THE VOICE

OF ONTARIO'S ENGINEERS

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Strategic Plan at AGM

What are the Barriers to
Engineering Leadership?

JUNE 2022

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Pierre B. Leduc

RESEARCH

CLIMATE CRISIS ACTIVISM – PART 2.

CALL TO ACTION.

This Letter to the Editor was submitted by OSPE member Geoff Sheffrin, P.Eng.

Some of you may have seen my last editorial comment on the Climate Crisis, which I now refer to as the Climate Emergency.

The OSPE team and many volunteers are highly active with many initiatives focusing on the Climate Emergency. These items include numerous provincial initiatives – critical minerals, mining, hydrogen, electrification of the transportation system, and modernizing Ontario's Building Code, among many others. We need to move these forward and urgently.

As many of you will know – I am reaching out to engineers everywhere – since we can make a technological difference, not just here, but across the entire planet. After all, this is a global problem. We need to move towards renewables now and ween ourselves off fossil fuels quickly – time is running out.

Mother Nature did not attend COP 26 (Glasgow Climate Change Conference) and does not know we have 2030 and 2050 targets in mind. She is ramping up the "climate emergency" and will soon make it a "climate catastrophe" and this will be before 2030 (mark my words).

We are the profession that can and must make a difference. We have all the science and all the data. But we need to act. We need to persuade our global leadership, our fellow engineers, and all our fellow citizens to act now.

What tools do we have to go green? Here are a few of my "go 100% green – now" highlights.

First, we do not have enough electrical generating and storage capacity anywhere. The entire global energy picture data indicates that total fossil fuel use is about 137,000 Tera Watt Hours – that is 137×10^{15}, whereas electrical capacity globally is 27,000 Tera Watt Hours. The ratio is near 5:1 and this suggests that globally we need 3x to 4x the electrical generating and storage capacity that we have now, as well as overall reductions in fossil fuel usage.

What do we have globally that is green? Hydro is at about 60% of renewables, with a century or more of virtually zero-carbon generation.

Nuclear is the next biggest globally (approximately 440 active reactors globally). It is costly to build but has a long zero-carbon life. Safety fears? According to the data, nuclear has created less than 2x more human deaths per Tera Watt Hour than wind or solar but 350x less than coal, and this includes Chernobyl, Fukushima, and Three Mile Island.

Small Modular Reactors are coming along quickly but not quickly enough. Some can reuse spent nuclear fuel. Ontario and OSPE are pushing this, and we are well ahead of the curve.

Fusion? We have recently had 5 seconds of a sustainable fusion reaction. 5 seconds doesn't sound like much, but this is hugely important. Containing a few 100 million degrees Celsius is difficult. This is the holy grail in renewables, but I fear it is still a few decades away.

Wind and solar combined are now approaching 10%. Wind needs more "re-birth" capability built-in though. Meanwhile, solar takes up a lot of real estate, and both need storage to support them 24/7.

Do not even get me started on the shortage of the rare minerals we need for many of our initiatives.

If you want to hear more about this topic, please have a listen to my OSPE Podcasts titled "Mother Nature doesn't care".

We risk doing too little too late. If you can contribute to our progress to go green – please do it and do it now!

Remember "movers make things happen, everyone else is just a spectator – be a mover."

It is paramount that we embrace the diversity of background, thought and perspective of everyone.

It is with great pleasure that I begin to serve you as the President and Chair of the Ontario Society of Professional Engineers. OSPE as an organization stands proudly behind the values that all Engineers are welcome and can find a place to lead, grow, unite and prosper, and I couldn't be more proud to work with you to find your place here at OSPE.

I start this term with a new strategic plan in place. A plan built on the inputs and voices of you, our members. A plan that encourages the whole engineering community to come together, to lead our profession through the pandemic recovery, to push ourselves to learn new skills, and to challenge the stereotypes within our work. There is much work to do but I'm confident and optimistic that as engineers, we can unite in building a resilient and sustainable recovery for Ontario and for our profession.

I have spent my 25-year engineering career dedicated to developing and managing technology to help people learn. Today we live in an era where the rate of technology advances is exponential, changing our daily lives and the way society functions. In order to stay at the top of our profession, upskilling and learning are paramount. As engineers we need to stay on top of technological advances and as technology replaces the hours of analysis we used to do by hand, we need to work even more on our power skills. The Ontario Engineering Academy (OEA) is OSPE's greatest resource for finding the training you need to stay at the top of the engineering profession. Our strategic pillar, Engineers Grow, outlines OSPE's objectives with the OEA.

Over the past two years we have all witnessed how much we can accomplish when everyone comes together around a single issue. As we emerge from the global pandemic, which gave us a reality check in our fragility, we have other issues that need attention. Climate change, energy, the environment, data privacy and diversity and inclusion, are issues that Engineers from all sectors are grappling with. OSPE is your place to come together, discuss, analyze and co-create plans to tackle the issues with greatest impact to the way we live and work. Our strategic pillar Engineers Lead, sets out how we plan to give you the opportunities to lead, create a collective voice to government and enact change. If you're looking for impact beyond your current position, OSPE is where you can make that contribution.

In tackling these issues, it is paramount that we embrace the diversity of background, thought and perspective of everyone. OSPE continues to lead courageously with our strategic pillar, Engineers Care. Creating an inclusive engineering community that welcomes all engineering graduates, whether domestically or internationally trained, professionally licenced or in non-regulated disciplines, we want you to find a home at OSPE where you can join the conversations on emerging technologies impacts on society, government policies impact on our profession, find your next career move, or mentor a young engineer. In so doing, we will focus on helping you and the profession prosper.

To close this message, I just want to say that I hope this is just the beginning of the conversation. I encourage you to stay curious and open in your observations, challenge yourself to identify biased thoughts, actions and systems. Realize that in protecting the public, we are doing so in the physical realm but also the mental realm, and as society is ever more interconnected with technology we have helped create, society is also more vulnerable to new threats.

Join me this year in forming an inclusive community for our engineering profession. I look forward to meeting many of you as we host more in-person events while continuing to provide hybrid events so that more of you can join in the most comfortable way to do so. Let this be the year where we as engineers lead, care and grow and by doing so, we all prosper.

> OSPE's greatest resource for finding the training you need to stay at the top of the engineering profession.

Dr. Marilyn Powers, P.Eng.
President & Chair
Ontario Society of Professional Engineers

> Our intent, as always is to create the best possible engineering labour market so that you, our members, can thrive.

With summer approaching, we all have a lot to look forward to. The warmer weather always lifts the spirit and in a COVID world, it makes it easier for us to comfortably connect with those we have been missing.

At OSPE, we are also looking forward to beginning to implement our next 3-year strategic plan. The last one was conceived in normalcy yet primarily executed in the midst of a global pandemic. A time of uncertainty that expectedly showed the many ways in which professional engineers, like you, are essential to the health and safety of our community.

This time around, we did something the organization had never done before which was to conduct the entire strategic consultation process using virtual platforms. That format made it tougher to capture the vitality of our volunteers and members, though it did allow for broader participation which was a benefit. I am excited that we have identified key themes that will help guide the organization into the future.

This strategic plan was introduced at the Annual General Meeting on May 9 and at the same event, it was my pleasure to announce Dr. Marilyn Powers P.Eng. as the new President and Chairperson of OSPE. Marilyn is not only a dedicated volunteer, she is an engineer who has consistently broken new ground in our industry. Her personal and professional dedication to understanding and enhancing learning is one that will help move the organization forward.

She is also most certainly a champion of OSPE's efforts to increase equity, diversity, and inclusion, and with the Board of Directors, she will help OSPE continue to engage decision-makers in the most important advocacy areas, such as Economic Recovery and Climate Change.

While the pandemic has helped magnify the importance of engineers, OSPE continues to advocate behind the scenes in favor of changes to the Professional Engineers Act. Our intent, as always is to create the best possible engineering labour market so that you, our members, can thrive.

On a personal note, I am very much looking forward to being among you, our members, in the near future. Our annual conference scheduled for November will be a hybrid event this year and I am excited to see familiar faces in person (and meet new members of course). These engagement opportunities are wonderful times to learn your stories and how OSPE can continue to represent you best.

I know not everyone can attend these events, so I encourage all of you to share your thoughts and observations with OSPE as we can only be in so many places. We rely on members like you to inform our staff of specific issues that affect your community. It is then that we can take strategic action towards resolution, as we did when the City of Toronto attempted to shift their liabilities related to railway incidents, to the Professional Engineery who developed the railway safety plan, this past year.

It is in situations like these where OSPE can take targeted action in support of the professional engineering community, and we were appreciative that this issue was brought to our attention.

I truly look forward to hearing from you, our members, on how we can continue to serve you best in the future.

> While the pandemic has helped magnify the importance of engineers, OSPE continues to advocate behind the scenes in favor of changes to the Professional Engineers Act.

Sandro Perruzza
Chief Executive Officer,
Ontario Society of Professional Engineers

INCENTIVIZING

DEEP ENERGY RETROFITS
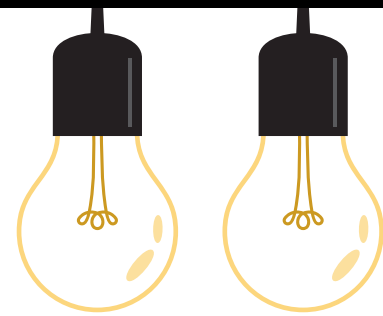
I n April 2021 Canada updated its target for reducing greenhouse gas (GHG) emissions by 40-45% from 2005 levels, by 2030. The major sources of GHG emissions in Canada are from three sectors: residential (homes and buildings), transportation, and industrial. The homes and buildings sector includes single and multi-dwelling homes, and both existing stock and new build.

Considering that GHG emissions from these sectors have not fallen significantly over the past decade, accomplishing this new GHG emissions goal will require transformational change in how we use energy. Transportation sector emissions rose 27% from 2000 to 2018[1]. Secondary energy use (energy to run vehicles and to heat and cool buildings) rose by 12% from 2000-to 2017, and natural gas usage grew by 18% during this same period[2].

Homes and buildings undergoing major retrofits today will be replaced three decades from now. Therefore, there is a need for regulatory and policy changes to decrease the carbon footprint of our existing homes and buildings. Deep Energy Retrofits should reduce the amount of energy used and replace carbon-based energy sources (such as oil and natural gas) with clean low-carbon energy sources. A Deep Energy Retrofit is defined for the purposes of this paper as a "whole building analysis and construction process that aims at achieving on-site energy use minimization in a building by 50% or more compared to the baseline energy use, making use of existing technologies, materials and construction practices". Deep Energy Retrofits can adopt technologies from net-zero energy designs, which are technically feasible but not yet scalable or affordable for the average home buyer.

To make a significant reduction in home and building energy use, new homes must be close to net-zero. The Net-Zero Energy Project[3] demonstrated that homes can be made net-zero using existing off-the-shelf technologies. Some of these technologies can be adapted to the large stock of existing homes, which will be in-use well beyond 2030.

This paper seeks to identify ways of significantly reducing energy use in single and multi-unit residential buildings (up to 3 stories, MURBs) as well as commercial buildings, through deep energy retrofits.

There are opportunities for the Ontario government to provide additional energy-saving programs. This paper makes recommendations that would achieve home energy use reductions.

Deep Energy Retrofits are expensive and in order to make them happen at a large scale, there needs to be:

- additional financial incentives to make these cost-efficient, until the retrofit industry is more mature,
- support for these industries (such as policies that increase demand) to enable them to reduce the cost of deep energy retrofit technologies,
- assistance to contractors and homeowners with the applications for energy grants for retrofits
- energy audits performed by type and vintage of dwelling/building, to reduce costs.

British Columbia, in 2017, became the first North American jurisdiction to create a regulated pathway for net-zero energy-ready buildings, through its BC Energy Step Code.

ONTARIO'S BUILDING CODE MUST ALSO BE REVISED:

The National Building Code (NBC 2020) and the National Energy Code for Buildings (NECB 2020) contain new guidelines for energy efficiency in homes, small buildings, and commercial and institutional buildings. NBC 2020 section 9.36 focuses on energy efficiency and reducing greenhouse gas emissions to support a long-term goal of net-zero energy ready (NZER) model building code by 2030. However, The National Energy Code of Canada for Buildings is a model code that only comes into force when provinces and territories elect to write, enact and enforce laws and regulations relating to that code. Also, it does not apply to retrofitted homes and buildings.

Provincial building codes vary across provinces, with some, such as BC, containing detailed pathways for significantly reducing energy use in new homes. British Columbia, in 2017, became the first North American jurisdiction to create a regulated pathway for net-zero energy-ready buildings, through its BC Energy Step Code. British Columbia's success rests on:

- Prioritizing the building envelope. An envelope-first approach designs a measurable level of performance into the very fabric of the building, permanently wedding energy efficiency to the structure.
- Prescribing outcomes, not processes, by defining a target, and working backward with fixed interim deadlines and requirements.

- Providing a baseline and working towards the capacity building by allowing local governments to adopt higher energy-efficiency requirements at a pace that works for them
- Consulting appropriately with municipalities and local governments, professional associations, and utilities

Ontario should adopt section 9.36 of the NBC 2020 that focuses on energy efficiency and reducing greenhouse gas emissions into the Ontario building code O.Reg. 332/12 and define clear steps and deadlines to achieve an NZER code by 2030. ⓥ

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[1] *https://www.nrcan.gc.ca/science-data/data-analysis/energy-data-analysis/energy-facts/energy-and-greenhouse-gas-emissions-ghgs/20063#L1*
[2] *https://www.nrcan.gc.ca/science-data/data-analysis/energy-data-analysis/energy-facts/energy-and-greenhouse-gas-emissions-ghgs/20063#L1*
[3] *https://www.nrcan.gc.ca/energy-efficiency/energy-efficiency-homes/buying-energy-efficient-new-home/netzero-future-building-standards/20581 has demonstrated that R-2000 has*

Ontario Pre-Budget Submission 2022

Engineers are at the centre of a prosperous economic recovery for our province and country. Engineers generate wealth through the development and commercialization of innovative technologies and by designing innovative and sustainable solutions for the benefit of all Ontarians. Engineers also ensure safety and stability by designing resilient infrastructure and reliable energy and water systems that Ontarians rely on daily. Without the important work that engineers perform, short and long-term economic recovery will not be possible.

In times of crisis, you will always find engineers working tirelessly, in the background, without much accolade, diligently supporting the communities they serve. Engineers were among the first to point out that SARS-CoV-2 was an airborne disease, and hence called on the government to invest in proper ventilation in schools and Long-Term Care homes to prevent its spread.

Unfortunately, the engineering community, like others, has been severely impacted by this pandemic, as thousands of engineering jobs are linked to the infrastructure, manufacturing, technology, and research and innovation sectors. This has not only affected the profession, but the entire Ontario economy.

Despite this setback, engineers possess the technical knowledge and talent to help lead the economic recovery of our province. As such, the province must now support the engineering community in rebuilding the engine that drives Ontario, and the rest of the country.

Ahead of the release of Budget 2022, OSPE called on the Ontario Government to:

Engineering Workforce Development

1. Invest in talent development, knowledge training, and supports for engineers across the province.
2. Train engineers for the skills required to succeed in new and green emerging sectors.
3. Support the growth of a diverse workforce to enable economic equity and recovery in Ontario.
4. Work with the federal government to establish a $10 a day child-care program in Ontario.

Climate Crisis

1. Provide further relief to Ontario families and businesses by making surplus electricity available at current market rates.
2. Accelerate the electrification of the transportation system, including electric vehicle (EV) adoption.
3. Modernize Ontario's Building Code.
4. Ensure all provincial infrastructure projects:
   · Use a Qualifications-Based Selection (QBS) framework
   · Effectively report life-cycle costing
   · Create diverse supply chains
5. Establish an Ontario Critical Minerals Research and Market Development Council within Ontario's Critical Minerals Strategy

> Under the Professional Engineers Act, engineers must ensure that life, health, property, and the public welfare are protected.

Research and Innovation

1. Support local manufacturing innovation and production.
2. Support the generation, protection, and commercialization of intellectual property (IP) in small to medium enterprises (SMEs).

Advocacy Submissions

OSPE Responds to PEO's Call for Consultation on the Anti-Racism and Equity Code

Professional Engineers Canada has a responsibility to help facilitate an equitable industry as the regulatory body and this collaborative process is a great starting point. OSPE is also glad to see PEO is committed to articulating and maintaining policy, direction, and control in alignment with human rights laws and Ontario's public policy directions.

OSPE Consults on the CEQB Guidelines for Engineering Firms on Indigenous Engagement and Consultation

OSPE operates on the values of equity, diversity, and inclusion, putting our support behind all dimensions of diversity, including being an ally to the Canadian Indigenous community. The engineering profession is long overdue for systemic change and creating space for Indigenous engineers and an indigenous voice is an essential starting point.

ERO-019-5054- Proposal to Enable a New Voluntary Enhanced Time-of-Use Rate Including Consideration of a New Ultra-Low Overnight Price

Minister Smith's letter to the Ontario Energy Board (OEB) requests the OEB to examine and report back on potential designs for a new optional Time-of-Use price plan featuring an ultra-low overnight rate. The government will consider the OEB's report along with stakeholder feedback received through the public consultation on the Environmental Registry of Ontario with the intention of making the new price plan available to customers by April 2023. OSPE agrees that the new ultra-low overnight rate could help shift workers and residential consumers that use more electricity at night save money while supporting electric vehicle (EV) adoption, by reducing overnight EV charging costs when province-wide electricity demand is lower.

ERO- 019-4974 Proposed Changes for the Next Edition of Ontario's Building Code (Winter Consultation)

The Ontario Building Code requires every building designed by an architect and/or professional engineer to be reviewed for general conformity to the approved design by professionals. Professional Engineers play a vital role in executing these general reviews. This should be the norm. Professional Engineers are trained and have the expertise to perform such reviews. Under the Professional Engineers Act, engineers must ensure that life, health, property, and the public welfare are protected. Engineers know that protecting the environment is essential to promoting a sustainable and healthy lifestyle for current and future generations. Eroding the essential jobs performed by Professional Engineers equates to eroding safety measures within Building Code Standards. Therefore, The Ontario Government should make it a priority to ensure that Professional Engineers are required to conduct the necessary reviews that will ensure the public's safety

Government Meetings

It is OSPE's goal to solidify our position as the voice of the engineering profession and its reputation as the association where engineers gather, share expertise, and provide recommendations on issues facing the profession and society.

One way we do this is by ensuring engineers are recognized advocates to government, industry, media, the public, and the regulator.

As a non-partisan association, OSPE is committed to meeting with all political leaders, independent of their political party to ensure that they understand the need to listen to the engineering expertise to solve society's biggest challenges.

OSPE met with Steven Del Duca, Ontario Liberal Party Leader, to discuss solutions to the global climate crisis, as well as Ontario's rising electricity prices, ahead of this year's Provincial Election.

OSPE also met with MPP Peter Tabuns, NDP Energy and Climate Crisis Critic. OSPE is here to ensure that all parties commit to fighting climate change by listening to data, science and experts, such as engineers.

OSPE also met with Dianne Saxe, Ph.D., Deputy Leader of the Green Party of Ontario. Meeting with all political parties is important, to ensure leaders are listening to engineers. The Climate Crisis requires all of us to come together with real solutions.

OSPE, through its Podcast: *Engineering the Future* also had the opportunity to speak to MPP Deepak Anand, MPP for Mississauga-Malton and Parliamentary Assistant to the Minister of Labour, Training, and Skills Development. We discussed the recent changes in engineering license requirements and the impact they will have on the overall profession.

MPP Mississauga-Malton
Deepak Anand

OSPE Hosts Climate Consultations to Inform Future Advocacy Work

Our successful advocacy work is driven by our members who work in diverse engineering fields. In late February and early March, OSPE hosted two climate crisis consultations that aimed to understand the engineering communities' priorities when it comes to the global climate crisis. We discussed topics such as:

- The use of Infrastructure guidelines:
  - Use of a Qualifications-Based Selection Framework
  - Effectively reporting life-cycle costing
  - Considering Diversity and Inclusion
- Modernizing Ontario's Building Code
- Electrification of the Transportation Systems
- Excess Soils
- Cancelling Highway 413
- Investing in Ontario's Mining Industry
- Establishing an Ontario Critical Minerals Research and Market Development Council within Ontario's Critical Minerals Strategy
- Investing in Hydrogen Technology

These valuable conversations inform our advocacy work.

Ontario Votes 2022: Engineers Call for a Comprehensive Climate Action Plan that will reduce Ontario's GHG Emissions

Ahead of Ontario's Provincial Election, OSPE released its 2022 Election Platform, calling on all political parties to "get serious" when trying to deal with climate change. Engineers are calling on the government to:

1. Push for the Electrification of the Transportation Sector
- Work with the federal and municipal governments to allocate specific resources to the electrification of the public transportation system.
- Develop and implement an incentive program for consumers to purchase electric vehicles, until a mass adoption "tipping point" is achieved.
- Establish a robust network of electric vehicle charging stations across Ontario.

2. Ensure All Infrastructure Projects Are Sustainable and adhere to the following principles by:
- Using of a Qualifications-Based Selection (QBS)

> A few days before the end of the fiscal year, the Ontario government has officially signed a deal to bring affordable childcare to the Province.

framework
- Effectively reporting life-cycle costing
- Considering diversity and inclusion

3. Reinstate the Office of the Environment Commissioner of Ontario
- The environment would be better safeguarded under the watch of an independent office such as the Environment Commissioner of Ontario
- The support of this independent body is determinant to report on government progress on climate change, energy, and other environmental issues.

4. Ensure Engineers Have the Skills Required to Succeed in Low Carbon Jobs

OSPE is calling on the Ontario government to invest in green jobs. Engineers know that as Ontario and Canada transition towards a low-carbon future, the energy efficiency and building sectors will be at the forefront of change. To accelerate this, it is important to strengthen the capacity of the existing workforce and attract more people to work in these sectors, especially engineers.

5. Modernize Ontario's Building Code to be Net Zero

The building sector accounts for about 22 per cent of Ontario's total greenhouse gas (GHG) emissions. Reducing this sector's carbon footprint is key in achieving Ontario's and Canada's climate targets. The National Building Code (NBC 2020) and the National Energy Code for Buildings (NECB 2020) contain new guidelines for energy efficiency in homes, small buildings, and commercial and institutional buildings.

Provinces have the option to adopt these provisions. Ontario should adopt these sections of the NBC 2020 into the Ontario Building Code O.Reg. 332/12 and define clear steps and deadlines to achieve a Net Zero Energy Ready code by 2030. By doing so, not only would Ontario decrease its carbon footprint, but it would also create jobs moving forward, especially under the lens of more energy-efficient buildings and retrofits.

POLICY WIN – Ontario Strikes a deal with the Federal Government to bring $10 a day childcare to the Province

Enabling women to participate fully in the economy is not only a policy driven by gender equality and social justice, but also a way to fuel Ontario's economic growth and labour productivity. Providing affordable early learning and child-care options will remove one of the barriers that women, including engineers, have in being able to fully participate in paid work. Our 2022 Budget Submission highlighted the need for affordable childcare, a major barrier that disproportionately prevents women from fully participating in the workforce. A few days before the end of the fiscal year, the Ontario government has officially signed a deal to bring affordable childcare to the Province. The plan is based on five pillars: improved affordability, improved access, sustaining high-quality services, inclusion, and enhanced data and reporting.

POLICY WIN – The Government of Ontario is Investigating Options for a New Ultra-Low Overnight Electricity Rate

Ontario's Energy Minister Todd Smith has asked the Ontario

Energy Board (OEB) to provide him with options to implement a new ultra-low overnight Time-of-Use electricity price plan as the province continues to try and provide Ontario families with more ways to control their energy bills. OSPE's Energy Task Force has been advocating for this new price plan, and we are pleased to see that the government is seriously looking at this possibility.

News and Events

OSPE sits with Green Party's Deputy Leader, Dr. Dianne Saxe, to review their Climate Action Plan

OSPE is working to keep the engineering community as informed as possible. On March 3rd, we hosted an informative event with Dr. Dianne Saxe, who gave an in-depth presentation on the Green Party's Climate Action Plan. Quoting the UN Secretary-General, Dianne reminded us that the level the climate crisis has reached has been described as an "atlas for human suffering" and there is no time left for delay. Members had the opportunity to ask questions and share their concerns with the opportunity of hearing directly from an integral member of the Green Party.

OSPE hosts a Small Modular Reactors and the Future of New Nuclear Energy Event

On March 30th, OSPE facilitated a webinar called *Small Modular Reactors and the Future of New Nuclear Energy: An Opportunity for Ontario*. The Honourable Todd Smith, Minister of Energy provided a keynote address highlighting the government's progress in this field. This was followed by a panel discussion with representatives from SNC Lavalin, Bruce Power, Ontario Power Generation (OPG), and GE Hitachi Nuclear. OSPE supports the development of SMRs because nuclear energy is known to be an effective way

to reduce atmospheric emissions, including greenhouse gases. As a supporter of Canada's SMR Action plan, OSPE is responsible for engaging both non-nuclear engineers and the public, so they understand the role SMRS play in meeting our energy and environmental goals.

OSPE hosts National Engineering Month Event focused on the Future of the Engineering Licence

For the entire month of March, engaging and educational virtual events took place across the country to expose people of all ages to the tremendous wonders of engineering.

On March 1st, to commemorate Professional Engineers Day in Ontario, OSPE hosted an event to discuss the future of the engineering license. Moderated by Steve Paikin, this event counted with the presence of the following panelists:

- Jay Nagendran, P.Eng., Registrar and CEO of the Association of Professional Engineers and Geoscientists of Alberta (APEGA)
- Heidi Yang, P.Eng., CEO of Engineers and Geoscientists British Columbia
- Mark Frayne, P.Eng., President and Chair of the Ontario Society of Professional Engineers (OSPE) and
- Christian Bellini, P.Eng., President of Professional Engineers Ontario (PEO).

Over time, society, technology, and standards evolve. Therefore, it is imperative that engineering keep current with new advancements, while ensuring the goal of public safety. However, within the engineering community, the current slow-to-change licensing of engineers doesn't quite line up with the rapid advancement of emerging technologies. Licensing comes with several different challenges around education, legislation, and public perception. Panelists from engineering regulators across the country discussed how they are working to modernize regulation in their own provinces to serve and protect the public. ◆

INSIGHTS
BY
ENGINEERS
FOR
ENGINEERS.

Ontario Society of Professional Engineers

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REDUCING GREENHOUSE GAS EMISSIONS
from Ontario Diesel Highway Trucks

Canada has committed to reducing its Greenhouse gas (GHG) emissions by 40-45% from 2005 levels, by 2030. If we intend to reach this target, our attempts to reduce GHG emissions must include a significant reduction in emissions from a critical sector: transportation.

Greenhouse gas emissions from the transportation sector primarily come from burning fossil fuels for our cars, trucks, ships, trains, and planes. This paper examines one of these subsectors: highway trucks. GHG emissions from Ontario freight trucks, caused mostly by the combustion of diesel fuel, have increased at a higher rate than emissions from any other sector in Ontario's economy.

Ontario freight truck GHG emissions increased from 6,390 kt CO2e in 1990 to 12,700 kt in 20191, a 99% increase, or 41% per capita. In contrast, during the same years, Ontario's GHG emissions from railways decreased by 13%, and emissions from stationary combustion sources and industrial processes also decreased.

The movement of goods and services by the freight trucking sector contributes to the growth and well-being of our economy. It is a key component of a robust and sustainable supply chain for businesses. Reducing the sector's GHG emissions would meet all the ESG (Environment, Social, and Governance) metrics used by financial investors to rank progress towards sustainability. These reductions would be a competitive edge for Ontario.

OSPE's recommendations toward this objective include:

THE NEED FOR UNITY AND COORDINATION

The federal, provincial, and municipal governments, alongside industry associations, labour unions, and civil society, must work together in a coordinated fashion, to reduce GHG emissions from diesel trucks.

Many of the industry experts interviewed in this study expressed their concerns about the lack of coordination between levels of government. For example, the provincial government has jurisdiction over motor vehicles and highways, while the federal government has jurisdiction over railways and marine. Several attempts to interest provincial officials in the advantages of truck-to-marine intermodal freight shifting met with zero response.

UPGRADING ONTARIO'S INFRASTRUCTURE

Ontario needs to improve its infrastructure to achieve the necessary GHG emission reductions from diesel trucks. Ontario needs efficient intermodal freight terminals, better access to these, and a more efficient, less fragile freight rail network. These infrastructure improvements would cost hundreds of millions of dollars, but they would be cost-effective and achievable within the next ten years.

INVESTING IN NEW TECHNOLOGIES

In coordination with other jurisdictions, the Ontario government should continue to encourage the Research, Development, and Demonstration of new technologies that will reduce GHG emissions from Ontario freight trucks in the future. Some of these include:

- Biodiesel Fuel – Production and Use
- Renewable Natural Gas Fuel
- Renewable Ethanol and Methanol in Diesel Fuel
- Autonomous Trucks
- Truck Platooning
- Electric Battery Infrastructure, Charging, and Propulsion
- Hydrogen Infrastructure and Propulsion

WHAT DOES THE FUTURE OF THE ENGINEERING WORKPLACE LOOK LIKE?

WE DID SOME RESEARCH AND FOUND OUT.

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OSPE BOARD OF DIRECTORS
RELEASES NEW STRATEGIC PLAN

Formulating a new strategic plan, while executing the previous one during an unprecedented time in human history was new ground for the OSPE Board of Directors. However, with the guidance of consultants, and input from members, the virtual planning process was very effective.

Building on extensive research, members were eager to participate in four virtual sessions to provide input into an initial draft of the strategic pillars. Your feedback supported the direction that the previous plan laid out and gave clarity on some additional areas to focus on. The Board of Directors and Board Development and Strategic Planning Committee (BDSP) took the ideas planted by members and grew them into the plan that you see today.

In February, at virtual town halls, members reacted to the draft with support and enthusiasm, especially for the newly created pillars.

The Plan was shared with all members during OSPE's Annual General Meeting and presented by the President and Chair, Mark Frayne, P.Eng., and Vice-Chair and Chair of the BDSP, Dr. Marilyn Powers, P.Eng.

OSPE encourages all members to review the plan in depth. Here is an overview of what to expect

OSPE is a member-driven professional association that welcomes the entire engineering community, to contribute knowledge, skills, and leadership.

VISION
OSPE is the home of the entire engineering community in Ontario, where engineers come together to realize their full potential.

MISSION
OSPE engages, educates, and enables the engineering community to lead in order to help create a better future for our profession and society at large.

VALUES
- We believe engineers are obligated to lead
- We believe the engineering profession must be equitable, diverse, and inclusive in order to thrive
- We believe engineers must solve problems through collaboration
- We believe that by embodying and exemplifying diversity in all that we do OSPE can accelerate the emergence of a more diverse engineering workforce
- ·We believe all decisions must be guided by factual evidence

The plan continues to build on two core pillars from the recently completed strategic plan, Engineers Lead and Engineers Care, with the addition of Engineers Grow, as well as Engineers Prosper.

Here is how OSPE will use each of these pillars to direct action in the years to come.

ENGINEERS LEAD
Solidify OSPE's position as the voice of the profession and its reputation as the association where engineers gather, share expertise, and provide recommendations on issues facing the profession and society.

ENGINEERS GROW
Become the trusted resource for Ontario engineers to grow professionally and personally, delivering continuing education and value at every career stage.

ENGINEERS CARE
Elevate awareness of the role that a diverse and inclusive engineering community plays in making the world a better place and deepen the respect for the engineering profession in Ontario.

ENGINEERS PROSPER
Expand opportunities for engineering jobs in Ontario and protect the practice rights of engineers, so that both our members and Ontario can prosper.

President Frayne and Dr. Powers thank all the OSPE members and stakeholders who participated in the development of this plan. Your Board of Directors values your input and hopes that you will continue to lend your voices, expertise, and opinions for the benefit of our profession.

2022 OSPE PRESIDENT'S
award winner

Darya Duma, P.Eng. is a Senior Trainer and Consultant in project management for the construction and engineering sector. She is the owner of 4DPM and a senior consultant with Procept Associates. Darya designs and leads training courses in Project Management theory and application and provides consulting services focusing on a client's practical needs for best project performance. Darya is currently a member of the Infrastructure Task Force. She has been an active member of OSPE since 2015 when she joined the Professional Development Career Services Committee. Darya has also volunteered her time as a mentor on the OSPE mentorship program and is the Vice-Chair of the Canadian Mirror Committee to ISO Technical Committee 278 on projects, programmes and portfolios. ◈

> Darya designs and leads training courses in Project Management theory and application and provides consulting services focusing on a client's practical needs for best project performance.

Darya Duma, P.Eng., PMP

OSPE
NATIONAL ENGINEERING MONTH
BY THE NUMBERS

OVER
40
EVENTS

OVER
100
SPEAKERS & EXPERTS

OVER
4200
ATTENDEES

OVER
20
ENGINEERING DISCIPLINES

OVER
80
HOURS OF ENGINEERING CONTENT

Leader Partner

HUMBER
Faculty of Applied Sciences & Technology

Champion Partners

ASSOCIATION OF CONSULTING ENGINEERING COMPANIES ONTARIO

CANADA POST · POSTES CANADA

OSPE · CCIIO

CONESTOGA
Connect Life and Learning

Manulife

McMaster University · ENGINEERING

ONTARIO POWER GENERATION

OntarioTech UNIVERSITY

Seneca
FACULTY OF APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Sheridan

uOttawa

UNIVERSITY OF TORONTO
FACULTY of APPLIED SCIENCE & ENGINEERING

UNIVERSITY OF WATERLOO | FACULTY OF ENGINEERING

Ally Partners

alectra

BrucePower
Innovation at work

CANADIAN SOCIETY OF PROFESSIONAL ENGINEERS

Carleton University | Faculty of Engineering and Design

CENTENNIAL COLLEGE

CROZIER
CONSULTING ENGINEERS

General Contractors' Association toronto

notarius

nwmo
NUCLEAR WASTE MANAGEMENT ORGANIZATION

Ontario Professional Engineers Foundation for Education

arva

SNC·LAVALIN

TORONTO HYDRO

University of Windsor

Western Engineering

Advocate Partners

Albarrie

INVEST WINDSOR ESSEX

JLR J.L.Richards
ENGINEERS· ARCHITECTS· PLANNERS

TATHAM ENGINEERING

OSPE'S ANNUAL GENERAL MEETING

O SPE's Annual General Meeting (AGM) was held virtually on Monday, May 9, 2022. The meeting began with OSPE's President and Chair, Mark Frayne, P.Eng. and CEO, Sandro Perruzza, reviewing accomplishments with regards to the OSPE's Strategic Plan Lead, Care, and Unite pillars.

"We have had another impressive year of activity and achievement" Frayne said, and "OSPE brought those values to life in the past year".

Perruzza thanked OSPE's dedicated members saying, "The knowledge and camaraderie you bring is what makes this community so welcoming and special".

For more details on some of OSPE's major activities in 2021, as well as a full breakdown of financials, you can access the 2021 Annual Report online.

Following this Year in Review, the Chair of the OSPE Nominations Committee, Dave Carnegie, P.Eng., provided the report to the membership on behalf of the 2022 Nominations Committee, which included Ronald Clifton, P.Eng., Jonathan Hack, P.Eng., and Christina Visser, P.Eng.

According to the nomination and election procedures set out in the Society's bylaws, he announced that the following professional engineers shall be Directors of the Society to hold office for three-year terms, effective immediately following the close of this meeting:

- Sandra Ausma, P.Eng.
- Stephanie Holko, P.Eng.
- Raymond Mantha, P.Eng.
- Jane Ravenshaw, P.Eng.

The next item of governance business was the presentation of the financial statements of the Society for the fiscal year ended December 31, 2021, by Treasurer, Nicholas Burgwin, P.Eng. The Treasurer then noted that requests for proposals were sent out to various audit firms for the 2022 audit. This was conducted as a matter of good business practice and due diligence. As a result of this review, it was recommended that BDO Canada, LLP, be appointed as the Society's auditors for 2022. This motion was approved by the membership.

Following the financial review, President Frayne presented a motion to amend bylaw #2, Article 6, Governance, 6.9, Committees of the Society, 6.9.1 (c). The proposed amendment would revise the wording and composition of the Human Resources Committee, adding "President and" in front of Chair as the Chair is the President of the Society, as per the bylaws. As well, it was proposed

to add the formal participation of the Vice Chair. He noted that it is important for continuity that both the President and Chair of the Society, and the Vice Chair, participate

on this committee. This motion was approved.

As is custom, OSPE members were encouraged to ask questions of leadership at the AGM. Below are the questions that were asked and the responses.

What are some initiatives for members to be more active and contribute as volunteers?

The Ambassador Program includes all opportunities for OSPE members to volunteer with the organization. The time and expertise of members are invaluable and we consistently want to create opportunities for members to network, develop new skills, contribute to important issues and make a positive impact within the engineering profession. Opportunities include being a subject matter expert, joining a task force or working group, or participating in an Exchange Hub. Visit the ambassador website at www.ospe.on.ca/membership/ambassador for more information.

With respect to the OSPE Board elections, why are candidates not given the ability to log in to the portal to view the results themselves?

OSPE has its own Board elections processes and procedures, which were made available on our website to all members and to all candidates during the Call for Nominations. OSPE uses a secure third-party elections platform, Big Pulse, to run the election. All voting is done electronically through the BigPulse platform. Votes are not submitted to the OSPE office or to the OSPE staff during the election period.

The voting period for the Board Elections ended on Friday, April 15th at 11:59 pm. At that time, the BigPulse system automatically closes the poll and sends the results of the elections to the OSPE staff at 12:00 am on April 16th. This process is all computer-generated and the results are final. It is then our procedure that the CEO, or their designate, calls each candidate personally to advise them of the results on the following business day. We limit access to the site to minimize any security risks.

This process has served the association well and has ensured there is no staff or other outside influence or interference, for several years.

Why was there no mention of transparency in the OSPE Values?

Although transparency is not specifically noted in the values, it was discussed by the Board Development and Strategic Planning Committee as well as the Board. President Frayne agreed that transparency is a right of members and is implied in all actions of the organization.

NATIONAL ENGINEERING MONTH ANNUAL UNIVERSITY STUDENT CHALLENGE

This student competition takes place every March. Teams of up to 5 students work together to host one or more public outreach events in their local community. Getting involved in public outreach is a great way to strengthen communication and organization skills – something future employers will be keen to see.

THE WINNERS WERE ANNOUNCED
1st MCMASTER UNIVERSITY
Lead: Kira White
2nd CARLETON UNIVERSITY
Lead: Baillie Noell & Bailey Lenihan
3rd UNIVERSITY OF WATERLOO
Lead: Yukttha Sivaraju & Jhanavi Chaitanya

PRESIDENT'S VOLUNTEER AWARD WINNER

OSPE was pleased to announce the recipient of the President's Volunteer Award to an individual who has gone above and beyond in effecting positive change for the engineering profession in Ontario.

The 2022 President's Award – Professional Category was awarded to Darya Duma, P.Eng.

CLOSING COMMENTS AND THANKS

President Frayne thanked OSPE's outgoing Board Directors for contributing their time and service to the engineering profession:
- Ronald Clifton, P.Eng.
- Anna Gkalimani, P.Eng.
- Sue Tessier, P.Eng.

The evening ended with Vice-Chair, Dr. Marilyn Powers, P.Eng. acknowledging and thanking President Frayne for all his hard work and dedication throughout his term.

INTRODUCING THE NEWLY ELECTED OFFICERS OF THE BOARD

The first meeting of the Board was held immediately following the AGM and it is our pleasure to announce that the following individuals were elected as officers of the Board:
- Dr. Marilyn Powers, P.Eng., President and Chair
- Stephanie Holko, P.Eng., Vice-Chair
- Nicholas Burgwin, P.Eng., Treasurer
- David Carnegie, P.Eng., Secretary
- Mark Frayne, P.Eng., Past Chair

OSPE
Classic Golf Tournament 2022

May 18, 2022 — Angus Glen Golf Club

144
Golfers

180
Dinner Guests

35+
Partners

RAISED OVER
$2,300
for Ontario Professional Engineers Foundation for Education

ONTARIO SOCIETY OF PROFESSIONAL ENGINEERS

Stay tuned for The OSPE Classic Golf Tournament 2023 at **www.engineersgolf.ca**

ENGINEERING
CONFERENCE

Join us at OSPE's annual Engineering Conference on November 3, 2022, in Ottawa!
This is Canada's Largest Engineering, Diversity, and Recruitment Event.

Engineers will join members from industry, academia, and government to discuss the latest opportunities, challenges, and innovations in engineering.

ATTENDEES WILL:

- Network with colleagues while learning about the innovative engineering work taking place in Ontario
- Learn about the Climate Crisis through a special session addressing this global issue
- Attend impactful and relevant panel session on Diversity & Inclusion in STEM
- Participate in interactive presentations by professional engineers and subject matter experts on important issues facing the profession, with opportunities to provide input
- Visit tradeshow booths from industry, government, and academic partners who are ready to connect and network!
- Interact with OSPE staff and affinity partners to take advantage of all OSPE member benefits

THERE WILL BE FOUR UNIQUE AND INFORMATIVE STREAMS AT THIS YEAR'S EVENT:

1. Equity, Diversity, and Inclusion
2. Engineers in a Digital World
3. Professional Engineers and Public Safety
4. Engineering Solutions to the Climate Crisis

CONFERENCE SESSIONS

Within each stream, there are four sessions that will investigate and delve into each topic further. Session titles are:

1. How Micro-Fulfillment Strategies are Changing the Retail Industry: An overview of Logistics, Systems, and Store Operations
2. Engineering and Cybersecurity
3. Valuing the "Professional" in Professional Engineering
4. Environmental, Social, and Governance Criteria and their role in Climate Action
5. Critical Conversations to Influence and Persuade: A Strategic Approach for Engineers
6. Wastewater monitoring diseases in the built environment: A new tool for Public Health
7. Nuclear Waste and its role in fighting Climate Change
8. Using Artificial Intelligence (AI) to promote greener smart mobility and improve road safety
9. Landfill Gas to Renewable Energy Projects in Niagara
10. Data Governance and Innovation in Ontario
11. Professional Engineers and Pre-Start Health and Safety Reviews in Ontario Manufacturing
12. Assessing the climate risks to infrastructure in First Nations communities: methodology and case studies

PLUS: Be sure to join the Climate Crisis panel discussion from 9:05 am to 10:25 am as experts explore the current situation and how to move forward.

HERE IS A PREVIEW OF SOME OF THE SESSIONS WE THINK YOU WILL FIND INTERESTING

Using Artificial Intelligence (AI) to promote greener smart mobility and improve road safety: Between 1990 and 2019, greenhouse gas (GHG) emissions have increased in Canada by more than 20%. At 25% of total national emissions, the transportation sector is the second-largest source. Various government policies such as the introduction of High Occupancy Vehicle (HOV) lanes were introduced to promote smart mobility and thus reduce emissions and congestion. However, it is estimated that between 20 to 50% of vehicles typically using the HOV lanes are gas-powered, single-occupant vehicles deliberately cheating the system. This greatly reduces the potential GHG reduction the policy intended to drive. Envision AI will present the latest performance results of its computer vision and artificial intelligence (AI) based road-side unit that is capable of automatically determining vehicle occupancy count and providing a number of statistical traffic information in an automated and privacy-preserving fashion, thus paving the way to a fairer, smarter and greener future.

Engineering and Cybersecurity: Hear about real cases of cyberattacks on digital infrastructure such as smart grids, transportation, and food chains. Also, learn about the attacks and their outcomes and impacts on society using real statistical data. Plus hear about some practical engineering solutions and the shortcomings of regulations and governments.

Data Governance and Innovation in Ontario: This panel seeks to pose thoughtful questions to our fellow technocrats, the data innovators in Ontario, as we grapple with newly proposed data legislation and emerging business opportunities that the new data economy presents. In this panel, we seek to engage the wider engineering community on issues relating to responsible data innovation. It is our hope that guests will come forward to share their opinions on this topic illustrating the diversity of opinions that exist on this complex technical subject.

Nuclear Waste and its role in fighting Climate Change: As Climate Change becomes a more pressing issue, increasing nuclear to phase out fossil fuels is seen as a key mitigating opportunity. Small Modular Reactors (SMRs) represent the next generation of nuclear technology and will play a vital role in decarbonizing the energy sector in Canada (and worldwide). Canada is positioned to become a global leader in the development and deployment

of SMR technology with the recent announcement that OPG (Ontario Power Generation) and GE Hitachi will collaborate to build a BWRX-300 SMR at the Darlington new nuclear site. The most significant impediment to achieving Canada's new nuclear goals is the public's perception of the negative societal impacts of nuclear waste. This prevalent and deeply rooted negative perception has been fostered over several decades by anti-nuclear groups, and reinforced in popular culture (e.g., The Simpsons). What is nuclear waste? What are the different types of waste and how are they managed? What are the new technologies and innovations being developed to deal with and reduce the amount? How does this waste compare to the waste from other forms of energy? This presentation will aim to answer these questions and demystify the largely publicized, but rarely analyzed, the topic of nuclear waste.

For those not able to attend in person, we will be live-streaming the conference to a virtual audience. You won't want to miss OSPE's Engineering Conference 2022!

MARK YOUR CALENDAR:
Thursday, November 3, 2022 | 8:15 am to 6:30 pm ET

We will be in-person in Ottawa, Ontario:
The Shaw Centre
55 Colonel By Dr, Ottawa, ON K1N 9J2

ON THE WEB

For more information on our presenters, please visit the conference website:
www.engineeringconference.ca

UPCOMING EVENTS

OSPE is excited to present a number of events for members in the coming months.

Virtual Engineering Event (VE3)

Save the dates for these upcoming VE3s in 2022:

October 3,4,6 & 7

OSPE's virtual career event brings together employers and members of Ontario's engineering community. If you are an OSPE member, this event is FREE for you, one of the many benefits of OSPE membership!

Hear what people have to say about OSPE's VE3s: **https://youtu.be/ThRdG_dHDzs**

If you are a member of the engineering community and would like to find out more about these valuable events please visit **https://ospe.on.ca/career-services/ve3/**

If you are an employer who would like to be a part of this virtual event and connect to applicants via a live video meeting, visit OSPE's Virtual Engineering Employment Event (VE3s)

OPEA on November 18, 2022

The Ontario Professional Engineers Awards (OPEA) Gala is a special evening that recognizes and celebrates engineering achievements within the profession.

On Friday, November 18, 2022, at the Universal Event Space in Vaughan, Ontario, we will honour the winners in 9 unique award categories:

1. Gold Medal
2. Engineering Excellence
3. Research and Development
4. Young Engineer
5. Citizenship Award
6. Management Award
7. Entrepreneurship
8. Project or Achievement ⌵

ON THE WEB

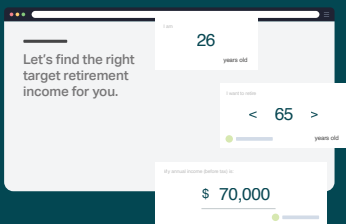Visit the OPEA website for more information: Home - OPEA Gala (**opeawards.ca**)

FOREWORD

"Data is a precious thing and will last longer than the systems themselves."

- Tim Berners-Lee, inventor of the World Wide Web

This report is the result of thoughtful research and consideration from OSPE's Data Working Group (DWG), a subgroup within OSPE's Research & Innovation Task Force. It is comprised of senior level Artificial Intelligence (AI), cybersecurity, public policy, business, and litigation subject matter experts. While this paper is not an in-depth academic literature review of peer-assessed research, it contains our observations as professionals in a wide variety of disciplines including law, engineering and entrepreneurship.

In his recent address at OSPE's 2021 Engineering Conference, OSPE member Dr. Doug Reeve, Ph.D., P.Eng., quoted Yogi Berra "The future ain't what it used to be."1 Dr. Reeve was speaking to the accelerated rate at which the complexity of the problems posed to engineers has evolved over his lifetime. Looking to the future, Dr. Reeve commented, "We need to add skills. We need to drive conversations. We need to change our culture. We need to add consciousness. We need to be leaders." Data innovation is a field where this is urgently needed.

In recent years, the use of AI has seen exponential growth.2 Consequently, law makers, civil rights advocates and engineers are wondering what new professional norms will govern this work. It is our aim to provide a starting point for this multi-stakeholder conversation. Our review of this field has five parts:

1. **The Potential of Artificial Intelligence**
2. **Cybersecurity**: Data Governance & Information Security
3. **The Current State of the Law:** Data Regulation in Canada in 2022
4. **Data and the Public Interest**: Fair Questions from Civil Society
5. **Building a Data Economy**: Economic Growth & Prosperity

This report is designed to pose thoughtful questions regarding emerging business opportunities and proposed data legislation. In each chapter, we have posed questions to the wider engineering community to encourage OSPE members to share their thoughts on this complex subject.

Our main goal is to help business leaders and policy makers understand the principles that underlie these tech-policy positions. A secondary goal is to start discussions and debate within the engineering community that will illuminate the knowledge and talent of Ontario's engineers. If the pandemic has taught us anything it is the importance of connectivity, access, and thoughtful implementation. Since March 2019, it has been data-driven technology that has enabled many of us to stay connected to co-workers and loved ones. It is also data-driven technologies that has allowed our businesses and public institutions to continue to operate and thrive. But not everyone is able to participate in this new data economy. Some in our communities are being left behind.

Across the province, engineers have risen to the challenge of expanding and improving broadband access in our province, developing innovate ways of ensuring business continuity and providing essential services, and leading the charge on tracking the transmission of COVID-19 and vaccine roll-out.

Ontario engineers tackle complex, ill-defined problems every day. As a profession, we should be at the table leading the discussion on data innovation and regulation in our province. ◈

> Our main goal is to help business leaders and policy makers understand the principles that underlie these tech-policy positions.

Beatrice Sze, P.Eng., J.D.
Barrister & Solicitor
Chair, Data Working Group

READY TO RETIRE?

WE CAN HELP YOUR MONEY LAST LONGER AND KEEP GROWING IN RETIREMENT.

HERE'S HOW WE COMPARE WITH THE OTHER GUYS
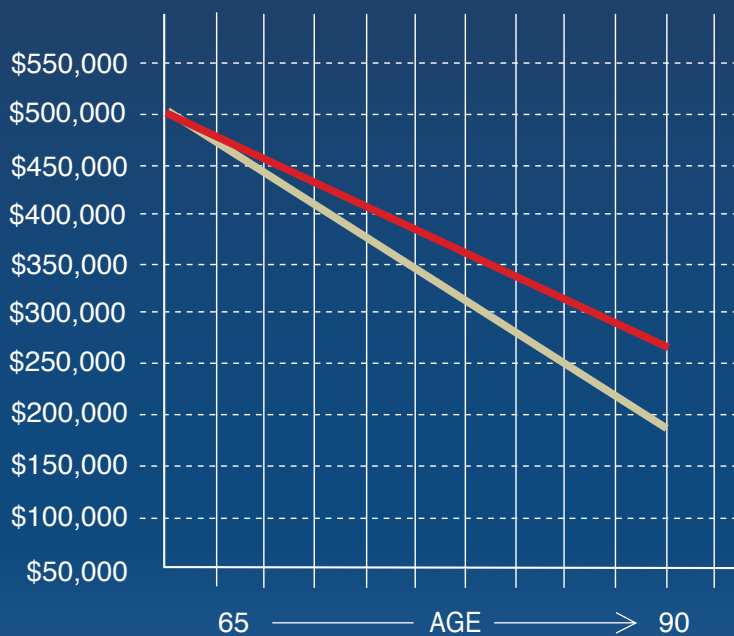
FINANCIAL SECURITY PROGRAM
$258,634

THE OTHER GUYS
$180,055

THIS **DIFFERENCE** IS
$78,579

LET'S DO THE MATH FOR YOU.

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1-866-788-1293 EXT. 5786 OR ANGELA.HARVEY@CANADALIFE.COM

We've assumed a rate of return of 5% over a period of 25 years on an investment of $500,000 and minimum annual required income payments for the Engineers Canada RRIF when compared to retail financial institution RRIF.

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CYBERSECURITY:
Data Governance & Information Security

Defining Data Governance, Information Security, and Cybersecurity

John Wang, P.Eng., CISSP, CISA, CRISC and Ryder LeBlanc, B. Sc.

Data governance is a data management concept concerning the capability of an organization to ensure high data quality throughout the complete lifecycle of data.[1] Data governance also refers to data controls and data strategies that are implemented to support business objectives (SAS). Key focus areas of data governance include data availability, usability, consistency, integrity, and security. It involves establishing processes to ensure effective data management such as accountability for the adverse effects of poor data quality and ensuring that data within an enterprise can be used effectively by the entire organization (Vaughan, 2020).

Information security is a subset of data governance. In accordance with the US government National Institute of Standards and Technology (NIST), information security is "the protection of information and information systems from unauthorized access, use, disclosure, disruption, modification, or destruction in order to provide confidentiality, integrity, and availability."

Cybersecurity is a subset of information security that involves protecting electronic data. In accordance with the US Government Cybersecurity & Infrastructure Security Agency (CISA), "Cybersecurity is the art of protecting networks, devices, and data from unauthorized access or criminal use and the practice of ensuring confidentiality, integrity, and availability of information."

TYPICAL STEPS IN DATA GOVERNANCE

A key element of data governance is information asset management.[2] For organizations to properly implement data governance, they need to inventory and classify their informational assets. Creating an inventory of informational assets means that the organization knows where informational assets are stored, transmitted, and processed. Classifying informational assets means that the organization understands the business impact if proper data governance is not applied.

ASSESSING BUSINESS IMPACT

Within the context of information security, classification is typically based on the business impact to (a) confidentiality, (b) integrity, and (c) availability. For example, using the Royal Canadian Mounted Police / Communications Securities Establishment (RCMP/CSE) Harmonized Threat Risk Assessment (TRA) methodology (Canadian Centre for Cyber Security, 2018), information security classification is based on the criteria outlined in Table 1.

TABLE 1: INFORMATION CLASSIFICATION CRITERIA

Level of Injury	Injury to People		Financial Impact
	Physical	Psychological	
Very High	1. Widespread Loss of Life	1. Widespread Psychological Trauma 2. Potential Civil Unrest	> $1 billion
High	1. Potential Loss of Life for Some 2. Permanent Disability for Some 3. Serious Illness or Injury for Many 4. Serious Physical Hardship for Many	1. Serious Embarrassment for Many 2. Serious Doubts/Uncertainty for Many 3. Widespread Public Suspicion 4. Alienation of Large Groups	> $10 million
Medium	1. Serious Illness/Injury to Some 2. Serious Discomfort for Many 3. Minor Pain for Many	1. Serious Embarrassment for Some 2. Serious Doubts/Uncertainty for Some 3. Serious Inconvenience for Many 4. Minor Embarrassment for Many 5. Minor Doubts/Uncertainty for Many	> $100 thousand
Low	1. Serious Discomfort for Some 2. Minor Pain for Some 3. Minor Discomfort for Many	1. Serious Inconvenience for Some 2. Minor Embarrassment for Some 3. Minor Doubts/Uncertainty for Some 4. Minor Inconvenience for Many	> $1 thousand
Very Low	1. Negligible 2. Minor Discomfort for Some	1. Negligible 2. Minor Inconvenience for Some	< $1 thousand

In this information security classification model, all data is classified using the three questions and using the table above to determine the level of injury.
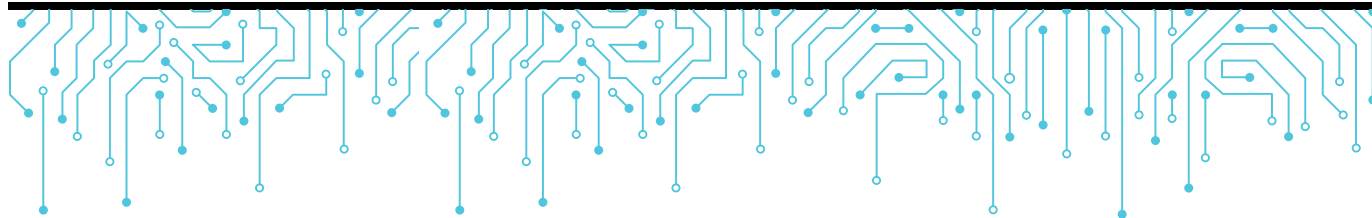
Confidentiality: How much injury can occur if data is leaked to unauthorized people?

Integrity: How much injury can occur if data is not accurate, not complete, corrupted, or not up to date?

Availability: How much injury can occur when information is not accessible to authorized people when they need it or in a format that can be understood by them?

By preparing an inventory and classifying information, an organization can understand the sensitivity of its data and apply the appropriate controls based on classification. For example, encryption may be required if the data is of High confidentiality.[3] On the other hand, the same data may have Very Low availability, which means redundant information technology infrastructure for storing, transmitting, or processing the data is not required.

IDENTITY THEFT PROTECTION

The ultimate target of most cyber-attacks is personal information. Identity theft is one of the most common types of fraud and costs society millions of dollars each year. Interestingly, the size of an enterprise does not indicate how vulnerable it is to cyber-attacks, and in North America, 80% of these attacks are classified as phishing.[4] Thankfully, there are some general rules that can protect against these threats.

Identity Theft Protection – Golden Rules
- Never provide information to people who have contacted you, even if you know them.
- Never click on a file/link/site that you do not know the nature of.
- Never act in a physical environment before making sure it is safe (be cautious of cameras / skimmers/ etc.).

Identity Theft Protection – Silver Rules
- Use strong passwords (combinations of numbers, letters, characters).
- Use at minimum 2-factor authentication.
- Never respond to emails from an unknown source.
- Always use a virtual private network to connect to the internet when in a public place.
- Always set up a reliable backup system.
- Always disconnect devices from the internet when they are idle.

As engineers, we design the electronic systems, write the software, integrate various electronic systems to an information technology system which stores, processes, or transmits data. These systems are used in critical industries such as power generation, aerospace, mining and oil, and financial services to name a few.

Poorly written software or errors in configuring systems can allow an attacker to exploit such vulnerabilities and compromise systems. Inadequate documentation can lead to improper implementation or use of the system. This can lead to loss of life, massive destruction of property, massive ecological damage, significant financial loss, and endangerment of national security.

Data governance and especially information classification is the foundation for ensuring that systems are designed with the appropriate controls in place. By classifying data within a system based on defined levels of confidentiality, integrity and availability, systems and software engineers understand the security expectations and design accordingly. For example, the information within a public web site that publishes boilerplate advisories would likely be classified as low confidentiality, high integrity, and high availability. By understanding the security expectations, this system can be designed and the proper security controls can be implemented. The system engineers would likely ensure that the system is highly redundant to maintain high availability. The software engineers would likely implement strict input validation controls to minimize input errors into the system. Since the information is publicly accessible, controls to protect the confidentiality of boilerplate advisories would not be considered.

Before designing any information system, classification of the information within the system must be completed to ensure that appropriate security controls are designed into the system as opposed to be implemented as an afterthought. **V**

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[1] *The data life cycle is the sequence of stages that a particular unit of data goes through from its initial generation or capture to its eventual archival and/or deletion at the end of its useful life (https://whatis.techtarget.com/definition/data-life-cycle)*

[2] *Information assets are bodies of knowledge that are understood, shared, protected, and exploited because they have value within an organization.*

[3] *Encryption is "any procedure used in cryptography to convert plain text into cipher text to prevent anyone but the intended recipient from reading that data." (https://csrc.nist.gov/glossary/term/encryption)*

[4] *Phishing is considered "A technique for attempting to acquire sensitive data, such as bank account numbers, through a fraudulent solicitation in email or on a web site, in which the perpetrator masquerades as a legitimate business or reputable person." (https://csrc.nist.gov/glossary/term/phishing)*
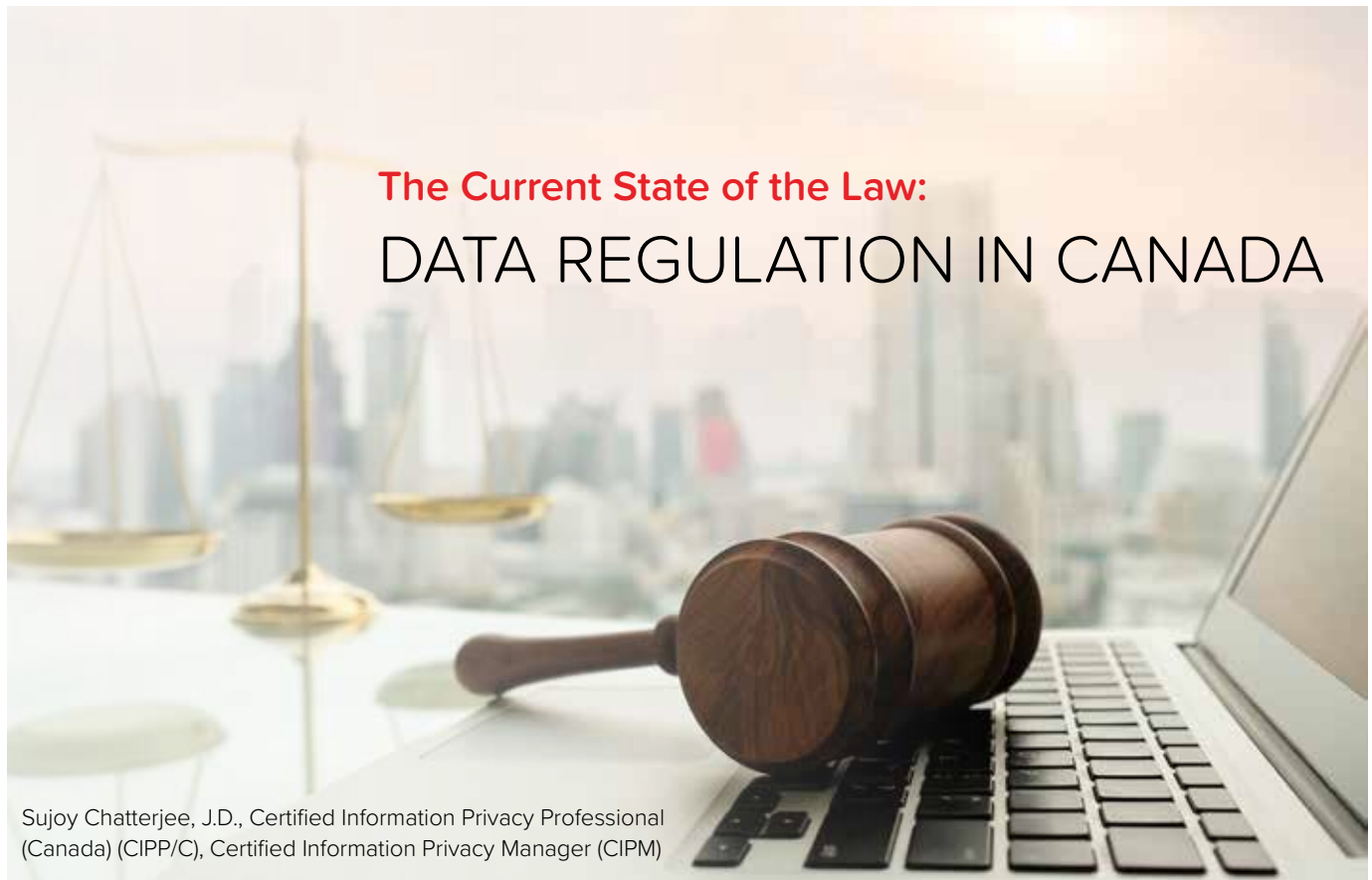
The Current State of the Law:
DATA REGULATION IN CANADA

Sujoy Chatterjee, J.D., Certified Information Privacy Professional (Canada) (CIPP/C), Certified Information Privacy Manager (CIPM)

EXECUTIVE SUMMARY

1. Canadian law is going to change to align with General Data Protection Regulation (GDPR).
2. Change will happen at the federal and provincial level. Be prepared for both and watch for the harmonization of privacy laws internationally.
3. Have infrastructure in place on your teams to manage privacy as a program within your organization. This includes having a privacy office that manages requests in line with legislative requirements.

BILL C-11 COMMENTARY - PRIVACY CONSIDERATIONS

For OSPE members, how you collect, use, retain, and disclose the personal information of your clients, employees, and other stakeholders is an important business consideration. Significant changes were proposed in the 43rd session of parliament under what was then called Bill C-11: The Digital Charter Implementation Act, 2020 (DCIA). The September 2021 election effectively put an end to any progress on Bill C-11 and it is unlikely that this Bill will become law before the end of 2022 (Shah et al., 2020). Nevertheless, it is important to discuss Bill C-11 for what it represents: a much-needed overhaul of private sector legislation relating to privacy, and data protection.

This Chapter discusses business considerations for Professional Engineers if the successor to Bill C-11 becomes law. New requirements around de-identification of data, data portability requirements, and consent impact how Professional Engineers manage private sector customer data. OSPE members should consider the following rules and behaviours in light of the proposed legislation. Now is an excellent time to plan for the changes that are likely to come as Canada looks to harmonize and catch up with privacy laws such as the European Union's General Data Protection Regulation (GDPR).

BACKGROUND AND EXISTING LEGISLATIVE FRAMEWORK

Bill C-11 is a bellwether that we can use to understand where privacy laws are going in Canada over the next several years. The federal government is not alone in proposing changes to privacy legislation – Ontario is in the early stages of modernizing its privacy laws and benefits from the commentary and discussion that have surrounded Bill C-11.

Private sector businesses currently operate under the federal Personal Information Protection and Electronic Documents Act (PIPEDA). Bill C-11 proposed repealing parts of PIPEDA and replacing it with new legislation, namely the federal Consumer Privacy Protection Act (CPPA), the Personal Information and Data Protection Tribunal Act (PIDPTA), and the Electronic Documents

TABLE 1: SUMMARY OF SIGNIFICANT CHANGES TO THE CONSUMER PRIVACY PROTECTION ACT

Requirement	Section(s) of the CPPA	Commentary
Establishment of a Privacy Management Program	Section 9	Requirement for all businesses to establish/maintain policies and procedures for training personnel in privacy program management and ability to explain policies
Same protection of information	Section 11(1)	If your organization transfers personal information to a third-party service provider, the organization must ensure that the service provider provides substantially the same protection of the personal information as your organization.
Consent	Section 15	Requirement to obtain explicit consent from consumers at the time of data collection. Consumer must be made aware of the purpose of data collection, be able to understand the specific type of information that is being collected, used, or disclosed, and the names of any potential third parties to which the information may be disclosed.
Consent obtained by deception	Section 16	An organization must not obtain an individual's consent by providing false or misleading information or using deceptive practices. This includes the business providing a service to the individual, conducting due diligence, for security or information management purposes, safety, or in a situation where obtaining consent would be impracticable.
Business Activities	Section 18	An organization may collect or use an individual's personal information without their knowledge or consent for business activities.
Internal Research	Section 21	An organization may use an individual's personal information without their knowledge or consent for the organization's internal R&D purposes if the information is de-identified before use.
Prevention, detection, or suppression of fraud	Section 27(2)	An organization may collect an individual's personal information without their knowledge or consent if the information was disclosed to it in relation to fraud detection, suppression, or prevention.
Socially beneficial purpose	Section 39(1)	Disclosure without consent is permissible if personal information is de-identified. Information can be disclosed to certain public institutions such as a health care institution, post-secondary educational institution, public library in Canada or other organization with a mandate to carry out a socially beneficial purpose.
Initiative of organization — national security, defence, or international affairs	Section 48	For national security matters, defence of Canada, or international affairs, an organization may disclose an individual's personal information without consent to a government institution.
Disposal at individual's request	Section 55	If an organization receives a written request from an individual to dispose of personal information, the organization must dispose of the information as soon as feasible unless disposal relates to personal information of another person, or the organization is prevented from disposing of information by contract or law.
Service providers	Section 61	A service provider must notify as soon as possible when there is a privacy breach
Policies and practices	Section 62(3)	If the organization used an automated decision system to make a prediction about an individual, the individual can request an explanation of the prediction, recommendation, or decision and how personal information was used to achieve that.
De-identification of Personal Information – proportionality	Section 74	An organization that de-identifies personal information must ensure any technical and administrative measures applied to the information are proportionate to the purpose for which they information is de-identified as well as the sensitivity of the personal information.
Prohibition (on use of de-identified information)	Section 75	De-identified information cannot be used to re-identify an individual unless an organization is testing the effectiveness of safety and security measures.
Code of practice approval	Section 76 (note: this applies to sections 77- 81 which relate to administering a code of practice and are all new sections proposed under Bill C-11.	An organization or entity can apply to the Federal Privacy Commissioner for approval of a Code of Practice for protection of personal information
Complaint (Investigation of)	Section88 (note: sections 82-102 address the complaint process	This section allows the privacy commissioner to conduct an inquiry after a complaint is made about an organization.
Nature of inquiries	Section 90(1)	The complaint investigation process may be a private inquiry. The Privacy Commissioner is not bound by any legal or technical rules of evidence in conducting an inquiry; this is an informal process meant to be expedient, with considerations for fairness and natural justice.
Penalties (recommendations)	Section 93	The Privacy Commissioner can make decisions about penalties (e.g., amount and whether a penalty is warranted) for organizations that have contravened the CPPA.
Promoting purposes of Act and Prohibition — use for initiating complaint or audit, respectively	Sections 109 and 110	For an indictable offence (i.e., a serious criminal offence), fines of up to $25 million and 5% of the organization's gross global revenue may be imposed for breach of security, failure to retain records, improper use of de-identified information, or obstruction of an inquiry or investigation. For an offence punishable on summary conviction (i.e., a lesser offence) the maximum fine is $20 million and 4% of an organization's gross global revenue).
Offence and Punishment	Section 125	The Privacy Commissioner has to develop educational materials to inform the public of the CPPA. This includes developing guidance materials for organizations to understand how to comply with the CPPA. An organization may request guidance from the Office of the Privacy Commissioner (OPC) with respect to their Privacy Management Program. The information obtained when providing guidance to an organization must not be used by the OPC to initiate a complaint or conduct an audit of the organization.

Consent

De-identification of data

Privacy Management Program

Act (EDA) (Government of Canada, 2020). PIPEDA would still exist, with its emphasis shifting to electronic documents and e-commerce instead of consumer privacy (Schober & Thompson, 2020).

CHANGES TO PRIVACY REQUIREMENTS FOR BUSINESSES UNDER THE CPPA

The CPPA is of relevance to OSPE membership at large. Some of the key components of the CPPA are summarized below in Table 1. The changes that are highlighted include either entirely new sections, or sections of the CPPA that have been significantly modified from the corresponding section under PIPEDA.

Note that this section paraphrases what is written in Bill C-11 and is not a word-for-word transcription of the changes in the Bill. As such, interpretations of what is written below may differ slightly from the actual wording in the Bill. The language is modified for brevity and clarity.1

NEW REQUIREMENTS UNDER THE CPPA
Consent

The CPPA applies to protection of personal information that is collected, used, or disclosed in the course of commercial activities (CPA, 2002, s.6.1.a). Consent to the collection and use of customer data is a significant aspect of the CPPA and in particular there is an emphasis on providing easy to understand, plain language communications about how a business will be collecting, using and sharing information (CPA, 2002, s.15.3). Essentially, consumers should be able to understand how a business will use personal

> The implied consent model recognizes that an individual may not think about or understand all the different ways in which their information may be used in a complex information economy.

information and how the consumer has control to withdraw consent or have their information removed from company databases all together.

Bill C-11 addresses the consent-to-use-of-information issue more broadly by allowing an organization to rely more upon implied consent. Under PIPEDA (the existing private sector legislation), the knowledge and consent of the individual are not required for the disclosure of personal information. In limited circumstances, information collected for one purpose may be used for another related purpose.2 There is indication within Bill C-11 to simplify how an organization obtains permission to use personal data. The implied consent model recognizes that an individual may not think about or understand all the different ways in which their information may be used in a complex information economy. Implied consent is used in processes such as preventing or detecting fraud – an organization should not require consent from an individual if it is acting to protect the individual's personal information from a potential criminal act. That said, with implied consent, the Office of the Privacy Commissioner has called for greater accountability by calling for privacy policies to be registered and reviewed by the Commissioner for organizations that are holding personal information.

De-identification of data

The CPPA allows for the use of de-identified data for internal R&D and socially beneficial purposes without the consent of the individual (Shah et al., 2020). Bill C-11 uses the term "de-identified data" as personal information that has been modified by using

Right to disposal

Data Portability

**Trans-border
data flows**

technical processes to ensure that the information does not identify an individual. Data that has been de-identified could not be used in reasonably foreseeable circumstances, alone or in combination with other information, to identify an individual.

This use has implications for data analytics, AI, machine learning, and B2B interactions. Organizations that that process data has to have an ability to use de-identified customer data. De-identification is also an element in the purchase or sale of a business. While PIPEDA currently allows organizations involved in the purchase or sale of a business to share personal information about their customers without consent, under the CPPA, the seller would be required to de-identify data before providing information as part of due diligence in the transaction. For small businesses (and start-ups in particular) investors and potential business partners will want to know the strategy around due diligence. It is prudent for businesses to have de-identification measures in place before it becomes a legal requirement (Shah et al., 2020).

Privacy Management Program

The CPPA requires maintenance of a Privacy Management Program for each organization. A Privacy Management Program must have policies and procedures explaining how your organization protects personal information, how you manage privacy complaints, privacy training for personnel, and an explanation of all privacy related policies and procedures. Small, data-intensive organizations may find it particularly challenging to implement these privacy practices.

> More freedom for consumers to move their data to other organizations and the requirement to maintain similar privacy protection and data standards is a boon for companies that require customer data.

Right to disposal

In other jurisdictions, the Right to Disposal is called the "right to be forgotten" or "right to erasure" wherein an organization is required to have a mechanism for the removal of personal information of individuals from their systems. The right is not absolute and is subject to legal retention obligations. In other words, an individual may request that a company remove personal information from company databases, as long as there is no legal obligation to keep that information.

Whether you are an organization that collects information directly from individuals, or you work with data processing and management along the supply chain, there are practical challenges to meeting this requirement (Shah et al., 2020). The right to disposal involves understanding record keeping, data storage, and employee access procedures. Organizations need to know where their data is stored, including redundancies. In order to ensure total removal of personal information relating to an individual, these systems must be audited and maintained. Doing so gives consumers more control over who has their data.

Data Portability

The CPPA casts data portability as a right for individuals. If an organization transfers personal information to a service provider, the organization must ensure that the service provider allows for substantially the same protection of personal information as the original organization (CPA, 2002, s.11.1). There is an opportunity here for OSPE members, particularly those in the start-up space.

More freedom for consumers to move their data to other

organizations and the requirement to maintain similar privacy protection and data standards is a boon for companies that require customer data. The corollary is that start-ups will have to develop compliant data management frameworks with the purpose of distinguishing between the information organizations directly collect from individuals as compared to data created by your organization. Further information is needed about the CPPA's planned data portability framework before OSPE members can be advised on best practices to execute this. A starting point would be to look to the financial sector and how fintech based companies may be working on this data portability framework (Shah et al., 2020).

Trans-border data flows

Related to data portability, the flow of data across international borders has been highlighted by the Office of the Privacy Commissioner and others as a gap in Bill C-11 (Therrien, 2021). As practitioners, you may be familiar with "adequacy requirements" under the European Union's General Data Protection Regulation (GDPR). If data protection measures are deemed adequate, this permits a cross-border transfer of data outside of the EU. Bill C-11 has been critiqued for not having adequate protections in place for data transferred to third parties (Therrien, 2021). If this portion of the bill is strengthened, expect changes to requirements for data protection and consistency in security measures between other organizations that OSPE members would do business with.

NEW POWERS FOR THE OFFICE OF THE PRIVACY COMMISSIONER: PENALTIES, FINES, AND INVESTIGATIVE POWERS

Bill C-11 expands the powers of the federal Office of the Privacy Commissioner (OPC) to impose penalties for non-compliance, fines, and to allow for a private right of action after a finding of non-compliance by the OPC. Penalties and fines are delivered through the Personal Information and Data Protection Tribunal - this body would also be responsible for hearing appeals of orders issued by the OPC (Government of Canada, 2021).

Penalties

The OPC may recommend that an organization comply with the CPPA and publicly document its privacy practices to show compliance with OPC orders. Penalties for non-compliance can be significant – up to $10 Million or 3% of an organization's gross global annual revenue for contravening processing provisions or security safeguards. These are significant increases in the penalties for non-compliance as compared to PIPEDA, which currently limits penalties to $100,000 per indictable offence. OSPE members should be mindful of these requirements and consider how best to achieve compliance in a start-up or small business context.

Fines

Distinct from penalties, the OPC can also administer fines for when an organization knowingly contravenes the CPPA, whether in relation to a privacy breach, misuse of de-identified data, or failing to respond to an access request from a member of the public. Denying whistleblower protection or obstructing OPC proceedings may also result in significant fines – up to $25 Million or 5% of gross global revenue, depending on the nature and severity of the offence. Mitigating this risk involves proper business insurance as well as legal and privacy advice. Also consider the reputational risks of having a conviction under the CPPA and what that would mean for the viability of business operations in the future (Shah et al., 2020).

RELATED ONTARIO LEGISLATION

Bill C-11 was not developed in a vacuum. Specific mention of the Federal Privacy Commissioner's comments on Bill C-11 have fed into Ontario's own modernization of privacy legislation. In June of 2021, the Government of Ontario released its White Paper discussing uses of data based on legitimate need and limiting use. There is also consideration of Artificial Intelligence and machine learning. While this is in its earliest stages, some consideration of what may be in the Ontario legislation includes:

- **Right to be forgotten:** also known as right to erasure, the requirement for an organization to remove data at the request of an individual
- **Data mobility and portability:** the ability to move data without loss of privacy protection rights.
- **Safe use of automated decision-making:** relating to surveillance, algorithmic bias, and Artificial Intelligence.

It will be difficult to predict how federal and provincial legislation will interact, given the positioning of Bill C-11 within the House of Commons, and the newly elected federal government. Both legislative efforts pose significant generational changes for privacy in Canada.

CONCLUSIONS AND QUESTIONS FOR THE ENGINEERING COMMUNITY

It will likely be several years before Canada's private sector privacy legislation changes to be more in line with EU and various U.S. privacy laws at the state level (i.e. in Colorado, Virginia, and California). The legislation proposed via Bill C-11 speaks to the consent and data management issues that are relevant for a variety of business organizations. Continued monitoring of legislative change across Canada is essential. Strategies can be developed to respond to new legislative requirements and minimize the disruptions faced by OSPE affiliated organizations. OSPE members should seek out resources to advise on the fast-changing landscape in privacy and information management. ⓥ

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Sandra Odendahl, P.Eng.
OSPE Member

Nick Mocan, P.Eng.
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Kam Leong, P.Eng.
OSPE Member
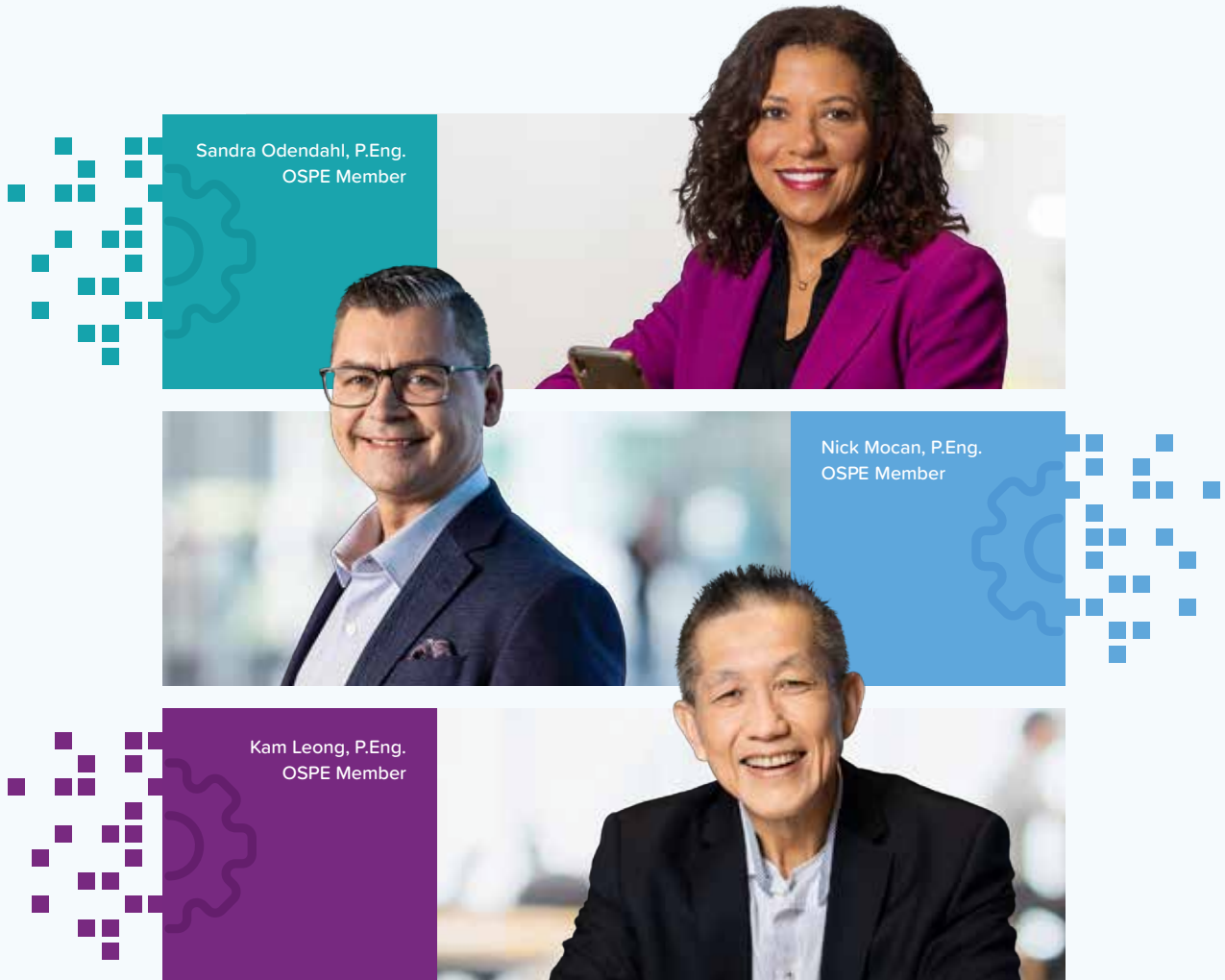
We are keeping our families, friends and neighbours safe at home, work and play. We are guiding public policy and championing sustainability. And our innovative spirit is helping our province tackle tomorrow's challenges today.

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Learn more at ospe.on.ca/weareengineering

ONTARIO SOCIETY OF PROFESSIONAL ENGINEERS

BUILDING A DATA ECONOMY

ECONOMIC GROWTH & PROSPERITY

Mukul Asthana, P.Eng., M.B.A. and Ryder LeBlanc, B. Sc., M.E.P.P. (candidate)

THE DATA-DRIVEN ECONOMY

Canada is undergoing a digital transformation accelerated by several emerging technologies (AI, ML, quantum computing, etc.) which is ushering in a data-driven economy. To maximize the benefits of this new paradigm, data must be seen as an opportunity rather than a threat. Data supports the public, private, and third sectors by improving the delivery of existing services, creating entirely new products and services, and spurring technological innovation. These advances create jobs, strengthen the economy, and further societal goals like tackling climate change and improving health services. Transitioning to a data-driven economy requires data governance — the processes, roles, policies, standards, and metrics regarding data collection, storage, and use.

GROSS DATA PRODUCT: A USEFUL METRIC

As Canada transitions to a data-driven economy it will be important to track our progress relative to other nations. One metric that can be useful for this is the Gross Data Product (G.D.P). This G.D.P. measures the value of data within a country and can be used to track digital competitiveness around the world.

Harvard Business has developed four metrics for measuring G.D.P.:
Accessibility: Institutional openness to data flows as a way to assess whether the data generated in a country permits wider usability and accessibility by multiple AI researchers, innovators, and applications.

Volume: Absolute amount of broadband consumed by a country, as a proxy for the raw data generated.

Usage: Number of users active on the internet, as a proxy for the breadth of usage behaviors, needs and contexts.

Complexity: Volume of broadband consumption per capita, as a proxy for the sophistication and complexity of digital activity.

Based on these criteria, Canada ranks 7th in the world overall. This indicates that Canada has done well with data so far and that there is an opportunity for us to collaborate and play a leading role among global partners to establish an international order for data governance. Countries with a high G.D.P. ensure their businesses can start up, grow, and be globally competitive in this new technological era. To position themselves as data leaders, many nations are taking ambitious steps to incorporate data into their governance structures.

UNITED KINGDOM: A CASE STUDY IN DRIVING INNOVATION

The UK is currently focused on developing data innovation over data regulations. This is clearly stated in its National Data Strategy as "data and data use are seen as opportunities to be embraced, rather than threats against which to be guarded". The core pillars influencing the data strategy are data foundations, skills, availability, and responsibility. To ensure the best use of data the UK believes that data must be standardized and fit for purpose, that its people must be able to develop their data skills, that data should be shared and widely accessible, and that data use must be lawful, secure, fair, ethical, sustainable, and accountable.

The National Data Strategy has identified five priority areas of action:
- Setting the correct conditions to make data usable and accessible across the economy
- Developing a pro-growth data regime that fosters public trust without restricting access to data
- Radically transforming the use and sharing of data within government
- Ensuring the security and resilience of national data infrastructure
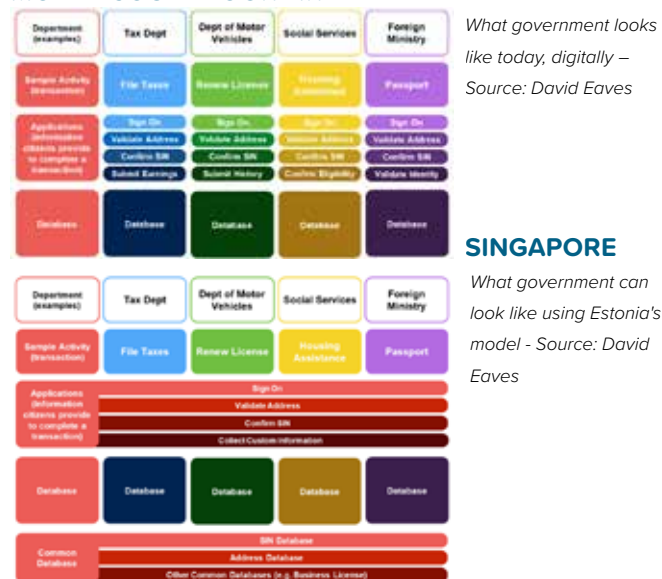- Championing the international flow of data

ESTONIA: A CASE STUDY IN E-GOVERNANCE

Estonia is rethinking the very idea of government and digital infrastructure. Not only are they increasing broadband connectivity so that more people anywhere can access services on the go, but they are also defining standards so that the core sets of public tools and databases – 'the platforms'– can be reused by the public and private sectors to drive down costs and simplify services. This is in direct contrast to many existing forms of digital government, where departments digitize their services

and functions independently and duplicate the efforts of other departments in gathering citizens' information.

These online platforms have allowed Estonia to offer public services faster and cheaper than ever before. Healthcare has been revolutionized by digitizing health records, prescriptions, and medical bills. One way this improves service quality is that paramedics responding to an emergency can query the patient's medical history and plan their treatment before they arrive. e-Estonia supports the private sector by making it easier to start a business. 98% of companies in Estonia have been established online, where registration times are a couple of hours instead of five days in person (e-Estonia, 2019a). Estonia's digital government even facilitates internet voting. In 2005, it became the first country in the world to hold nation-wide elections using this method, and currently 44% of Estonians use this service (e-Estonia, 2019b). These are depicted in Table 1.

TABLE 1: WHAT THE ONTARIO GOVERNMENT'S MODEL COULD LOOK LIKE

What government looks like today, digitally – Source: David Eaves

SINGAPORE

What government can look like using Estonia's model - Source: David Eaves

The key competitive advantage of Singapore's data strategy is Virtual Singapore: a dynamic three-dimensional city model and collaborative data platform.

Virtual Singapore is transforming the country through:

Innovation; a testbed for new ideas, technologies, and procedures

City planning; an integrated platform for the development of analytical apps, useful for monitoring things like transport flows and pedestrian movements patterns. By leveraging the big data

environment and aggregating information from both the public and private sector, the potential uses of virtual modelling for tackling livability issues are limitless

Research and development; a rich data environment which allows researchers to develop new technologies

Improving government administration; supports the creation of smart cities, the delivery of municipal services, and OneMap, a detailed national map of Singapore

Improving communities; making geo-visualization, analytical tools, and 3D semantics-embedded information accessible to the public; providing people with a virtual yet realistic platform to connect and create awareness and services for their communities

Supporting businesses; a wealth of data that can be used for business analytics, resource planning and management, and specialized services

Collaboration and decision making; a virtual model that integrates various data sources including government agencies, 3D models, the Internet, and Internet of Things devices. The platform allows different agencies to share and review the plans and designs of various projects in one place

DATA GOVERNANCE FROM THE PRIVATE SECTOR

Amazon, Google, Alibaba, and other data-driven behemoths are fostering economic growth by providing digital services to small and medium enterprises (SMEs). Alibaba in particular is focusing its efforts on digitizing and democratizing global trade by providing SMEs with services such as:

- Providing online marketplaces for trade
- Verifying merchant identities
- Handling payments
- Providing financing

Our governments should look to the innovation of these tech giants to understand how best to grow the economy by leveraging data.

ONTARIO'S DATA STRATEGY

Ontario's Digital and Data Strategy, as laid out by the provincial government in, sets a course for a data-driven economy that is compatible with Canadian values. This strategy includes various funding and initiatives, but more policies will undoubtedly be needed to meet the challenges ahead. As engineers we can sway public policy and a duty to society to exercise this for the public good. Now is the time to educate ourselves on these issues and prepare our recommendations for when policy makers turn to us for advice. ◆

DATA GOVERNANCE QUESTIONS
For the Engineering Community

1. What are the top five challenges to supporting Artificial Intelligence (AI) applications where you work?

2. What skills and training do you think are needed to implement AI?

3. Does your company have a framework for AI adoption? How do you avoid AI projects becoming stuck in proof-of-concept purgatory?

4. There is a tendency for industry to think AI only resides in the IT space, that is a misconception. Where do you think engineering becomes central to AI both in terms of application and safety? Do you know of any examples?

5. Because the career path isn't obvious, it's difficult to find technical leaders for these types of projects. How do you approach similar issues in your organization? Does AI fit well?

6. Given the increase in cybercrime and cybersecurity breaches, what is the role of engineers in ensuring the implementation of sound data governance practices?

7. Should the engineering regulator in Ontario, Professional Engineers Ontario, consider creating a licensing category for computer engineers?

8. How has your organization responded to changes in privacy law before?

9. Can you look to your colleagues in other jurisdictions (such as in Europe with the General Data Protection Regulation) to understand if you can manage the changes that are coming to privacy law in Canada?

10. What costs are associated with these changes? Do you have the resources to support a privacy officer? Does that role already exist, or does it have to be created?

11. Who should benefit from the digital economy?

12. How much power should individuals have over their data?

13. Should non-technical specialists (such as humanities or civil rights specialists) be embedded in the engineering design cycle as we develop new technology? Why or why not?

14. What are our values in the context of data governance and what business norms should be reflected in our digital strategy?

15. As engineers, how can we use data to enhance and grow our organizations, and do we have the skills to identify these opportunities?

16. What information should government be able to share, and what say should citizens have?

17. Should access to a base level of internet be a civil right? ◆
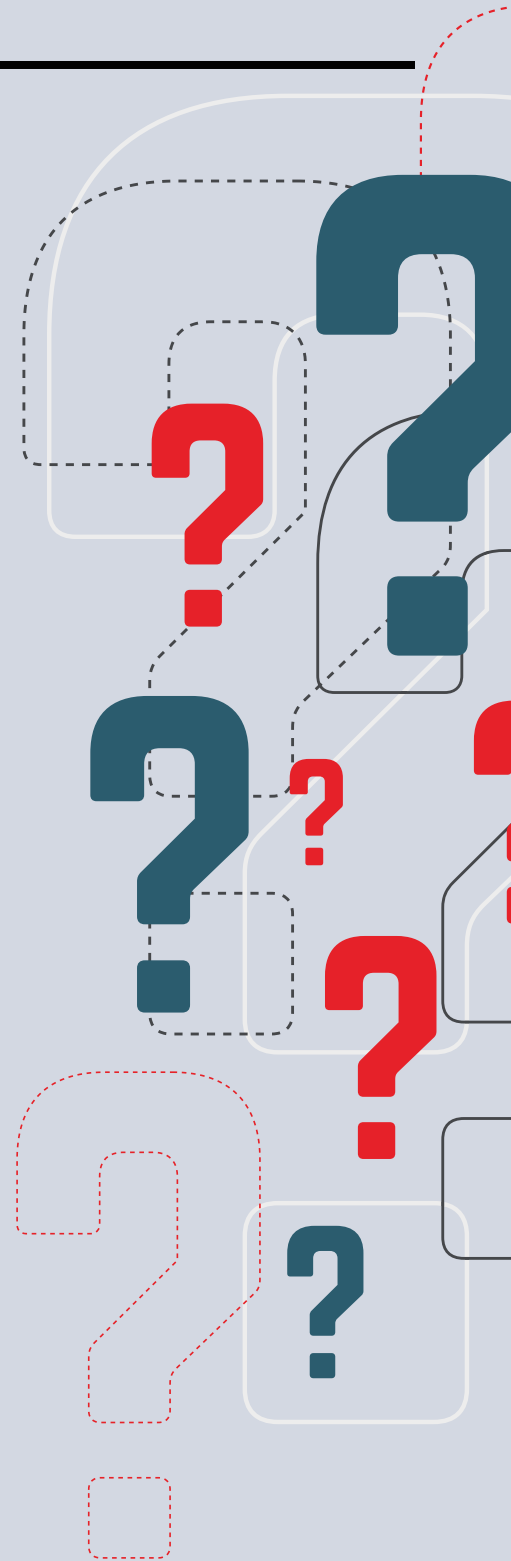
Mandatory continuing professional development is coming in 2023

PEO's current voluntary PEAK program is transitioning to a mandatory program that will begin in January 2023. The program is designed to help licence holders maintain their professional knowledge, skills and competence as engineers and is in keeping with PEO's regulatory, public protection mandate as set out in the *Professional Engineers Act*.

As of January 2023, all licence holders (both practising and non-practising) must comply with the program. More information can be found at **www.peopeak.ca**.

Professional Engineers Ontario

PEAK
REACHING NEW HEIGHTS

MEMBER
PROFILE

AHMED ABBAS
Student Member
Engineering Student

JACK ABBRUZZESE, P.ENG.
Professional
Process / Systems Engineer

What does your job or volunteer work consist of?

I work as a developer. I am working on full-stack application for a company called Uvaro. They provide sales training for people who are transitioning in their job search

How do you apply engineering knowledge and principles to your job or volunteer work?

In two ways, the first being hard skills. There is a lot of programming and developing we do in courses that are relevant to work. The second is soft skills, I took a lot of courses that specialized in project management, how to break up tasks, how to plan for deadlines, and what to do when you get stuck, I find this to be very helpful when it comes to my job. Being able to know how to ask questions to ensure that you know how you can contribute but also know how to get the most out of your work term.

Why are you an OSPE member/why do you think the work OSPE does is important?

It's good to be a part of a community. There are a lot of people out there who have things in common with you, but it is sometimes difficult to find that one thing to start a conversation. OSPE does a good job to open that door, meet with like-minded individuals, to network, and connect with other people.

What issues in the profession are most important to you? What should OSPE focus on?

The most important issue to me is climate change and I definitely believe that Engineers can influence how sustainable we choose to be. We have a meaningful impact on the choices that are being made. When making changes those impacts can span several industries too.

What advice would you give your younger self?

Try to get more involved with things as early as possible. There are many opportunities during high school that I could have joined, and I would have benefitted from that if I had done it early on.

What does your job or volunteer work consist of?

My role at work has varied as I have been a professional engineer for over 30 years. From IT to manufacturing, processing, electrical, mechanical, instrumentation, PLC programming, generalist, and technical roles.

How do you apply engineering knowledge and principles to your job or volunteer work?

I have been on the Lean Committee at PEO Southwestern Ontario Chapter, and I have done presentations to universities students talking about Lean. Continuous improvement is very important in the engineering field.

Why are you an OSPE member/why do you think the work OSPE does is important?

I have been a member of OSPE since the beginning when it branched out from PEO. As PEO is the regulatory body and OSPE is the advocacy body, I think OSPE has many benefits and an important role to play.

What issues in the profession are most important to you? What should OSPE focus on?

OSPE fights for the rights of engineers. As an example - OSPE advocated on the industrial exemption. Perhaps OSPE should look at the role of a post-graduate degree for an engineering degree, similar to other professions.

What advice would you give your younger self?

Make sure you stay current. Continuing education is important.

MARWA AL-HAJI
Associate
Manager of Capital Engineering Services
(Mississauga)

What does your job or volunteer work consist of?
I manage a team of project engineers responsible for construction and infrastructure upgrade projects as well as manufacturing capital projects in a pharmaceutical company.

How do you apply engineering knowledge and principles to your job or volunteer work?
I support operations and environment, health, and safety (EHS) by providing engineering solutions to enhance process safety and efficiency. I also ensure all my projects are designed in compliance with codes and regulations and executed in a safe, timely, and cost-effective manner, with minimal interruption to the site's daily activities.

Why are you an OSPE member/why do you think the work OSPE does is important?
I love the professional development opportunities that are available for engineers through OSPE. The Engineering Academy courses offered are very interesting especially courses focused on engineering management.
The program OSPE offers to support Engineers- in-Training throughout the Professional Engineering licensing journey is very useful. I took the OSPE's prep course, and I was able to pass the exam with ease.

What issues in the profession are most important to you? What should OSPE focus on?
Climate change and sustainability are very important issues. Engineers and OSPE should focus on promoting green engineering to improve sustainability and reduce the carbon footprint in manufacturing.

What advice would you give your younger self?
Take risks and don't be afraid of failure, learn from it, and believe in yourself.

PIERRE B. LEDUC

P.Eng.
May 27, 1922 – June 6, 2001

Pierre grew up in Ottawa, graduating from Ottawa University High School in 1941 before attending the Ottawa University engineering faculty for 2 years. He then joined the Canadian military. Following this, he returned to his studies at McGill University and completed his B. Eng. in 1950. On September 16, 1950, Pierre became a member of the Corporation of Professional Engineers of Quebec.

His first employment in the engineering sector was with Anglo Pulp and Paper in Quebec City. Pierre traveled several times to Anglo's Kapuskasing pulp mill where he provided his expertise. He worked at Anglo for several years before accepting employment with an engineering consulting firm, again in Quebec City, called Walker and Tessier. His responsibility there was to inspect several projects that the firm was overseeing. At times, he traveled to sites outside of the area which took him as far afield as Gaspe. Pierre then moved on to Imperial Tobacco in the 1960s, first at their plant in Quebec City as Plant Engineer and then to their facility in Montreal. He took on the position of Supervising Engineer and ultimately ended his career as Manager, Civil Engineering and Architecture, retiring from the company in May of 1987 after a long career. Following retirement, he did work on a few contract positions with Imperial.

Pierre became a member of the American Institute of Plant Engineers in 1970 and became a member of the Professional Engineers Ontario in 1992.

Pierre attended several workshops to enhance his knowledge, including the Built-up Roofs Institute through the University of Wisconsin-Extension and Steam Trapping and Air Venting through SARCO Canada Ltd., to name a couple.

While at Anglo-Canadian Pulp & Paper Mills Ltd., Pierre co-wrote an article called: Proving a New Pulp: Behind-scenes story of Gaspesia's new chlorine dioxide sulfite pulp, Wonderwhite: engineering, designing and quality analyses.

In the parting speech at his retirement from Imperial Tobacco, his contributions were recognized, and he was credited with preserving the older buildings because of his knowledge and expertise. ◆

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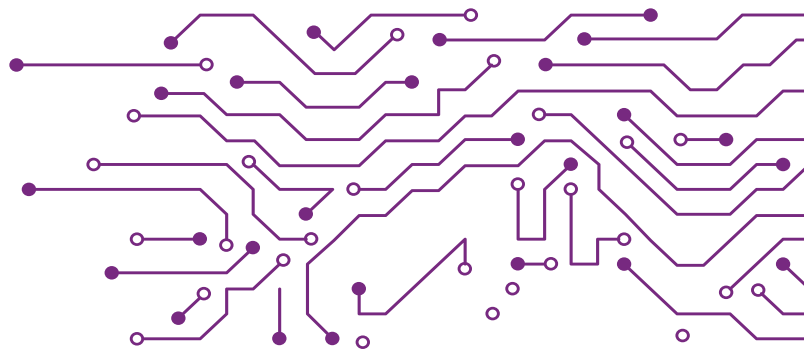
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PLANNING FOR THE FUTURE
THE NEXT GENERATION OF ENGINEERS

The future of work, the workforce, and how to best prepare for the many unknowns ahead are some of the biggest challenges currently facing Canada's governments, employers, educators, and policymakers.

With Canada's aging population, nearly one in four workers is 55 or older. There has never been a more critical time for Canadian companies to consider the long-term needs of their workforce and begin investing in talent management.

In the engineering field alone, thousands of engineers are reaching the age of retirement. In a report called *Engineering Labour Marketing in Canada – Projections to 2025*, Engineers Canada expects that organizations across Canada will be short 100,000 engineers over the next decade as a result of retirements and growth in business demand.

According to Mary Wells, Dean of the Faculty of Engineering at the University of Waterloo, retiring engineers pose an opportunity for organizations to assess their current talent strategies. "This emerging group will be unlike the engineers before them – they'll be the first generation to grow up completely embedded in technology since birth. Paired with the advances spurred by the COVID-19 pandemic, the new talent pool will bring a new dimension to current employers and organizations."

Wells cautions that while the next generation will bring new perspectives to the industry, it is up to organizations to meet the needs of talent and help keep them in Canada.

"We are losing engineering talent to major tech hubs around the world," says Wells. "If Canadian employers focus on creating unique work experiences and career opportunities for our students, there will be more of a desire for them to stay and as the potential for Canadian technology investment grows, they will return."

At Waterloo, preparing the next generation of talent for an evolving workplace and a complex future has become central to many programs.

"Co-operative education and work-integrated learning enables students to gain experience and helps employers engage with emerging talent well before they graduate," says Norah McRae, Associate Provost of Co-operative and Experiential Education at the University of Waterloo. "By the time they graduate, students typically have two years of experience navigating the workforce and applying their skills to solve problems across organizations."

Co-op experiences have been central to the University since its founding in 1957 when 74 students started engineering classes. In October of that year, the same students began their first co-op placements.

"We are home to the largest pool of co-op talent in the world," says McRae. "More than 25,000 Waterloo co-op students are hired each year by 7,500 employers located in more than 60 countries."

Today, nearly 3,500 engineering students on average look for work each term. In 2021, more than 7,130 engineering students were employed over the year, with a total of 10,400 total work terms completed.

The Changing Workforce

"Our workforce is drastically shifting. There is a heightened need for employees who have complementary and sometimes unusual combinations of transferable skills. The future workforce will require talent that has a strong educational foundation coupled with technical skill and agility. Our students are very equipped to contribute their talents in unique and meaningful ways," says McRae.

For example, Geotab, one of the fastest-growing technology companies in North America, is preparing for more millennials and Gen Z to enter the workforce by embracing the significance of generational change.

"Geotab is preparing for more millennials and Gen Z in the workforce by providing opportunities for growth and development. They are constantly finding new ways to keep students engaged to position Geotab as an employer of choice," says Tharsiga Selvathilagan, campus talent acquisition partner at Geotab. "We believe in the power of fostering key relationships and setting employees up for success through mentorship opportunities. Our new Buddy Program is designed to uphold this philosophy by pairing new hires with a seasoned "Geotabber" to ease the transition into their new role."

For Canada's leading general contractor, PCL Construction, co-op participants have become a significant source of talent acquisition. "The student program at PCL is truly invaluable from a talent perspective," says Brendan O'Neil, District HRPD manager at PCL Constructors Canada Inc. "We always look

to our student program first when hiring for our entry-level positions across all districts as they are already familiar with our business and processes. Additionally, students provide us with new perspectives and ideas to improve processes and approach challenges through a different lens."

At Wind River, Waterloo Co-op offers talent that can bring a fresh perspective to projects for their software development roles. "As an organization, we use the co-op term to evaluate a student's interest, performance, output, and potential as we build our future talent pool," says Stephanie Muldoon, Senior Human Resources Partner at Wind River. "As a result, we've had some brilliant co-op students who have brought energy, enthusiasm, and new ideas into the team—often sparking conversations and allowing the teams to look at technical issues in a new light."

The Next Generation Wants Their Work to Align with Their Values

In a recent survey published by Waterloo on the future of the workforce, almost 50 percent of Gen Z student respondents said they'd be unlikely to accept a full-time job that matches their skills, but not their values.

Providing opportunities for students to contribute meaningfully during work terms is a central aspect of engaging them through the work term and retaining talent long term.

Maddie Whibbs, Talent Acquisition Manager at BlackBerry, says, "students are given various projects to work on depending on their role and product team."

"Previous students played an integral role in preparing and improving the functionality of the kernel for safety certification on the QNX team. Students are also involved in developing and testing hardware and sensors used as part of the BlackBerry IVY ecosystem in partnership with Amazon Web Services (AWS)," said Whibbs.

At Geotab, students are treated as contributing team members working alongside their teammates to complete tasks that impact software deliverables. Depending on their level and experience, this may vary from simple tasks at first, developing later into more complex tasks that the team counts on them to complete.

"Waterloo is committed to being a leader in engineering education and research," says Selvathilagan. "We see a spark in many students hired from Waterloo. The motivation and eagerness to learn are very apparent and students have a strong academic acumen that they bring to the table, along with past co-op/internship experience."

Employer Q+A

We asked some Waterloo employers from various sectors and industries why they continue to hire co-op students from the engineering program each year. Here's what they said:

What leads your organization to continue hiring emerging talent from Waterloo each year?

"It is evident that the University of Waterloo makes a significant effort to prepare their students for their co-op term, from the interview right through to completion of their work term. We eagerly accept the opportunity to bring students back for sequential terms, enabling them to build on and apply what they have learned in previous terms with PCL and from their classes in-between." - *Brendan O'Neil, District HRPD Manager PCL Constructors Canada Inc.*

"BlackBerry and the University of Waterloo have a long-standing partnership rooted in community and innovation. Over the past 30 years, thousands of Waterloo students and graduates have helped to build our company and turn it into one of the world's most recognized and celebrated technology brands." - *Maddie Whibbs, Talent Acquisition Manager, University & Colleges, BlackBerry*

"Waterloo students are prepared! They come to a work term understanding what's expected and eager to learn and work. Often, they also have previous work experience, which lowers the time to ramp up. From an HR perspective, the platform to post, interview, and select is top-notch. It is easy to use, well supported by the co-op team office, and flexible to allow for changes as they occur." - *Stephanie Muldoon, Senior Human Resources Partner, Wind River*

What advice do you have for employers who are considering hiring co-op?

"Take the time to understand your student's goals and how you can support them in achieving those goals. Keep in mind that this is a learning opportunity, and it might be a student's first entry into professional job experience. Providing continuous informal feedback is also key to supporting the student's experience and ability to develop in the role."- *O'Neil*

"Get granular with your job descriptions to ensure you capture what sets this role apart from the other opportunities on the market. Be sure to be specific about the projects and technologies that the student will be working on." - *Whibbs*

"Be ready to commit. Having a successful term on both ends means planning the work, and providing the proper training and support along the way. Be reasonable with your expectations and set aside time weekly for check-ins." - *Muldoon*

"Co-op students are here to learn! They may not know everything like a seasoned working professional. However, as an employer, it's our job to guide them and provide opportunities for growth and development to reach their full potential." - *Tharsiga Selvathilagan, Campus Talent Acquisition Partner, Geotab*

Developing a strong talent pipeline starts with providing young talent with an environment where they can thrive. Don't hesitate to get them through your doors early as the competition for brilliant talent increases. **V**

ROLE OF SIGHT DISTANCE:
Making Mixed Autonomous and Human-Driven Vehicles Operate Safely

Prof. Said Easa, Ph.D., Azam Alaei, M.Eng., Harsheev Desai, M.Eng.
Dept. of Civil Eng., Toronto Metropolitan University (formerly Ryerson) Toronto, Ontario

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School of Automobile and Transp. Eng., Hefei Univ. of Tech., Southeast Uni., PR China.

Lee Weissling, Ph.D.
Ontario Society of Professional Engineers, Toronto, Ontario

M any people are not aware that autonomous vehicles (AV) have eyes. The height of the driver's eye of a human-driven vehicle (HDV) is crucial in determining the sight distance (SD) needed for safe operation. Likewise, an AV has an electronic eye to scan the environment for safety. This electronic eye is called Lidar (light detection and ranging). Eliminating the driver will have direct effects on highway alignment design. Since the AV response time is much less than the driver's perception and reaction time (PRT), the required sight distance (RSD) for AV would be shorter than that for HDV. Determining the height and characteristics of the Lidar was the scope of a recent project jointly funded by the Ontario Society of Professional Engineers (OSPE) and the Mitacs Accelerate[1] program. An Executive Summary is provided in this article.

Introduction

Autonomous vehicles will reduce human errors and are expected to lead to significant benefits in safety, mobility, and sustainability. Current highway geometric design is based on human driver-related parameters, such as PRT. However, AV will mix with human-driven vehicles on existing highway infrastructures during the transition period. This study focuses on the sight distance aspect of highway geometric design. It is essential for safety that AV effectively detect the objects within its RSD using the Lidar. Therefore, determining the needed sensor configurations (e.g., height, effective range, and field of view) is necessary for safe AV operation.

This study used a simulation approach to determine the needed sensor configuration. First, the required Stopping Sight Distance (SSD), Decision Sight Distance (DSD), and Passing Sight

Distance (PSD) for AV were established. Second, the automated driving simulation toolbox, MATLAB, was used to construct different scenarios involving the road, obstacles, and actors. The road models were created following the current design guides. Third, many simulations were conducted with different sensor configurations to determine the Lidar configuration that achieves 100% detection for the safe operation of AV on existing highways.

Sight Distance Needs for AV

The reaction time of AV is much shorter than that of HDV, which will significantly affect all sight distances, including SSD, DSD, and PSD. A value of PRT of 0.5 seconds is widely accepted for AV, which is 2 seconds faster than human drivers.

SSD is the sum of the distance travelled by the AV during system perception-reaction time and the braking distance from the operating speed to stop. The results show that SSD for AV is about 20% less than that needed for HDV.

DSD is the distance that allows the AV to manoeuvre or change its operating speed or stop to avoid an obstacle on the roadway surface at complex locations. DSD ensures that a driver has enough distance to come to a stop or manoeuvre through difficult situations. DSD values are substantially greater than the SSD values for HDV. However, since AV are equipped with Lidars, they require less manoeuvre times. According to the American Association of State Highway and Transportation Officials, a human driver requires 3 seconds for a rural road and

9.1 seconds for the stopping manoeuvres on rural and urban roads, respectively. The results show that the AV requires substantially less DSD than HDV for these stopping manoeuvres. More research is needed to determine the AV requirements for the manoeuvres related to speed, path, or direction change.

PSD is the distance, including system reaction time, required by the AV on rural two-lane roads to allow the vehicle to pass a slower vehicle using the opposing lane. PSD provides a driver with sufficient distance ahead and ensures that passing can be accomplished without interference from an oncoming vehicle. The PSD for AV is about 25% less than that needed for HDV.

Virtual Road Environment

In this study, 3D road models are manually created according to the existing design policies using the MATLAB simulation. Different road models of the combined alignments were created in the MATLAB app. There were two main types of obstacles: continuous roadside obstacles (Fig. 1a) and overpass obstacles (Fig. 1b). Roadside obstacles may affect an AV's view on horizontal curves, while overpass obstacles may cause occlusions to trucks on vertical sag curves.

The horizontal sightline offset (HSO) is commonly used to demarcate the boundaries of sight-clear zones to ensure that human drivers have adequate available sight distance on highways. The roadside obstacles were modeled by continuous concrete walls (Fig. 1a). The lateral distance from the inner-lane centerline to roadside obstacles is HSO. Note that roadside obstacles are high enough to adequately block an AV's view.
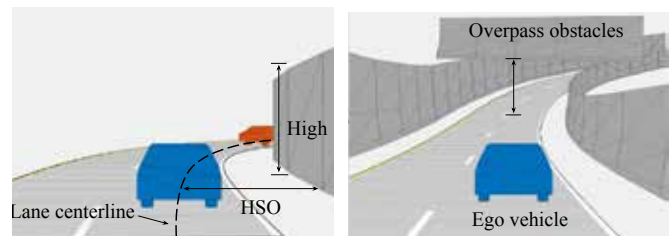
(a) Roadside obstacles   *(b) Overpass obstacles*

Fig. 1 Egocentric view of roadside and overpass obstacles in a virtual-road environment

Actors and Sensors

Unlike human drivers who see the road environment using their eyes, AV perceive their ambient surroundings based on the fusion of Lidar, camera, and radar. In terms of AV's SD, Lidar is the most critical sensor as it performs 3D detections of objects and can measure spatial distance accurately. Therefore, this study mainly focuses on Lidar as 'eyes' for AV, though radar and camera sensors are also implemented.

The MATLAB app provides a flexible way of configuring Lidar sensors. Users can interactively adjust Lidar parameters to simulate different Lidar products. Generally, Lidars' detection performance is associated with several technical parameters shown in Fig. 2: detection range, horizontal and vertical fields of view (FOV), and horizontal and vertical angular resolutions. Besides, the placement of the Lidar sensor may also affect its detection results, especially on vertical sag (concave) curves. This

study mainly focused on vertical FOV, horizontal and vertical angular resolutions, and mounting height.
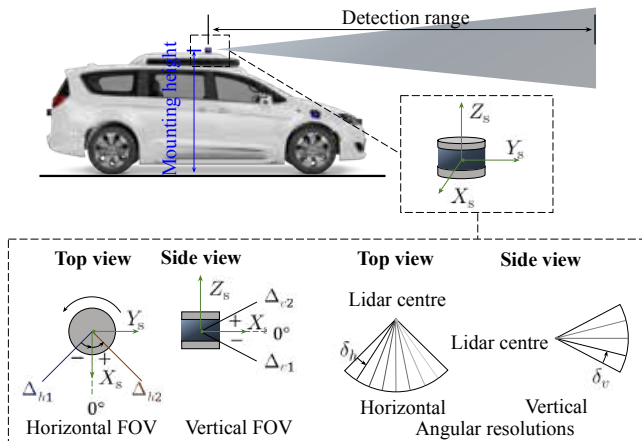

Fig. 2 Technical parameters of the Lidar sensor

A typical test scenario is shown in Fig. 3. An AV equipped with multiple sensors and another actor (a car in this case) are placed on the road surface. Both the AV and the front actor travel at the same speed along the same path with the lane centerline. As noted, the actor ahead is placed RSD away from the AV. The RSD here denotes the required sight distance for AV whose PRT is much less than human drivers.
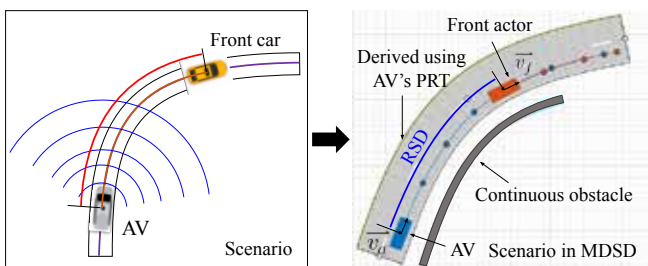
Fig. 3 Top view of a typical test scenario

Safe Lidar Configuration for AV

For three-dimensional alignments, 150 simulations were conducted using the MATLAB simulation. The aim was to achieve 100% object detection using the camera and Lidar. The optimal Lidar configuration parameters that achieved 100% object detection were determined as 0.03 m (metres) (accuracy), 360° (horizontal FOV), 40° (vertical FOV), and 1.6 m (Lidar mounting height).

The angle at which the laser is emitted and recorded determines the azimuth angle, where the elevation angle of

> Unlike human drivers who see the road environment using their eyes, AV perceive their ambient surroundings based on the fusion of Lidar, camera, and radar.
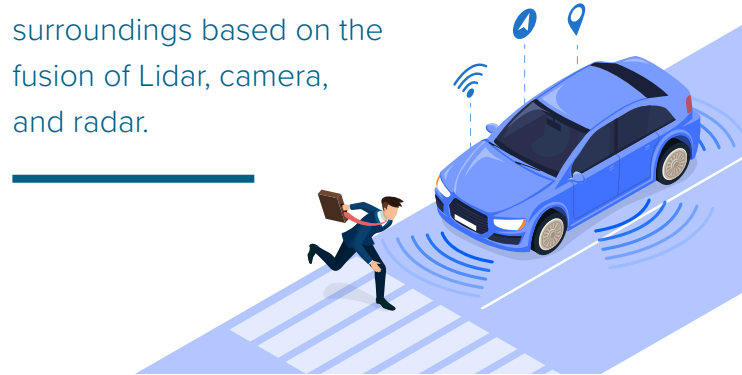
a laser emitter in a sensor remains constant. The optimal vertical and horizontal angular resolutions were 0.5°and 0.16°, respectively. Different heights ranging from 1.5 m to 2.2 m were tested using combinations of the Lidar configurations, and the Lidar mounting height that achieved 100% object detection was 1.6 m for combined alignments.

For vertical sag curves with overpasses, the overpass may obstruct the line of sight and limit the visibility. A road profile was created in MATLAB to determine the optimal Lidar mounting height. The results showed that the Lidar mounting height that achieved 100% object detection was 1.6 m, identical to 3D alignments, indicating that existing vertical sag curves with overpasses would be safe for autonomous trucks.

Conclusions

This study explored the optimal Lidar configuration for AV to operate safely with HDV. The revised SD values for AV were first established and then used to determine the Lidar mounting height, effective range, and field of view using a simulation-based approach. The results show that AV requires substantially less SD than HDV. Furthermore, the results show that a Lidar mounting height of 1.6 m, a horizontal FOV of 360°, a vertical FOV of 40°, a horizontal angular resolution of 0.5 centimetres, a vertical angular resolution of 0.16°, and a range accuracy of 0.03 m will help AV safety travel with HDV on existing roadways. Field testing is expected in future studies to confirm the simulation-based results presented in this article. ⓥ

2023 OPEA Call For Nominations

NOMINATIONS ARE BEING ACCEPTED FOR THE 2023 ONTARIO PROFESSIONAL ENGINEERS AWARDS (OPEA).

Now in their 75th year, the OPEAs showcase Ontario professional engineers who have made outstanding contributions to their profession and community. Nominate an exceptional engineer or team of engineers who have led a successful engineering project. OPEA recipients are honoured annually in November at a black-tie gala hosted supporting equity, diversity and inclusion within society.

THE AWARDS

GOLD MEDAL

The premier award, the Gold Medal recognizes commitment to public service, technical excellence and outstanding professional leadership.

AWARD FOR ENGINEERING PROJECT OR ACHIEVEMENT

This award recognizes a team of engineers who have conceived of, designed and executed an outstanding project or achievement that has had a significant, positive impact on society, industry or engineering.

CITIZENSHIP AWARD

Those who earn this award have given freely of their time, professional experience and engineering expertise—to the benefit of humanity.

DEADLINE:
Nominations are due by 4p.m. EST on Wednesday, February 23, 2022.

ELIGIBILITY:
More information about the awards, including selection criteria and nomination forms, is available at **www.opeawards.ca**, or by email at **awards@ospe.on.ca.**

ENGINEERING MEDAL

The Engineering Medal recognizes professional engineers who have improved our quality of life through the ingenious application of their engineering skills and whose achievements rise significantly above the normally high standards of the profession. **It can be awarded in the categories of:**

ENGINEERING EXCELLENCE

Recognizes overall excellence in the practice of engineering, where the innovative application of engineering knowledge and principles has solved a unique problem, led to advanced products or produced exceptional results

MANAGEMENT

Awarded for managing and directing engineering projects or enterprises where innovative management practice has contributed significantly to the overall excellence of the engineering achievement

RESEARCH & DEVELOPMENT

Awarded for using new knowledge in developing useful, novel applications, advancing engineering knowledge or applied science or discovering or extending any of the engineering or natural sciences

ENTREPRENEURSHIP

Awarded for applying new technologies or innovative approaches that have enabled new companies to get started and/or assisted established companies to grow in new directions

YOUNG ENGINEER

Awarded to outstanding young Ontario engineers who have made exceptional achievements in their chosen fields. Candidates must be no older than 35 as of December 31 in the year the nomination is submitted and have demonstratedexcellence in their careers as well as in communityand professional participation

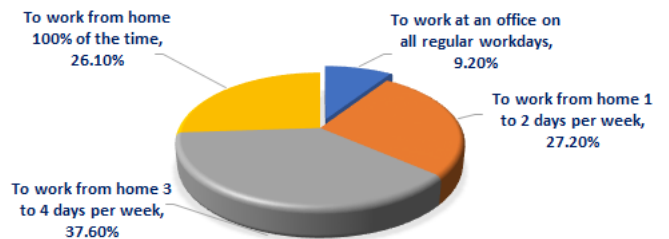# NO GOING BACK:
THE FUTURE OF ENGINEERING

For close to two years, a large majority of engineers worked from home at least part of the week. Many worked from home almost all the time and these experiences have fundamentally changed how engineers see the future of engineering work.

Over the past year, with the support of the Future Skills Centre and the Government of Canada, OSPE has been researching the impact of working-from-home. This research included a large survey, interviews with engineering employers, and focus groups with engineers, as well as a literature review.

The conclusion is indisputable: the landscape for engineering work has changed. There is no going back to the way things were before COVID.

Prior to COVID, roughly a quarter of engineers worked from home at least part of the time. During the last two years, that proportion rose to 97.0%.

Regardless of age, gender, or recency of immigration, almost two-thirds of engineers want to continue working-from-home at least three days per week. More than a quarter prefer to work from home 100% of the time, and only 9.2% want a full-time return to the office. Even more striking is the finding that two in every five engineers state that whether they remain with their current employer will depend on having at least a partial work-from-home option. An even larger proportion say that whether an employer offers a work-from-home option will be an important factor in future career choices.

To work from home 100% of the time, 26.10%

To work at an office on all regular workdays, 9.20%

To work from home 1 to 2 days per week, 27.20%

To work from home 3 to 4 days per week, 37.60%

Over the past two years, by working-from-home, many engineers achieved a better balance between their personal life and their career. Many also welcomed the reduction in commuting time and, to a lesser degree, the reduction in work-related stress. Focus group participants described their office workspace as prone to distractions and interruptions. Working-from-home provided the opportunity to focus and concentrate in a way that many offices do not. While a minority of engineers miss the connectedness that comes from working in an office, most have little enthusiasm for returning to "cubicle world" with its lack of privacy and frequent distractions.

Engineers did cite some advantages to working in an office. Approximately a third of engineers report that working-from-home reduces the quality of their interactions with colleagues, persons who report to them, and managers. Engineers also recognize that the office provides an opportunity to socialize with co-workers.

Close to half of non-supervisory engineers report that their productivity increased while they were working-from-home, while only one in eight reported reduced productivity. Engineering supervisors were less sanguine about productivity. They estimate that productivity increased for more than a third of their staff but declined for around a fifth.

There is no consensus on the impact of working-from-home on the robustness of engineering teams. Some employers and managers believe that the loss in creativity is a significant problem. Others believe that the downside of remotely connected teams is more than offset by the productivity advantages.

The transition to more flexible workplaces that incorporate a work-from-home option has implications for equity, diversity, and inclusiveness in the engineering profession. Almost three-quarters of women agreed that at least a partial work-from-home option would enable them to achieve a better balance between their personal/family life and their career. For women in the age group 35 to 44, this proportion increased to over 80%. On the other hand, for early career engineers, working-from-home may entail a hidden cost - a decline in the quality or extent of professional mentorship. Mentoring happens naturally in an office environment. When engineering work moves out of the office, there is a need to structure and plan mentorship. The decline in office-based mentoring and colleagueship may also slow down the integration of internationally educated engineers. These are problems that both employers and the profession will need to address.

Where are we heading? While it is too early to draw strong conclusions, there are important indicators of how the landscape will change for engineers and engineering employers.

In the first place, we are likely to see a spike in turnover. This will occur as both employers and engineers seek a better alignment between how organizations carry out their engineering work and the preferences of engineers.

> I would accept a hybrid model with two or three days in the office. But, if I had to return to the office full-time, I would quit.
>
> - Focus Group Participant

A second change will be in where engineers prefer to work. Organizations that were previously "employers of choice" may have difficulty retaining that status if they do not adjust to the change in engineers' preferences and expectations. Organizations that believe they can restore the office-centred world are mistaken.

The challenge for management and for organizations is not how to get back to where they were before COVID. Rather, their challenge is to define what the future of engineering work and engineering workplaces will look like. Organizations that succeed in doing this will attract and retain talent. Those that do not, will face chronic hiring and retention problems.

Working-from-home 100% of the time severs the link between the location of an employer and the location of its employees. More than half of engineers surveyed "strongly agreed" with the statement that they would consider working for an employer in another city if that employer allowed them to work-from-home all of the time. This fundamentally changes the engineering labour market – for both engineers and engineering employers.

Given the strong preference for working-from-home, employers that need on-site engineers may need to offer a premium. If more men than women take advantage of this premium, we could see a widening of the gender pay gap.

To avoid the challenges of mentoring recent graduates in the post-COVID environment, some organizations may require a minimum of three to five years of experience. While this may be a sound strategy when viewed from the perspective of an individual employer, in the long run, it worsens system-wide skills shortages.

When the public health advisories to work from home were issued in March of 2020, few observers expected the changed working arrangements to last for two years. Fewer still anticipated that the experience of working-from-home would have such a significant impact on attitudes and expectations. After two years, however, it is clear that there is no going back to the way things were prior to COVID. Both engineers and engineering employers need to focus on how to adapt to the changes in engineers' views about engineering work in a way that maximizes the advantages of greater flexibility while offsetting the potential drawbacks. Successful organizations will be those that seek out and implement these strategies.

We are no longer tied to the local talent pool. With remote working, we can recruit from anywhere.

- Engineering Employer

Future Skills Centre

Canada

WHAT ARE THE BARRIERS
To Engineering Leadership?

By Emily Moore P.Eng., Cindy Rottmann,
and Andrea Chan

Engineers enter the workforce ready to make an impact, and indeed as a profession, we are called upon to lead. However, we know that many engineers feel that their professional influence is challenged by several personal and professional barriers.

An online survey of the OSPE membership in February 2021 to explore the nature of these barriers, with 1240 people completing the survey. The respondents were demographically consistent with the profession (18.5% women, 18.7% racialized[1], 24.6% internationally educated) but skewed older, more hierarchically senior, and more licensed than the population of engineering degree holders in the province (mean age 51, 45.2% in a formal management role, 79.6% licensed).

Most respondents (73%) agreed with the statement "engineering is a leadership profession', suggesting that a critical mass of engineers in the province understand the importance of leadership. This is an important finding for us as engineering leadership educators because it suggests that we would do well to supplement introductory explanations about the importance of leadership with a wider range of leadership development opportunities.

When asked about barriers to leadership, however, it was found that most respondents encounter leadership challenges, with only 19% of participants agreeing with the statement "I rarely encounter barriers to my leadership'. When these responses were disaggregated by gender, race, and age (Figure 1) it was observed that racialized men and women, white women, and younger engineers were more likely to experience barriers to their leadership than their white, male, senior colleagues.
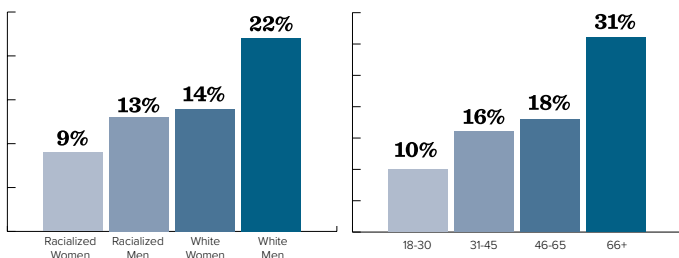
Figure 1: Percent of survey respondents who indicated that they rarely encounter barriers to their leadership; disaggregated by gender, race, and age.

Further questions explored the personal and professional barriers respondents experienced to their leadership—with personal barriers relating to factors internal to the individual respondent, and professional barriers, including structural barriers, found in the workplace and society. The top two personal barriers across the sample were confidence (22% agree this is a barrier) and personality (21%). Women and younger engineers were more likely to name confidence as the top barrier, while men and internationally educated engineers viewed their personalities as the top barrier.

Personality features such as being shy, anxious, detail-oriented, introverted, risk-averse, disinterested in playing politics, rude, inflexible, task-oriented, and averse to taking on responsibility for others were cited as inconsistent with leadership. Implicit in some of these qualities is the assumption that leaders ought to be extroverted, confident, risk-takers who play politics. This finding is important to engineering leadership educators, suggesting the expanded training on the many different and authentic ways in which engineers may lead.

Another finding that appeared in the open-ended questions about barriers was the notion that respondents' "analysis paralysis" impeded their abilities to move a project forward. When it came to confidence, many engineers of all demographic backgrounds pointed to imposter syndrome as a key hindrance, "either I have imposter syndrome in spades, or I have no idea what I'm doing". Finally, related to the idea of confidence, participants expressed a perceived skill deficit in four key areas: persuasion,

interpersonal relations, business skills, and communication. These findings provide key focus areas to integrate into leadership development programs for engineering students and professionals.

Shifting from personal to structural barriers, the top two professional barriers expressed by respondents included concerns about being penalized for disagreeing with management (45%) and difficult organizational cultures (37%). On the other side of the coin, over 80% of respondents saw professional autonomy and decision-making authority as an important support, suggesting that in instances where that autonomy or authority is not present, there is a structural barrier to leadership. Our analysis of open-ended questions suggests the presence of four additional barriers: differential mobility, compound discrimination, professional regulation, and organizational structure.

To illustrate the nature of differential mobility, compound discrimination, and organizational structure, we examined the distribution of leadership roles by demographic group. There were more white men in all managerial roles than any other group but, as illustrated in Figure 2, racialized women in formal management roles were over-represented in project lead positions, white women in team lead positions, racialized men in senior managerial roles, and white men in executive positions. While this finding may be partially explained by the relative youth of marginalized groups compared to the sample, our analysis urges us to pay attention to the ways in which formal access to organizational authority may reflect structural inequities in Canadian society.
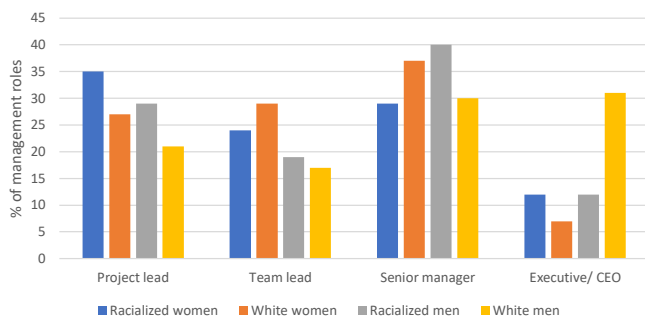

Figure 2: Distribution of management role by gender and race; the denominator is the total number of individuals in each demographic group in a formal management role.

Overall, the project findings suggest that OSPE members are largely interested in leadership and motivated to lead but need more help navigating personal and professional barriers to leadership. To be able to lead at the societal level, we need to first unlock the leadership potential of engineers in the workplace. Current initiatives to bring leadership and communication skills into university engineering programs and professional development can help to support individuals to better surmount or navigate around barriers, but changes to organizational culture and structural bias require a concerted effort on the part of engineering organizations, from licensure to corporate recognition and promotion practices.

Professor Emily Moore, P.Eng. is the Director, Dr. Cindy Rottmann the Associate Director of Research, and Dr. Andrea Chan is a Research Associate at the Troost Institute for Leadership Education in Engineering at the University of Toronto. This research was funded by a Partnership Engage Grant from the Social Sciences and Humanities Research Council of Canada. This is the second article to be published in the Voice based on this survey. The first was in our Summer 2021 issue. A more complete report on the survey and focus groups will be published shortly on the OSPE website. ◥

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[1] *The lack of race-based data at the provincial level makes it difficult to ascertain the extent to which our sample reflects the racial makeup of the profession.*

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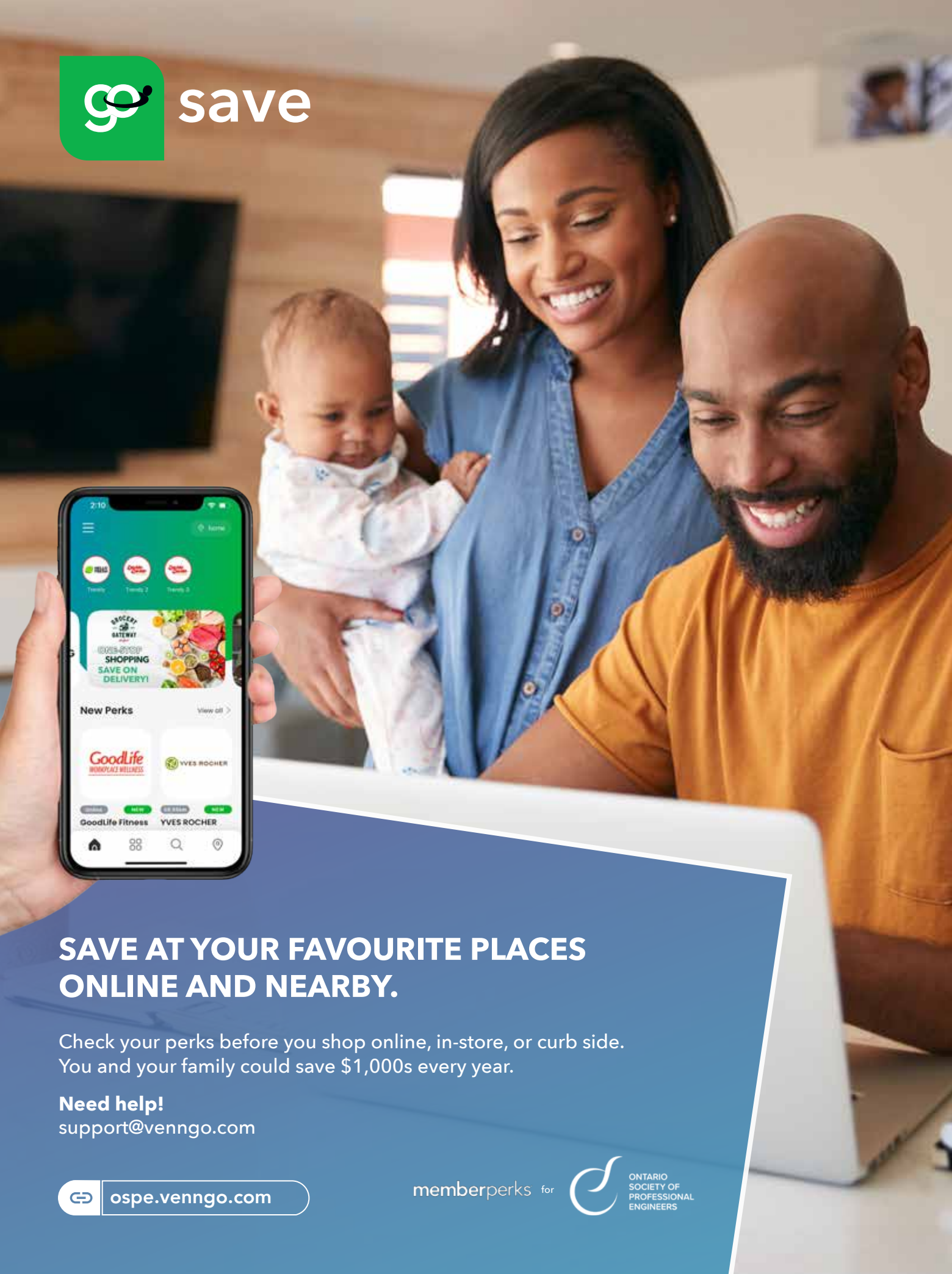
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