



Maintaining and Improving Marketability of Coal Fly Ash

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National Concrete Consortium - Sustainability in Concrete Construction

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A Headline You May Have Seen

Plants' Cleanup May Create Side-Effect

By ANNA JO BRATTON
The Associated Press
Sunday, August 26, 2007

OMAHA, Neb. -- As the nation's coal-fired power plants work to create cleaner skies, they'll likely fill up landfills with millions more tons of potentially harmful ash...

- 🔥 What is the future of coal fly ash utilization in a mercury controls world?
- 🔥 What other business and regulatory trends may affect ash utilization?

Challenges & Opportunities

🔥 Examples of two challenges:

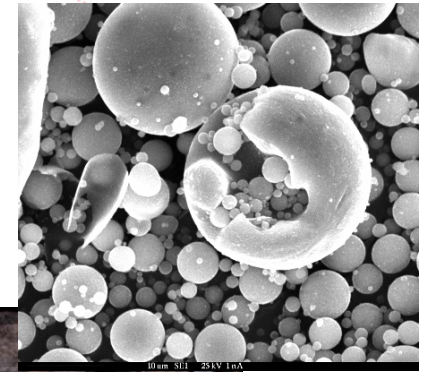
- Effects of emissions control technology installations (especially for mercury removal)
- Other ash quality issues

🔥 Examples of two opportunities:

- "Green Building" trends
- Carbon trading

A Little Background

- 💧 Fly ash is produced when coal is consumed by power plants
- 💧 Fly ash can be used beneficially in numerous applications
- 💧 The highest value application is replacing cement in production of concrete
- 💧 Fly ash use improves concrete quality and creates significant environmental benefits
- 💧 More than 15 million tons of fly ash used in concrete production during 2006



Just Like Children...

- ...There is no “bad ash” - only some ash that needs a little more love
- Fly ash used in concrete must meet ASTM C-618 standard

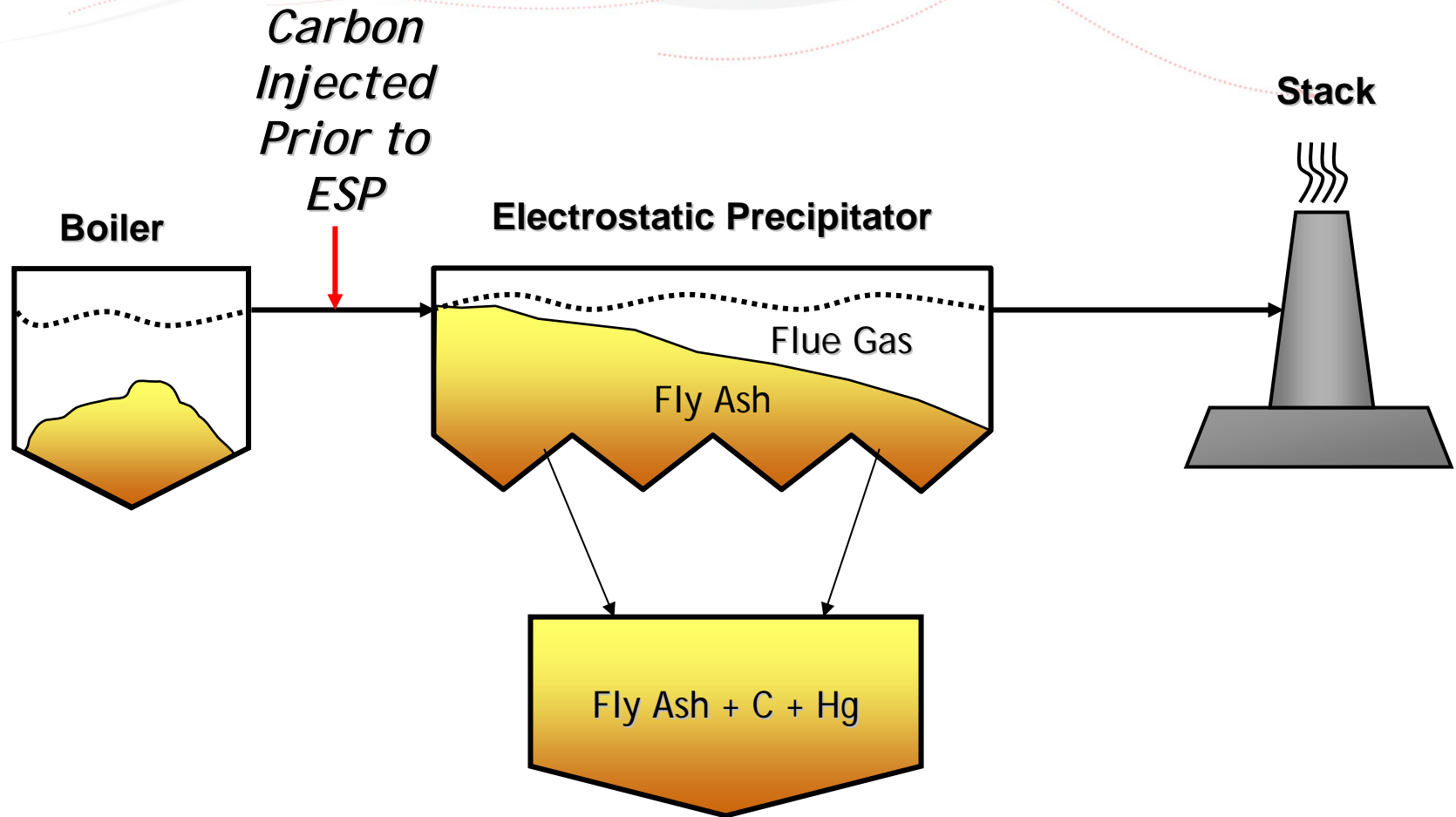
		F	C	N			F	C	N
Chemical					Physical (continued)				
SiO ₂ + Al ₂ O ₃ + Fe ₂ O ₃	min %	70	50	70	Uniformity Requirements				
SO ₃	max %	5	5	4	Density Max. Var.	max %	5	5	5
Moisture Content	max %	3	3	3	Fineness Points Var.	max %	5	5	5
Loss on Ignition	max %	6	6	10	Optional Physical				
Optional Chemical					Multiple factor		225	-	-
Available Alkalies	max %	1.5	1.5	1.5	Inc. In Drying Shrinkage	max %	0.03	0.03	0.03
Physical					Uniformity Requirements				
Fineness + 325 Mesh	max %	34	34	34	A.E. Admixture Demand	max %	20	20	20
Strength Activity/Cem.	min %	75	75	75	Control of ASR				
Water Requirement	max %	105	105	115	Expansion, % of low alkali cement	max %	100	100	100
Autoclave Expansion	max %	0.8	0.8	0.8	Sulfate Resistance				
					Moderate exposure, 6 months	max%	0.10	0.10	0.10
					High exposure, 6 months	max%	0.05	0.05	0.05

- “LOI” - referring to residual carbon in ash - is a common area of concern

Challenge: Mercury Controls

- 🔥 One approach to reducing mercury emissions from power plants is injection of powdered activated carbon sorbent into flue gases
- 🔥 Too much carbon in fly ash can interfere with proper air entrainment of concrete
- 🔥 Numerous strategies exist to protect fly ash quality

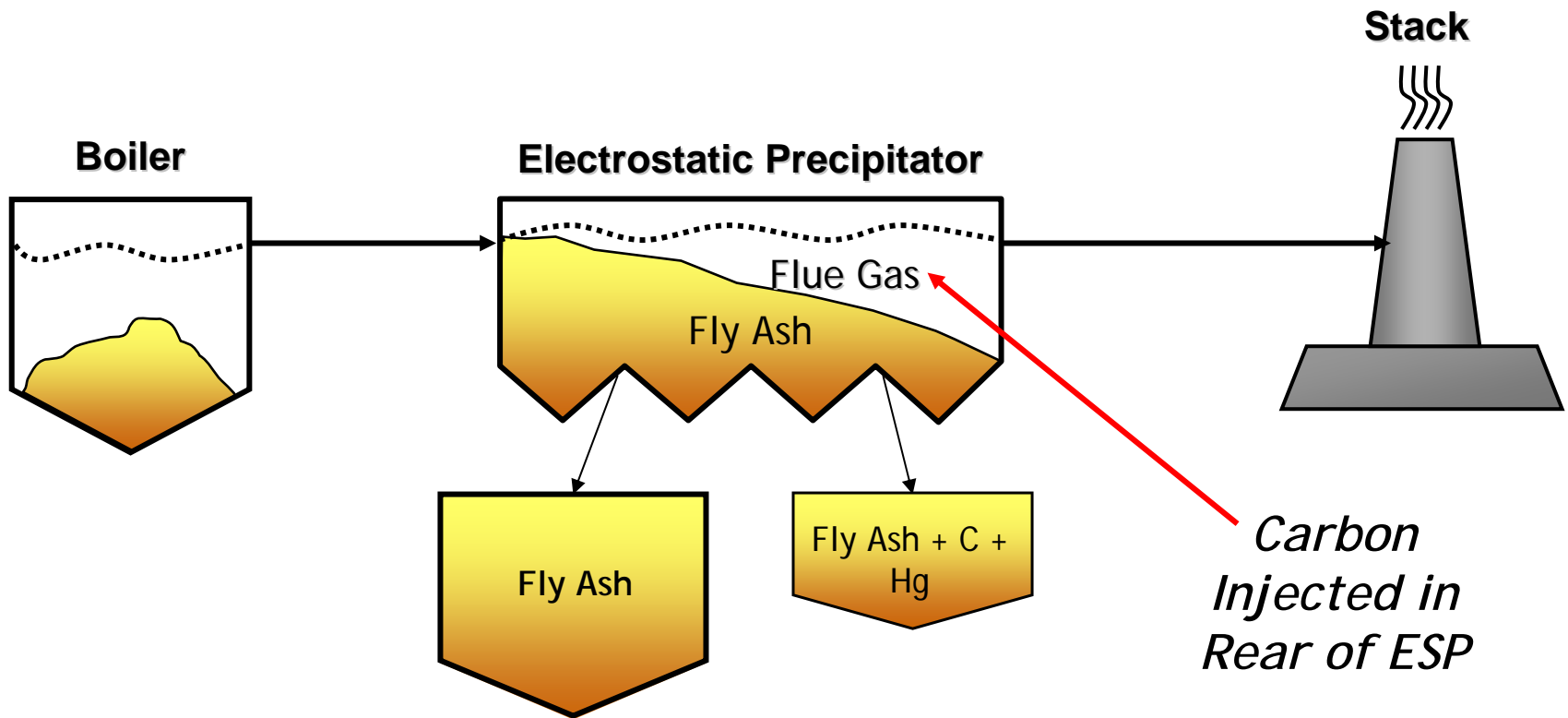
Activated Carbon Injection Pre Fly Ash Collection



Pre Fly Ash Collection Injection

- ♠ Strategies to Protect Ash Quality:
 - Use of concrete friendly sorbent
 - Chemical fixation of carbon in ash
 - Carbon removal

Activated Carbon Injection Last ESP/Baghouse Row

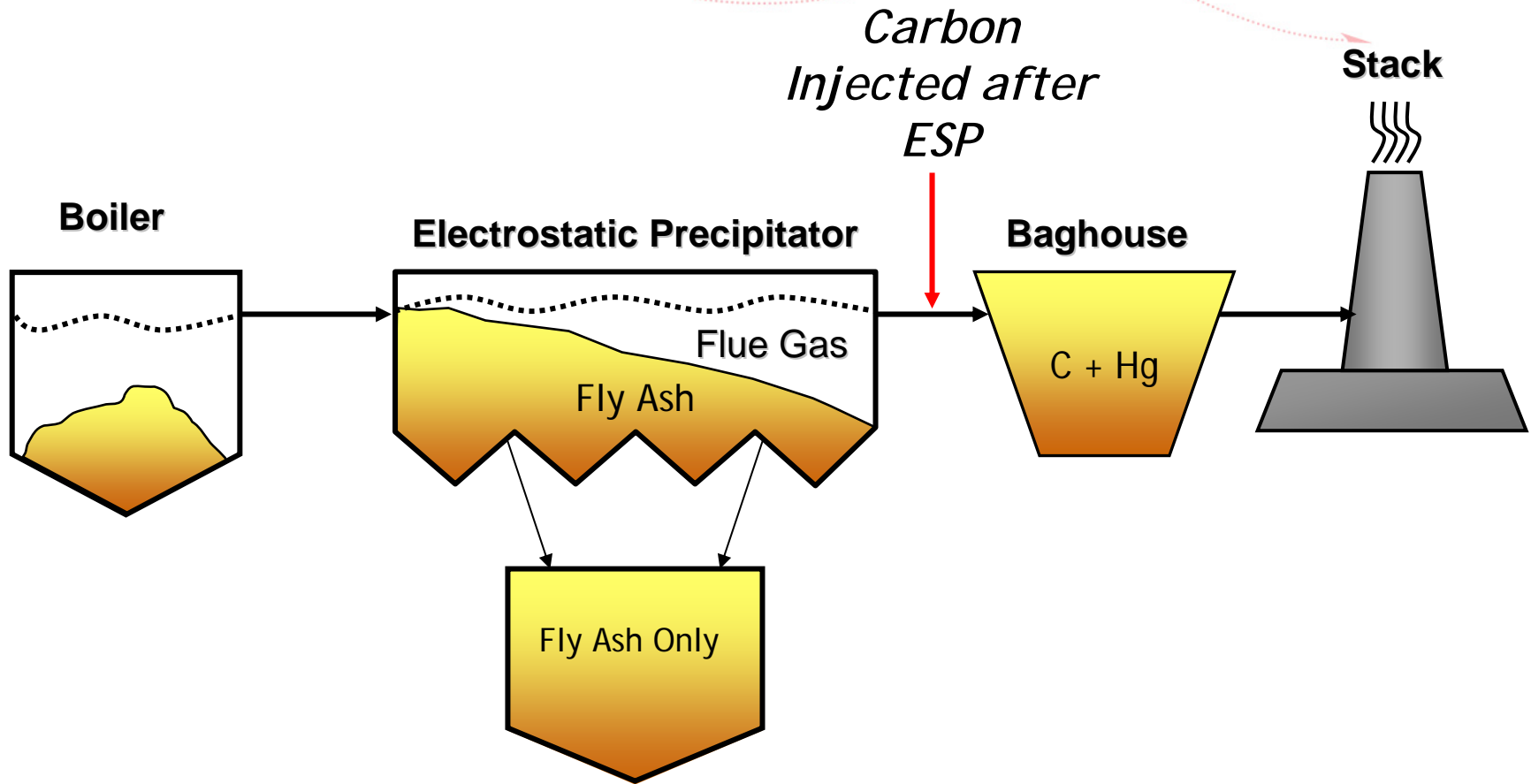


Rear Row of ESP/Baghouse Injection

🔥 Strategies to Protect Ash Quality:

- Typically 4 - 8% of overall fly ash production is collected in rear row, so carbon contamination is minimized
- Use of concrete friendly sorbent
- Chemical fixation of carbon in ash

Activated Carbon Injection Post Fly Ash Collection

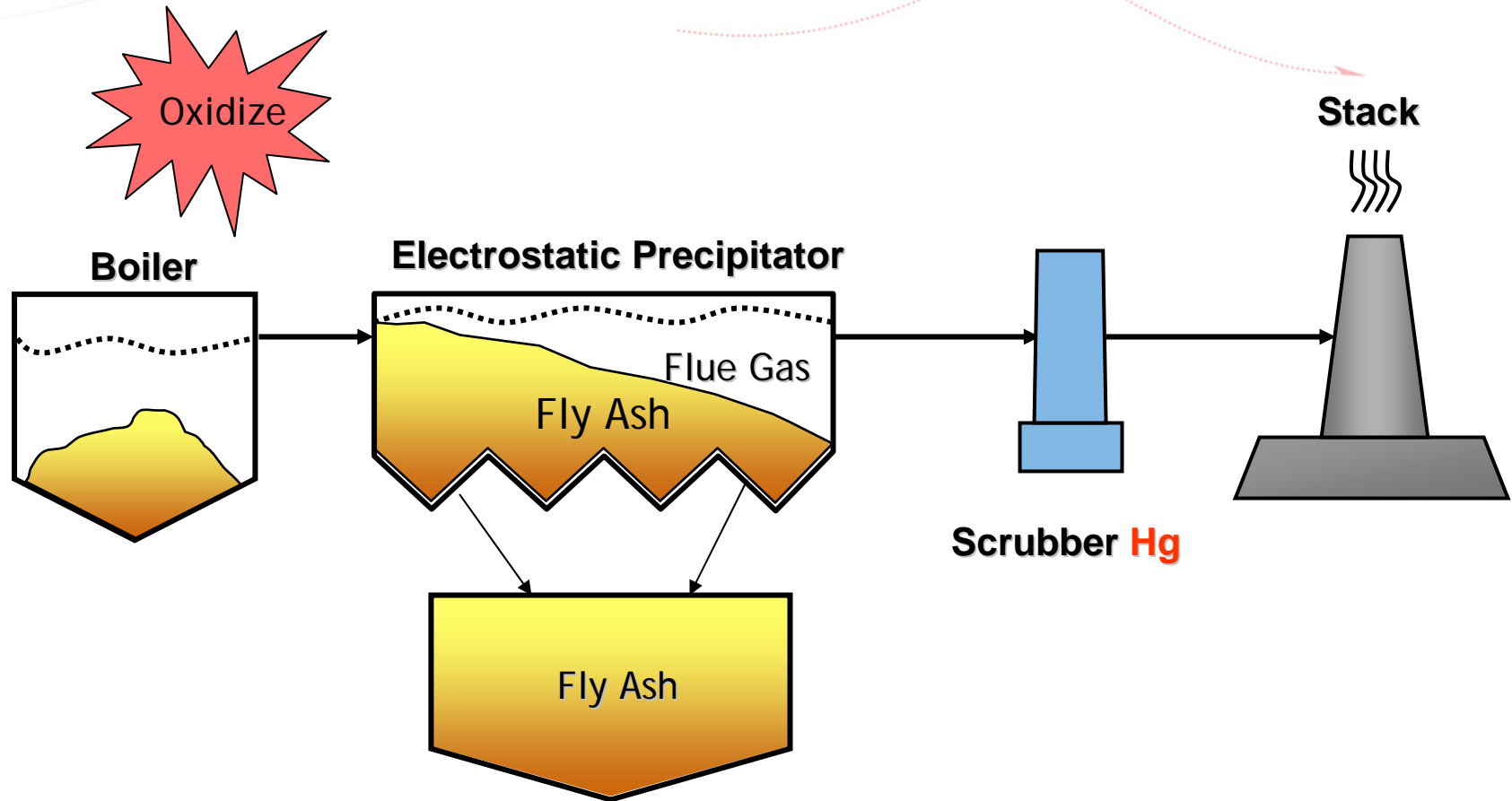


Post Fly Ash Collection Injection

🔥 Strategies to Protect Ash Quality:

- No impact to fly ash quality
- Potential to recycle sorbent

Oxidation and FGD



Oxidation and FGD

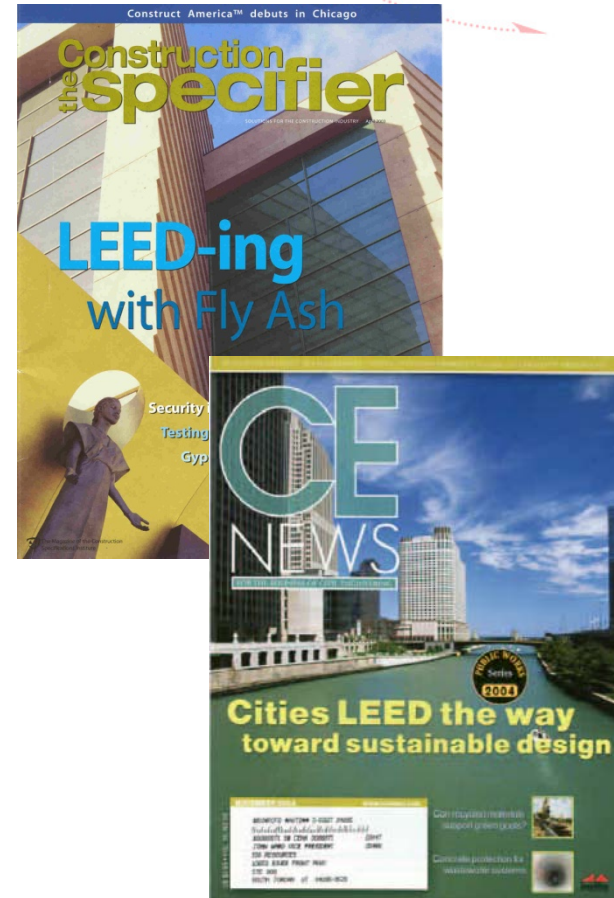
- 🔥 Strategies to Protect Ash Quality:
 - Mercury is captured in the FGD System
 - No impact to fly ash quality

Challenge: Other Quality Issues

- 🔥 Fly ash has successfully managed quality issues resulting from emissions control requirements before, such as impact of:
 - Low NOx burners
 - Fuel switching
- 🔥 Ash quality improvement technologies exist
 - Carbon reduction or removal
 - Reburning, air or water separation, chemical fixation
 - Particle size management
 - Mechanical processing

Opportunity: Green Building

- 🔥 National Association of Home Builders estimates \$40 - \$50 billion green home construction market by 2010 - up from \$7.4 billion in 2006
- 🔥 National Association of Industrial and Office Properties Research Foundation estimates 100 state and local governments now providing incentives for green building
- 🔥 U.S. Office of Management & Budget increasing green building requirements in all federal contracts
- 🔥 U.S. Green Building Council's LEED (Leadership in Energy & Environmental Design) registered projects growing at 74% annual rate
- 🔥 Local, state and federal agencies now beginning to require LEED certification



Opportunity: Carbon Trading

🔥 American Coal Ash Association Greenhouse Gas Emissions Trading Task Team

- Coal Combustion Products utilization can reduce greenhouse gas emissions
- U.S. moving closer to implementing formal greenhouse gas regulations
- Quantifying and monetizing CCP-related reductions becoming more important



GHG Task Team Overview

🔥 Objective:

- Stimulate greater utilization of coal combustion products by ensuring that CCP contributions to reducing greenhouse gas emissions are recognized and allowed to participate in any regulatory programs that may emerge in the United States.

🔥 Operational Goals

- Monitor developments in local, state, regional and federal greenhouse gas emissions regulation
- Increase visibility of American Coal Ash Association's role in defining CCP impacts on greenhouse gas reductions
- Develop defensible industry standards for technical matters related to monetization of CCP related emissions reductions
- Provide input to regulatory agencies as appropriate

Conclusion: No Bullets

There are no bullets - magic or fatal. Ash marketability depends on interaction of numerous economic factors:

💧 Discourages utilization:

- High capital expense to improve or maintain quality
- High costs to store material prior to use
- Rising costs of transportation to deliver material to markets

💧 Encourages utilization:

- High disposal costs
- Rising costs / decreasing availability of competitive material (eg. cement)
- Increased recognition of performance benefits
- Incentives for green building
- Carbon offset potential

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About Headwaters

With 4,800 employees in 39 states, Headwaters operating companies discover and capitalize on opportunities for making more efficient use of our world's natural resources - especially fossil fuels.

- Headwaters Energy Services offers pre-combustion clean coal technologies for reclaiming coal wastes and producing cleaner, usable fuel for America's power plants.
- Headwaters Resources is America's largest manager and marketer of coal combustion products, including fly ash. Utilization of these materials improves performance of building products while creating significant environmental benefits.
- Headwaters Construction Materials is a market leader in manufacturing architectural stone veneer under the Eldorado Stone brand, the market leader in manufacturing window shutters and siding accessories under various Tapco brands, and also holds regional market leadership positions in manufacturing concrete blocks and brick. HCM also developed innovative FlexCrete aerated concrete. Many of these products utilize coal fly ash.
- Headwaters Technology Innovation Group is developing and deploying a range of breakthrough technologies that improve natural resource utilization, including heavy oil upgrading, coal liquefaction and several nanocatalyst applications.

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