



ClearStack = Clean Air

The Ashworth Gasifier - Combustor™

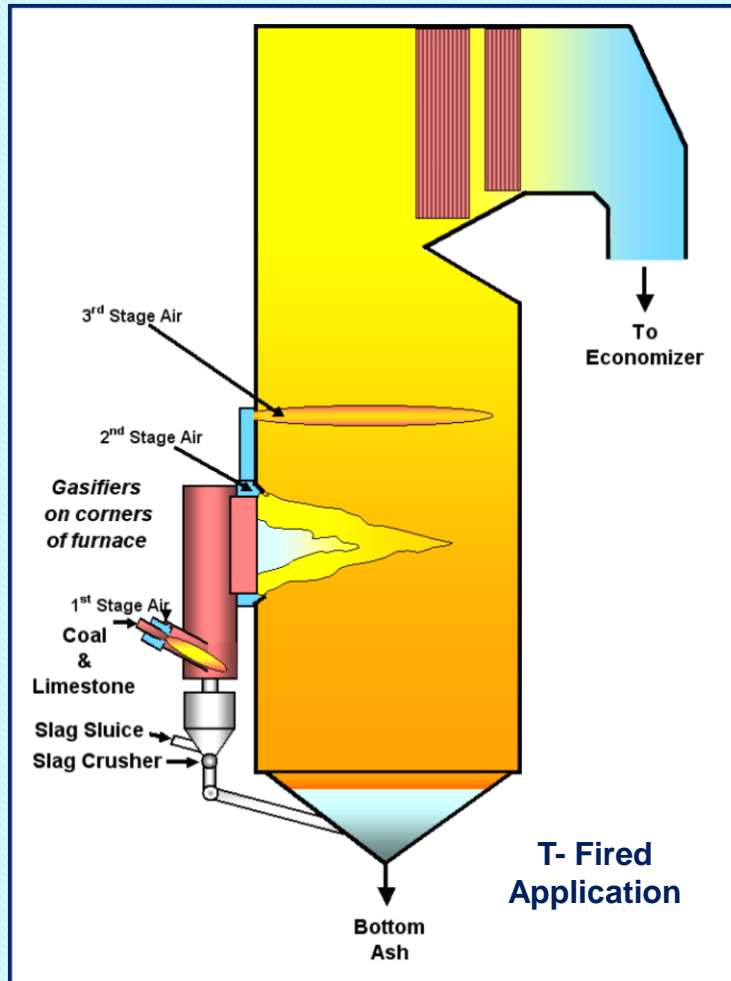
Clean “Green Coal” Technology



Presented by:

Bob Ashworth
Sr. VP - Technology

Ashworth Gasifier-Combustor



Ashworth Gasifiers are attached to an existing or new coal-fired furnace. Coal (with powdered limestone) is gasified by firing downward into a molten slag bath where sulfur, mercury and other air metal toxics are captured in the molten slag. Gasification of coal eliminates any fuel bound NO_x production.

Two stages of oxidation occur in the boiler furnace to combust fuel gas from the gasifier in a manner to reduce thermal NO_x formation from taking place.

It is a simple technique to reduce multiple air emission pollutants to the atmosphere.

Lincoln Developmental Center AGC Test Results



NO_x : Low as 0.095 lb/10⁶ Btu

SO₂ : 1.70 lb/10⁶ Btu @ Ca/S ratio of 0.85 (72% Reduction for coal w/6.14 lb SO₂/10⁶ Btu)

CO : 15 - 30 ppmv @3% O₂ dry

Hg : 93 to 100 % removal (TCLP Leach tests: Slag = 0 mg/l, Fly Ash = 0 mg/l)

Carbon Conversion: 99 wt % (Slag = 0.2 wt % C, Fly Ash = ~ 5 wt % C)

Chlorine & Fluorine: 13% Cl & 26% F (w/Ca:S ratio of 0.85) Reduction

80 to 100% Capture: Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Lead, Manganese, Molybdenum, Nickel, Selenium, Silver, Thallium, Vanadium and Zinc

Leach tests on slag and fly ash showed that Ag, As, Ba, Cd, Pb, and Se (only metals regulated besides Hg) were well below the EPA regulatory limits

Mercury Capture

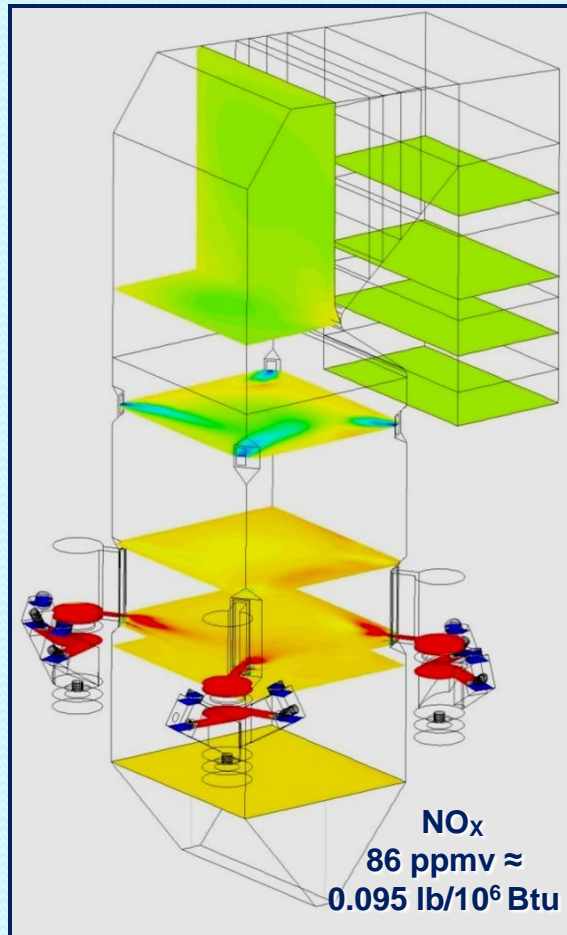
Mercury capture in the strongly reducing alkaline molten slag bath is believed to be the result of :



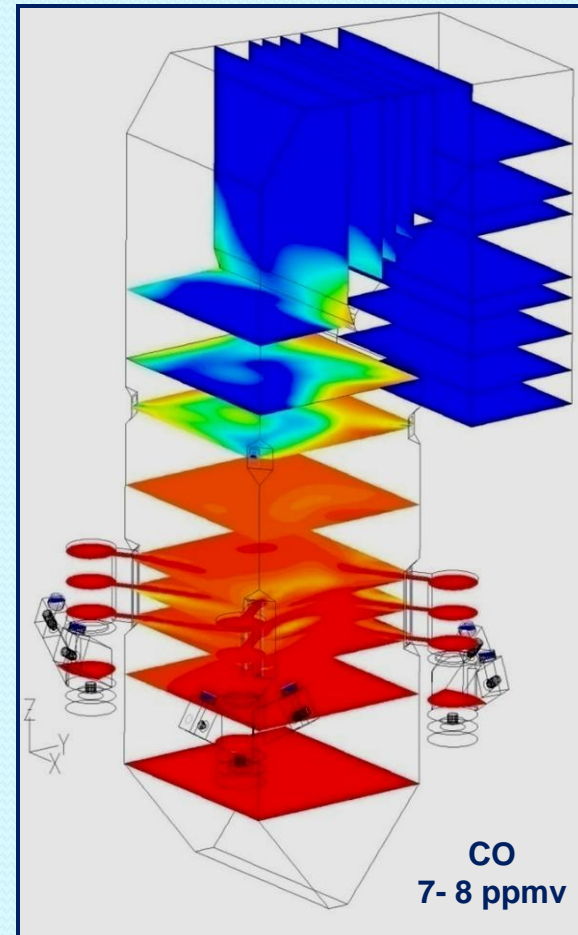
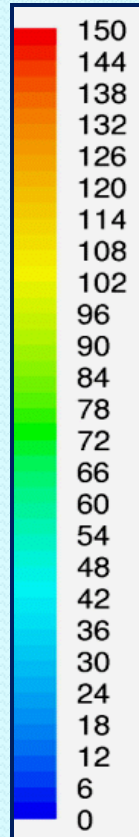
Unique to Ashworth Gasifier

*Paul Chu relayed that the coal gasifiers EPRI tested showed
No mercury capture!*

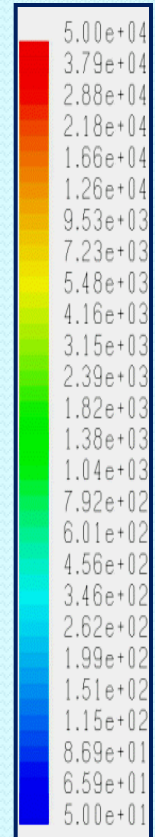
NO_x and CO Emission Predictions



NO_x, ppmv
@ 3% O₂ dry



CO, ppmv
@ 3% O₂ dry



Alstom Analyses for a 77 MWe T-Fired Unit Firing IL #6 Coal

180 MWe Economic Comparison

Ashworth Gasifier - Combustor vs. (SCR + WS + ACI)

Technology	Capital Cost	Operating Cost/Yr
Ashworth Gasifier - Combustor	\$24,150,000	\$5,195,000
Selective Catalytic Reduction + SO ₂ Wet Scrubber + Activated Carbon Injection (Hg)	\$30,610,000 \$32,450,000 \$1,500,000	\$6,290,000 \$8,230,000 \$1,510,000
Total [SCR+WS+ACI]	\$64,560,000	\$16,030,000

AGC - 37% of (SCR + WS + ACI) Capital Cost and 32% of Operating Cost

Refined Coal Tax Credits

AGC Qualifies for Tax Credits (10 years)

- 1. NO_x reduced by 20% and SO₂ or Hg reduced by 40% compared to firing of reference coal (AGC reduces all three by more than 40%)**
- 2. Fuel gas based on tons (Coal + Air) sold/year Equivalent to \$30 - \$40/ton of coal fired**
- 3. Current H.R. 4213 passed both House and Senate will extend these tax credits until Jan. 1, 2011**

Marketing

ClearStack is currently discussing installations of the Ashworth Gasifier-Combustor with:

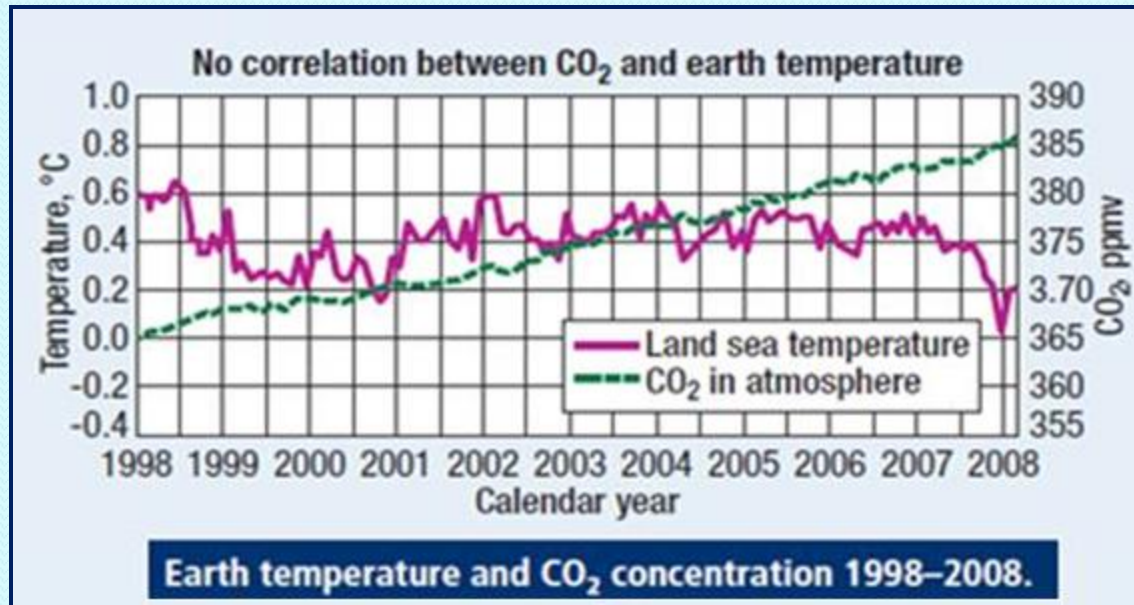
- 1. A Midwest Electric Utility for a 35 MWe T-Fired Unit**



- 2. An Enhanced Oil Recovery firm for use of the gasifier to generate steam for a thermal oil recovery unit**



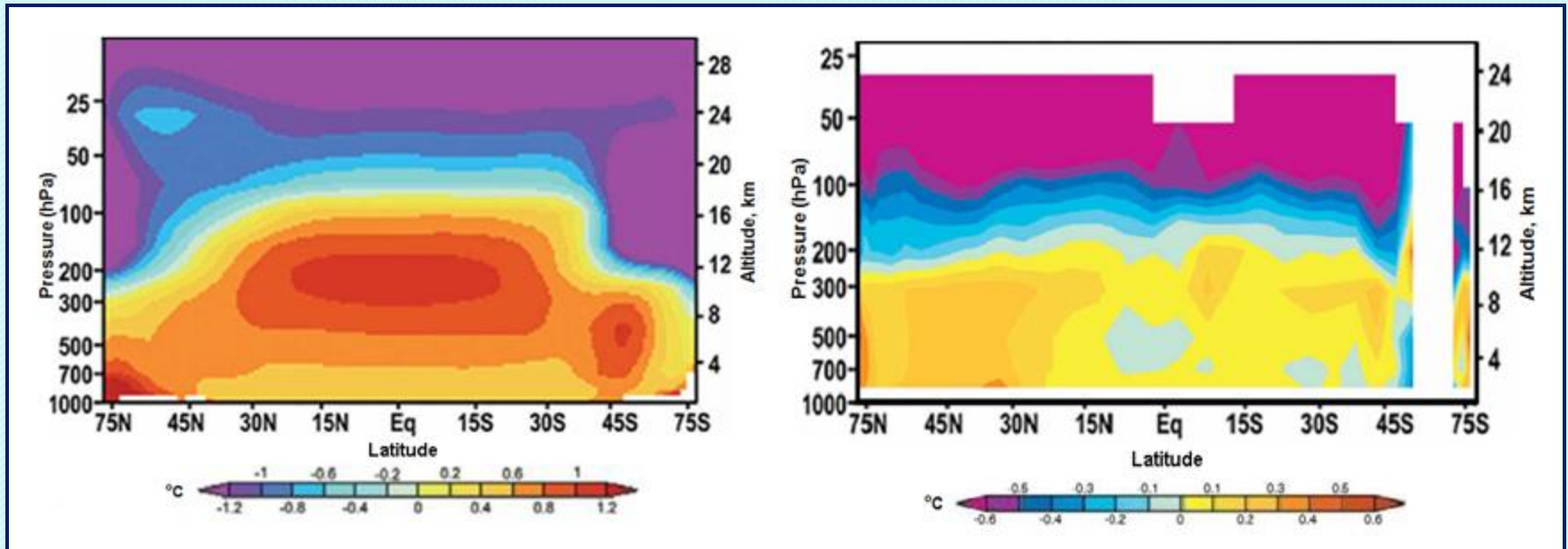
CO₂ Does Not Heat Earth - *it Greens it!*



Man only contributes 3% of CO₂ emitted to the atmosphere, nature the rest. If we eliminated all man made CO₂ tomorrow, we would go back to the level we had in 2004!
Oh yes, it was warmer then than now!

Although touted as such, **there is nothing green about windmills, solar, or nuclear power.** The only **Green Way** to make electric power is to use fossil fuels, and the **greenest fossil fuel on earth is Coal.**

IPCC Greenhouse Signature not in Atmosphere



Predicted IPCC Computer Signature

Actual Signature

Dr. Martin Hertzberg, a retired Navy meteorologist with a PhD in physical chemistry, distrusts climate computer models. The models do not adequately account for water in the atmosphere. Hertzberg said, “Carbon dioxide and the greenhouse gases are, by comparison to water vapor, the equivalent of a few farts in a hurricane!”

Dr. Neil Frank, former director of the National Hurricane Center, told the Washington Post, “Global warming is a hoax!”

Conclusion

The Ashworth Gasifier-Combustor is a clean technology:

- 1) It reduces multi-pollutants (NO_x , SO_2 , Hg, halides and other air metal toxics).
- 2) Unlike SCR it reduces sulfur trioxide (SO_3) emissions that create opacity (bluish-white haze) problems and does not use noxious chemicals (NH_3).
- 3) In the near term it is an immediate low cost answer for pollution from coal-fired power plants of 200 MWe and less, ~ 1/3 the capital and operating cost of Selective Catalytic Reduction plus Wet Scrubbers plus Activated Carbon.
- 4) Once proved at the smaller scale it should become the technology of choice for new large power plants as well. It will work well with ultra-supercritical units, some now operating at 45% efficiency, with a future potential of achieving 50%+, which is similar to the upper efficiency possible with IGCC technology.
- 5) CO_2 is not a pollutant so coal use should not be stymied. Although IPCC computer models predict global warming from CO_2 , actual temperature measurements show no warming. The average earth temperature in January 2008 was 0.6 °C cooler than in January 1998, even though CO_2 concentration increased 20 ppmv over those ten years.
- 6) In a growing worldwide population, the more CO_2 emissions the better; it translates to more plant growth (more food)! Cutting CO_2 also means less oxygen for us to breath.