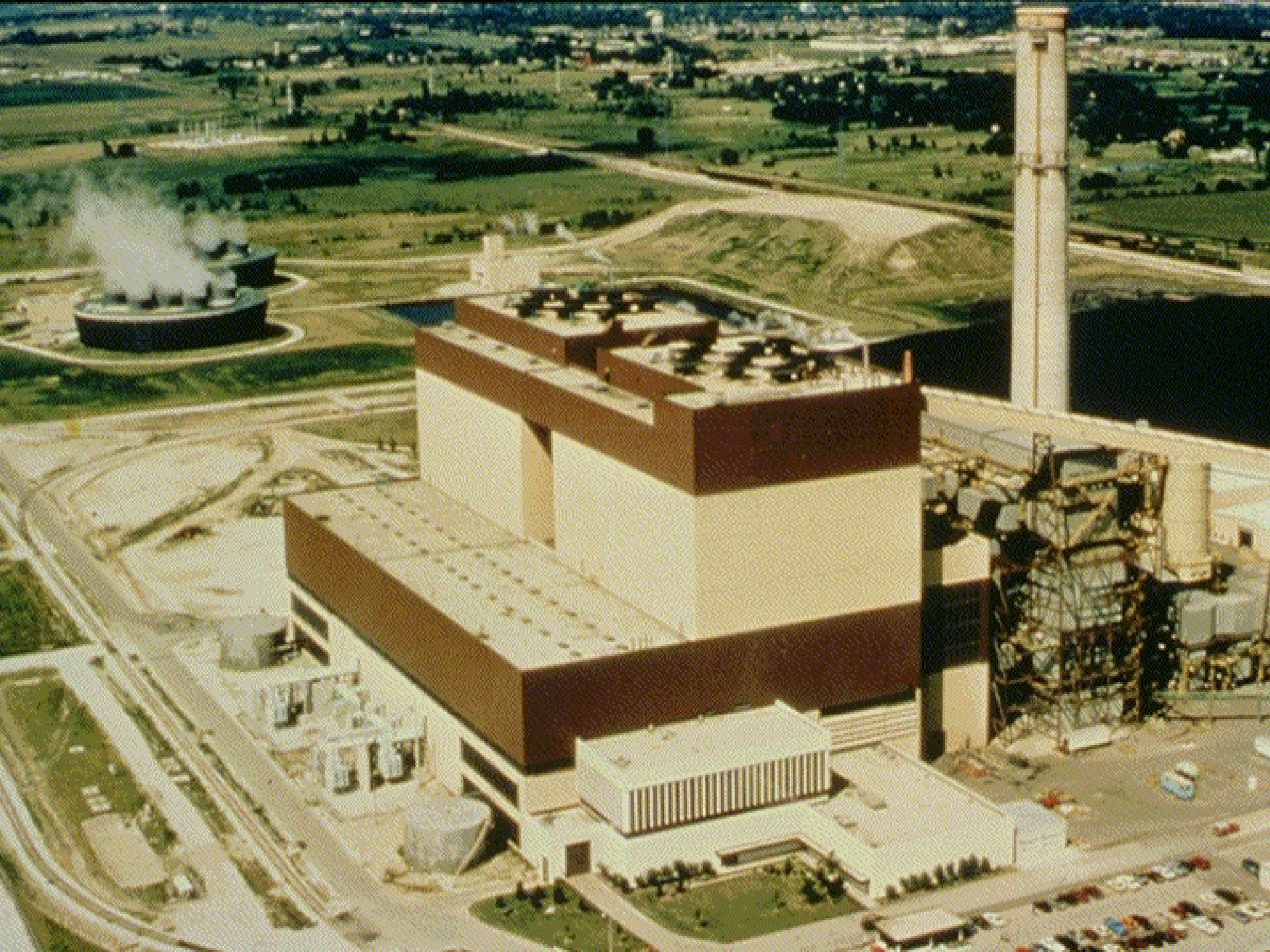


Coal Ash Beneficiation for Quality Construction Materials and Sustainability

NETL 2003 Conference on
Unburned Carbon on Utility Fly Ash
October 28, 2003
Pittsburgh, PA







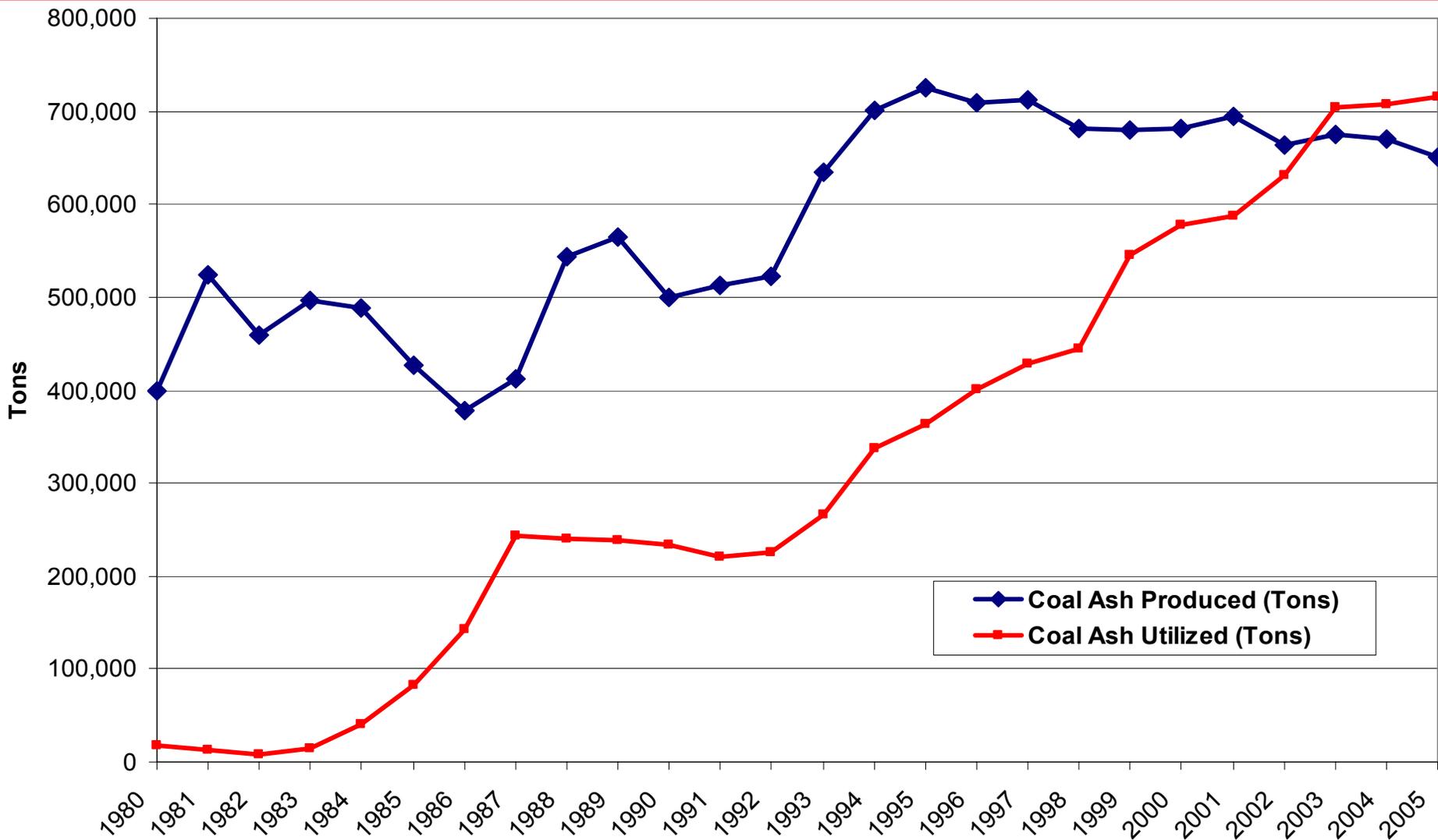
2002 CCP's Utilization (Tons)

● Concrete	190,000
● Waste Stabilization	170,000
● Supplemental Fuel	131,000
● Sub-Base (Btm. Ash)	130,000
● Cement Raw Feed	30,000
● Soil/Asphalt Stabilization	12,000
Total	663,000



We Energies

CCP Production & Utilization



Quality Management

- Environmental Regulations
- User Specifications
- Chemistry
- Physical
- Storage - Shelf Life

Quality of CCP's

- Importance of Consistency
 - Loss on Ignition (LOI)
 - Foam Index
 - Chemistry (Coal Changes)
 - Fineness (Mill Performance)
- Ash Sample Requests
 - Quality Record
 - Outside Research



Lower Quality CCP's?

- **No Users?**
- **Solution = Change the CCP to a material that is needed and can be beneficially used.**

Why Beneficiate?

- **Economics**
- **Quality Enhancement**
- **More Revenue**
- **Avoid Landfilling and Expense**
- **Sustainability**

Carbon (LOI) Reduction

- **Ash Fuel Reburn**
- **Fluidized Bed Combustion**
- **Electrostatic Separation**
- **Froth Floatation**

Valley Power Plant



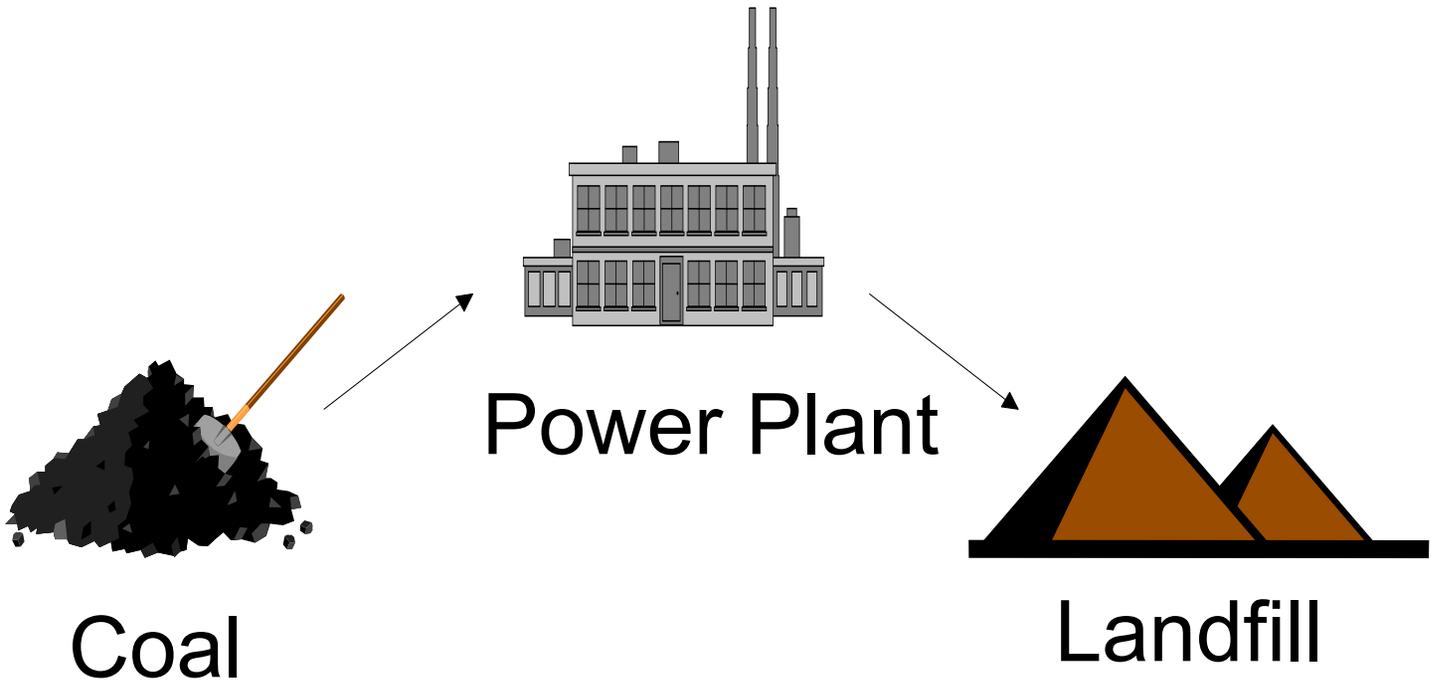
- **Located near downtown Milwaukee**
- **Responsible for 280 megawatts of power for the downtown area**
- **Provides all of the steam for the district heating system**
- **Fly Ash has LOI near 25 %, bottom ash has LOI near 50 %**

Pleasant Prairie Power Plant



- Wisconsin's largest power plant (2 units)
- Located near Wisconsin-Illinois border
- Serves as baseload plant for system
- Fly ash has LOI of less than 1%

Old System

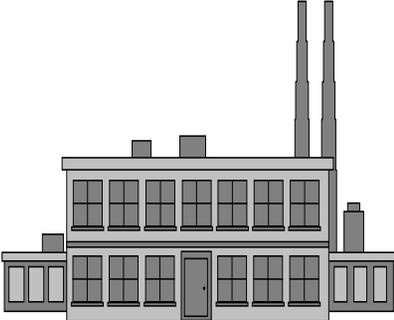


New System

Coal

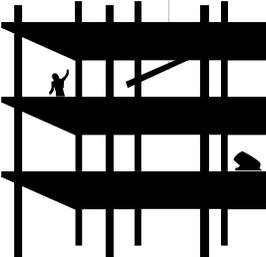
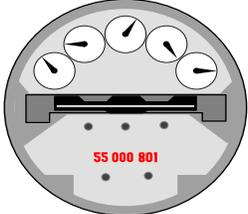


Virgin Ash
From Other
Plants



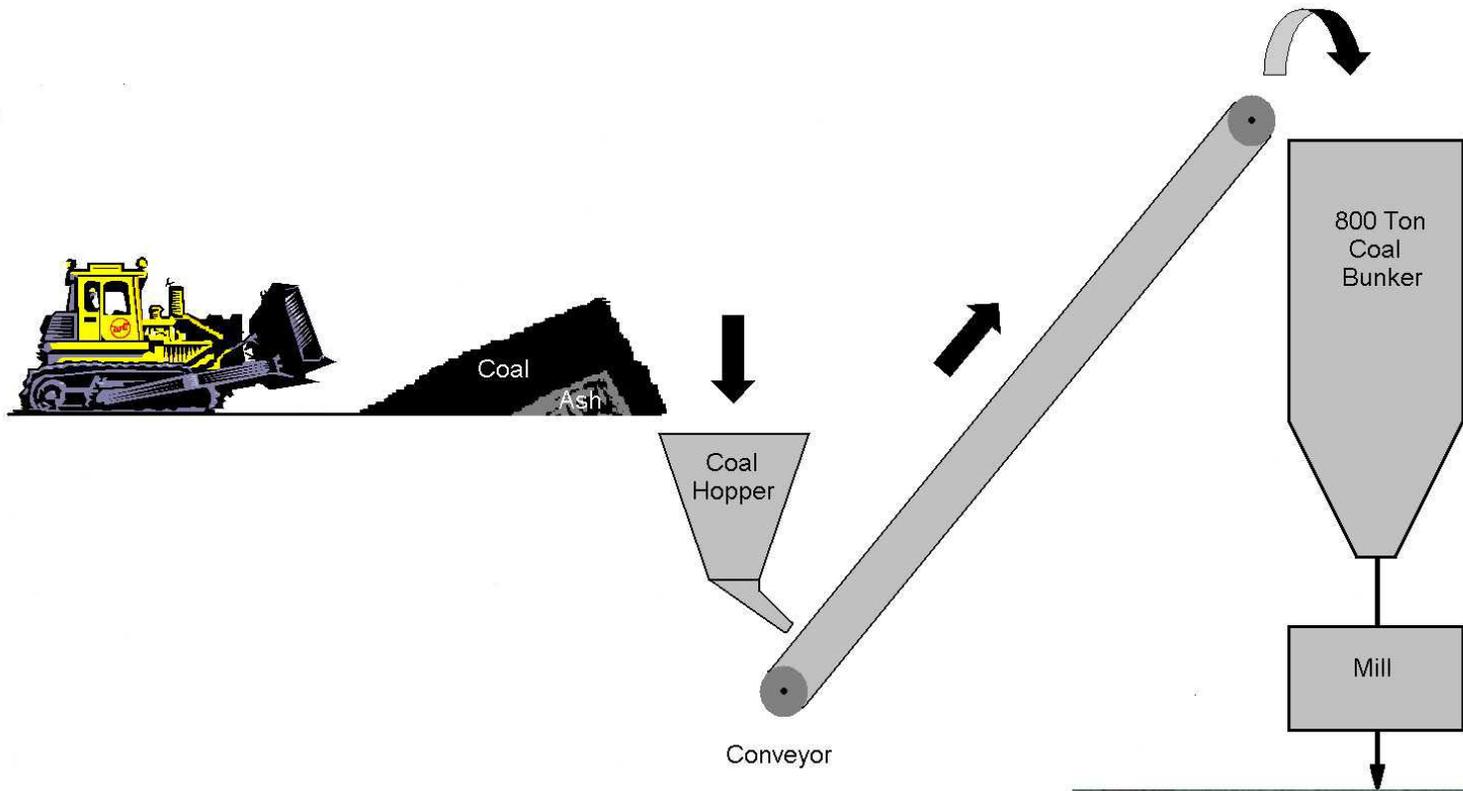
Power Plant

Energy



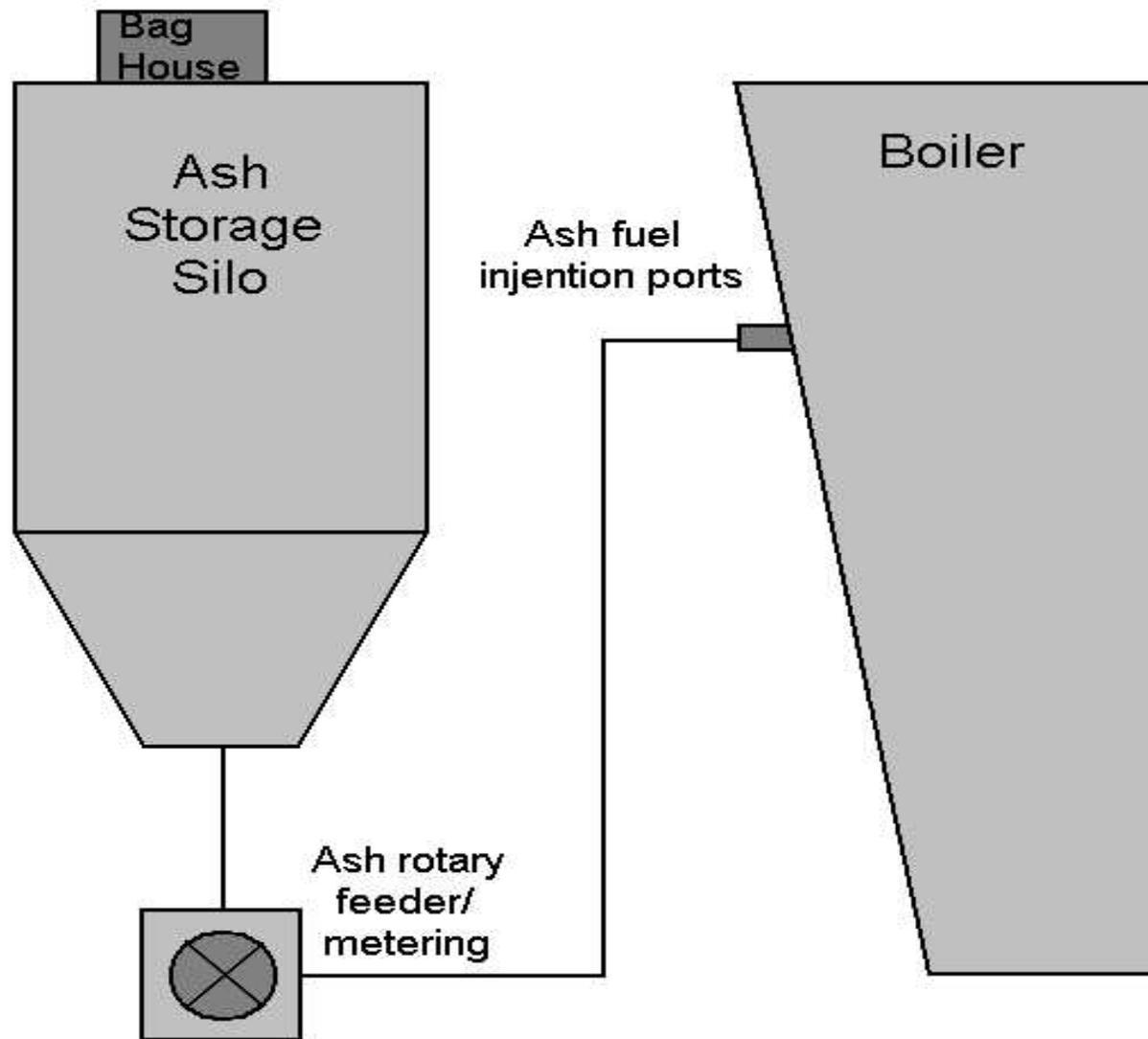
Building
Materials

**Ash Fuel Reburn
Wet
Process
Ash Fuel Reburn**





Ash Fuel Reburn
Dry Process
Ash Fuel Reburn





Test Burn Results

☑ Bottom Ash

VAPP LOI In = 37.9%

PPPP LOI Out = 0.3%

☑ Fly Ash

VAPP LOI In = 26.5%

PPPP LOI Out = 0.3%

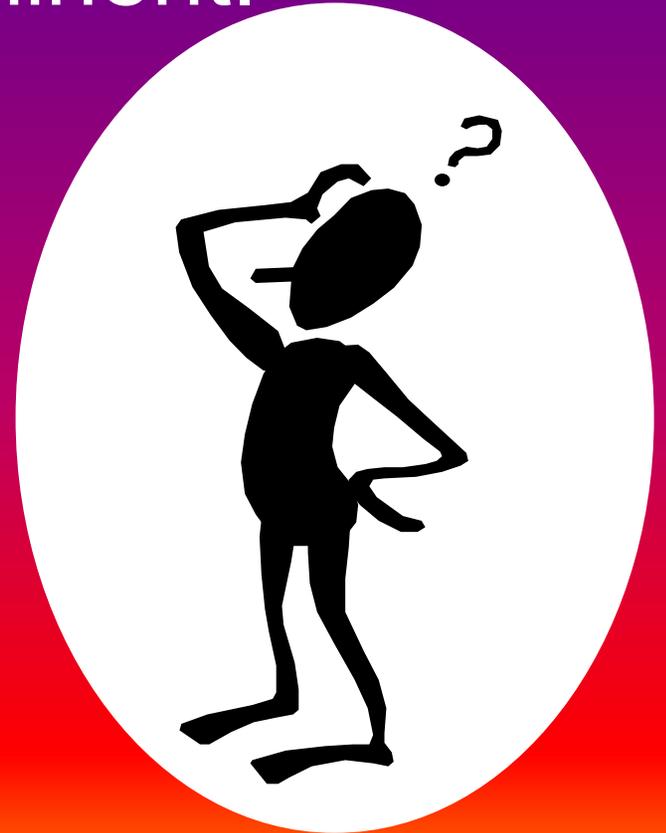
Benefits

- ☑ Recover Otherwise Lost Energy
- ☑ Preserve Existing Landfill Capacity
- ☑ Reduce Need for New Landfills
- ☑ Provide Additional Improved Fly Ash for Concrete
- ☑ Reduce Additional CO₂ and other Emissions from Cement Production
- ☑ Avoided Cost of Landfilling

**Recovering
Ash Stored In
Landfills**

Coal fired power plants have existed for several decades, but only recently has ash utilization become prominent.

The question is, where is all the ash from years past?





In Landfills!

Licensing and constructing landfills is becoming less attractive as an option because:

→ There is less space for new construction of landfills

→ Increased regulations make landfills more expensive to license and build

→ People do not want landfills to be built near their homes or businesses

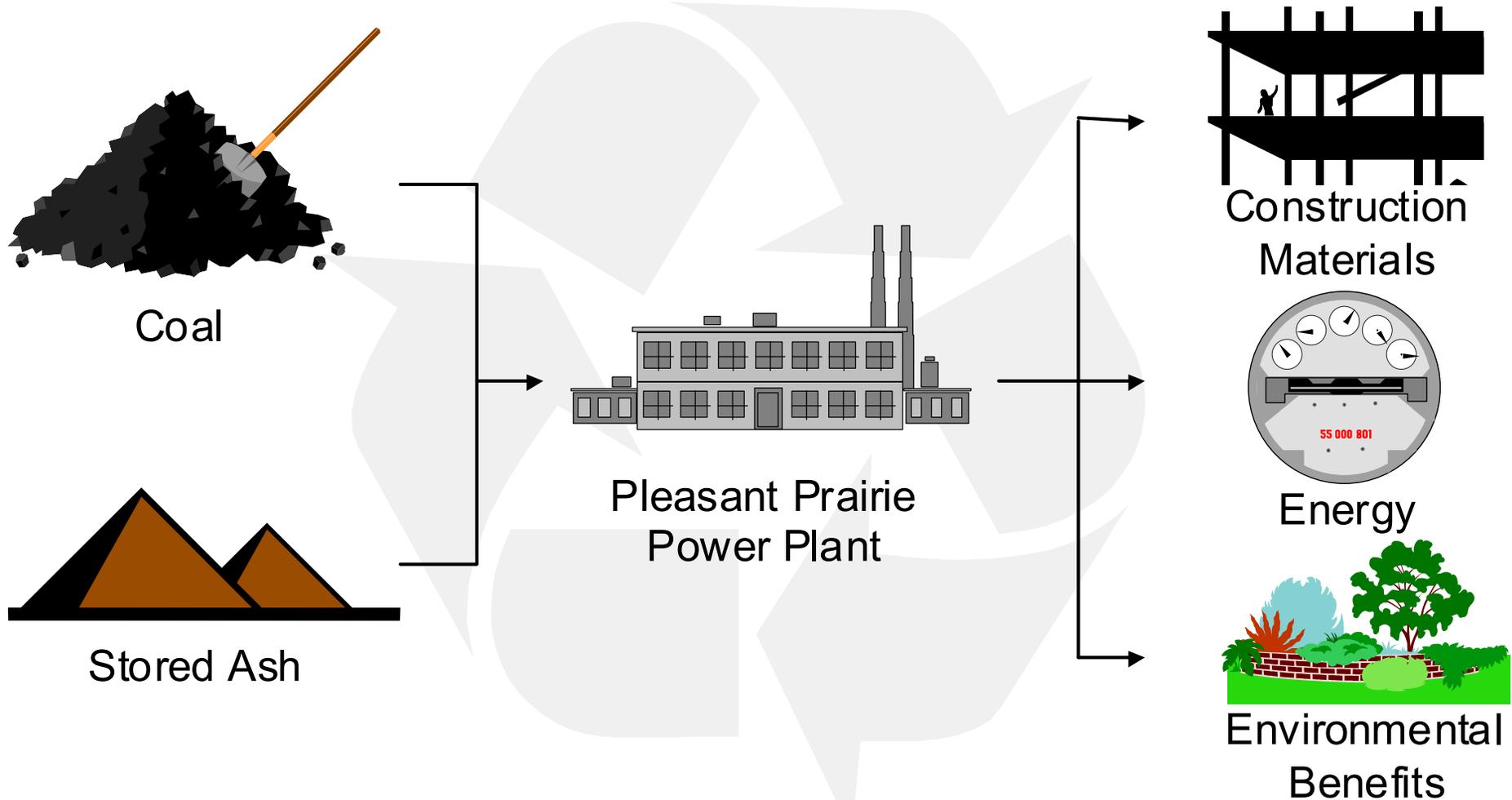
In addition to the expense of building and maintaining landfills, hundreds of thousands of acres of landfills contain significant amounts of ash that either was not or could not be utilized.

Much of this ash has a high L.O.I. value, and is therefore

WASTED ENERGY

Ash Recovery Process

(Patent #6,637,354)



Ash Reclamation at Former Landfill Site



By reclaiming, reburning, and treating ash from landfills:

- ✓ Landfill space is reclaimed and is available for more productive uses**
- ✓ Energy is recovered**
- ✓ Concrete quality fly ash is produced**
- ✓ Raw fuel is conserved for future generations**

Other Benefits Include:

- **Reduced Risk to Soil/Groundwater**
- **Allows Redevelopment of Former Landfills**
- **Reduced Mining and Transportation of Coal**
- **Reduced Limestone and Clay Quarried for Portland Cement Production**
- **Reduced Emissions from Cement Kilns**
 - CO_2 , NO_x , HCl , SO_x
- **Higher Quality/Strength Concrete**
- **Production of Product Close to Market**

P4

**Ash Fuel Reburn
Results**

Reburn Statistics

	Ash Reburned (tons)	Coal Displaced (tons)	Fly ash produced (tons)
P4	280,000	120,000	125,000
PIPP	10,000	2,500	4,500

Ash Fuel Blending

- Coal typically has 5% Ash Content
- High Carbon Supplemental Fuel has 80% Ash Content

- For 2% Ash Fuel Addition:

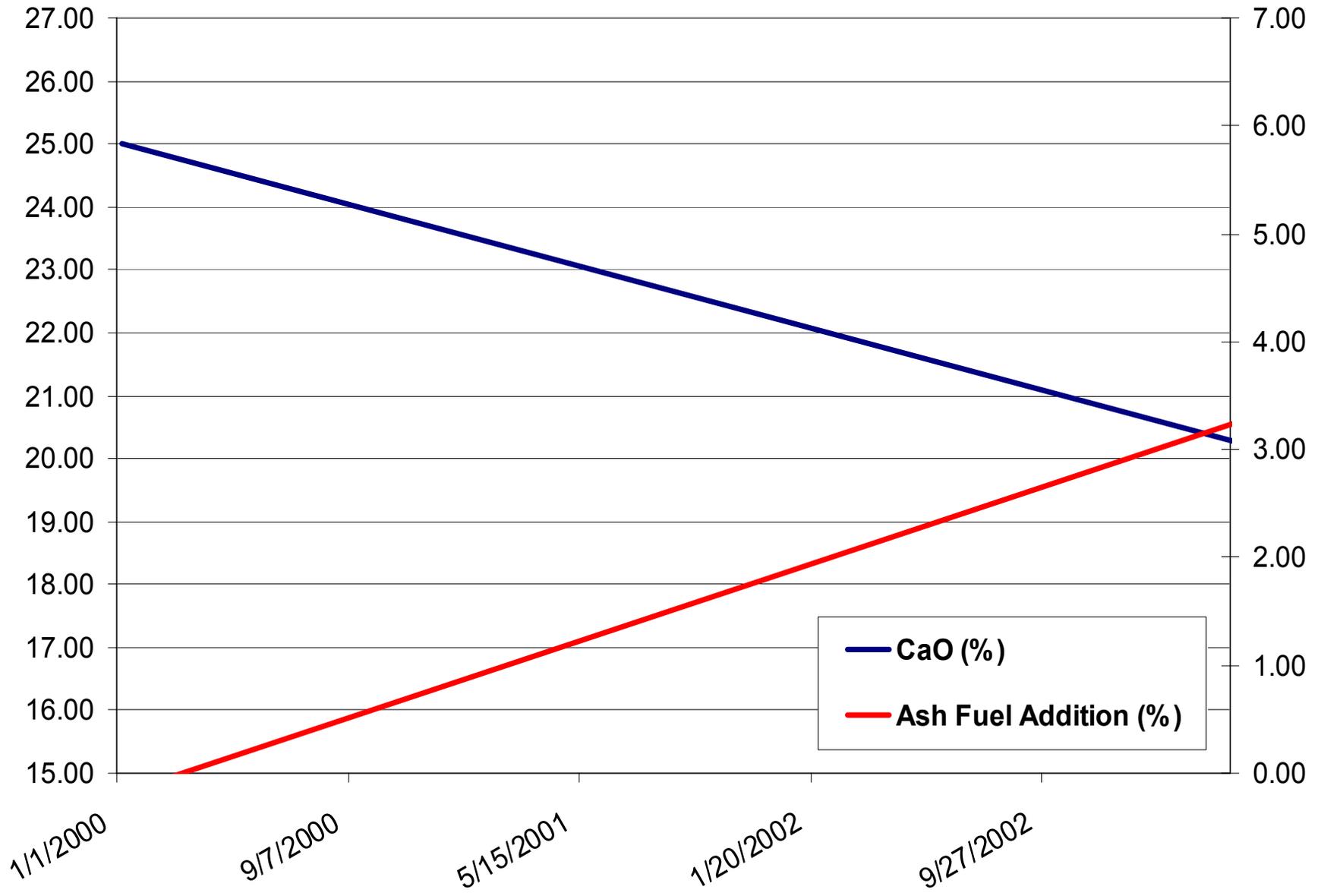
Resulting Coal Ash Influence =

$$(.98 \times .05) + (.02 \times .80)$$

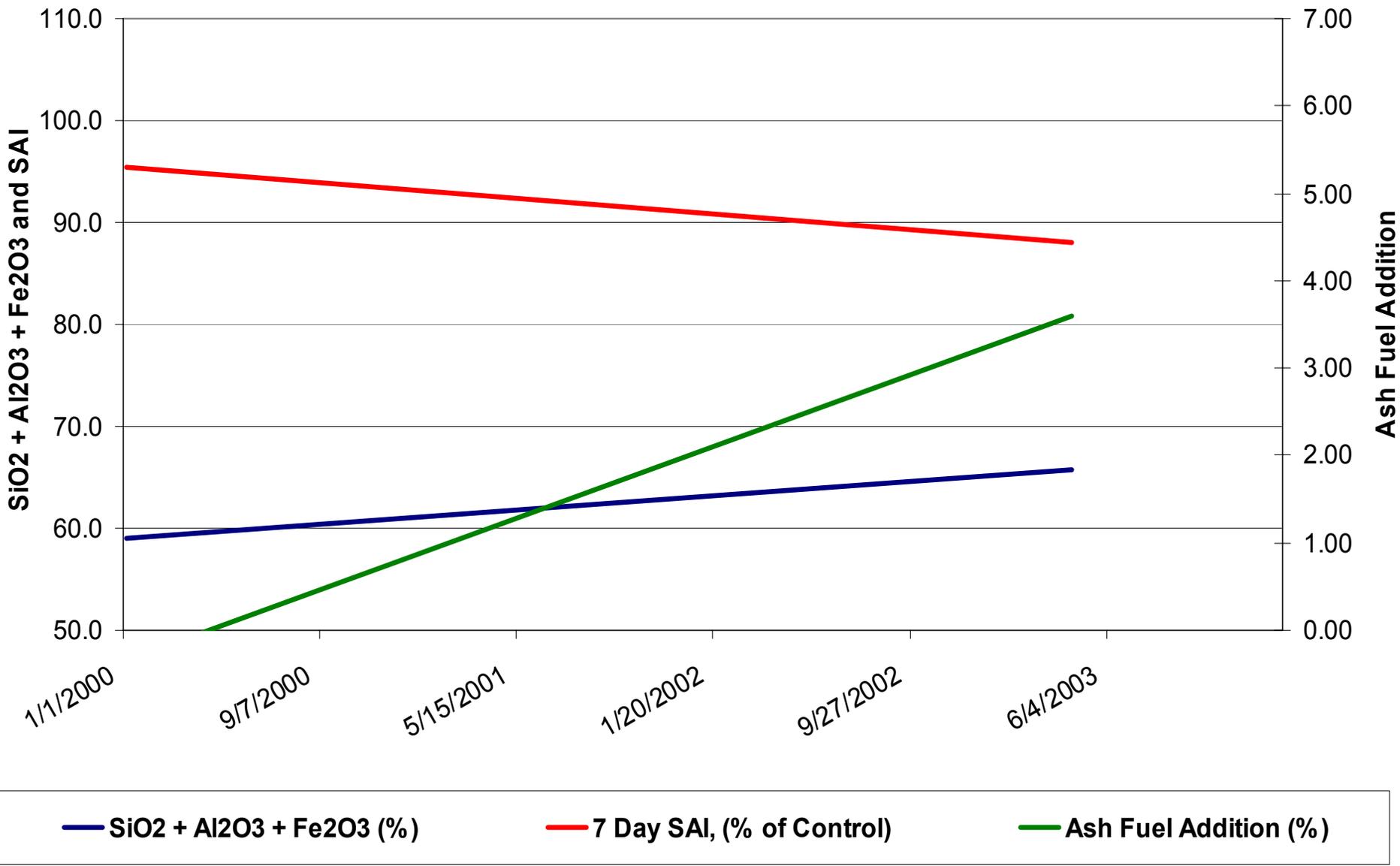
$$.049 + .016 = .065$$

So for $.016/.065$ we have 25% influence in total ash by adding 2% Ash Fuel.

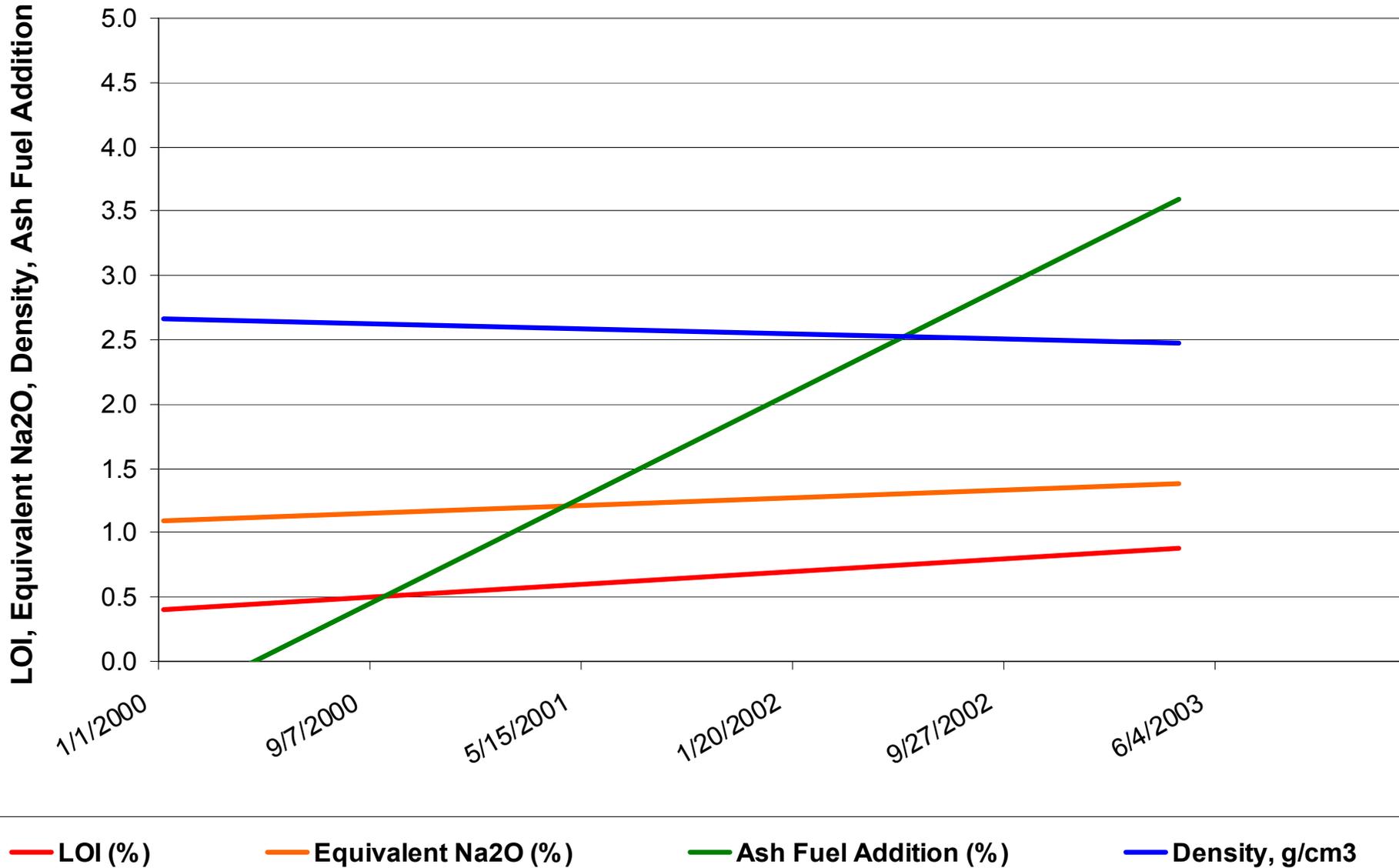
CaO vs. Ash Fuel Addition Trend



Fly Ash Characterists for P4 Ash Fuel



Fly Ash Characterists for P4 Ash Fuel



Conclusions

- ☑ **“The Right Thing to Do.”**
 - **Environment**
 - **Cement Industry**
 - **Utility Customers**
 - **Utility Stockholders**
 - **Global Community**
 - **Sustainable Development for the Future**