Invest Durham

Durham Region: Accelerating Energy Innovation

InvestDurham.ca

The global threat posed by climate change makes the transition to clean energy more urgent than ever.

Countries and companies around the world are focused on actions and technologies that reduce carbon emission however without a major acceleration in clean energy innovation, they still will be unable to meet their committed climate change goals.

As the Clean Energy Capital of Canada, Durham Region is a natural for clean energy innovation. Not only has the region prioritized clean technology innovation which will support research, development and demonstration activities, we also are:

Strategically located in Ontario on the eastern side of the Greater Toronto Area. Ontario has the largest and fastest-growing cleantech sector in Canada and is home to 36 per cent of the nation's cleantech companies with proprietary technology.

Headquarters to Ontario Power Generation. OPG is the second largest electricity generator in Canada and one of the largest, most diverse low-cost clean power generators in North America.

Supported by a deep history in energy dating back over four decades.

From the establishment of the first Nuclear Generating Station in 1965, through to the 2020 launch of the Centre for Canadian Nuclear Sustainability.

A well-established energy innovation cluster with 45+ private and public sector organizations providing synergies that increase productivity, drive innovation, and stimulate new business.

A highly skilled and experienced workforce employing over 10,000 energy professionals.

Post-secondary educational attainment in the Region is close to 70%.

Home to an established collaboration between private and public sector organizations, teaching and research institutions serving as a catalyst for innovative breakout technologies that provide globally competitive and environmentally responsible solutions.

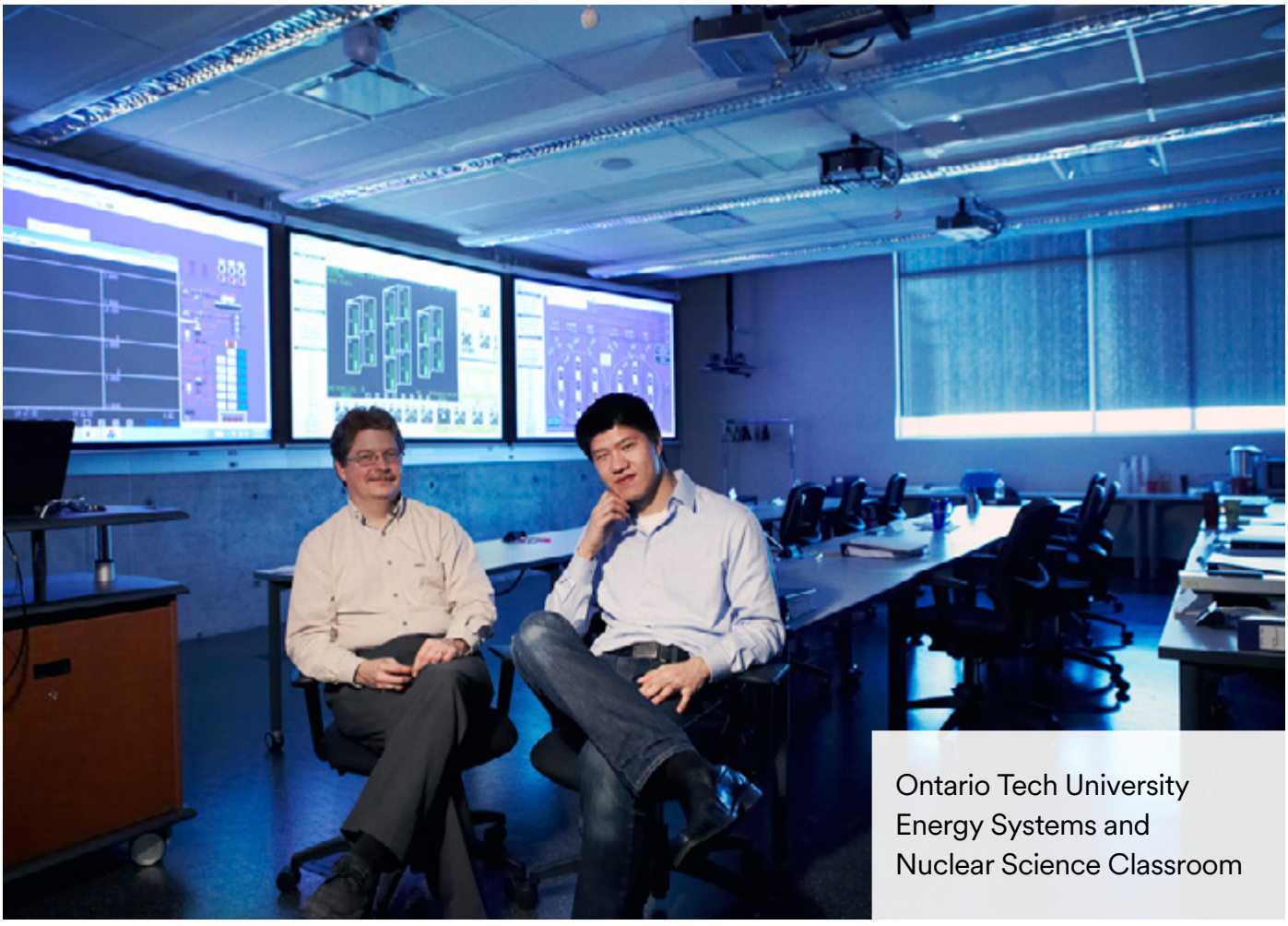
By enabling advancements in energy innovation such as micro grids, electric vehicles, electric-vehicle infrastructure, fuel cells, life-saving cancer treatments, and small modular nuclear reactors, we are supporting the evolution of our business ecosystem, so Durham Region continues to be home to businesses that innovate for good. We are working together to accelerate the transition to a clean energy economy.

We're full of optimism about what we'll do next →

Durham's Commitment to Energy Innovation

The transition to a cleaner energy economy requires using energy more efficiently, moving from fossil fuels to sustainable energy wherever possible and generating electricity with low or zero carbon emissions. Specific activities include retrofitting nearly the entire existing building stock, dramatically increasing the energy performance of new buildings, rapidly deploying local renewable energy technologies, installing energy storage and electrifying personal and commercial vehicles.

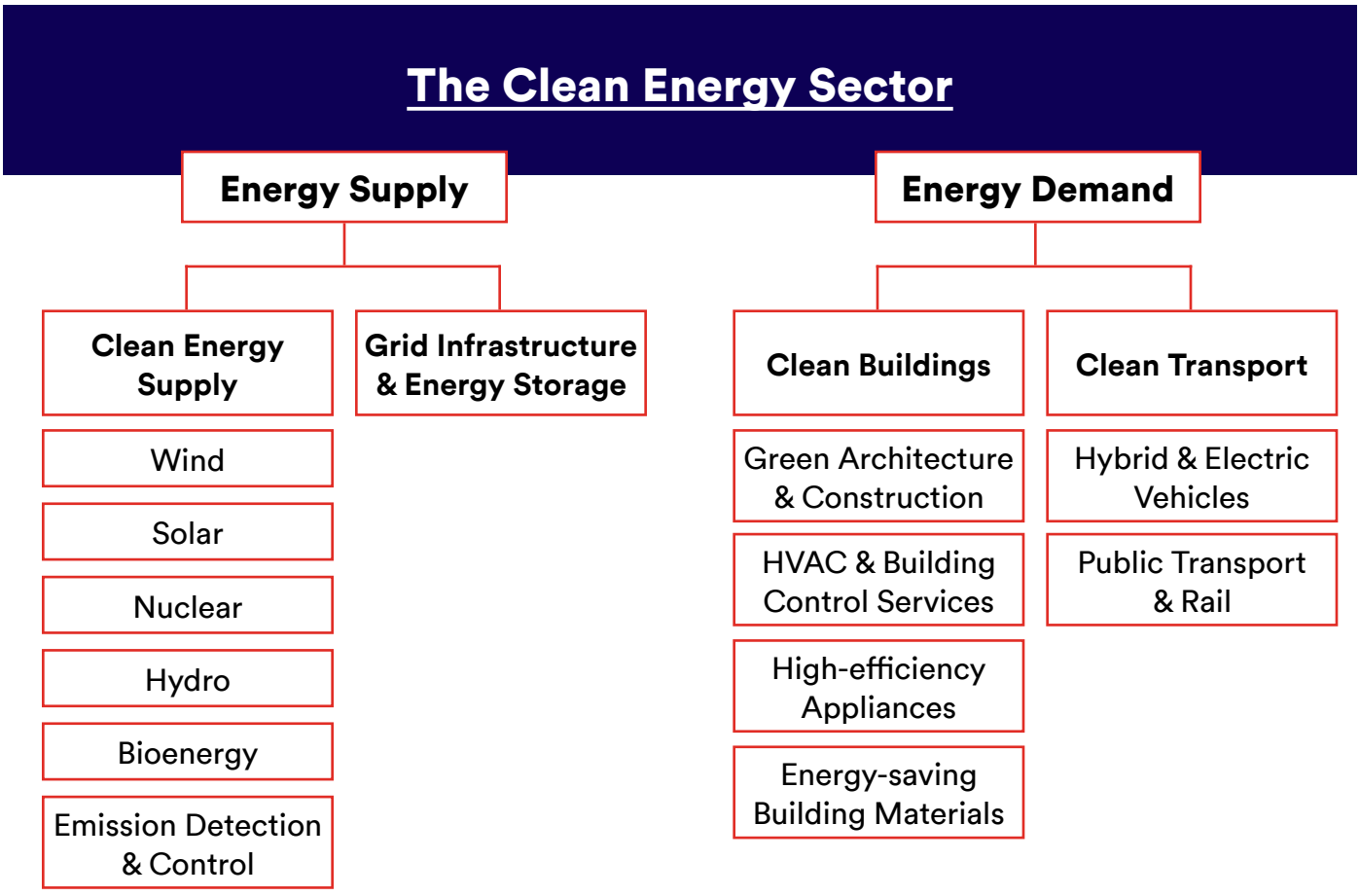
Excerpt from the **Durham Region Community Energy Plan**



Ontario Tech University Energy Systems and Nuclear Science Classroom

The Clean Energy Sector in Durham Region

Durham Region is in a unique position as it is home to the full spectrum of energy stakeholders; from generators to consumers. The well-established energy innovation cluster provides synergies that increase productivity, drive innovation, and stimulate new business.



As transitioning to clean energy becomes ever-more critical for all industries, our cluster will provide the region's business sectors with an increasing competitive advantage. Durham Region boasts all the key characteristics of a successful cluster; experienced talent, a collaborative ecosystem, a competitive business environment and opportunities for research and development.

With its broad supplier networks and resultant multiplier effect, energy innovation forms a wide ecosystem in Durham Region.

Select Companies in Durham Region's Energy Ecosystem

Generation	Utilities
CCI BioEnergy Ganaraska Wind Farm Clarington Ontario Power Generation Oshawa PUC Energy Services (OPUCES)/ Toronto Zoo	Elexicon Corporation Enbridge Hydro One Olco Petroleum Oshawa Public Utilities Corporation (OPUC)
Electric Vehicles (EV) and EV Infrastructure	**Post-Secondary Institutions**
Autonomous Vehicle Innovation Network (AVIN) Durham Region Transit General Motors Ontario Power Generation Ontario Tech University OPUC	Durham College Ontario Tech University Trent University Durham GTA
Globally recognized companies	
ABB Aecom Canada Areva NP Canada AZZ (previously Nuclear Logistics) Black & McDonald Canadian Nuclear Partners CANATOM (Nuclear Engineering) CALM Management Consulting Chemetics Durham Instruments En-Pro International ES Fox Framatome Canada	Ian Martin J.A. Plourde Performance Practicing Perfection Canada Quantum CNC Inc. RCM Technologies Canada Siemens SNC Lavalin Tetra Tech (Consulting and Engineering) Worley Parsons StonCor Group Canada TRC Limited UCC Industries International

Talent

A highly skilled and experienced workforce

Today the energy sector in Durham Region employs approximately 10,000 people permanently, directly and indirectly. As is the case globally, the talent supporting this industry requires technical education with concentration on science and engineering fields. The required skills in all disciplines within the sector are continuing to evolve, with continued investment in technology and automation.

A strong energy ecosystem requires a mixture of leading research talent as well as experienced senior-level talent. Durham Region boasts both; providing the required mix that organizations need.

Through significant investments of over twelve billion dollars in mega-projects with the Darlington Nuclear Refurbishment, experienced international talent has been attracted to the opportunities offered in the region. From technical nuclear specialists, engineers and information technology (IT) and project management professionals (PMP), the capital investment in the region has strengthened the depth of the workforce profile.

Post-Secondary Institutions: a talent pipeline

Durham Region's post-secondary institutions are focused on the next generation of talent in the energy sector, providing a strong pipeline of students from technical and engineering programs. Durham College and Ontario Tech University, both located in Durham Region, are promoting the development of innovative clean-energy solutions, as well as numerous other emerging technologies.

30% of Ontario Tech University's Research Grants for 2019-2020 were in Energy Systems, Nuclear Science and Engineering, and Applied Science.

Durham College and Ontario Tech University have extensive facilities that are dedicated to energy-sector research and development, preparing students for immediate entry into the workforce. As a result of Durham Region's cluster of Energy, Environment and Engineering businesses and local mega-projects, Durham College and Ontario Tech University have developed strong programs and partnerships with industry.

Building on over 10 years of collaboration, in 2016, Ontario Power Generation announced a further $5 million investment over five years to support capital expenditures, educational programs, equipment, scholarships, and bursaries for students at both institutions.

Durham College aims to solve business and social challenges, such as the need for clean energy, by focusing on innovative solutions and partnering with industry. As part of its commitment to addressing the growing need for highly skilled professionals who meet the market needs of the energy sector, Durham College's School of Applied Sciences, Apprenticeship, Skilled Trades & Technology offers several programs including Power Engineering Techniques, Energy Audit Techniques and Renewable Energy Technician.

Ontario Tech University is focused on energy as a strategic research and training priority. As a national leader in energy and sustainability research, their programs attract top students to study nuclear, mechanical, electrical and software engineering, materials science, chemistry and more. Ontario Tech offers Canada's first and only national accredited Bachelor of Engineering in Nuclear Engineering, and has a Faculty of Energy Systems and Nuclear Science in addition to its Engineering and Applied Science Faculty. Ontario Tech provides students with hands-on learning in partnership with industry. They are well-positioned to be the national leader in next-generation energy solutions, and to set standards for safe and efficient energy for the future.

Durham Region's post-secondary institutions feed the energy sector with highly-educated workers who have gained specialized technical knowledge, and who are well-prepared to contribute to clean-energy innovation.

Research and Development — Local Energy Innovation Resources

Durham College
Energy Innovation Centre (EIC)

The EIC employs clean, sustainable underground thermal energy for heating and cooling. It provides students with a unique living lab that offers both a self-guided learning experience and the chance to apply technical skills in renewable energy, environment technology, and instrumentation and controls for electrical technicians.

Simcoe Geothermal Field and Innovation Centre

The geothermal field at Durham College is part of an ongoing transformation of the College's energy infrastructure, supporting and implementing sustainability-focused initiatives on campus. Located underground, the geothermal field harnesses 550 tons (1.9 megawatts) of clean, sustainable geothermal power, which is then processed through the EIC and sent to campus buildings to fuel their energy needs. The system is one of the largest geothermal well fields in North America.

> We're very appreciative of our relationship with Durham College and proud that they chose Siemens as their partner to help make the geothermal field and Energy Innovation Centre a reality."
>
> **– Stephane Chayer**, vice-president of Smart Infrastructure, Siemens Canada

Siemens Canada is the primary contractor and industry partner for the EIC and the Simcoe Geothermal Field and Innovation Centre.

Ontario Tech University

The Clean Energy Research Laboratory (CERL)

CERL is equipped to conduct research in hydrogen production, heat engines, and nanotechnology. It is home to the world's first lab-scale demonstration of a copper-chlorine cycle for thermochemical water splitting and nuclear hydrogen production. The copper-chlorine cycle promises to achieve higher efficiencies, lower environmental impact, and lower costs of hydrogen production than any other existing technology. Hydrogen is a clean energy carrier of the future and potentially a major solution to the problem of climate change.

Energy Systems and Nuclear Science Research Centre (ERC)

ERC is a 9,290-square-metre facility that houses a unique-in-Canada education program and research in geothermal, hydraulic, hydrogen, natural gas, nuclear solar and wind energy technologies. The ERC enables leading-edge research in clean and green technology, and promotes Canada's entrepreneurial advantage through public-private research and commercialization partnerships.

Smart Grid

Ontario Tech is the site of a project demonstrating the commercialization potential for a smart microgrid concept. The project demonstrates a scalable emergency grid-tied islanded power application for hospitals, military bases, pharmaceutical manufacturing, and chemical processing plants. Research addresses wide-ranging energy topics such as bio-fuels, bio-based materials, hydrogen fuel cell technologies, energy storage, energy transmission, solar and wind energy generation, and energy management.

Nuclear Simulations Lab

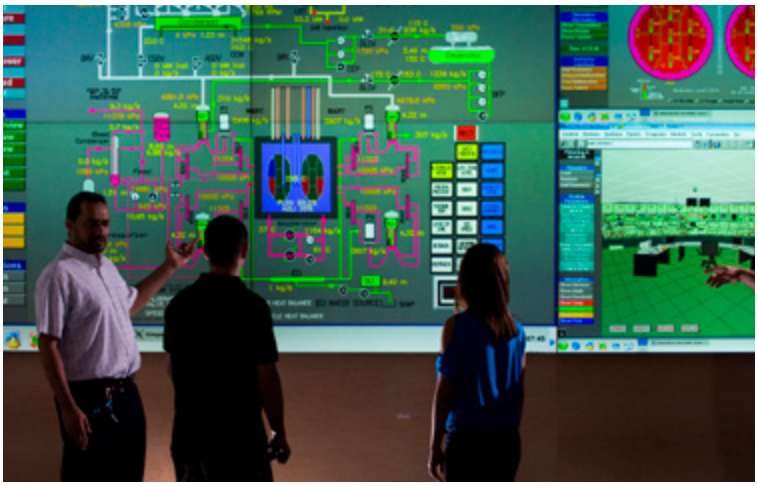
Ontario Tech University's Nuclear Engineering program features the most extensive nuclear power plant computer simulation of any engineering program in Ontario. The Nuclear Simulation Lab houses a state-of-the-art computer and display system for the operation and simulation of nuclear power plants. Students

receive instruction on a virtual CANDU 9 simulator, as well as learn how to use Ontario Power Generation's (OPG) only off-site full scope virtual simulator, designed for the Darlington nuclear-electric generating unit. The university also has the capability to develop software for advanced reactor designs within the lab.

Incubators and Accelerators

Spark Centre

Located in Downtown Oshawa, Spark Centre is one of 14 Regional Innovation Centres funded by the Province of Ontario. It assists maturing and start-up technology companies with issues such as scalability, growing a market, and internal organization.



1855 BDO Accelerator

1855 BDO Accelerator, located in Downtown Whitby, provides support for high-potential tech and innovation companies. Established as a strategic initiative funded by the Town of Whitby and the CEO of local tech industry leader 360Insights, 1855's vision is to accelerate growth and expand the innovation sector in Durham Region. 1855 Masterclass is a high-profile thought leadership series presented by 1855 in partnership with Invest Durham. The series features industry leaders—with proven track records of success in their areas of expertise—presenting defined strategies to achieve and drive growth.

Brilliant Catalyst

Brilliant Catalyst at Ontario Tech University offers support and space for entrepreneurship and innovation to students, recent alumni, faculty and industry. Recent projects include exploring energy independence, generation of new materials and catalysts, and artificial intelligence solutions to solving industry and community problems.

Government Investment in Innovation

The Government of Canada's multi-year plan to stimulate innovation includes investing in high-value emerging technological areas—such as clean energy—in the fight against climate change. The plan also involves helping companies scale-up to become globally competitive.

Both the Provincial and Federal governments are seeking to develop collaborative, community-based programs with local governments and the private sector. Durham Region has already reached this level of cooperation with the Ontario and Canadian governments, and local businesses have been avid supporters. Durham Region is eager for new initiatives, and constantly advocates for maximum funding of environmentally beneficial endeavors.

Spotlight: Nuclear Energy

Durham Region at the centre of it all

As the world faces the reality of a rapidly changing climate, nuclear power is essential in the fight against climate change because of its ability to produce large amounts of low-cost power safely, reliably, and virtually without carbon emissions.

Canada's nuclear industry—the seventh largest in the world—is located primarily in Ontario and the national nuclear-industry association, the Organization of Canadian Nuclear Industries, is headquartered in Durham Region.

The epicenter for Ontario's nuclear power generation is Ontario Power Generation's operations in Durham Region. As a result of the two major facilities in the area, Durham Region has been a leader in the safe use of nuclear energy as an alternative to fossil fuels, and significant investments in nuclear technology are continuing to be made. This investment greatly benefits both the Regional and Provincial economy, and environment.

In 2014, the Province of Ontario was able to close numerous fossil-fueled power stations because it had the nuclear capabilities available to handle the base load.

Durham Region's two nuclear-generating stations provide more than 30% of Ontario's power needs.

OPG's facilities are renowned for safe, effective operations. The Pickering B Unit 7 reactor holds the world record for the longest, non-stop operation at 894 days, and in 2016, Darlington was named by The World Association of Nuclear Operators as one of the safest and top-performing nuclear stations in the world—for the third time in a row.

Four units at the OPG Darlington facility are undergoing a major $12.8 billion refurbishment that is expected to result in $14.9 billion in economic benefit, including thousands of construction jobs at Darlington and about 60 Ontario-based component suppliers. The project, which will provide 30 more years of baseload power, is scheduled for completion by 2026.

After years of efficient service, the Pickering Nuclear GS will end commercial operations in 2024. Decommissioning begins in 2028. With an increasing number of nuclear facilities being decommissioned throughout the world, the engineering and technical experience and expertise gained during the Pickering shutdown will be valuable internationally.

Small modular reactors (SMRs) — Clean, safe and affordable energy

SMRs are seen as part of the energy innovation required to combat global climate change and meet emissions targets. Canada has an opportunity to become a world leader and desired partner in this area of energy innovation – with organizations in Durham Region leading the way. In a Global Market with an estimated value of over $150B (by 2040), Durham Region has the existing strengths to capitalize on the related jobs, intellectual property and supply chains associated with SMRs. This technology could help the whole country deliver on climate change and clean energy commitments.

Nuclear medicine uses radiation to sterilize, provide diagnostic information and for treatment.

OPG also brings benefits across the world as a supplier of heavy water, Cobalt-60 and tritium. These stable and radioactive isotopes are key components in medical application, sterilization and fusion research. About 40% of the world's single-use medical devices (syringes, gloves, implants and surgical instruments) are irradiated and sterilized with Cobalt-60. OPG will soon begin to harvest Molybdenum-99 (Molly99). This isotope is used in over 30 million diagnostic and medical imaging treatments around the world each year, helping to detect illnesses like cancer and heart disease.

The Centre will: advance solutions for nuclear materials with a continuing emphasis on minimizing its environmental footprint...

Centre for Canadian Nuclear Sustainability

In 2020, OPG has launched the Centre for Canadian Nuclear Sustainability in Pickering. With participation from the wider industry, this world-class facility will operate as a hub to leverage and coordinate Ontario's vast talents and competencies to make Canada a world leader in nuclear decommissioning.

The Centre will:

- Advance solutions for nuclear materials with a continuing emphasis on minimizing its environmental footprint.
- Create economic growth in Ontario and a significant number of highly skilled jobs over the next several years.
- Mobilize Ontario's strong nuclear supply chain to develop tooling required for nuclear decommissioning.
- Collaborate by forming partnerships with the industry, community, local businesses, academia, Indigenous communities and global entities to discover research, development and export opportunities for innovative nuclear energy solutions.

The Centre for Canadian Nuclear Sustainability has recently announced an innovative collaboration between Laurentis Energy Partners and BWXT Canada Ltd to develop technology that will assist in the recycling of heavy water at OPGs nuclear facilities. Once recycled, the heavy water will be utilized in a growing number of non-nuclear applications that include pharmaceuticals, medical diagnostics and next generation electronics including fibre optics.

Ontario Power Generation Corporate Centre Investment

OPG has announced plans to locate their corporate centre in the City of Oshawa. The project is scheduled for completion in 2024. The building will house OPG's corporate headquarters, bringing more than 2,000 jobs to Durham Region.

Clean Energy Excellence

OPG is one of the most diverse electricity generators in North America, using mostly nuclear and hydropower to generate electricity, but also biomass, gas, and solar.

"OPG's investment will help to ensure that our region remains a focal point for clean energy excellence and innovation for decades"

– John Henry, Regional Chair and Chief Executive Officer

X-Lab – Innovation at OPG

From virtual-reality headsets to specialized glasses that deliver real-time information, innovation is happening in the OPG X-Lab at the Pickering generating station. This special division is tapping into modern technologies to improve training and make work processes more efficient across operations.

In one initiative, the X-Lab team is experimenting with augmented reality via Google Glass and Microsoft HoloLens smart-glasses. The technology can communicate and deliver real-time information, such as alerts about increasing radiation levels in a work environment. The vision is to have these glasses eventually replace physical manuals, diagrams, and written procedures for production staff at the plant. The HoloLens can even overlay dynamic 3D images—for instance, a cutaway of a pump or valve that can be examined and manipulated in a 360-degree environment.

At 350,000 sq. ft., OPG's training facility is one of the largest in the world and features a full-scale reactor mock up!

Other innovative X-Lab ideas include software that automates certain plant tasks and a phone app that can gauge components' battery life.

What's next for Energy Innovation in Durham Region

The energy industry is in the midst of disruption across all stages of the value chain—from generation to consumers.

With disruption comes opportunities.

In Durham Region, the energy, environment and engineering sectors, and the existing energy cluster are rapidly capitalizing on these opportunities. New entrants are emerging and new technologies and new skills are driving transformation within the sector and across related industries including technology and transportation.

Collaboration between industry, post-secondary institutions, government, and innovation centres, alongside a robust talent pipeline, positions Durham Region to be at the forefront of energy innovation in Canada, and the world.

An opportunity to join this innovation community awaits your business in Durham Region.

Contact our team to share in our optimism about what we'll do next.

Invest Durham

Economic Development and Tourism
605 Rossland Road East, Level 5
Whitby, Ontario, Canada L1N 6A3

Telephone: +1 905-668-7711
investdurham@durham.ca

Durham Region, Ontario, Canada

InvestDurham.ca

If this information is required in an accessible format, please contact Economic Development & Tourism at 1-800-706-9857, ext. 2619.