

# Department of the Navy SBIR/STTR Transition Program

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Topic # N152-097

Plasma Gasification System for Waste-to-Energy Conversion

Creare LLC

## WHO

**SYSCOM:** NAVFAC

**Sponsoring Program:** EXWC

**Transition Target:** Installation Waste to Energy (WTE) Systems

**TPOC:**

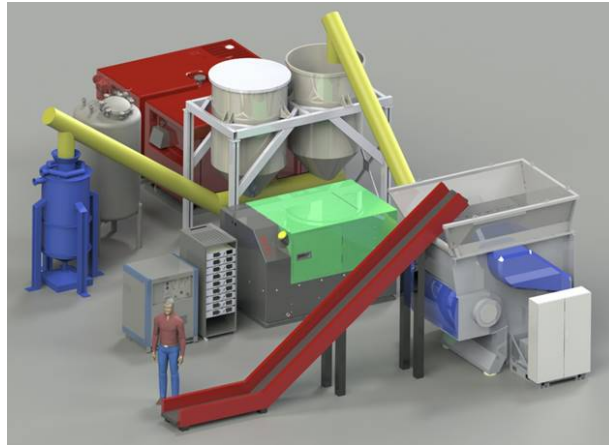
Heros Nersesian  
(805)982-6097

[heros.nersesian@navy.mil](mailto:heros.nersesian@navy.mil)

**Other transition opportunities:** U.S. Air Force Research Laboratory's Acquisition Systems Support Branch/Advanced Power Technology Office.

US Marine Corps Warfighting Lab; Expeditionary Energy Office (E2O), Deputy Commandant Installations and Logistics (DC I&L), II Marine Expeditionary Force (MEF).

**Notes:** Conceptual drawing of a compact scalable 3-4 tons of feedstock per day municipal solid waste (MSW) Ionic Gasification disposal system. Note the absence of additional 2nd and 3rd stage equipment for by-product materials processing or syngas cleanup found in competing WTE systems. Ionic Gasification forces feedstock into direct contact with a large, stable 10,000 deg plasma field that dissociates long chained hydrocarbon molecules into individual elements. This conversion technology produces ultra-pure synthesis gas in a single step reducing capital, operating, and sustainment costs.



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## WHAT

**Operational Need and Improvement:** Advanced thermal approaches to MSW disposal are sought that generate energy in the form of a fuel, useful thermal energy, or electrical energy. Achieve net zero consumption of energy in the disposal of MSW while meeting air quality standards.

**Specifications Required:** i. Be simple to operate and maintain in all climate conditions.

ii. Handle solid waste to include food, waste oil, and damp wood or vegetation.

iii. Provide a 90 pct reduction in volume of waste.

iv. Process 1200 lbs of waste a day.

v. Produce environmentally safe effluents and char by-products that are easy to dispose.

vi. Small footprint - this depiction is approximately 2,000 square feet by 10 feet high.

**Technology Developed:** Based on patented and patent-pending designs, Creare's feedstock-agnostic WTE system is a generational advance in waste conversion technology. By fully immersing unsorted feedstock with up to 50 pct moisture content in a 10,000 deg drop-through plasma processing zone, the system fully converts all carbonaceous matter into ultra-pure CO/H<sub>2</sub> syngas in a single vessel. Unlike competitor approaches, this syngas has no contaminant long chain hydrocarbons -- requiring no secondary or tertiary gas processing or cleanup components which enhances energy efficiency and system reliability to maximize surplus energy production.

**Warfighter Value:** i. Creates Energy Resiliency by saving 15,000 gallons of diesel fuel per month used to burn 8 tons of waste per day 6 days per week. Backs out additional gallons because the syngas can be used to generate surplus electricity at the rate of almost 800kWh per ton of feedstock. Further, when coupled with a gas-to-liquids conversion system, each gasifier system is estimated to produce up to 25 barrels (~1,000 gallons) per day of biodiesel or other liquid fuel.

ii. Reduces or "flattens" supply chains. Closes gaps in distribution models for providing fuel and energy across large areas of operation.

iii. Creates onsite energy while eliminating solid waste; adaptable to land and sea platforms performing Theater Security Cooperation and Humanitarian and Disaster Response missions.

## WHEN

**Contract Number:** N39430-17-C-1962 **Ending on:** July 31, 2019

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Established fundamental feasibility and provided a strong experimental basis for subsequent systems	N/A	Impacts of feed stock type, size, and moisture content on syngas composition, residual material composition, and plasma power consumption	4	March 2017
Demonstrated the technology converts heterogeneous waste materials into high-quality syngas without creating hazardous byproducts or carbonaceous residue	N/A	Syngas quality validated by Idaho National Lab to contain no hydrogen sulfide, sulfuric acid, sulfur oxides, nitrogen oxides, chlorides, or hydrocarbons	4	May 2017
Operate full scale system to process 1 ton per day of municipal solid waste and further characterize syngas quality and quantity	Med	Flared syngas is consistent with expected quantity produced	5	August 2018
Operate full scale system processing 3 tons per day	Med	Produced syngas powers a diesel generator demonstrating net-zero.	6	July 2019

## HOW

**Projected Business Model:** Commercial developers of end-to-end WTE projects will license/lease/buy gasifiers and integrate them with appropriate front-end and back-end components to handle their desired feedstock and to produce desired products. Creare is available to lead project development, technology integration, and site implementation primarily to prospective project companies. We will also offer broad distribution and marketing licenses with applications companies that wish to develop numerous projects in a given region or for a particular type of end user.

**Company Objectives:** DoD/Prime commitment to fund construction of an on-site, full scale system demonstrator designed for in-situ iteration leading to operational test and evaluation, and system qualification in real-world environments.

**Potential Commercial Applications:** Examples include conversion of waste to fuels or electricity from: plastics and tire recyclers, commercial and municipal entities in islands and remote northern communities, farms overwhelmed by agricultural byproducts, hazardous waste from hospitals, hotels and resorts, college campuses, mining camps and industrial parks. Because it is efficient even at small scale, these are 'white space' new markets that have been unserved or under-served by technologies that are either too large or inefficient. Furthermore, other back-end conversion systems can use the syngas to produce chemicals, lubricants, and other valuable products.

This renewable energy system creates social benefits as well -- not only does it reduce the need for landfills while reducing fossil fuel-based and landfill-associated greenhouse gas emissions, but it can also bring affordable electricity and fuels to small remote and economically disadvantaged communities. Using their local waste and agricultural residue as feedstock, this system simultaneously addresses their waste handling and energy supply needs, creating economic value.

**Contact:** Paul Movizzo, Creare DoD Business and Commercialization Development  
[pgmovizzo@creare.com](mailto:pgmovizzo@creare.com) (603) 643-3800