Alternative, Energy Efficient Transportation Choices Showing Promise

By Doug Ward & Amy Ellsworth

So, you're in the market for a new car. Perhaps you are considering an alternatively fueled, hybrid, or high fuel efficiency vehicle, but you're not sure where to start. The good news is *there is a growing number of options.* The bad news -- *there is a growing number of options.*

Why should you care?

Burning gas in an internal combustion engine produces a lot of greenhouse gas emissions. On average, for every gallon of gas burned, about 19 pounds of CO^2 emissions are released. There are about 204 million vehicles in America using an average of 600 gallons of gas a year and emitting about 1170 million tons of CO^2. That is enough to fill a coal train 198,000 miles long -- every year.[1]

Eventually, a range of alternative options are likely to displace the internal combustion engine. But which of today's technologies, if any, will survive the transition is a question. In the meantime, efficient and alternative-fueled vehicles are attracting a growing customer base. Each of these products has its merits and, in some cases, downsides. The good news is that whatever type of super-efficient or alternative-fueled vehicle you choose, you'll be doing the environment and your wallet a favor. With that in mind, in the sections that follow, we'll look at four classes of fuel efficient, clean cars. Our guidelines table summarize the merits, as well as some of the drawbacks, of each.

Conventional Combustion:

Although hybrids have stolen the spotlight recently, don't count conventional cars out of the green transportation picture. Virtually every big name automaker offers conventional cars with very high fuel efficiency and low emissions. For example, the Toyota Yaris and the new Honda Fit both get city/highway EPA fuel efficiency ratings around 33/40. The ZAP! SMART Car, a European design available through a US distributor, boasts the most efficient gasoline engine on the market getting upwards of 40 mpg in both city and highway driving.

The industry has so much invested in combustion technology that it will be some time before it's phased out. In the meantime, you can still get a conventional car that's comfortable, reliable, and environmentally friendly.

The Zap! SMART car is a zippy urban commuter with room for two and a couple bags of groceries.

Hybrid:

Hybrids have come of age with Honda and Toyota leading the field. Major manufacturers are now offering hybrid models in many different body styles with all the options. But, hybrid buyers should be aware, there are *hybrids* and then there are *hybrids*.

Hybrids that offer the best high fuel economy have small combustion engines and a motor with a battery pack. In these applications, regenerative energy is

A recent report issued by automotive consumer information service, Intellichoice.com, found that across the board, hybrids offer a lower cost of ownership than comparable competitors. On average, the report found that owners of the Toyota Prius for example, will save about $13,000 over 5 years or 70,000 miles.

captured from the engine during braking to charge the battery, which supplements power when it's most needed for acceleration or for sustained driving.

Some hybrids, however, use regenerative energy from braking to charge a larger battery that is used to boost acceleration power. While this approach is technically a hybrid, it does not offer a significant increase in fuel efficiency over a comparable conventional model.

If you want maximum fuel savings from your hybrid, select a model that captures braking energy to recharge the battery, has an electric motor integrated into the drive train, and a very efficient engine that is the primary source of battery charge.

The Greenest Vehicles of 2007

Compiled by the American Council for an Energy Efficient Economy

	City MPG	Hwy MPG	Green Score*
Honda Civic GX	28	39	57
Toyota Prius	60	51	55
Honda Civic Hybrid	49	51	55
Nissan Altima Hybrid	42	36	48
Toyota Yaris	34	40	47
Toyota Corolla	32	41	46
Toyota Camry Hybrid	40	38	46
Honda Fit	33	38	45
Kia Rio/Rio 5	32	35	45
Hyundai Accent	32	35	45
Hyundai Elantra	28	36	45
Honda Civic	30	40	44

* Based on compliance with Federal and California emission certifications.

Source: greenercars.com

Flexible Fuel Vehicles:

Flex-fuel vehicles are designed to burn either standard gasoline or gas mixed with up to 85% ethanol (E85), which is most frequently produced from corn, soybean, or wheat.

There is some controversy around the energy value of ethanol and its overall environmental advantages over petroleum. The total ethanol value equation is complex. Various studies show that ethanol production results in a life cycle reduction in greenhouse gas emissions of 15 to 30% over gasoline.[2] Some proponents claim net energy value – the total energy derived from ethanol over energy required for its production – is around 25%.[3] Other studies that claim to measure all the sources of energy used to produce ethanol show a net loss of up to 29%.[4] It's not a debate we'll resolve here.

In addition, because ethanol is an agricultural commodity, factors associated with its production – soil contamination and water pollution from pesticide and fertilizer use, erosion, and water consumption used for irrigation – may be troubling to some.

However, these downsides may be a small price to pay if they lead to a much more promising future fuel alternative. Proponents of cellulosic ethanol point to significantly lower environmental impacts, including 80% to 100% fewer life cycle greenhouse gases than gasoline[5] and virtually no sulfur dioxide emissions. The sources of biomass that can be used to produce cellulosic ethanol are fast growing, require very few agricultural inputs and are ubiquitous, including everything from prairie switchgrass to all types of organic waste.

The exciting thing about ethanol as a fuel source is that the journey has just begun. Over time, the combination of ingenuity, economics, and environmental balance will make ethanol an increasingly important component of the worldwide energy strategy.

Biodiesel:

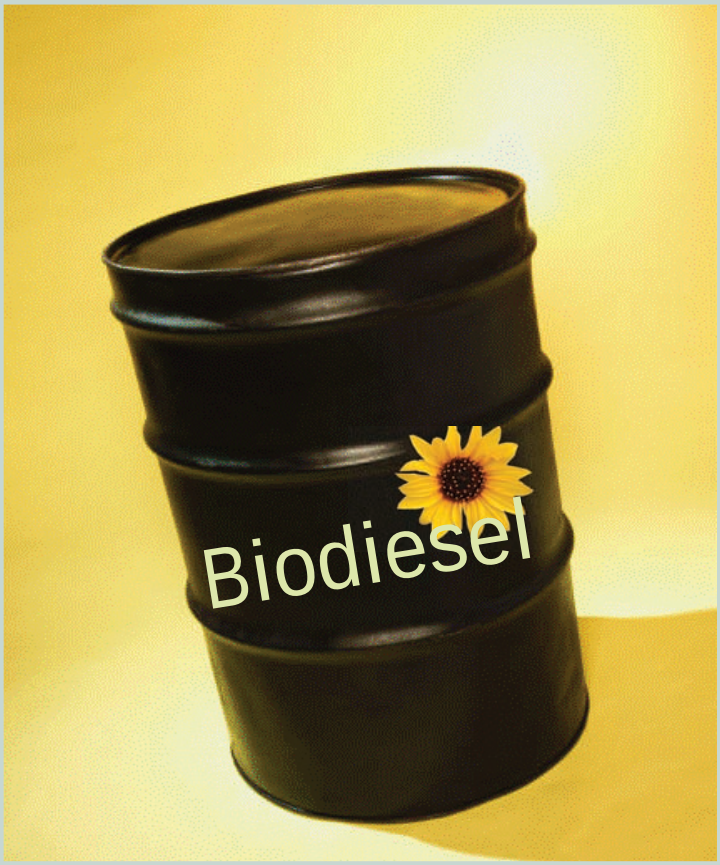
In the last ten years, diesel engines have made huge advances in fuel efficiency and lowered emissions, with even more improvements on the horizon.

Burning biodiesel can reduce emissions even more. Virtually any diesel car made since about 1995 can burn up to 100% biodiesel without modifying the engine. Biodiesel, can be formulated from virtually any organic matter or reprocessed vegetable oil. It is generally available as a mixture of 20% (B20), 80% (B80), or 100% (B100) bio-based material blended with standard petroleum diesel. Some diesel vehicles are even able to burn straight vegetable oil, but this does require an engine conversion (and tolerance for exhaust that smells like french fries).

A 1998 study found that biodiesel was four times as efficient as diesel fuel in utilizing fossil energy[6]. The total life cycle CO^2 emissions were found to be up to 78%[7] lower for biodiesel than diesel fuel.

The Future Of Transportation

For years, fuel cell vehicles – which use hydrogen as its primary fuel source and emit only water vapor as exhaust – have been just "over the horizon." Although there are some concept cars on the road,



Biodiesel is better for the environment because it is made from renewable resources and has lower emissions compared to petroleum diesel.

the promise is still just a promise with the exception of Iceland. Iceland has massive renewable energy resources and a laser fixation on becoming the world's first hydrogen economy. For 20 years, Icelandic scientists have been quietly developing hydrogen technology and refining fuel cell capabilities. In another 20 years, Iceland's entire transportation fleet will be powered by hydrogen. Perhaps Iceland will be the Henry Ford of the 21st century, however Americans shouldn't expect to see fuel cell cars on the showroom floor any time soon.

Just over a closer horizon may be the "plug-in" hybrid. At the 2007 North American International Auto Show, General Motors introduced a plug-in hybrid concept car that can go about 40 miles on a fully charged battery – enough that most daily commuters will never use a drop of gas. Assuming it's charged up each night with clean, renewable electricity, this could save 4.4 metric tons of CO^2 annually. DaimlerChrysler also has an active electric car program. However, neither manufacturer is expected to have market ready plug-in hybrids available for two to three years.

The hybrid diesel is another technology to watch. Hybrid diesels are being used in some municipal bus fleets and all of the big US automakers are working on prototype passenger cars. GM has a hybrid diesel concept car that gets about 59 miles per gallon. High mileage, combined with biodiesel as the fuel source could mean ultra low CO^2 emissions. The downside -- integrating hybrid and diesel technology adds about $8,000 to the sticker price. Still, with volatile and increasing gas prices, the savings may eventually outweigh the cost.

A note about EPA ratings

In the past, EPA mileage ratings ignored factors like cold weather, road resistance, stop-and-go driving, and air conditioning. Starting in 2008, EPA tests will represent more realistic driving conditions. Mileage ratings are expected to drop by 10-20% for city and 5-10% for highway driving. Some reports have indicated that hybrid ratings might drop by as much as 20-30%.

Need more detail?

A more thorough discussion of the material in this article is available under the Energy section of the CRC's web site: www.ConservationCenter.org

Here are some guidelines to help you consider clean vehicle options:

Vehicle Class	Pros	Other Considerations
High fuel efficiency, standard combustion engine	• The technology is proven and has a mature service infrastructure. • You can get a car with nice features at a reasonable price. • There are high-efficiency options from all of the major manufacturers. • Fuel is available everywhere.	• Much of the fuel efficiency derives from reducing weight and size.
Hybrids	• The most efficient hybrid cars can get twice the city fuel efficiency and 25% better highway mileage than comparable combustion engine cars. • You'll get a roomy car with a comfortable ride and stellar efficiency. • The technology is maturing and so is the service infrastructure. • Fuel is available everywhere.	• Hybrids cost a bit more than conventional cars. The bottom-line depends on available rebates and tax incentives. • Most hybrids have small, lightweight engines and can lack power on long or steep inclines. • At around 100,000 miles the battery must be replaced.
Flex-fueled	• The greenhouse emissions and criteria air pollutants are significantly lower than emissions from petroleum fuels.[8] • Ethanol is made from renewable biomass and offsets the demand for oil. • Cars can be fueled either by E85 or standard gasoline without modification.	• E85 fuel availability is limited in most states. • Flex-fuel vehicles get lower mileage when running on E85 (estimates range from 2% to 30% lower mileage).
Biodiesel	• Biodiesel is made from renewable biomass and offsets the demand for oil. • Any diesel engine can run as either diesel or biodiesel without modification. • Biodiesel produces lower overall emissions than standard diesel fuel. • The fuel is non-toxic and biodegradable • Biodiesel fuels can be made from almost any plant material, vegetable oils, or animal fat.	• Biodiesel is not widely available. • Depending on the blend, biodiesel can cost a bit more at the pump. • Using a blend greater than 20% biodiesel (B20) will void some manufacturer engine warranties. • Blends greater than B20 can gel in cold weather and vehicles may need engine pre-heaters to operate dependably. • There is some propensity for biodiesel engines to produce higher NO^2 emissions.[9]

(Footnotes)

[1] http://environment.about.com/od/globalwarming/a/autoemissions.htm The referenced article list statistics for carbon only. The numbers shown in this article have been extrapolated to represent the equivalent measures in carbon dioxide.

[2] http://www.harvestcleanenergy.org/biofuel/sub_biofuel_ethanol.htm

[3] http://www.ethanol-gec.org/corn_eth.htm

[4] http://www.agriculture.com/ag/story.jhtml?storyid=/templatedata/ag/story/data/agNews_050719crETHANOL.xml

[5] http://www.harvestcleanenergy.org/enews/enews_0505/enews_0505_Cellulosic_Ethanol.htm

[6] May of 1998, US Department of Energy (DOE) and US Department of Agriculture (USDA) published results of the Biodiesel Lifecycle Inventory Study.

[7] May of 1998, US Department of Energy (DOE) and US Department of Agriculture (USDA) published results of the Biodiesel Lifecycle Inventory Study.

[8] http://www.drivingethanol.org/ethanol_facts/ethanol_facts.aspx

[9] http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/eng4435