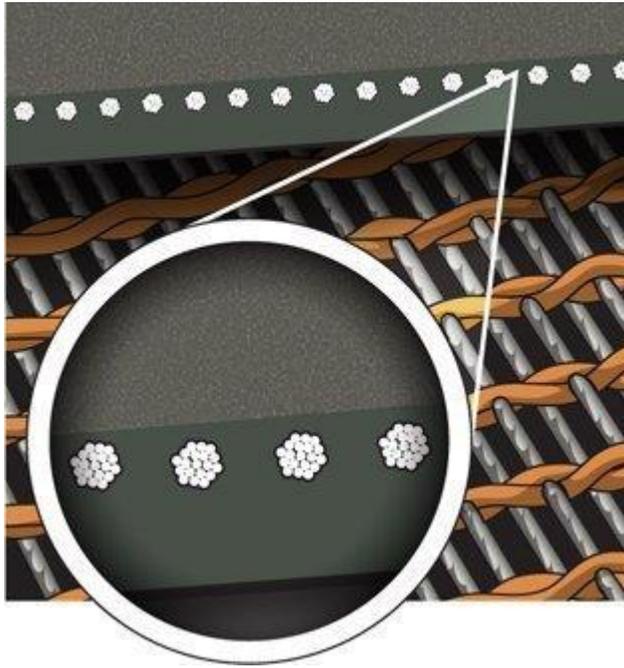


2013 10Best: 10 Most Promising Technologies

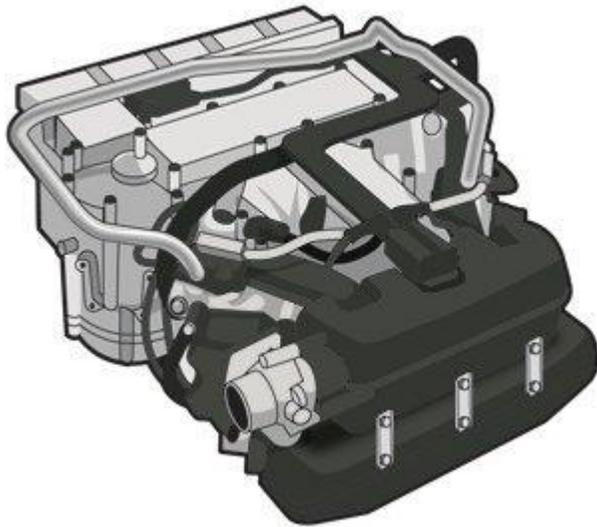
And why, in the future, you'll love the parking lot at Walgreens even more.

DECEMBER 2012
BY CAR AND DRIVER
ILLUSTRATION BY PETE SUCHESKI



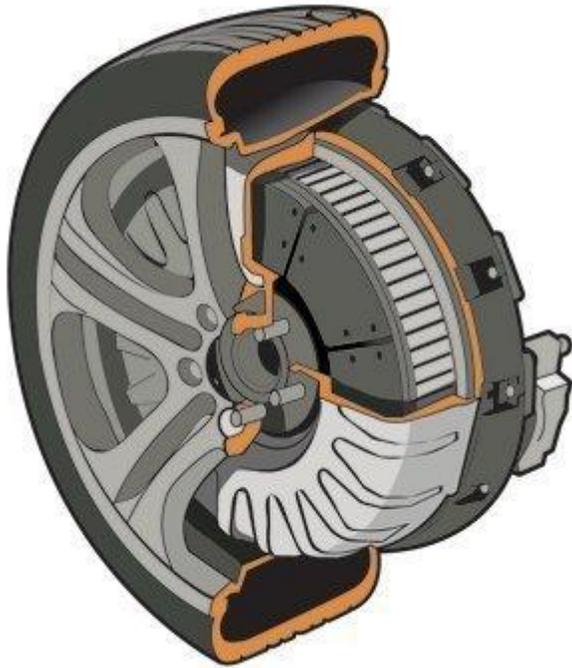
SUPER PLASTICS

Now that carbon-fiber composites are gaining ground, suppliers are investigating other hybrid materials capable of improving collision performance and saving weight. BASF, Bekaert, and Voestalpine are collaborating on thermoplastics fortified with steel cord. Bumper beams, body members, and interior trim made of injection-molded, steel-reinforced plastic combine excellent energy-absorption and structural-integrity characteristics with low manufacturing complexity and cost. Some clever carmaker will surely add the chrome or faux woodgrain finishing touch.



RANGE-ANXIETY RELIEF

Fear of running out of juice on the road can be a deal-killer for prospective electric-car buyers. Improved charging infrastructure will help to relieve range anxiety, but electric cars could also benefit from onboard mileage extenders. Audi, BMW, Lotus, Mazda, and two European engineering firms—AVL and FEV—have experimented with compact, engine-driven generators (smaller and less integrated than, say, the engine of the Chevy Volt) that hum to augment electrical energy on the roll. The ultimate solution—not yet under development—is a portable hydrogen fuel cell you load with your luggage and attach to the battery pack, enabling highway range comparable to gas-powered cars. A possible solution to the hydrogen-fuel storage concern is on the next page [see “Not That H2”].



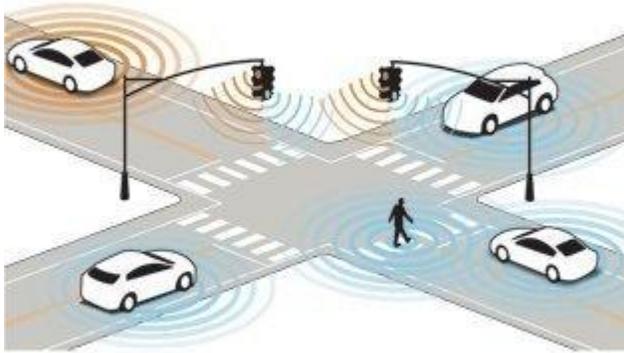
⌚ WHEELING AND DEALING

Ferdinand Porsche's idea of building a hybrid's electric motors into the wheel hubs leaves more space for passengers and batteries, but carmakers have hesitated to adopt this arrangement, fearing that major increases in unsprung weight will harm rough-road ride and handling. Challenging that assumption, Protean Electric contracted with Lotus Engineering to conduct extensive tests comparing a standard sedan with one propelled by wheel-hub motors. Lotus's surprising conclusions: Average drivers won't notice the performance degradation attributable to extra unsprung weight, and normal development tuning should overcome most steering, ride, and handling ill effects. Protean expects to start wheel-hub-motor production in 2014.



⌚ GETTING THE LEAD OUT

Shutting down an engine at stoplights to improve mileage is becoming standard operating procedure, though this strategy necessitates more robust electrical systems. Nickel-zinc battery chemistry (NiZn), patented by Thomas Edison in 1901, is a candidate to replace conventional lead-acid batteries because it can handle aggressive stop-start duty cycles without loss of performance or life span. NiZn battery maker PowerGenix claims that, compared with lead-acid batteries, NiZn batteries last twice as long, weigh 60 percent less, and are easier to recycle.



WIRELESS CROSSING GUARD

Some 3000 Ann Arbor, Michigan, motorists are engaged in a Department of Transportation study using wireless car-to-car connectivity to avoid collisions. Depending on the results, Wi-Fi could be mandatory in-car equipment by 2020. Taking the idea further, GM wants to help drivers avoid mowing down pedestrians. The underlying technology, called Wi-Fi Direct, allows a smartphone in a car to communicate with a phone carried by a pedestrian without routing the dialogue through cell-phone towers. The direct connection cuts the time required to identify a risk from eight seconds to one.



DIMENSIONAL DISPLAYS

Now that realistic three-dimensional images have leapt from the megaplex screen to the living-room television, 3D is bound for automobiles. Using thin-film transistor technology, Johnson Controls created an experimental 3D instrument cluster that displays critical information in the foreground with secondary data located deeper in the driver's field of view. This technology could add realism to navigation displays and action-movie thrills to emergency lane changes.



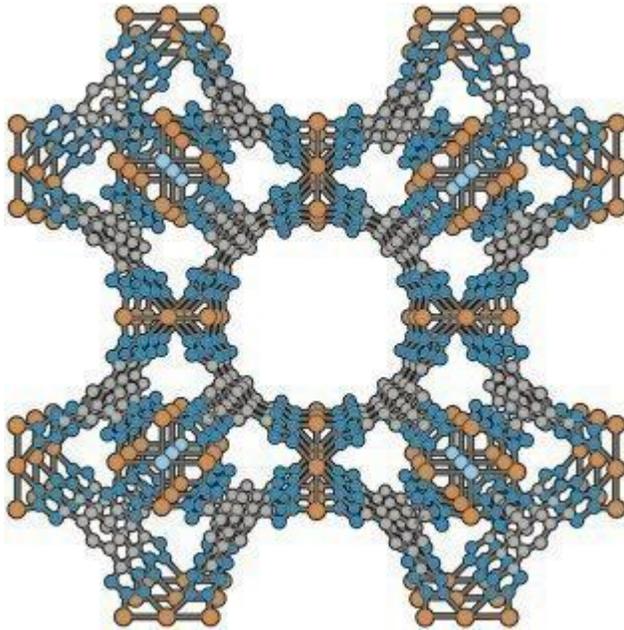
FREE JUICE

Best Buy, IKEA, Kohl's, Macy's, and Walgreens have begun installing free electric-car charging stations in their parking lots. After a successful start in California, Walgreens now has 385 hookups across the country and hopes of doubling that count. Government subsidies cover most of the expense while the electricity to charge an EV or plug-in hybrid costs only pennies per hour. Tesla joined the club with six solar-powered Supercharger stations (all in California) capable of adding 50 percent of a Model S's charge in 30 minutes. Tesla says it will have more than 100 stations open in 2015.



RECYCLED MOMENTUM

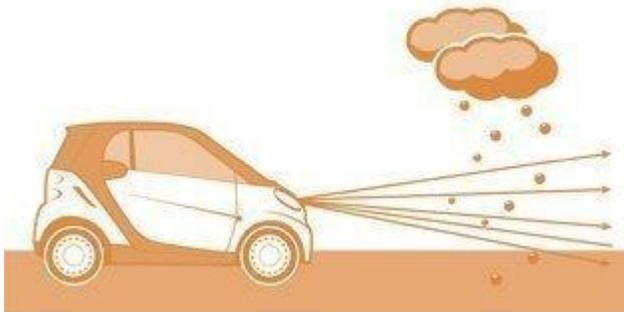
A major contributor to a hybrid's efficiency is regenerative braking. But who says this trick has to be exclusive to hybrids? Starting with the 2010 5-series Gran Turismo, BMW has offered alternators programmed to charge mainly during deceleration, a fuel-saving measure called Brake Energy Regeneration. Mazda's version, called "i-Eloop" (intelligent energy loop), stores captured momentum in a capacitor. The 2013 Mazda 6's climate control and entertainment systems draw electricity from the capacitor instead of an engine-driven alternator.



NOT THAT H2

Attempts to store hydrogen for fuel-cell cars as a 10,000-plus-psi gas or as a cryogenic (-423 degrees Fahrenheit) liquid have been disappointing. What's left is hydrogen stored in molecular (H₂) form at reasonable temperatures and pressures but greater density.

California's Lawrence Berkeley National Laboratory is studying how to do that using metal-organic framework (MOF) storage materials. These lightweight three-dimensional lattice structures attract and hold hydrogen like microscopic sponges. So far each potential storage site holds but one H₂ molecule, but the U.S. Department of Energy is betting \$2.1 million that the Berkeley team can develop MOF materials capable of adsorbing three or four times as much.



RAIN AND SHINE

Driving through a heavy downpour or snowfall can be agonizing, in part because precipitation can cause light from your headlights to reflect back at you. To part the curtain of impaired vision, Carnegie Mellon University researchers invented headlamps capable of looking between individual drops or flakes. In sync with a camera tracking the motion of falling particles, multiple LED light sources flash on and off to cut reflection by 70 percent. The flickering is so rapid that the driver perceives a continuous beam of light. At this stage of development, lab systems can vary the illumination 77 times per second, but quicker flashes will be necessary for these headlamps to be effective at highway speeds.