

# GREEN TEAMS: UNIVERSITY-NATIONAL PARK ENERGY PARTNERSHIP PROGRAM



## University of Washington & Pacific West Region

**OVERVIEW.** The University of Washington and the Pacific West Region of the National Park Service teamed up over the summer of 1999 to study the potential for improving the energy usage of the tour boats at Crater Lake National Park. The unique study identified issues associated with retrofitting the boats to run on alternative fuels, with controlling the emissions from the boats, and with using PV as a supplemental power source for boat operation.

"We don't often think of alternative fuel studies in the context of boats," notes James Winebrake, Program Director for UNPEPP. "But the conclusions of the study are quite gratifying. The recommendations, if implemented, could go far toward improving energy utilization at the park, and toward improving local air quality."

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***- Dr. James Winebrake, UNPEPP Director***

Indeed, four boats have been operated on Crater Lake for years. The four boats that operate during the summer season (each capable of holding 60 passengers) are powered by large inboard, four-stroke, gasoline engines, all of which lack emission controls. The environmental impacts of the boats--water, air and noise pollution--are significant.

**ALTERNATIVE FUELS AND EMISSIONS CONTROLS.** The project team assessed the viability of methane, methanol, ethanol, and biodiesel as alternative fuels for the tour boats. One particular benefit of these alternatives is the ability to manufacture each from renewable biomass, which could ultimately lead to the development of a self-sustaining energy system.

The project team noted the lack of infrastructure for methane or natural gas delivery at the Park. This shortcoming would require both the transportation of fuel (either compressed natural gas (CNG) or as liquefied natural gas (LNG)), and the development of suitable infrastructure for fuel storage and distribution. While there is a system installed at the boat dock in Cleetwood Cove, it is designed for gasoline and alternative liquid fuels and is not adaptable for use with methane and natural gas.

Of the alternatives considered, the team expressed particular support for implementing a biodiesel system to run the tour boats. In addition to being a potentially renewable energy source, diesel engines tend to be more efficient and emit fewer unburned hydrocarbons and less carbon monoxide than spark engines. Yellowstone National Park currently has a truck that runs on biodiesel fuel. As the project team wrote: "Since the Crater Lake tour boats may be replaced with new equipment within a few years, it makes sense to seriously consider diesel propulsion and biodiesel fuel."

### Partnership Successes

- Evaluated alternative fuel and emission control options for the tour boats at Crater Lake.
- Evaluated the potential for using photovoltaic (PV) as a supplemental power source for the tour boats.

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***- UWA Report to Crater Lake***

The project team also assessed advances in marine engines and emissions control technology. A more detailed report of the findings will be developed by Spring 2000.

**PHOTOVOLTAIC POWER FOR THE BOATS.** The project team identified two opportunities for the use of solar photovoltaic (PV) in the tour boat operation. One idea proposed was the development of a roof-mounted PV system built over the passenger area of the boat. Such a system could provide up to 20% of the energy required per tour. The electrical energy would be stored in batteries, and used by an electric motor to help drive the boat's propeller. The combustion engine would provide the primary energy.

The tour boats are stored and maintained at boathouses located on Wizard Island. Another possibility for PV would be to place panels on the boathouse roofs. The electricity would supplement or replace the electricity currently derived from generators.

**STUDIES TO BE COMPLETED IN 2000.** Both the alternative fuels study and the solar PV system measurements and data analysis will be completed in Spring 2000. The project team is looking forward to conducting more work with the park in the future.

"We are looking forward to completing our analyses and developing plans for further research in this area," notes Dr. Phil Malte, UWA project lead. "Specifically, we are interested in further work on the boathouse PV system, and on evaluating fuel-cell electric propulsion for the tour boats."

**PERSONNEL.** Personnel involved with this project include: Dr. Philip Malte, UWA Faculty Advisor; Michael O'Keefe and Craig Connors, graduate students at UWA Department of Mechanical Engineering; and Joe Dunstan, Columba Cascades Support Office, National Park Service.