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CLEAN SOLID FUELS FOR THE 21ST CENTURY

Engineered Coal Fuels for US Energy Association

Target Boilers

- Need to reduce CO_2
- Need to control Mercury
- Need to control HCl
- Need to employ Renewables
- No Activated Carbon Injection
- No Wet Scrubber

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Solution

- On site upgrade to Engineered Coal Fuel
  - Reduce Moisture, Mercury, Chlorine in fuel
  - Use waste plant heat for an energy source
- Results:
  - Mercury Compliant and HCl
  - Increased Btu/lb fuel
  - Lower CO_2 emission
  - Up to 50% renewable biomass addition
  - Reduced costs: fuel feed, milling, air, PM, ash, CO, NOx, SOx, make up water

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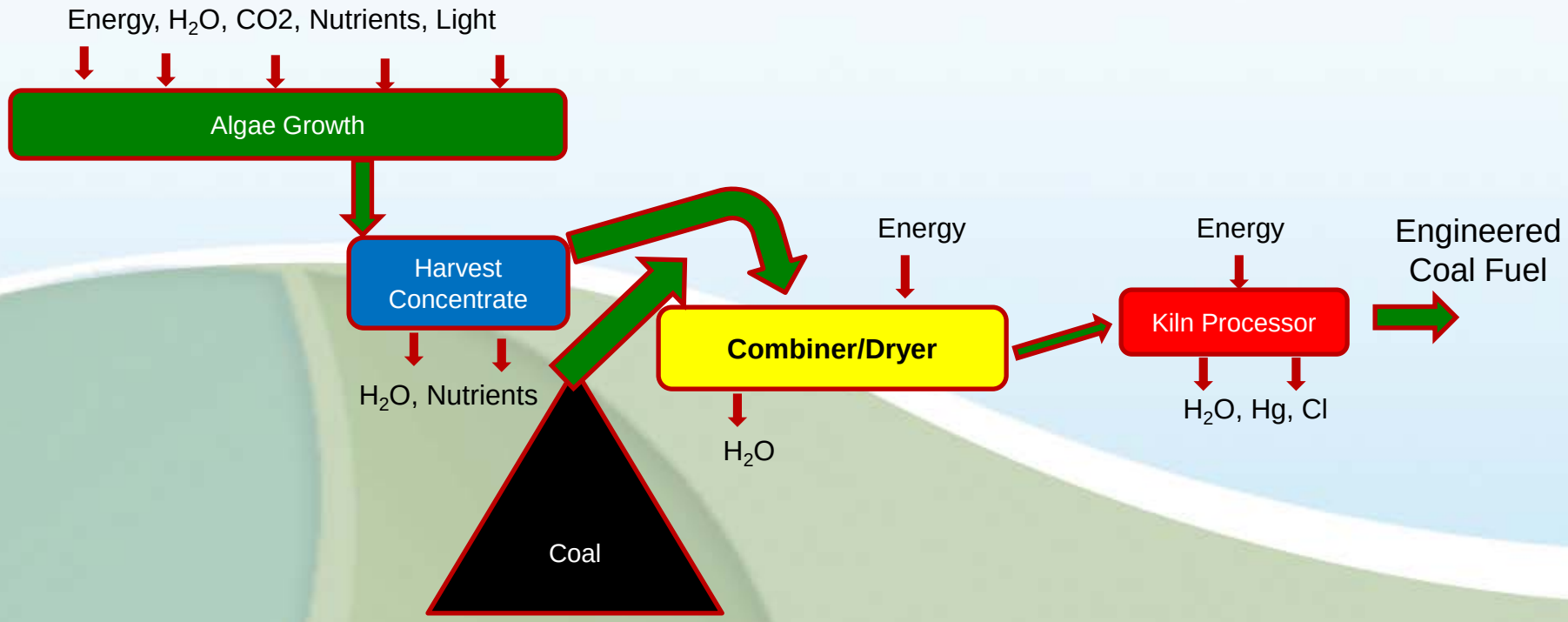
Process Flow Diagram



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Example – Illinois Basin

- Objective - Hg, Cl compliance, No biomass
- 275 MW plant, low NOx, SCR, Baghouse, Lime spray dryer for SOx
- Base Fuel
  - Btu 11670
  - Moisture 11.12%
  - Sulfur 2.5%
  - Chlorine .29%
  - Mercury .12%

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Solution

- Engineered Coal Fuel
  - Btu 12970, Fuel flow rate reduced 14%
  - Moisture 0.1%
  - Sulfur 2.6%
  - Chlorine .001%
  - Mercury .00001%
  - Cost: Btu Parity plus 3%

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Solution Value

- CO_2 reduced 1%
- Operating cost savings 2.6%
- Upfront ECF investment $7.5 million
- Capital for ACI and Wet scrubber - $93 M
- Fuel Preparation - not subject to NSR for same MW output

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Example – PRB

- Objective - Add biomass, produce activated carbon
- 1 GW plant, low NOx, SCR, Baghouse, Lime spray dryer, wet cooling tower
- Base Fuel
  - Btu 8340
  - Moisture 30.24%
  - Sulfur 0.37%
  - Chlorine 0.01%
  - Mercury 0.10%

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Solution

- Engineered Coal Fuel
  - Btu 12000, 50% biomass as 10% if fuel supply
  - Fuel flow rate reduced 5%
  - Moisture 29.42%
  - Sulfur 0.35%
  - Chlorine .009%
  - Mercury .091%
  - Cost: Btu Parity

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Solution Value

- CO_2 reduced 10%
- Operating cost savings 1.9%
- Upfront ECF investment $72 M
- Cost of Amine scrubber $130 M
- Algae growth requires 1400 acres
- Algae is fed
  - Waste nutrients from local farms
  - CO_2 from the plant

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Summary

Engineered Coal Fuels

- **Multi-pollutant - treatment**
- Pre-combustion coal and biomass
  - Mercury and Chlorine at compliant levels
  - Moisture removed
  - Dust controlled
  - Improved boiler efficiency reducing CO, bottom ash, fly ash, SOx, NOx, PM, H_2O, and CO_2
  - Recycles additional CO_2 and excess nutrients

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