Small-Scale Waste-to-Energy System

A Waste-to-Energy System for expeditionary forces and remote installations.

Generator waste heat recovery and power conversion at ExFOB for the United States Marine Corps (USMC) (2014)
Introduction

This paper describes the features, benefits and strategies of the Small-Scale Waste-to-Energy System program. Remote operations face unique waste reduction and energy sourcing challenges. Military installations have often used open burn pits to process waste, creating risks for troops, local citizens and the environment. Additionally, fuel that must be trucked in and protected in remote locations can be vulnerable and scarce.

The Waste-to-Energy System addresses waste processing challenges while creating fuel-free, sustainable, environmentally sound energy sources. The system provides a distributed electrical power generation and cooling capability that is powered by the residual waste streams typically available in remote installations or small forward bases.

Project requirements and strategies

Rockwell Collins is currently supporting ECO WASTE SOLUTIONS and EthosGen on a demonstration program selected as part of the Environmental Security Technology Certification Program (ESTCP) scheduled to begin May 2018.

The 18-month project will demonstrate the capability to address small-scale expeditionary waste streams. It will provide a platform to increase the Technical Readiness Level (TRL) to TRL 8 and obtain emissions data in a realistic operational environment.

Requirements

The project must meet specific requirements for an expeditionary environment. Requirements include:

- Reliable electric power supply to meet mission (no grid for reliability)
- Eliminate vulnerable fuel oil supply
- Transportable
- Simple to operate
- Reduce/eliminate environmental impacts

Strategy

The U.S. Naval Facilities Engineering Command (NAVFAC) Expeditionary Warfare Center (EXWC) proposed waste-to-energy strategy includes:

Large or non-remote installations
For large or non-remote installations with a greater than 50 tons per day (TPD) municipal solid waste (MSW) stream, the strategy is to partner with the community/industry to ensure that the MSW is handled in the most effective manner.

Medium and remote installations
For medium and remote installations with one to 50 TPD of MSW, the strategy is to continue to search for cost-effective, reliable commercial or near-commercial systems that we can deploy. These systems will typically be run by base services contract.

Small, forward-deployed force solutions
For small, forward-deployed force environments such as a 250- to 500-person tent camp, the strategy is to continue to partner with the U.S. Army and Air Force to push for technical, low-tech, rugged and deployable systems. This falls under the NAVFAC Expeditionary Combat Command (NECC).
Improve energy efficiency and security while eliminating waste

The Waste-to-Energy System is a unique, durable and modular system that can be easily transported and deployed on location. It comprises four major components: a waste reduction module, a heat recovery unit, an Organic Rankine Cycle generator and an adsorption chiller. This modular approach enables the use of waste streams in solid, liquid or gaseous states.

The combination of electrical power generation with a cooling capability will improve distributed generation efficiency and simultaneously reduce the electrical load on those generation systems. It does this by significantly reducing the cooling load, which often makes up approximately 50 percent of the overall electrical load in remote and expeditionary locations.

The adsorption chiller allows for an 85 percent reduction in electrical load for cooling in areas of operation such as Navy remote installations or expeditionary operations encountered by the USMC. This unique combined cooling and power capability will improve energy efficiency and security while addressing current waste disposal issues. In addition, waste energy from existing remote power generation systems can power the same Waste-to-Energy Systems as well.

Summary

Expeditionary forces and remote installations will benefit from improved energy efficiency and security with the Waste-to-Energy System. Operations will be able to make use of residual waste streams to generate electrical power and cooling capability, reducing power consumption, fuel reliance and environmental impact while addressing current waste disposal challenges.

Providing the Navy and USMC with on-site electrical power and cooling capabilities by harvesting installation waste sources.
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