

# Carbon Burn-Out



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## Commercialization and Experience Update May 14, 2002

By: James G. Keppeler

**Progress  
Materials  
Inc.**

a  **Progress Energy**

The logo for Progress Energy consists of a stylized, three-dimensional 'X' shape. The 'X' is formed by two overlapping, curved shapes in red and yellow, creating a sense of motion and energy.

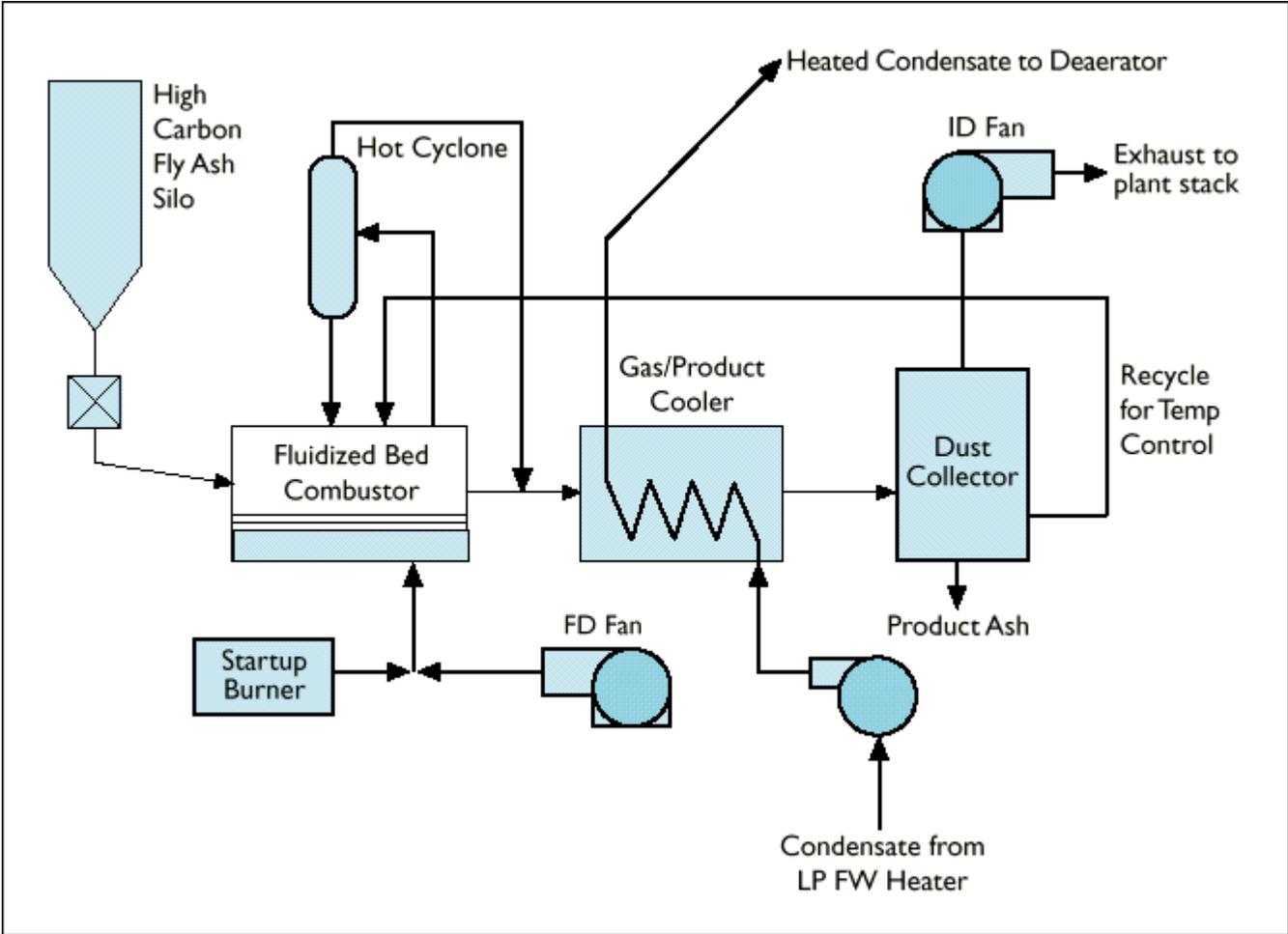
Company

# Carbon Burn-Out Overview

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- Beneficiates high-carbon fly ash to produce low-carbon, high-quality ash
- Removes carbon
- Removes ammonia
- Recovers heat
- No ash goes to waste

# Carbon Burn-Out Schematic



# PMI - Carbon Burn-Out Development

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- Pilot plant 1992
- PMI Patents – US, Canada and Europe
- First Commercial Plant 1999, Second 2002
- SEEE Environmental Award - 2001

# Economic Drivers

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- Avoided land fill costs
- Avoided landfill expansion
- Heat recovery
- Continued ash sales after low NOx burner, SCR or flue gas conditioning installations
- Enables fuel blending with pet coke while recovering significant heat from fly ash and maintaining/improving ash quality

# CBO - Process

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- **High carbon ash pneumatically conveyed from existing storage silo to CBO silo.**
- **An FD fan provides fluidization and combustion air to the CBO fluid bed combustor.**
- **Feed ash is metered into the combustor.**
- **Carbon combusts on a continuous basis.**

# CBO - Process (Cont.)

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- **Material exits combustor at 1350°F**
  - ✓ Product fly ash
  - ✓ Flue gas from fluid bed combustion
- **Heat exchange occurs between the hot product ash plus flue gas and the condensate of the power plant.**
- **Product ash is separated from the flue gas by a cyclone and a baghouse.**
- **Product ash is pneumatically conveyed to the storage and load -out area.**

# Technology - CBO System Description

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- **Fluidized bed technology**
  - ✓ **Self-sustaining combustion above ~7% carbon**
  - ✓ **Consistent Product LOI**
  - ✓ **Product quality not dependent on feed ash LOI**
  - ✓ **Flue gas returned to boiler or to stack**
  - ✓ **No solid waste, all processed ash is available for sale**
  - ✓ **No liquid waste**
- **Heat recovery**
  - ✓ **Power plant performance is improved by returning heat collected by CBO**

# Experience - Full-scale

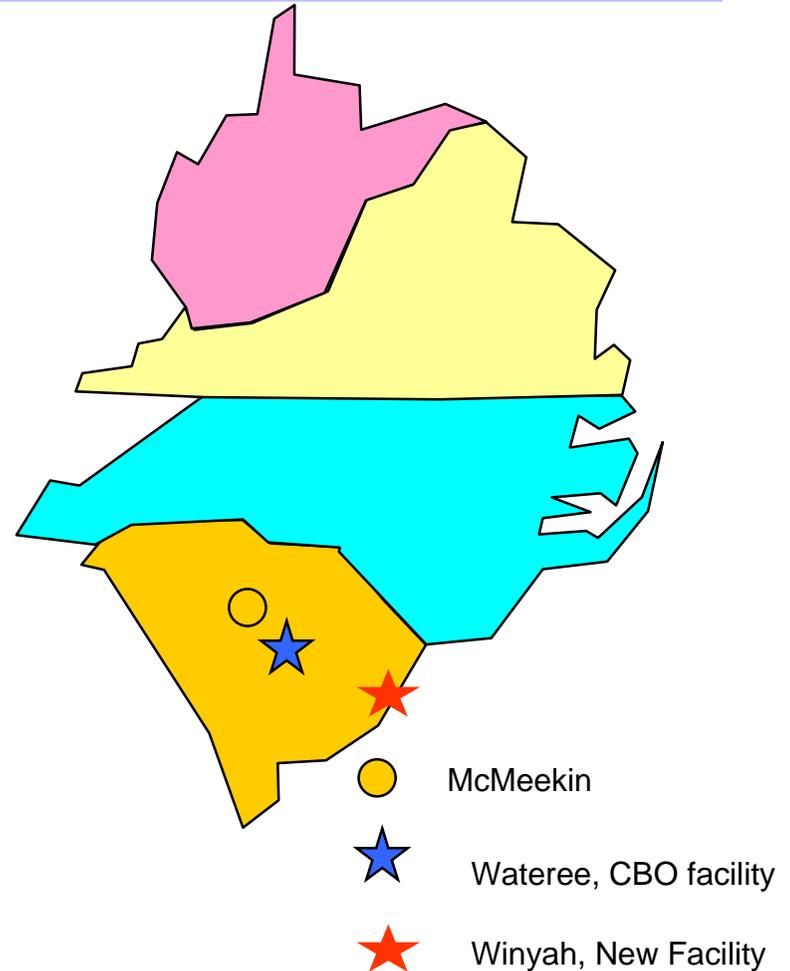
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## ① SCE&G Wateree Station

### ● Processes ash from:

- ✓ Wateree, 720 MWe
- ✓ McMeekin, 294 MWe
- ✓ Others

## ① Santee Cooper CBO - 2002



# Experience - Wateree CBO

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- Design Capacity
  - ✓ 25 TPH, has operated at >40 TPH
  - ✓ Operation 24/7
  - ✓ Feed ash LOI 12.5%
  - ✓ Product ash LOI 2.5%
- Process keys off product ash quality, not feed LOI



# Experience - Wateree Heat Recovery

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- Tube-in-Shell
  - ✓ Counter-flow
  - ✓ Single pass
  - ✓ Flue gas/ash to condensate
- Gas/ash side
  - ✓ Inlet temp, 1350 °F
  - ✓ Outlet temp, 300 °F
- Steam cycle side
  - ✓ Significant efficiency improvement
  - ✓ Connected to condensate system



# Operating Conditions

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- 1350 °F
- 45 minute avg. residence
- Throughput 20-45 tph, depending on feed ash LOI



# CBO - Product Ash

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- Excellent pozzolanic activity
- Consistent air entrainment
- 2.5% carbon

# Waterree Dome/Load-Out View

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- 16,000 ton storage dome
- 4 - 250 ton loadout silos
- 2 - 250 ton receiving silos



# Ash Storage and Loadout

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- Truck traffic rerouted away from power plant - minimal interference with plant
- Delivery of feed ash and product loading around-the-clock, without scale-house attendant
- Two loading stations, both on scales
- Dome provides additional storage - maintain product availability during plant outages

# Waterree Dome, Loadout

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# Waterree - Performance to date

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- Feed Ash LOI 6.5%-18%. Average ~10.6%
- Product Ash LOI 2.5% based on Market. Have achieved 0.8% during normal operations.
- >18,000 tons/month produced, sold

# Current Implications

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- Further reductions in  $\text{NO}_x$  emission limits may result in ammonia contamination of ash
- CBO Pilot demonstration showed that ammonia contamination can be eliminated without process changes



# Winyah CBO Construction (5/'02)

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# Carbon Burn-Out Summary

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- Commercially demonstrated, proven technology
- Highly consistent low carbon ash
- Removes ammonia with no change in process, saving capital & operating \$\$\$
- Recovers valuable thermal energy
- No waste