



AUTO GUIDE


Solar Cells

 Panels collecting the sun's rays on a car cannot sustain an engine, but they could run a generator that charges an electric battery. Toyota's newest Prius has a rooftop solar panel option. The cells run a fan that circulates air through the parked car, preventing excessive heat buildup and reducing the amount of energy needed to pump the air conditioning when the car is restarted. Combined with other fuel sources, solar cells could help create a fleet that is friendlier to the environment than ever before.

Compressed Natural Gas

 Compressed natural gas, or CNG, is used mainly to power buses and trucks—you can even see it advertised on the side of the vehicles. CNG cars reduce greenhouse-gas emissions by 30 to 40 percent compared with gasoline or diesel (buses and trucks typically use large diesel engines, so the reduction is 25 to 30 percent), but natural gas sources are non-renewable and often come at great environmental cost. "There's a limited amount of natural gas, and it tends to be used more for electricity generation and home heating," says UC Davis's Sperling. The Honda Civic GX runs on CNG, making it among the cleanest internal combustion cars on earth.

Clean Diesel

 Diesel used to be thought of as loud and dirty, but improvements in diesel combustion have slashed particulates and acid rain-causing sulfur and nitrogen emissions by at least 90 percent, so the fuel meets emissions standards in all 50 states. Volkswagen, BMW, and Mercedes are releasing diesels that are 25 to 30 percent more fuel-efficient than their gas-burning counterparts. Clean diesel is Europe's answer to the hybrid, says Michael Omotoso. "The [U.S.] diesel market right now is about 2 percent of light vehicle sales; we expect that number to exceed 9 percent by 2016." These models could also be combined with electric engines to make diesel



Dashboard Displays

Dashboard displays can boost fuel efficiency by 10 percent. Some hybrids already have these gauges, which indicate how efficiently the vehicle is being operated. "Displays give instantaneous miles per gallon or average miles per gallon, and people get competitive with themselves," says Michael Omotoso, senior manager of global powertrain forecasting at J.D. Power and Associates. The Ford Fusion hybrid has a display that grows electronic digital leaves (above) when the driver is operating the car efficiently by maintaining a steady speed and not revving the engine. Most other hybrids, including the Chevy Malibu, also have gauges. "When you don't have that display, people aren't as conscious of their fuel economy," says Omotoso.

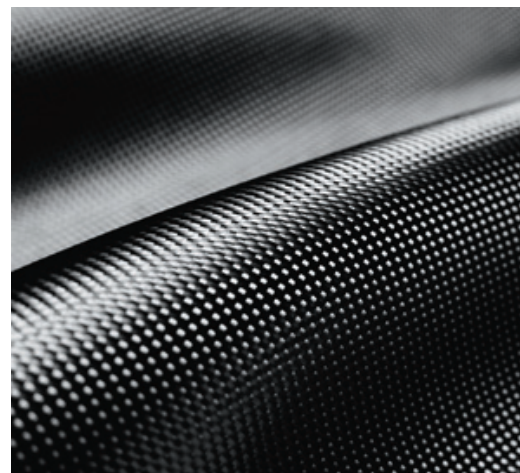


Lighter Materials

The lighter the car, the less energy wasted on friction, leaving more available for propulsion. In most internal combustion engines, only one-quarter of the energy generated actually moves the vehicle forward. All companies are thus replacing heavy steel with carbon fiber, aluminum, and plastics—light, strong materials. When companies do use steel now, the plates are thinner. Carbon fiber composites are even tougher than steel, but they are prohibitively expensive. Larger economies of scale will bring down the price, Motavalli predicts.

Lithium-ion Batteries

Most hybrids come with nickel-metal hydride batteries, but improvements in lithium-ion batteries, which are lighter and can store more energy, could help companies mass-produce plug-in electric cars like the Chevy Volt, scheduled for release in 2010. Today's lithium-ion batteries are large and expensive, but advances in the technology are shrinking them and their price. President Obama's stimulus package allocated \$2.4 billion to accelerate advances. "I think that battery technology is taking the lead at this point," says Jim Motavalli, author of *Forward Drive*. Large lithium reserves are found in Bolivia and China, and critics point out that we could be trading dependence on oil from the Middle East for a resource from South America and Asia. Meanwhile, researchers are investigating domestic lithium sources and other kinds of batteries that would not be dependent on lithium.



Electric Motors

In the future many cars will be all electric, with a motor that lasts the vehicle's life and requires no mechanical adjustments. The motor will most likely run on a battery charged from a wall socket. Gasoline engines and electric motors come standard in hybrids, whose gas engines, along with something called regenerative braking, charge the battery, so you'll never be stranded without a charge. Still, hybrids are not as efficient as all-electric models. So far Toyota and Honda are the leaders in hybrid design. Ford has also offered hybrids for some time. Tesla, a small American startup, sells electric sports cars; Mitsubishi's electric MiEV will go on sale next spring in Japan; and Chevy plans to be the first to mass-market a plug-in hybrid, the Volt, next year. It's likely that all companies will have hybrids or all-electric models in the near future.



Efficient Tires

Any tire, if properly inflated, improves fuel economy. There are also new, specially made tires with low-resistant pockets in the tread, known as low rolling-resistant tires, which increase efficiency by 4 percent. Replacing tires with a new set of these on 80 percent of the cars and light trucks in the U.S. could save up to 2 billion gallons of fuel a year, the equivalent of taking 4 million vehicles off the road, according to the California Energy Commission. The Bridgestone B381, Nokian NRT2, and Sumitomo HTR 200 received high recommendations from Green Seal, a nonprofit that reviews green products. Right now they come standard on a few hybrid models, including the Chevrolet Cobalt XFE (which stands for extra fuel efficiency) and the Ford F-150 SFE (which stands for superior fuel efficiency). Yokohama now makes a tire that mixes orange oil with petroleum. The result: a tread that is 22 percent less resistant.




Plug-in Capability

Cars equipped with a snaking electric cord will hit showroom floors in the next few years. The batteries in these models get the charge that powers their motors from standard electrical outlets. Even though much of our country's electricity now comes from coal and other non-renewable sources, reducing the number of cars that run on gasoline will lower emissions. "If you can replace all of your oil consumption with electricity consumption, even if you have a predominately fossil-fuel-based grid, you're still getting benefits, just because the electric motor is that much more efficient"—by 80 percent—says Matt Mattila, a vehicle consultant for the Rocky Mountain Institute.




hybrids, but it is still expensive and the resource is limited. "They could be synergistic rather than competitive," says the RMI's Mattila. "It's not greenwashing. They really are reducing emissions and using their fuel more efficiently."

Biodiesel

 Switchgrass and prairie grass, sugarcane, fry grease, and organic waste oils are just a few of the materials that can be converted to biodiesel. Congress passed a law in 2007 requiring that nearly one-fifth of the 170 billion gallons of fuel sold in the U.S. come from biofuels by 2022. About 40 percent of that will likely come from corn ethanol, says Sperling, even though it is only three-quarters as fuel-efficient as gasoline and has yet to show that it lowers greenhouse-gas emissions. The U.S. Department of Energy is currently building small-scale demonstration plants that will refine different fuel sources. "I'd say that the most attractive options are using waste materials: crop residues, forestry residues, and municipal solid waste," Sperling says.

Hydrogen Fuel Cells

 Hydrogen fuel could power cars in just a few years or in decades. Research is progressing, but funding was cut in favor of more immediate technologies like lithium-ion batteries, and there are numerous technological hurdles to overcome. Still, at least five car companies and institutions are seriously focusing on harnessing the abundant power source, which comes from water or, potentially, biofuels. In cars, hydrogen emits only water vapor and requires no fossil fuels. Both Honda and a small UK research group named Riversimple produce cars powered by hydrogen fuel cells. The major obstacle is that there is currently no nationwide infrastructure in place for refueling. As we green our fleet, hydrogen cars may be a good alternative to electric ones that have to be plugged into an energy grid fueled primarily by fossil fuels like coal.