

# NBVC Biodiesel Production Plant

## *Project Background*

In 2003, the NAVFAC Engineering and Expeditionary Warfare Center (EXWC) entered into a Cooperative Research and Development Agreement (CRADA) with Biodico of Santa Barbara, CA (formerly Biodiesel Industries, Inc.) to demonstrate the feasibility of producing biodiesel at Naval Base Ventura County (NBVC) using waste vegetable oil collected from on-base food service operations and the surrounding community. In the initial phase of the agreement, Biodico fabricated and installed a tenth-scale Process Demonstration Unit (PDU) based on the design of their full-scale commercial facilities. The pilot-scale biodiesel reactor, installed in a standard shipping container, was capable of producing 140 gallons of biodiesel per day. This equipment was sited at the NBVC Port Hueneme National Environmental Technology Test Site (NETTS).

As part of the CRADA, the NAVFAC EXWC has developed capabilities to perform laboratory testing required to confirm that the biodiesel produced meets industrial specification ASTM D6751. The NAVFAC EXWC has also executed a laboratory kinetic study of the biodiesel production chemical reaction known as "transesterification." The goal of this study was to identify the reactants and concentrations that yield the optimal conversion of vegetable oil in the shortest time possible, including an evaluation of a variety of feedstocks. Results from the laboratory studies were incorporated into the PDU and adapted for commercial use in Biodico's full-scale facilities. The NAVFAC EXWC has also performed extensive air emission testing on DoD vehicles and generators operating on the biodiesel produced from Biodico's PDU.

## *Future Efforts*

In the current phase of the CRADA, Biodico is replacing its one-tenth scale PDU with a transportable full-scale plant capable of producing ten million gallons of biodiesel per year from multiple feedstocks. Once the new system is installed, NAVFAC EXWC will participate with Biodico in the demonstration and validation. Biodiesel production will be in accordance with the production limits set by the existing Air Permit (Ventura County Air Pollution Control District) and Environmental Assessment (NEPA).

The full-scale unit is expected to become operational in 2014 and serve as a showcase for future implementations as well as test bed for chemical, hardware, and process improvements. The new plant utilizes ARIES (Automated Remote Real-time Integrated Energy System), an innovative platform developed by Biodico and their private partner, Aerojet, Inc. to enable remote process control of networked biofuel production plants from a single control center. Long term, NAVFAC EXWC expects that these units may be sited at military facilities around the world. The proposed business model is that future plants will be commercially funded and operate with the military providing the real estate, waste vegetable oil (from on-base food operations), and a partial market for the biodiesel produced. By consuming locally-produced biodiesel, the military will significantly improve their fuel security, reduce net greenhouse gas emissions and stabilize their fuel costs.

## Technology Goals

In addition to efforts to optimize biodiesel production, NAVFAC EXWC and Biodico have immediate goals to:

- Investigate other sustainable non-food based feedstock options.
- Demonstrate the ability to produce advanced biofuels that can be readily utilized by the DoD using the existing infrastructure and equipment.
- Make the biodiesel production process more sustainable by incorporating various renewable energy sources including solar thermal and electric, anaerobic digestion, and gasification.

To further these goals, Biodico has installed greenhouses at the Port Hueneme test site in order to research the potential for producing feedstock from algae and another aquatic species. Laboratory data and analysis shows very promising oil yields if the process were to be scaled up. Portions of this work are funded by research grants from the California Energy Commission (CEC).

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*PDU Ribbon Cutting Ceremony, October 2003*



*ARIES Delivered to NBVC, April 2010*



*ARIES Placed on Secondary Containment Pad, May 2012*



*Greenhouses for Algae Feedstock Research, July 2011*