Waste to Energy Power Production
at DOE and DOD Sites

January 13, 2011
Overview – Federal Agency Innovations

- **DOE: Savannah River Site**
  - Biomass Heat and Power

- **USAF: Hill Air Force Base**
  - Landfill Gas to Energy Generation
DOE Savannah River Site

- **DOE Savannah River Site (DOE-SR)**
  - Georgia / South Carolina border
  - 300+ sq miles extending into 3 counties
  - Began operations in 1950s

- **Challenges faced by DOE-SR**
  - Aging Infrastructure
  - Coal and fuel oil power plants
  - Increased / new clean air requirements
  - New energy efficiency / sustainability requirements
Business Case Analysis

- Site need for both steam and power
- Repair, renovate, or replace
- Mandates and desire for renewable energy solution
- Appropriated funds not available

- Solution: DOE ESPC program

- Solution: Biomass
  - $34M in first year operational cost savings
  - Provides numerous environmental benefits
  - Results in GHG reductions of over 100,000 tons/ year
Biomass Solution

- Largest DOE ESPC to date
- Largest renewable ESPC
- Largest biomass operation in Federal government
Biomass Availability in U.S.
Biomass Availability in U.S.

Biomass Resources of the United States
Forest Residues

Forest residues include logging residues and other removale material left after carrying out silvicultural operations and site conversions. Logging residues are the remains left in the woods. Other removale materials are the unutilized volume of trees cut or killed during logging operations. Source: USDA Forest Service Timber Product Output database, 2007.

For more information on the data development, please refer to http://www.nrel.gov/docs/fy06osti/39190.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.

Author: Billy Roberts - September 23, 2009

www.nrel.gov/gis
This map was produced by the National Renewable Energy Laboratory for the U.S. Department of Energy.
Biomass Availability in U.S.
DOESR - Project Scope

- The project consists of two measures
  - Measure 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
  - Measure 2 includes the turnkey installation of two 10,500 PPH steam heating facilities; one to be located in the K Area and one to be located in the L Area

- Clean biomass will be the primary fuel source for all of the new boilers
  - Measure 1 will also utilize bio-derived fuel to supplement biomass for temperature control
  - Measure 2 will use 100% biomass with fuel oil as back up
DOESR – Project Scope

- Measure 1 will replace existing coal-fired cogen plant
  - Located closer to end user
  - Will operate 24/7/365
  - Includes a central fuel yard for all three plants

- Measure 2 replaced a fuel oil-fired packaged boiler plant that served both the K and L Areas of the site
  - Eliminates 2.5 mile of steam line
  - Seasonal operation for winter heating beginning Dec 2010
DOE SR – Cogeneration Plant Construction

Nov 5, 2010
Dramatic reduction in energy / water consumption and harmful air emissions.

First-year energy and O&M cost savings in excess of $34M and greenhouse gas emissions will be reduced over 100,000 tons.

Environmental: The biomass plants will result in an annual reduction of 400 tons of per year of particulate matter, 3,500 tons of sulfur dioxide emissions, and 100,000 tons of carbon emissions.

Water consumption will be reduced by 1.4 billion gallons.

Eliminates the burning of 161,000 tons of coal each year.
Hill AFB Landfill Gas to Energy
Hill AFB Background

- Hill Air Force Base, Utah
  - Home to many operational and support missions, including a large aircraft depot maintenance activity
  - Very large industrial site with heavy electrical load
  - Utah’s largest single site employer
  - Electrical demand of 45+ MW – annual cost more than $26M
  - Comparable to a small city with 16 million square feet of administrative, industrial, commercial, residential space

- The Base has long been a leader in energy innovations
  - More than a dozen contractor-financed energy projects
  - Utility agreements
  - Transport or spot market gas buyer
Hill AFB Renewable Energy Initiatives

- **Landfill Gas to Energy Electrical Generation (LFGTE)**
  - First of its kind in the USAF/ DOD/ Utah
  - First Project Under DOE Biomass Alternative Methane Fuel ESPC Program
  - Numerous awards and recognitions

- **Solar Photovoltaic System**
- **Solar Heat Recovery System**
Hill AFB - LFGTE

- Air Force Base is adjacent to the Davis County Landfill
Hill AFB - LFGTE

- **Davis County Landfill:**
  - ~4.5 M tons of waste in place with collection system and flare
  - ~1.5 miles from flare station to property line with the Base
  - Scheduled closing date of 2026

- **LFG** is a potent GHG produced from decaying waste
  - 50% methane; 50% carbon dioxide; <1% non methane organics
  - MSW landfills are largest source of GHG emissions in US

- Larger landfills required to collect and dispose the gas

- **Heating value of ~ 500 BTU / MCF**
  - Natural gas is ~ 1000 BTU / MCF
Hill AFB – 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 system provides continuous remote monitoring and control with trending capabilities
Hill AFB – LFGTE

- Project awarded as an ESPC with contractor provided financing and guaranteed annual production minimums
- Plant began operations in Jan 05 with 1250 kW capacity; capacity expanded to 2250 kW in Aug 08
- Contractor purchases gas from landfill and operates plant
- Power input to Base distribution system
- Production monitored and credited to monthly utility bill by the serving electric utility
- Since operations began in Jan 05 more than 50,000,000 kWh produced providing savings of more than $2,000,000
Hill AFB – LFGTE Plant
For More Information

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