Sound of Science 理聲
Newsletter of Science Promotion Team
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Ready, unplug, drive

Plug-in hybrid cars run on both gasoline and batteries, an energy combination that would let drivers travel longer without refueling.

When a handheld video game runs out of juice, all you have to do is plug it in and charge it up. Within a few years, some of you might do the same thing with mom's car.

Automobile companies are developing vehicles that will plug in to electric sockets, just like many laptops, digital cameras, cell phones and small video-game players do. Called "plug-in hybrids," these cars will get most of their power from electricity. Their drivers will rarely have to stop at gas stations.

The technology is more than just gee-whiz cool. In our automobile-filled world, plug-in vehicles could reduce the amount of gasoline our nation uses. That gas is made from crude oil, which has been skyrocketing in cost. Much of our oil also comes from countries overseas where wars and other unrest make supplies uncertain. So plug-in hybrids could both save both money and lessen the nation's dependence on overseas energy supplies. Plus, motoring around in these hybrids may even help the environment.

"Plug-in hybrids are a promising automotive powertrain option for the 21st century," says Dan Santini. He's a transportation economist at Argonne National Laboratory, a government research center run by the U.S. Department of Energy.

The first company-produced plug-in hybrids could hit the roads by 2010.

But plug-in hybrids aren't a cure-all for energy problems. Some experts say that replacing gasoline with electricity (much of it generated by burning coal) might simply swap one type of environmental strain for another.

And engineers still have a lot of work to do to make plug-in hybrids practical and inexpensive. Researchers need to figure out what kind of technologies will work best and how much people will be willing to pay for the cars, among other questions.

"The answers don't exist yet," says Ted Bohn, an electrical engineer at Argonne, near Chicago. "As a kid I thought someone someplace knows the answer to everything. All of these questions haven't been decided. That's what engineering is about — making a guess, running tests and fine-tuning assumptions."

Out of gas

In many places, people depend on their cars and trucks to get everywhere — from school and work to the grocery store or doctor. And most automobiles today get their *vroom* from gasoline. It produces enough energy to power the engine, turn the wheels and make the car go.

Burning gas produces more than just energy, though. Gas-burning cars also produce a lot of carbon dioxide, a type of greenhouse gas. These gases accumulate in the atmosphere, where they trap heat and fuel global warming.

Gasoline is also getting more expensive — and prices at pumps throughout the United States surged to record highs this past summer. Reasons for the rise are complicated, but the trend is leading many people to look for alternatives to gasoline.

Recharging the batteries in a plug-in hybrid car would be similar to recharging the batteries in an all-electric (no gas) car, shown here.

Hybrid vehicles are one solution. Introduced in the late 1990s, hybrid cars get power from a combination of electricity and gasoline. At times, such as when driving on the highway, they run like regular gas-powered cars. But hybrids also have a special type of rechargeable battery and an electric motor, which allow them to sometimes drive with the engine off. With the engine off, the car uses no gasoline.

As a result, hybrids can go more miles on less gas. For example, the newest model of the Toyota Prius, the most widely purchased kind of hybrid in America, gets an average of 46 miles per gallon, according to the website www.fueleconomy.gov. By comparison, the gas-powered Toyota Camry, a similar-sized car, gets about 26 mpg on average.

Plug-in hybrids will go a step further. On a full charge, they'll be able to drive up to 40 miles without using any gasoline at all, Bohn says. Surveys show that nearly 80 percent of Americans drive fewer than 20 miles a day. So people who only drive short distances could, in theory, recharge their cars every night and not refill the gas tank—for years! During longer trips, plug-in hybrids will work like regular hybrids, with a gas-powered engine that recharges the battery.

On average, a typical plug-in hybrid driver would get an estimated 150 miles per gallon. Sounds like the perfect way to save money on gas, right? And you might even help to save the planet from pollution.

Perhaps, but scientists still have some kinks to work out.

The Weak Link

Batteries pose the biggest challenge. A standard gas-powered car uses something called a lead-acid battery. These devices are fairly cheap and they last a long time. But lead-acid batteries are also extremely heavy. You also have to run the engine regularly to keep them charged. And they are only strong enough to power the car's lights and other electronic equipment.

In a hybrid vehicle, batteries must store much more energy — enough to actually run the car with the engine off. It would take many, many lead-acid car batteries to do the job, Bohn says. In fact, so many that batteries would take up half of the car.

Instead, most hybrid cars use nickel-metal-hydride batteries. They're lighter, more efficient and quicker to charge than lead-acid batteries. They are also more expensive, which helps explain why hybrids cost thousands of dollars more than gas-powered cars the same size.

Batteries for plug-in hybrids need to be able to store even more energy than do those in typical hybrid cars. And that's where scientists keep getting stuck — designing smaller, more powerful, long-lived and lighter-weight batteries

Not surprisingly, Bohn says, " Battery research is very hot."

In the plug-in-hybrid world, lithium-ion (Li-ion) batteries are getting the most attention. These batteries can store a large amount of energy in a small package, and they last a relatively long time between charges. Li-ion batteries are standard in laptops, cell phones, heart devices, power tools and similar portable devices.

Scientists have found ways to make Li-ion batteries — and the gadgets that contain them — smaller and sleeker in recent years. But because cars are so big and heavy, it would still require a suitcase-sized Li-ion battery to power about 8 miles of driving, Bohn says. It would take five of these mega-batteries to propel a car for 40 miles. What's more, the batteries are extremely expensive.

"A car filled with batteries could go a long distance," Bohn says. "But it couldn't haul any people, and it would cost $100,000."

Engineers continue to look for ways to shrink Li-ion batteries even more. In the meantime, companies that are designing plug-in vehicles are making lots of guesses about how much money people are willing to spend on them, Bohn says. Batteries are central to those questions. "As we speak, huge decisions are being made [by the automobile industry] about how big the battery should be," he says. "The battery can be as expensive as the whole car."

Drive for the environment

Several companies plan to release fleets of plug-in hybrids in the next few years. Still, it'll probably be a while — if ever — before most people make the switch. One reason is that there simply aren't enough Li-ion batteries on the planet right now to produce enough plug-in cars for everyone, Bohn says.

In addition, these cars may not be a good choice for people without a garage to store their hybrid — and plug it in. The same would be true of people who live in high-rises or apartment buildings. Where would these people plug in their cars? And for rural families, daily travels may far exceed the 40-mile range of plug-in hybrids. These people might be better off with the less-expensive, conventional hybrid vehicles.

There are environmental complications, too. One study last year found that if 60 percent or more of U.S. drivers switched to plug-in hybrids, the country would produce a third fewer greenhouse gasses. But most of the electricity that comes out of our wall sockets is produced by power plants that burn coal, Bohn says. And burning coal produces pollution, just as burning gasoline does.

To get around that environmental dilemma, Bohn says, plug-in owners could someday choose to charge their cars in the middle of the night instead of in the middle of the day. Thanks to the way the country's energy system works, the timing would allow the car to get electricity created by wind power and other more Earth-friendly technologies.

In this way, drivers of the future might start to realize that, "My car is not just going to get me from point A to point B," Bohn says. "It will help me make energy decisions." **Emily Sohn**☺

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Lunch Time Video Shows: 12:20 p.m. @ Chem. Lab. (Room 512)

Date	Name of Program	Phy	Chem	Bio
2/2/2010 (Tue)	Carnivore – Lion 地球上的食肉動物之獅子 (Part 1)			🗁
5/2/2010 (Fri)	Carnivore – Lion 地球上的食肉動物之獅子 (Part 2)			🗁
9/2/2010 (Tue)	100 Greatest Discoverier: Earth Sciences 世界百大發現: 地球科學 (Part 1)	🗁	🗁	🗁
26/2/2010 (Fri)	100 Greatest Discoverier: Earth Sciences 世界百大發現: 地球科學 (Part 2)	🗁	🗁	🗁

Topic of Science Quiz 你知道唔知道? in February

5th, 1/2-10/2: **Move** 6th, 24/2-5/3: **Fossil Fuels**

Questions are posted on the notice board of Science Promotion Team near the Staff Common Room. Students can find the five questions and get the answer sheets on our board. After filling in your answers, put it into the box provided. Students who can get all the answers correct will be awarded a small gift.

Science Festival 2009-2010 Theme: MOVE

Date	Time	Event	Venue
1/2 - 5/2	Opening hours of Library	Book Exhibition	School Library
1/2 - 10/2	School time	Quiz Competition on "MOVE"	Notice board of Science Promotion Team
3/2 – 5/2	Morning Assembly	Prize presentation and sharing on Science topics	Playground
3/2	Lunch time 12:20 - 12:50pm	Talk on "Space Travel"	School hall
3/2	After school 4:10 - 5:10pm	Documentary Program Watching: "Africa's Secret Seven 非洲七怪"	School hall
4/2	After school 4:00 - 5:30pm	1st round / trial of "過關斬將" competition	School hall
5/2	School Assembly	Final round of "過關斬將" competition and prize presentation	School hall

二零零九至一零年度上學期 校內外科學比賽得獎名單

獎項	得獎同學
金風綠遍東亞運 環保風車創意設計比賽 優異獎	2A 黃冠賢，霍情，徐樂瑜及蘇家樑
全港環保創新科技大比拼 (2009 智能電動車) 最佳外觀優異獎	6S 蘇英健，鄧志聰及鄭海華
香港科學青苗獎(個人獎)	4E 曾兆聰及李俊豪 (一等獎) 2A 霍情及徐樂瑜 (三等獎)
上學期 午間科學紀錄片欣賞 最高出席率獎 (共二十二次)	4D 楊雋邦，2B 周雅詩及梁愷恩 (22 次) 4D 麥駿穎及 1D 周浩翔 (20 次) 2B 梁菁欣 (19 次) 2A 張葆雯，劉詠茵及黃冠賢 (18 次) 3E 張衍華 (17 次)
第一階段“你知道唔知道”科學問答比賽	冠軍：4E 姚永鏗 亞軍：3A 黃雪澄 季軍：3D 莫凱欣