

Waste-to-Energy Projects at Army Installations

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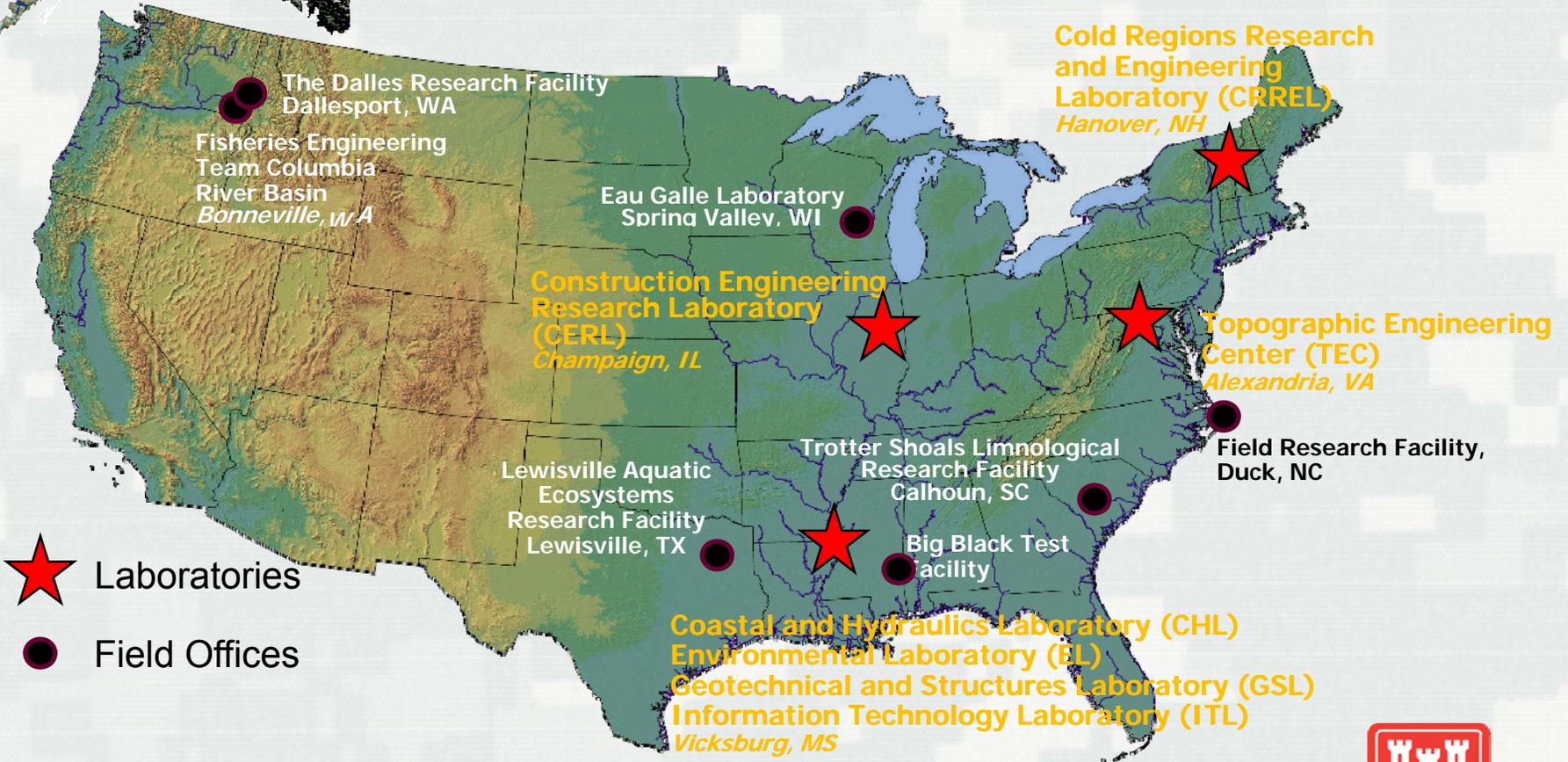
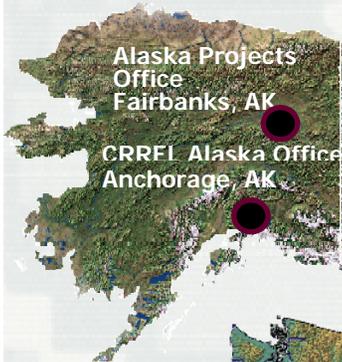
Outline

- **Background**
 - ▶ Intro to ERDC
 - ▶ Army/DoD Energy Requirements & Objectives
 - ▶ 2008 Installation WTE Workshop
 - ▶ 2009 Air Force WTE Workshop (Alt Energy Now!)
 - ▶ 2009 RDECOM WTE Technology Assessment
- **Selected Army WTE Projects**
 - ▶ ERDC Fuel Cell Demos
 - ▶ Army Tactical WTE Demos
 - ▶ Technikron RETC (at Picatinny Arsenal)
- **Others**
- **Conclusions**
- **Acknowledgments**



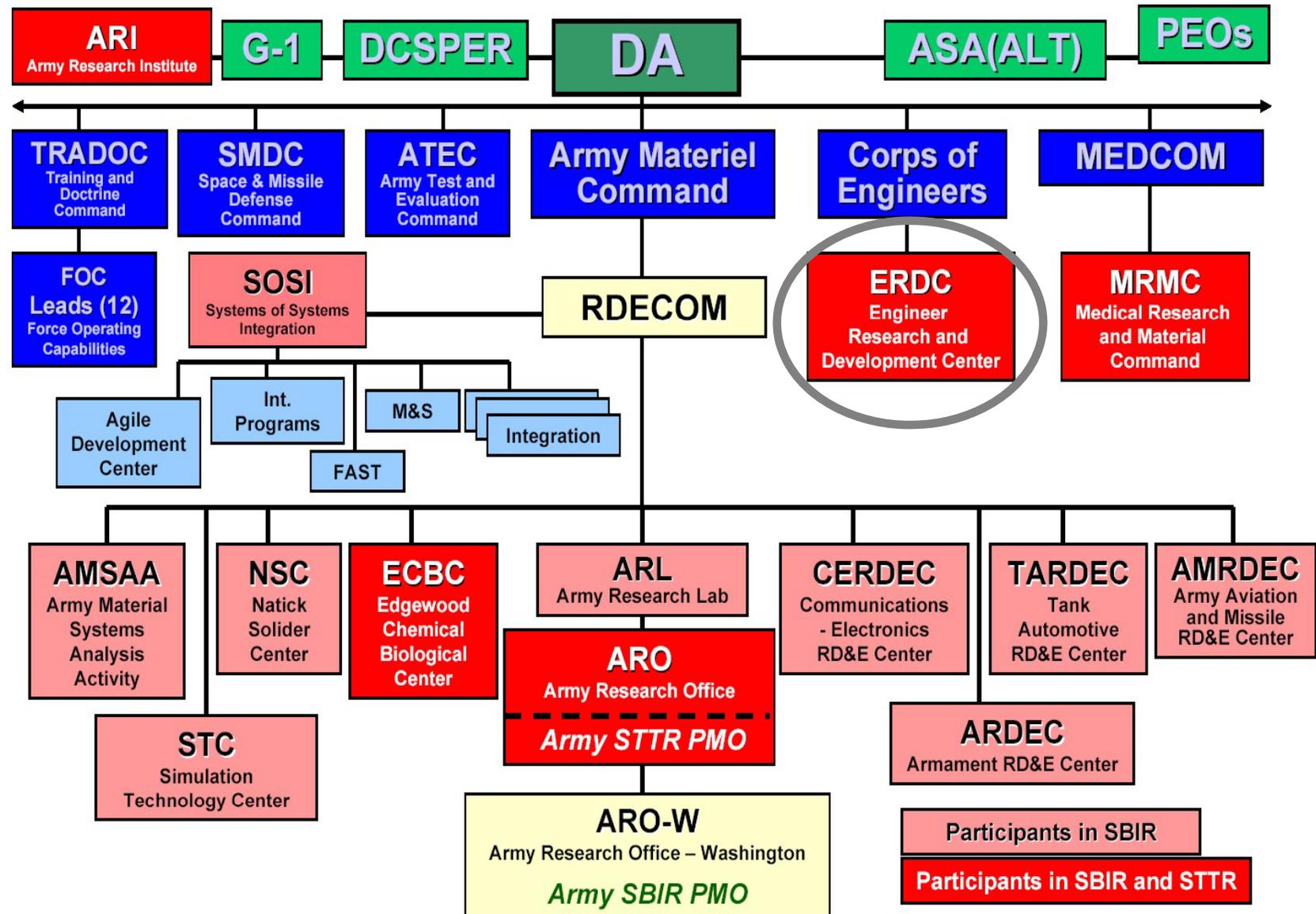
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2500 ERDC Team Members



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ARMY R&D Organizations



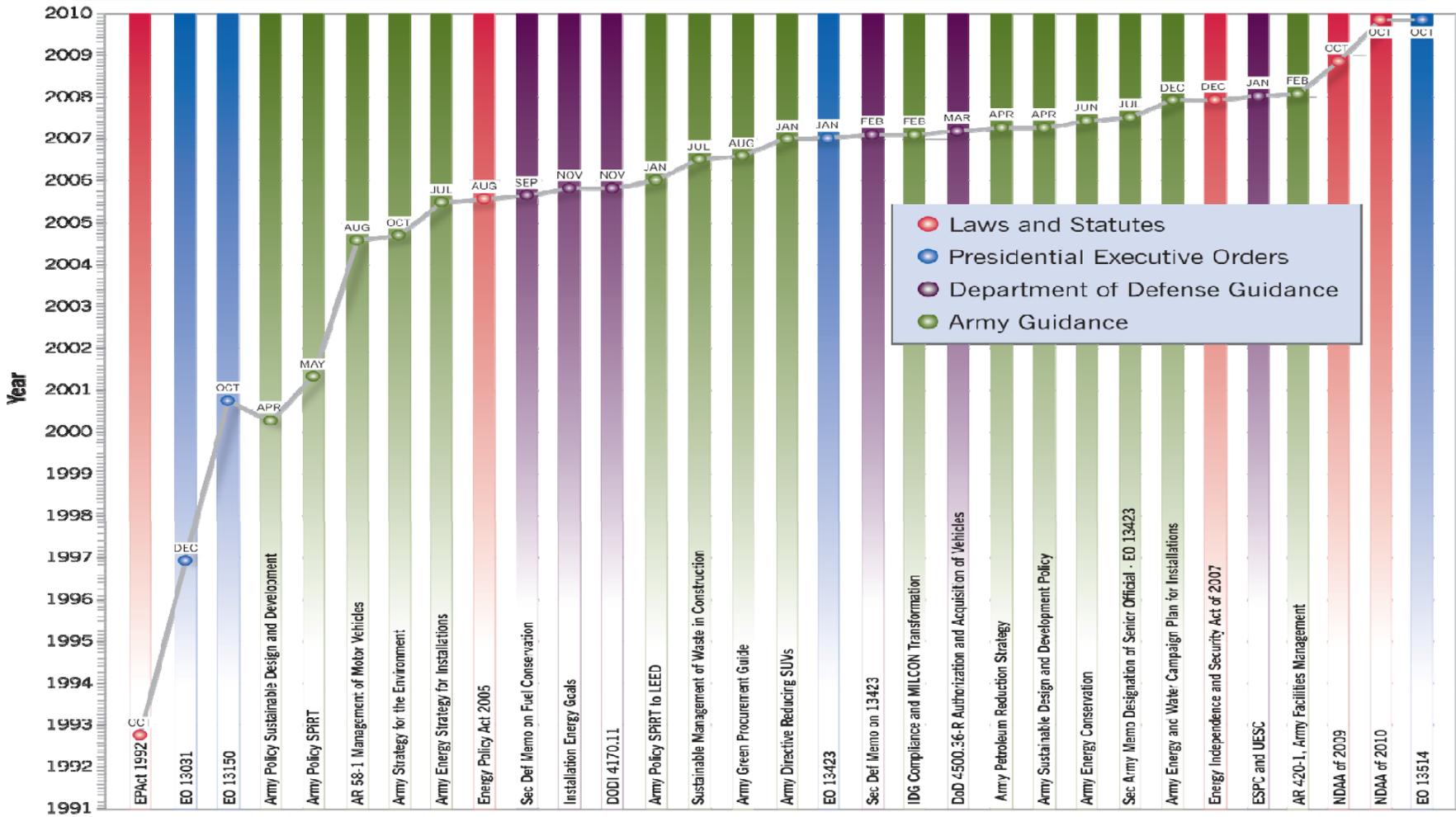


Key Energy Directives

- Challenge and Opportunity -



The Army has requirements for energy performance established by legislation, Presidential Executive Orders (EO), Office of the Secretary of Defense (OSD) mandates and Army policies.





Federal Energy Mandates



Mandate Topic	Energy Performance Target [Source]
Energy use in Federal buildings	<ul style="list-style-type: none"> Reduce 3% per year to total by 30% by 2015 (2003 baseline) [EO 13423, EISA 2007]
GHG emission reduction	<ul style="list-style-type: none"> Identify GHG emission reduction targets to be met by 2020 from 2008 baseline [EO 13514] Army target – 34% [SA Memo to OSD]
Energy metering for improved energy management	<ul style="list-style-type: none"> Meter electricity by Oct 2012 [EPACT 2005] Meter natural gas and steam by Oct 2016 [EISA 2007]
Electricity use for federal government from renewable sources	<ul style="list-style-type: none"> At least 3% of total electricity consumption (FY07-09), 5% (FY10-12), 7.5% (FY13 +) [EPACT 2005, NDAA 2007]
Total consumption from renewable sources	<ul style="list-style-type: none"> At least 50% of required annual renewable energy consumed from “new” renewable sources [EO 13423] 25% by 2025 -”Sense of Congress” [EISA 2007]
Hot water in new / renovated federal buildings from solar power	<ul style="list-style-type: none"> 30% by 2015 if life cycle cost-effective [EISA 2007]
Fossil fuel use in new / renovated Federal buildings	<ul style="list-style-type: none"> Reduce 55% by 2010; 100% by 2030 [EISA 2007]
Net zero buildings	<ul style="list-style-type: none"> All new buildings that enter design in 2020 and after achieve net zero energy by 2030 [EO 13514] New federal buildings achieve net zero by 2030 [EISA 2007]
Fleet vehicle petroleum consumption	<ul style="list-style-type: none"> Reduce 20% by 2015 (Base 2005) [EISA 2007] Reduce by 2% per year thru FY2020 (Base 2005) [EO 13423, EO 13514]
Fleet vehicle alternative fuel use	<ul style="list-style-type: none"> Increase 10% by 2015 (Base 2005) [EISA 2007] Increase by 10% annually to reach 100% (Base 2005) [EO 13423]
Water consumption	<ul style="list-style-type: none"> Reduce consumption intensity by 2% annually FY 08-FY 15 (2007 baseline) [EO 13423] Reduce consumption by 2% annually for 26% total by FY 2020 (2007 baseline) [EO 13514]

- **1st Workshop held at Army Research Office in MAY 2008**
- **Goals were to share information, spread visibility on current efforts, and explore the potential of waste to energy technologies for Army (and DoD) installations, and to potentially launch working groups to further advance implementing installation waste to energy technologies.**
- **Identified a Need to Determine the “Burdened” Cost of Waste at Installations**
- **2nd Workshop Sponsored by Air Force on 22-23 JAN 2009 (Alt Energy Now!)**

ERDC/CERL TR-08-11



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Proceedings of the 1st Army Installation Waste to Energy Workshop

Franklin H. Holcomb, René S. Parker, Thomas J. Hartranft, Kurt Preston, Harold R. Sanborn, and Philip J. Darcy August 2008



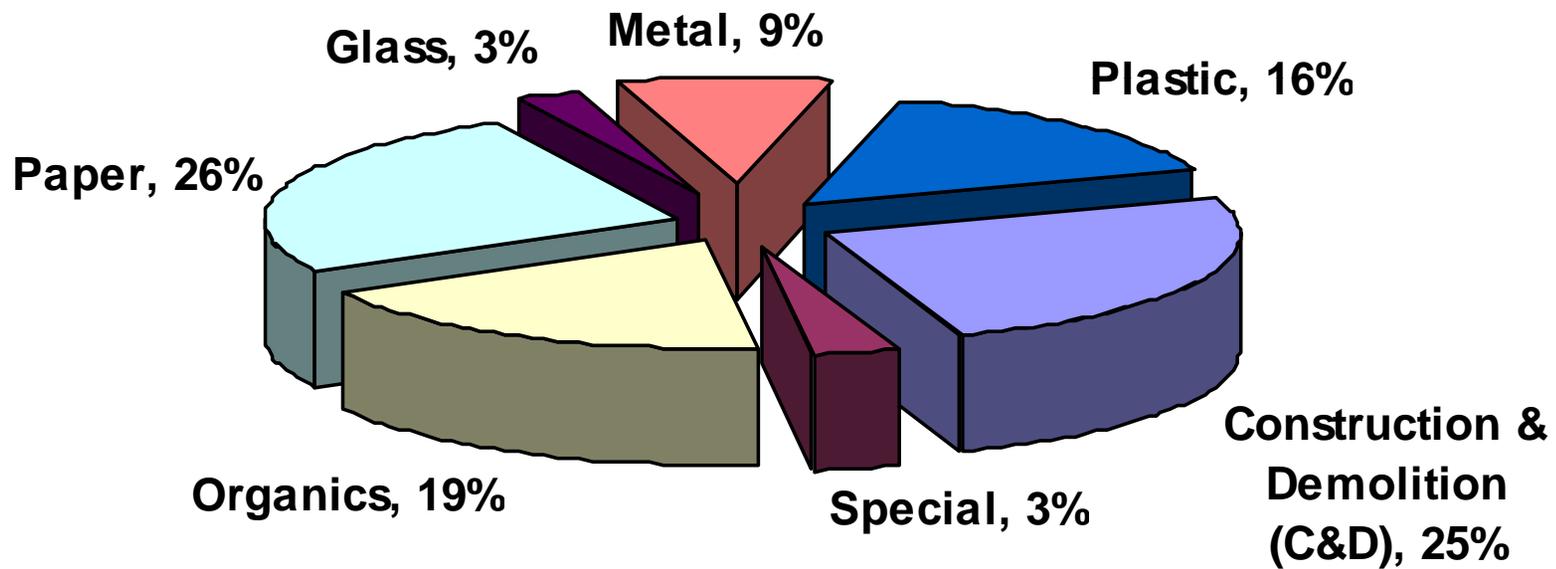
Waste as Integral Part of Distributed Power Architecture



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http://dodfuelcell.cecer.army.mil/library_items/ERDC-CERL_TR-08-11.pdf

Solid Waste Composition Example Army Installation

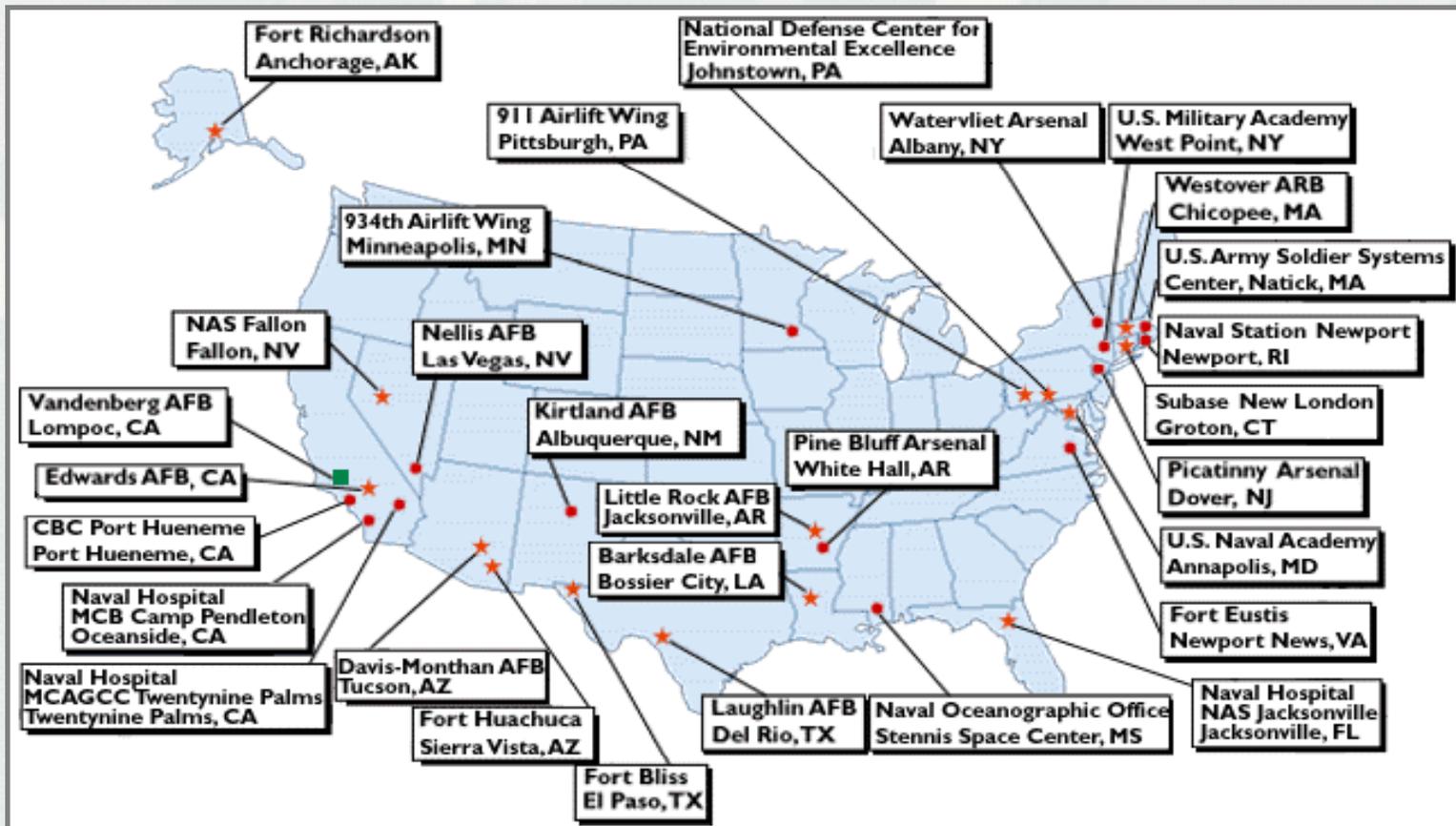


2009 RDECOM WTE Technology Assessment

- **Sponsored by RDECOM Power & Energy Technology Focus Team (TFT)**
- **Hosted by Army Research Lab (ARL)**
- **Goal was to evaluate the current status and potential direction of waste-to-energy technologies vis-a-vis tactical applications and operations.**
- **Focus on the requirements that drive the WTE efforts and to evaluate technologies that are appropriate to battlefield operations.**



FY93-FY94 Phosphoric Acid Fuel Cell (PAFC) Project Sites



31 fuel cells – United Technologies Corporation (UTC) Manufacturer

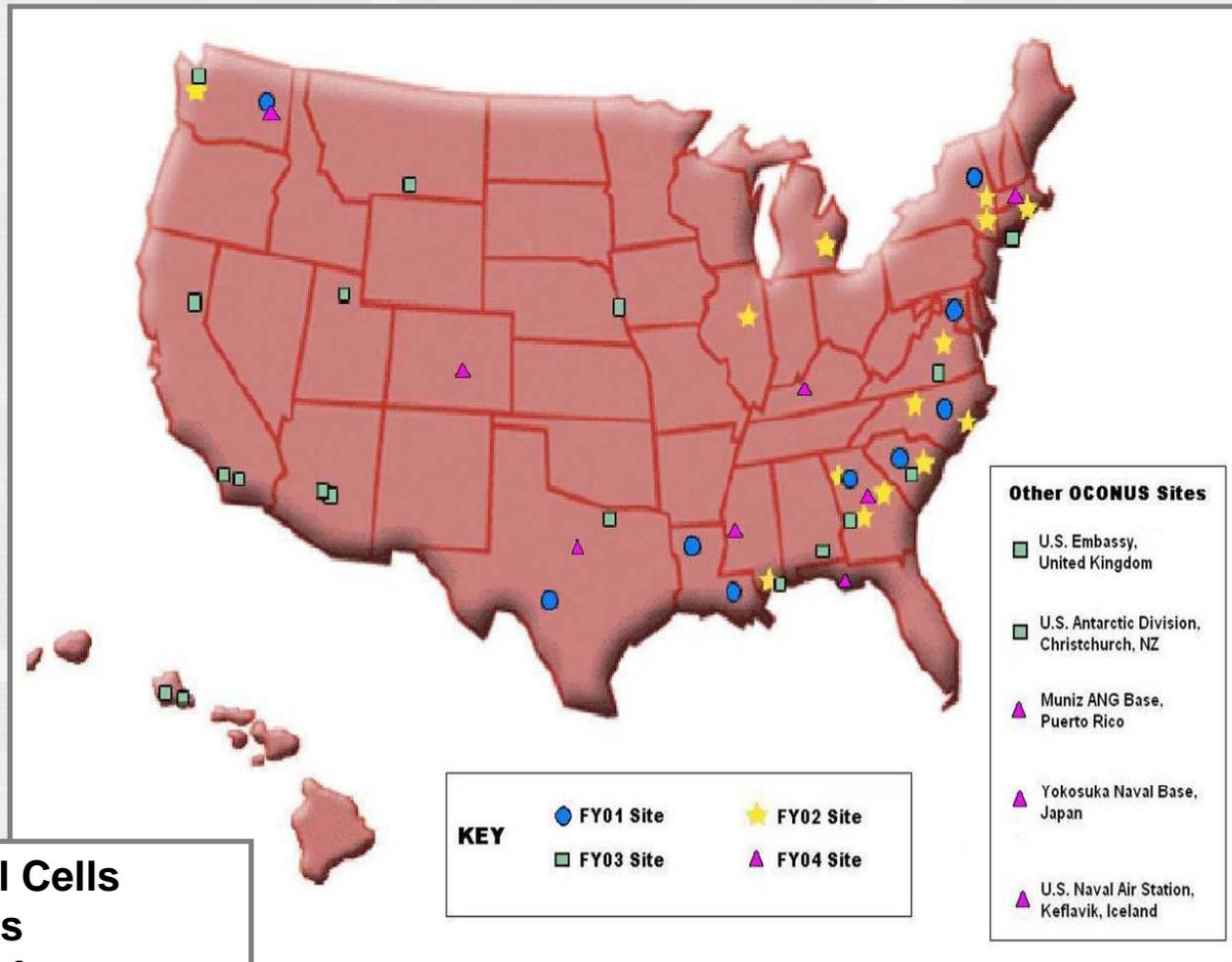
■ PC25A SITE
● PC25B SITE
★ PC25C SITE



<http://dodfuelcell.cecer.army.mil>

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FY01-FY04 Residential PEM Fuel Cell Project Sites



91 Fuel Cells
56 Sites
5 Manufacturers



<http://dodfuelcell.cecer.army.mil>

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Tactical WTE Efforts & Demos*

- **Defense Advanced Research Projects Agency (DARPA) and Army Research Lab (ARL)**
 - ▶ Basic research and fundamental technology development (MISER, etc)
- **Natick Soldier RDEC (NSRDEC)**
 - ▶ Combination of SBIR and mission funded projects for Waste to Energy Converter (WEC) since 2000 Contractors include Community Power Corp (CPC), Infoscitex, General Atomics, and Green Liquid and Gas Technologies
 - ▶ Targeting PM Force Provider for technology transition / deployment
 - ▶ Mobile Encampment Waste to Electrical Power System (MEWEPS) project with CPC, second field demonstration scheduled at Ft. Irwin, CA in Feb 2011
- **Edgewood Chemical / Biological Center (ECBC)**
 - ▶ Tactical Garbage to Energy Refinery (TGER) AIDE project with DLS, Purdue University, and CPC, field demonstration executed in theater
- **Communications-Electronics RDEC (CERDEC)**
 - ▶ Biofuel / Tactical Quiet Generator Hybrid Waste to Energy project with CPC, contract on-going



* Information provided by Daniela Caughron, APG

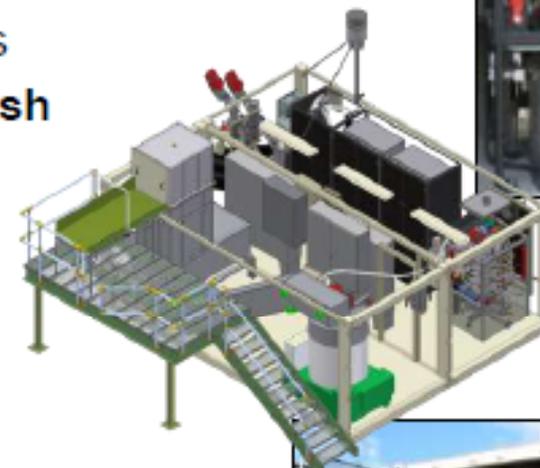
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Community Power Corporation, Littleton, CO

- **Approach: BioMax® Stratified Downdraft Gasifier**
 - Innovative design with electronic instrumentation and active air controls to optimize the process
- **Reduces dry feedstock to fuel gas and char/ash**
 - The clean producer gas can be used in an internal combustion engine
- **Pre-commercial system designed to convert woody biomass into electricity and heat**
 - Markets include small industrial, agro-processing, and rural electrification
- **“OFWEC” SBIR Phase II tech demo in 2008**
- **“MEWEPS” demo in 2009 at Camp Grayling**
- **“OFWEC III” demo planned for Net Zero Plus JCTD**
- **“HEDWEC” contract awarded 2009 for 2 TPD system in 2011**

Typical
BioMax®
Gasifier



OFWEC III
System



MEWEPS Gas Production
Module at Camp Grayling



Renewable Energy Testing Center (RETC)

US Army Contract W15QKN-05-D300



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RETC Example: International Environmental Solutions



- 8 ton/day Gasifier system designed for MSW, tires, food wastes, green biomass
- Waste to steam and power
- 2nd Generation Design
- Have 40 ton/day system permitted in Southern California on MSW-to-power (1 of 4 candidate MSW to energy technologies selected in LA)
- 8 ton/day system will also be integrated with microturbine steam generator

Others

- **Fort Stewart 94,000 lbs/hr steam Wood Chip Plant (off line).**
- **Aberdeen Proving Ground - Offsite plant supplies approx 70,000 lbs/hr (peak) and approx 452,000 Mlbs total 350 psi steam/year.**
- **The Eielson Air Force Base system processed over 560 tons of paper products in the base's central heat and power plant which provided 7.82 mmBtu of energy (program currently suspended because the pellet plant is inoperable).**
- **Hill Air Force Base, which generated 2.1 MW of electricity from landfill gas and has plans to expand to 3.2 MW.**
- **Dyess Air Force Base which is pursuing a 5.5 MW municipal solid waste energy plant.**
- **SUNY – Cobleskill Bioenergy Center**



Conclusions – WTE Projects at Army Installations

- **Need to Determine the “Burdened” cost of Waste**
- **3rd Party Financing Required in Most Cases**
- **Privatization of Utilities is an Issue**
- **Siting & Permitting can be an Issue**

- ***WTE Systems for Tactical Operations have different requirements!**



Acknowledgments

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