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# **Biomass / Biogas Federal Case Studies**

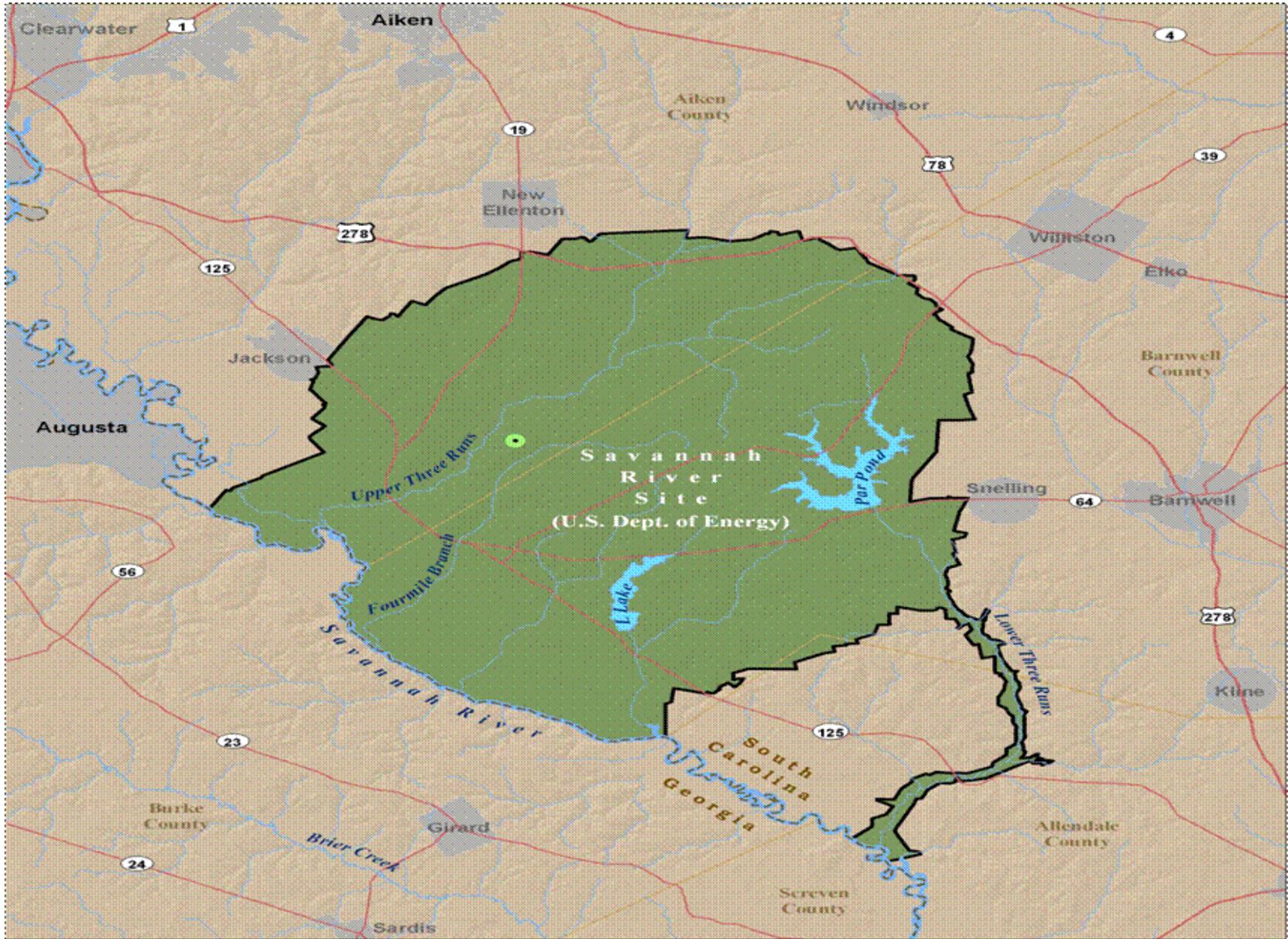
# Biomass and Biogas Case Studies

## Overview

- Department of Energy Savannah River Site - Biomass Fueled Central Plants
- Hill Air Force Base - Landfill Gas to Energy

# Project Background

- DOE-SR (DOE - Savannah River Site)
  - Georgia / South Carolina border
  - 300+ sq miles
  - Built in 1950s as nuclear development site
- Challenges faced by DOE-SR
  - Aging Infrastructure – coal and fuel oil power plants
  - Increased / new clean air requirements
  - New energy efficiency / sustainability requirements
  - No appropriated funding



# 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 coal-fired co-generation facility and provides approximately one half (20 MW) of the Site's electrical demand.

# Project Drivers

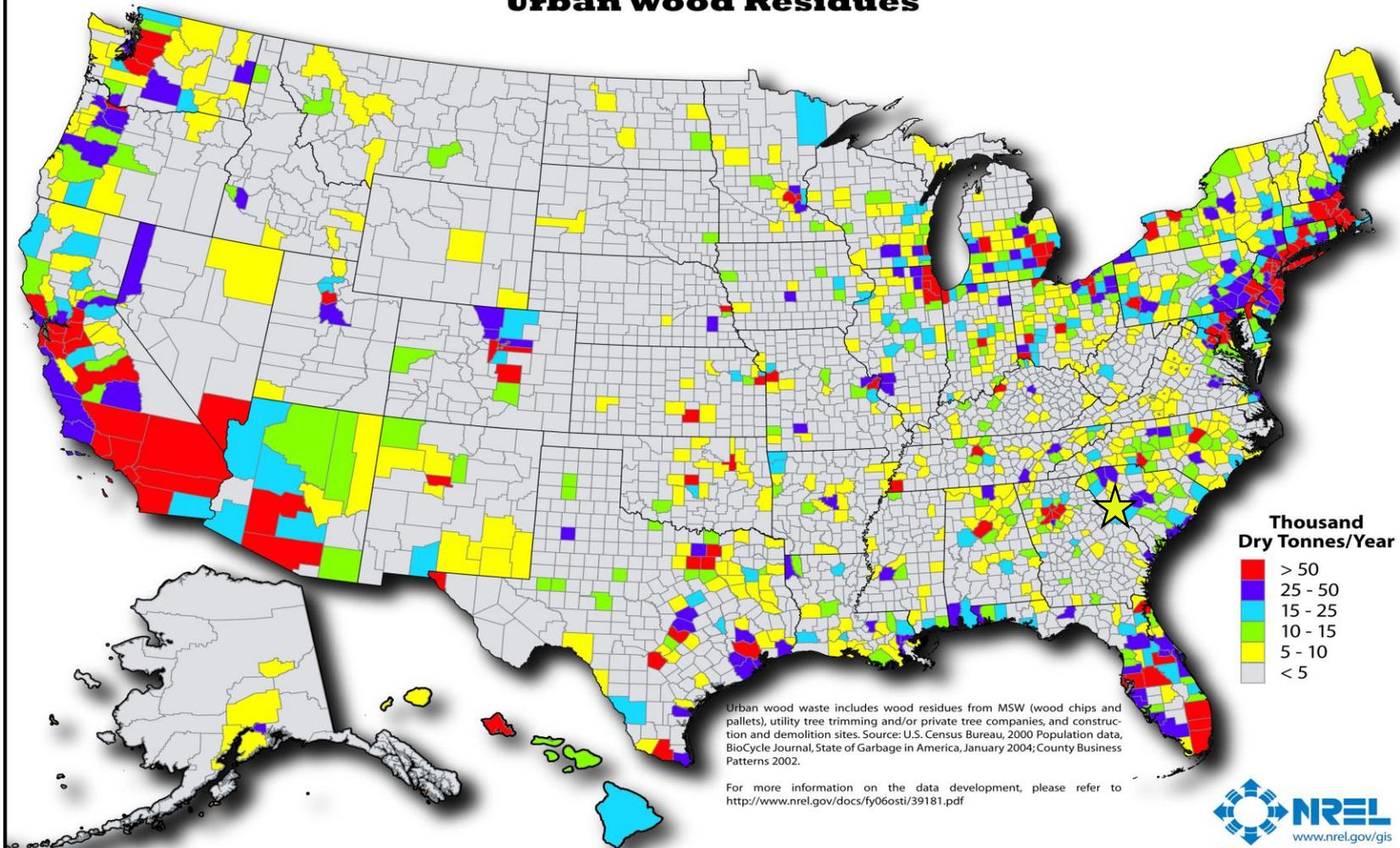
- D-Area Powerhouse is over 55 years old and well past its economic life. Condition and reliability are rapidly deteriorating.
- Regulatory drivers, age, and condition required significant upgrades for continued operation.
- Steam demand will remain for current and future critical missions, but will be reduced over time.
- Executive Order 13423 and DOE-HQ initiatives (TEAM) mandate maximum use of renewable energy sources and ESPC type contracts. Statutory requirement of EPACT 2005 to increase use of renewable energy to 7.5% by 2013.

# DOE-SR Solution

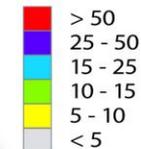
- Technology: Biomass combustion
- Contract Vehicle: DOE ESPC
- Project Scope: 2 Central Heating Plants and a Central Heat and Power Plant
- Fuel Source: Wood waste/residue; tire derived fuel
- Contract Award: May 2009
  - Implementation: 30 months - Performance 19 years
- Financial Overview: \$150+M investment and \$30+M first year savings

# Biomass Resources of the United States

## Urban Wood Residues



Thousand  
Dry Tonnes/Year



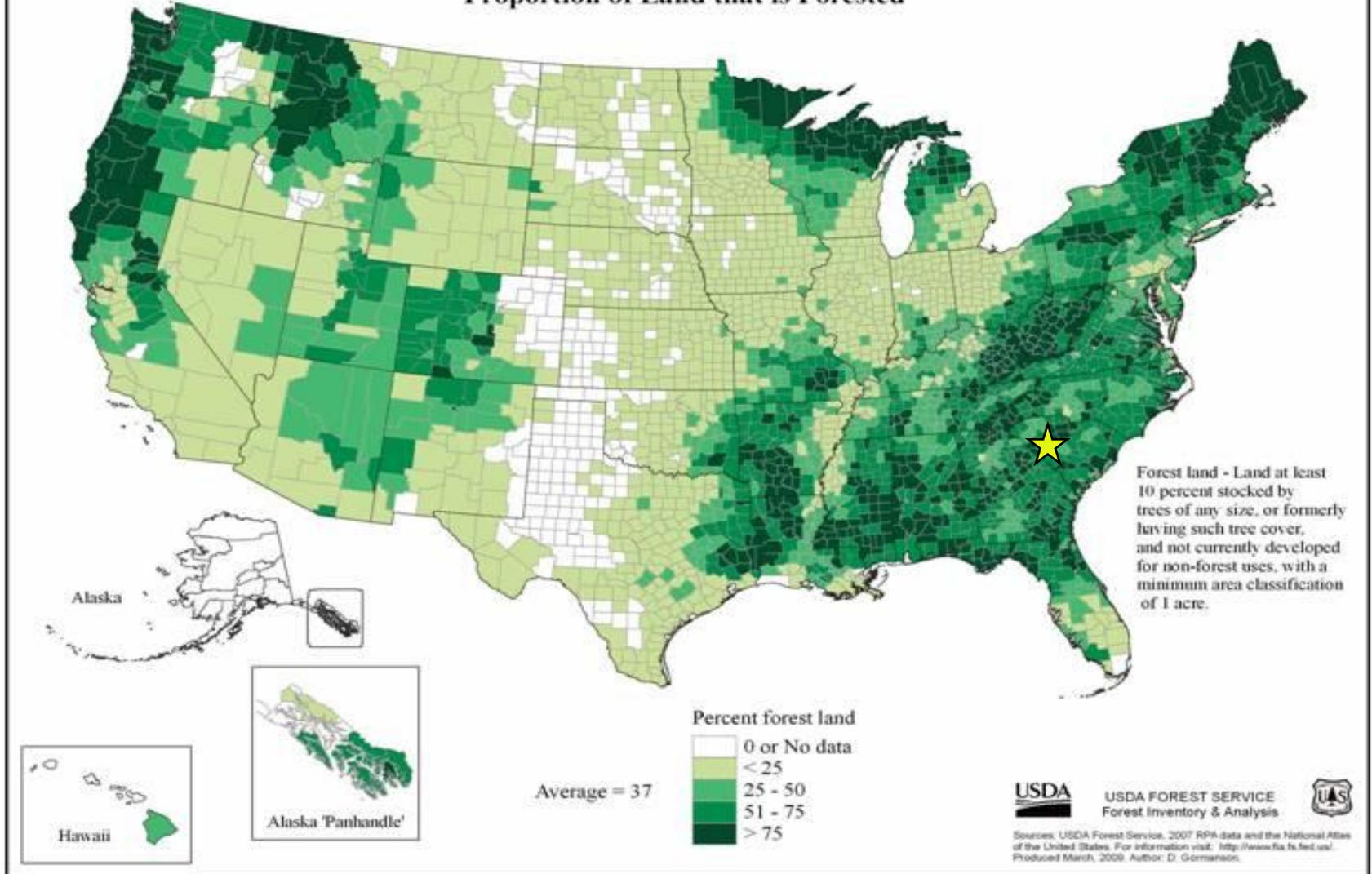
Author: Billy Roberts - September 23, 2009



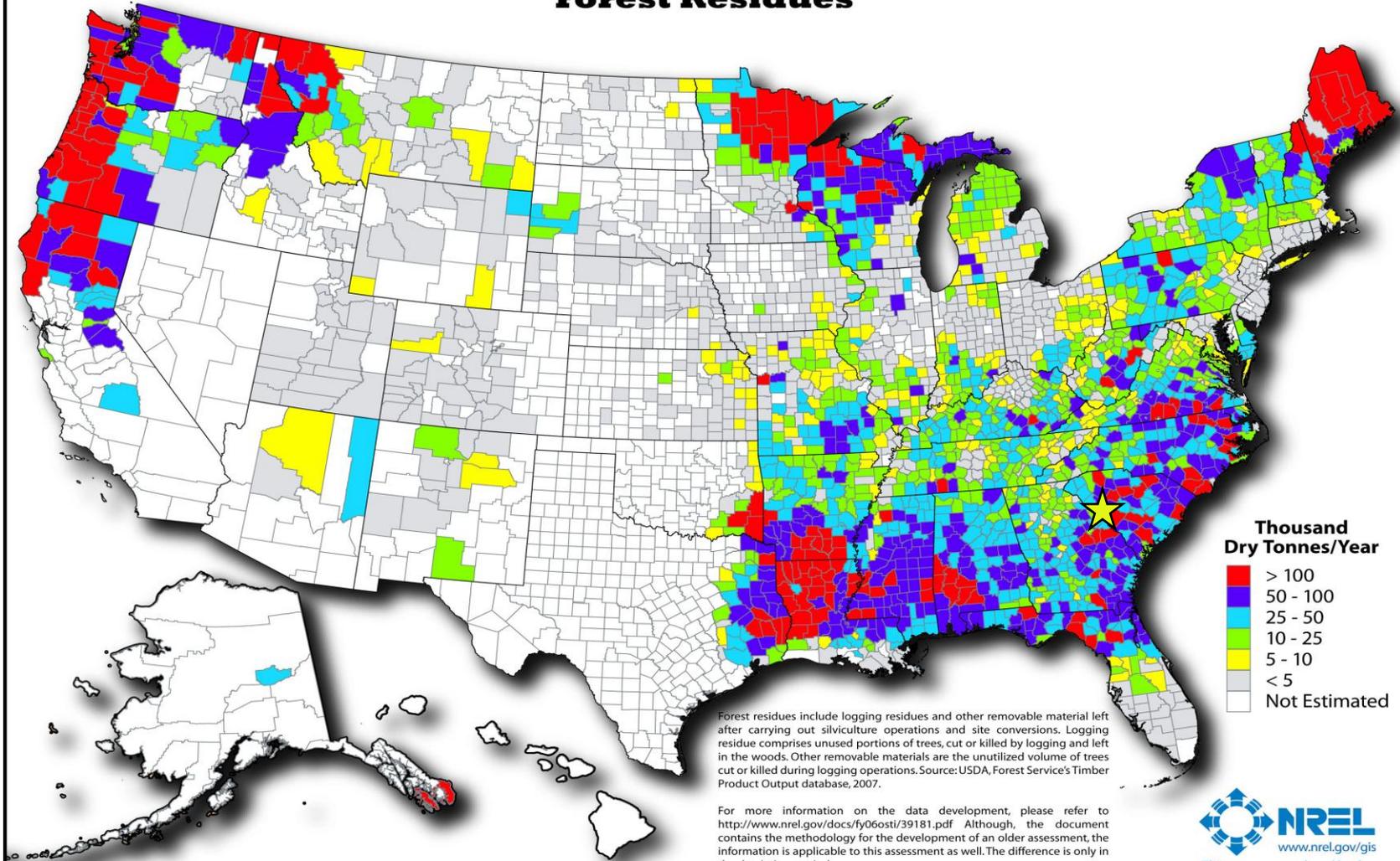
[www.nrel.gov/gis](http://www.nrel.gov/gis)

This map was produced by the  
National Renewable Energy Laboratory  
for the U.S. Department of Energy.

## Proportion of Land that is Forested



# Biomass Resources of the United States Forest Residues



Thousand  
Dry Tonnes/Year

- > 100
- 50 - 100
- 25 - 50
- 10 - 25
- 5 - 10
- < 5
- Not Estimated

Forest residues include logging residues and other removable material left after carrying out silviculture operations and site conversions. Logging residue comprises unused portions of trees, cut or killed by logging and left in the woods. Other removable materials are the unutilized volume of trees cut or killed during logging operations. Source: USDA, Forest Service's Timber Product Output database, 2007.

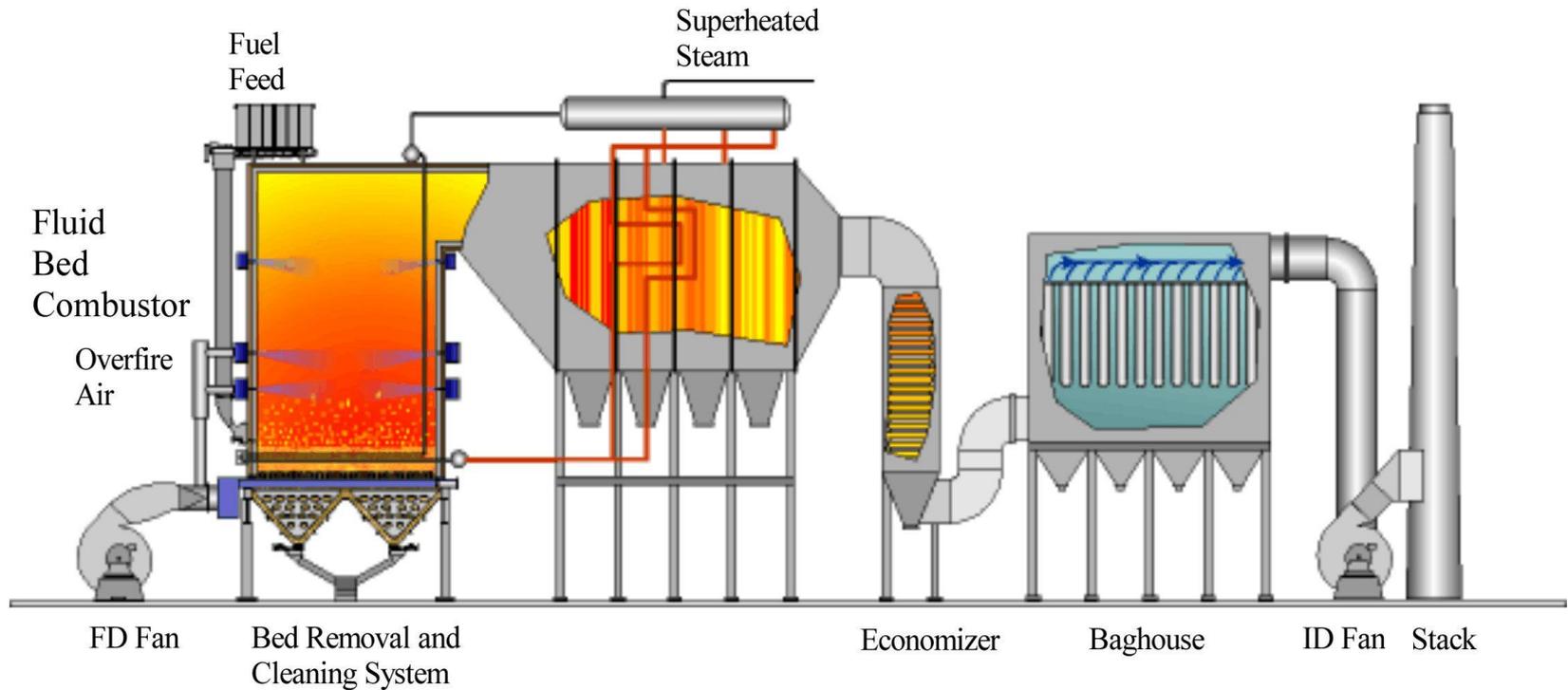
For more information on the data development, please refer to <http://www.nrel.gov/docs/fy06osti/39181.pdf>. Although, the document contains the methodology for the development of an older assessment, the information is applicable to this assessment as well. The difference is only in the data's time period.



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# Fluidized Bed Technology



★ Fuel Flexibility   ★ Better Emission Control   ★ Low Maintenance

# Fuel Sources

- Utilize ~ 325,000 tons of biomass annually as 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)

# DOE SR – Project Scope

- The project consists of two ECMs
  - ECM 1 provides for turnkey installation of a new Biomass Cogeneration Facility with a design capacity of 240,000 PPH of steam and 20 MW of electric power
  - ECM 2 includes turnkey installation of two 10,500 PPH steam boilers; one located in K Area and one in L Area
- Clean biomass will be the primary fuel source
  - ECM 1 will also utilize bio-derived fuel to supplement biomass for temperature control
  - ECM 2 will use 100% wood waste with fuel oil as back up

# DOE SR – Project Scope

- ECM 1 – 20 MWe biomass-fired co-gen plant
  - Located closer to end user
  - Will operate 24/7/365
  - EPI Fluidized Bed Boilers / TGM turbine generator
  - Includes a central fuel yard for all three plants
- ECM 2 will replace an oil-fired packaged boiler plant that served both the K and L Areas of the site
  - Eliminates 2.5 mile steam line from K to L Areas
  - Hurst Boilers
  - Seasonal operation for winter heating began in 2010

# 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
- Eliminates the burning of 161,000 tons of coal / year
- The amount of river water 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



# Financial Overview

- >\$150 M Implementation cost
- >\$30 M first year savings
- Contractor is responsible for all O&M
- Contractor is responsible for fuel risk

# DOE SR – Project Status

- Dec 2006 - ESCO selection
- May 2009 – ESPC Task Order Award
- Sep 2009 – Site Work Began
- Aug 2010 – ECM 2 Start up, Testing, Commissioning
- Oct 2010 – ECM 2 Acceptance
- Mar 2010 – ECM 2 Completed Yr 1 Heating Season
- Aug 2011 – ECM 1 Boiler Start up
- Sep 2011 – ECM 1 Start up, Testing, Commissioning
- Jan 2012 – ECM 1 Scheduled to be on-line

# DOE-SR Biomass Cogeneration Site



October 2009

# DOE-SR Biomass Cogeneration Site



January 2010

# DOE-SR Biomass Cogeneration Site



April 2010

# DOE-SR Biomass Cogeneration Site



January 2011

# DOE-SR Biomass Cogeneration Site



June 2011

# Biomass ESPC Provided Solution

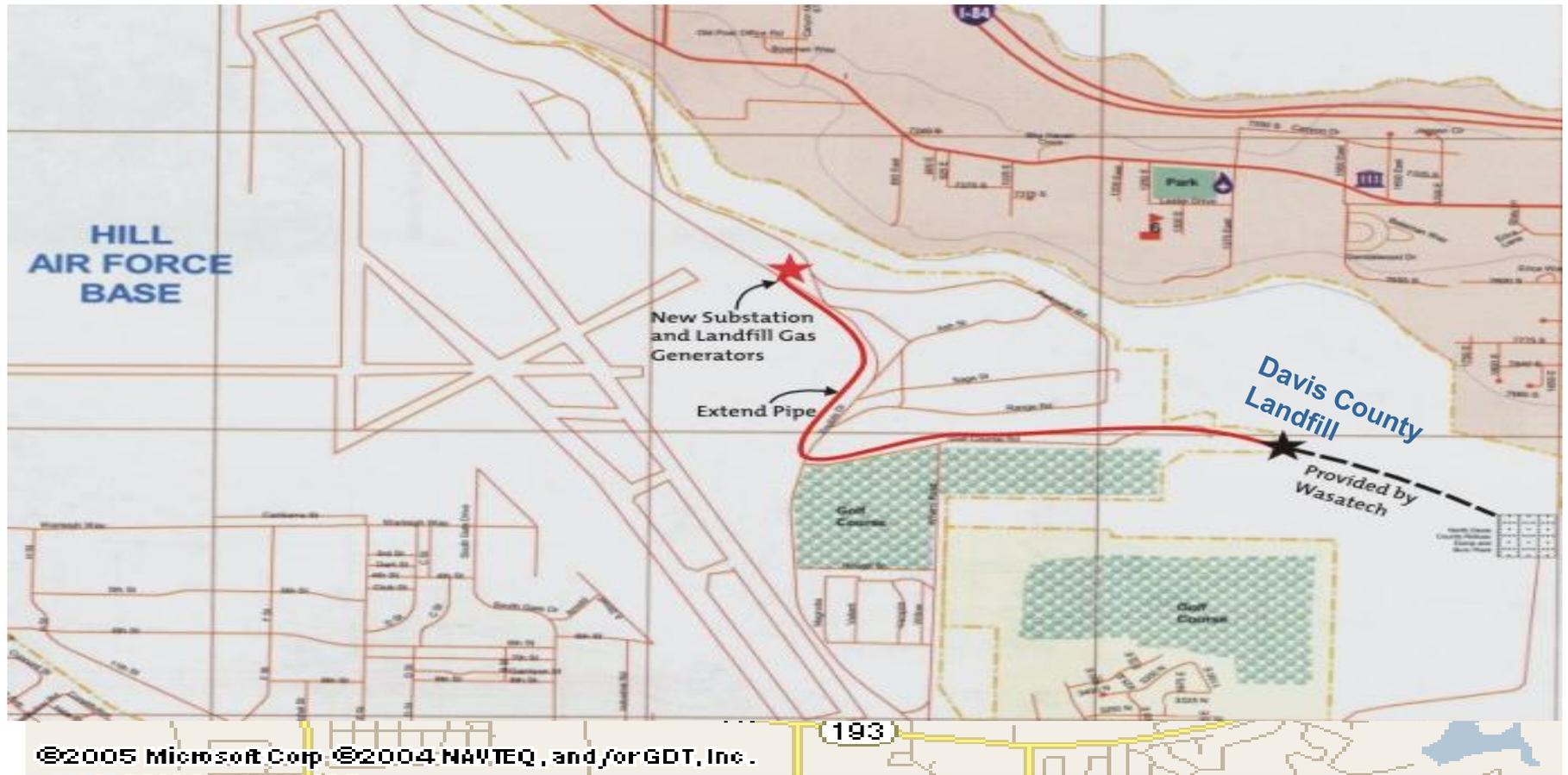


Savannah River Site, South Carolina  
(Nov 2009)

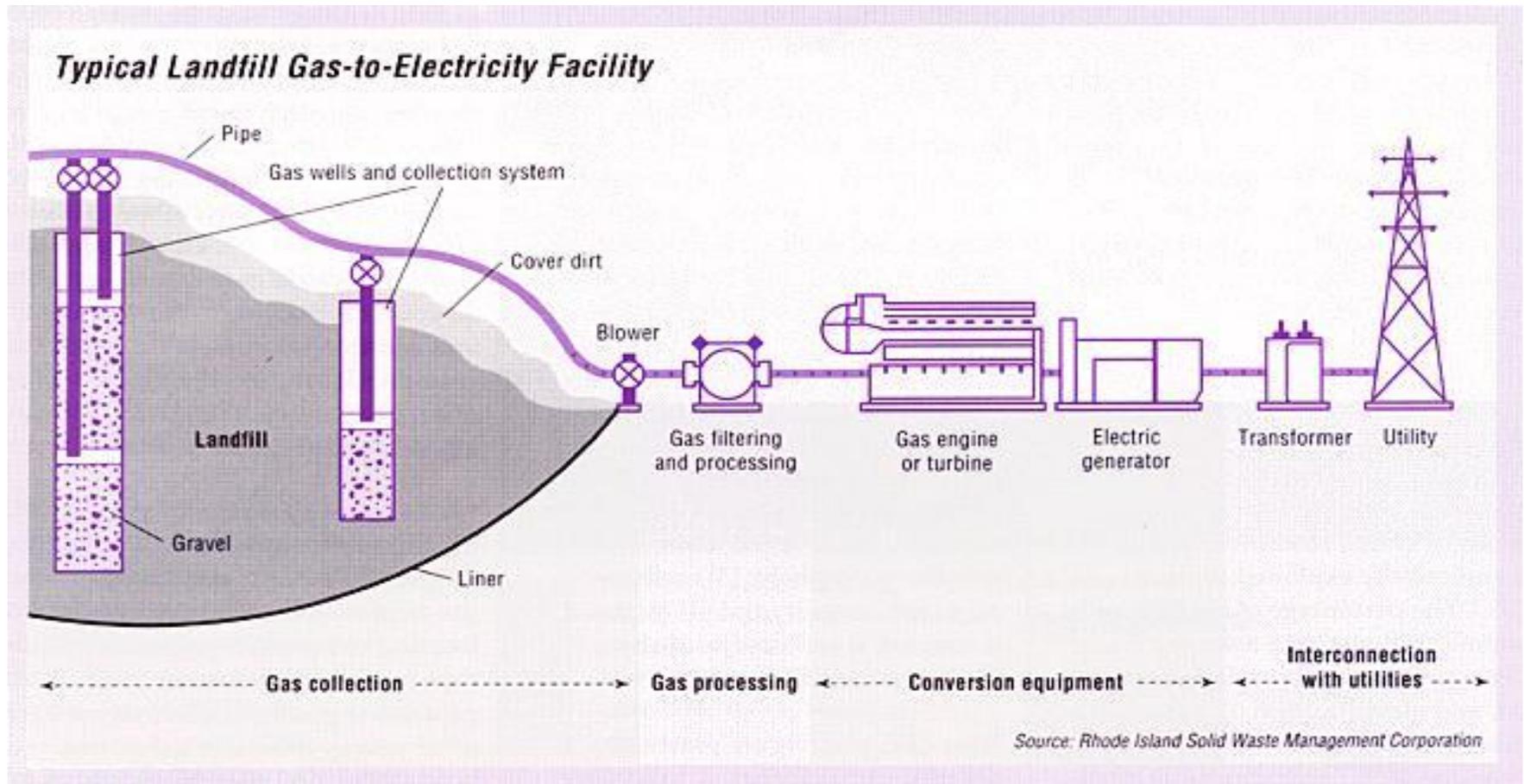
- One of the largest ESPCs to date
- Largest renewable ESPC
- Largest biomass operation in the Federal sector
  - 300,000 tons / yr fuel required
  - 60 to 70 trucks / day
- Ameresco financed, designed, built and will provide O&M of all 3 plants
  - Ameresco provide biomass fuel

# Hill AFB - Landfill Gas To Energy (LFGTE)

- Base is adjacent to Davis County Landfill



# LFGTE Concept



# Hill AFB – LFG Project Details

- Three Internal Combustion Engine Generators
  - Caterpillar 3512 and 3516; GE Jenbacher 320
  - Designed for landfill gas combustion
- Electrical Interconnection
  - Low voltage switchgear connected to transformer to step power up to 12.47 kV
  - High voltage gear connected to Base distribution system via two substations
- Control System
  - Web-based continuous remote monitoring and control

# Hill AFB – Landfill Gas To Energy



# For More Information

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