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Background on Biomass Co-firing and Repowering

Prepared for:
Forest Biomass in a National RPS Briefing
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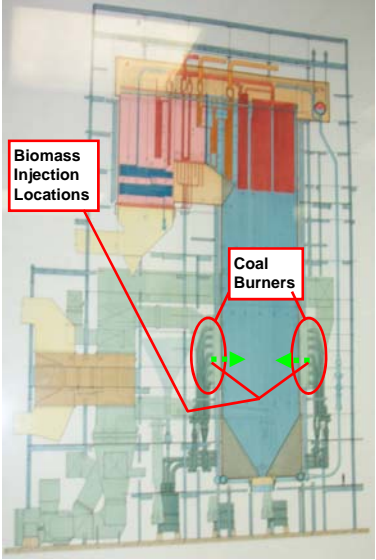
Presentation Objectives

- Provide brief overview of biomass cofiring and repowering
- Provide examples of equipment/projects
 - Near term renewable energy option
- Brief Description of Benefits & Risks
- Example of Cofiring treatment for an RPS (NY)

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Background on Biomass Cofiring


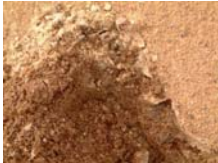

- Biomass replaces *a portion* of fossil fuel (usually coal)
- Can replace up to 20% of heat input
- Renewable power generation *using existing (or new) power plants*
- Lowest investment cost option for adding new biopower
- Relatively high efficiency for biomass to electricity
- Not without risk or complication—many plants will be considered “off limits” at least initially
- Wide implementation in Europe




The diagram illustrates a biomass cofiring system. It shows a large industrial structure with various components. A red box labeled 'Biomass Injection Locations' points to several points on the left side of the structure. A red box labeled 'Coal Burners' points to two circular burners on the right side. Green arrows indicate the flow of biomass from the injection points towards the coal burners.

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Biomass Cofiring Implementation Options

- Wood Fuel Forms for Cofiring
 - Chips 
 - Sawdust 
 - Pellets 
- Blended Feed
 - Lowest capital cost option
 - Usually limits heat input to 3% or less
 - Pellets under consideration by some
- Separate Injection
- Gasification
 - Most expensive capital costs
 - Potentially offers some technical advantages



The image shows a conveyor belt system with a mix of white biomass pellets and black coal particles, illustrating a blended feed example.

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NRG Energy – Dunkirk Cofiring

- Separate Injection
 - Up to 10% heat input from biomass
 - Modified oil gun ports
 - Installed new wood burners
 - On-site processing and handling system w/silo and milling
- Status
 - DOE Demonstration project complete
 - Demonstration project being upgraded for commercial operation
 - Moving from 6 to 11 MW
- Fuels
 - Wood waste (clean sawdust)
 - Chipped/milled pallets, other clean wood
 - Possibly willow energy crop
 - Open loop and closed loop biomass

Dunkirk Station

3 Year Old Willow

Storage Silo & Hopper

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Biomass Delivery & Handling Equipment

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Green Circle Bioenergy



2 million cubic ft storage,
up to 24,000 tons

This aerial photograph shows a large-scale industrial facility for biomass processing. In the foreground, a massive, conical pile of light-colored wood chips or biomass is visible. A long, white conveyor system extends from the left side of the frame towards the center. In the background, there are several large piles of dark brown wood chips and a dense line of green trees under a clear sky.

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Green Circle Bioenergy



2 million cubic ft storage,
up to 24,000 tons


This ground-level photograph shows a conveyor system in operation. A green conveyor belt is moving a large volume of light-colored biomass material into a large, flat-topped storage pile. In the background, there is a large, white industrial building with a tall metal structure on its roof. A green container is visible on the left side of the frame.

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Alliant Energy – Ottumwa Station Cofiring

- Fuel: Switchgrass (Closed Loop)
- Status: Demonstration Activities Complete
Commercial Development Under Consideration
- Details:
 - Generated up to 17 MWe renewable electricity, 3 extended tests
 - Locally grown switchgrass replaced 2.5% of coal, CRP land used (pilot test)
 - Demo. project cost-shared by DOE, USDA, Alliant Energy, local farmers
 - Carbon savings documented, certified, and sold on CCX

Ottumwa Generating Station, Iowa



Switchgrass



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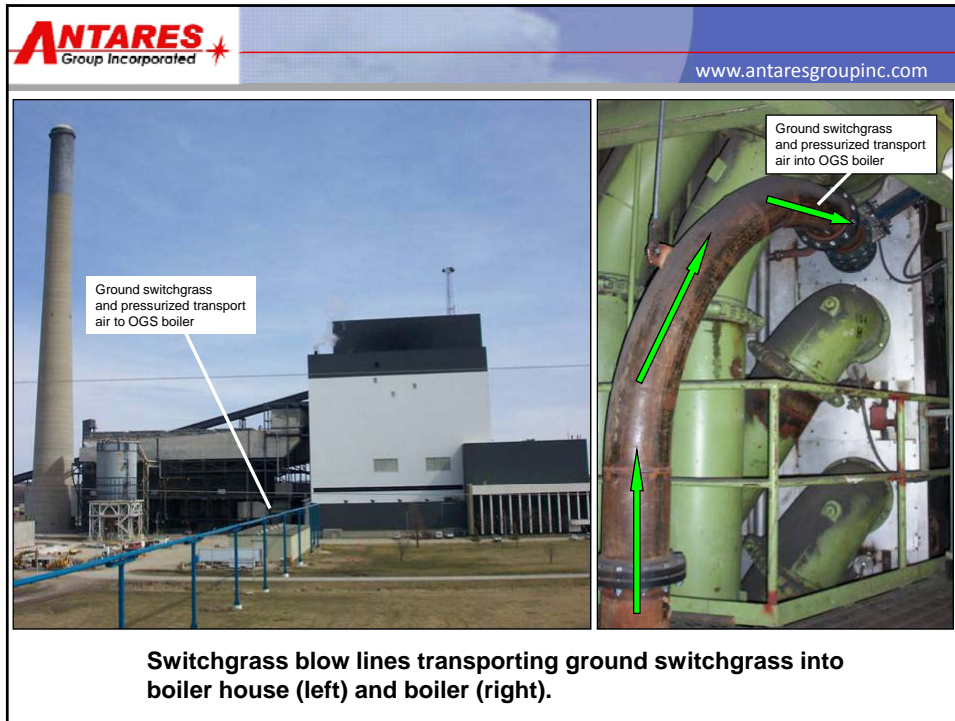
Replacing up to 5% of this



with this



Ground Switchgrass (R1 - High SWG, Low Moisture) 42006
Full Load, Coffin Test, 1" Debris Screen, 11.4 tons/hr



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Background on Biomass Repowering



- Biomass replaces *all* of fossil fuel at existing power plant
- Can add new value to aging power plants (preserves jobs)

Small
Coal Plant

→

Large Biomass
Plant

- Far more extensive and expensive modifications compared to cofiring
- Huge decreases in NO_x, SO₂, and net CO₂ emissions
- Will not occur without policy drivers/incentives

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Plant Schiller Repowering (50 MW)

- Power for 40,000 average homes
- Large reductions in SO₂, NO_x, net CO₂
- Built in 2006 to sell RECs into MA RPS




Wood chip power

Public Service of New Hampshire has made the move to renewable energy—and significantly reduced emissions—with the \$75 million conversion of a coal-fired power plant to a biomass power plant that is fired with wood chips.

enerG, November/December, 2007.

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Benefits and Risks

- Benefits
 - Commercially available renewable energy (RE) option, relatively low to modest capital costs
 - Baseload/dispatchable RE option
 - Emissions reductions are real, measurable
 - Fuel use is measurable / verifiable
 - Cofiring does not threaten plant power output
 - On-going local job creation/preservation
- Potential Risks
 - Fly ash market interruption
 - Emissions control equipment operations concerns
 - Impacts on existing power plant equipment
 - Fuel supply (impacts on existing customers)
- An important and necessary near-term RE option
 - Planning flexibility is very necessary for utilities

State-level RPS Biomass Cofiring Example

- Biomass cofiring is allowed for meeting NY RPS
- Handbook stating compliance & monitoring requirements developed
 - NYSERDA / Antares Group
- Requirements are:
 - Only clean wood chips, unadulterated wood waste, ag. residues & energy crops allowed,
 - Wood harvest must be according to sustainable guidelines
 - Established by RPS documentation
 - Continuous measurement of biomass flow to boiler
 - Frequent moisture content measurement
 - Document biomass heat content
 - Periodic lab analysis of biomass supplies
 - Third-party operational project review & certification to qualify RECs for RPS
 - NYSERDA / Antares Group
- It helps to have a good example to go by