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Biomass Cogeneration Facility Savannah River Site, Aiken SC Clean- Green- Sustainable Steam

Savannah River Site – Citizens Advisory Board
Facilities Disposition & Site Remediation Committee
October 25, 2011

Savannah River Site Project Overview

- *Project Background & Drivers*
- *Project Scope*
- *Project Benefits*
- *Project Status*

Project Background



- The existing D-Area Powerhouse was built in 1953 and provides steam to nuclear and industrial activities in F-, H-, and S-Areas. It is a co-generation facility and provides approximately one half (20 MW) of the Site's electrical demand.

Project Drivers

- D- Area Powerhouse is over 55 years old and well past its economic life. Condition and reliability are rapidly deteriorating (capability for up to 60 MW, (4) 300,000 PPH boilers).
- Regulatory drivers, age, and condition will require significant upgrades for continued operation.
- Steam demand will remain for current and future critical missions, but will be reduced over time.
- Executive Order 13423 and DOE-HQ initiatives mandate maximum use of renewable energy sources and ESPC type contracts.

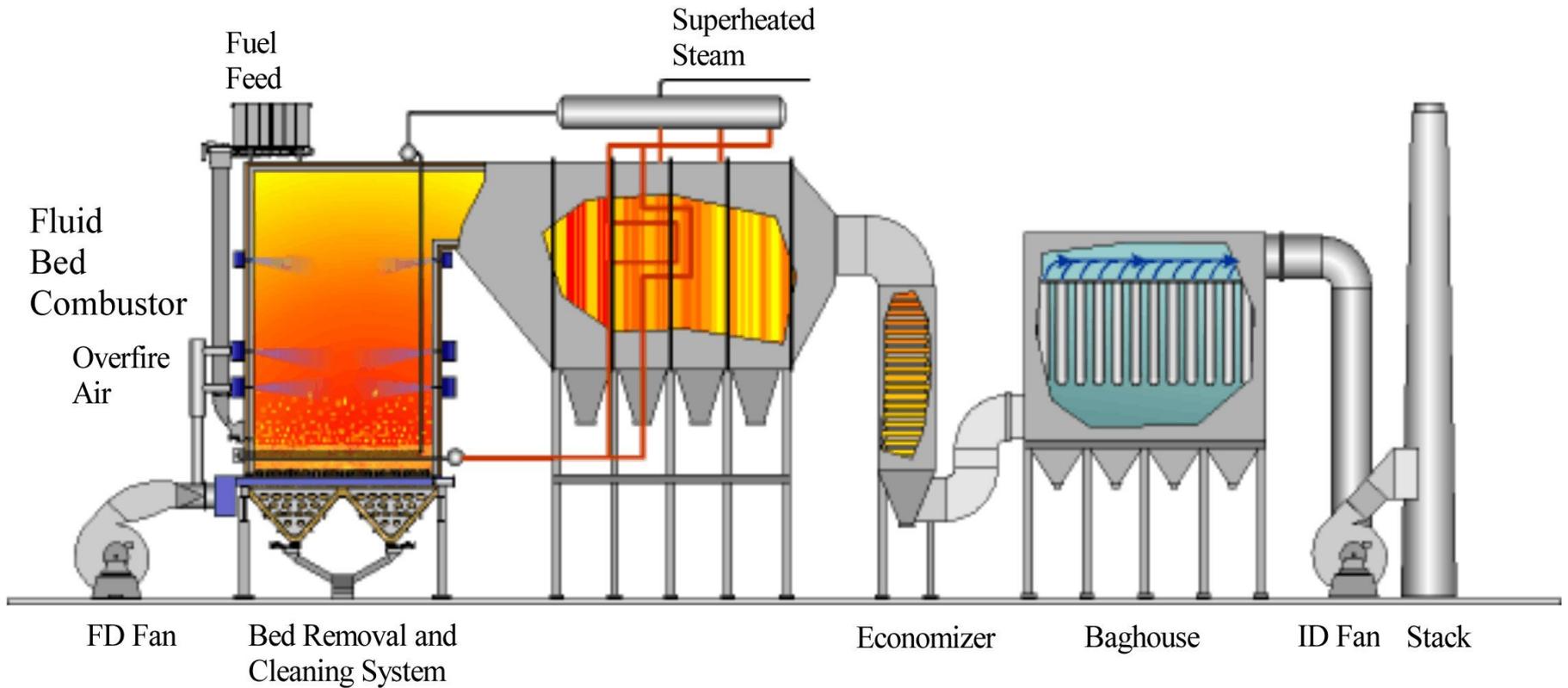
DOE SR ESPC Project

- Energy Savings Performance Contract funded from savings from energy and operations and maintenance of the D area Plant (coal to biomass, best available technology, reduction in line losses)
- Designed & Constructed to Industrial Codes and Standards
- Performance based contract
 - Ameresco totally responsible of operation and maintenance costs
 - 19 year performance period
 - Reduces risk to the Government
- No upfront Capital funds - Contract fully funded by Ameresco via third party lender (Provides new infrastructure with unique alternative funding contract vehicle)
- Largest renewable ESPC & Biomass Operation in Federal Sector

Project Scope

- Project Scope: Biomass Fueled Energy Plants for the SR Site
 - Energy Conservation Measure (ECM) #1 - Install new biomass fired cogeneration plant with design capacity of 240,000 pounds per hour (PPH) of steam and 20 MW of electric power to replace the existing coal-fired D-Area plant. (Will operate 24/7/365)
 - Energy Conservation Measure (ECM) #2 - Install two 10,500 PPH biomass fired steam boilers; one in the site's K-Area and one in the L-Area to replace the existing fuel oil fired K-Area boiler. (Seasonal operation for winter heating)
 - Energy Service Company (ESCO) will purchase biomass fuel (over 300,000 tons per year) from local community businesses to provide energy to these new plants in order to meet Federal mandates for site renewable energy sources.

Fluidized Bed Technology



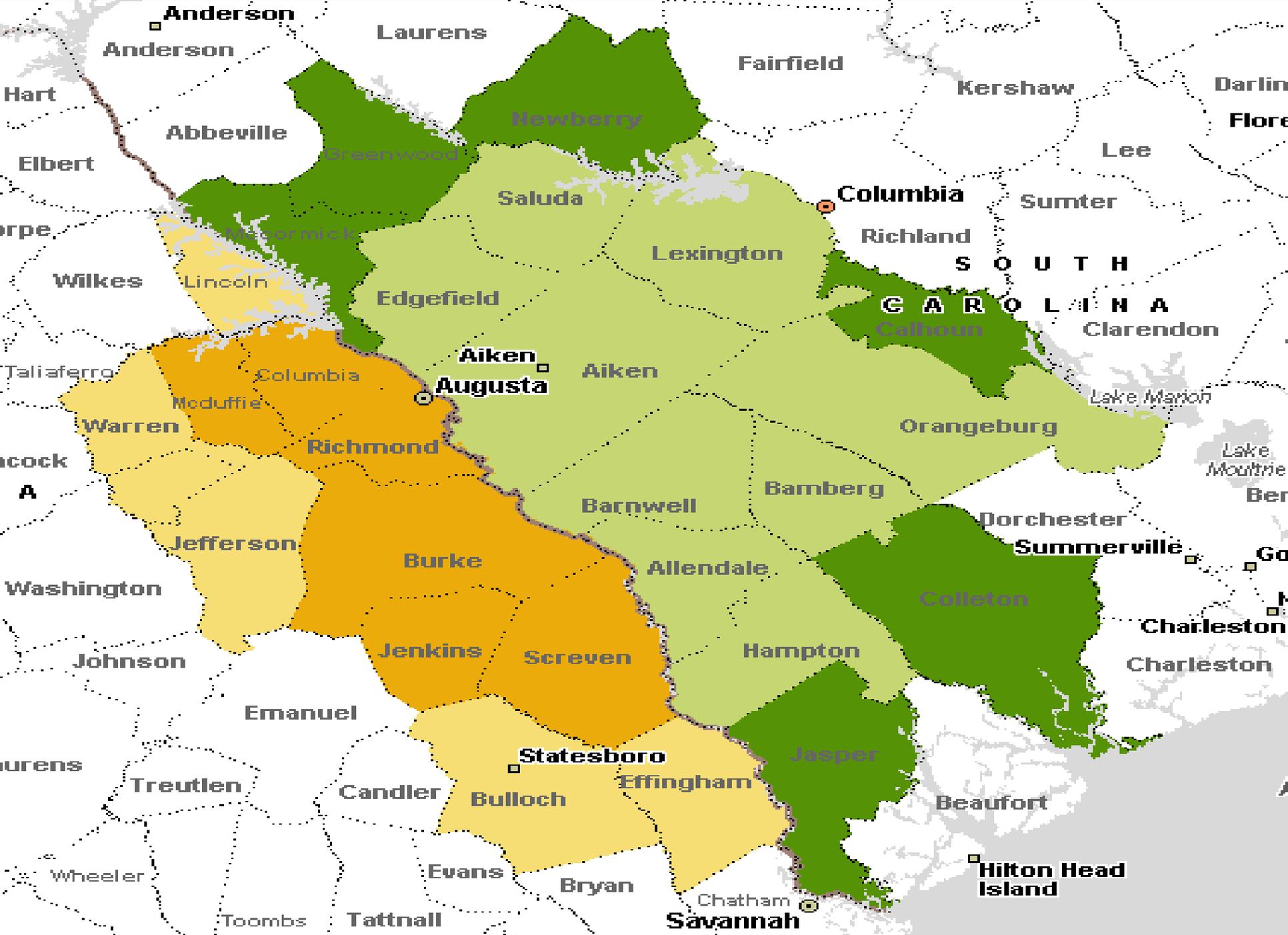
★ Fuel Flexibility

★ Better Emission Control

★ Low Maintenance

Fuel Sources

- Utilize ~ 325,000 tons of biomass for fuel source for the plants
- Main source of fuel will be forest residue
 - Heating value of 4,300 - 4,500 Btu/lb for forest residue
- Permitted to burn up to 30% (by weight) of biomass derived fuel (urban wood waste and tire derived fuel)



Plant Fuel Sources



Primary Source Clean Biomass

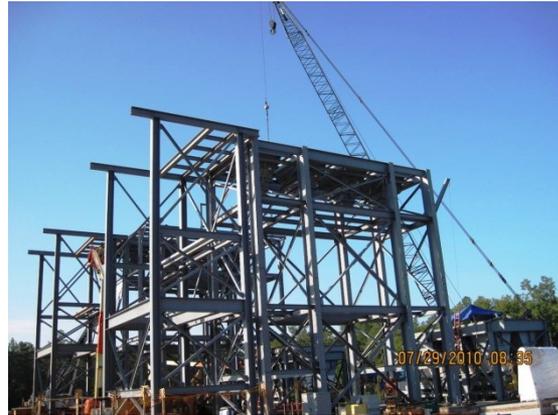
Project Benefits

- Greenhouse Gas (GHG) emissions reduced by 100,000 tons a year significantly decreasing the carbon footprint of the SR Site
- Overall annual air emissions rates will decrease:
 - Particulate Matter - > 400 tons a year,
 - NOx by > 2,500 tons a year, and
 - SOx by more than 3,500 tons a year
- The amount of river water currently drawn from the Savannah River will decrease by over 2.8B gal per year
- Sustainable design methods are being used and energy efficient technologies incorporated



Project Status

Sept 14 2009 to Sept 2011



Integrated Project Team (IPT)



- IPT formed in September 2009
- Included CO, FPM, representatives of FRs, Permits, SRNS, technical representatives as required
- Held meetings almost every week for the two year construction of the project
- Provided input to the IMRT which has met almost every quarter

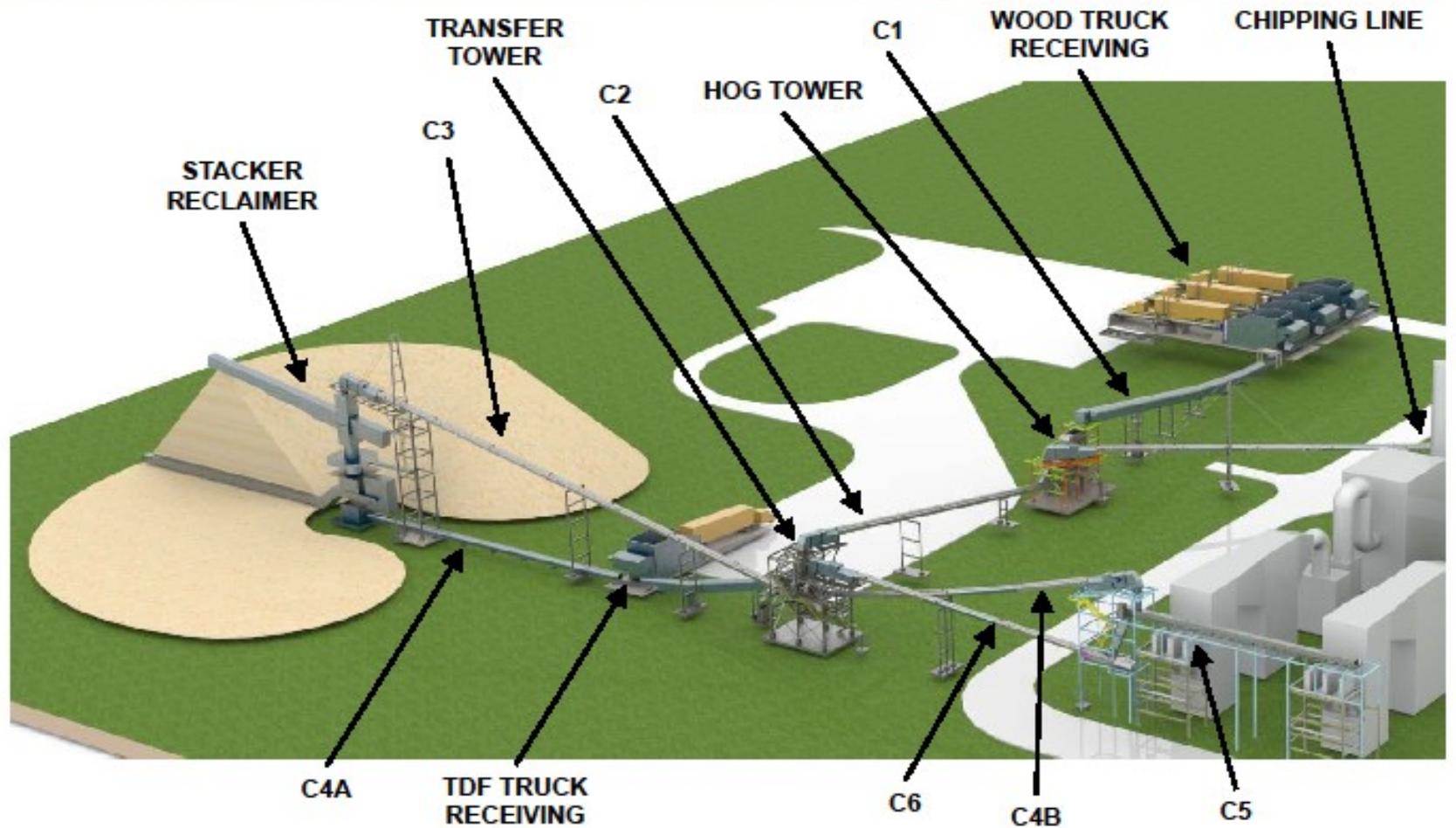
Start of Construction Ceremony November 2009



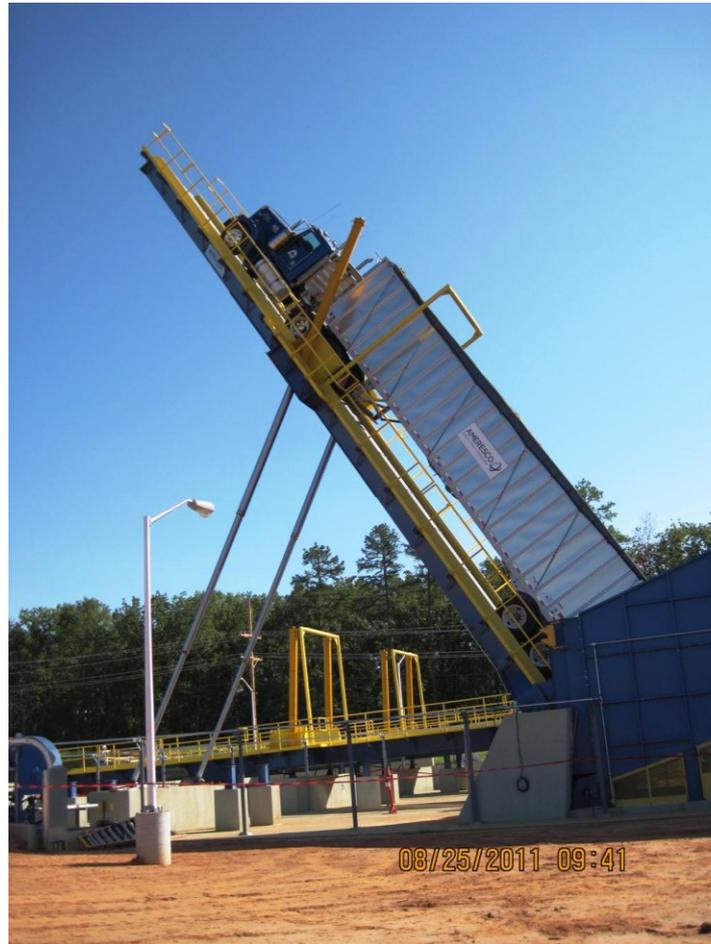
- Held in November 2009
- Attended by the Secretary, Governor, Senator Graham, 4 Congressmen
- CEO of Ameresco and AFS
- Off to a good start



Rendering of Fuel Handling System



Truck Off Loading Pad



- First footer poured in June 2010
- Three off loading pads
- Dump time is 6-10 minutes
- The hopper holds two loads (80T wood chips)
- 50 truck per day is about 1 truck load every 15 minutes

Hog Tower



- ❑ First footer poured in May 2010
- ❑ Receives chips from truck dumps and whole log chipper
- ❑ Chips go to the transfer tower or are resized through the Hog chipper
- ❑ Wood is sent by tubular conveyor to the transfer tower

Stacker Reclaimer



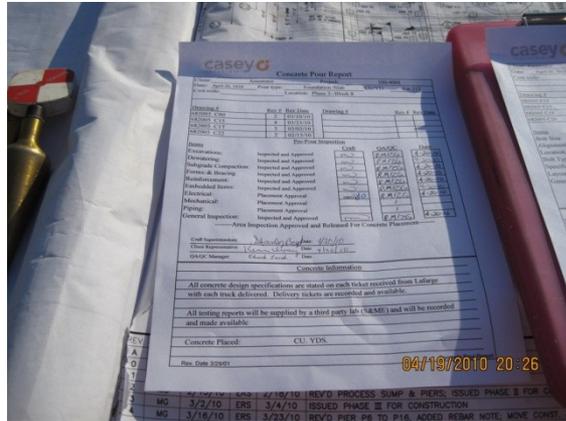
- First footer poured in May 2010
- Receives chips from the transfer tower
- Holds about 800 truck of wood chips (32K Tons)
- About a 30 day supply at 1KT per day

Boiler



- EPI Boiler
- 170 Tons
- Constructed in Texas
- CSX rail
- Stored at F area siding
- 96 wheel lowboy transported to Burma Road
- Critical lift of 170 tons
- Installed 1 month ahead of schedule

Boiler Island



- Two 120KPPH Boilers
- Fuel metering system
- Combustors with 3 feet of fluidized sand
- Forward Draft fans
- Economizer
- Pre heater
- Bag house
- Induced draft fans
- Stacks
- Support systems, Ammonia, Limestone, Backup Generator, water treatment

Turbine Building



- Started construction 15 Dec 10
- Pre Engr Bldg
- 18K SF
- Houses water treatment, control room, and turbine

Turbine



- Additional piles constructed for turbine foundation
- WEG generator and turbine
- Made in Brazil
- Turbine produces 20 MW of green power to the grid (MOX substation)

Steam Line Interconnection



- Major Effort & Coordination with Ameresco, DOE & SRNS
- Coordinate interconnection during planned site steam outage
- Successfully completed April 12, 2011

13.8 Kv Line Tie In



- Decision made to use the MOX substation vs F area
- Worked with SCEG, MOX, DOE SR
- 18 months of effort
- SCEG approved design in May
- Construction started in June
- Burma Road powered off of MOX substation August 10, 2011
- **Ameresco to provide 30% of the SRS power and 100% steam from renewable fuel by December 2011**

River Water Line



- Provides about 300 to 500 GPM river water to Burma Road
- Over 10,000 feet of pipe
- Sections above ground to avoid contaminated areas
- Started construction in December 2010 and completed in June 2011

Out Fall Line



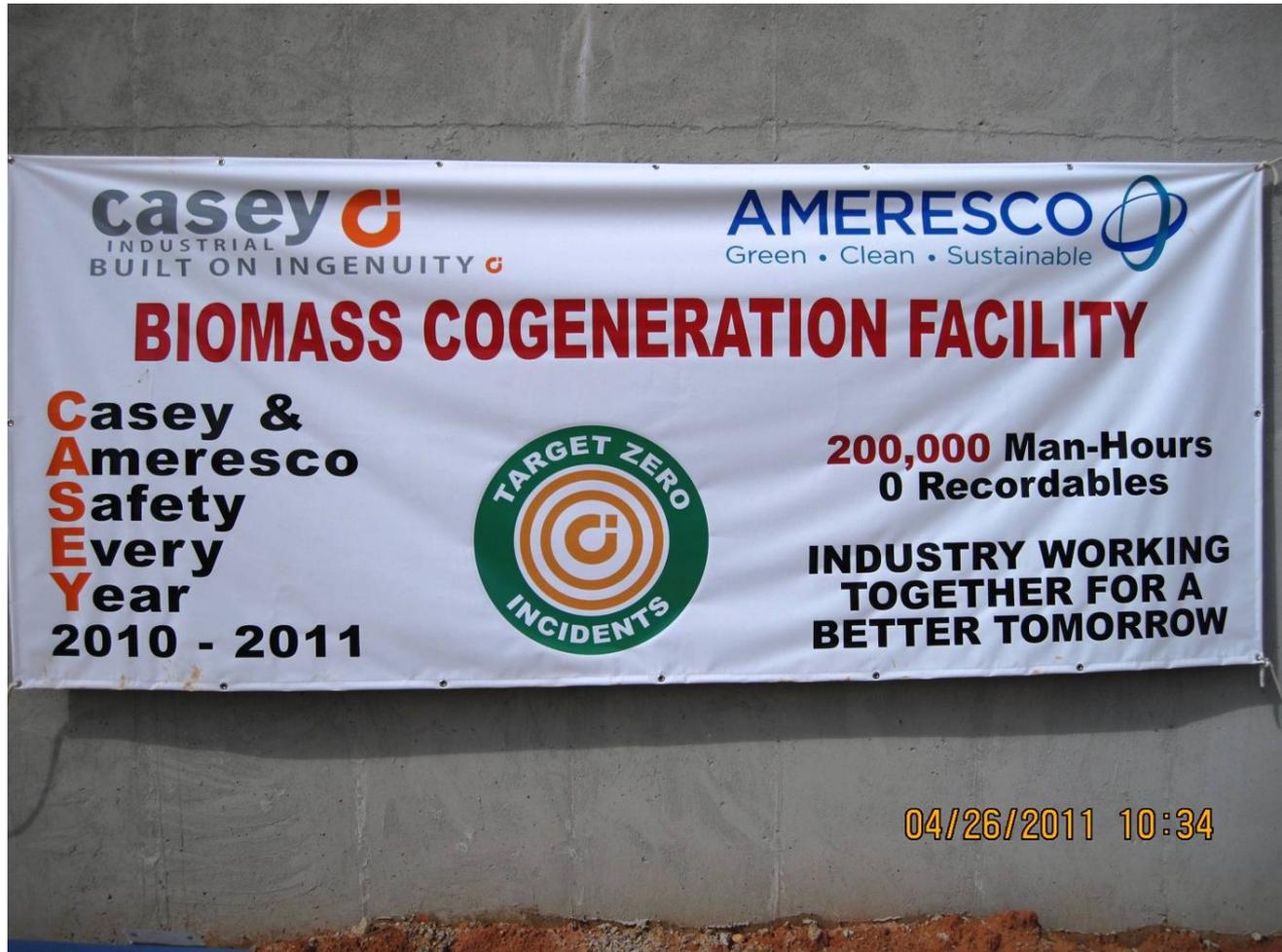
- 4 year permit effort involving DHEC and CoE
- 3,500 feet of pipe that discharges to Upper Three Runs River
- Discharges about 300-500 GPM
- Construction completed in two phases
- Construction completed in June to support commissioning

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Burma Road Construction (from 3K feet)



Burma Road Construction Safety



K and L Area Boilers



- Construction completed end of October
- Refractory installed, cured, and boil out completed.
- Training completed
- 48 hours test in L area completed 1 Nov
- Ameresco Commissioning completed 9 Nov
- Received conditional acceptance on December 7
- Provided steam to L area on Dec 13
- Provided steam to K area on Dec 15
- Great Team Effort

Commissioning

Steps of Commissioning & Startup



- Steps of Commissioning & Startup
- Ameresco System Commissioning of 30 systems
- Ameresco Equipment Performance Testing
- DOE –SR Team Readiness Assessment



Commissioning Milestones

- **System Checkout**
- **Auxiliary Equipment Testing**
 - Air Compressor System
 - Water Treatment System
 - Fuel Handling System
- **Boiler System Checkout & Testing**
 - Boilout & Cure
 - Performance Testing
 - Emission Testing
- **Turbine System Checkout & Testing**
 - I/O point check
 - Mechanical check
 - Steam Blows
 - Generator – Phase testing & Synchronization testing
 - Load Test
- **Facility Assessment & DOE Readiness Assessment**

Project Successes

□ Construction Status

- 38 acres of site clearing
- 150K CY of fill, 17K CY of top soil removed, 800 ton of rip rap installed, 8,400 feet of silt fence installed
- 13,000 cubic yards of concrete
- 812 Tons of steel
- 42,000 Linear feet of pipe
- 750,000 ft (142 miles) of cable
- 200 Motors installed
- 45 pieces of major equipment procured & installed
- 1900 Instrumentation I/O loops
- 150 workers (average on site during construction)

Project Successes

- Construction Status (continued)
 - 30 + environmental and site permits required
 - LEED Certified Administration Building installation in progress
 - 18,000 sq ft pre-engineered bldg installation completed (turbine building)
 - Project on schedule - start up in progress - targeting December for final Government Acceptance
- Commissioning underway and DOE RA is scheduled for the first part of November
- **Over 550,000 safe manhours**
- First year Operation of the K&L Area Biomass Plants
 - 13,026,000 lbs of green steam generated to K&L area
- **Ameresco to provide 30% of the SRS power and 100% steam from renewable fuel by December 2011**
- **Great Team Effort – Ameresco & DOE & SRNS**

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Thank You