

# Ideas on the Edge



## Catalyst for a Dream

KUNAL KARAN AT QUEEN'S UNIVERSITY IS DOING HIS PART TO FULFILL A LONG-DELAYED TRANSPORTATION DREAM.

"Dude, where's my fuel cell car?"

The idea of the hydrogen fuel cell vehicle first showed up on the popular radar when early prototypes appeared in the late 1990s. And almost from the start, it seemed too good to be true. A car that produced only water at the tail pipe? It was an environmentalist's dream.

Today, we're still waiting. And over a decade's worth of hype is starting to turn sour.

"All the focus on fuel cell cars has been both a boon and bane," says Dr. Kunal Karan, a scientist at the Queen's University Fuel Cell Research Centre. The boon has been a level of public

interest that has helped fuel a decade of productive research. The bane has been misplaced expectations. "People got the idea that the main application of fuel cells was going to be in vehicles," says Dr. Karan. In fact, fuel cells have come into commercial use in a wide range of other applications, from powering fork-lifts to



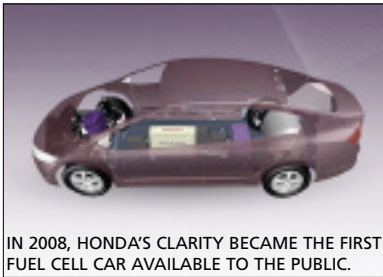
KUNAL KARAN

providing back-up power units where noisy and heavy diesel generators aren't an option.

When it comes to cars, though,

significant obstacles still remain. How do we generate the massive amount of hydrogen needed for millions of vehicles—preferably with carbon-neutral processes and/or renewable sources? And how do we safely contain and distribute it? Then there's the fuel cell system itself. How can we make it as cheap and reliable as the time-tested internal combustion engine?

Still...the dream of the fuel cell car continues to



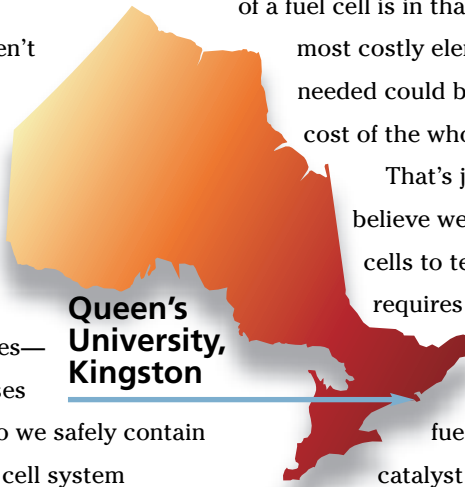
IN 2008, HONDA'S CLARITY BECAME THE FIRST FUEL CELL CAR AVAILABLE TO THE PUBLIC.

beckon. And despite the disappointments, it's closer than ever to being realized. Increased solar capacity may help provide the power

needed to produce enough hydrogen. And safety concerns may be addressed by new nano-engineered materials that are both light and very strong.

As for cost and reliability—that's where Dr. Karan's research comes in. In particular, he's interested in reducing platinum usage in fuel cells. Some of the most promising technology relies on the precious metal as a catalyst in the device at the heart of the cell—the

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membrane assembly that transforms hydrogen into the electricity that powers the wheels. About 80 per cent of the cost of a fuel cell is in that membrane, and platinum is its most costly element. If the amount of platinum needed could be drastically reduced, so could the cost of the whole cell.

That's just what Dr. Karan is aiming to do. "I believe we can reduce platinum use in fuel cells to ten percent of current levels. But it requires altering the nano structure of these catalyst layers." By re-arranging the molecular "building blocks" of a fuel cell membrane's incredibly thin catalyst layer—about one-quarter the thickness of a human hair—he hopes to help make fuel cells cost-competitive with the good old gas engine.

He's quick to say that there's still a long way to go. But Honda has begun leasing its first fuel cell vehicles to the public in California. And Dr. Karan points out that every major car manufacturer has a fuel cell strategy. "We'll see wide-scale deployment in 10 to 15 years."

The dream of the fuel cell car isn't dead after all. It just needs a little catalyst to make it happen. And the less the better.

**Project:** Infrastructure for Solid Oxide Fuel Cell and Fuel Processing Research  
**Institution:** Queen's University  
**Research Sector:** Engineering  
**Principal Investigator:** Kunal Karan  
**Trust Investment:** \$115,693  
**CFI Investment:** \$115,693  
**Total research investment from all sources:** \$303,520



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## Infrastructure for Innovation About the Ontario Innovation Trust

The Ontario Innovation Trust was created in 1999 by the Government of Ontario to invest in research equipment and facilities at Ontario's universities, colleges, hospitals and other non-profit research institutions. The Trust is governed by a volunteer Board of Directors, according to the terms of a Trust agreement established by the Ontario government. A small permanent staff looks after day-to-day operations.

Since its inception, the Trust has committed almost \$843 million to strengthen Ontario's position in the global marketplace of ideas. This represents more than a third of the \$2.44 billion in total funding that has been invested in Trust-supported projects.