

AIR FORCE SPECIAL OPERATIONS COMMAND

Air Commandos – Quiet Professionals

Update on the Transportable Plasma Waste to Energy System at Hurlburt Field

**2010 ENVIRONMENT, ENERGY & SUSTAINABILITY -
Symposium & Exhibition**



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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 10,000 to 20,000°F.
- No fossil fuels



PyroGenesis has been designing, manufacturing and continually improving its core technology.



As hot as the surface of the sun

There are four states of matter

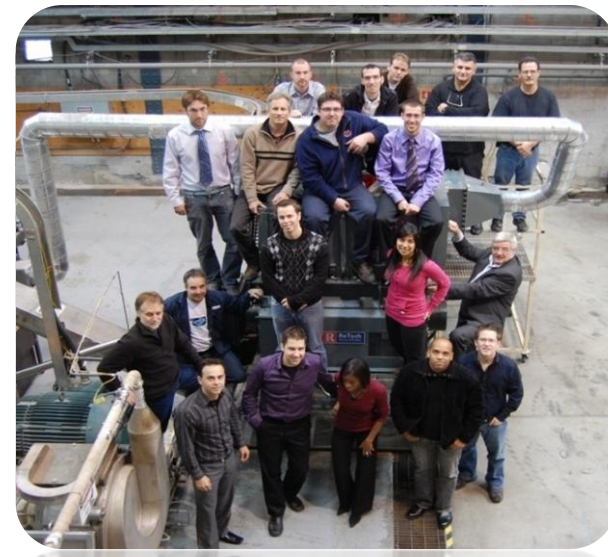
Solid	→	Liquid	→	Gas	→	Plasma
<32°F		>32°F		>212°F		>10,000°F
Ice		Water		Steam		Ionized Gas



PyroGenesis Canada?



- PyroGenesis was established in 1991
- A technology based company with 7 patents in 28 jurisdictions
- Design, development, fabrication and assembly of pilot scale and commercial systems
- Electrical, automation and process control capabilities
- Delivery of turn-key solutions



50 employees including chemical, mechanical and electrical engineers and process technologists



From a Mere Idea to a Commercial Reality



- Plasma is traditionally an expensive technology for waste treatment.
- Identification of a niche market → Marine
 - Marine environment characterized by lack of space
(most expensive real-estate in the world)
- Plasma allows for the development of small compact systems
- Marine expertise led to opportunities on “land-based” waste treatment





PyroGenesis' Unique Plasma Based Systems



**Plasma Resource Recovery System –
Designed as a Clean and Efficient
Waste to Energy Solution**

***10.5 TPD Transportable System for
Hurlburt Field AFB***



**Plasma Arc Waste Destruction System –
Designed for Marine Industry
requirements**

***To be installed on the US Navy's CVN 78
Air Craft Carrier***

Installed on a Carnival Cruise Lines Ship



Plasma Resource Recovery System (PRRS)



Patented two stage process

Vitrification

Inorganic material is melted at 3,000°F to produce an inert slag that is safe for use as a construction material

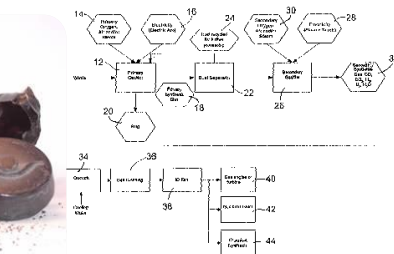


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(13) A1

(17) Date de dépôt: 18 sept. 2003
(18) Date à la disposition: 18 sept. 2003
(19) Inventeur: PIERRE, CAROL
(20) Agent: PIRAK & CO.

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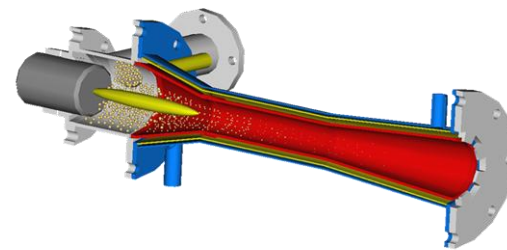


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Canada
http://www.cipo.gc.ca
Ottawa-Hull K1A 0S7
CIPC
GPO

Gasification ~~Pyrolysis~~

Thermal conversion of organic matter into synthesis gas consisting primarily of CO and H₂ using a sub-stoichiometric amount of oxygen





Molten Metal Oxides





Thermal Shock to the Slag Produces Inert Aggregate





Plasma Arc Gasification & Recycling



Waste

Recyclables

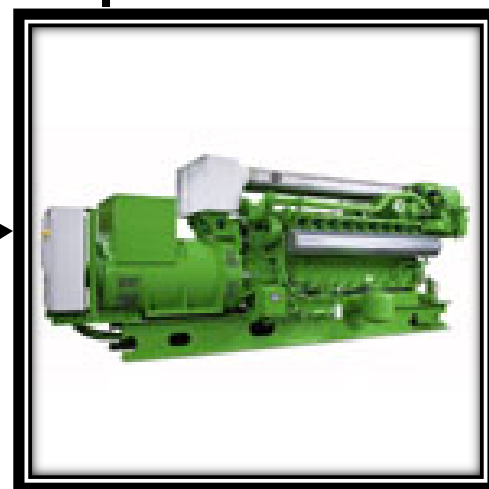


PRRS:
Plasma Waste to
Energy System

Syngas

Electricity

Power to
Grid



Jenbacher
JCS 312



PRRS is Designed to Process...



**Hospital /
Clinical**



Municipal Waste



**Construction
waste**



**PCB's-
Transformer oils**



Fly Ash



**Hazardous
Chemical waste**



**Hazardous
Chemical waste**





Plasma Resource Recovery System (PRRS)- Animation





Plasma Resource Recovery System (PRRS)



Features

Energy Efficient → **NET ENERGY PRODUCER**

Robust and Flexible so that it can handle virtually **any** type of waste (hazardous and non-hazardous) without the need to pre-sort.

Clean Technology with no Secondary by-products requiring disposal

Compact so that smaller units can be designed to be **transportable**

Design to be safe and easy to operate (minimum man-power requirements)

Design to be a **low capital & operating cost** alternative to conventional waste management practices.

Scalable : 2 to 50 tons per day with possibility of scaling up to 240 TPD and beyond



Plasma Waste to Energy System



Pilot System



Plasma Torch

Technology

- System uses intense heat of plasma energy to gasify and vitrify virtually any type of waste
- Unit is a net energy producer and yields marketable by-products with no pollutants

The So What

- System allows on-site destruction of virtually any material eliminating disposal in landfills
- Relatively low capital/low operating cost alternative to conventional waste management practices
- Wide spread use in the US would reduce dependence on fossil fuels
- Designed to be mobile allowing deployment to clean up polluted sites or use in AOR to solve problems with open pit burning

Participants

- Sponsor: AFSOC/A7
- Industry Partner: PyroGenesis Inc. of Canada
- Contributors: OSD/CTO, AFSO21, Cdn Gov't, Gulf Power, AF/SG

Schedule

Issue RFP	11 Apr 08
Contract Award	6 Jun 08
Initial Planning Meeting w/ Contractor	9 Jun 08
Design/Permits for Facility/Infrastructure	30 Sep 09
Receive/Assemble Equipment	30 Dec 09
Developmental/Operational Testing	30 Mar 10
System Acceptance Decision	30 Jun 10

RDT&E Funding (\$M)

	FY08	FY09	Total
CTO	1.7	2.0	3.7
AFSO21	2.0	0.0	2.0
Canada	2.0	0.0	0.8
AF/SG	0.0	0.8	0.8
GP	0.0	0.1	0.1
TOTAL	4.5	2.9	7.4

Benefits

- Eventually 100% recycling of all waste streams at Hurlburt
 - O&M cost avoidance is estimated to be \$0.7M per year
 - Payback less than three years



Plasma Resource Recovery System (PRRS)



PRRS 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**.

“Be a more mobile, agile force”



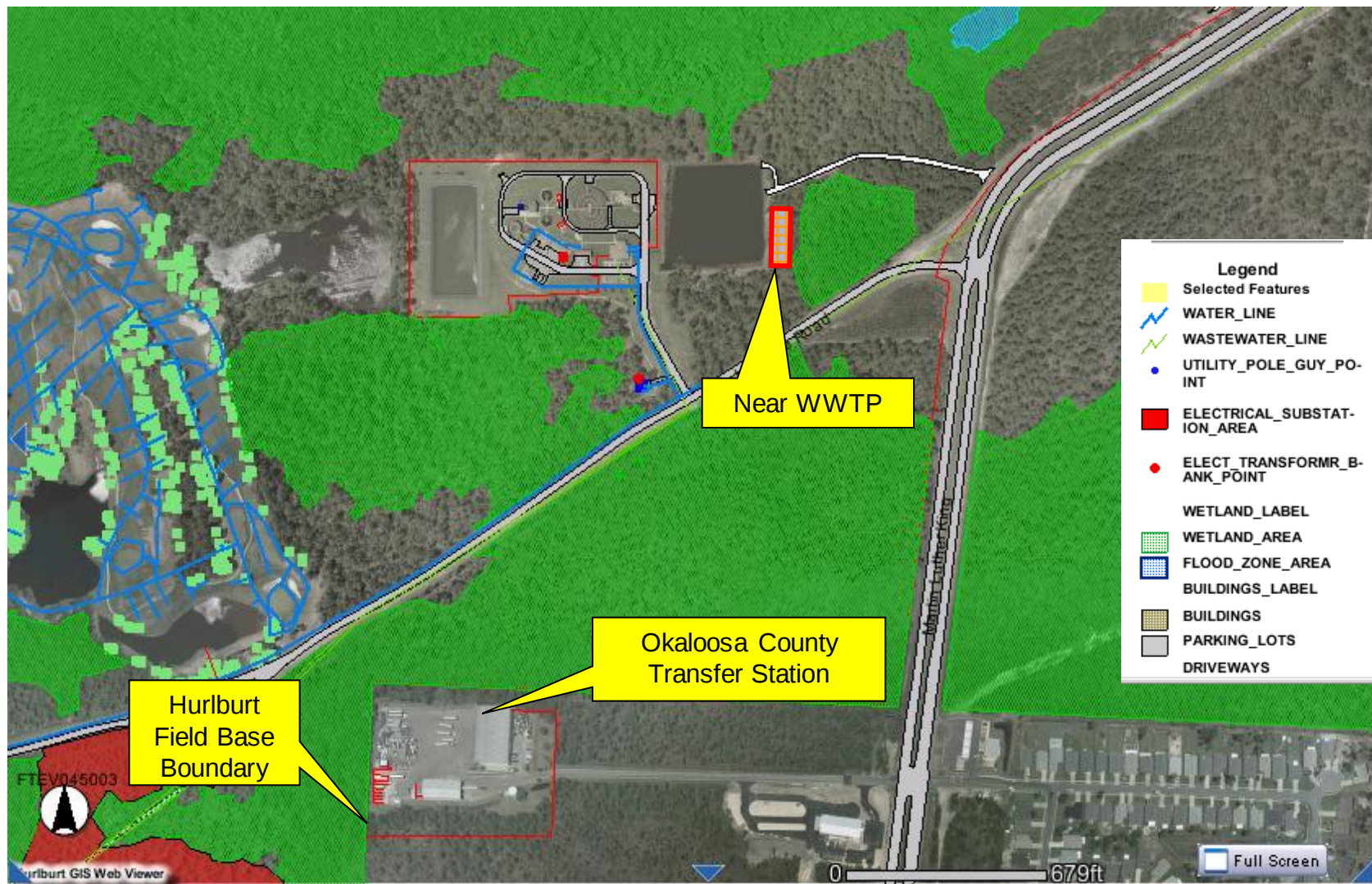
“Energy is now seen as a national issue”

“DoD is the single largest buyer of fuel in the US”

1. The System can be designed to be **mobile**, allowing for a more **agile** and **autonomous** operation.
2. The PRRS allows for the **on-site destruction** of virtually any material, including chemical and biological waste.
3. PRRS could **reduce the US dependence on fossil fuels** with virtually no environmental impact.
4. The PRRS is a **low capital and operating cost** alternative to conventional waste management practices.



Plasma System Approved Site on Hurlburt Field





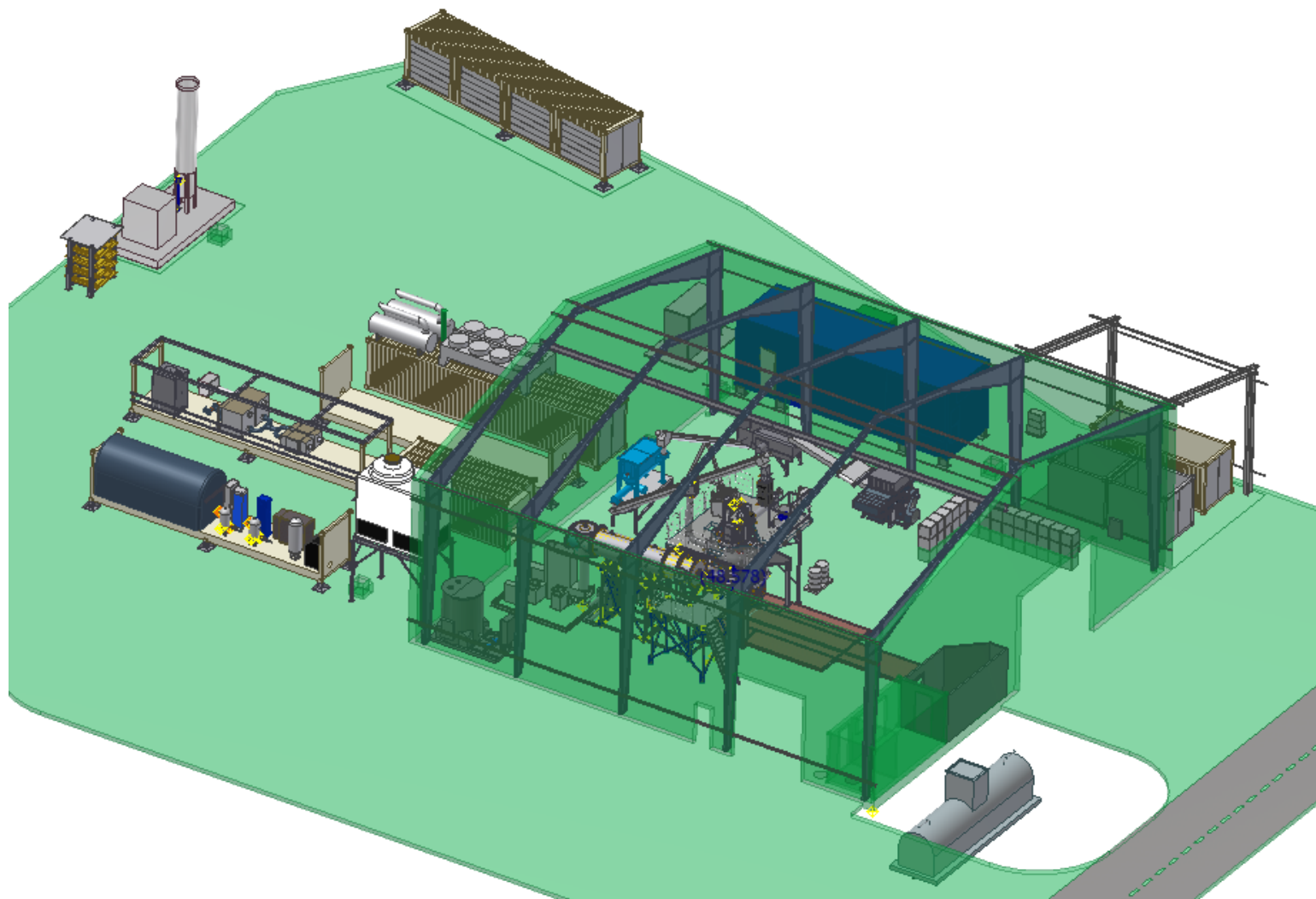
Environmental Permitting



- ***Storm Water Permit received in March 2009***
 - ***RD&D Permit received in July 13, 2009***
 - ***3 tap permits (reuse, potable, force main)***
 - ***Air Construction Permit received on Oct. 1, 2009***
 - ***Hazardous Waste Treatability Study submitted in May 2010***
-



3D model of Hurlburt Field TPWES





Facility Overview During Construction





Electrical Conditioning Module





Waste Feeding overview





Shredder



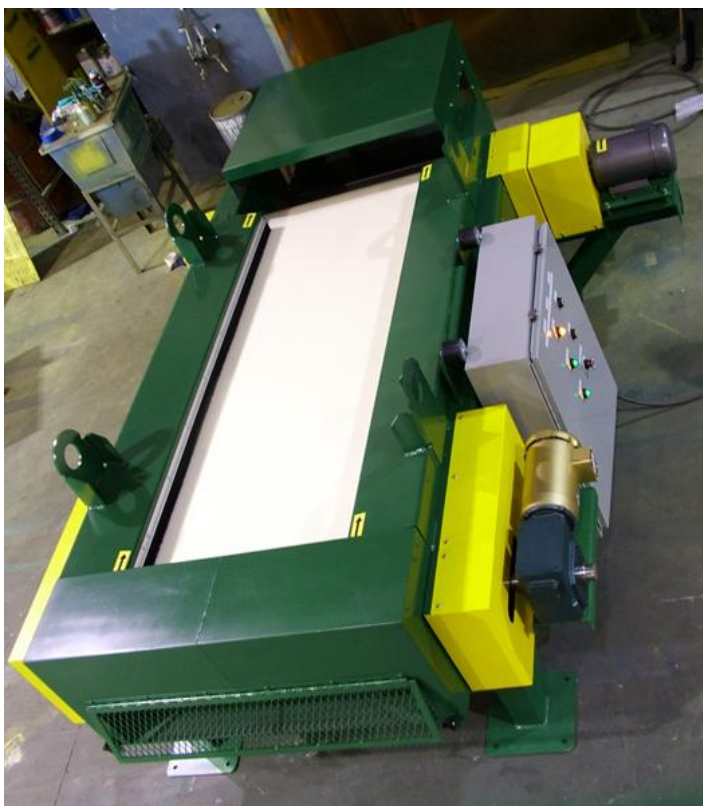


Magnetic Metal Separator





Eddy Current Separator





Plasma Furnace and Eductor





Caustic Scrubber





H2S Scrubber





Cooling Water skid installation





Cooling water & Gas Cleaning skids





Gas Cleaning and Gas Engine (Top View)



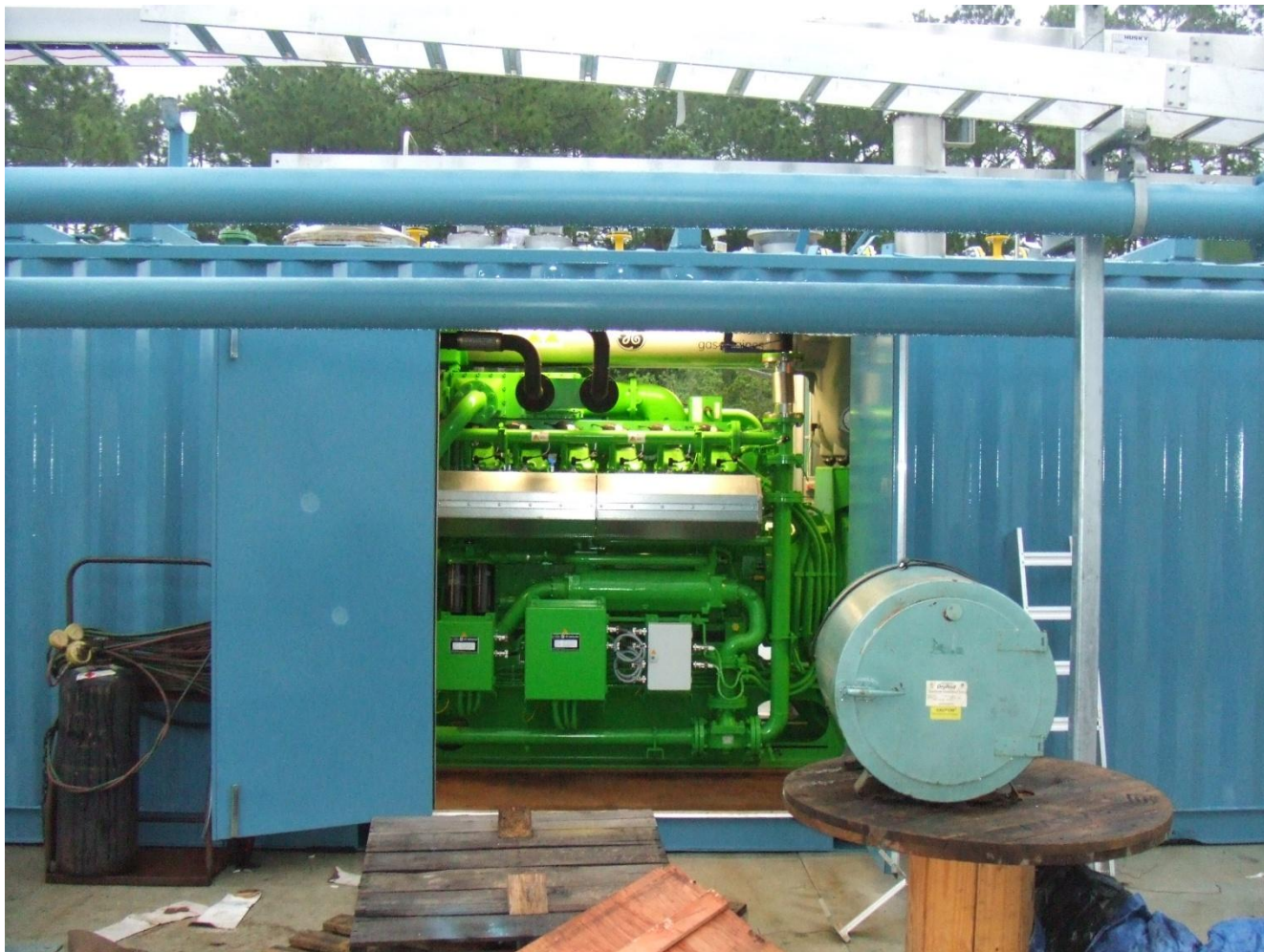


Gas Cleaning, Gas Engine and Emergency Flare





GE Jenbacher 12 Cylinder Internal Combustion Engine





GE Jenbacher IC Engine





Continuous Emissions Monitoring System



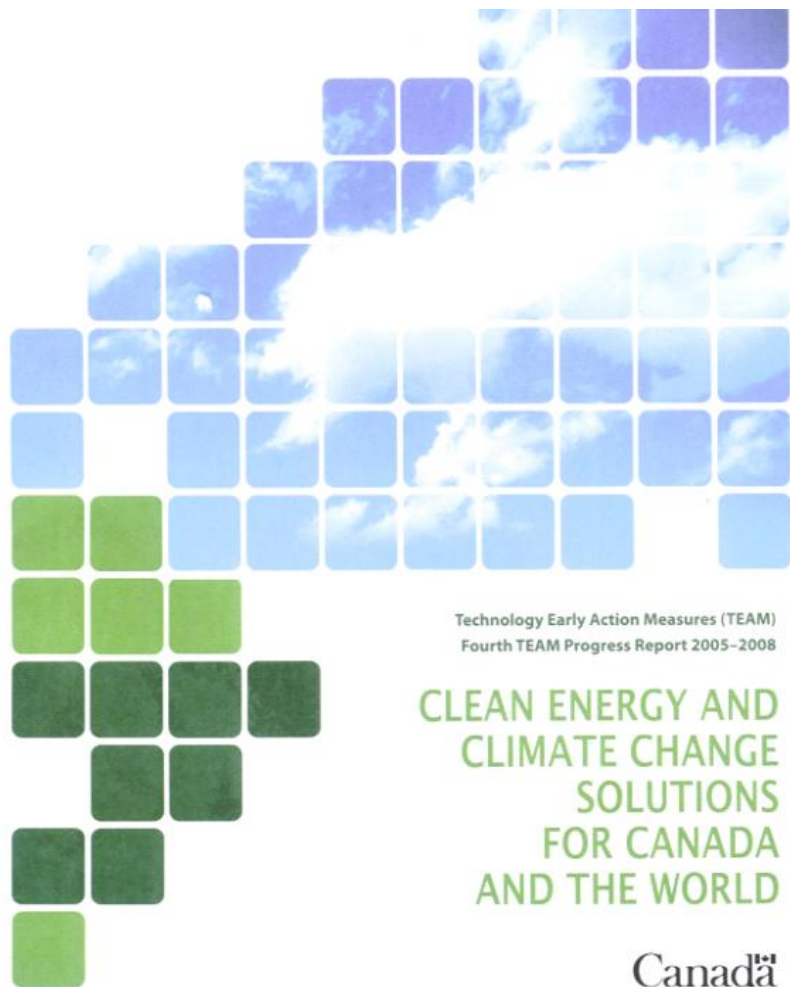


Human Machine Interface





Carbon Credits



INT-049 PyroGenesis Canada

Plasma resource recovery system turns waste into energy

In this project, PyroGenesis Canada will enhance its existing design towards commercial scale and demonstrate a 10 tonne-per-day plasma resource recovery system (PRRS) that turns waste into syngas, vitrified rock and metal. Syngas can be used to generate electricity and heat while the "glassy rock" can be used as an aggregate for construction and metals can be sold for recycling. This project will use a wide range of waste streams from the United States Military, including municipal solid waste, hazardous waste and bio-medical waste.

Greenhouse gas reduction:

- 83,037 t CO₂e per year
- 25.66 t CO₂e per tonne of waste processed

Partner:

- The United States Military



Summary



-
- ***Hurlburt Plasma Waste to Energy System can:***
 - ***Save tax payer dollars***
 - ***Convert waste to energy, i.e. electrical and heat***
 - ***Recover waste stream products***
 - ***Reduce green house gas emissions***
 - ***Divert waste from landfills***
 - ***Help AFSOC exceed EO 13423/13514 mandates***
 - ***Opens the door for future DoD and National applications by springboarding larger scale systems***
 - ***Help solve tough war fighter problems!***
-



Questions?

