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Steel City Project Puts Electric Cars in Charge of the Commute

By SAQIB RAHIM of ClimateWire

PITTSBURGH -- Chuck Wichrowski remembers the first car he ever worked on, when he was just a college graduate and knew nothing about cars: His wife's 1970 Chevy Nova.

The second? A 1964 Studebaker Wagonaire.

"I just sort of applied the college model, which is: You look the things up, you get a book, and then you do it," Wichrowski said.

As the years rolled by, Wichrowski put his wrench to the cars that drove the Steel City through its industrial heyday. But times have changed in Pittsburgh, and while he still runs Baum Boulevard Automotive, his customers have moved on to mostly foreign cars, and increasingly, hybrids.

Wichrowski used to run two gas stations, and he knows electric-drive cars need less maintenance than the gas-driven ones. Yet he has loaned a mechanic to a local university to help it design electric cars for regular Pittsburghers, and he thinks his shop can cash in if the future really is electric.

And for the team at Carnegie Mellon University, which is designing cars to get residents to work without burning a pint of gas or even wasting an electron, the future of electric cars is Pittsburgh.

Designers of the ChargeCar project say that instead of selling pricey new vehicles, they want to create a kit that makes it easy for local auto shops like Wichrowski's to convert a gasoline car to run on electricity.

"There's a bunch of machine shops running idle in Pittsburgh," said Illah Nourbakhsh, a robotics professor at CMU and a co-director of ChargeCar. "There's a ton of shops that can do that kind of thing. There's mechanical know-how in this town like no other that I've seen."

Electric-car conversions have been available for decades, whether through small, independent companies or engineers tinkering in their garages. But ChargeCar is likely the first effort to gut a gasoline car and redesign it for a single purpose: the perfect commute.

When Nourbakhsh and his colleagues looked at how Pittsburghers drive, they found that most trips are about half a dozen miles. Some zoom along the highway, while others plod past stop signs and red lights. Some drive on flat roads; others climb or coast down the city's hilly terrain.

The team reckoned a battery, combined with a gadget called a supercapacitor and controlled by software, could make most of these miles electric-powered, at a price Pittsburghers could afford.

Fiddling and fact-finding

ChargeCar's latest projects sit in a former gas station across the street from Carnegie Mellon. One is a 2006 Honda Civic: Over the next month, the team will convert it into a short-range, all-electric car. Wichrowski's mechanic will lend a hand and advise on how to make such conversions as simple as possible for other auto repairers in Pittsburgh.

The other car in the garage feels more like an airplane. From the outside, it looks like a common Scion xB; surrounding the cockpit, though, are scores of dials and gauges.

The car is an experiment.

As Nourbakhsh pulls onto the road, he points to wobbling needles and flashing numbers on the computer screen. This car is powered by a battery and a supercapacitor, and these gauges are constantly crunching numbers: how much juice is left, how much power is flowing, how hot the battery is.

He switches between using the supercapacitor and the battery. He tries each one on hills, up and down. When he slows at a red light, he can choose which device he wants to charge up.

As the professor fiddles, the team is learning important facts about the most efficient way to power an electric car.

The reason has to do with how batteries work -- and a major technical challenge for automakers.

Custom-designed batteries?

Batteries are good at storing energy, but they degrade if they have to take on, or release, too much power too quickly. To deal with that degradation, automakers stuff cars with larger batteries, but that adds cost and weight.

Unlike batteries, supercapacitors are built for abuse: They can take a huge charge and discharge, thousands of times, without losing a step.

They're not so good at holding a charge, Nourbakhsh says, so the team decided to pair one with a battery.

Those Pittsburgh hills and traffic lights? They become energy savers.

"When you're stopping, all the current gets dumped into the capacitor, therefore saving the energy so that you can reuse it, rather than going into the battery, because putting it into the battery costs battery life," he says.

As the argument goes, if one knows exactly how someone drives, it's possible to come up with the perfect-size battery and supercapacitor for that driver.

At www.chargecar.org, the group is asking Web surfers to share information on their commutes in gasoline cars, including every highway ride and stop at Starbucks.

A $10,000 price tag

Nourbakhsh and his team are at work on a computer program that can predict where a driver speeds up, hits traffic and pauses for doughnuts -- all to make a battery system that's the perfect size.

Over time, this program could even learn more about the driver, firing up the capacitor or battery at precisely the right times to get her to work.

Nourbakhsh says a regular battery may cost $8,000, but adding a $1,000 capacitor to handle the sudden charges means the battery doesn't need to be as big, so the combo may cost only $2,000.

The total price of conversion? ChargeCar is targeting a $10,000 tag.

Paul Scott, vice president of advocacy group Plug-in America, said such a system could be the "magic bullet" of energy storage in cars, since it balances capacity and power.

Capacitors have already drawn interest from researchers, engineers and even some of the automakers. A spokesman for Toyota said, however, that the company has placed more focus on other electric technologies because it found capacitors too costly.

Scott panned the idea of designing electric cars mainly geared to the commute. "Everybody I know drives a car a lot of different ways," not just for commuting but also for going to the movies or visiting friends, he said.

Mechanics say this is the future

"If you optimize a car for just one specific task, it may not work as well for other tasks," he said.

Nourbakhsh said the car doesn't have to spend its last electron at the office -- it's possible to design "headroom" for a specific commute while still being efficient and saving on cost.

"But the point is, for the thing you do most frequently -- that you spend the most energy on -- let's have it be super-efficient at that," he said in an e-mail.

Some families might choose to have a ChargeCar and reserve a gasoline car for longer trips, said Leland Thorpe, a master's student at Carnegie Mellon who's on the ChargeCar team.

The project is recruiting local companies to sponsor the first wave of car conversions. Nourbakhsh says that would be a uniquely Pittsburgh solution, as companies "green" their reputations and Pittsburghers do the work in auto shops.

Even if electric cars catch on in Pittsburgh, Wichrowski, the manager of Baum Boulevard Automotive, isn't worried about having to lay off mechanics.

"Every hybrid car that we have also has conventional brakes, conventional exhaust, other things that you really need to do to have a regular car," he said as customers milled in and out of the shop. "They just have an added layer of the hybrid system bolted into the car somewhere."

He said today, some cars have up to a dozen computers to control their systems: air conditioners, power steering and the like.

The modern mechanic often has the equipment and know-how to work with them, so electric cars shouldn't be too much harder.

"This is something that all the technicians are going to have to move into," he says. "If you want to repair cars, you're going to have to be able to know how to do this."