Peter Gorrie , Torstar News Service Thu Dec 06 2012 00:01:00 0 Comments 0 Recommend

Mac charges into battery research

MacAUTO is a research centre at McMaster University that focuses on electric transportation, and aims to improve the performance of greener cars.

Ali Emadi doesn't shy away from superlatives.

His project is "one of the largest, if not the largest," of its kind in North America, he says. It's "the most sophisticated, most comprehensive ... We've developed a powerhouse."

Emadi is director of MacAUTO, a research centre at McMaster University that focuses on electric transportation.

His team of 43 — set to grow to 50 by January — will soon operate from the new 80,000-square-foot MacAUTO Research Centre, with a $150-million budget for the next seven to 10 years.

"It's truly exciting," he says.

It's another example — like the Fraunhofer Centre in London — of how with little fanfare, ambitious work is carving out a role, and jobs, for Ontario in the world of greener cars.

MacAUTO is delving into just about everything needed to develop electric vehicles — battery chemistry and controls, heat management, motors and powertrains, charging stations, the grid, and public policy.

"I'm very optimistic about EVs," Emadi says.

"There's no question in my mind that we're at the beginning of major technical advancement and market penetration."

That's indeed optimistic, since EVs still account for a tiny fraction of vehicle sales; hobbled by high costs and, for pure battery power, short range and long recharging times.

Emadi predicts that within a decade, "almost all cars in North America will be, one way or the other, electrified." But he has a broad view of what that means, ranging from the stop-start technology being installed in internal-combustion cars, up to conventional hybrids and the various forms of plug-ins.

His institute is working to hasten the change by cutting EV costs and improving their performance.

One example is electric motors. Most, Emadi says, use magnets made with rare-earth minerals, whose price has doubled in the 18 months he's been at MacAUTO. So his group is developing motors that require fewer or no magnets.

Researchers have "a conceptual design" they believe can match or even exceed the 90 per cent efficiency of conventional motors at a lower cost, he says.

Others are working to combine batteries and supercapacitors — a different type of electricity storage device — to improve EV performance.

Capacitors are used in many electrical devices, but on their own can't cope with the intense demands of EVs.

On the other hand, Emadi says, each device does part of the job well.

Batteries are good at storing energy and generating constant power flows, but degrade relatively quickly when asked to produce quick bursts. Capacitors are weak at storage but excel at bursts. And they're not sensitive to high or low temperatures.

"They take a lot of the load off things that aren't good for batteries," Emadi says.

Combining the technologies could increase range by 20 per cent and extend battery life by 25 per cent. That's not enough improvement to make EVs mainstream, but it would be a significant step.

The main challenge is developing electronics that allow the devices to work together seamlessly and reliably, and cutting their price.

The system already "makes sense" for buses and heavy-duty vehicles, but it might take 10 years to get the cost low enough for passenger vehicles, Emadi says.

MacAUTO is also trying to improve prospects for batteries when they're down to 80 per cent of their original capacity and no longer suitable for EVs.

Most promising is having older batteries store electricity from intermittent sources like wind and solar until it's needed by the grid. The key here, Emadi says, is to reduce the cost of connecting thousands of these small devices.

Like the Fraunhofer Centre, MacAUTO is working with carmakers and aims to generate spinoff jobs. They're helping to keep Canada in the green car game.

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