DEVELOPMENT OF “GREEN” COAL FOR UTILITIES*

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Who is WRI?

- WRI is a 501 (c) 3 research, technology development and contract services organization serving the energy and highway materials industries.

- WRI is a former U.S. DOE Energy Technology Center (LET). In 1983, LETC was privatized and WRI came into existence.

- Currently, WRI is a $13 million per year company employing about 75 highly skilled scientists, engineers and support personnel.

- WRI has two major Federal contracts:
  
  - A contract with the FHWA to apply asphalt chemistry to specifications for better highway performance.
  - A Cooperative Agreement with the U.S. DOE wherein we work jointly with industry to support the needs of the coal and power industries.
A Renewable Portfolio Standard (RPS) is a policy that seeks to increase the proportion of renewable electricity used by retail customers.

From a utility’s perspective, cofiring biomass in an existing coal-fired facility is the easiest way to achieve these targets.

Biomass cofiring in an existing power plant needs to be hassle-free with little or no equipment modifications.

- Storage, Transport & Handling Characteristics?
- Pulverizing/Grinding?
- Heating Value?
- Ash Deposition/Fouling?
- Corrosion?
Based on economic considerations, biomass can not compete with coal...

- Biomass is a low-grade fuel
- Biomass is a high cost fuel
- Biomass has a low bulk density
- Biomass is wet and strongly hydrophilic
- Firing biomass with high moisture content has a negative impact on boiler efficiency
Make biomass compatible with existing power plant equipment

Reduce moisture content
Increase heating value
Improve grindability & handling
Impart hydrophobicity
Increase energy density

Make Biomass Behave Like Coal!
RBE’s Coal Upgrading Technology
RBE Technology

- Fluidized bed-based technology
  - Continuous process
  - High Throughput
- Coal is processed in an oxidizing environment
  - Source of heat is coal
  - Oxygen is consumed
  - Drying occurs at 600 F
  - Temperature control via feedrate
- Rehydration to equilibrium moisture
  - Product equilibrium moisture 5-9%
  - Parent 25-30% moisture

- Increases heating value of low-rank coals
- Reduces particle size and dries coal
- Partial decarboxylation and desulfurization

Figure 1(a) - RBE Coal Upgrading Process
RBE Technology

Pilot Plant

Up to 400 pph, air blown fluidized bed reactor
RBE Technology

Demonstration Plant – 40 tons per day
RBE Technology

Technology Advantages…

- Two key process steps to making a stable product from low-rank coals
  - Processing in oxidizing conditions
  - Rehydration of product to equilibrium moisture
  - Product is stable and not subject to spontaneous combustion
Technology Advantages…

- Two key process steps to making a stable product from low-rank coals
  - Processing in oxidizing conditions
  - Rehydration of product to equilibrium moisture
- Product is less dusty
Technology Advantages…

- Cheap source of heat; Coal itself
- All processing occurs in a single reactor
- Continuous, high-throughput process
Biomass Processing

River Basin Coal upgrading technology can be used for processing biomass (Torrefaction?)

- Upgrades energy density
- Increases reactivity
- Improves grindability and handling properties
- Processes in oxidizing environment
- Produces a stable, hydrophobic product
- Converts biomass into a coal-like feedstock
- Low-rank coal and biomass can be co-processed to produce a homogeneous blend
Biomass Processing

Equilibrium moisture content processed biomass 6-9% range

HGI and HHV of woody biomass as a function of temperature
We have completed tests in our demonstration facility to produce a product with excellent “grindability” and hydrophobic characteristics suitable for outdoor storage in the utility coal stockpile, pulverizing and co-firing with coal.

We have successfully produced wood chips, increasing the BTU value to 9,400 Btu/lb (upper picture).

The product can be directly consumed, pelletized, or combined with coal to produce a coal/biomass pellet (green coal).
Imagine…

- A plant coprocessing Wyoming subbituminous coal and wood chips from pine beetle kill, agricultural residue, energy crop
- Coal is dried and upgraded by self heating using RBE technology
- Waste heat from coal upgrading torrefies biomass

Imagine the economics of such a process
Imagine the emissions benefits
Questions?