Onsite Field-feeding Waste to Energy Converter - Phase III (OFWEC III)

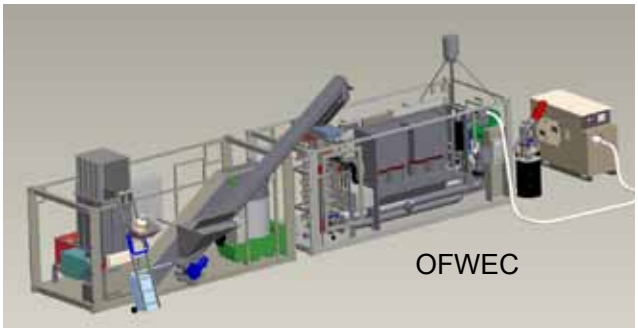
The NDCEE further advanced the OFWEC III, a waste-to-energy (WTE) unit developed by Community Power Corporation (CPC) and owned by the Army. The unit was field tested at Aberdeen Test Center, MD, and then at Fort Irwin, CA. While it successfully processed waste, some upgrades were recommended. In 2011, the NDCEE worked with CPC to design, fabricate, and install upgrades and demonstrate the improved system.

Problem Statement

Deployed forces and contingency operations generate tons of packaging and other waste that must be buried or transported to disposal sites--a costly logistic burden, requiring personnel, vehicles, and fuel that could otherwise be used for the warfighting mission. At the same time, this waste is a potential source of chemical energy sufficient to power a field kitchen and/or other force sustainment systems. Waste management facilities may also use large amounts of electricity provided by diesel-engine fueled generators.

Technology Description

A generic WTE conversion process can be broken down into three general challenges: feedstock conditioning, conversion into a fuel product, and power generation. Feedstock conditioning includes actions taken to improve the raw waste stream, including manual operations such as sorting and segregation and mechanical processes such as shredding and densification. With conversion, prepared feedstock is transformed into a gaseous or liquid fuel product. Power generation includes the means by which the fuel product is converted into electricity, minimally to self-power the process, but ideally to generate a surplus that can be used to power other organizational equipment.



OFWEC

The OFWEC operates from two 20' ISO containers: a fuel processing system and the BioMax® downdraft gasification system. The fuel processing system consists of a shredder and a briquette system. The densified feedstock, in the form of cylindrical "briquettes," are sent to a patented gasifier to be converted into producer gas and some residue char/ash. The producer gas is very different chemically from natural gas, but both can be burned to provide heat and/or power. The OFWEC gas is sent to a standard Army-issued 60-kilowatt Tactical Quiet Generator (TQG) adapted for bi-fuel operation.

The OFWEC III gasifier consumes about 50 pounds (lbs) of dry biomass per hour at full power and produces about 65 normal cubic meters per hour or approximately 40 standard cubic feet per minute of producer gas. The yield of char/ash is dependent upon the ash content of the feedstock, but is usually less than 2% of the dry biomass fed or less than 1 lb/hr. Trash typically has higher ash contents and higher char yield.

Environmental, Safety, Occupational Health, and Energy (ESOHE) and Cost Benefits

- **ESOHE Benefit.** The OFWEC reduces nonhazardous solid waste by 90% or more based on weight. It also produces a clean gas that normally burns cleanly in an internal combustion engine with no discernable odors or harmful emissions. In addition, the hot gas travels through a heat exchanger, which can be used to provide heat, hot water or steam. The OFWEC does not use or generate liquids for disposal.

NDCEE
National Defense Center for Energy and Environment

DoD Executive Agent
Office of the Assistant Secretary of the Army for Installations, Energy and Environment

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CTC Concurrent Technologies Corporation

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- **Cost Benefit.** Using an unburdened fuel cost of $3.95 per gallon, the payback period is estimated to be 99 years. Using a burdened fuel cost of $24 per gallon, the payback period falls to 3 years. The analysis did not include intangible benefits associated with reducing a camp's logistical fuel tail. The conclusion that can be drawn is that by trying to calculate the actual project costs with a burdened cost of fuel, even a small fuel savings can result in large variations in cost over the life of a project.

Technology Benefits and Advantages

- Reduces nonhazardous solid waste by 90% or more based on weight
- Is net energy positive; designed to work with a TQG
- Housed and operated from two 20' ISO containers
- Capable of handling multiple waste streams without the need for sorting
- Meets or exceeds applicable United States federal emissions guidelines
- Compatible with existing Army infrastructure and systems
- Produces at least one usable byproduct (energy)
- Operations and maintenance requirements that require little specialized training

Technology Limitations

- Still in the development stages; future versions may be developed before the OFWEC becomes commercially available.
- Designed for dry wastes defined at no more than 20% moisture
- Requires disposal of char/ash
- Requires use of a forklift rated 18,000 lbs to move containers

Accomplishments

- Worked with CPC to design, fabricate, and install the following upgrades:
  - Improved vibrator mounts
  - Improved gasifier material flow
  - Ladder hoist
  - Conveyor improvements
  - Benzene mitigation
  - Shear gates
  - Surge hopper and auger
  - Quick disconnect electrical connections
- Conducted two OFWEC demonstrations in summer 2011 to evaluate the upgrades. These demonstrations also validated that the OFWEC III satisfies most of the other WTE features that are desirable for Army operations.
- Developed an animation of the OFWEC to support training courses
- Produced a Strawman Material Fielding Plan that will assist the Army with deploying the OFWEC
- Produced a Demonstration and Validation Test Report that documented test activities and findings as well as results from cost-benefit analyses

Technology Transition Opportunities

WTE systems, such as the OFWEC III, could simultaneously solve two large logistical burdens for deployed services: disposing of waste in an efficient and environmentally sound manner while maintaining a fuel supply sufficient to meet operational requirements. During the NDCEE demonstration, the OFWEC reduced the weight of incoming material by 90% while displacing up to 34% of diesel usage by the TQG within the baseline process.

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A ladder hoist transports waste to the top of the OFWEC (top photo). The waste falls into a shredder (center photo); shredded waste is conveyed to a densification system and compressed into briquettes (bottom photo).

Briquettes enter the gasifier to be transformed into syngas, which is supplied to a TQG set.