



Alternative Fuels and Technologies for Ferries

By replacing conventional dirty diesel with cleaner fuels such as natural gas, biodiesel, solar/wind energy and, soon, fuel cells, ferries can generate low or zero emissions, helping to protect air quality, public health and the global environment, while reducing dependence on fossil fuels.

Following is a summary of alternative fuel types and technologies and the typical emissions reductions compared to conventional diesel. The key emissions from marine diesel engines are nitrogen oxides (NO_x), sulfur oxides (SO_x), and particulate matter (PM). The primary greenhouse gas carbon dioxide, which traps heat in the atmosphere and contributes to global warming, is also considered.

- ▶ **Biodiesel** is a renewable plant-based fuel made from common vegetable oils and recycled restaurant greases that has combustion characteristics identical to ordinary diesel but causes far less air pollution and global warming emissions. A transition fuel to cleaner alternatives, biodiesel burns in any marine diesel engine.

Burning 100 percent biodiesel instead of petroleum diesel reduces emissions of air toxics by 60 to 90 percent and releases of microscopic particulate matter by 50 percent. It contains no sulfur, so sulfur oxide emissions are eliminated. Climate-changing carbon dioxide emissions are reduced by 78 percent. However, nitrogen oxides increase by as much as 14 percent.

- ▶ **The Solar Sailor** is the world's first hybrid solar-electric wind-powered ferry. Solar wings capture the sun and wind, producing zero emissions. Back-up generator and battery provide auxiliary power with low emissions. Maintenance and operation costs are low compared to conventional ferries. The vessel is quiet and low wake. Now operating in Sydney, Australia, a second vessel is being built in Hong Kong. A demonstration vessel is needed in the US.

- ▶ **Natural Gas** is a clean fossil fuel that has been proven safe in marine applications for 40 years on Liquid Natural Gas (LNG) tankers. Ferries have successfully used Compressed Natural Gas on rivers and lakes in British Columbia. Natural gas emits 50 percent less air pollution than marine diesel, including 99 percent less soot (particulate matter), 99 percent less sulfur, and no toxics.

- ▶ **The Surface Effect Ferry** is an advanced design tested by the US Navy. The vessel rides on a cushion of air and uses 60 to 85 percent less fuel than other fast ferries, so emissions are dramatically reduced. The ship is designed for low wake, low wash properties. A 99-foot, 150-passenger 50-knot ferry has been launched in the Florida Keys.

- ▶ **Fuel Cells** are the fuel sources of the future; the only emission from hydrogen fuel cells is water vapor. Buses, cars and military vessels are already testing fuel cells. Sunline Transit in Thousand Palms, CA, is running its bus fleet on hydrogen fuels cells. Tugboats and fishing boats will be testing them soon. Commercial use in ferries and other transport is not far off. Hydrogen is as safe as diesel or gasoline when handled and stored properly. It is already used extensively in the US in many industries.