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Waste to Energy Power Production at DOE and DOD Sites

January 13, 2011

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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

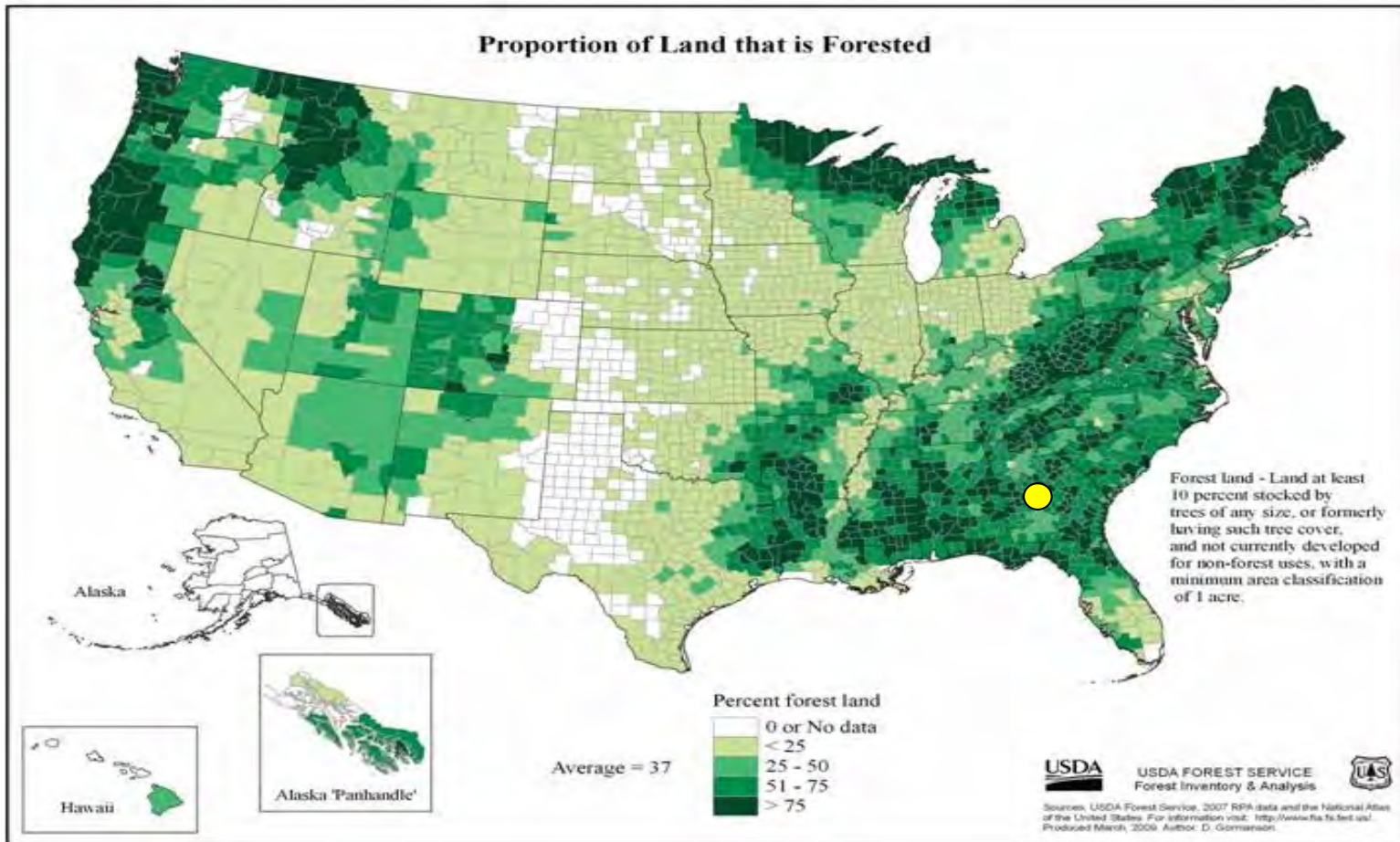
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Biomass Solution

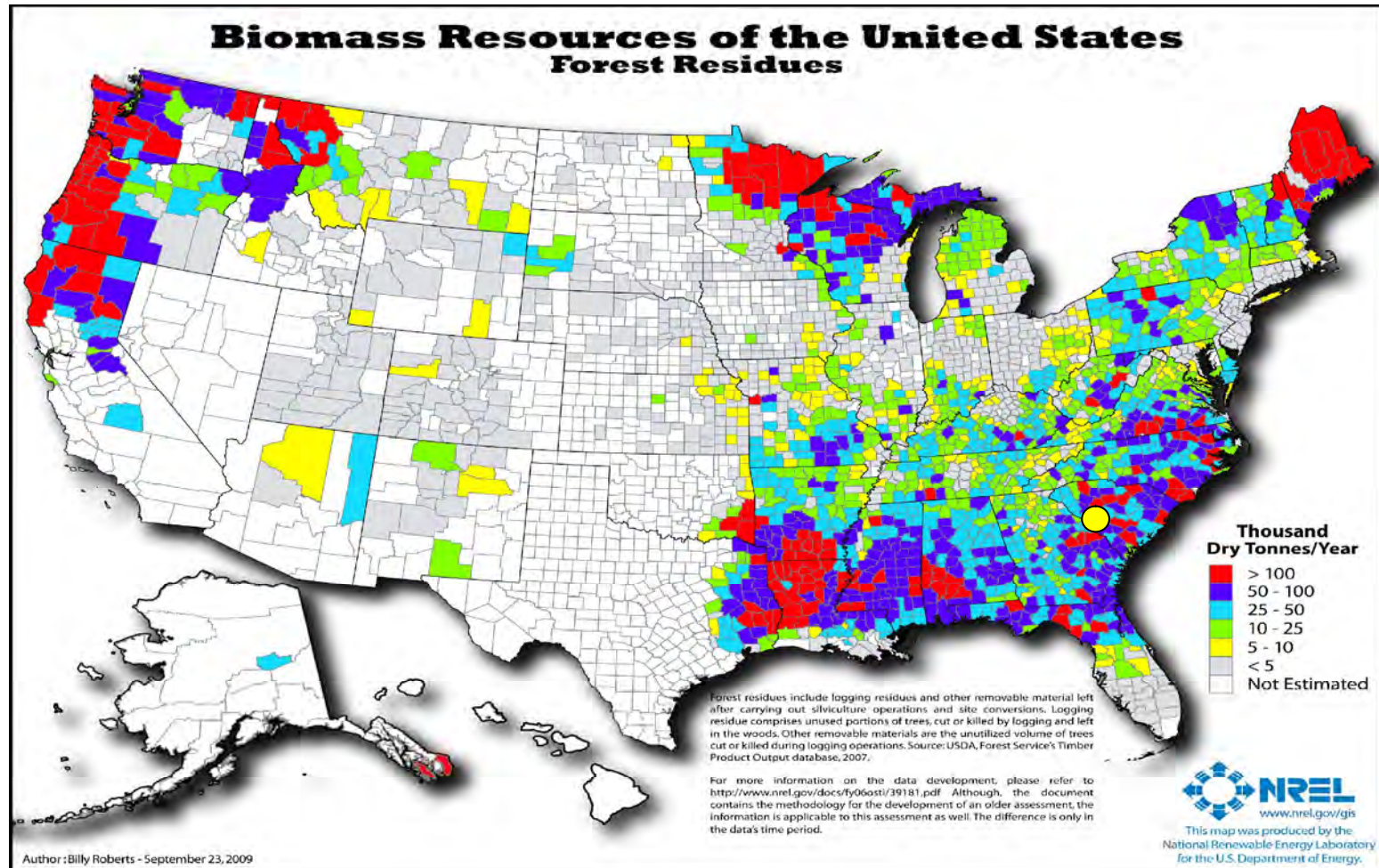


- ✓ Largest DOE ESPC to date
- ✓ Largest renewable ESPC
- ✓ Largest biomass operation in Federal government

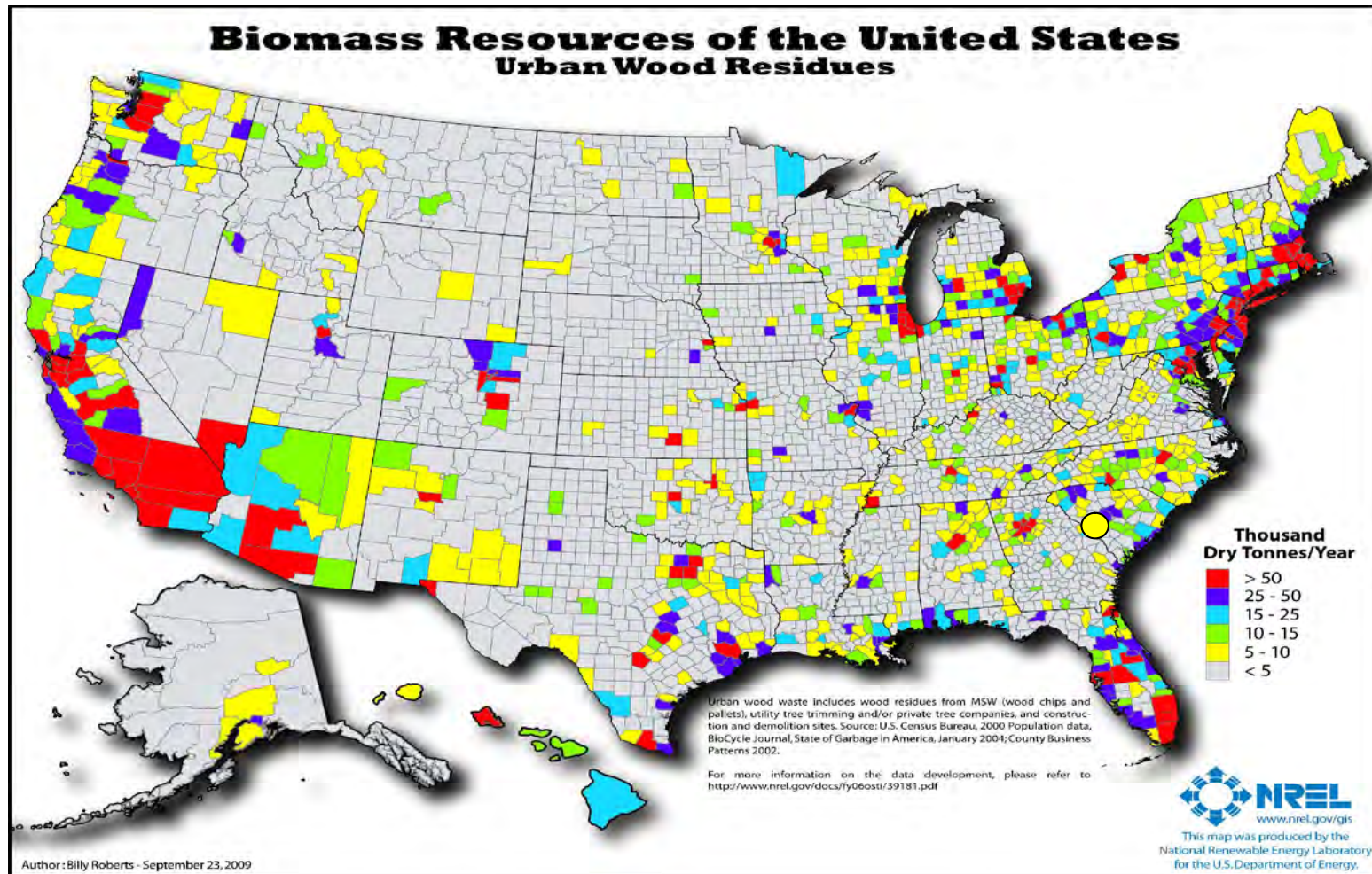
Biomass Availability in U.S.



Biomass Availability in U.S



Biomass Availability in U.S



DOE SR– 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

DOE SR – 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



Oct 4, 2010

DOE SR– Cogeneration Plant Construction



Nov 5, 2010

DOE SR– Project Benefits

- 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

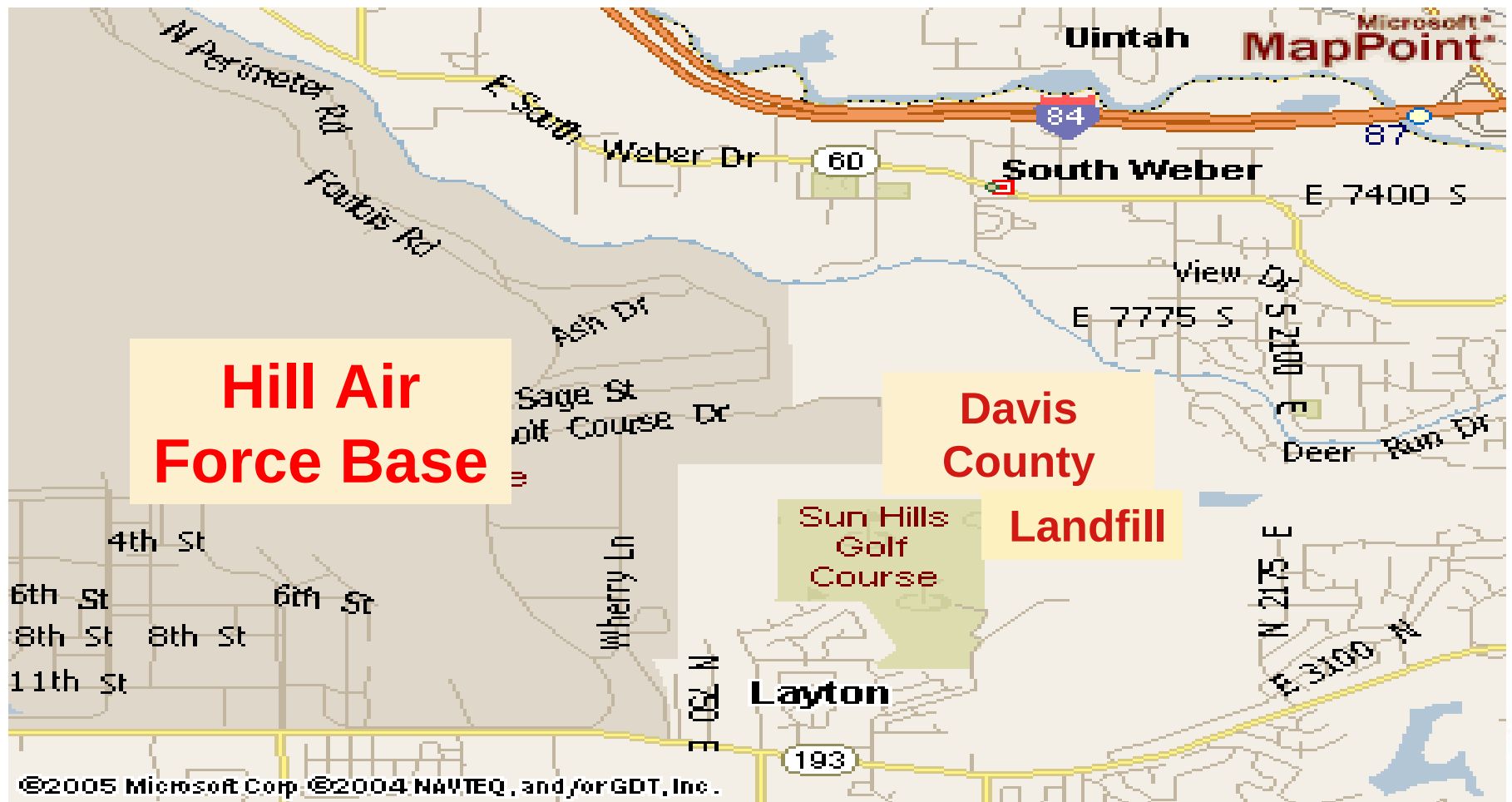
- Hill Air Force Base, Utah
 - Home to many operational and support missions, including a large aircraft depot maintenance activity
 - Very large industrial site with heavy electrical load
 - Utah's largest single site employer
 - Electrical demand of 45+ MW – annual cost more than \$26M
 - Comparable 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

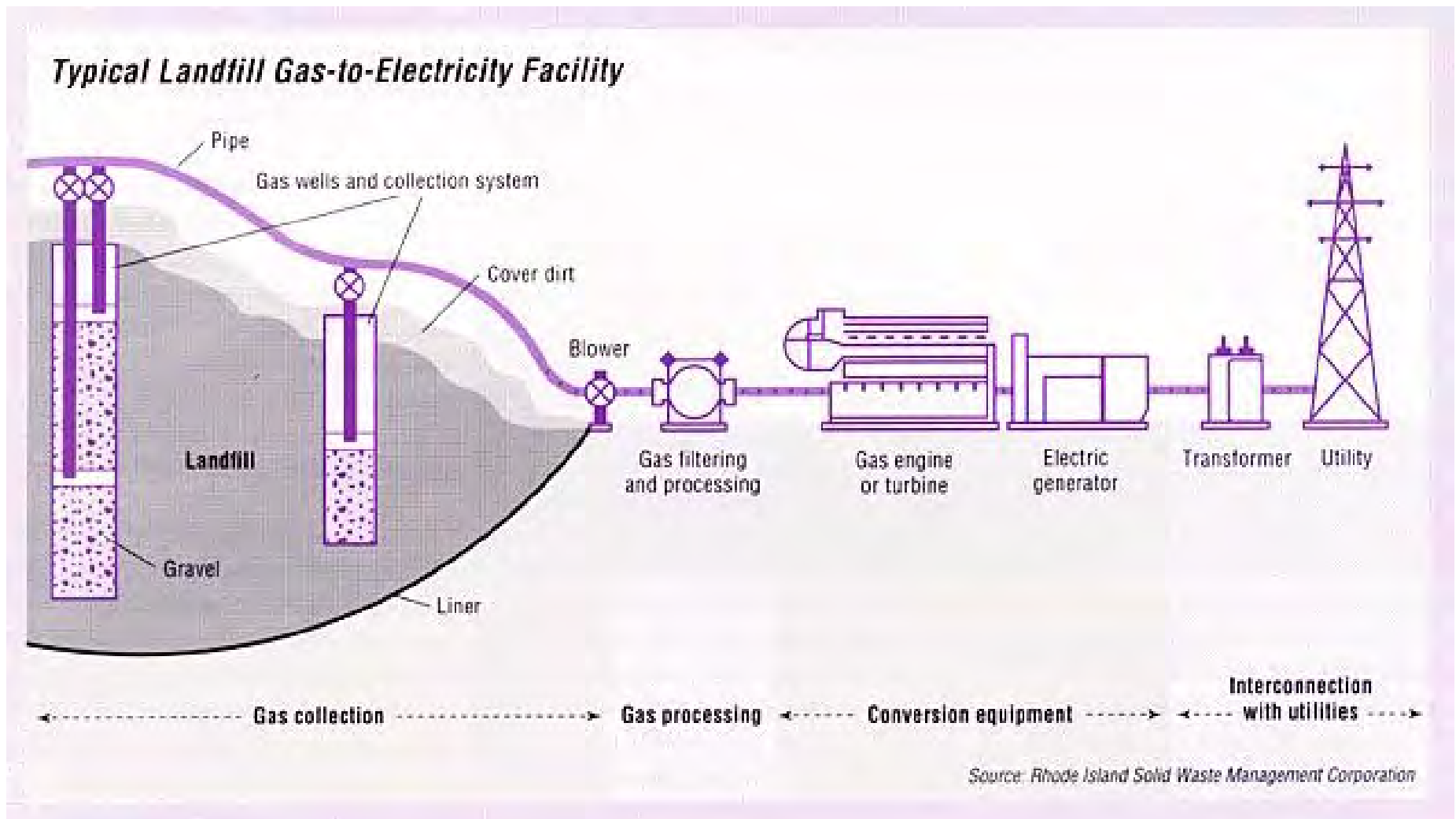
- Air Force Base is adjacent to the Davis County Landfill



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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