DATA INPUT AND USE

Tools in the form of curves that graphically represent the coal and allow the selection of theoretically achievable quality by gravity separation (and other techniques) are standard. These include:

- Size Distributions vs Ash
- Primary Curve
- Clean Coal Curve
- Discard Curve
- Relative Density Yield Curve
- $\pm 0.1$  relative density distribution curve
- Mayers "M" curve



# EQUIPMENT MODELING

- Raw Coal Handling
- Crushing
- Washing Devices, Selection and Applicability
  - Size Dependent
  - Material Specific Gravity
  - Ecart Probability ( $E_p$ )
  - Manufacturers Input
  - Refined log-logistic model of partition curves



# FLOWSHEET SELECTION

- Matrix of equipment by size fraction
- Simulation of each equipment
- Cost vs Benefit Sensitivity
- Combined Optimization



# ESTIMATING CAPITAL COSTS

- Major equipment
- Erection cost



# OPERATING COSTS

- Power Demand
- Labor
- Supplies
- R & M
- Administration



# SIMULATION METHODS

- Constant Overall Product Quality
  - Maximizes the overall clean coal yield by producing identical product quality
  - Does not guarantee maximum yield
- Constant Incremental Product Quality
  - Maximizes the clean yield by equalizing the ash content of the dirtiest particle
  - Good for single quality constraints



# SIMULATION METHODS

- Optimization Modeling
  - Uses high-order algorithms such as the Genetic Algorithm, a random search technique based on Darwin's theory of evolution.
    - Allows multiple product constraints



# POWER PLANT BENEFITS

- Transportation
- Grinding and Pulverizing
- Auxiliary Fuel Use
- Heat Rate
- Plant Efficiency
- Plant Availability
- Boiler Maintenance
- Emissions and Emissions Control Costs
- Fly Ash Handling & Disposal



# ENVIRONMENT BENEFITS

- Carbon Reduction
- Particulates
- Flyash Handling



# US ROLE

- Coal beneficiation design and equipment selection
- Coal beneficiation operations and maintenance
- Clean coal use in the Thermal Power Cycle
- Costs saving by Clean Coal Use
- Thermal coal power plant operations and maintenance
- Power generation from high ash washery rejects
- Computer modelling advisors
- Project Administration and Overhead
- Travel and Contingency



# SUMMARY

- US EXPERIENCE
  - INDUSTRY
  - INSTITUTIONS
  - RESEARCH GROUPS

