Futuristic Clean Cars Run on Solar, Biodiesel or DME

October 14, 1999

WASHINGTON, DC, October 14, 1999 (ENS) - Some of the newest fuel options that promise to make road travel nearly pollution free seem like alchemy - turning lead into gold. Scientists are now taking materials that have traditionally been discarded, from grass clippings and wood chips to used vegetable oil, and creating clean, green fuels. Other researchers are looking at ways to turn energy from the sun into horsepower - giving a whole new meaning to the term sunroof.

Biofuels, one of the biggest groups of new fuels, are alcohols, ethers, esters, and other chemicals made from plants, agricultural and forestry leftovers, and a large portion of municipal solid and industrial waste. Biofuels used for transportation include bioethanol, biodiesel, biomethanol and pyrolysis oils.

Unlike petroleum based fuels, biofuels are rapidly biodegradable. An accidental biofuel spill would have minimal impacts on wildlife and the environment. Biofuels burn more cleanly and completely, resulting in less pollution, and avoiding the emission of petroleum pollutants like hydrocarbons, sulfur, carbon monoxide, particulates, and cancer causing chemicals like benzene and toluene into the air and water.

Biofuels

Biofuels can provide about the same or better fuel efficiency as petroleum based fuels. Biofueling stations now serve fleets of government and company cars in many cities across the U.S., but are not yet widely available to consumers.

In the U.S., the two most common types of biofuels being developed and used are bioethanol and biodiesel. Biofuels give off fewer and less toxic emissions than petroleum fuels, and are made from renewable and virtually inexhaustible resources. Because biofuels can be grown domestically, their use can reduce dependence on foreign oil.

Bioethanol

Ethanol is the most widely used biofuel today. More than 1.5 billion gallons are added to gasoline in the U.S. each year to improve vehicle performance and reduce air pollution.

Ethanol is an alcohol, and most is made using a process similar to brewing beer where starch crops like corn are converted into sugars, the sugars are fermented into ethanol, and then the ethanol is distilled into its final form. Ethanol made from waste materials instead of specially grown crops is called bioethanol.

Ethanol is used to increase the octane, or energy content, and reduce the emissions of gasoline. Ethanol also avoids the side effects of other gasoline additives, including MTBE, which can be toxic if they leak into drinking water. But ethanol can also be used alone as a fuel, either burned in an engine directly, or used to create hydrogen to power a fuel cell.

Both Ford and Chrysler Motor companies sell flexible fuel vehicles, which can run on either gasoline or a blend of 85 percent ethanol and 15 percent gasoline.

Biodiesel, fuel made from used french fry oil or other edible oils, conjures up fantasies of turning fast food restaurants into combined food and fuel depots. In reality, making biodiesel is not as simple as pouring fry oil into your gas tank.

For years, scientists have been producing and testing biodiesel fuel, made by converting vegetable oils or animal fats into diesel fuel, as an alternative to petroleum based diesel fuel, or "petrodiesel." U.S. production of biodiesel is about 30 million gallons per year and growing. Biodiesel is used in some federal, state, and transit fleets, at marinas, and in tourist boats and launches. There is a growing interest in using biodiesel where workers are exposed to diesel exhaust, in aircraft to control local pollution near airports, and in locomotives that face restricted use unless emissions can be reduced.

Traditionally, biodiesel is made by mixing used oil and an alcohol such as ethanol with a base liquid. Over several hours, a chemical reaction turns the mixture into biodiesel and glycerol. The products must be allowed to sit for several more hours or days so that they separate into easily retrievable fuels.

A new process, announced in March, was developed at the U.S. Department of Energy (DOE) Idaho National Engineering and Environmental Laboratory. Researchers Bob Fox and Dan Ginosar have found used french fry oil can be converted into an environmentally friendly diesel fuel faster and less expensively than current processes while producing an even higher grade fuel.

Fox and Ginosar accomplished this by developing a system using a catalyst fixed in the solution. The solvent is constantly recycled, in the processing solution, leaving it out of the finished product. The result is a better separation of biodiesel and glycerol, and a cleaner, higher grade of both substances.

When the new biodiesel is burned, it smells remarkably like fried chicken. In fact, when the National Park Service began considering using biodiesel fuel for tour buses in the parks, it worried that bears would chase the vehicles in the mistaken perception they were chasing finger licking good meals on wheels.

"We told the Park Service that bears don't often eat at Kentucky Fried Chicken," Fox quips. Yellowstone National Park later began experimenting with biodiesel in its "Truck in the Park."

Other Alternatives: Dimethyl Ether (DME)

Researchers at Penn State University are working on a way to run vehicles with clean burning dimethyl ether (DME), the chemical that replaced fluoro-chloro carbons in spray cans. In a study of the emissions produced when burning DME as a substitute for butane or propane, the researchers found that DME had lower carbon monoxide emissions and the same or lower nitric oxide emissions than either of these commercially available fuels.

DME is normally produced from methanol, but DME production from natural gas and from coal derived syngas may open up this clean fuel for broader use, the researchers suggest.

Andre Boehman, director of the Penn State Combustion Laboratory, is planning to test DME-blend fuel in a school motor coach. The shuttle bus, which seats 22 passengers and is handicapped accessible, normally uses petrodiesel fuel. The motor coach is in daily use as a faculty/staff shuttle bus.

Solar Cars

Using solar panels to convert energy from the sun directly into power to run a vehicle creates perhaps

the cleanest cars ever. Incoming solar radiation light from the sun is captured by the photovoltaic panels on top of the car. They make electricity, which is then stored in batteries. The electric motor draws energy from the batteries to move the car.

These cars need sunlight to run, and most cannot store enough energy to keep running overnight, or on a cloudy day. In addition, most solar vehicles must make a trade off between the distance they can travel and the top speed they can reach. Solar cars can either travel all day, slowly, or travel rapidly for short distances.

Still, there are competitions around the world every year for prototype solar vehicles. The World Solar Challenge for cars is a race which promotes research and development into practical ways to harness solar energy for transportation. Held every three years since 1987, the race covers a 3010 kilometer (1870 mile) course between Darwin and Adelaide in Australia.

The 1999 race, scheduled for October 17 through 26, promises to feature some of the most advanced solar vehicles ever, as teams from around the world vie to set speed and distance records.