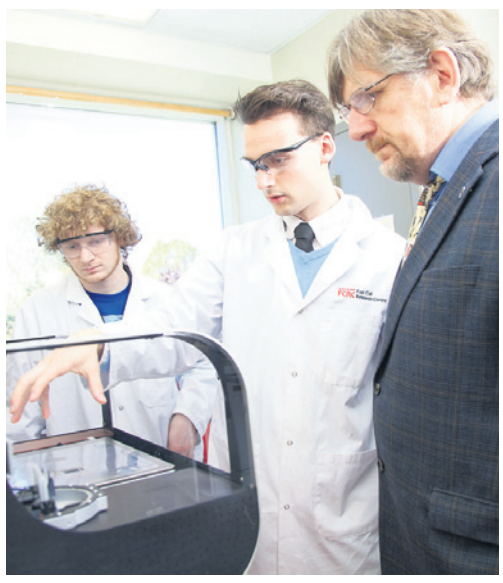
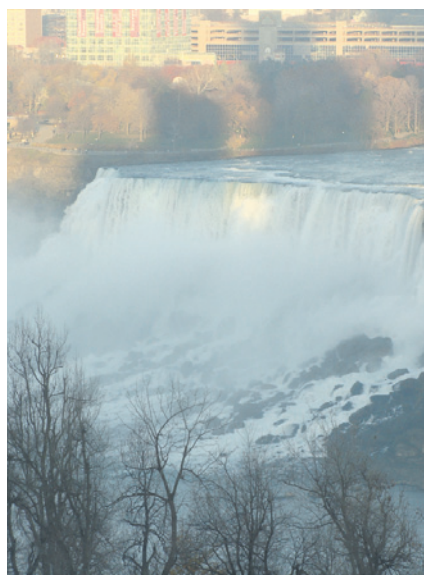
EXCELLENCE IN ENGINEERING

THE 2015 ONTARIO PROFESSIONAL ENGINEERS AWARDS GALA





Ontario's engineers are exploring ways to shift to energy sources that don't rely on carbon-based fuels. Left: Dr. Brant Peppley, of Queen's University, has led the five-year Energy Storage and Recovery Ontario initiative, which has made significant advances in fuel cell technology. Centre: At a custom-built house in Ottawa, Dr. Ian Beausoleil-Morrison of Carleton University and his team are testing innovations in solar energy and other zero-carbon technologies. Right: Improving our existing low-carbon energy sources, like hydro power, is a focus of the work of Dr. Bryan Karney of the University of Toronto. SUPPLIED

The shift to a low-carbon economy

By 2050, Ontario aims to reduce carbon emissions by

80%

below 1990 levels.

It's an ambitious target that will require radical technological change.

To get there, Ontario's engineers are bringing their technical expertise and problem-solving skills to the design of new technologies and processes that will allow us to shift away from high-carbon fossil fuels to low- or no-carbon alternatives.

DOING AWAY WITH THE FURNACE

Over the past three decades, we've made housing more energy efficient through stringent building codes and improving the efficiency of windows and furnaces. "These are positive steps," says Dr. Ian Beausoleil-Morrison, "but they are incremental. We're increasing efficiency by a few percentage points at a time, but if we are serious about tackling climate change, we can't tweak the furnace, we need to get rid of the furnace entirely."

Achieving this in Canada's northern climate, however, will require a rethinking of what is possible, says the Canada Research Chair and professor at Carleton's Faculty of Engineering and Design.

Dr. Beausoleil-Morrison is the project lead for the newly built Urbandale Centre for Home Energy Research, a custom-built 1,600-square-foot two-storey house at Carleton that is providing opportunities to test innovations in solar energy and explore other zero-carbon technologies.

One project is looking into seasonal thermal storage – finding a way to store the energy collected by the house's solar panels during the summer so that it can be used during an Ottawa winter, when the temperature is in the minus 20s and sunlight is in short supply.

What is basically a large and heavily insulated sandbox might provide a solution. "In the summer, we can heat the wet sand up to 80 degrees and store that energy, so that in winter we can draw the energy back out to supply the home's hot water and heating needs."

Dr. Beausoleil-Morrison adds that moving towards renewable energy and away from fossil fuels is far more than just an engineering challenge to be solved. "Engineering is a big part of the solution, but we also need to change public policy and shift our overall mindset."

FINDING NEW WAYS TO STORE AND RECOVER ENERGY

"Renewable energy is great – except when the wind is not blowing or the sun is not shining," says Dr. Brant Peppley, a professor in the departments of chemical engineering and mechanical and materials engineering at Queen's.

"If you can store water, you can store energy. I'm working on many projects to improve the efficiency of our hydro resources because it will allow us to add more high-quality wind and solar into the system."

Dr. Bryan Karney
is a professor in the department of civil engineering and associate dean of cross-disciplinary programs at the University of Toronto

Dr. Peppley has spent the past five years as the project lead of Energy Storage and Recovery Ontario (ESARO), a $5-million initiative funded by the provincial government and supported by eight companies, including two focused on fuel cells. ESARO's researchers are investigating ways to store excess renewable energy and dispatch it when needed – doing so with a minimal or zero-carbon footprint.

Much of Dr. Peppley's work has focused on developing energy storage solutions that take the excess electricity generated by wind power and converting it into hydrogen. Dr. Peppley is looking at ways to improve the efficiency of these polymer electrolysis systems by developing new alloys and catalysts.

"We're trying to overcome some of the barriers that are slowing the commercialization of these technologies so that they can last longer and be more stable, easier to manufacture and less expensive."

Hydrogenics, a Mississauga-based company that has partnered with ESARO, is already deploying this technology on a large scale, and partnerships with other companies, including Ballard and General Motors, are also generating innovative ways to store energy and retrieve it with a minimal carbon footprint.

IMPROVING EFFICIENCIES OF BACKUP ENERGY SOURCES

Dr. Bryan Karney, a professor in the department of civil engineering and associate dean of cross-disciplinary programs at the University of Toronto, is also seeking solutions that will allow for a greater reliance on renewable energy sources.

"As we put in more supplies of renewable energy, we also need to ensure the quality and reliability of the electrical grid," he notes. Rather than relying on backup generating capacity that uses fossil fuels, Dr. Karney thinks we can get the backup power we need by using hydro resources more strategically.

"If you can store water, you can store energy," he says. "I'm working on many projects to improve the efficiency of our hydro resources because it will allow us to add more high-quality wind and solar into the system."

Some of his recent work has involved pursuing ways to "ease some of the constraints" of the Niagara River system. "This complex already plays a strategic role in stabilizing the province's electrical grid – we think it may be possible that it can do even better."

TECHNOLOGY IS ONE PIECE OF THE PUZZLE

The challenges of climate change and the shifts that will be required to transform our economy away from a reliance on fossil fuels are not to be underestimated. But what the work of these Ontario engineers shows is that the drive to innovate – to improve existing technologies or create new ones – can ultimately bring about the solutions we need to create a more sustainable future.

ABOUT

2015 ONTARIO PROFESSIONAL ENGINEERS AWARDS GALA

Since 1947, the Ontario Professional Engineers Awards have recognized professional engineers in Ontario who have made outstanding contributions to their profession and their community. Professional Engineers Ontario and the Ontario Society of Professional Engineers are proud to co-host the awards gala in celebration of the very best of engineering. This year's gala will feature keynote speaker Glen Murray, Ontario minister of the environment and climate change. Awards will be presented for excellence in engineering innovation, leadership and entrepreneurship.

For more information, please visit www.ospe.on.ca/opea.

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POLICY

Minister of Environment says new solutions needed to mitigate climate change

Ontario minister Glen Murray took engineering courses in university, even though he was a liberal arts student and couldn't get credit for these subjects. He had two reasons: engineering fascinated him and he believed then, as he does now, that engineering should be part of a liberal arts degree.

"I really do think we should teach engineering in undergraduate education," says Mr. Murray, who took on the province's environment and climate change portfolio last year. "Liberal arts and science and engineering should be in the same place."

Mr. Murray, who majored in urban studies at Montreal's Concordia University, has put his building and engineering knowledge to good use over the years: in his posts as Ontario minister of research and innovation, transportation and infrastructure, and in his earlier, private sector roles as managing partner at a Toronto urban sustainability consulting firm, and as senior resident and visiting fellow at the University of Toronto's Faculty of Architecture and Landscape Design.

Today, as the provincial minister responsible for the environment, Mr. Murray sees engineering – and the practitioners of the discipline – as a vital part of the solution to the challenges of climate change and **Murray, Page OPEA 4**

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St. Lawrence Seaway Management Corporation • University of Toronto – Engineering • University of Toronto – University Advancement • Western Engineering

ONTARIO PROFESSIONAL ENGINEERS AWARDS

REGULATION AND ADVOCACY

One profession, two professional organizations

The work of Professional Engineers Ontario (PEO) and the Ontario Society of Professional Engineers (OSPE) is complementary, regulating and advancing the profession in Ontario.

Through the Professional Engineers Act, PEO governs licence and certificate holders and regulates professional engineering in Ontario to serve and protect the public.

Established on June 14, 1922, PEO is the licensing and regulating body for engineering in the province. It fulfills the same role for engineers as the College of Physicians and Surgeons for doctors or the Law Society of Upper Canada for lawyers.

OSPE is the voice of the engineering profession in Ontario. OSPE raises awareness of the role of engineers in society and influences public policy that affects the profession. OSPE was formed in 2000 after members of PEO voted to separate regulatory and member-interest functions into two distinct organizations.

Although OSPE and PEO have separate mandates, there are a number of initiatives where the two organizations collaborate to ensure Ontario engineers are celebrated and that engineering work is done by qualified engineering licence holders.

This past June, OSPE and PEO formed a joint team in the Big Bike Ride for Heart to raise money for the Heart and Stroke Foundation. The team was one of the top 20 fundraisers in the province. SUPPLIED

Both organizations work together through many of the local PEO chapters hosting joint events, seminars and engineering competitions across Ontario. Every November, OSPE and PEO host the Ontario Professional Engineers Awards to celebrate the accomplishments of the profession's best and brightest.

OSPE and PEO also work closely together at the head office level. For example, in May 2015, OSPE, PEO and Consulting Engineers of Ontario met with officials from the Ministry of Economic Development, Employment and Infrastructure to present a united front on the omission of professional engineers from Bill 6 – the *Infrastructure for Jobs and Prosperity Act*. PEO and OSPE issued a joint submission to the Standing Committee on General Government to ensure the new legislation defines the role of a Professional Engineer in the Act.

CLIMATE CHANGE

OSPE ADVOCATES THE MERITS OF A CAP-AND-TRADE SYSTEM

In September 2015, OSPE released *Engineering a Cleaner Economy: Examining Ontario's Carbon Pricing Program and the Role of Innovation* and included the following recommendations to government:

1. Decarbonization to the extent proposed by the Ontario government (reduce emissions by 15% below 1990 levels by 2020, 37% by 2030, and 80% by 2050) will require a huge amount of technological innovation and a coordinated, enduring approach to technology policies and research and innovation.
2. Engineers must be involved in the design and maintenance of this technology.
3. Cap-and-trade must be implemented in a way that does not cause economic hardship for energy-intensive and trade-exposed industries.
4. Ontario must follow the lead of other jurisdictions and take proactive measures to mitigate the financial impacts felt by individual households.
5. Revenue from the program must be re-invested in sustainable infrastructure and research and development of green technologies. Early estimates suggest that Ontario could generate between $1.5-billion and $2-billion annually from cap-and-trade auction revenues by 2020.
6. Research and development grants and policies should recognize and support individuals and small companies for pilot projects and new inventions in addition to support for well-established firms.

INNOVATION

Removing roadblocks to sustainable transportation

Dr. Sheldon Williamson is working to reduce some of the barriers that are preventing the widespread adoption of electric vehicles. One of the biggest roadblocks is vehicle range, says the associate professor in the Faculty of Engineering and Applied Science at the University of Ontario Institute of Technology (UOIT).

To address this, he and his colleagues are investigating ways to extend vehicle range by improving the energy management of battery packs using advanced power electronics. "Through our innovations with power electric converters we are currently able to extend the range of an electric car from 150 kilometres on a single charge to more than 200 kilometres, at the same cost."

Increasing a vehicle's driving range is one side of the equation; the other is finding more efficient ways to charge vehicles, including strategies that don't involve plugging in an electrical cord. Dr. Williamson is collaborating with industry partners to develop lightning-fast wireless charging systems that can charge fleets of electric vehicles, such as those used on campuses, and he's also exploring wireless charging for mass transit vehicles.

State of the art laboratories in UOIT's Faculty of Engineering and Applied Science give students a competitive edge when entering the job market. SUPPLIED

However, when looking at the net impact of electrified transport, it's important to consider the source of the electricity. An electric vehicle powered by electricity generated from a coal-burning power plant has a lower carbon footprint than a conventional vehicle, but it still has an impact. With this in mind, Dr. Williamson and his students are looking at ways to charge electric vehicles using energy collected by solar panels connected to a smart microgrid on the university's campus.

Dr. Williamson says that providing opportunities for students to investigate these issues is critical. The UOIT Faculty of Engineering and Applied Science's research in the area of sustainability is led by a globally recognized faculty who have strong partnerships with both government and industry. State-of-the-art teaching and research facilities, such as the Clean Energy Research Lab and the Automotive Centre of Excellence, play an important role in developing innovative ideas into real-world solutions. The electrical engineering specialization in smart grid and mechanical engineering specialization in energy are also excellent avenues to develop the engineers our society needs as we shift away from a carbon-based economy.

"In my field, there is a desperate need for engineers to develop solutions for sustainable transport," says Dr. Williamson. "The research happening in our Faculty can provide the expertise and remove some of the roadblocks that are preventing the widespread commercialization of electric vehicles."

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ONTARIO SOCIETY OF PROFESSIONAL ENGINEERS

Professional Engineers Ontario

WATER MANAGEMENT

Smartening up our infrastructure

In Essex County, Dr. Rupp Carriveau is working with stakeholders, including greenhouses and the water utility, to make water distribution smarter – which will bring positive impacts in terms of energy use and operating efficiency. SUPPLIED

"It's fair to say that water distribution, like electricity distribution, has historically been quite 'dumb,'" says Dr. Rupp Carriveau, a professor of civil and environmental engineering at the University of Windsor. "If there's a leak in the water system, you often only know about it if someone is flooded out."

Through his work with the Essex Region Smart Water Project, he's searching for ways to smarten up the system with sensors that monitor pressure loss and collect data that can be used to make more informed water management decisions.

Ontario's Essex County has the highest concentration of greenhouses in North America, and, in 2012, it accounted for 80 per cent of the province's greenhouse vegetable production, valued at $660-million. These greenhouses also account for more than three-quarters of the area's water use, which has raised questions as to whether the industry can expand further without negatively impacting water availability or water pressure for the region's other residential, commercial, industrial and agricultural customers.

Through the Essex Region Smart Water Project, Dr. Carriveau is installing sensors in greenhouses to monitor pressure and flow loss, which will enable him to build a model that incorporates historic trends and real-time data.

"This model will allow us to recognize patterns in real time and be predictive about demand requirements," he says. "We can see how a greenhouse growing cucumbers pulls water compared to one growing tomatoes, and we can predict the impact of other factors like sunshine and temperature. In practical terms, this means we are able to build a demand curve that the utility can follow to be more strategic in its planning."

The current data shows that unlike earlier predictions that greenhouse growers were close to being "capped out waterwise," the water was simply being allocated inefficiently. The utility will be able to use Dr. Carriveau's work to better align water supply and demand.

His experience on this project exemplifies the unique strengths that university-based research engineers bring to complex, multi-stakeholder projects. "As an unbiased third party, we're able to go in and see the challenges. We were then able to bring together the municipalities, water supplier and greenhouse growers, and that allowed important conversations to occur."

EDUCATION

Research institute seeks innovative solutions to urban challenges

Bringing together multiple stakeholders and points of view is a priority for Dr. Arnold Yuan, professor of civil engineering at Ryerson University. As director of the Ryerson Institute for Infrastructure Innovation (RIII), Dr. Yuan leads a multidisciplinary group of researchers who are seeking ways to improve the water, transportation, wastewater and energy infrastructure in our cities.

"The broad scope of our work addresses the four qualities that need to be integrated into our built environment – sustainability, intelligence, resilience and flexibility.

"We brought in very strong data analysis and empirical evidence to show that P3s have an advantage in managing residual value risk."

Dr. Arnold Yuan
is a professor of civil engineering at Ryerson University

In its first year of operation, RIII completed two projects for PPP Canada that assessed the engineering innovations and economic risk of projects funded through public-private partnerships (P3s).

The first project compared the engineering innovations incorporated into P3-funded projects to those funded through traditional mechanisms and identified the factors that need to be in place to allow for innovative approaches.

"Overall, the Canadian P3 market takes a very positive view on the track record on the use of innovations in P3s," says Dr. Yuan. "But we have identified areas where it can be done better."

The second project analyzed the residual value risk of P3 projects – the risk that the asset does not have the value originally expected. "We brought in very strong data analysis and empirical evidence to show that P3s have an advantage in managing residual value risk," he says. "This finding is an important consideration when planning large infrastructure projects and affirms that P3s offer value for money."

These are still early days for the Institute, but Dr. Yuan sees many opportunities to bring together researchers from multiple disciplines to collaborate on initiatives that address the complex and interconnected challenges of our urban environments.

ONTARIO PROFESSIONAL ENGINEERS AWARDS

2015 OPEA recipients embody the varied qualities

The Ontario Professional Engineers Awards celebrate the wide-ranging accomplishments of our province's engineers. The Awards recognize engineers' contributions to the well-being of the profession, and honour their commitment to innovation and excellence. Congratulations!

CRISTINA AMON
Sc.D., P.Eng., FAAAS, FASEE, FASME, FCAE, FCSME, FEIC, FIEEE, FRSC, NAE
Dean, Faculty of Applied Science & Engineering, University of Toronto
Alumni Professor in Bioengineering, Department of Mechanical & Industrial Engineering

GOLD MEDAL

Dr. Amon is a pioneer in developing computational fluid dynamics to formulate thermal designs subject to multidisciplinary constraints and an engineering leader of exceptional research and leadership accomplishments.

She joined U of T's Faculty of Applied Science & Engineering as Dean in 2006. Under her leadership, the faculty is globally recognized for interdisciplinary research and education and has achieved record scholarly awards, research funding and industry partnerships.

Dr. Amon is widely known for her initiatives to promote diversity and inclusion, including co-founding the Society of Women Engineers workshop for female and minority high school students and the Skule Sisters program, connecting female high school students with current female U of T engineering students.

Through her research, Dr. Amon addresses thermal transport in nanoscale semiconductors, energy systems and biomedical devices. She is internationally acclaimed for her contributions to engineering education, concurrent thermal designs, electronics cooling and transient thermal management of wearable computers. She has authored over 350 articles and in 2012 was named among Canada's Top 25 Women of Influence.

MICHAEL A. BUTT
P.Eng.
Chairman and CEO, Buttcon Limited

ENGINEERING MEDAL – MANAGEMENT

Since starting his first company as an undergraduate, Michael Butt has worked for over 50 years in the construction industry, building his own companies while continuously championing change and innovation within the profession.

As a managing director with Mitchell Construction Canada, Mr. Butt worked in Barbados, where he introduced Canadian materials and construction methods; following a transfer to Johannesburg, South Africa, he spearheaded the use of table forms to revolutionize building timelines.

In 1979, he started Buttcon Limited, a 100 per cent employee-owned Canadian general contractor; clients and employees attribute the company's success to Mr. Butt's commitment to outstanding management practices. The company has completed high-profile projects that include restoring Queen's Park and converting Maple Leaf Gardens into a multipurpose facility. It is currently restoring St. Michael's Cathedral in Toronto.

Mr. Butt's dedication to outstanding management practice and engineering excellence was particularly evident when, as elected chair of the board of directors of the Greater Toronto Airports Authority, he oversaw the $4.4-billion expansion of Toronto Pearson International Airport, one of the largest infrastructure projects in Canada, on time and on budget.

ANDREW DAUGULIS
M.E.Sc., Ph.D., P.Eng.
Professor of Chemical Engineering and Research Chair, Biochemical and Cell Culture Engineering, Queen's University

ENGINEERING MEDAL – RESEARCH & DEVELOPMENT

Dr. Daugulis's pioneering research has changed the way microbial cells are cultivated in toxic environments, transforming long-used chemical processes into environmentally sustainable biological ones. A technology platform known as two-phase partitioning bioreactors (TPPBs) is based on Dr. Daugulis's work. TPPBs eliminate the toxicity associated with the accumulation of valuable bioproducts within fermentation systems, a long-sought-after objective applicable across many industrial processes.

His research in ethanol extractive fermentation has enabled more efficient production of ethanol; this work has gained worldwide attention and commercial interest, and led to the development of patented technologies that have been licensed to U.S. and Canadian companies.

He has consistently demonstrated the versatility of TPPBs to provide clean, innovative and efficient technologies in removing pollutants. With more than 200 peer-reviewed articles published in top-ranked international journals, Dr. Daugulis has helped transfer TPPB technology and supporting concepts into industry, ensuring this class of green process technologies receives serious consideration from industrial manufacturers.

SETH DWORKIN
M.Sc., M.Phil., Ph.D., P.Eng.
Associate Professor, Mechanical and Industrial Engineering, Ryerson University

ENGINEERING MEDAL – YOUNG ENGINEER

Although still early in his career, Dr. Dworkin is an established leader in high-performance computation of combustion, with his research cited as some of the most rigorous science published on the formation and oxidation of soot.

He has been at the top of his field since graduating summa cum laude and first in his class from McMaster University. He completed both his master's and PhD at Yale University and then completed a postdoctoral fellowship at the University of Toronto, where he continued to make major research achievements in computational combustion.

In 2015, Dr. Dworkin was granted tenure and promoted to associate professor of mechanical and industrial engineering at Ryerson University. With his team at Ryerson, he uses state-of-the-art, high-performance computing techniques to simulate combustion systems and the pollutants they emit, and numerical analysis to solve problems related to Canadian industry and the global environment.

His group has developed novel numerical algorithms to lower the cost of implementing ground source heat pumps (GSHP). Dr. Dworkin's start-up company, HGS, provides software tools and performs computations for improved GSHP designs.

M. HESHAM EL NAGGAR
M.E.Sc., Ph.D., P.Eng., FASCE, FEIC
Associate Dean of Research, Faculty of Engineering & Research Director, Geotechnical Research Centre, Western University

ENGINEERING MEDAL – RESEARCH & DEVELOPMENT

A leading authority on soil dynamics, machine vibrations and foundations, and earthquake engineering, Dr. El Naggar is internationally respected for his development of non-linear computer modelling and carefully designed and executed experimental modelling and full-scale testing. His findings have been successfully transferred to industry and incorporated into national design guidelines and international codes.

He was the lead developer and co-author of the DYNA6 computer program that calculates and analyzes the response and design of foundations subjected to dynamic loading; the software is used by more than 200 organizations worldwide. He also developed a fast and economical approach to predict the bearing capacity of piles.

Dr. El Naggar helped Western secure more than $2.3-million in NSERC Engage Funds to collaborate with industry, has published more than 350 technical papers and taught more than 100 courses. He has consulted on many challenging projects, including Synchrotron in Saskatoon, the Dupont facility in Kingston, and petrochemical and cement plants throughout North America, Europe, Asia and the Middle East.

BY THE NUMBERS

0.8°C
Increase in global temperature since 1880

650,000
CO_2 levels at their highest in 650,000 years

13.3%
shrinkage in Arctic sea ice in the last decade

178 mm
Rise in sea level over past 100 years

Source: NASA

FROM OPEA 1

Murray: Engineers' expertise crucial

sustainability.

"Every area of engineering, from computer science to civil engineering, is critical to our efforts to mitigate the effects of climate change," he says.

Quick deployment of technology and processes that can lessen the impact of climate change is key, says Mr. Murray, who will be the keynote speaker at the Ontario Professional Engineers Awards gala, scheduled for November 21 in Toronto.

These solutions run the gamut, from replacing energy-guzzling engines with technology that runs on hydrogen and other clean fuels, to ecological services designed to reduce "heat bubbles" in cities.

"We need engineers who are literate about biology and germination systems," says Mr. Murray. "Because green technology deployment can't be just about green roofs and energy-efficient heating systems."

Mr. Murray says the province has a long history of working with members of the Ontario Society of Professional Engineers and the Professional Engineers of Ontario. As a recent example, he points to Bill 66, the proposed *Great Lakes Protection Act* to protect and restore the Great Lakes - St. Lawrence River Basin.

Mr. Glen Murray says engineers will play a crucial role in efforts to mitigate climate change. SUPPLIED

"This brought together different professions and disciplines, including the engineers who looked at things like the standards of emissions of ships to water treatment plants," says Mr. Murray.

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Professional Engineers Ontario

WILLIAM GOODINGS
P.Eng.
(Retired)

CITIZENSHIP AWARD

Mr. Goodings volunteered from 2002-2010 with the Canadian Executive Service Organization (CESO) – a Canadian volunteer-based international development charity – following over 50 successful years as a civil engineer and leading authority on solid waste management. With CESO, Mr. Goodings and his wife June carried out assignments in the Philippines, Bolivia, Honduras and Sri Lanka, helping thousands of people in 16 towns and villages.

On his first assignment in the Philippines, Mr. Goodings developed a simple, inexpensive and innovative waste management technique that resulted in mature black compost that was used in vegetable gardens by the people who lived on or near the dump. This technique helped the community recycle almost 90 per cent of its municipal solid waste. His solution was subsequently introduced to 15 additional communities.

Mr. Goodings was also a devoted volunteer prior to retirement, both within his community and for his profession. As a member of the Corporate Fundraising Sub-Committee for the Ontario Professional Engineers Foundation for Education, he solicited donors to help the Foundation increase the size and frequency of its university undergrad student scholarships to benefit tomorrow's engineers.

BRIAN ISHERWOOD
P.Eng., MICE, FCSE
Founder, Isherwood Geostructural Engineers

ENGINEERING MEDAL – ENGINEERING EXCELLENCE

For over 40 years, Brian Isherwood has had a significant impact on the excavation and underground industry in Ontario, pioneering the field of geostructural engineering.

Since founding Brian Isherwood and Associates (now Isherwood Geostructural Engineers) in 1972, Mr. Isherwood's ability to find solutions in deep excavations, often in extremely difficult ground conditions, has changed the construction landscape in the Toronto area. His firm has completed the excavation shoring, underpinning and foundations of prominent structures that include the CN Tower, Rogers Centre and Toronto Pearson International Airport.

In the 1990s, his firm designed cut-and-cover tunnels for the Sheppard Line and cut-and-cover tail tracks, launch and exit shafts for the tunnel boring machines; 15 years later, he is once again working on the newest extensions to the subway system, a testament to the quality of his work.

Mr. Isherwood provided the shoring design for Living Shangri-La, a hotel and condominium tower 26 metres deep, as well as shaft designs for the Billy Bishop Pedestrian Tunnel, which, at 30 metres deep, was one of the deepest excavations adjacent to Lake Ontario.

CLAIRE M.C. KENNEDY
P.Eng., LL.B.
Partner, Bennett Jones LLP

CITIZENSHIP AWARD

One of Canada's leading tax lawyers, Ms. Kennedy has also distinguished herself as an extraordinary volunteer and leader in the engineering community. After obtaining her P.Eng. designation in 1991, Ms. Kennedy shifted her focus and obtained a law degree. Now a partner at a major Canadian law firm, she still holds strong ties to the engineering community through her numerous volunteer efforts.

At the University of Toronto she has served as president of the Engineering Alumni Association and founder and chair of its successful outreach program, BizSkule, a networking and C-suite speaker series. She has raised funds for U of T's Department of Chemical Engineering and Applied Chemistry, personally raising more than $20,000 for a micronutrient project to aid developing countries. In 2013, Ms. Kennedy was appointed to U of T's Governing Council, where she also serves on the Business Board and on the Executive and Elections Committees and as Chair of the Pension Committee.

Ms. Kennedy is a past board member of, and current pro bono legal counsel for, Wildlife Preservation Canada, and she serves as pro bono counsel to SunFarmer, a non-profit organization that brings affordable and reliable electricity to developing markets.

SUSHANTA KUMAR MITRA
Ph.D., P.Eng., FCSME, FASME, FEIC, FRSC (UK)
Associate Vice-President Research, York University

ENGINEERING MEDAL – ENGINEERING EXCELLENCE

Dr. Mitra's wide-ranging research achievements include developing a method to detect E. coli in contaminated water within two to 60 minutes based on the level of contamination, a ground-breaking engineering feat. This field-deployable water quality monitor sensor, the Mobile Water Kit, detects the presence of E. coli through visual colour change on the filter surface. Dr. Mitra also developed mechanisms to detect a biomolecule that helps identify vector-borne diseases like listeriosis and dengue.

In the energy field, Dr. Mitra pioneered a technique that provides a better understanding of the oil-recovery process. Called Reservoir-on-a-Chip (ROC), the technology maps pores in dense minerals and creates a micro-scale replica so researchers can see how oil is transported through the tiny pores.

Over the past six years, Dr. Mitra has attracted more than $20-million in external funding for his work. He has also helped bridge engineering education between Canada and India as a founding member of the Canada-India Research Centre of Excellence, and has provided support and leadership to Canada's indigenous communities through his involvement with Engage North.

JEANETTE M. SOUTHWOOD
M.A.Sc., P.Eng., FEC, FCAE, QPESA, QPRA
Principal, Global Sustainable Cities Leader, Canadian Urban Development & Infrastructure Sector Leader, Golder Associates

ENGINEERING MEDAL – ENGINEERING EXCELLENCE

Ms. Southwood demonstrates vision and leadership with a focus on the pressing issues of, and value-creating solutions for, urbanization, sustainability and resilience. A sought-after speaker and panellist at conferences and workshops, she has authored articles, book chapters, technical papers and presentations that detail research, practice and contributions to the fields of urbanization, urban resilience and sustainable development.

At Golder, a global employee-owned firm of more than 8,000, Ms. Southwood leads the company's largest sector: Urban Development & Infrastructure. She shares her knowledge and experiences with young and aspiring professionals as an adjunct lecturer at the U of T's Chemical Engineering Department.

In 2014, she was honoured as one of Canada's Clean50 for her work and dedication to sustainable development, leading change-championing innovation and changing our world for the better. In 2014, she was also inducted as a Fellow of the Canadian Academy of Engineering, which recognizes engineers contributing in exemplary ways towards their disciplinary fields and the wider community.

HANDS-FREE MOORING PROJECT
St. Lawrence Seaway Management Corporation

ENGINEERING PROJECT OR ACHIEVEMENT

Years of research and innovative engineering led to the creation in 2014 of the world's first hands-free mooring (HFM) system for deep water locks by the St. Lawrence Seaway Management Corporation (SLSMC). The innovation was designed to improve safety, reduce transit times and increase the competitiveness of this all-water trade corridor.

Development of the pioneering technology began in 2005 and was completed eight years later with a production-ready system. HFM was a complex project involving key design, operational and programming changes.

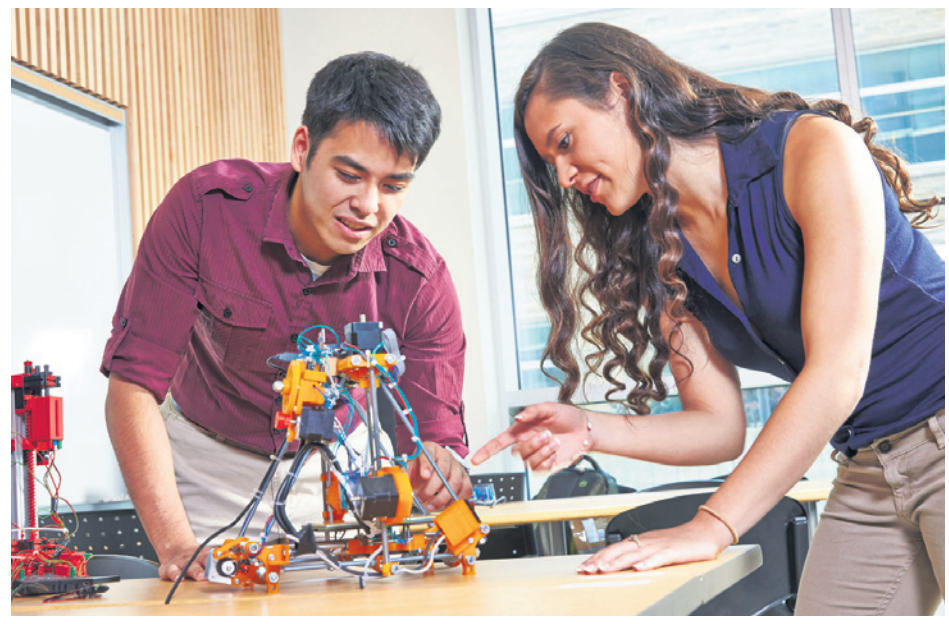
The HFM system uses vacuum pads mounted on vertical rails to secure a vessel during the lockage process, tracking the ship as it is raised or lowered, while keeping it at a safe, fixed distance from the lock wall during the mooring process. This new technology allows the seaway's high-lift locks to attach to vessels that could not previously access the system.

Deployment of HFM technology is now under way, and it is scheduled to be fully implemented into all 16 of the seaway's high-lift locks by the summer of 2016.

ONTARIO PROFESSIONAL ENGINEERS AWARDS

EDUCATION

Experiential, hands-on learning essential for developing engineers of the future



At McMaster University, Adam Moniz (materials engineering and society student) and Rachel Lim (electrical and biomedical engineering student) are immersed in a holistic and hands-on approach to education that is central to McMaster's emphasis on experiential learning. BANK MEDIA

Engineers of the future will be as multifaceted as the world they work in. The complexity of the problems they will be called upon to solve and the multitude of forces acting upon them – social, political, cultural and environmental to name a few – will require them to be critical thinkers and adroit innovators, says Dr. Ishwar K. Puri, McMaster University's dean of engineering.

"Engineers of the future are going to have to move well beyond the confines of their discipline in order to be agents of change," he says. "If you look at the big challenges the world is facing – including energy independence, food security, climate change, water quality and disease eradication – they are all interrelated."

As a result, in addition to technological skills, engineers need to develop a skill set that includes business acumen as well as an understanding of social sciences, history, the humanities and even literature because of the way it can reflect the content and aspirations of communities.

"The way to provide this kind of education is through experiential learning," he says. This is a hands-on, minds-on learning that eschews the "sage on the stage" style of teaching and replaces it with an interactive environment where knowledge flows in all directions. Much of this kind of learning is already taking place at McMaster, but it is going to get supercharged when the new $11-million Gerald Hatch Centre for Engineering Experiential Learning opens in 2017.

"It will be a building made for students," says Dr. Puri. "There will be no teaching, only learning." Highlights include a Thought Leaders seminar series featuring prominent speakers addressing topics related to global challenges and complexity, and MacChangers, which will serve as an interdisciplinary partnership program providing students with opportunities to identify and propose solutions leading to positive change.

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is dean of engineering at McMaster University

The Building Thinkers, Building Leaders program includes several elements that promote analytical and critical thinking, leadership and social responsibility designed to educate the whole engineer, not just the technical engineer, says Dr. Puri. As well, a "living, learning residence community" is being established that will not only welcome and integrate first-year students into the faculty and university, but also enable all students to form cohorts and establish interdisciplinary social networks.

Experiential learning begins with profound thinking about shared community and collaboration, and it ends with citizen scholars who can address the world's problems with technological expertise tempered by a sensitivity and appreciation for local aspirations and conditions.

INNOVATION

NEW BUILDING EXEMPLIFIES SUSTAINABILITY IN ACTION

A team of 16 McMaster University energy experts are aiming to test community-based, integrated energy systems through a new living lab housed in a soon-to-be-built student centre dedicated to hands-on learning. The team of engineers and other scientists has received $3.8-million in government funding to invest in the new Research Facility for Integrated Building Energy Harvesting Systems on campus.

The in-house system will serve as a test lab within the $11-million Gerald Hatch Centre for Engineering Experiential Learning. The sustainable, 28,000-square-foot centre was largely funded by engineering undergraduate student fees and private donations, including one from Gerald G. Hatch, the founder and first president of global engineering firm Hatch Ltd.

The goal of the energy project is to explore how a community-based approach can harvest wasted energy. About 70 per cent of energy is lost during production at generation facilities and during delivery.

The project will examine how neighbourhoods and their supporting energy networks can be designed together to improve system-wide efficiency while also providing structures with more resilience to power losses during major weather events.

Expected to open in early 2017, the Hatch Centre will also serve as a hub for 5,000 undergraduate engineering students to collaborate on team projects and foster experiential learning outside the classroom.

When it is completed in 2017, the Gerald Hatch Centre for Engineering Experiential Learning will incorporate many innovations in energy use. SUPPLIED