



U.S. Coast Guard Yard Landfill Gas to Energy Project

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Military Energy Alternatives Conference
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Agenda

- ✍ USCG Yard Overview
- ✍ Landfill Gas to Energy Overview
- ✍ USCG Project Overview
 - Quarantine Road Landfill
 - LFG Collection System
 - LFG Compressor/Dryer
 - LFG Pipeline
 - Renewable Energy Center (REC)
 - Project Benefits
- ✍ Energy Savings Performance Contract (ESPC) Overview
- ✍ Ameresco Overview



USCG Yard Overview

- ✍ Located in Baltimore, MD
- ✍ USCG's only full-service shipyard
 - Builds, repair, renovates USCG ships
 - 112 Acre Site
 - 110 Years old
- ✍ \$88M Annual Budget
- ✍ Houses other USCG tenants
 - Maritime law, First responders, DHS, etc.
- ✍ First organization in the United States government to achieve ISO 9001 certification in 1995 and ISO 9001 recertification in 1998



USCG Yard Overview

- ✍ Shipyard Facilities
 - 3550 ton capacity
 - 55' x 334' lifting platform
 - Rail transfer up to 48' beam vessel to land side work area
 - Two 450' rail systems
 - ✍ Allow cutters to be worked side by side.
- ✍ Engineering Division
 - Electronics, Electrical, Mechanical & Structural Detail Design
 - Commercial Specs & Test Procedures, Prototype Vessel Design
 - CAD & CAD/CAM - Special Expertise
- ✍ Certifications
 - ISO14001:2004 Environmental Management System
 - Certified Asbestos & PCB Removals onboard facility
 - Ammo Storage / Handling Certification



Landfill Gas 101

- ⌘ Landfill gas (LFG) is a natural by-product of Municipal Solid Waste (MSW) decomposition
- ⌘ Largest source of human-made methane emissions in US
- ⌘ LFG Composition:
 - ⌘ ~50% methane (CH_4)
 - ⌘ ~50% carbon dioxide (CO_2)
 - ⌘ <1% non-methane organic compounds (NMOC's)
- ⌘ A potent greenhouse gas if released un-combusted into the atmosphere
 - ⌘ Global Warming Potential (GWP) of 21
 - ⌘ CO_2 GWP = 1



State of the U.S. LFG to Energy Industry

- ⌘ 500+ Operational Projects in 40 States providing
 - 12 Billion kWh of Electricity
 - 85 Billion cubic feet of LFG to direct use applications
- ⌘ 500 + Candidate Landfills with total energy potential of over 1,500 MW
- ⌘ EPA LMOP maintains database of operational projects and potential landfills
- ⌘ DOE maintains database of Federal Facilities & nearby landfills (and biomass resources)
- ⌘ Estimated Annual Environmental Benefits
 - Planting ~ 19,500,000 acres of forest, or;
 - Preventing the consumption of 200,000,000 barrels of oil, or;
 - Removing emissions equivalent to over 15,700,000 vehicles

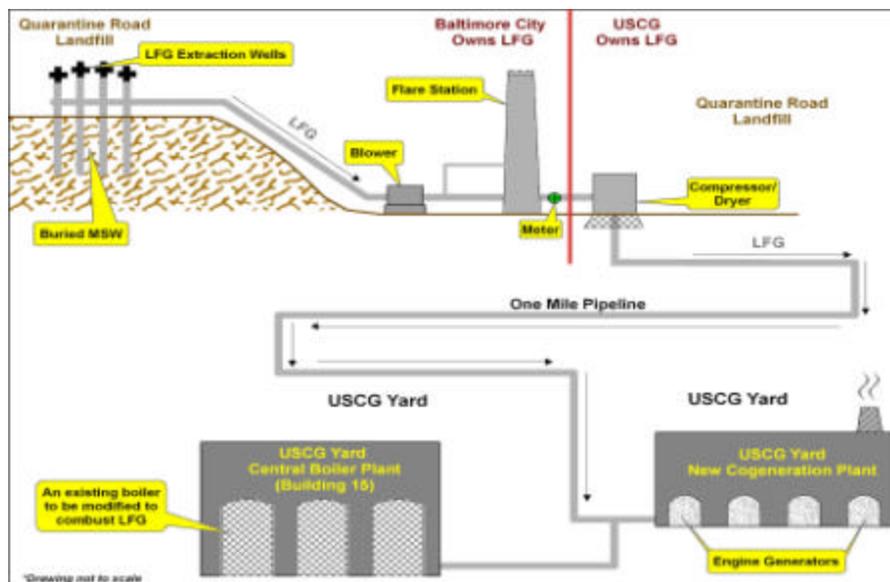


LFG – A Competitive Renewable Fuel

- ✂ Low-cost local renewable energy source
- ✂ Excellent medium Btu (typically 500 Btu/cf) fuel for boilers and electric generators
- ✂ Typically more economic than natural gas on a Btu delivered-cost basis
- ✂ Proven technology successfully used for process heat and electric generation for over 20 years in the US and globally
- ✂ Availability: Continuous except for system maintenance



USCG Yard Project Overview



Quarantine Road Landfill

- ✍ Owned and operated by the City of Baltimore
- ✍ Opened in 1985
 - Current closure planned for 2019
- ✍ 157 Acres
 - Planned expansion & extension of closure date
- ✍ 10,000,000 tons of waste
 - 50% MSW
 - 30% Ash
 - 20% C&D

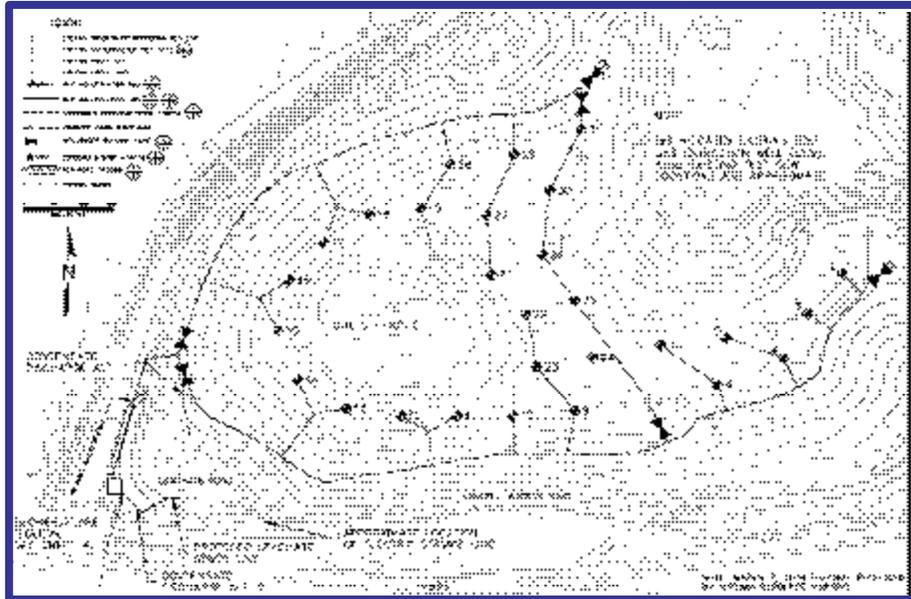


Landfill Gas Collection System

- ✍ 31 wells are installed
 - 33 more as the landfill expands
 - Connected to 10,000 foot long header
- ✍ Investigating expansion
 - ~ 10 additional wells
 - Horizontal in stockpile area
- ✍ Dual blowers to draw vacuum on wells
 - 2300 scfm @ 20 psig
- ✍ 300 - 3000 cfm candlestick flare
 - Combust LFG during Energy Plant maintenance downtime & USCG load variations



Landfill Gas Collection System



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Landfill Gas Delivery System

- ✍ (2) Gas Blowers
 - Compresses gas to 8 psig
- ✍ LFG Refrigeration Dryer
 - Installed downstream of gas blowers
- ✍ Gas cooled to 40° F to knock out moisture & contaminants
- ✍ Condensate routed to existing leachate collection pond



Landfill Gas Pipeline

- ✍ 10" High Density Polyethylene (HDPE)
- ✍ ~1 Mile in length
- ✍ Directional bored under Rte 695 & Hawkins Pt. Rd.
- ✍ Splits once in Yard to serve new REC and boiler plant (Bldg 15)



Renewable Energy Center



Power Generation

- ✦ Four (4) Low NOx GEJ 320 Engines
 - 0.6 grams/bhp NOx
 - Each unit 1,057 kW @ 4160V
 - Plant output stepped up to 33kV
- ✦ USCG Substation Modifications
 - Improved protection systems
 - Conversion to DC control power
 - Added auto-transfer for improved outage response
 - Added and reconfigured 33kV equipment to accommodate REC



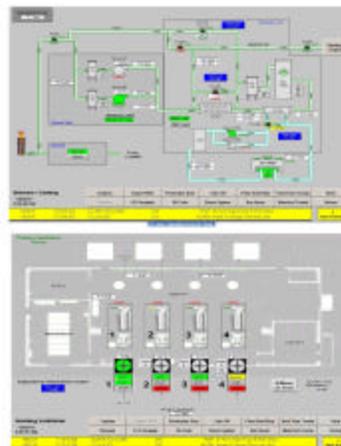
Steam Production

- ✍ Four heat recovery steam generators (HRSG)
 - Recovers heat from engine exhaust
 - 2000 lb/hr @ 95 psi per engine
 - Generated steam offsets load on existing steam plant.
- ✍ Existing Boiler Retrofit
 - New tri-fuel burner and control system
 - Burns LFG, NG, and #2 oil



Automation & Control

- ✍ PLC-based Control Systems
- ✍ Dedicated SCADA servers
 - Provide visual interface
 - Log and trend data
 - Alarming
- ✍ Dedicated Communications to Landfill Equipment
- ✍ Remote Monitoring and Control Capability



Project Benefits

- ✍ Stable, predictable energy costs for 15 years
 - Project offsets 18,000 MWH & 71,000 Dthm
- ✍ Energy Security for the USCG
 - Multiple sources of supply
- ✍ Achieve entire Department of Homeland Security renewable energy goals
 - Through 2012
- ✍ Electrical grid stability on peak demand days
 - Removes equivalent of 2,500 homes
- ✍ Estimated annual environmental benefits
 - Removing emissions equivalent of over 33,000 vehicles
 - Planting 36,000 Acres of forest

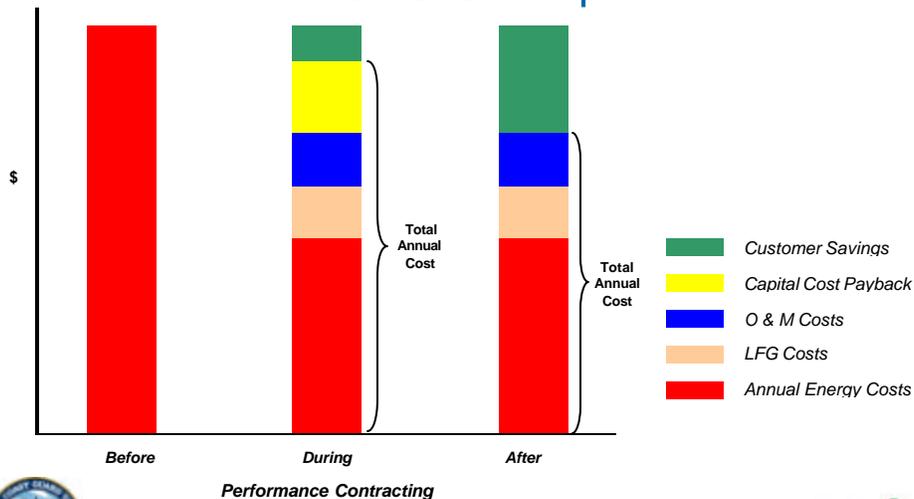


DOE ESPC Contract Overview

- ✍ DOE Super Energy Savings Performance Contract (ESPC)
- ✍ Available for use by all Federal Agencies
- ✍ Governing Legislation
 - ESPC Authority
 - ✍ Energy Independence & Security Act of 2007 (EISA 2007)
 - ✍ National Energy Conservation Policy Act (42 USC 8287)
 - ✍ Energy Savings at Military Installations (10 USC 2865)
 - ESPC Regulation
 - ✍ Final Rule on ESPC (10 CFR 436 Subpart B)
- ✍ Contract term up to 25 years
- ✍ Project must be self funding
 - Total Annual Payments after project < Total Annual Payments before project



ESPC Concept

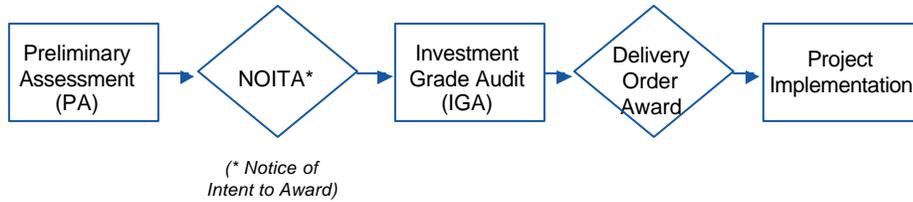


DOE ESPC Facts

- ✍ Over 460 ESPC projects awarded
 - 19 different Federal agencies in 47 states.
- ✍ Approximately \$2.3 billion invested in Federal facilities through ESPCs
- ✍ Savings of over 18 trillion Btu annually
 - Equivalent to energy used by a city of 500,000
- ✍ Energy cost savings of \$7.1 billion for the Federal Government
 - \$5.7 billion for financing projects
 - Net savings is \$1.4 billion



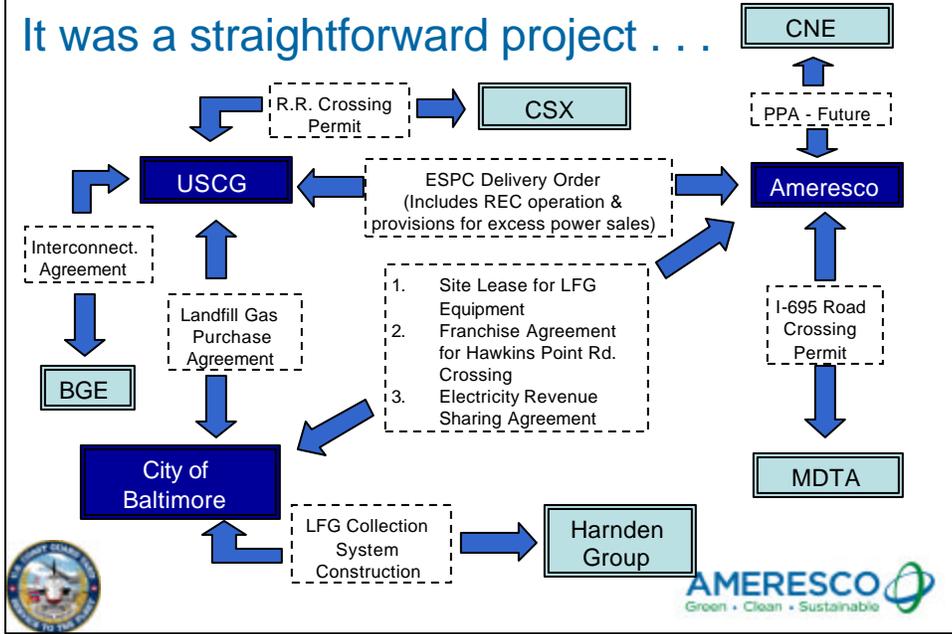
ESPC Development Process



Ameresco Company Overview

- ✦ Largest Independent Energy Services Provider in North America
 - Over 580 energy professionals in 56 North American offices
 - 175+ PE licensed in 29 states
 - Fully qualified construction management and O&M divisions
- ✦ \$4 Billion in energy solutions delivered
- ✦ Federal Expertise
 - Industry Leader with experience going back 30 years
 - 60+ ESPC Projects implemented worth over \$1 Billion
 - Audited 300+ installations; 10,000+ buildings
 - Provided training to 20,000+ government energy professionals
 - Worked with all Military Branches & Federal Agencies
- ✦ No utility or manufacturing parent company
 - Technology, equipment, utility neutral ✦ Customer focused solutions
- ✦ Environmental permitting & NEPA Assessment experience

It was a straightforward project . . .



If something can go wrong . . .



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For more information please contact:

Bob Albertini

Business Development Manager

balbertini@ameresco.com

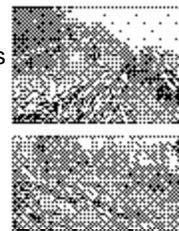
O: 630-203-2625

M: 757-619-3628

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DOE Savannah River Site

- ✍ Project includes
 - Elimination of aged & inefficient coal fired plant
 - Elimination of 4 miles of steam lines
 - Two 120,000 pph biomass fluidized boilers
 - One 20MW steam condensing turbine
 - Two 10,500 pph biomass boilers
- ✍ Annual biomass: 320,000 tons of forest residue
- ✍ Implemented through an ESPC
 - Ameresco will operate & maintain plant for 19 years
- ✍ Renewable Energy Production
 - 2,000,000 MBtu/yr of thermal renewable energy
 - 77,000 mWh (264,444 MBtu) of green power.
- ✍ Annual Cost Savings: \$34M
- ✍ Project Cost: \$149M



Renewable Energy

- ✍ Energy Plants developed, designed, built and in many cases owned and operated by Ameresco
- ✍ Projects focused on addressing the site-specific conservation & renewable energy goals of clients
- ✍ Evaluate applicability of renewable tax credits, carbon credits, and RECs
- ✍ Worked with serving public utilities and sites to meet electrical interconnection requirements

34 Projects
Gross Capacity: 143.7 eMW
747,420 tons of CO2 per year avoided

Other Potential Energy Procurement Vehicles

- ✍ Power Purchase Agreement (PPA)
 - Government leases land to contractor
 - Contractor builds, owns, operates energy plant
 - ✍ biomass, landfill gas, solar, wind
 - Sells power (kWH) or thermal energy (mmbtu)
 - Government agrees to a minimum purchase quantity
- ✍ Utility Energy Services Agreement (UESC)
 - Very similar to ESPC concept
 - Contracted via local electric or gas utility company
 - 10 year maximum terms

