



Feasibility of Advanced Coal Cleaning for Near Zero Emissions

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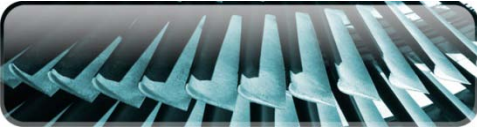
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A brief word about EPRI...Our Mission

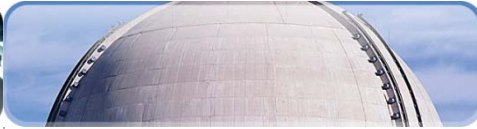
EPRI conducts research, development and demonstration (RD&D) relating to the generation, delivery and use of electricity for the benefit of the public. An independent, nonprofit organization, we bring together scientists and engineers as well as experts from academia and the industry to help address challenges in electricity.

A brief word about EPRI...Structure



Generation

- Advanced Coal Plants, Carbon Capture and Storage
- Combustion Turbines
- Environmental Controls
- Generation Planning
- Major Component Reliability
- Operations and Maintenance



Nuclear Power

- Material Degradation/Aging
- Fuel Reliability
- High-Level Waste and Spent Fuel Management
- Nondestructive Evaluation and Material Characterization
- Equipment Reliability
- Instrumentation and Control
- Risk and Safety Management
- Advanced Nuclear Technology
- Low-Level Waste and Radiation Management



Power Delivery & Utilization

- Distribution
- Energy Utilization
- Grid Operations and Planning
- Substations and Asset Planning
- Transmission and Increased Power Flow



Environment

- Air Quality
- Global Climate Change
- Land and Groundwater
- Occupational Health and Safety
- T&D Environmental Issues
- Water and Ecosystems
- Renewables

What is “Near Zero Emissions” Coal Cleaning

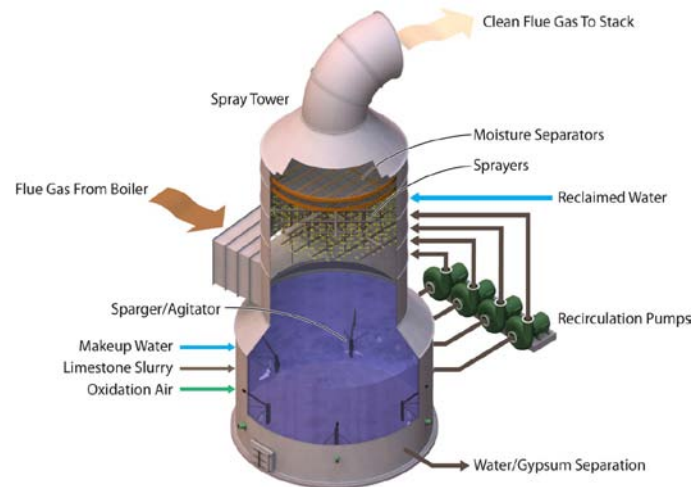
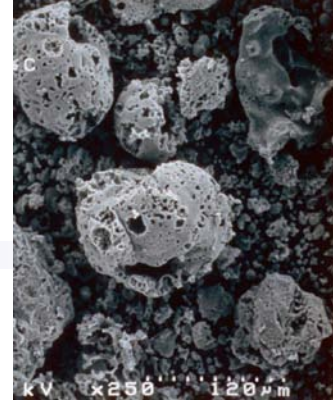
Removal of non-combustible materials from coal such that the “new” fuel works in concert with existing post-combustion controls and that it produces the lowest possible level of emissions.

Why “Near Zero Emissions” Cleaning?

- Anticipation that future regulations will be more stringent
- All fossil fuels (including nat. gas) are a finite resource
- Define a trade-off between ‘pre’ and ‘post’ combustion cleaning
- Higher quality fuel means:
 - Lower Net Plant Heat Rate (NPHR)
 - Reduced deposition, corrosion, erosion
 - Reduced auxiliary power requirements
 - Reduced solids handling
- What are the costs?

What Are the Emissions Benefits? *Need to be Quantified!*

- SO_x
- NO_x
- Mercury, other HAPs
- Particulates
- Multi-Media
- Heat Rate

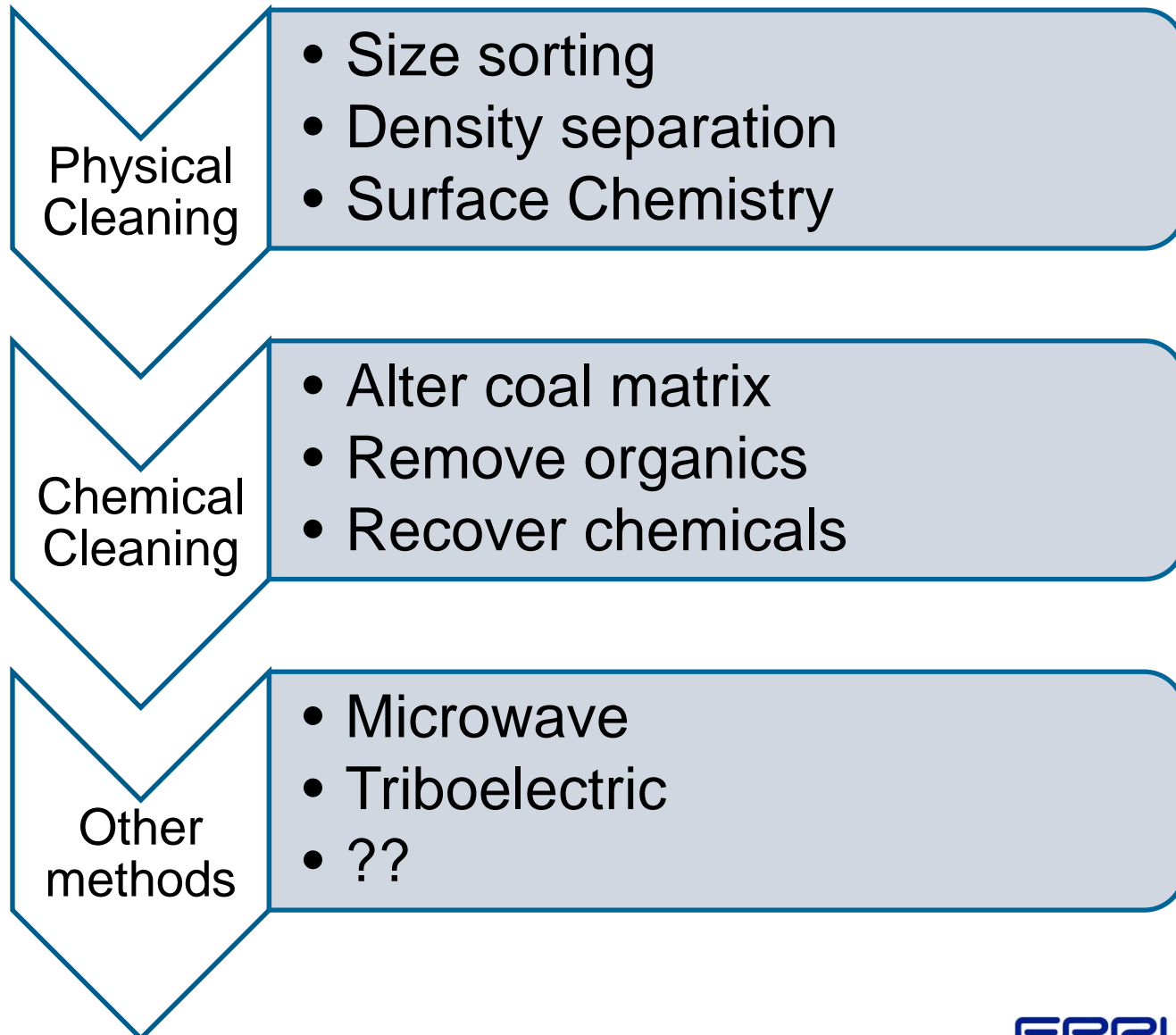


EPRI's Technology Innovation Research Program

Advanced Coal Cleaning for NZE

- Reviewed literature for “state-of-the art”
- Surveyed technologies and costs
- Contacted developers for tech specifications
- Conducting preliminary performance and economic analysis
- Identify promising technologies
- Select candidate host sites
- Conduct demonstration projects

Coal Cleaning Processes



Survey to Technology Developers

Facility:

- Size: 1,000,000 tons/year product
- Greenfield Site either at the mine or at the power plant; rail and/or barge access is assumed available
- Coal: Eastern bituminous (we will provide analysis)

Questions:

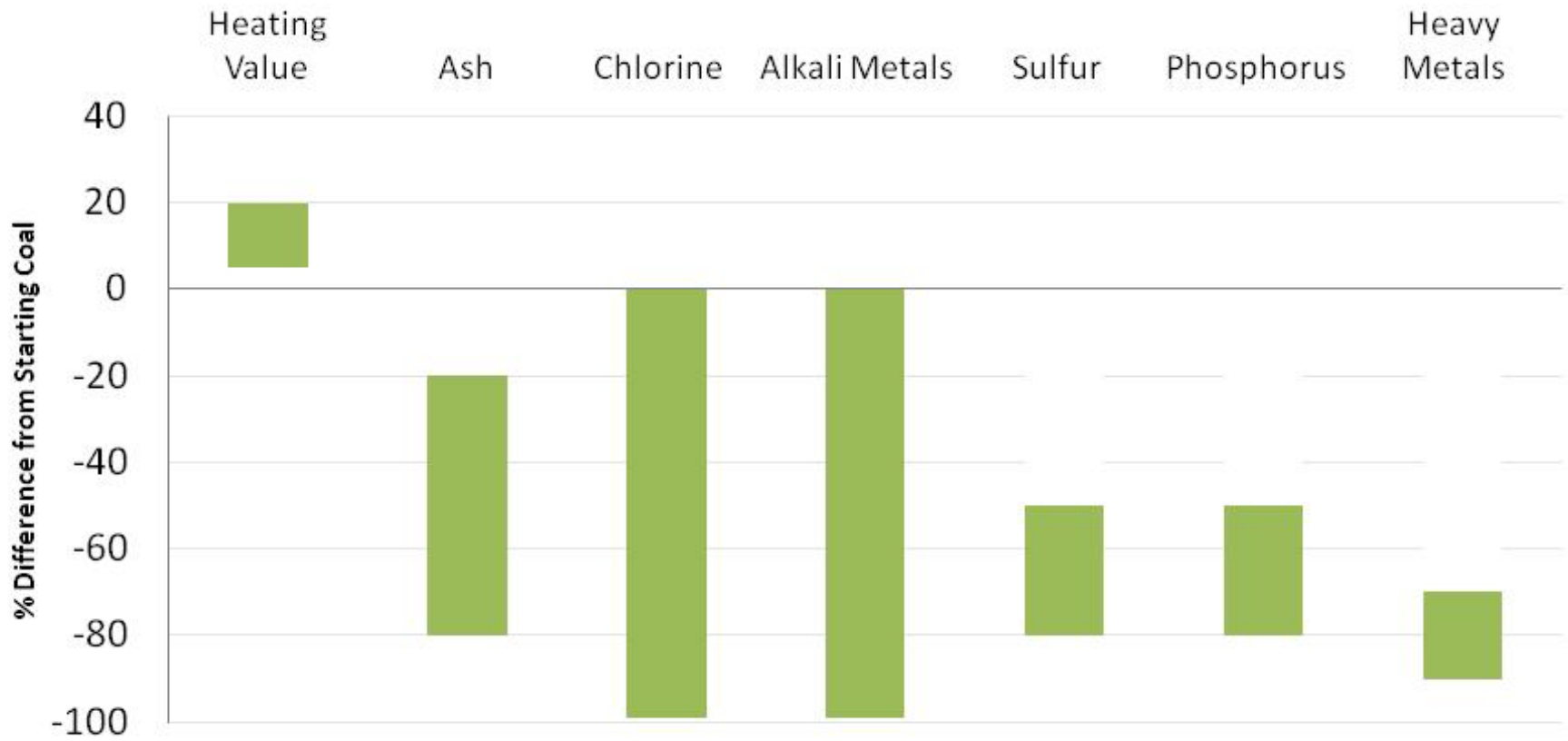
- What are utility requirements?
- What is the manpower requirement to operate the facility?
- What percent reductions in sulfur, mercury, trace metals, ash, and moisture are expected?
- What will the recovery percent be?
- What is the anticipated higher heating value of the product?
- What are the capital costs (2010 dollars) for the plant?
- What is the footprint or land requirement for the plant?
- What are the operating costs/year for the plant?
- What is the cost/ton product for the process?
- At what scale (size) have you tested your process?

Survey Respondents

- Chemical Processes
 - MacArthur Energy
 - Nu-Fuel
 - Thermorefinery Technologies
- Physical Processes
 - EXPORTech
 - Allmineral
 - FGX Septech

Range of Cleaning Capabilities

Anticipated Removal Rates From Process



EPRI PERFORMANCE AND ECONOMIC ANALYSIS

U1

- B&W balanced-draft, front-wall-fired
- 114 MW with LNB
- ESP, wet limestone FGD system

U2

- CE balanced-draft, tangential-fired furnace
- 180 MW with overfire air and low-NO_x burners
- ESP, and wet limestone FGD

U3

- CE balanced-draft, tangential-fired furnace rated
- 446 MW with overfire air, low-NO_x burners
- SCR, ESP, and wet limestone FGD system

EPRI PERFORMANCE AND ECONOMIC ANALYSIS (Cont.)

Two cases evaluated

- Case 1 – As-delivered coal compared to current coal cleaning technology
- Case 2 – As-delivered coal compared to fully cleaned coal and Best Available Control Technology on the downstream side
 - ACI + Acid gas control
- Two coals each from CAPP, NAPP, ILB regions

Conclusions

- No current technology meets “near zero emissions” level
- No pre-combustion technology is effective at reducing NO_x emissions
- Precombustion cleaning has several presumed advantages
 - Improved and more consistent coal quality
 - Reduced deposition, corrosion, erosion
 - Reduced demand for fuel-related equipment
 - Improved net plant heat rate

Conclusions (Con't.)

- Future emissions regulations may require removal far in excess of current or proposed clean-up technologies
- Future regulations may require pre-combustion and post-combustion technologies
- Technology gaps identified

Feasibility of Advanced Coal Cleaning for Minimizing Power Plant Emissions

Objectives and Scope

- Assess technical and economic feasibility of implementing advanced coal cleaning technologies at existing power plants
- Characterization of existing plant limitations
- Define retrofitting limits and balance-of-plant impacts
- Quantify benefits

Value

- Avoid conversion of mineral matter and related pollutants into “ash”
- Potential reduction in O&M costs
- Proactive strategy to minimize the costs of compliance with future air and water environmental regulations



Details and Contact

- Price: \$40,000
 - Qualifies for TC and SDF
- Jose Sanchez**
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- Tony Facchiano**
• afacchia@epri.com, (650) 855-2494
- SPN Number: 1025742**

Remove pollutant precursors before combustion

References

- *Program of Technology Innovation: Near-Zero Emissions – Precombustion Treatment Technologies Review: Prescreening and Literature Survey. EPRI, Palo Alto, CA: 2010. 1022389*
- *Program on Technology Innovation: Assessment of Coal Cleaning for Near-Zero Emissions (NZE): Performance and Economic Analysis Using Vista. EPRI, Palo Alto, CA: 2012. 1022075.*

QUESTIONS?