

A smarter approach to using electricity

Bob Burt, Special to The Record

Imagine driving home, and plugging your car in to recharge overnight with power generated by solar panels on the roof of your house or a wind turbine.

The next morning, you drive to the office, plug your car in at the office parking lot so it can be recharged using energy from solar panels on the roof of the building.

From your desk, you use a remote control to reset the air conditioner in your home and turn on the oven to cook a roast for dinner; you also instruct the washer to turn on to clean a load of laundry.

These seem like scenes from a science fiction movie, but they are closer to reality than you might think. The technology to make them possible is coming in the not too distant future, says Jatin Nathwani, a professor at the University of Waterloo.

Nathwani, a former executive with Hydro One, holds the Ontario Research Chair in Public Policy and Sustainable Energy Management at UW. He also is a member of Ontario's Smart Grid Forum.

"There is a world of change coming upon us," he says.

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ROBERT WILSON, RECORD STAFF

Jatin Nathwani, head of the Waterloo Institute for Sustainable Energy at the University of Waterloo, talks to Hung Nguyen (left), Alex Koch (rear) and Carl Chan, members of UW's alternative fuel team.

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A major centre for sustainable energy research

Bob Burt, Special to The Record

The ways people create, move and use energy are changing rapidly and scientists at the University of Waterloo are at the centre of research that is driving the changes.

Jatin Nathwani heads a group of about 70 professors and researchers at UW who bring a diversity of expertise to the table.

Nathwani, a former senior manager with Hydro One and author of several books on risk management, was awarded a \$3-million research chair in public policy and sustainable energy management at the university in 2007.

Nathwani, an adjunct professor at UW for 20 years, doesn't underestimate the challenges that will need to be addressed as the entire electricity system in the province is changed, modernized and improved.

One of the first steps he took after

he was awarded the research chair was to pull together professors and researchers doing work on a variety of energy-related issues under one umbrella by forming the Waterloo Institute for Sustainable Energy. UW is now considered to be home to the largest institute of its kind in the world, he says.

The institute conducts research in areas such as solar and wind energy, fuel cells, battery technologies and storage, clean coal technologies, clean diesel fuel for green vehicles, integration of small and locally sited power sources, and energy efficiency.

By bringing together people with expertise in engineering, environmental studies, science and business, Nathwani thinks the institute can answer some of the questions that will need to be addressed as the province's power system evolves.

One of his goals is to train a new generation of highly qualified re-



ROBERT WILSON, RECORD STAFF

Professor Jatin Nathwani believes Ontario has a unique opportunity to use technology to overhaul its electrical system.

searchers and professionals who will play a key role as the province modernizes its power system and adopts new technologies.

One of the things Nathwani and his colleagues are working on is a document to address questions related to the introduction of electric vehicles.

He believes it could serve as a road map for the province as it tries to bring large numbers of plug-in cars onto our roads.

"We need an action-plan for plug-in cars," he says. "We need to say, 'OK, we want two million plug-in electrical cars in 10 years, so what are the problems in terms of technology, business, policy, utility organization and so on.'"

Nathwani developed expertise in working with people with diverse backgrounds and areas of expertise while he was manager of strategic planning at Hydro One.

He believes that experience is valuable in developing a multi-disciplinary approach to problem solving at the university.

'Electricity is a good thing that has enormous value'

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"You'll be able to use computers to get into your house and make any adjustments to your energy use that you want."

Nathwani, formerly manager of strategic planning at Hydro One, the largest electricity delivery company in Ontario, enthusiastically talks about smart appliances and smart grid technology.

A smart grid is described as a modern electric system that uses sensors, monitoring communications, automation and computers to improve the flexibility, security, reliability, efficiency and safety of the electrical system.

A report from the smart grid forum, released earlier this year, notes that the smart grid provides consumers with information about what electricity costs at any given time and allows them to make choices about when to use it, enabling them to save money by using electricity at off-peak hours. It also provides a variety of energy sources, with a focus on green energy from renewable sources, and allows homeowners to generate their own power and sell what they don't use back to the grid.

"In short," says the report, "it brings all elements of the electricity system (production, delivery and consumption), closer together to improve overall system operation for the benefit of the environment. Homeowners will have the tools and information to ... actively manage their electricity use, taking advantage of their smart meters, smart appliances

and other control devices."

Right now, Ontario is saddled with aging systems that generate and transmit power to distribution systems that provide electricity for the province.

But that means it is the ideal time for the province to modernize the system, take advantage of smart grid technologies, choose green sources of energy over polluting sources and combat climate change by bringing electric cars into mainstream use, says Nathwani.

"There is a perfect opportunity now because the system is aging," he says. "So the question is do you go back and build the same thing you did 50 years ago. Now is the opportunity to transition and to install new technologies with all the promise they offer."

The Ontario government's plan to equip every home and small business with a smart meter, a device that records how much electricity is used hour by hour, is a good first step, says Nathwani.

That and the decision to shut down coal operating power plants in Ontario put the province ahead of other jurisdictions, including the United States, in moving toward adopting smart grid technologies, he says.

With the commitment to move away from coal and use nuclear energy, along with power generated by water, wind and the sun, Nathwani believes the province is well on its way to dramatically reducing greenhouse gas emissions in the power sector.

He believes plug-in electric cars

have the ability to do the same thing for the transportation sector. In fact, he sees electric cars as the cure to many of society's ills.

Historically, one of the big challenges with electric systems is that the power that was generated needed to be used as it was generated; there were no effective ways to store it on a large scale.

Electric cars could provide an easy way to store energy at night when demand and prices are at the lowest and use the stored energy during the day when prices are high.

"All governments over the last 40 years have looked to fuel efficiency to reduce use of oil but with that you end up with more cars driving farther and fuel demand goes up," says Nathwani.

"We need a completely different fuel and even ethanol doesn't do the trick."

Electric cars, lots of them, will do the trick, he says.

Concerns about limits to the distance you can travel once an electric car is charged are valid, says Nathwani. But they can be addressed by making electric cars that switch to gas once the range for electric power is exceeded, he says.

Then again, the problem might not be as big as it seems. Nathwani cites studies that suggest most people in Canada or the United States drive less than 50 or 60 kilometres on most days.

"The technology is being improved all the time," Nathwani adds. "Soon we'll be able to go 100 kilometres, then 160."

In Nathwani's vision, electric cars

would be charged at night using clean, renewable sources of energy. He notes that by using stored power, electric cars have potential to lower peak demands on power systems and dramatically reduce the cost of providing electricity.

He laments the trend that sees growing elements of society frown on the development and construction of new facilities to generate and transmit power.

"We used to promote electricity as a first-rate system and the driver for growth in the economy and a benefit for society, but we lost track of that and it became a sin to even think about wanting to build an electric plant, because of public opposition."

Nathwani says there is "enormous value" in building infrastructure to meet future electricity needs and address problems in the transportation sector.

He notes that public policy thinking about electricity is minimalist; you find ways to conserve a kilowatt of electricity and don't build anything until you absolutely have to.

"I believe in conservation to the fullest. Don't get me wrong, all those things you have to do. But you have to step beyond that and say electricity is a good thing that has enormous value to society and this is the way to solve other social problems.

"Don't be shy about it," Nathwani says.

"If that means building more supply or transmission lines so be it. Electricity has great value. You can use it to drive semiconductors, power factories, to dry your hair and now to drive cars."