

## INVESTMENTS AMP UP ONTARIO'S CLEAN ENERGY SUPPLY

## INFRASTRUCTURE

# Nuclear among powerful technology solutions

Canada is among 23 states (22 nations and the European Union) that have agreed to double their national investments in clean energy innovation over five years, while also encouraging the private sector to invest in clean energy technologies.

The global initiative known as Mission Innovation was launched in November 2015 at the United Nations international climate change conference, COP21. Canada's participation is central to two high-priority federal government goals: to promote sustainable economic growth through innovation, and to drive the country's transformation into a low-carbon economy.

Canada believes that nuclear energy has a key role to play in the achievement of these two closely connected aspirations.

"Canada is one of nine countries to confirm that nuclear energy research and development (R&D) is an important part of Mission Innovation," says Dr. Shannon Quinn, Vice-president, Science, Technology and Commercial Oversight for Atomic Energy of Canada Limited (AECL).

One of the measures the federal government implemented to strengthen Canada's nuclear industry and increase its international competitiveness was to restructure AECL's Nuclear Laboratories division into a government-owned, contractor-operated model. The restructuring completed at the end of 2015 created the new entity known as Canadian Nuclear Laboratories (CNL), with most of its facilities located at Chalk River, in Ontario.

Canada's historic leadership in nuclear technology has produced strong benefits and will help position Canada and Canadian industry for leadership in the future, Dr. Quinn says.

"The Chalk River facilities are Canada's largest scientific site," she says. "This was the birthplace of the CANDU technology – the basis of a \$6-billion-a-year domestic nuclear industry that provides 30,000 direct jobs and 15 per cent of Canada's electricity mix."

Experts predict that by the middle of this century the world will use twice as much energy as it does today, and without more clean energy at an affordable cost, the climate change challenge will become more difficult to meet.

With nuclear energy's proven low-carbon strengths and the cost-effectiveness of the electricity it generates, researchers are investigating new technologies to further improve affordability.

"The energy market is very competitive and, in some cases, nuclear energy may have a difficult time competing with other sources, particularly when other sources are subsidized," says Dr. Kathryn McCarthy, Vice-president, Research and Development at CNL.

"Nuclear energy has the highest capital cost but one of the lowest O&M costs. The fuel (uranium) is relatively inexpensive, and the price of uranium is relatively stable," says Dr. McCarthy. "Meanwhile, a natural gas plant, for example, is less costly to build, but the electricity cost depends on the price of natural gas – which is volatile and can reach high levels." When natural gas prices are low, as they are now, the competitive case for nuclear can get more complex, she explains.

Canadian Nuclear Laboratories and many industry players are conducting R&D into technologies with the potential to reduce capital costs and speed up the construction of nuclear energy installations. Investigative areas include manufacturing techniques and new types of fuel – and innovations to benefit existing nuclear generating stations and to improve development of future plants.

According to Dr. McCarthy, CNL stands ready to work with industry partners to help them break new ground in pursuit of these advancements; this includes the emerging technologies around small modular reactors (SMRs).

"There is a lot of interest around the world in developing these smaller reactors," she says. "There are many different designs under development by vendors and startup companies, with coolants ranging from the more conventional water to coolants such

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Director of Regulatory and Environmental Affairs, Canadian Nuclear Association

as liquid metal or molten salts. We are positioning ourselves as 'technology neutral' and are able to apply our strengths to support technology developers regardless of their design.

"It is our vision that CNL will be a hub for SMR development in Canada. We have recently launched an effort to gather input and feedback from technology developers, researchers, the nuclear supply chain, potential end users and interested stakeholders. We welcome anyone interested in SMR to share their thoughts with us through the form on [www.CNL.ca/SMR](http://www.CNL.ca/SMR). The feedback we receive is helping inform our research programs and our planning as we begin the initial SMR site-selection process later this year."

The government has committed to long-term support of the R&D at the laboratories," says Dr. McCarthy. "A planned investment of \$1.2 billion over 10 years will support government priorities, while also helping Canadian industry access world-leading nuclear science and technology facilities and expertise."

Small modular reactors are also generating considerable excitement among nuclear industry players, says Steven Coupland, director of regulatory and environmental affairs with the Canadian Nuclear Association.

"A range of sizes is being explored – from units that come in packs that would connect to grid baseload and replace coal plants, for example, to smaller units designed to go into northern, off-grid communities or mining operations, to replace diesel generation," says Coupland.

The smaller reactors hold prospects for cost-effective applications within Canada, as well as elsewhere in the world, he adds. "Consider that many parts of the world do not have access to extensive water resources. That means that options for using hydro power as a non-emitting baseload power source are limited in many regions. The clear alternative is nuclear energy."

Nuclear energy is a prime clean technology for many reasons, Coupland says. The clear advantage is that it emits virtually no greenhouse gases.

"The single biggest reduction in carbon emissions in Canada and in North America occurred when Ontario stopped electricity generation by coal-fired plants. That initiative was made possible because of the clean energy generated by the province's significant assets in nuclear energy, as well as hydro," he says.

Another strength of nuclear energy is its small environmental footprint. As Coupland explains: "Nuclear generating stations create massive amounts of electricity on a reasonably small physical area. To generate comparable amounts of electricity using other technologies such as wind turbines, for example, would take up very large tracts of land."

Nuclear power companies have also developed strong environmental protection programs to preserve habitat, water quality and species around their sites, he adds. ■



Canadian Nuclear Laboratories' Chalk River facilities are conducting R&D for advancing nuclear energy and other technologies. SUPPLIED

## ONTARIO POWER GENERATION

# Efforts driving clean electrification of transport sector

You could call it an effort to drive cleanly into the future. As part of its commitment to help de-carbonize Ontario's transportation sector, Ontario Power Generation (OPG) is a founding sponsor of Plug 'n Drive, a non-profit organization working to accelerate the adoption of electric vehicles and to maximize their environmental and economic benefits.

In May, Plug 'n Drive announced the opening of the world's first experiential learning facility dedicated to electric vehicle education and awareness, with OPG sponsoring the centre's training facility, OPG Power Place.

Cara Clairman, President and CEO of Plug 'n Drive, said the centre provides "a one-stop shop" at which consumers can explore and test-drive the latest electric vehicle models, as well as home and commercial charging stations.

The effort is among various OPG initiatives aligned with Ontario's climate change plan, which includes a goal of seeing electric vehicles represent five per cent of new vehicle sales by 2020.

OPG, which supplies almost half of the electricity used in the province, is at the forefront of electrifying the province's transportation sector, largely because of its broader efforts to de-carbonize the electricity sector. OPG is doing this in a number of ways:

First, OPG successfully shut down its coal generation, which remains North America's single largest climate change action to date. Two of those stations were converted to run on biomass. As a result of this and other actions, OPG's diverse generating fleet is more than 99 per cent free of smog and carbon emissions.

OPG's Darlington Nuclear station, which powers one in five homes in Ontario, is currently undergoing a refurbishment. At a cost of \$12.8 billion, it is the largest clean energy project in Canada and will provide 30 more years of clean, reliable, low-cost baseload power. The additional years of operation will

“ I'm pleased to say we're developing an electrification strategy that works to promote and incorporate a greater electric vehicle presence into our operations.”

**Jeffrey Lyash,**  
President and CEO, Ontario Power Generation

reduce carbon emissions by an estimated 297 million tonnes.

"That's the equivalent removing two million cars per year from Ontario's roads," said OPG President and CEO Jeffrey Lyash.

While the Darlington refurbishment is underway, OPG is planning to continue operations at its Pickering Nuclear station until 2024, which will avoid at least 17 million tonnes of carbon emissions.

OPG is also investing in its fleet of hydro-electric stations to ensure these heritage assets continue to generate clean power for generations. The utility is also incorporating electric vehicles into its operations.

"As Ontario's largest clean energy provider, we believe using clean electrons to power cars, trains and buses is the next big climate change victory for the province," Lyash said. "OPG is well positioned to continue providing Ontario with clean power well into the future."

The commitment to being a safe, reliable, low-cost clean-energy provider remains an important distinction for our employees," Mr. Lyash added. "They are proud to be part of these efforts to build a stronger, cleaner Ontario." ■



OPG is embracing electric vehicles as Ontario's next climate change win. SUPPLIED

## ELECTRIC VEHICLE DISCOVERY CENTRE

A partnership involving the Province of Ontario, the Power Workers' Union, Bruce Power, Toronto Hydro, Ontario Power Generation, and the TD Bank Group has produced the world's first electric vehicle (EV) education and awareness centre.

Located in Toronto, and led by the not-for-profit Plug 'n Drive, the Electric Vehicle Discovery Centre (EVDC) is the first facility of its kind in the world, focused entirely on providing an experiential learning environment for electric vehicles.

A well-attended ribbon-cutting ceremony took place at the EVDC on Wednesday, May 18. Leaders from each of the partnering organizations spoke about the economic and environmental advantages coming to the people of Ontario through the electrification of the transportation sector.

During the event, Don MacKinnon, President of the Power Workers' Union (PWU) and an original member of the Plug 'n Drive Board of Directors, said, "It's a natural fit for our organization because our members work in the generation, transmission and distribution of Ontario's low-carbon electricity. In order to meet the carbon emission targets set out by the federal government, electrification of most transportation in every major city in this country is essential."

Transportation is the largest source of greenhouse gas emissions in Ontario. Adopting the use of EVs for personal road transportation is expected to significantly reduce GHG emissions thanks in part to the province's low-emitting electricity supply made up mostly of hydro and nuclear power.



On May 18, dignitaries gathered to officially open the Electric Vehicle Discovery Centre in Toronto. Pictured from left: Jeffrey Lyash (Ontario Power Generation), Anthony Haines (Toronto Hydro), Hon. Glen Murray (Minister of Environment and Climate Change), Cara Clairman (Plug 'n Drive), David Collie (Electrical Safety Authority), Don MacKinnon (Power Workers' Union), Mike Rencheck (Bruce Power), Raymond Chun (TD Insurance).