

Innovative Solutions for Landfill Diversion

Dave Robau, LEED AP
CEO & Chief Scientist
National Energy USA

September 27, 2018



Agenda



Challenges with Solid Waste Management



Think Globally, Act Locally



Technology to the Rescue



The DoD is Leading the Way



Innovative Technologies & Case Studies



Key Learning Objectives:

1. Students will learn about the operational challenges of managing solid waste and the financial impacts on traditional recycling markets,
2. Students will gain a better understanding of waste-to-energy technologies, including the benefits and hurdles associated with different methods,
3. Students will gain insight and updates into specific projects at various military installations in the United States, and abroad,
4. Students will understand the Technology Readiness Level (TRL) Program used by NASA and the DoD to assess the maturity of a technology. The speaker will illustrate how TRL is used to assess program concepts, technology requirements, and demonstrated technology capabilities, and

Challenges with Solid Waste Management

In the U.S. we landfill over 250,000,000 tons of solid waste each year



Challenges with Solid Waste Management

In the U.S. we landfill over 250,000,000 tons of solid waste each year ...after year...after year



Welcome to “Away”

Challenges with Solid Waste Management

- Landfilling of waste contributes to a variety of environmental impacts and, above all, landfills account for most of the greenhouse gas (GHG) emissions from the waste management sector.
- Most landfills in the U.S. don't have liners.
- Landfill liners protect a community's drinking water supply from the toxic mixtures of hazardous chemicals.
- Landfills have been described as "toxic timebombs"
- Landfills pollute air, water, and land resources.
- Florida has 145 Superfund Sites where groundwater impacts human health.



Think Globally, Act Locally

- The “traditional” recycling model is changing...dramatically!
- Up until last year, China was the world’s largest importer of recyclable materials.
- Overnight, Materials Recovery Facilities across the country closed, indefinitely.
- Many communities have been forced to landfill its recyclables.



Think Globally, Act Locally





NERC
NORTHEAST RECYCLING COUNCIL


ELEVEN STATES UNITED FOR ENVIRONMENTALLY SUSTAINABLE MATERIALS

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China's Ban on Recyclables: Beyond the Obvious...



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China trash ban is a global recycling wake up call

by Ivana Kottasová @ivanakottasova

🕒 April 20, 2018: 11:08 AM ET

 Recommend 2.1K

ENVIRONMENT

Recycling Chaos In U.S. As China Bans 'Foreign Waste'

December 9, 2017 · 8:00 AM ET
Heard on Morning Edition

[CASSANDRA PROFITA](#)[JES BURNS](#)

FROM 

A photograph showing three people (two men and one woman) standing in front of two large, towering bales of compressed recycling waste. The bales are made of various types of paper and cardboard, appearing as a chaotic mix of colors and textures. The people are dressed in winter clothing, suggesting a cold environment.

Technology to the Rescue



Robots Perform Surgery



Watch Phones

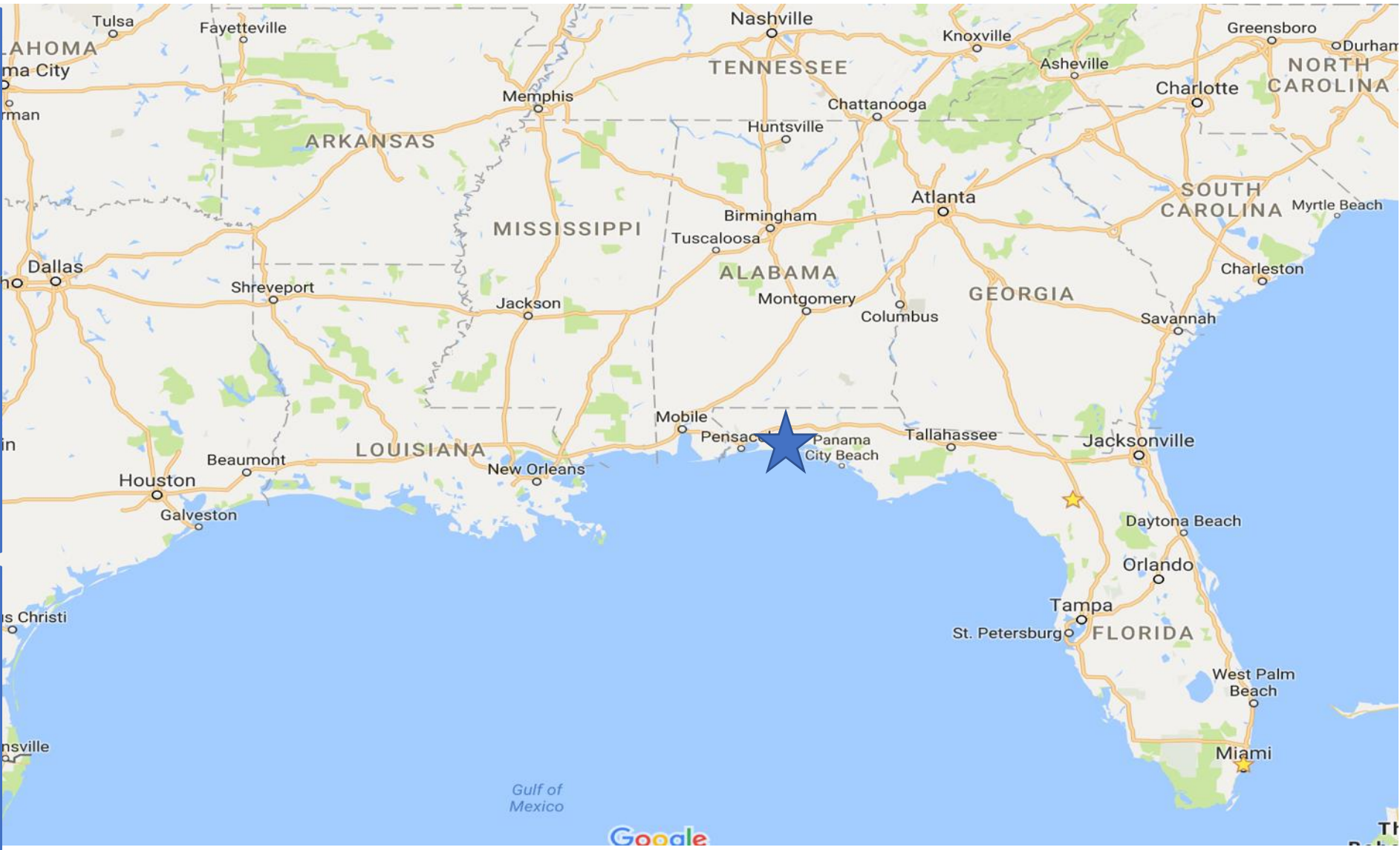


Electric Cars in Space

Our investments in innovation will lead to applications in:

- **Robotics**
- **Artificial Intelligence**
- **Electric Garbage Trucks for Zero Emissions**
- **Sensor Technology to Improve Efficiency**
- **Efficient Route Management Using Real-Time Data**
- **Accountability Using Blockchain**

The DoD is Leading the Way



The DoD is Leading the Way

Solid waste management creates significant challenges for warfighters in combat zones.

- Airmen would dig a hole (pit burn) and literally light everything (yes, everything) on fire.
- Significant impacts to human health for our Airmen.
- Resulting in violations of Host Nation Agreements and other international protocols.
- Who thought this was a good idea?!



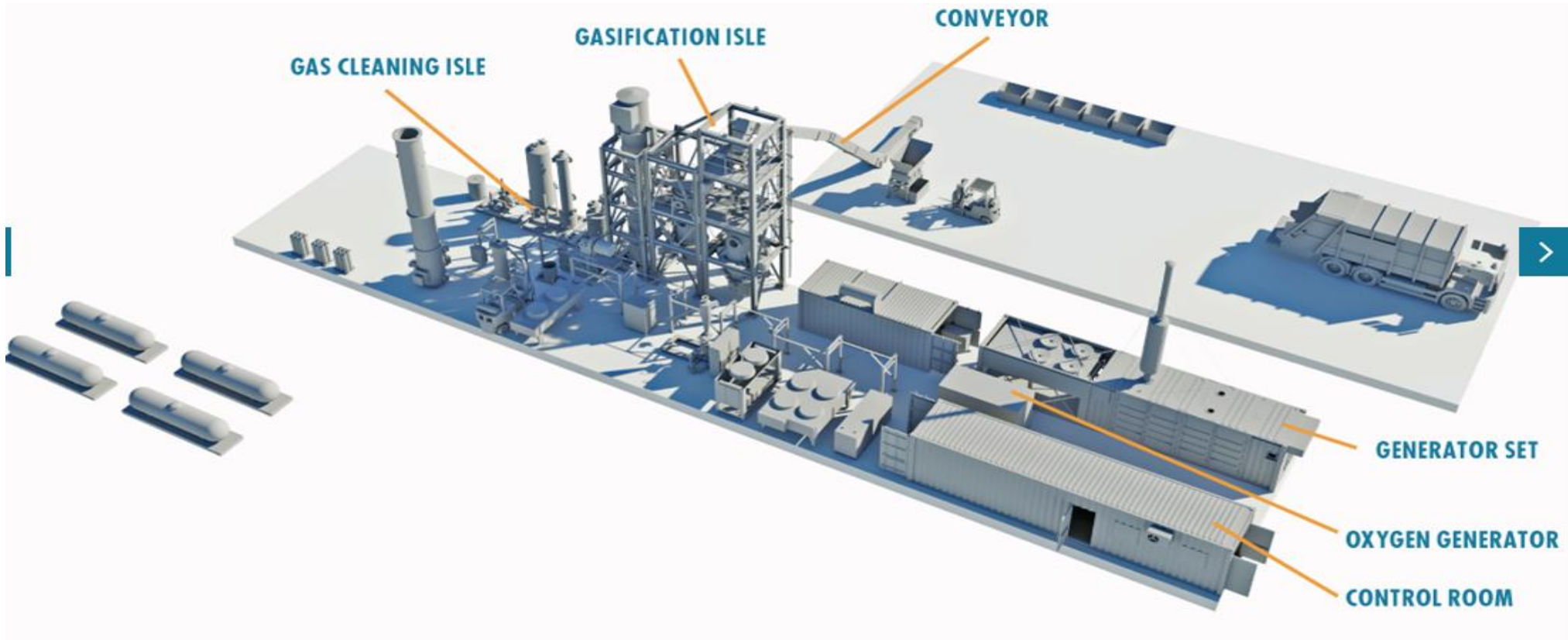
The DoD is Leading the Way

These “pit burns” in active combat zones also created significant security concerns and logistical challenges for resupply efforts and use of the runway.



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Army Garrison Fort Hunter Liggett



This technology uses heat, steam and oxygen to break down waste at the molecular level. Organic materials turn into an energy-dense syngas. Inorganics melt into a non-leaching stone. Waste undergoes complete conversion into high value products without burning.

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Army Garrison Fort Hunter Liggett

Objective: To showcase how this technology can be used to process Municipal Solid Waste (MSW) and achieve energy security and zero-waste goals.

Commissioned: 2017

Cost: Undisclosed

Agency: U.S. Army Garrison Ft. Hunter Liggett

Location: Monterey County, Calif

Contractor: Sierra Energy, Inc

Technology: FastOx® Pathfinder

Capacity: 20 TPD of MSW or Biomass

Net Output: Electricity and Diesel Fuel



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Joint Base Pearl Harbor-Hickam (Hawaii)

The project is sponsored by the High Technology Development Corporation's (HTDC) Hawaii Center for Advanced Transportation Technologies (HCATT). Phase I of the project will utilize a rotary kiln gasifier that turns waste into fuel, heat and electricity. Phase II will produce a liquid jet fuel from waste.



Joint Base Pearl Harbor-Hickam (Hawaii)

Objective: A demonstration to showcase how gasification technology can work as part of a military microgrid.

A demonstration to showcase how gasification technology can be used to process Municipal Solid Waste (MSW).

Commissioned: March 2016

Cost: \$6.8 million

Agency: Hawaii Air National Guard

Location: Joint Base Pearl Harbor

Contractor: Biomass Energy Systems, Inc.

Technology: Rotary Kiln Gasifier

Capacity: Convert 10 TPD of waste into electricity

Net Output: 200-300 kW



Air Force Special Operations Command

Objective: Demonstrate the ability to use advanced plasma gasification technology in a portable application to deploy into the AOR.

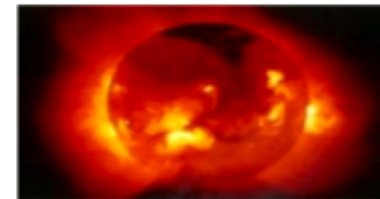
What is Plasma?

- *Plasma is an ionized gas that conducts electricity.*
- *The current releases large amounts of heat.*
- *Several technologies have been developed to use this source of heat which can reach temperatures from 9,000 to 20,000°F.*

There are four states of matter

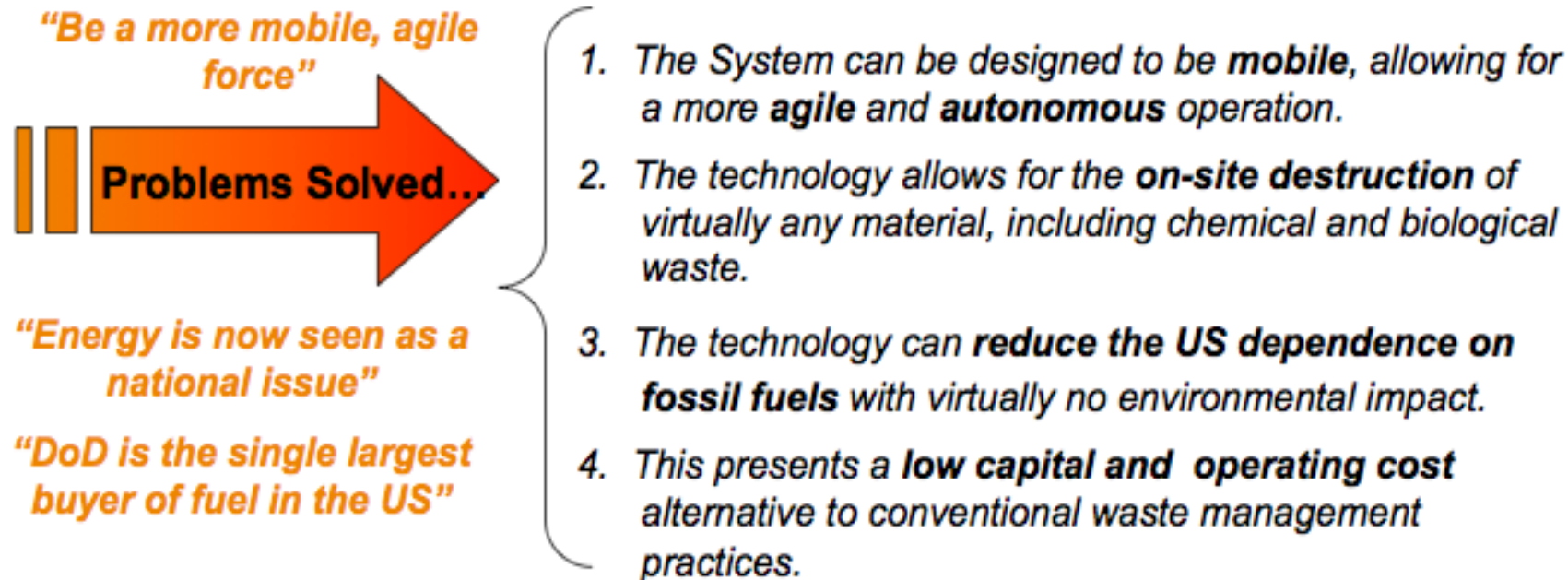
SOLID →	LIQUID →	GAS →	PLASMA
<32°F	>32°F	>212°F	>9000°F
ICE →	WATER →	STEAM →	IONIZED GAS

Hot as the surface of the sun



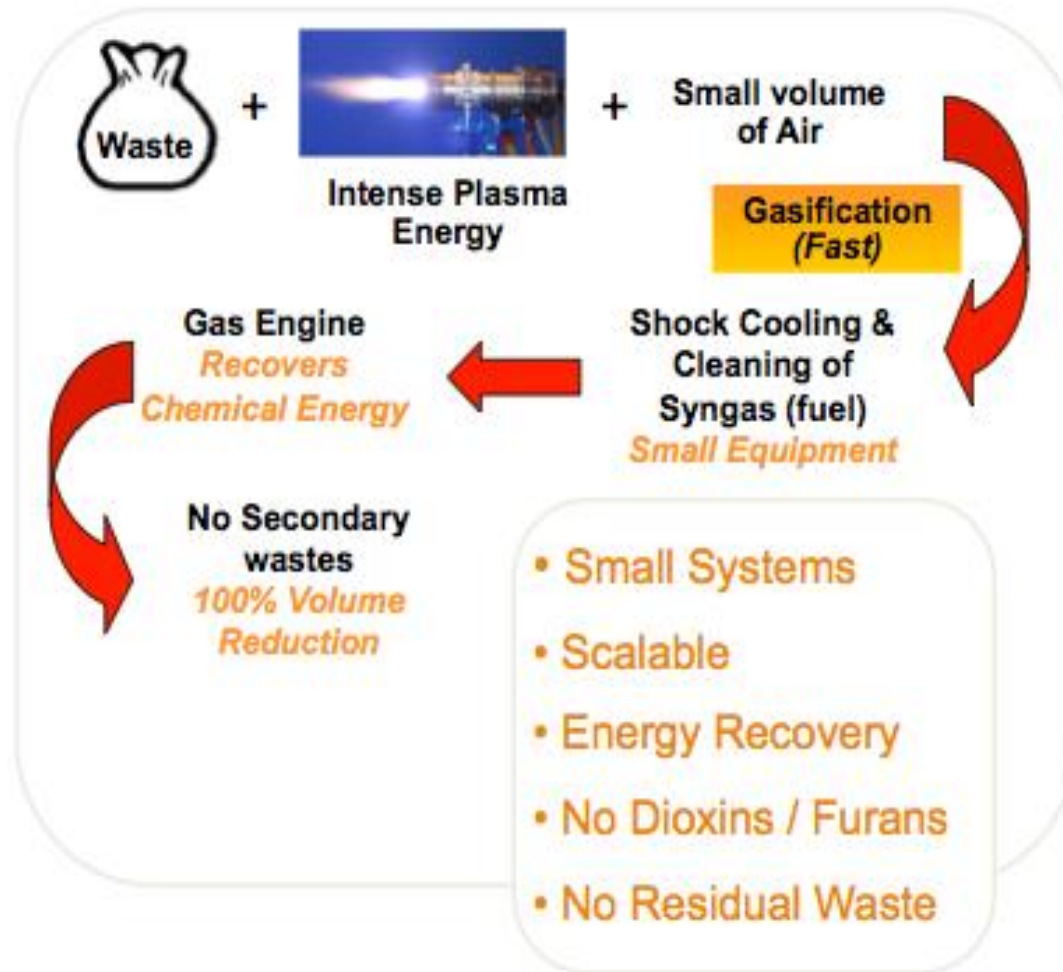
Air Force Special Operations Command

*Can safely and efficiently convert virtually **any type of waste** (hazardous & non-hazardous) into energy and useful products and is, in many instances, a **net energy producer**.*



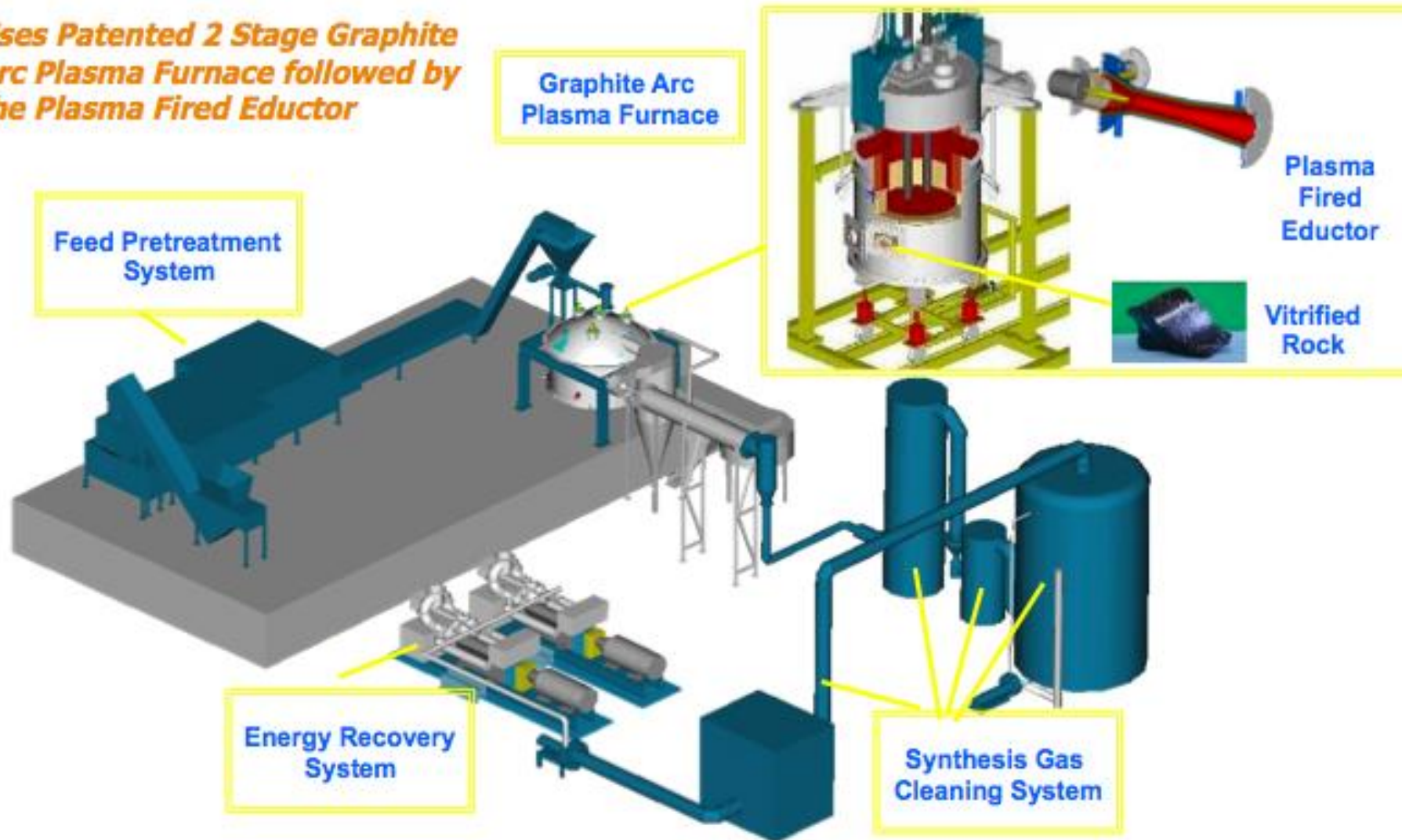
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Air Force Special Operations Command



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Uses Patented 2 Stage Graphite Arc Plasma Furnace followed by the Plasma Fired Educator



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Medical Waste



MSW



Hazardous Chemicals



1. Primary Gasification Furnace using graphite electrodes
2. Secondary Gasification Chamber, with air plasma torch and patented eductor
3. Quench to prevent dioxin and furan formation
4. Air Pollution Control tailored to waste stream

Gasification

Thermal conversion of organic matter into synthesis gas consisting primarily of CO and H₂ with only a small amount of oxygen

Syngas
(CO & H₂)

Slag

Metal

Heat/ Steam

Electricity

Chemical Products

Vitrification

Inorganic material is melted to produce an inert slag that is safe for use as a construction material

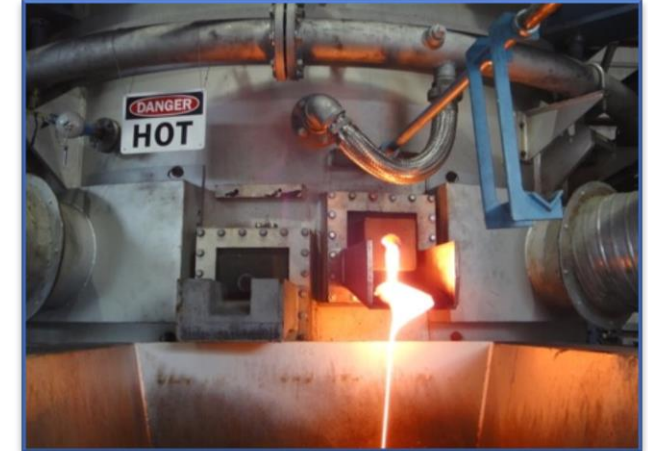
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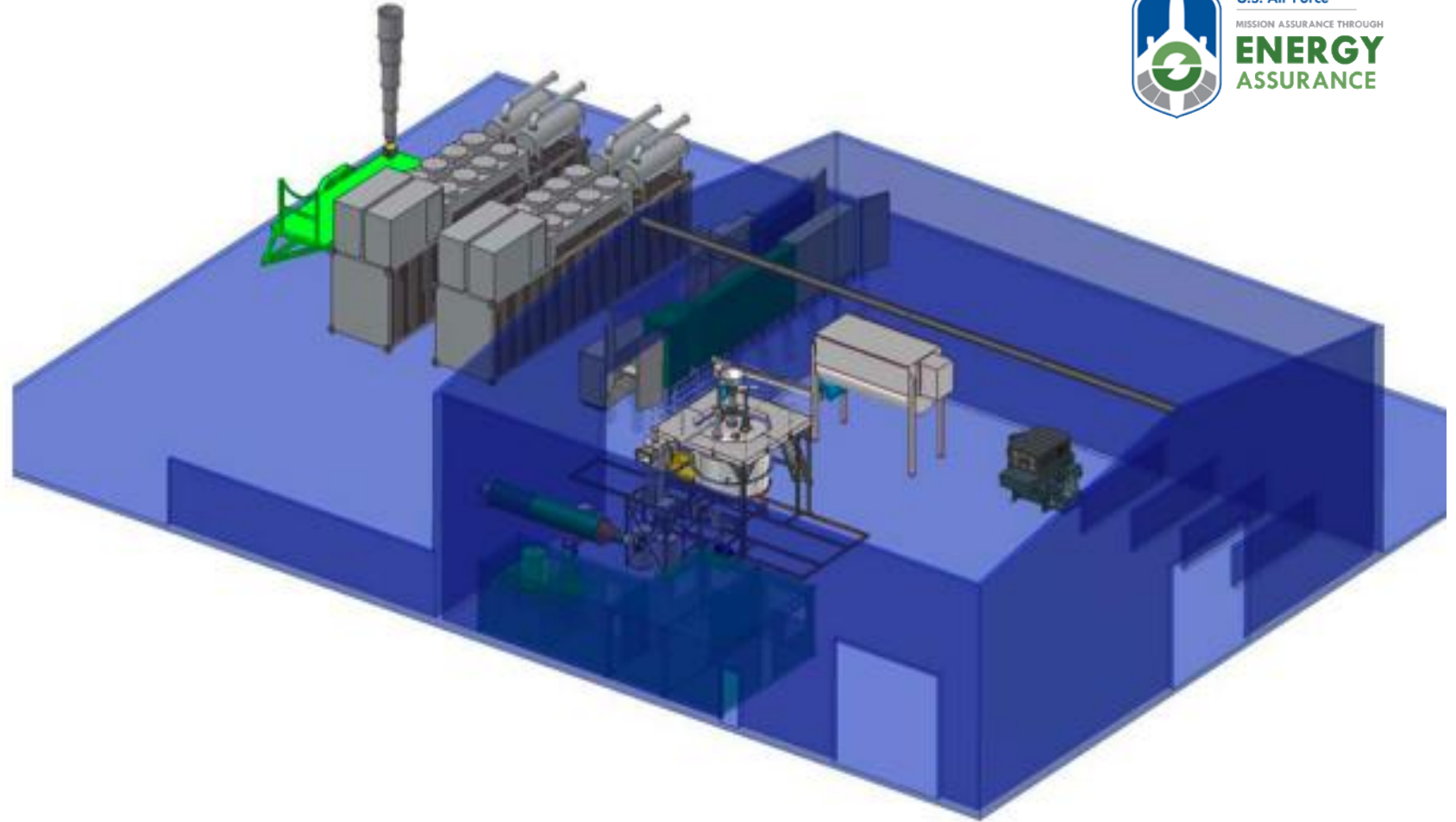
Air Force Special Operations Command

Tested	EPA Hazardous Waste #	Regulatory Level (mg/L)	Slag Concentration (mg/L)
Arsenic	D004	5.0	0.002
Barium	D005	100	1.253
Cadmium	D006	1.0	0.001
Chromium	D007	5.0	0.252
Lead	D008	5.0	0.004
Mercury	D009	0.2	0.0002
Selenium	D010	1.0	0.003
Silver	D011	5.0	0.010



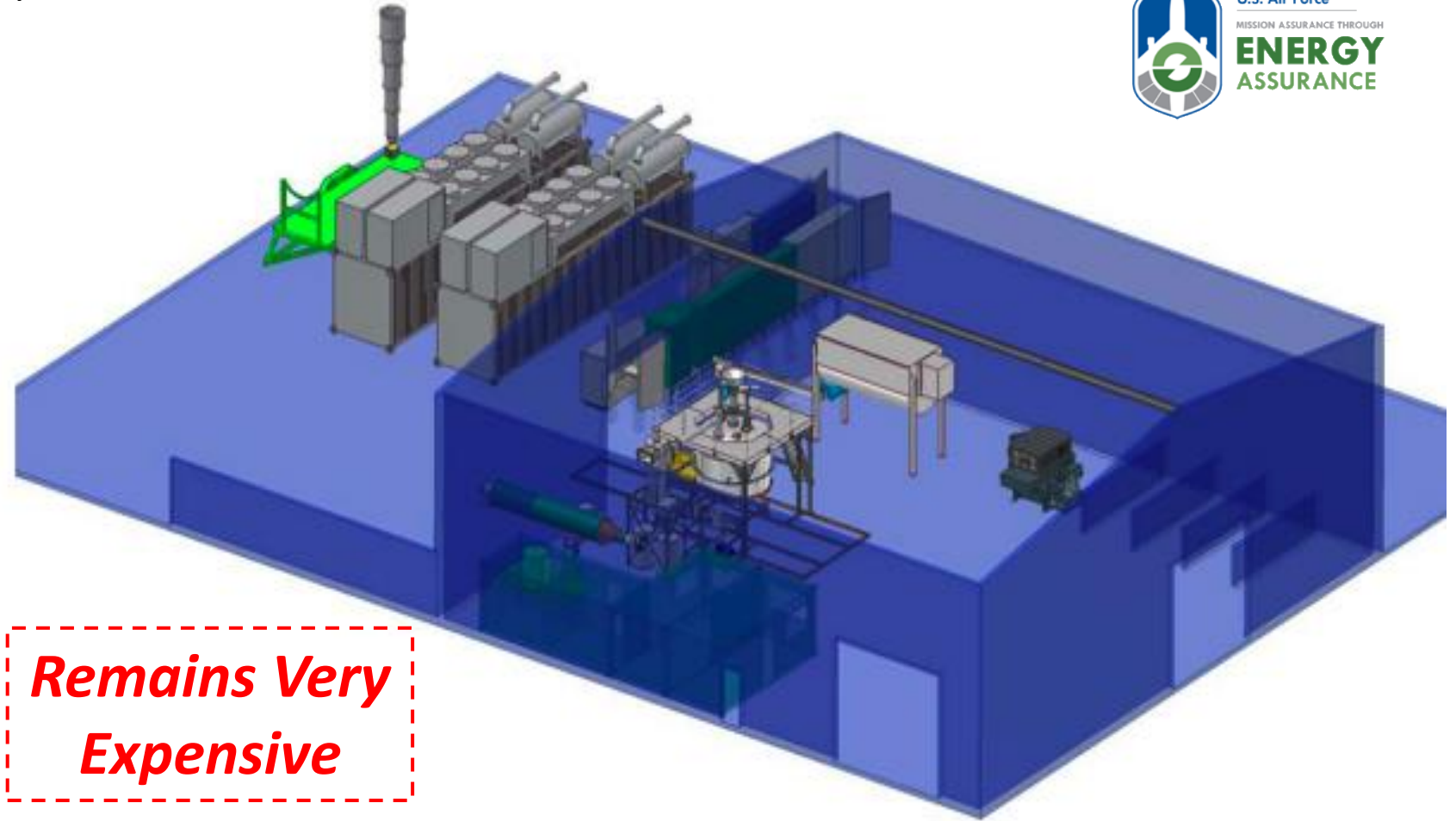
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- Eliminates the Environmental Liability of Landfills
- Meets Base Load Power Needs/Reduce GHG by 83,000 TPY
- Generates Clean Renewable Energy/Fuel
- Meets and Exceeds Federal/State Environmental Mandates
- Provides Energy Security for Deployed Forces
- Transportable System for Overseas Deployments
- Generates Other Marketable Products
- Very Compact Design (6,400 SF Building)



Innovative Technologies & Case Studies

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Remains Very Expensive

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U.S. Army Corps of Engineers

Objective: To jointly-develop a cost-effective solution that can be used to process Municipal Solid Waste (MSW) and produce a pathogen-free engineered fuel product.



ERDC/CERL TR-08-13

Construction Engineering
Research Laboratory



US Army Corps
of Engineers®
Engineer Research and
Development Center

Hydrothermal Processing of Base Camp Solid Wastes To Allow Onsite Recycling

Gary L. Gerdes, Deborah Curtin, and Christopher Gutkowski

September 2008

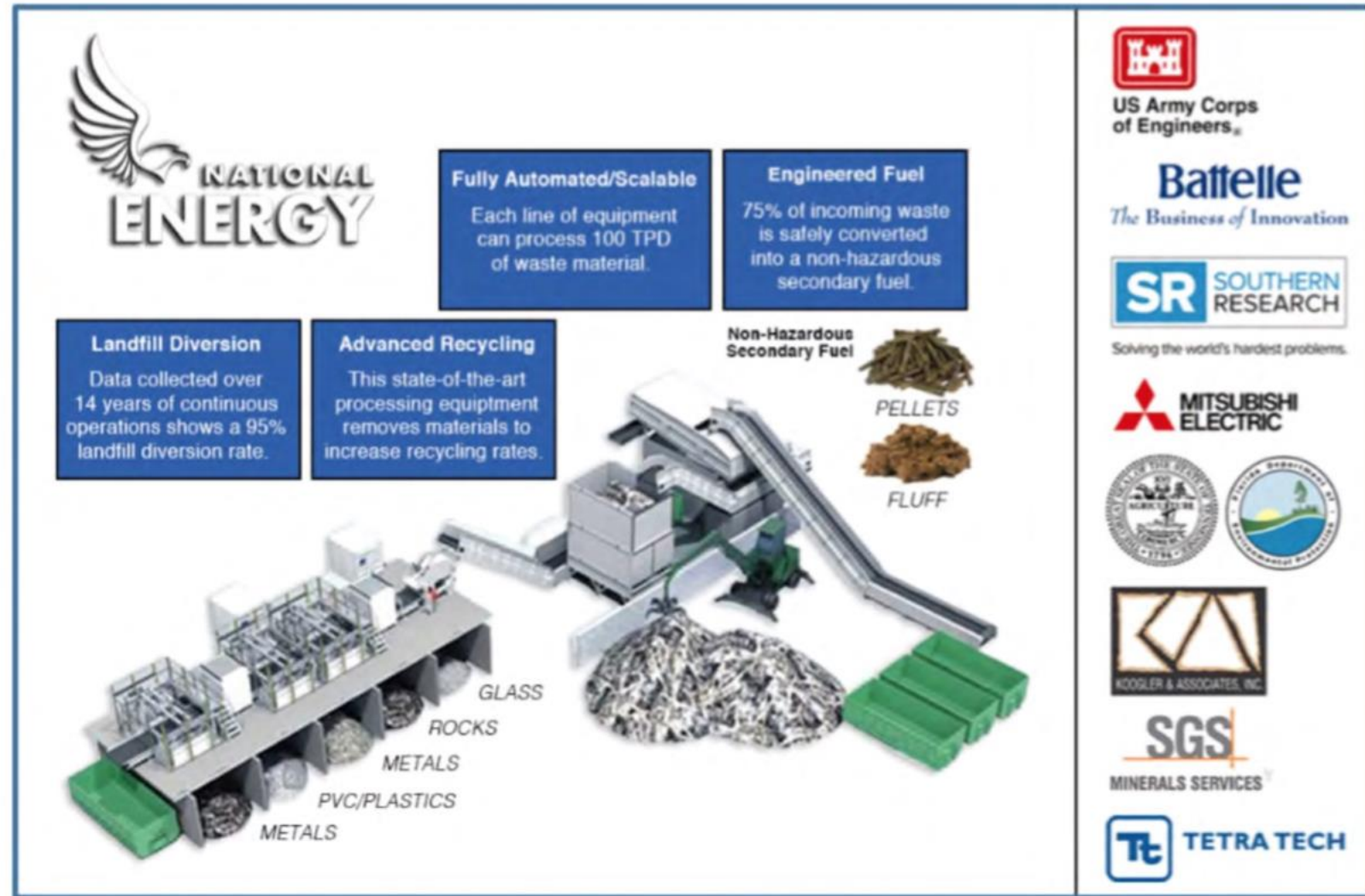


Approved for public release; distribution is unlimited.

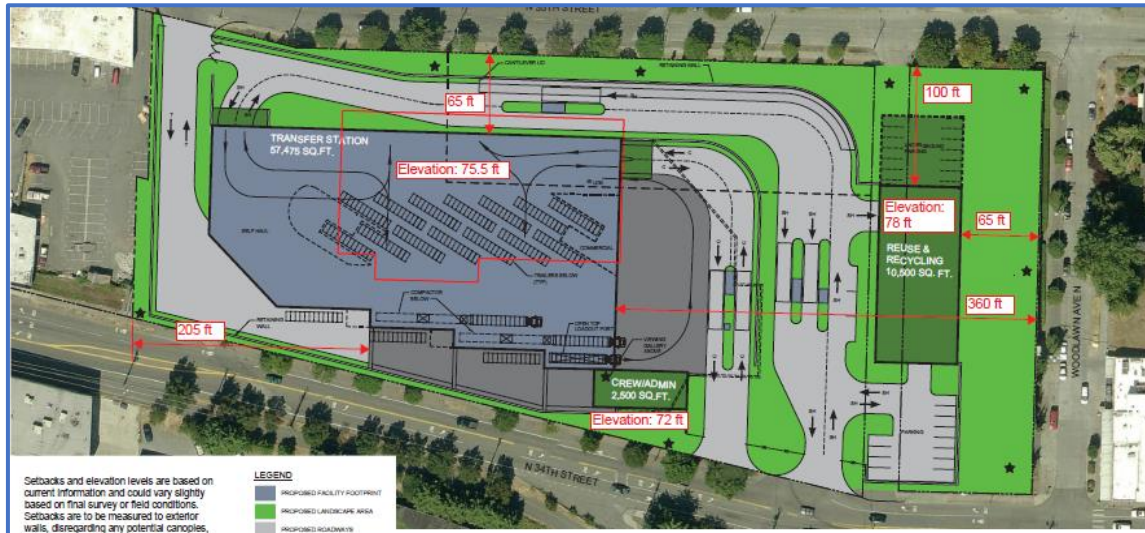
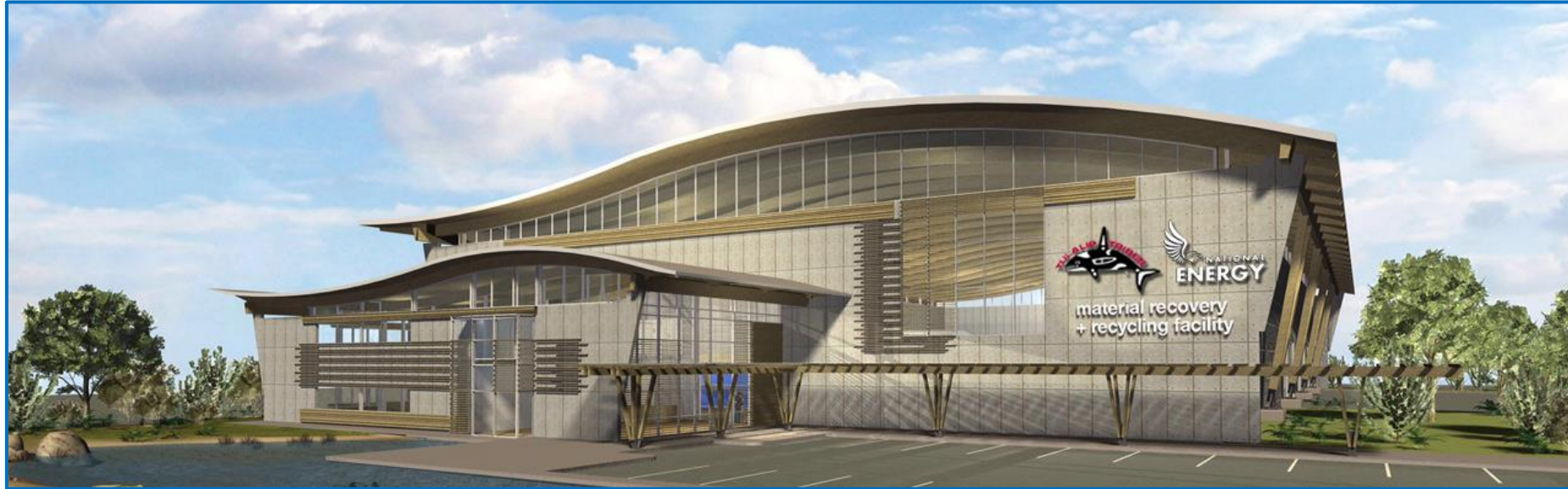
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U.S. Army Corps of Engineers

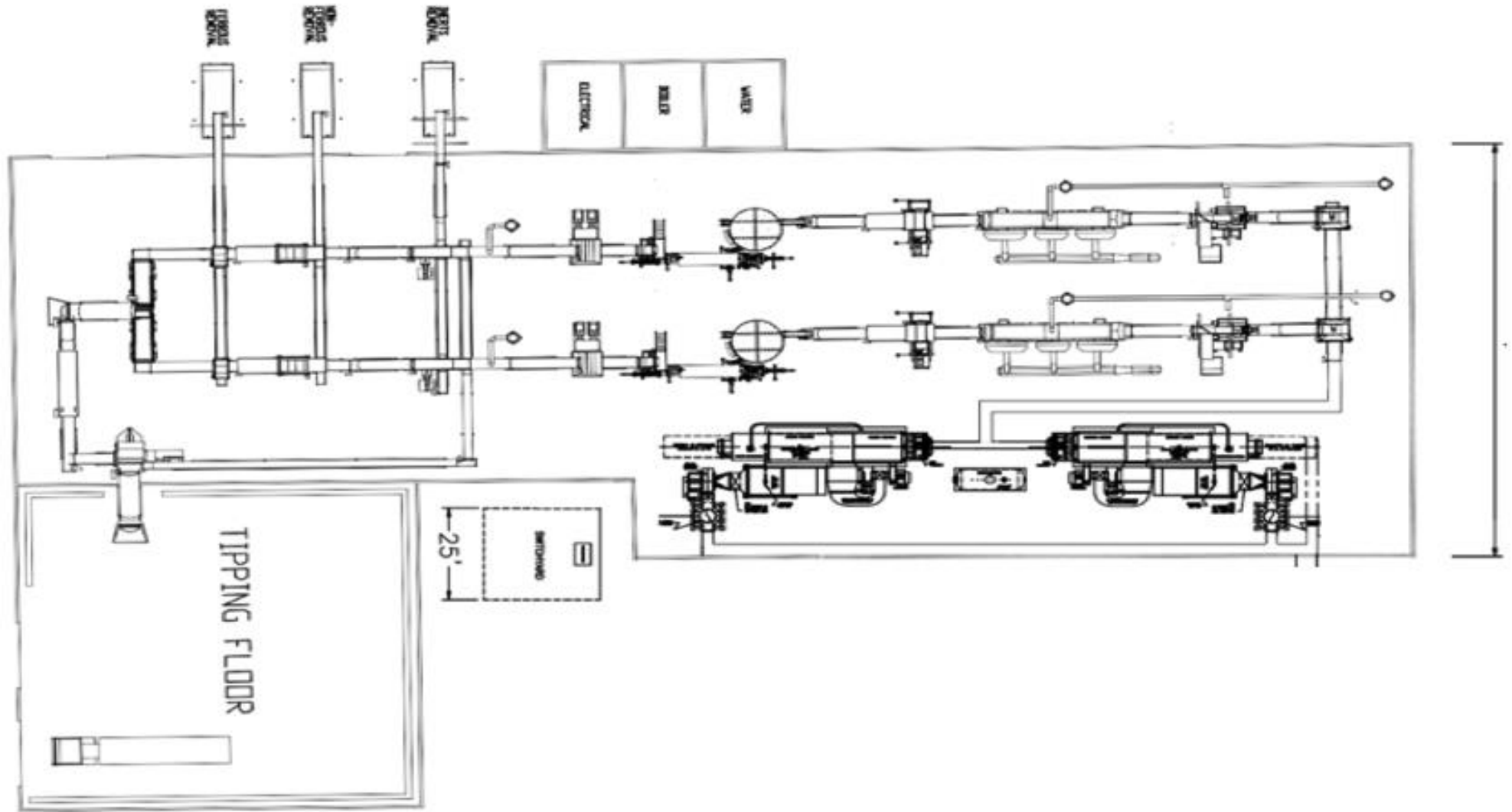
- Developed through a Cooperative Research and Development Agreement (CRADA) with the US Department of Defense.
- System efficiencies and process enhancements completed through a partnership with the US Department of Energy.
- Supported by 21 US and 2 International patents.
- 10 years of operational data and maintenance records.



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Dave Robau, CEM, LEED AP BD+C
CEO & Chief Scientist

DaveR@NationalEnergyUSA.com
(850) 855-2108