

# **Combustion Products for Concrete and Other Applications**

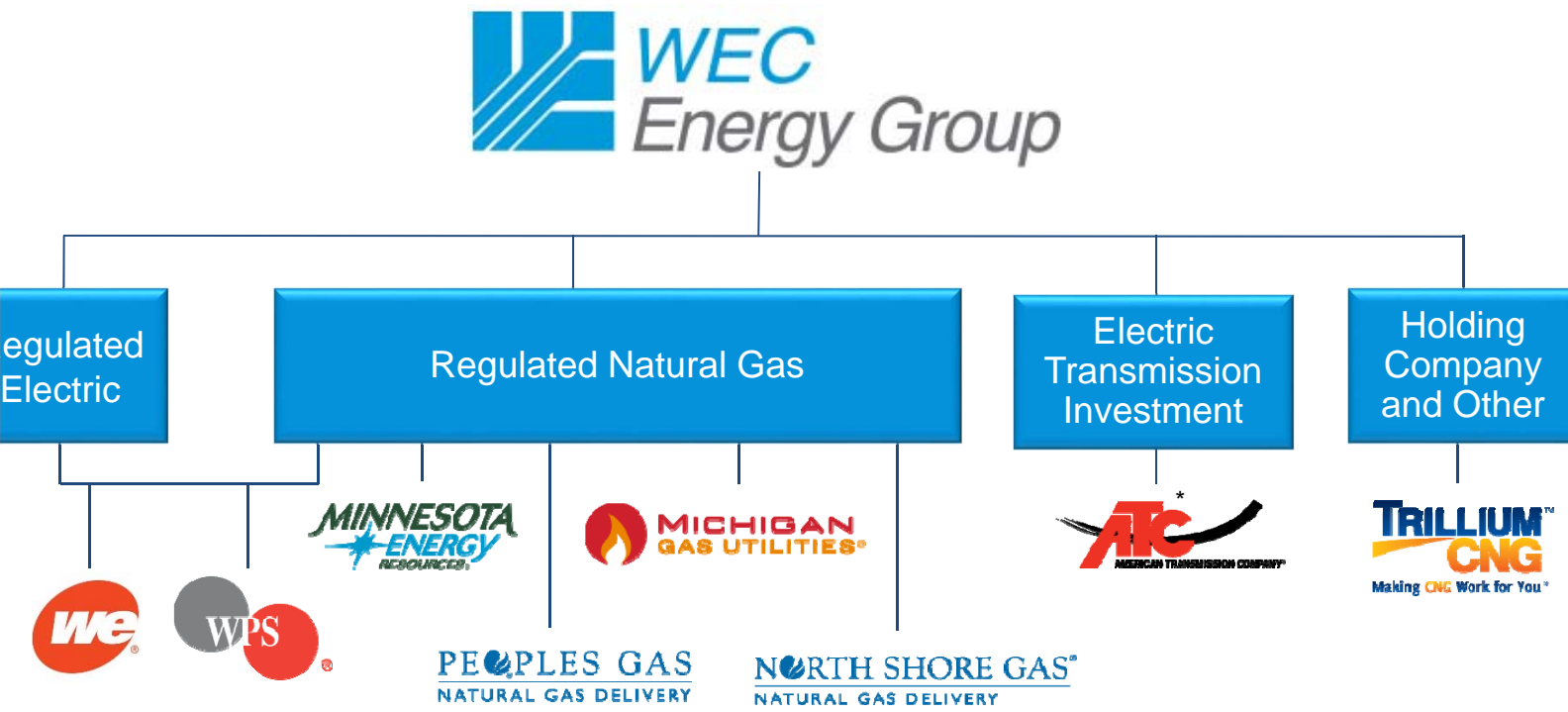


## **Presentation for National Concrete Consortium Visit to the Oak Creek Site**

**September 17, 2015**

**Bruce W. Ramme  
Vice President Environmental**

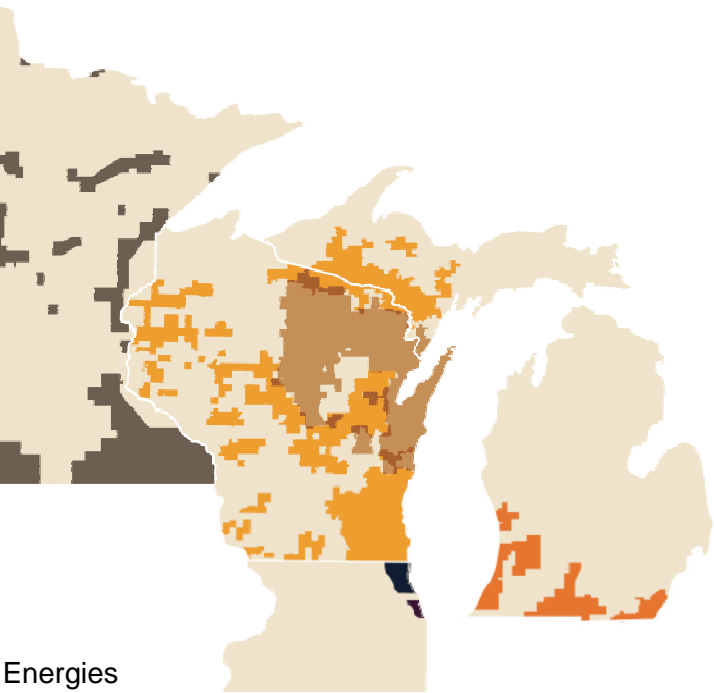
# Family of companies



WEC Energy Group owned approximately 60% of American Transmission Company, LLC.

# erving the region's energy needs

## Service Territory



Energies

Michigan Gas Utilities Corporation

Minnesota Energy Resources Corporation

North Shore Gas Company

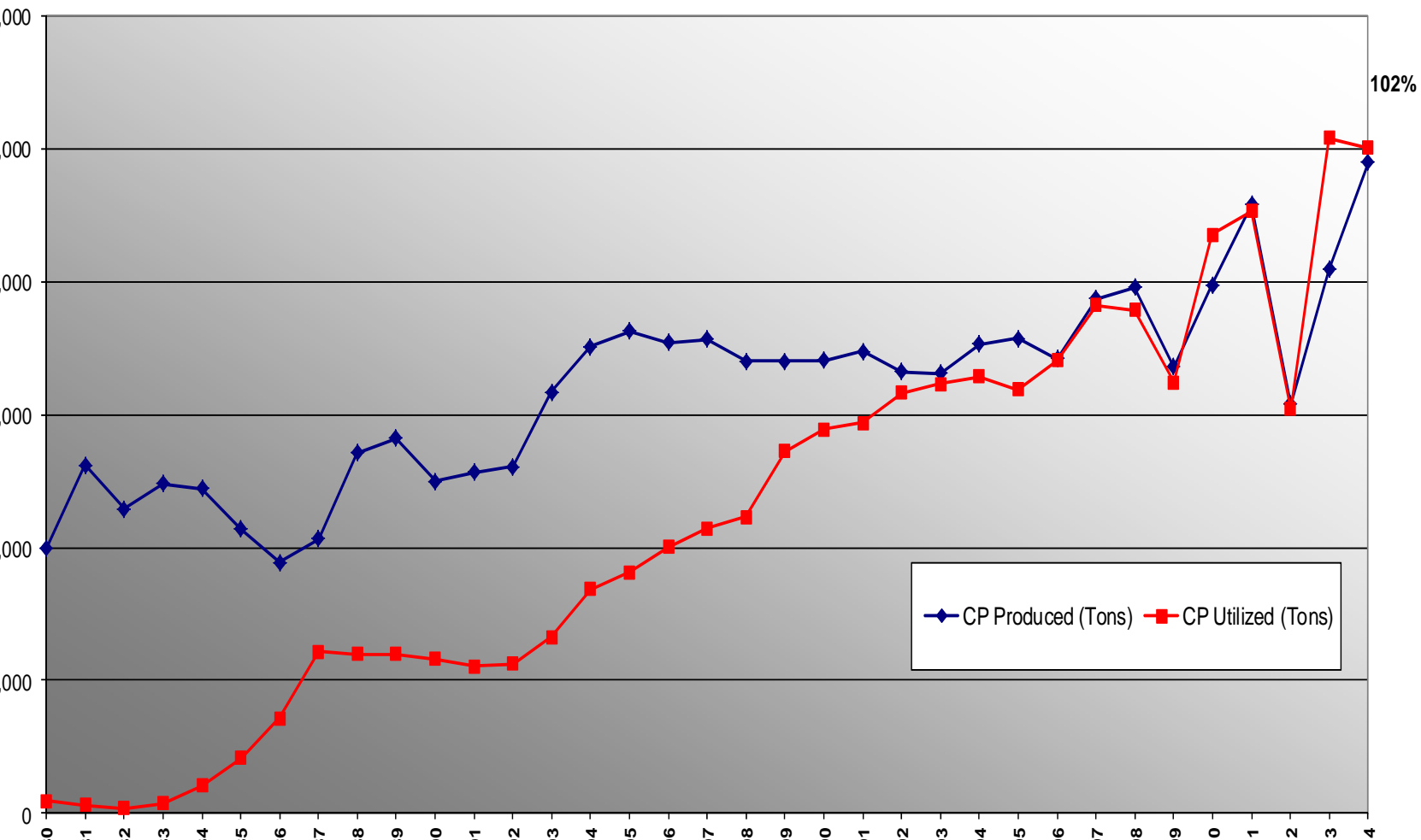
Peoples Gas Light and Coke Company

Wisconsin Public Service Corporation

## Company Statistics

- 4.4 million customers
  - 1.6 million electric customers
  - 2.8 million gas customers
- 60% ownership of ATC
- 70,000 miles of electric distribution
- 44,000 miles of gas distribution
- 9,400 MW of power plant capacity

# The Energies Combustion Products Production & Utilization



# Benefits from Combustion Products Utilization

*Avoids new landfills ..... Over 11 million cubic yards NOT landfilled since 1980, or equivalent of two new landfills avoided.*

*Reduces operating costs and provides customer savings.*

*Generates revenues for valuable commodities such as Fly Ash & FGD Gypsum.*

*Provides lower cost construction materials which perform the same or better than conventional materials.*

*Reduces greenhouse gas emissions.*

*Fly ash used in concrete offsets the CO<sub>2</sub> produced in making cement.*

*Reduces quarry and mining needs.*

*Promotes resource conservation and reduces energy use.*

*Conserves natural resources for future use.*

*Provides sustainability benefits from improved durability and longer life.*

# Fly Ash In Concrete

for High Performance Concrete



# Quality of CCP's – Fly Ash

- Regular/routine sampling of fly ash
- Importance of Consistency – routine tests
  - Loss on Ignition (LOI – carbon content)
  - Foam Index (impact of carbon)
  - Fineness (particle size - reactivity)
  - Ammonia content (if necessary)
  - On Site Labs at our Power Plants
- Performance testing of fly ash to meet specifications and standards of end users (ASTM C618)

# Black Creek Expansion Units

130,000 cubic yards of concrete

Up to 50% fly ash concrete in 25 different mixtures

0.45 or less - water/cementitious materials ratio

5 years to permit

17 miles of railroad track

33,000 tons of structural steel

6 million cu yds excavated

550 ft tall chimney

27 ft diameter intake tunnel

Over 5 years to construct





# ly Ash for Construction

*stronger, more durable concrete  
roads and structures*

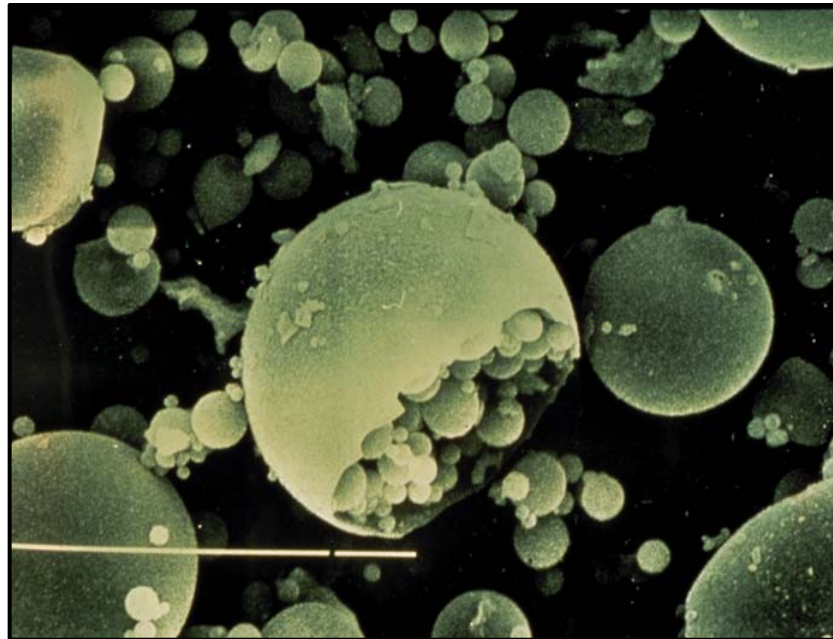
*10 Year Concrete, sustainable  
with lower carbon footprint*

*Road Base Stabilization -*

*longer life paving, lower cost  
roads*

*SM Flowable fills, for efficient  
most effective backfill and pipe  
bedding*

*asphalt ingredient, stronger,  
more durable, and lower cost  
pavements*

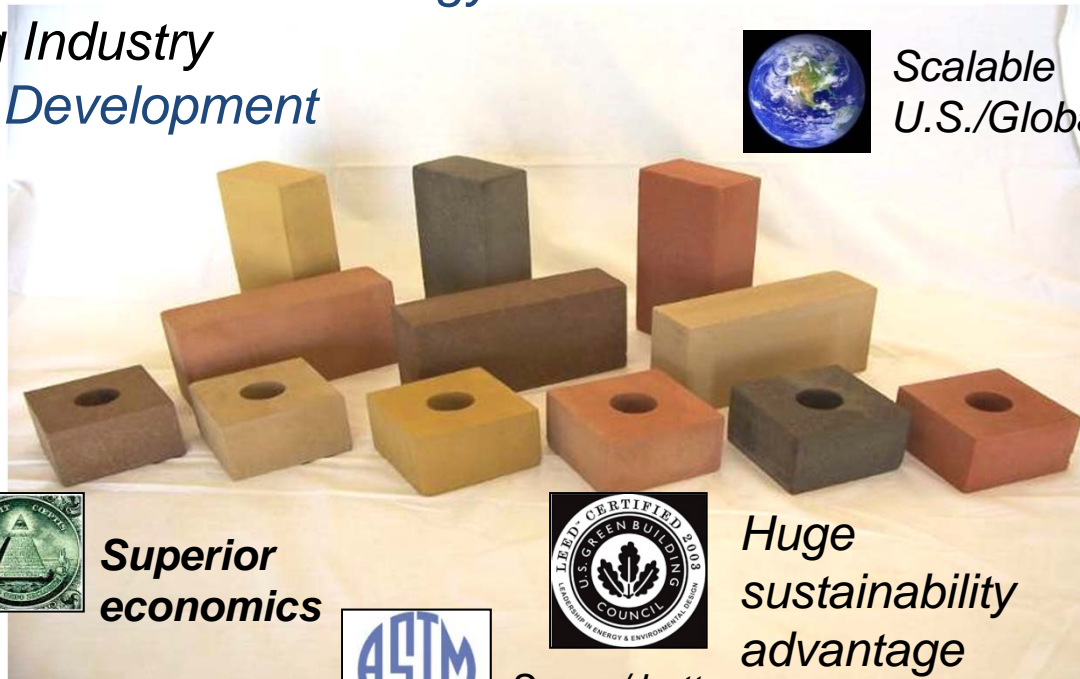


# Products – CalStar Brick

- > *CalStar – Caledonia Initial Plant and Mississippi Expansion*
- > *High Value Building Product, using Fly Ash*
- > *Low CO<sub>2</sub> Impact, Non-Fired Brick*
- > *Sustainable Building Material & Technology*
- > *Jobs in Green Building Industry*
- > *Community Economic Development*



*Scalable  
U.S./Global*



**Superior  
economics**



*Same / better  
performance*



*Huge  
sustainability  
advantage*



# Bottom Ash for Construction

*Cement Raw Feed*

*Fine Aggregate "Sand" & "Stone"*

*Foundation & Road Base*

*Local Source*

*Lower Cost*



# Ash Recovery from Monofill Landfill

*Same uses as bottom ash*  
*Helps meet customer demand*



# GD Gypsum Calcium Sulfate ( $\text{CaSO}_4$ )



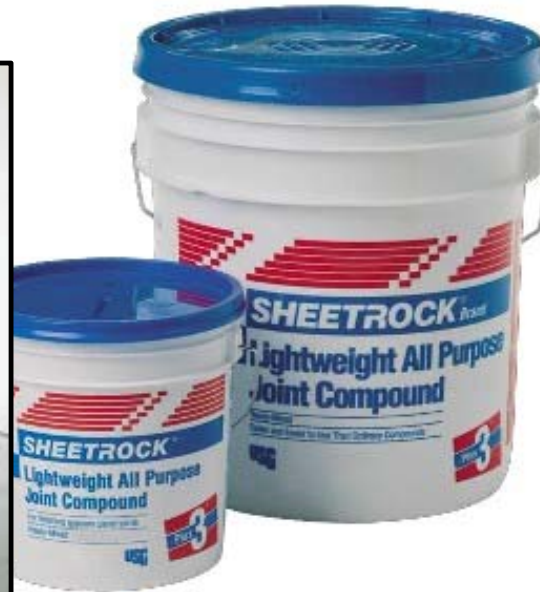
# D Gypsum Uses



Wallboard



Floors



Agriculture



Cement Ingredient

## **GD Gypsum Benefits for Agriculture**

*Improves soil properties and increases crop production by increasing soil permeability and water retention (drought resistance)*

*Promotes deeper rooting and growth, provides plant access to nutrients*

*Reduces silt loading in runoff from fields; Reduces fertilizer runoff into rivers and lakes*

*Lower cost gypsum for region's agricultural producers*

*Lower fuel usage and emissions with shorter haul distance for "locally produced" commodity*

*Reduces natural gypsum mining and associated impacts*

*Preserves natural gypsum supplies for use by future generations.*

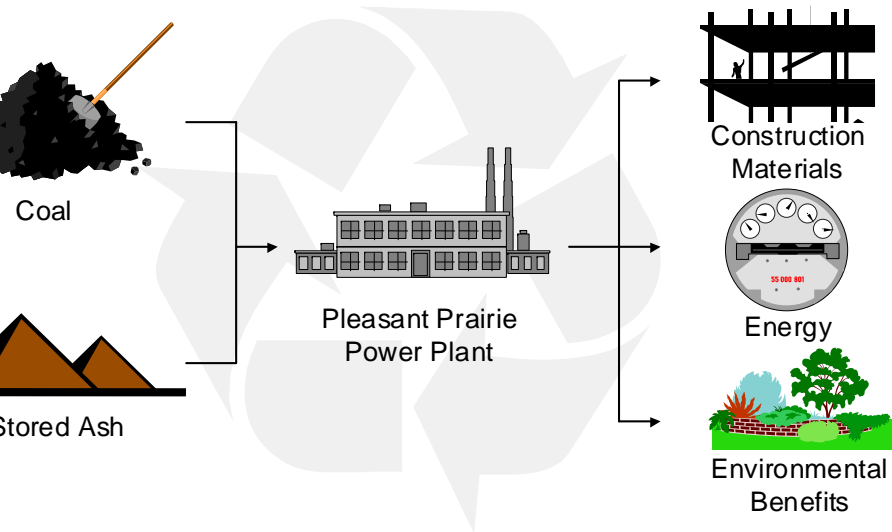
## Ash Fuel Reburn and Recovery

- ▶ *Ash Fuel Reburn is a key component of our beneficial use program*
- ▶ *Technologies are patented, and produce high quality fly ash for concrete with numerous environmental benefits.*
- ▶ *Uses remaining fuel value in currently produced and recovered ash*
- ▶ *P4 and ERGS power plants have advanced Air Quality Control Systems, and comply with their air permits.*
- ▶ *Legacy Ash Sites: No use for ash from the past*
- ▶ *Solution: Ash Recovery and Reburn changes ash from the past to construction materials in demand for beneficial use*



# Ash Reburn

## Ash Recovery Process (US Patent # 6,637,354)



**Fly Ash Reburn  
U.S. Patent  
5,992,336**

# Ash Fuel Influence ( Example)

- Coal typically has 5% Ash Content
- High Carbon Supplemental Fuel has 80% Ash Content
- For 2% Ash Fuel Addition:

Resulting Coal Ash Influence =

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

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

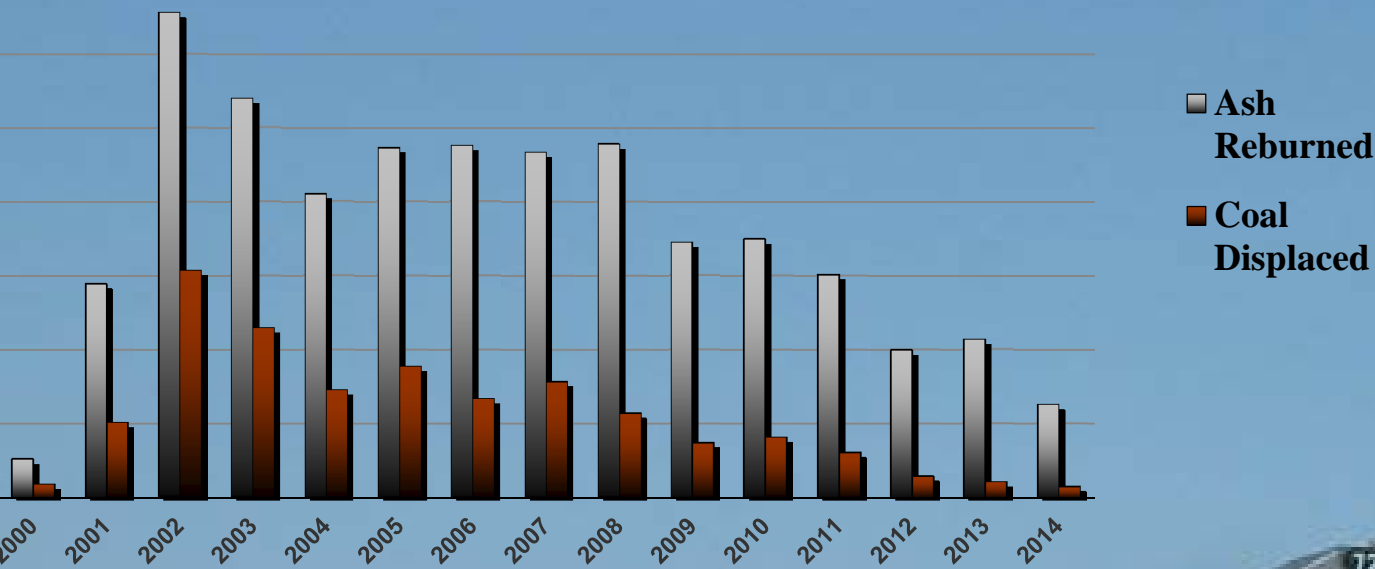
So for .016/.065 we have 25% influence in total ash by adding 2% Ash Fuel.

# Ash Recovery from Former Landfill Site



# Reburn and Displaced Coal

Annual Totals



*Displaced more than 2,900 railcars  
equivalent since 2000!*

*100 Tons coal equivalent*



# Fly Ash Storage Facilities



# 7 Ash Utilization: Old In-Place Recycled Pavement

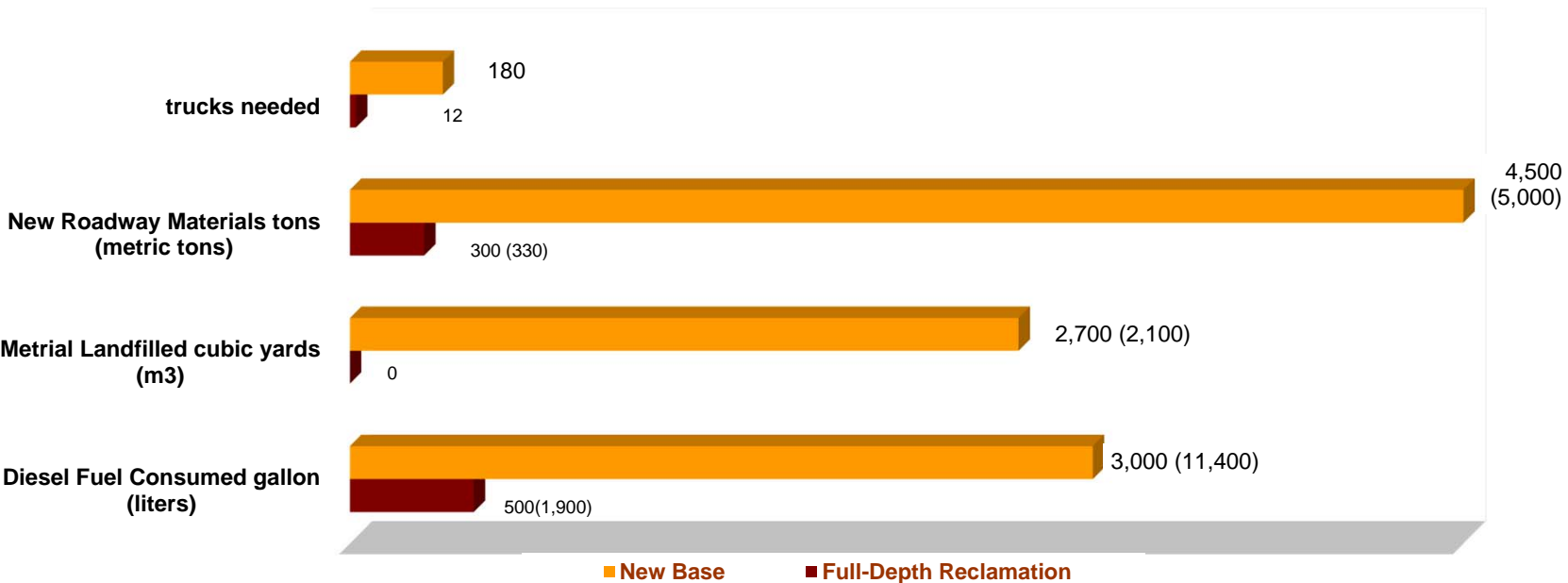
(Depth Reclamation)  
Using fly ash as binder  
In-place stabilization



# Environmental Benefits

and In-Place Recycled Pavement  
with Self Cementing Fly Ash

## Energy Use and Materials *Full-Depth Reclamation vs. New Base*



Based on 1 mile (1.6 km) of 24 foot (7.3 m) – wide  
2-lane road, 6-inch (150 mm) base

# CP Utilization: Biofuel Storage Building Eco-Pad

Low cost, fast paving installation  
Mixed in-place concrete  
Using 93% recycled materials

Ash, Portland Cement, Recycled Concrete





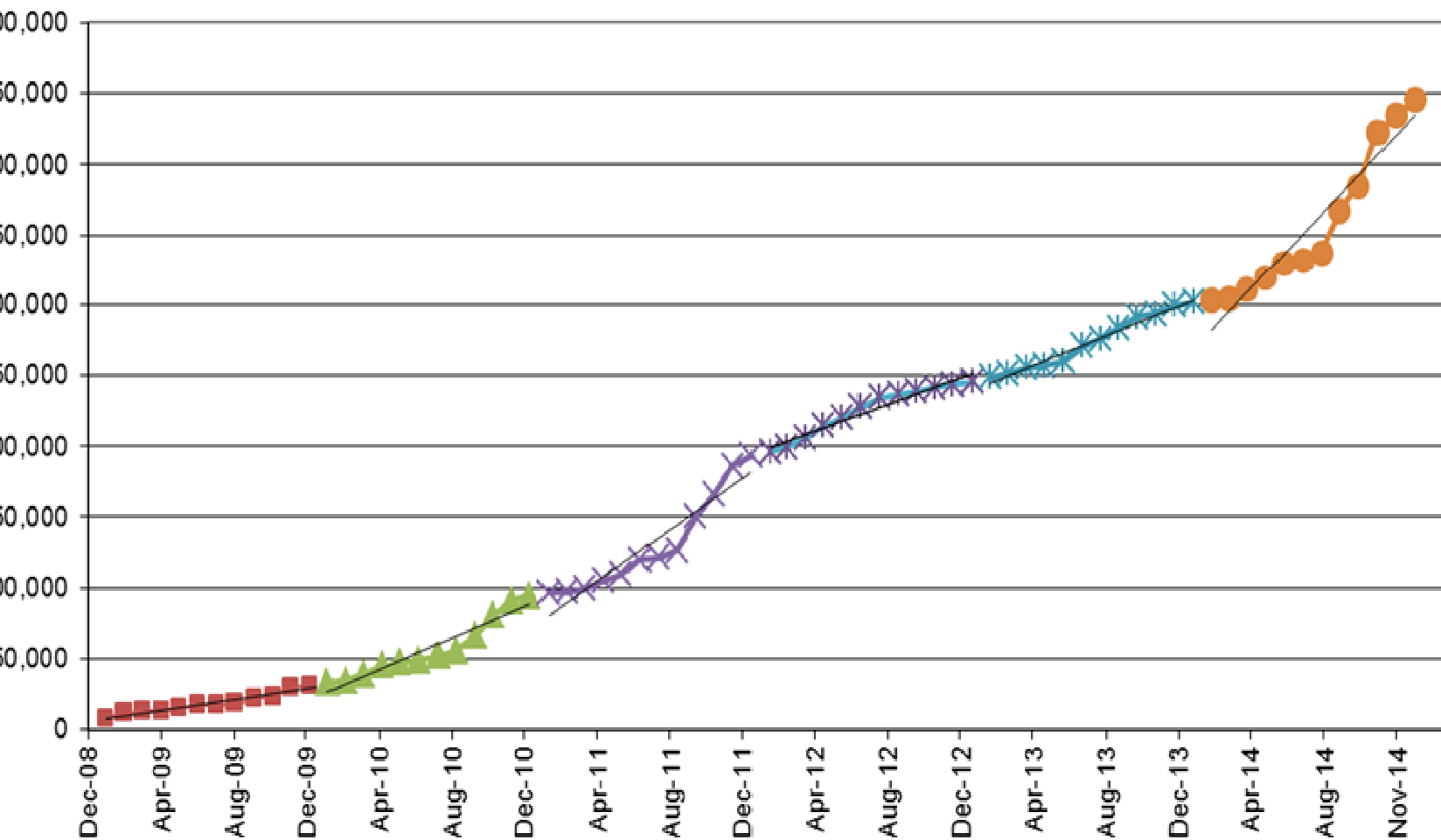
# P Utilization: Eco-Pad Stockyard Paving

Heavy point loads & truck traffic at service center



# Consumption to Agriculture

## Total Cumulative Gypsum Distributed Into Agriculture



# Combustion Products Utilization: Wood Ash



Annual Production  
10,000 tons Btm Ash  
5,000 tons Fly Ash

# CCP Patented Technologies

- *Ash Fuel Reburn & Ash Recovery*
- *Electrically Conductive Concrete & CLSM*
- *Ammonia Removal from Fly Ash*
- *Mercury Removal from Fly Ash*
- *Carbon Sequestration with Fly Ash*
- *Ash Alloy – Composite Metals*
- *Dry Cenospheres Separation*
- *Use of Ash Landfill Leachate for Production of Concrete and Concrete Products*

# CPs - New Beneficial Uses

## Ashphalt Research

Fly Ash for improved asphalt paving with longer life and durability



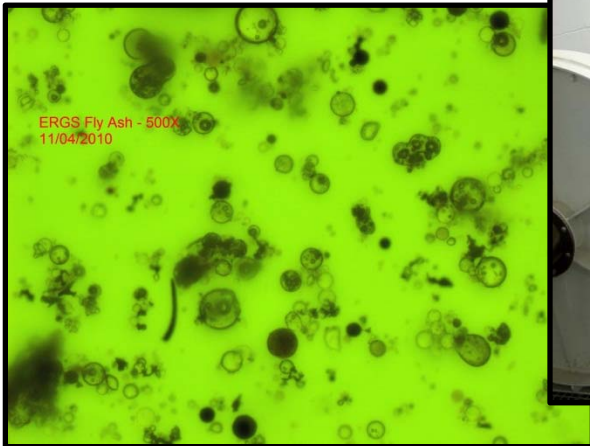
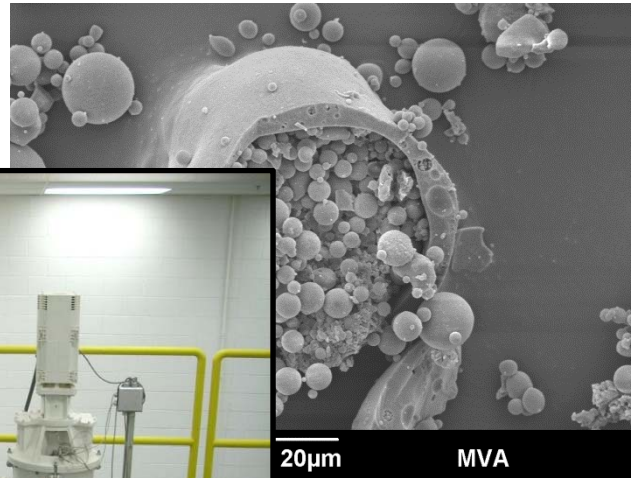
## Gypsum Research

Phosphorus Runoff Control on Agricultural Land,  
Reducing Algae in Rivers and Lakes.



# with Beneficial Uses

Cenospheres Research  
High Value Fly Ash Particles  
for Manufacturing



Manufactured Composite Lumber  
Fly Ash for Durable Building Products



# Sustainability Benefits

Benefits – Environmental, Economic, and Social  
Use of combustion products in concrete and other  
applications benefits:

- Reduced CO<sub>2</sub> emissions
- Reduced energy use
- Reduced water consumption
- Reducing demand for portland cement manufacturing
- Conserves virgin materials
- Conserves landfill capacity
- Conserves land

## Concrete Benefits

Use of fly ash in concrete can enhance:

- Ultimate compressive strength
- Decrease permeability
- Improve long term durability
- Extend service life (the single most important factor in reducing impact of embodied energy).
- Extended service life also decreases need for demolition, removal and recycling of building materials which reduces fugitive dust, greenhouse gases and other potential environmental issues



# Thank You – Questions ?



**Pleasant Prairie Power Plant**