November/December 2022

ReNew CANADA

The Infrastructure Magazine

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ReNew CANADA
The Infrastructure Magazine

NOVEMBER/DECEMBER 2022

DAMAGE CONTROL

By John Tenpenny

Millions now or billions later?

That's the question facing Canadian governments at all levels when it comes to maintaining infrastructure assets as the costs relating to climate change continue to mount.

According to a report from the Financial Accountability Office of Ontario (FAO), the effects of climate change are projected to cost Ontario an extra $1.5 billion annually in the next few years just to maintain public transportation infrastructure. By 2030, changes in extreme weather mean climate-related costs will accumulate to a total of $13 billion.

Over the long term, if global emissions peak by mid-century, climate hazards will raise infrastructure costs by $2.2 billion a year on average, without any climate adaptation and if emissions instead continue rising beyond 2050, those costs will increase by $4.1 billion a year, according to the FAO's report, entitled *Costing Climate Change Impacts to Public Transportation Infrastructure*.

Adaptation would add between $1.4 and $2.9 billion a year between now and the year 2100.

"While these additional climate-related costs are significant, they are less expensive for provincial and municipal governments than not adapting over the long term," said the FAO.

Given the long useful lives of public transportation infrastructure, late-century climate conditions are relevant to adaptation decisions being made now. These decisions will impact public infrastructure costs now, and throughout the century.

Climate damages are already impairing Canada's economy with these costs rising swiftly, according to a report released by the Canadian Climate Institute.

The report released in October indicates that the mounting costs of a volatile climate are already dragging down Canada's economy. The report—*Damage Control: Reducing the costs of climate impacts in Canada*—examines the macroeconomic costs of climate change, assessing them in both low- and high-emissions scenarios relative to a stable-climate scenario.

"The cost of inaction when it comes to climate change is measurable and mounting. We need to put adaptation and mitigation measures in place now to avoid severe damage to our economy, society, health, and well-being," said the institute's president Rick Smith.

Proactive adaptation measures and policies can limit climate change damage, said the report, cutting the projected costs in half, saving billions of dollars, with every dollar spent on adaptation measures saving $13-$15 in direct and indirect benefits.

The costs associated with climate change are top of mind with the recent destruction created in Atlantic Canada by post-tropical storm Fiona.

In response, Prime Minister Justin Trudeau announced a $300-million fund to help the East Coast recover by providing assistance over the next two years to repair and rebuild critical infrastructure damaged when the storm hit the region on September 24.

The federal government said rebuilding efforts will ensure infrastructure is better able to withstand future damage.

Another step in the right direction was the creation of a pair of federal initiatives aimed at climate resilience. With $47 million in funding, they will provide the knowledge to adapt our public infrastructure where necessary, inform changes to building and infrastructure codes, and create guides, standards, tools, and technical solutions for climate resilience.

It's a start, but more needs to be done because the frequency of weather and climate-related events is only going to increase.

John Tenpenny is the editor of ReNew Canada.
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ABOUT THE COVER

The new Chenab Bridge in India's Kashmir region represents an important rail link that will join the Kashmir Valley to the Indian Railways network, and at 359 metres, is the highest steel arch bridge for railway traffic in the world.
Read more about this international project on page 16.

NEW BRUNSWICK'S ONLY TWO-LANE COVERED BRIDGE OPENS

The new Vaughan Creek Covered Bridge in St. Martins provides an improved transportation link while preserving an important piece of the region's heritage.

The new Vaughan Creek Covered Bridge in St. Martins, New Brunswick is now open, providing residents and visitors an improved transportation link and preserving an important piece of the region's heritage.

The original bridge was built in 1935 and served as the primary link between St. Martins and what is now the Fundy Trail Parkway. It was closed in June 2017 due to deterioration.

Construction on the $6.7 million structure, which is on the same alignment as the original bridge, began last year. The new covered bridge is 32 metres long, with two lanes and a pedestrian walkway to resemble the traditional style of New Brunswick's covered bridges. The design also considers today's operational needs and can accommodate larger vehicles and buses.

The bridge superstructure is made of single-span wooden timbers that have been pressure-treated to help prevent rot and provide a service life of about 75 years.

TOP100 PROJECTS EVENT COMING TO VANCOUVER

Building on the success of its annual Key Players & Owners Dinner, the team at *ReNew Canada* is excited to announce that we will be hosting the first-ever Top100 West event happening May 11, 2023 in Vancouver.

This networking event, celebrating the annual Top100 Projects report, will give those in Western Canada the opportunity to gather with their industry colleagues to recognize Canada's largest infrastructure projects.

The Top100 Projects report—published annually since 2007—features the biggest infrastructure investments underway across Canada, ranking the largest public projects in the country by dollar investment, with input from project owners, governments, crown corporations, and dozens upon dozens of project delivery teams including engineers, architects, environmental consultants, law firms, insurance and risk management, financiers and many more.

The value of the 2022 Top100 Projects rose from just over $250 billion in 2021 to $273 billion. Projects in the report cover sectors including transit, energy, transportation, healthcare, and water/wastewater.

The annual Key Players & Owners Dinner will be held February 21, 2023, at the Carlu in Toronto..

Covered Bridge: Government of New Brunswick, ANMRC: Canadian Nuclear Laboratories

The Advanced Nuclear Materials Research Centre is part of a $1.2 billion revitalization of the Chalk River Laboratories.

CNL BREAKS GROUND FOR CHALK RIVER LABORATORIES RESEARCH FACILITY

Chief Science Advisor of Canada, Dr. Mona Nemer, and M.P., Jenna Sudds, joined leaders from Canadian Nuclear Laboratories (CNL) and Atomic Energy of Canada Ltd. (AECL) to officially break ground for construction of Chalk River Laboratories' Advanced Nuclear Materials Research Centre (ANMRC)—one of the largest nuclear research facilities ever constructed in Canada.

The ANMRC is not only the cornerstone of the Government of Canada's $1.2 billion investment in the site revitalization of the Chalk River Laboratories, it's the future facility for Canada's world-class research of next generation nuclear technologies.

The 10,000-square-metre ANMRC is expected to be critical to the life extension and long-term reliability of existing reactors, including Canada's fleet of CANDU reactors and other designs deployed around the world. It will also support the national nuclear laboratory's other research priorities, such as public health, environmental stewardship, and global security.

Construction of the new laboratory research complex is being managed via an integrated project delivery (IPD) agreement, which was unveiled in 2021. The IPD team leading the construction of ANMRC includes CNL, Chandos Construction Inc., Bird Construction Inc., M. Sullivan & Son Limited, Eclipse Automation, JP2G Consultants, RJC Engineers, Merrick & Company, Modern Niagara, MSE, Plan Group, and Siemens.

Top to Bottom: The two-week project was completed 30 per cent faster than originally planned to resolve an issue that had plagued the Bolivian community since its inception. Volunteers from across North America, including PCL Construction employees helped to build a pedestrian bridge for residents in rural Bolivia.

PCL VOLUNTEERS HELP CONSTRUCT PEDESTRIAN BRIDGE IN BOLIVIA

Recently, PCL Construction and Systra IBT partnered with Engineers in Action to construct a 55-metre (180-foot) footbridge over the Rio Sapse in Bolivia. The new bridge will provide safe access to education, health care and economic opportunity to almost 1,000 residents of five rural communities.

During the region's rainy season, the Rio Sapse's water levels rise to dangerously high levels. School children were missing an average of three weeks of school every year due to being unable to cross the river and a recent drowning death underscored the need for a safe way to cross the river.

Volunteers from across North America worked alongside community members during the seven-day build to make the new bridge a reality. Equipment was sparse and tool availability was a persistent challenge (a large shipment of tools donated by Milwaukee Tool was delayed in customs) rendering human power the most readily available resource on site. The Rio Sapse Bridge Build team worked nimbly and creatively to complete their bridge ahead of schedule, much to the excitement of the community.

The two-week project was completed 30 per cent faster than originally planned to resolve an issue that had plagued the community since its inception.

"I have the great fortune of working for a company, PCL Construction, that has given me this opportunity to work with organizations like Bridges to Prosperity and now Engineers in Action to use my skills to help others," said Patrick Malone, PCL business development manager. "I am proud of the work they are doing and honored to work alongside professionals dedicated to the mission."

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"With an evolving transit technology strategy, each investment builds toward an overall future vision."

IN THE DRIVER'S SEAT

Doug Parker speaks from decades of experience on how to evolve transit infrastructure

By Connie Vitello

A transportation systems engineer and planner with IBI Group, Doug Parker has overseen a vast array of urban transit system modernization projects in North America.

IBI Group

Doug Parker is a transportation systems engineer and planner, specializing in assisting public agencies with applying advanced technology. He is a recognized leader in transit technology consulting, working closely with the transit technology consulting practice across IBI Group, a global team of industry leading engineers, architects, planners, designers, and technology professionals united by a common desire: to create livable, sustainable, technologically advanced urban environments.

His 33 years of experience spans all public transit modes, including rail, fixed route bus, bus rapid transit, ferries, demand responsive transit, and rural transit. It also includes the full range of transit technologies, including those in support of planning, operations management, public information, revenue management, security, and business intelligence.

Parker has been involved with numerous planning, research and evaluation efforts including regional deployment program development, architectures, evaluations, and several Transit Cooperative Research Program projects.

ReNew Canada recently engaged Parker to pick his brain on how he helps Canadian transit agencies implement the latest advancements and what best practices he applies to the task at hand.

What are some of your lessons learned over the years when it comes to transit infrastructure?

Transit infrastructure and technology are only useful if thought of as ingredients for an overall transit operation that supports mobility for all customers while also improving their experience, or as ingredients to support agency staff for achieving this safely, effectively, and efficiently. It is important to avoid deploying innovations just because they seem interesting or exciting. Every change should support the customer-driven strategy. There is also an important equity goal for transit agencies as public sector organizations since everyone needs effective and affordable mobility for society to function. This was highlighted during COVID when essential workers still needed transit to get to those jobs. And the strategy of transit agencies needs to also focus on environmental sustainability by avoiding greenhouse gas emissions.

As head of the transit technology group at IBI, you've overseen a vast variety of urban transit system modernization projects, in-

TTC has started its zero-emissions fleet transition, building on its prior experience with electric subway/streetcars, hybrid-electric buses, and the recent zero-emission battery bus pilot.

Toronto Transit Commission

cluding several fleet and infrastructure electrification transition programs. How much change do you foresee in Canada in the next five years to 10 years?

Change has been a constant over the past 30 years that I have been working with transit agencies on innovation and improvements. My role has been to understand the goals and objectives of transit organizations and their operations, while at the same time understanding the vast and ever-changing array of technologies that could provide effective support. I help develop and evolve the overall customer and operations-driven transit technology strategy, and to effectively deploy the projects.

The technologies we have helped deploy address areas like fleet operations management, customer real-time information, fare systems, security, planning and scheduling, and maintenance. There has always been change, and over the next five to 10 years there will be as much change to face as ever—or maybe even more. Changes in both the technologies that transit can use and in how this will influence how transit service is delivered. Long-term planning is key so that technology is harnessed to support transit service improvements. Transit fleet transition to zero-emission vehicles will be a crucial area of such technology opportunity over the upcoming years.

Municipal transit agencies need to consider operational, management and internal cultural challenges when considering a transition from fossil fueled to zero-emission vehicles. How do you and your team advise agencies to address these challenges?

Transit organizations and staff will need to adapt to many changes in the fleet and facilities for the transition to zero-emission vehicles. Especially since the technology will continue to rapidly evolve as it is incrementally deployed to support fleet transition over the course of 10 years or more. They will need to operate and maintain the vehicles and charging infrastructure, and there will also be changes to how service is planned and scheduled. With a guiding overall deployment strategy, the needed changes in business processes and training can be proactively addressed.

What are some tricks of the trade in terms of meeting the complicated and combined expectations for operations management, public information, and revenue administration?

When we support transit agencies with making technology investments to improve in areas such as these, our goal is to help them address effective mobility, good customer experience, equity, and environmental sustainability. One keystone is to work with the people within the agency on identifying capabilities that could be improved through changes to their technology and how they use it. Another is to have an evolving transit technology strategy so that each technology investment builds towards an overall future vision for integrated technology.

Toronto City Council's capital budget for the Toronto Transit Commission (TTC) this year is $1.698 billion with future year commitments of $8.5 billion, totaling more than $10 billion as detailed by project. With your ongoing work with the TTC, what can you tell us about the path forward and projects planned for Canada's busiest transit hub?

It isn't my place to speak for TTC, but over the years we have continued to work with them on many technology improvements. These have included operations of the bus and streetcar fleet, garage dispatch, and Wheel-Trans specialized transit. TTC has now started its zero-emissions fleet transition, building on its prior experience with electric subway/streetcars, hybrid-electric buses, and the recent zero-emission battery bus pilot. There is an upcoming planned fleet transition for all buses to electric buses, expected to involve battery and possibly also fuel cell buses. This will require investment in more than just buses, with every TTC garage to be equipped

The Washington, D.C. Circulator system deployed 14 battery electric Proterra Catalyst E2 buses, making it one of the largest electric bus fleets in the U.S.

with charging infrastructure. Additional investments will likely be needed in areas like on-route charging infrastructure such as at major bus terminals, microgrid capabilities including onsite renewable energy and facility battery storage, and perhaps hydrogen production or dispensing.

What can we expect from new electrification projects?

Transit agencies across Canada from coast to coast are currently planning and beginning to deploy zero-emission fleets. Not just the large city transit agencies—we have completed fleet electrification transition plans for many smaller city agencies. Agencies typically replace only five to 10 per cent of their fleet each year on a rolling basis as older vehicles are retired. Zero-emission vehicles are normally added as older vehicles are retired, especially since opportunities will diminish to resell a bus not yet ready for retirement. Though there are also emerging options to convert current vehicles to electric.

But the pace of change depends on having the needed capital funding, the ramp-up of manufacturing capability from bus and charger suppliers, and improvements in the electrical grid transmission and generation. Some key variables across agencies will include climate, since colder weather can increase in-service energy use; the right timing for necessary facility improvements; the extent of improvements needed in the local electric grid; and local availability for green hydrogen.

Through the Zero Emission Transit Fund, the Government of Canada is investing $2.75 billion over five years, which started in 2021, to support the public transit and school bus operators plan for electrification, including charging infrastructure and facility upgrades. Do you think the shovels are getting in the ground at a sufficient rate?

One key need is the ramp-up in production capacity for buses and chargers. More agencies doing this planning will lead to this. I encourage ZETF to help get planning underway at as many different transit agencies as possible. This will require "all hands-on deck" by bringing to bear the full range of professional capacity available to transit agencies through the many experienced consulting organizations such as IBI Group.

In your planning, research, and evaluation efforts including regional deployment program development, evaluations, and transit cooperative research programs, how have you incorporated Indigenous partnerships?

A project involving Indigenous people must of course include their governance and needs from the earliest stages and must maximize their economic development opportunities. As an example, we are working with the Maskwacis Education Schools Commission in Northern Alberta to plan the electrification transition for their school bus fleet, in a way that will build on their previous investment in renewable energy generation since their existing electrical grid connection is not sufficient to support this transition.

Which sources do you look to for information and inspiration? Who would you say is leading the way in transit electrification — and how does Canada compare?

Canada can learn a lot from the extensive and ongoing efforts underway in Europe for transit fleet electrification, as well as in certain U.S. jurisdictions where California is at the leading edge. There has also been a lot of deployment in China, but the Canadian government and administration operate much more like in Europe and the U.S. Canada cannot yet claim to be leading the way, but we aren't lagging either. Especially in our larger cities, we have a transit-supportive culture approaching that of Europe to build on, relative to that of many U.S. cities.

Connie Vitello is the contributing editor of *ReNew Canada*.

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GOING GREEN

Harnessing green energy to achieve net-zero

By John Tenpenny

As Canada sets out on a transformative journey to reach net-zero GHG emissions by 2050, we need a powerful boost from wind energy, solar energy, energy storage and other renewable sources. These technologies will play a central role in driving the rapid decarbonization and massive expansion of electricity production required to make net-zero a reality.

Wind and solar energy infrastructure projects have contributed more to Canada's installed electricity-generating capacity than any other technologies over the last decade. Much of this growth is attributable to significant cost reductions, a product of game-changing technological improvements.

During a recent INFRAIntelligence webinar, *ReNew Canada* brought together a panel of experts to discuss how far we've come so far, what challenges remain, what solutions are needed, what investments are required and how we're partnering with our Indigenous communities.

Andrew Moles,
Director of Solar,
PCL Construction

Chief Sharleen Gale,
Chair of the Board,
First Nations Major
Projects Coalition

Robert Hornung,
President & CEO,
Canadian Renewable
Energy Association

Pranav Shah,
Director, (Clean Energy),
Canada Infrastructure Bank

***ReNew Canada:* It will take a combination of green energy sources to get to net-zero. What role will solar, wind, geothermal and other sources play in our decarbonization journey?**

Robert Hornung, president & CEO, Canadian Renewable Energy Association (CanREA)

We're going to need a lot of new energy: all the studies that have examined pathways to net-zero, conclude that Canada's going to essentially need to double its electricity production between now and 2050.

So, where's that going to come from? Well, there's going to be a lot of contributors, but we're quite confident the wind and solar energy are going to be front and center in that because they're the lowest cost sources of non-emitting electricity available in Canada. The cost of wind energies declined more than 70 per cent over the last decade and the cost of solar energies declined more than 90 per cent.

We're going to have to move from about 6 per cent of our electricity today coming from wind and solar to somewhere between 31 and 75 per cent of our electricity coming from wind and solar by 2050 in an electricity system that's twice as big as it is today. So, it's an enormous opportunity.

Andrew Moles, director of solar, PCL Construction

I think technology has significantly improved and significantly reduced the cost of wind and solar electricity generation. It wasn't always that way. When I started in

"The challenges of increasing renewable energy are jurisdictional, and each jurisdiction is faced with different challenges."

Pranav Shah

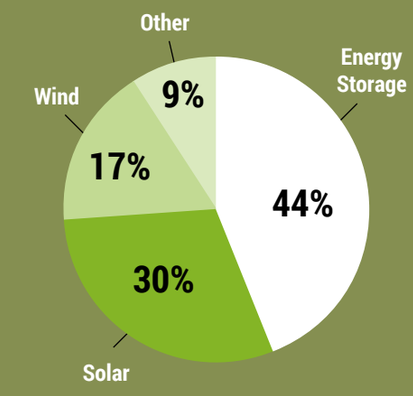
City of Edmonton

Workers attend to panels on the solar array—the largest rooftop array in Canada—on the Edmonton Expo Centre roof.

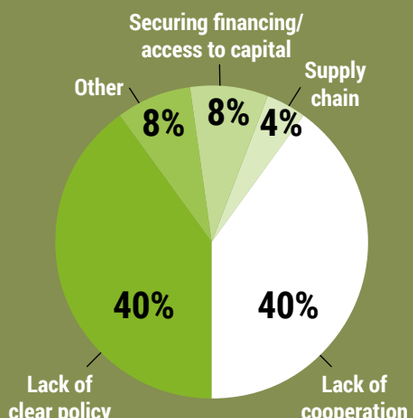
ACHIEVEMENTS

We asked recent INFRAIntelligence webinar attendees about Canada achieving net-zero. Here's what they had to say:

Which renewable energy source has the most potential to help Canada achieve net-zero 2050?



What do you see as the greatest challenge to achieving net-zero?



To watch a replay of the entire discussion or listen to the podcast, visit **www.renewcanada.net**.

> **"First Nations people are the biggest owners of renewable projects other than governments and local municipalities, so that's something we must keep in the forefront."**
>
> Chief Sharleen Gale

2009, we were putting solar panels up that had 90 watts in them, now they're 750 watts. We were using inverters that were 250 or 125 kilowatts, and now we're seeing them at five megawatts. I think there's still a lot of rumors out there that you must pay to be green and you have to pay more for renewable energy, and it's just not true anymore.

Chief Sharleen Gale, chair, First Nations Major Projects Coalition (FNMPC)
I believe that some people are in denial that we're going through an energy transition right now, but as First Nations we have big ambitions, and we think equity ownership is the key to creating a brighter future for our people in this transition to net-zero. Across this country, First Nations people are the biggest owners of renewable projects other than governments and local municipalities, so that's something we must keep in the forefront. This is going to be a bumpy ride and none of us want this to happen to us, we want to lead it and we also want to benefit from it. And I think as you start looking at this transition happening, you'll see Indigenous people are ready and they're stepping up to help position Canada better on this path.

Pranav Shah, director, (Clean Energy), Canada Infrastructure Bank (CIB)
I think it will take a combination of the sources of energy that we've talked about, but it will differ at different geographies. Our grid is somewhat fragmented from province to province and the challenges that each province and utility, its system operator facing in each of those jurisdictions is different.

> **"I think there's still a lot of rumors out there that you must pay to be green and you have to pay more for renewable energy, and it's just not true anymore."**
>
> Andrew Moles

The Tu Deh-Kah Geothermal project will re-purpose the Clarke Lake gas field in northeast B.C. and develop an electricity generation plant.

And so, I particularly think storage has a key place in all of this because it's going to unlock the opportunities for renewables to have higher penetration rates. And we're seeing this across the board. If you think the perspective of a system operator or utility that's running the grid, what they're trying to do because of legislation is remove thermal generation essentially from their grid and replace it with intermittent renewable generation. And so, that needs some balancing too.

What are the challenges facing government and the private sector as we look to meet our emissions goals?

Robert Hornung

We're going to need to mobilize a tremendous amount of investment and activity to be able to move forward and that's going to require first and foremost some policy certainty and clarity. What happens to the carbon price after 2030? What does a clean electricity standard really look like? We also have to recognize that the electricity system in 2050 is going to look really different than the electricity system today.

We need to ensure that we are developing comprehensive strategies that support electrification in areas like transportation and in buildings and in industry, not just one-off measures, but really a comprehensive plan to get there. So, we can list a whole bunch of challenges, but we must recognize that for every one of those things we talk about, we flip it over and it's a tremendous opportunity and that's what we need to focus on.

Andrew Moles

This is a big, big energy transition. We are already tapped out in our country with respect to skilled trades and construction workers to build out the infrastructure plans that we have not including the energy transition. So, figuring out how we're going to train people, attract, retain people, and frankly get the quantity of people and equipment.

And this impacts more than just the onsite construction but there's a whole support industry that goes with this, in transportation, in offsite manufacturing, and so on and so forth. This is a big wave that's coming that's going to require a lot of people and going to employ a lot of people, but we need to make sure that we're preparing ourselves and whether that means increase focus on skill trade immigration or other things, we need to solve that problem as well. Or we're going to have all these projects and no one to build them.

Sharleen Gale

One of the key challenges that I see is to secure competitively priced capital for First Nations to invest in these projects so that we can be leaders in this transition. I think it's really important that we're involved meaningfully, and we have to overcome the challenges for First Nations to have access to capital in a meaningful way that has low interest rates that makes sense for us to be involved in these projects. I know that I've worked with the Canadian Infrastructure Bank, they've been really, helpful in providing advice to us, especially with our Tu Deh-Kah Geothermal project at Clarke Lake.

But we need other financial institutions to really look at this and come together because I think for us to be successful as a country and bringing everybody in this transition together, we're going to need a new financing system in Canada. And that's for First Nations people to be true partners with a shared vision for this low carbon future. Without us, I don't think that this transition is going to happen.

Pranav Shah

The challenges of increasing renewable energy are jurisdictional, and each jurisdiction's faced with different challenges. And so, if you look at it from a utility's perspective, they have to rip out what they've already built so there's a cost to that. And then, they need to rebuild something that's cleaner. So, appreciating that I think is the first challenge. Tailor-making a solution that says that we acknowledge that there's tremendous costs there, there's also an opportunity to augment the grid and make it more resilient at the same time but it all comes down to costs. And so, I think that's where the [CIB] can be of assistance.

John Tenpenny is the editor of ReNew Canada.

Ryan Dickie/Tu Deh-Kah Geothermal

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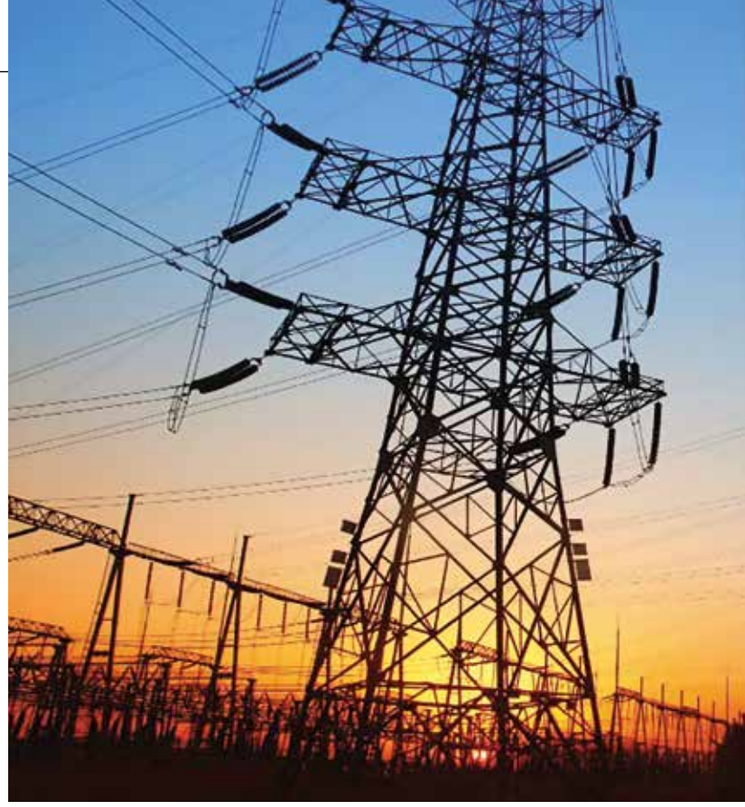


CANADA ABROAD

An overview of some of the infrastructure projects Canadian companies are working on around the globe

SIXTH STREET VIADUCT – U.S.

Spanning the Los Angeles River, the original bridge was constructed in 1932, but suffered from a fatal flaw. Its concrete included an aggregate that caused a chemical reaction known as alkali silica reaction, which severely damaged the structure over time. In 2016, the bridge was demolished.

At 3,060-ft-long and 100-ft-wide, the redevelopment of the bridge—designed by Michael Maltzan (architect) and HNTB (structural engineer)—includes 10 network arch spans, with a total of 388 hangers supporting the bridge deck.

Appointed as the erection engineer on the project with an extensive complex structure expertise, **COWI** worked closely with the contractor JV Skanska Stacy and Witbeck (SSW) to develop a constructable erection sequence, which included step-by-step camber and stress analyses, and hanger installation and stressing procedure of the bridge.

"It was a challenging project but the excellent teamwork between designer, city, contractor, and erection engineer made this project a success story," explained COWI's senior project manager Tobias Petschke.

COWI undertook a number of considerations to ensure the safety of both the public and the construction crew during this complex bridge erection, including the design of customized lock-up devices to stabilize the seismic pendulum bearings of the bridge during construction.

"Having the opportunity to apply our expertise to projects of this kind reminds you just how important our work is. By exploiting some of the most advanced techniques we can ensure the safe and sound erection of complex infrastructure projects," added Petschke.

U.S: Skanska Stacy and Witbeck (SSW) JV

UGANDA-CONGO POWER INTERCONNECTION LINE – AFRICA

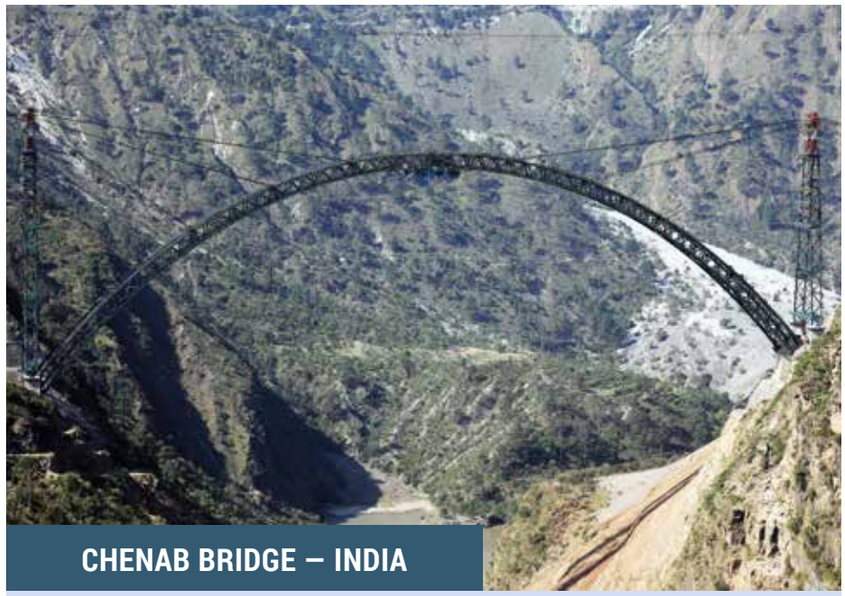
AECOM was awarded a contract to provide consulting services for the Uganda-Democratic Republic of Congo Power Interconnection Line project. This work was awarded by the Nile Equatorial Lakes Subsidiary Action Program Coordination Unit on behalf of the governments of Uganda and the Democratic Republic of Congo.

AECOM's project scope includes delivering a feasibility report in addition to detailed design and tender documents that examine the technical and economic viability of the proposed transmission line. Currently, parts of the region rely on main load centers supplied by small diesel generators. The Uganda-Democratic Republic of Congo Power Interconnection Line aims to connect these regions to the national grid, providing a less expensive, reliable, and secure power supply. AECOM conducted an initial feasibility study for this work in 2013.

"We're excited to partner with the Nile Basin Initiative, building upon our important previous work to help make the Uganda-Democratic Republic of Congo Power Interconnection Line a reality," said Joseph Salim, senior vice president with AECOM. "With the rich renewable energy potential in the Nile Basin, this work will help bolster the region's energy grid economy."

Project objectives include assessing existing and future power sector development in the region; recommending appropriate rural electrification along the proposed route; reviewing organization and institutional frameworks for the construction, ownership, and operation of the line; exploring possible climate change risks to the project and proposed mitigation measures; and estimating the impact of the interconnection on the countries' carbon footprints, specifically greenhouse gas emission reduction that will accrue from the transmission line.

Africa: AECOM, India: Afcons Infrastructure



CHENAB BRIDGE – INDIA

The new Chenab Bridge is part of the Udhampur-Srinagar-Baramulla rail link project in the Jammu and Kashmir region in India, in the Western Himalayas, approximately 600 kilometres north of New Delhi. The project represents an important rail link that will join the Kashmir Valley to the Indian Railways network.

The bridge has numerous design challenges, such as the erection of the steel arch by cable crane, the bridge's huge dimensions, and the special design requirements—redundancy of the arch, the earthquake load, and blast load effect.

Wind engineering also posed a significant challenge for the structure. The main challenge in wind engineering was not the size of the bridge itself but the site and altitude at which it is located. In extremely rough topography, standard models of wind and turbulence are unlikely to be realistic; a special type of wind tunnel testing was therefore conducted to assess the design wind parameters.

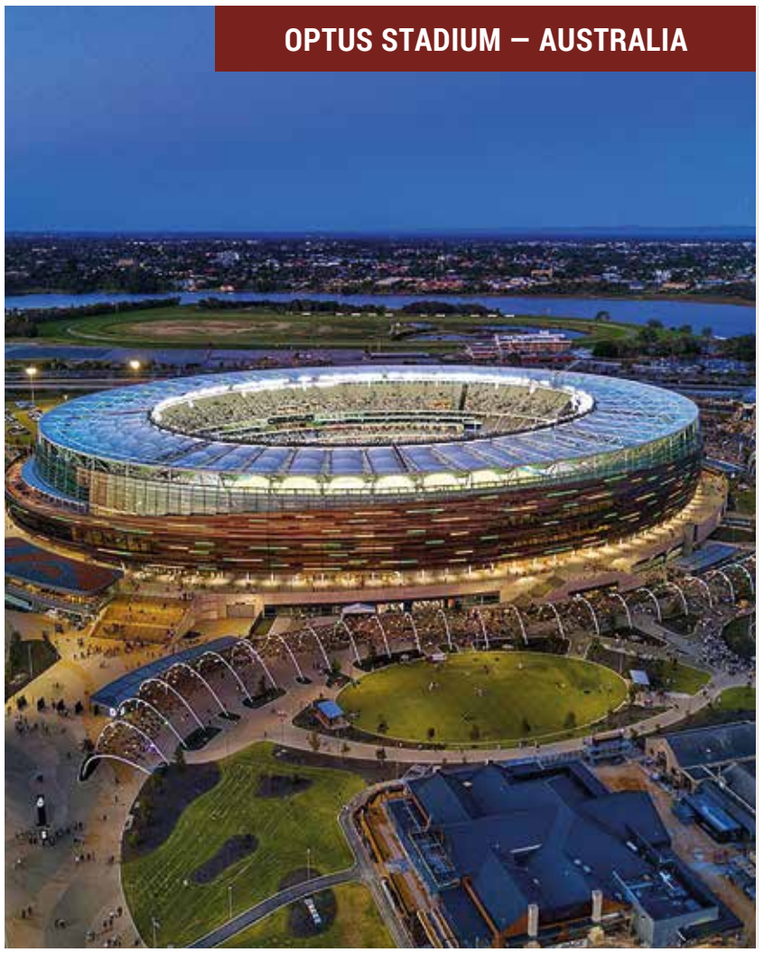
Wind engineering of the bridge was conducted by combining in-house wind engineering expertise and the wind tunnel tests of FORCE Technology in Denmark. The first test involved a large-size topography model of the bridge site. It revealed some unusual wind characteristics, including up to 11 degrees vertical inclination of the mean wind velocity and wide scatter of turbulence intensity from seven to 55 per cent, depending on wind direction.

The next test in the program was standard section model testing, which contributed updated aerodynamic input to **WSP**'s advanced 3D buffeting analysis and equivalent static wind load extraction. Wind resistant design of the bridge were further confirmed with full aeroelastic model tests.

Subsequent design changes and construction stages were assessed using digital modelling.

"The Chenab Bridge is a major achievement—for all the bridge designers and builders involved in the project," said Pekka Pulkkinen, design director, WSP in Finland. "The erection of the arch, a truly memorable moment, represents a great execution of engineering expertise. Cooperation between the design team and contractor has been essential for the project's advancement. The challenges in the project have been handled together, thereby facilitating the successful solutions."

OPTUS STADIUM – AUSTRALIA



The world-class, multi-purpose Optus Stadium was designed with one key vision: fans first. That commitment called for an innovative design that would ensure an exceptional atmosphere for every event—and a home ground advantage.

Key design and fans-first features included future-proofed stadium technology (such as full 4G Wi-Fi coverage) and more than 70 food and beverage outlets. The stadium includes the widest range of seating and hospitality options of any stadium in Australia, and the lightweight fabric roof covers 85 per cent of seats and responds to Perth's climate conditions. At night, it presents a spectacular glowing halo effect.

Stantec provided design and documentation for the electrical, fire engineering, fire protection, mechanical, sustainability, technology, and vertical transportation components of the project.

With a design that acknowledges Western Australia's unique sporting, cultural, and Aboriginal heritage as well as a Sports Precinct that provides a spectacular vista across the Swan River to the city, Optus Stadium is a community anchor to be proud of.

"This stadium represents our sporting culture. Beyond Western Australia, it's a place where all fans can come together to support their local and international legends," said Brett Davis, Stantec's regional director for buildings in Australia. "This project called for a fans-first approach throughout all aspects of our design which has subsequently led to exceptional experiences for patrons at every event."

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GUNNEDAH SOLAR FARM — AUSTRALIA

The project—**PCL**'s first solar work in Australia—consisted of the design, procurement, and construction of a 153-megawatt solar electricity generating station in Gunnedah, New South Wales. Covering 304 hectares, the large-scale solar photovoltaic system uses 353,528 bifacial Canadian Solar-made panels on a single-axis tracking system. The panels continuously generate energy as they follow the sun's movement throughout the day.

PCL completed the civil works, foundations, underground electrical works, racking and module installation and supply and install of inverter buildings. Canadian Solar supplied the foundation piles, tracker and solar modules and subcontracted the substation design-build.

After certification of substantial completion status, the Gunnedah Solar Farm will produce enough electricity to meet the needs of approximately 48,000 households and reduce greenhouse gas emissions by over 290,000 tonnes of CO_2 per year—the equivalent of removing approximately 125,000 cars from the road.

"As true solution providers, we were able to overcome the challenges of inclement weather, the pandemic, and other global uncertainties through resilience and a commitment to achieving our common goals. We extend our sincere thanks and appreciation to everyone involved with this project," said Gopi Govindraj, country manager for PCL Pacific Rim.

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Precast Parking

EllisDon's Civil Special Projects team is adding a new parking structure at the Trillium Health Partners Queensway Health Centre. This above-ground structure is almost entirely precast concrete, fabricated off-site and set in place using a crane. Once completed, the new eight-storey parking structure will include barrier-free, EV charging, reserved, pay-and-display, and gated parking spaces.

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Calgary, AB

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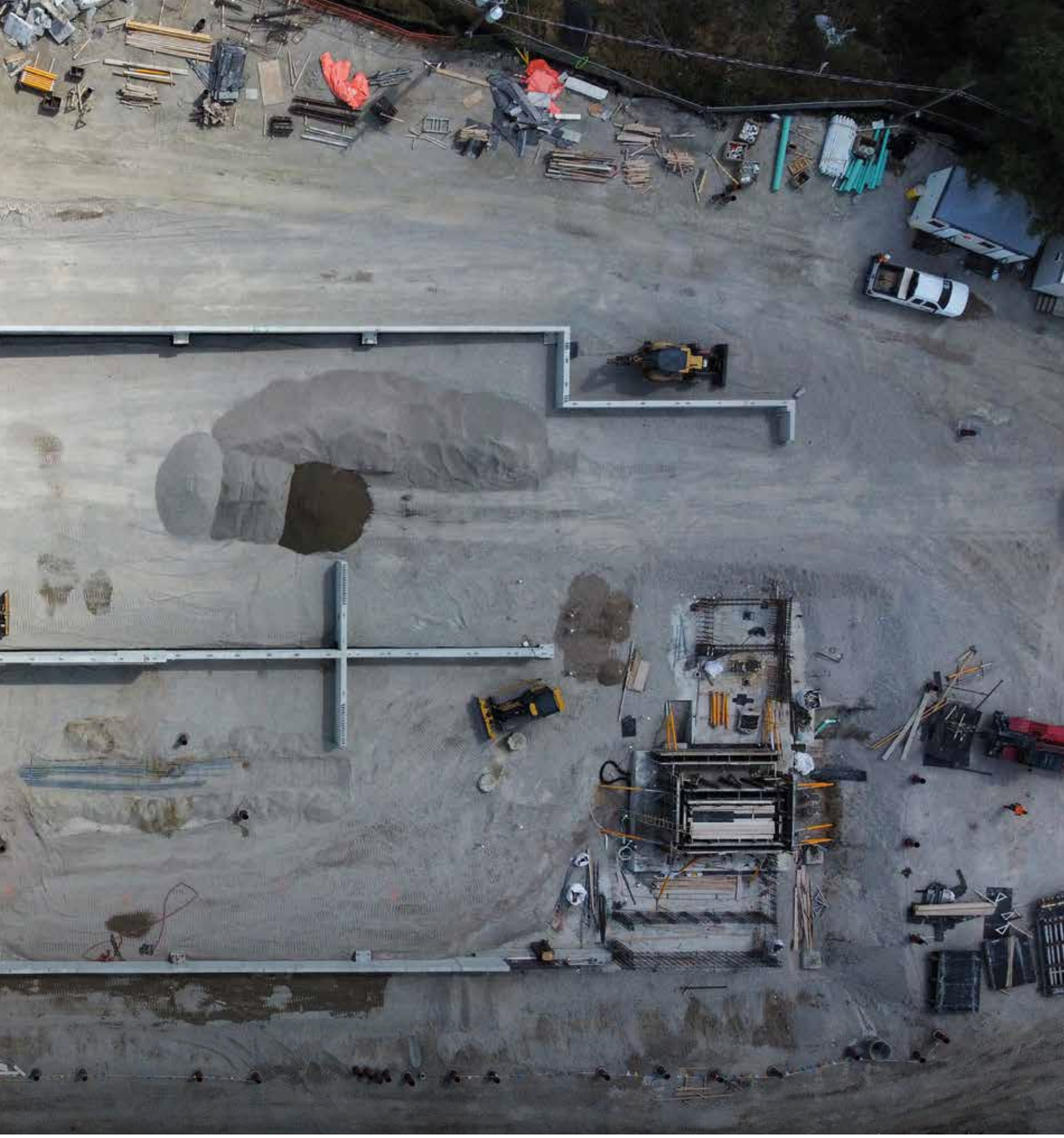


EllisDon

Metrolinx's Ontario Line subway project—No. 6 on the 2022 Top100 Projects report.

REALITY BITES

Cost rises cast a shadow over government infrastructure plans

By John Allen

Annual lookaheads are notoriously treacherous as recent years have shown. Barring unforeseen, once-in-a-lifetime global events, the main challenge governments across Canada face going into 2023 is achieving a heavy slate of policy and infrastructure priorities while trying to help tame rampant inflation. Ambitious infrastructure programs that have become a common feature for governments of all stripes across Canada are under increasing pressure as costs continue to rise. Without a stabilization of costs for materials and labour and concerted action for government and industry, the threat of project cancellations looms large.

No shortage of priorities

Infrastructure investment was at the centre of pandemic recovery policies across Canada. Investments in hospitals and care homes were seen as being most urgent to provide greater resilience in the face of future health threats. The state of the nation's schools was also brought into sharp focus as aging buildings and the possible impact of poor ventilation on children's health shone a light on the massive backlog of work required to bring school buildings up to scratch. Ontario alone would have to spend an estimated $15.9 billion to bring school buildings up to standard.

There were fears that the fall off in ridership from the pandemic could see transit investment suffer. For the most part governments have held course, recognizing the strong role transit will play in unlocking housing supply and providing access to jobs. There has also been a marked shift in mindset around the role stations play, with much more thought being given to using transit investment to catalyze vibrant, mixed-use transit-oriented communities, particularly in Ontario, Quebec, and British Columbia, and offset some costs of infrastructure development. More complex, integrated stations will require diverse industry skills.

Access to housing has become a key political battleground, supercharged by the focus new federal Conservative leader Pierre Poilievre has placed on the issue. After many years of political parties tinkering around the edges with policies to support first-time buyers, the reality of a shortfall in housing supply has become the inescapable elephant in the room. On the current trajectory the Canada Mortgage and Housing Corp estimates that an additional 2.3 million housing units will be built by 2030, but to restore affordability there will need to be an additional 3.5 million units on top of that. Many of these units will be delivered through large condo towers, particularly in major cities, which will draw from the same talent pool as some of the more complex infrastructure projects.

In the energy sector, the Russian invasion of Ukraine has caused turmoil in energy markets as countries look to diversify their supplies away from Russian gas. This has put the spotlight on Canada to step up and help fill the gap as a stable, reliable supplier. Proposals for new liquefied natural gas facilities that had previously stalled have become reinvigorated, but still must make the case with stakeholders and Canada's aggressive climate targets and present a strong business case. A visit from Germany's Chancellor Olaf Scholz to Canada highlighted the commitments being made in Europe to build the infrastructure to receive more LNG and the desire for Canada to play a bigger role.

In the longer-term Europe and other global markets are looking at Canada to be a supplier of clean energy, particularly hydrogen and critical minerals to help drive the transition to a clean economy. The role of nuclear and renewable energy as a source of energy, but also its potential to produce hydrogen for both domestic and international use is becoming more prominent with many provinces developing hydrogen strategies based on their own unique energy generation advantages. This may see a boon in new renewable energy projects and additional impetus for

Ontario Line: Metrolinx

L to R: B.C. Hydro's Site C Energy Clean Project—No. 1 on the 2022 To100 Projects report. West Park Healthcare Centre in Toronto—No. 57 on the 2022 Top100 Projects report.

the development of small modular reactors. The flip side is this ramp up in activity is also putting further pressure on skilled labour supply, particularly in Alberta and British Columbia.

Taming the cost dragon

Rising costs for infrastructure are top of mind for all governments across Canada. Back in January 2022, Toronto sounded the alarm that they would have to cancel $300 million of infrastructure projects and $1 billion of state of good repair work without support from other levels of government. In that case the budget shortfall was put down to COVID, but more recently the narrative has shifted. Governments are pointing to the need to cancel or delay projects or defer maintenance due to spiralling costs of key materials and equipment. With rising costs also putting pressure on the day-to-day public service delivery, there is a real risk of a return to the bad old days of infrastructure and state of good repair funding being raided to plug funding gaps elsewhere.

In the short-term governments are looking to index payments to offset some of the volatility in prices holding companies back from bidding on work but are growing increasingly concerned on the direction of travel on bid prices for public infrastructure. Industry will need to bring forward solutions here or else risk seeing the project pipeline wither.

For their part governments are looking at tackling some of the key drivers of project costs. Ontario deployed a rapid build program for long-term care homes and announced a pilot for schools. Both Quebec and Ontario previously brought in legislation to accelerate the construction of major projects by addressing some of the longstanding bottlenecks such as onerous environmental approvals, permitting, and utility work. British Columbia also set out an objective for the Minister of Transportation and Infrastructure to streamline consultation, tendering and construction of infrastructure projects. The role of the National Infrastructure Assessment in driving good project governance will also be important in ensuring money is being spent on the worthiest projects.

The hope is that prices will start to stabilize and eventually fall for key materials, but labour presents a more stubborn challenge. The burgeoning pipeline of projects across all sectors has driven up demand for key skills, notably mechanical and electrical engineers, and the sector has struggled to attract people. It is not something that can be solved overnight and requires government, industry, and the education sector work together to develop in-demand skills, as well as a smart immigration policy with international skills recognition.

All eyes on budget season

As spring arrives and budget season blooms for Canada's federal, provincial, territorial, and municipal governments, ambition will butt up against economic reality. In recent years, budgets have seen a ratcheting up of infrastructure priorities and spending; it may be that funding levels remain stable but commitments to projects are scaled back or delayed. There may be some high-profile project casualties with governments using the current inflationary environment to walk away from some of their grander promises. Governments are looking for help to maintain momentum in building out the nation's infrastructure. Faced with an ever-growing list of funding priorities and this challenging economic environment, there has never been a better opportunity for industry to propose solutions to help reduce project costs and improve the overall landscape for project delivery in Canada.

John Allen is vice president at Global Public Affairs.

Energy Clean Project: B.C. Hydro, West Park Healthcare Centre: Infrastructure Ontario

CRACKING UP

GIS technology helps Kelowna, B.C. streamline sidewalk inspection process and reduce costs

By Ron Santos

Municipalities deal with legal actions from sidewalk slip and fall accidents on a regular basis, and the costs can be substantial.

Provincial legislation requires Canadian municipalities to have their sidewalks inspected annually, a necessity that helps protect these municipalities from lawsuits. If someone is hurt tripping on a broken sidewalk, they go to the city for compensation.

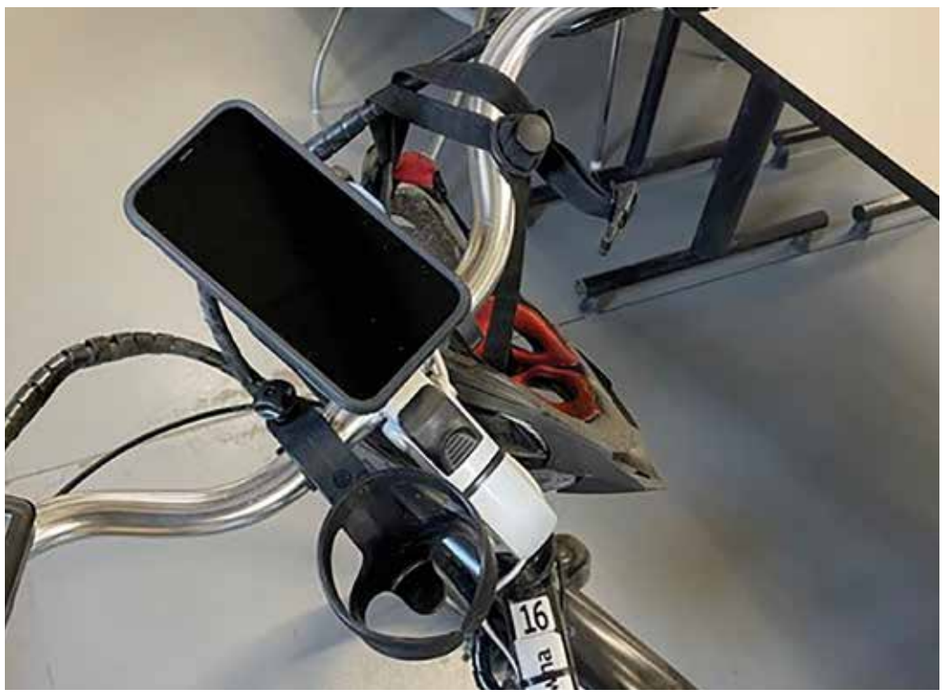
Municipalities deal with legal actions from sidewalk slip and fall accidents on a regular basis, and the costs can be substantial. (According to a CBC report, "A Hamilton [Ontario] court has ruled in favour of an 89-year-old woman who slipped and fell on a 23.8-millimetre bump in the sidewalk, a gap that cost city taxpayers $192,000 in damages.") In 2016 alone, Hamilton paid more than $2 million in compensation for sidewalk accidents.

The process of inspecting sidewalks is complex. It involves a combination of field and office-based components, informing property owners, sometimes managing contractors and many calculations working with different datasets. To record the condition of the sidewalk, its precise location, describe the repairs needed and track the process to make sure repairs are completed, demands multiple paper forms.

Until recently, like many Canadian cities this is how the City of Kelowna, British Columbia inspected their sidewalks.

Municipally trained operators rode specially outfitted bikes over Kelowna's sidewalks and made a note of any cracks or upheavals. The drivers could only enter one of eight kinds of deficiencies, the type, and the severity, based on the operator's judgement. The GPS system used to record the location of these inspection observations also varied by about five or six metres, which could suggest that the defect is in someone's front porch. There was no visualization of the problem. No one else could see what the damage looked like. There was no way to even confirm that the data had been entered into the system. The operators would not

Getty



L to R: Kelowna's sidewalks cover 211.85 kilometres and the previous inspection process took two people between six and eight weeks to complete. Kelowna updated their sidewalk inspection process by installing antennae on the bikes for an external GPS system, increasing its accuracy.

know they'd missed something unless they looked for it—often weeks later.

Kelowna's sidewalks cover 211.85 kilometres and this labour-intensive process took two people between six and eight weeks to complete. The information was then put on a spreadsheet and entered into a software program that included a map. That step took another six weeks. Even planning for needed repairs couldn't start for two months.

Mistakes were made partly because there were so many steps—increasing the possibility of human error—and as the asset management coordinator of Kelowna Greg Maier cautions, "It's always dangerous to let people handle the data who don't understand the total picture."

While this process was largely effective, it was laborious and awkward. Awkward always means inefficient and like all cities, Kelowna couldn't afford inefficiencies. Repairs, maintenance, and planned expansion of their infrastructure all come with heavy financial demands. They needed to save every nickel, and to do that they needed a culture change.

As Kelowna was implementing the corporate asset management system called Cityworks in other departments, they wanted to see if they could improve the sidewalk inspection program. Could they change how things were done and automate calculations, eliminate paper, reduce staff time, and become more efficient?

To start that process the senior project manager of the corporate asset management program, Hamid Butt, reviewed the issues and challenges of managing assets before discussing any technology to address them. He doesn't believe in technology for its own sake. When he saw that an enterprise asset management platform would drastically reduce costs and improve business processes, he presented it to the executives to get their endorsement and they were persuaded.

He initiated a formal change management process, or as Butt prefers to call it "managing change." He also says that managing change is always about people. He approached operations managers and supervisors to better understand issues, challenges, and opportunities. He found that the practice, and even the understanding of the workflow processes, differed amongst the staff.

Butt and the team developed a structured approach to corporate asset management using new software and technologies to enhance both their business processes and their efficiency. To help departments make this change, Butt asked them to choose five processes that are constants for them. Then he asked them to use the Cityworks software to see how they could be done differently. He wasn't going to foist change from the top onto front line staff.

"People don't often resist change" he says, "they resist having to change." And those who really dig in their heels and refuse to engage with a new system he describes as having "a performance issue, rather than a technology issue."

Once they got buy-in from the field crews, they started updating their sidewalk inspection process.

Antennae were installed on the bikes for an external GPS system, increasing its accuracy. The range reduced from 20-30 centimetres to 5-6 millimetres. They could categorize the sidewalk as asphalt, concrete, or interlocking brick. They could define defects and their severity (heaved, spalled, cracked) and what seems to be the cause (construction, road cut, tree) and even a suggest a repair method (bay replacement, grinding, levelling).

Operators were provided iPhones, so taking a picture of the problem was easy and automatically integrated into the system. They started using the ArcGIS QuickCapture application, which records the date and time on the photo. Instead of filling out multiple paper forms to record inspection details, using this Esri-based app, a defect is automatically logged with the location, the date and time of the inspection.

They were able to update their system every day, though the system can be updated hourly. At the end of a workday, the data of each sidewalk segment is reviewed. Significant defects are identified and depending on the severity of the upheaval or crack, they decide whether to make patch or full repairs. Because the data is shared, they can find out if there are plans to dig up that stretch of sidewalk soon for repairs on other assets like water or power lines. Or if this is a block with a lot of defects and can't just be patched but needs a larger permanent repair like full sidewalk bay replacements.

Once a decision is made, a work order is assigned and scheduled. The work order includes accurate information about the

City of Kelowna

defect, the cost of the repairs and when re-inspection is needed. Because everyone involved can have access to the information through reporting, dashboards, and workflow notifications, duplicating information on multiple forms is now unnecessary.

assets on a spreadsheet. Kelowna has moved towards a condition-based asset maintenance approach. They are centralizing their asset inventory and managing their assets by monitoring their condition using mobile data collection technology. They're using

equates to millions of dollars over the asset's lifespan and Kelowna owns approximately $4 billion worth of assets.

The system is being used for other legislatively required safety inspections like road guardrails. Kelowna's Parks department is now migrating to this asset management system to monitor the state of trails, identify areas prone to flooding and prioritize asset repairs for public safety.

This approach is sparking interest around the country. Maier has spoken to cities much bigger than Kelowna, (Brampton Ontario) and much smaller (Leduc, Alberta) regarding the city's corporate asset management program. He has also presented the city's enterprise asset management system at the Canadian National Asset Management (CNAM) conference.

Doing more with less is the clarion call for all Canadian communities and they can't afford to overlook anything, including sidewalk inspections.

"People don't often resist change, they resist having to change."

The speed and accuracy of noting the severity of sidewalk defects, their location, condition, and overall risk is crucial for smart asset management. As Maier says, "reactive maintenance, like an unscheduled break repair, is the most expensive fix. Preventative and predictive maintenance is much more cost effective." As every homeowner knows, start before it gets worse. The sooner you can attend to repairs, the better.

This is a shift in focus. Traditional asset management has been simply inventorying

empirical asset data to decide the timing of their asset maintenance and renewals, while minimizing risk, in line with the city's service level commitment.

This new approach is a big money saver. If a manufacturer says an asset—like a sidewalk—should last 40 years, Maier hopes that by using Cityworks and timely, proper maintenance, they can extend the life of their assets even a few more years. That may seem like small savings, but if they can expand a life span of an asset by only two per cent it

Rob Santos is the director of public works with Esri Canada.

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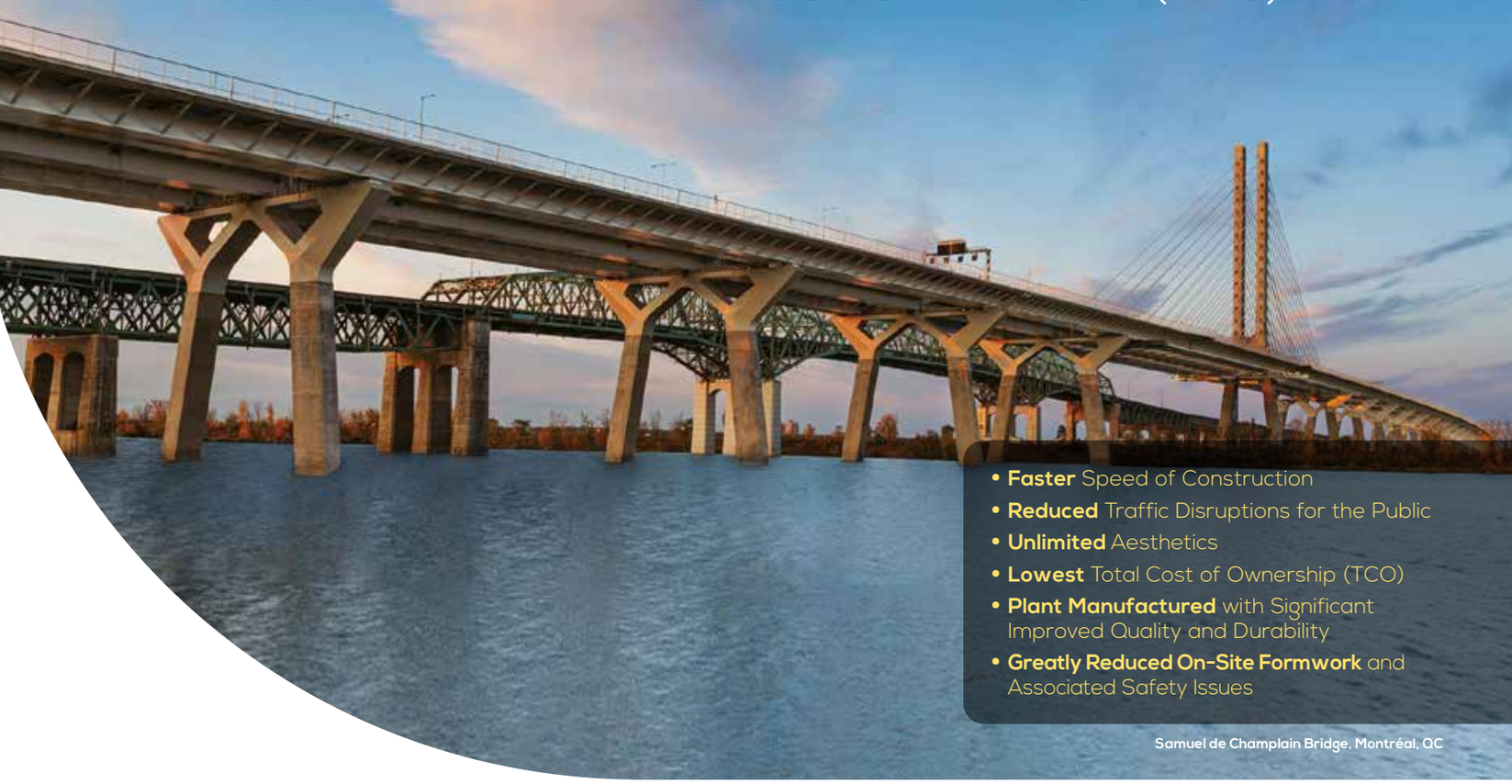

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For more information on this project: http://www.cpci.ca/en/about_us/project_month/january_2020/

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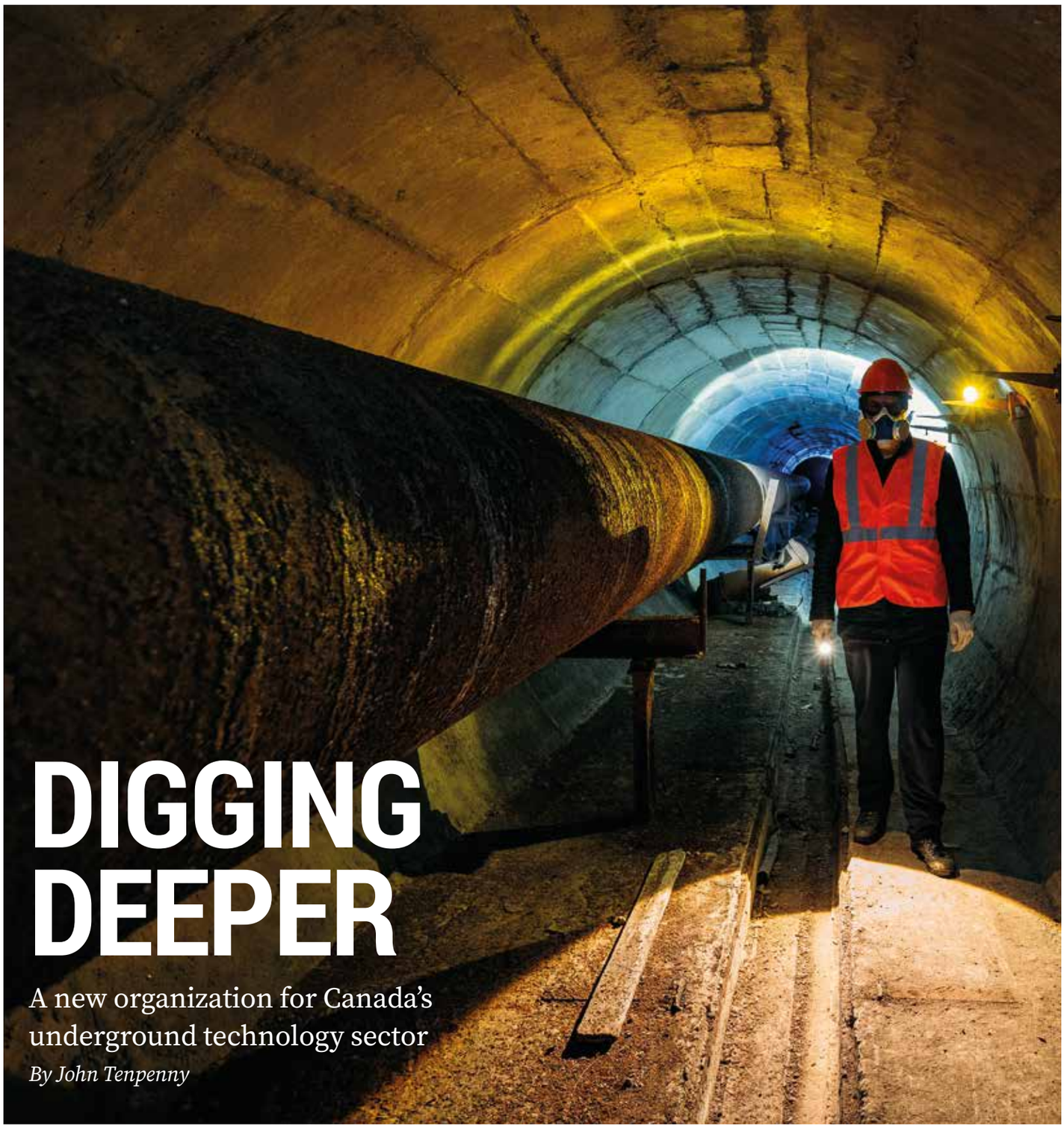


DIGGING DEEPER

A new organization for Canada's underground technology sector

By John Tenpenny

Many of the services communities rely on—including water, sewer, stormwater, and telecommunications—involve underground infrastructure. At the same time, this infrastructure is under increasing pressure due to aging systems, population growth in urban centres, and climate change.

So, it only makes sense to have a national organization dedicated to this important sector.

Earlier this year, the Canadian Underground Infrastructure Innovation Centre (CUIIC) at the University of Alberta was formed, replacing to two associations: The Centre for Advancement of Trenchless Technologies (CATT), based at the University of Waterloo, and the Consortium for Engineered Trenchless Technologies (CETT), at the University of Alberta.

The transition was swift. Knight asked the board of directors to explore what the next iteration of the sector should include

It began in the fall of 2021, when CATT explored how the sector could be better represented geographically. Soon discussions involved representatives from CETT and by the spring of this year, CUIIC had approval from the University of Alberta and letters of support for the transition from more than 20 organizations across Canada.

According to CUIIC's new director, Alireza Bayat, Ph.D., P.Eng., professor in the Department of Civil and Environmental Engineering at the University of Alberta, the new organization's mandate is broader, not just focused on trenchless technologies, but the broader underground infrastructure sector.

"We are forming a community for people who are working underground," says Bayat, who is also an NERSC research chair in underground trenchless construction and the former director of CETT.

"As a member you are joining this community and collectively as a community, we will identify problems and we are going to work

HOW POMERLEAU CAPITAL IS LEADING INVESTMENT STANDARDS IN THE CONSTRUCTION INDUSTRY

Following a successful track record that involved raising more than two billion dollars in project financing, Pomerleau Capital, Pomerleau's investment and financial subsidiary, launched its new infrastructure fund, PCap Infrastructure and Renewables, in 2021. Pomerleau Capital currently manages a portfolio of $750 million.

The fund invests in a broad range of infrastructure sectors, including public-private partnerships (P3), renewable energy, and real estate. "Pomerleau Capital is uniquely positioned to provide turnkey solutions to its customers, leveraging Pomerleau's national presence and reputation as a top contractor. Over the last two years, the Pomerleau Capital team has grown substantially, drawing in experts in financing, equity investments, and asset management," said Philippe Adam, President of Pomerleau Capital.

The fund's investor base currently includes Pomerleau, its senior leadership and CDPQ. Pomerleau is rooted in strong governance, and it translates this structure to Pomerleau Capital, which is led by an investment committee composed of internal and external experts in the three targeted sectors. The fund ensures the best interests of its investors while applying the technical know-how of Pomerleau and Borea Construction, Pomerleau's renewable energy subsidiary.

Pomerleau is focused on building impactful and sustainable projects of societal significance. "We want to give back to our communities by adding value to sustainable infrastructure and renewable energy projects in both civil and vertical sectors. Pomerleau Capital seeks to generate long-term returns to investors while positively impacting local communities," said Mr. Adam.

From schools to hospitals to public transportation, the company is working hard to become an industry leader in financing and investing in sustainable projects. This is supported by Borea Construction and Pomerleau, who have a natural pipeline of greenfield projects through client partnerships and procurement processes. The focus on sustainability aligns with Pomerleau's environmental, social and governance (ESG) objectives, which the company released in its inaugural ESG report earlier this year.

Pomerleau Capital is defining its market with its strong governance and expertise. The proficient team is fostering partnerships and establishing a discipline of best practices to promote trust and rigor in their work. The fund ensures longevity for investors and instills a confidence in the future of the industry

LEARN MORE ABOUT POMERLEAU CAPITAL HERE
pomerleau.ca/en/pomerleau-capital

POMERLEAU

toward finding solutions."

"CUIIC focuses on providing stakeholders with opportunities to collaborate on research and training opportunities in underground infrastructure to foster innovation to provide cost-effective, sustainable solutions to the challenges involved in building, assessing, and rehabilitating underground infrastructure."

The aim says Bayat is to drive innovation and lower the risks associated with underground construction. "The underground sector brings together many domains—water, wastewater, transportation, gas distribution, energy, power, and telecommunications among them—that face similar challenges related to the construction and maintenance of underground infrastructure.

"We hope through our research that we can improve methods so that the risk in underground infrastructure projects can be reduced."

CUIIC has organized three committees, that have met already, to chart new paths, with three pillars in place – research and innovation, education and outreach, and industry and membership.

"As a member, you are joining this community and collectively as a community, we will identify problems and we are going to work toward finding solutions."

University of Alberta engineering professor **Alireza Bayat** is the director of the newly created Canadian Underground Infrastructure Innovation Centre (CUIIC).

With CUIIC, any company becoming a member is officially a research partner with the University of Alberta.

"As a member, you aren't just paying a membership, you are a research sponsor for all the CUIIC research that will happen," explains Bayat. "The concept here is that for less money, people can be part of that research community. We are building a crowd together to support the research and education mandate of this program."

As research partners, CUIIC members will get access to the results and work that went into the research. To help shape the research, CUIIC plans to run a yearly survey for its membership to identify the problems that the industry is facing and prioritize the problems.

"CUIIC will act as an incubator for industry solutions," says Bayat.

On the education side, Bayat says CUIIC has a few plans under development to include classes, short courses, and webinars. He added that they are hoping to have the first classes, short courses and webinars in place for the fall semester.

John Tenpenny is the editor of *ReNew Canada*.

MULTI-USE TUNNEL CONSTRUCTION NOW UNDERWAY AT HIGHWAY 400

By Alex Iantorno

Recently Metrolinx's Finch West LRT team took a major step forward on a new pedestrian pathway when they installed 18 concrete tunnel segments under the Highway 400 southbound on-ramp at Finch Avenue West, that will form the body of a new multi-use tunnel.

The tunnel will provide a better way for pedestrians and cyclists to move through the area, instead of travelling beside high-speed traffic at the surface on-ramp.

While the tunnel itself is only 32 metres long, the entire portal length will be 155 metres in length when accounting for the tunnel's access points.

A new intersection with traffic lights was not feasible at this location, but designers saw that there was enough space to accommodate a tunnel and make a significant safety improvement for pedestrians.

Work began with the on-ramp closure, followed by excavation and placement of 18 precast concrete sections to create the tunnel. Each section weighs 39,525 kilograms—that's more than three school buses.

The precast tunnel has rigid foam on the top, bottom, and sides, providing thermal protection and noise insulation. Workers also installed a vapour barrier under each concrete section, providing additional protection from groundwater leakage.

Next steps include constructing the portals that will transition from the surface to the tunnel and installing a drainage system to help mitigate any water buildup or flooding issues. The drainage system is state-of-the-art and includes an alarm system that notifies maintenance crews immediately in the event of unexpected water buildup.

Construction is scheduled to be complete by the end of 2022.

Alex Iantorno is a capital communications senior advisor with Metrolinx.

METROLINX

Metrolinx's Finch West LRT team took recently installed 18 concrete tunnel segments under the Highway 400 southbound on-ramp at Finch Avenue West, as part of a new multi-use tunnel.

MAKE OR BREAK

The link between procurement type and financial performance *By John Tenpenny*

The new $1.377 billion Pattullo Bridge Replacement project is a four-lane toll-free bridge scheduled to open in 2024. The existing bridge will remain in use until the new bridge is open to traffic.

With the average size and frequency of large civil infrastructure projects, such as highways and bridges, jumping significantly over the past decade, the financial results on these projects for many contractors has fallen dramatically, according to the results of a recent study from surety provider Travelers.

The study examined 224 heavy civil construction projects across North America over a 17-year span from 2004-2020, focusing on projects with contract values over $250 million. Those projects included bridge, highway, rail/light rail, tunnel, and other similar large-scale civil work.

"As infrastructure spending in the U.S. and Canada continues to catch up and the number of large civil infrastructure projects increases, contractors will continue to make choices about where to invest their capital and about which projects to bid on and which to pass over," says Ray Bassett, VP and strategy officer for Travelers construction services. "Where companies can see a well-developed design or have control over the design process before fixing a price, they will see opportunities for a fair return."

However, says Bassett, some companies are concluding that that investing their capital in this space is something they are not prepared to do. "So, you see in the marketplace contractors withdrawing from these types of projects—they will just not bid certain works.

"It starts to explain some of the behaviour you see in the marketplace, where there are not enough bids on some projects."

"In recent years where that return has not been available on large civil work in some

B.C. Ministry of Transportation and Infrastructure

Ray Bassett,
VP and strategy officer for
Travelers construction services.

"As infrastructure spending in the U.S. and Canada continues to catch up and the number of large civil infrastructure projects increases, contractors will continue to make choices about where to invest their capital and about which projects to bid on and which to pass over."

markets, we've seen companies step away from large design-build and P3 infrastructure work given the high risk and poor returns. Outliers sometimes enter the market and provide capacity for a period of time, but we've seen that the model where contractors are asked to fix a price based on an underdeveloped design is likely not sustainable in the large civil space."

According to Bassett, the study was undertaken due the recent increase in infrastructure stimulus in both Canada and the United States since the beginning of the pandemic and the company's unique view of the North American construction industry. Travelers provides surety credit to contractors in Canada, the U.S. and select international markets.

"We have a very wide lens on the marketplace," he says. "Our clients range from small family-run businesses to multi-national companies with tens of thousands of employees and that gives us a unique view—here are very few large infrastructure projects that we don't get some view of."

The biggest takeaway, according to Bassett, was that there was a very close correlation between the procurement method for a project and the financial outcome for a contractor on that project.

"Where contractors are required to fix their price and schedule before the design is well-developed those projects perform on the whole quite poorly compared to contracts where the design is well-developed before the pricing and scheduling are fixed," says Bassett.

Travelers

The study found that on design-build-finance-operate-maintain (DBFOM) projects over $250 million, contractors, on average, did not achieve an acceptable return and could not cover overhead on nearly half of the projects. The result on design-build was only slightly better. While there have been successes, the study found that, on average, Public Private Partnerships (P3s) have been a losing procurement method for contractors.

The study also found:

- On mega construction projects, which are typically highly complex with a budget of more than $250 million, data showed that construction management (CM), CM/GC (general contractor), and design-bid-build (DBB) have been more successful options for owners and contractors.
- Unresolved claims and contractor "under billings" were at manageable levels on CM/GC and DBB procurements, while disputed claims and under billings on DB and P# procurements, on average, were much higher, affecting both contractors and owners. On large projects, these disputed claims can be very significant and become a consideration for contractors deciding whether or not to pursue work on these models.
- The DBB procurement method, where design is well-developed prior to fixing pricing and schedule, has produced much better results for contractors than DB procurements, with nearly 75 per cent of DBB projects earning some level of net profit.
- On average, the study showed that large highway and bridge projects over $250 million have failed to generate expected returns for contractors and are the lowest performing heavy civil segments.

Considering that some contractors looking to reallocate capital from underperforming types of projects, there's been a move recently to more collaborative procurement models where project owners, designers and contractors work to develop the design well before pricing is committed.

Collaborative procurement models, such as progressive design-build, integrated project delivery (IPD) and the Alliance model, are recent developments, that are intended to be more collaborative. They all involve different approaches to re-aligning the sharing of risk, and the timing of design development and fixing of price and schedule. Whether these procurement models will improve financial outcomes for contractors and owners is an open question; it's too early to say. There just isn't enough data yet, says Bassett.

"It's early days on these models, but they do start to get at the problem of pricing an incomplete design and some other imbalanced risk allocation on these projects. It's not ideal when the design is only 30 per cent complete and the price and schedule are being fixed.

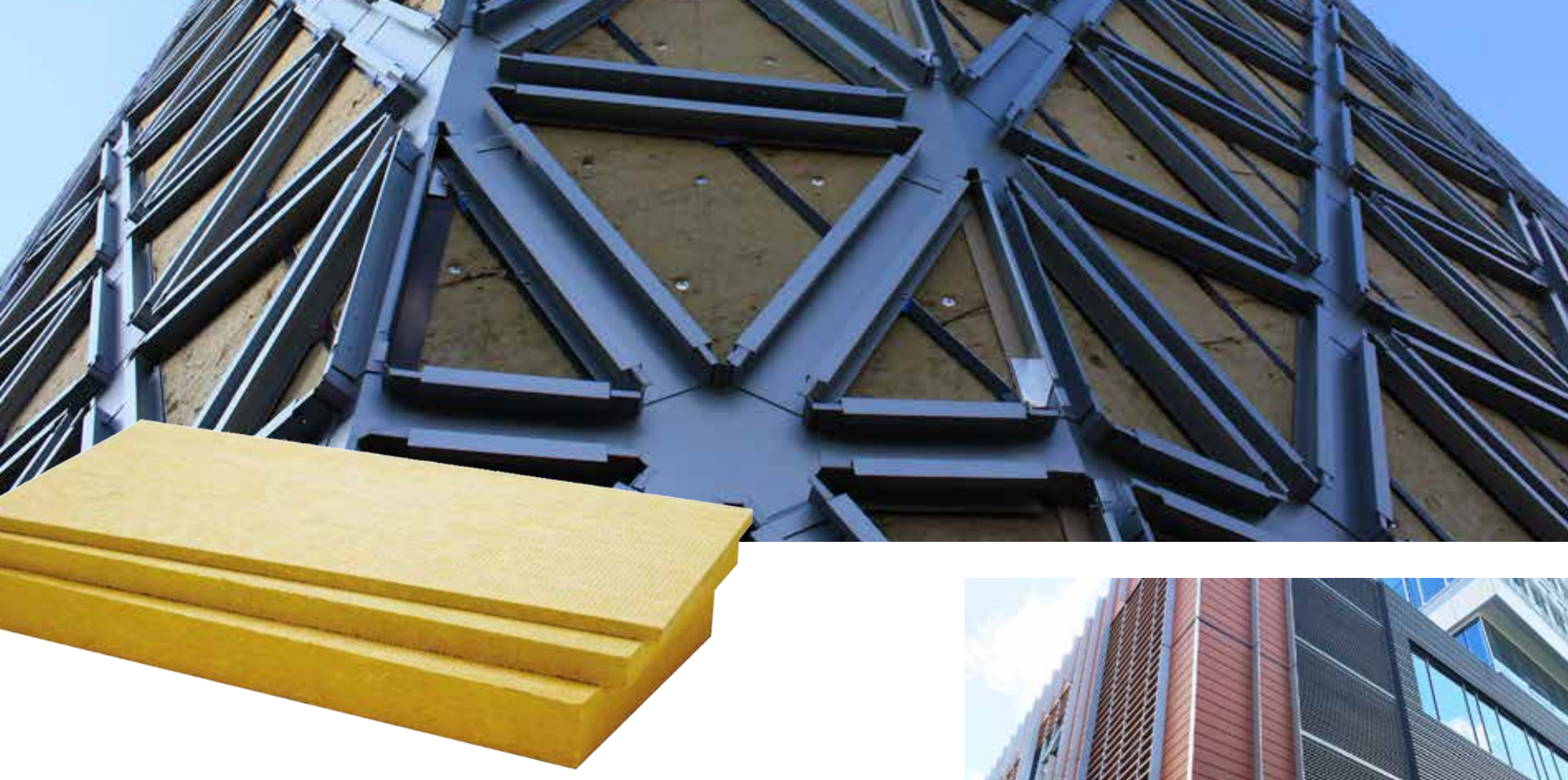
"People aren't saying it has to be one hundred per cent complete, but 30 per cent is not enough," says Bassett. "The more well-developed the design, the more accurate that pricing and scheduling is, and the better the overall performance and experience for all parties on the job.

"Value for money for taxpayers is important for public project owners," adds Bassett. "They think about value for money for taxpayers and there is an incentive to not overpay. But value for money shouldn't come at the expense of a reasonable return for contractors."

Public owners, consultants, and contractors need to continue to explore procurement models that provide value for money for all parties, including the contractor.

Says Bassett: "Better and earlier collaboration will, we think, improve the experience for everyone."

John Tenpenny is the editor of *ReNew Canada*.



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Top100 Canada's Biggest Infrastructure Projects

Michael Garron Hospital

2022 Top100 Projects Rank: 93
Value: $498.2 million

The Michael Garron Hospital (MGH) marked a major milestone in its hospital campus transformation, as the hospital reached Tower Interim Completion, meaning ownership of the Ken and Marilyn Thomson Patient Care Centre, also known as the Thomson Centre, has officially transferred from builder EllisDon Infrastructure Healthcare to MGH.

This milestone comes just over four years after the building's groundbreaking at Sammon and Coxwell Avenues.

"I'm thrilled that we are marking this milestone for the Thomson Centre, the centerpiece of the largest redevelopment project in our hospital's history," said Sarah Downey, president and CEO, MGH.

MGH will spend the next four to six months extensively preparing for the public opening of the Thomson Centre.

"This milestone represents the tremendous effort by all involved, including MGH, our consultants, subtrades, Infrastructure Ontario and the entire EllisDon team," says Jeff McKay, vice president, Public-Private Partnerships, EllisDon. "This new tower is a great addition to the neighbourhood with state-of-the-art facilities providing the best of healthcare. Over the next two years we will continue with the balance of the project and once completed, MGH will be a beacon for the neighbourhood and a project everyone can be very proud of."

Preparations include testing technology systems in the new building and ensuring integration with the existing hospital campus; refining security plans; and running on-site simulations and training programs for staff and physicians to prepare to deliver safe, high-quality care in a new space with new equipment, workflows and technology.

For additional details on this year's Top100 Projects report. visit top100projects.ca

Toronto East Health Network

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Randy Reymer

EllisDon Corporation announced the appointment of **Randy Reymer** to vice president and area manager for Southwestern Ontario.

Over his 24-year tenure with EllisDon, Reymer has gained experience in operations and estimating, culminating in his recent five years as the chief estimator for the Southwestern Ontario Area.

"I am very appreciative to take on this new challenge," said Reymer. "EllisDon presents endless opportunities, and I am excited to embrace the role and continue to evolve EllisDon as a premiere construction services company in the region where the company first began. We have some great people in the area, and I have no doubt that working together, we will continue to achieve many great things."


Geoff Howe


Jordan Clouthier

PCL Construction announced that **Geoff Howe** has been appointed as a second district manager for PCL's Ottawa district and **Jordan Clouthier** has been promoted to district manager for Regina.

Howe began his career with PCL as a student in 2007 before relocating to Saskatoon in 2012 as chief estimator, to Winnipeg in 2016 as senior project manager, and then to the B.C. Region in 2018 as construction manager.

"I'm looking forward to being a part of our very successful Ottawa team," said Howe. "It's so exciting to be involved with so many important and historic projects in the city and surrounding communities."

Clouthier began his career with PCL in 2008 as a field engineer in Ottawa where he progressed rapidly to take on the role of construction coordinator, lead project manager and, in 2019, to manager of Special Projects.

"I am excited to be joining our Regina team to help carry on PCL's rich building history in the city and surrounding area," said Clouthier.


Myke Badry


Marc Pascoli


Bruce Sonnenberg

The PCL family of companies announced changes to its senior leadership team based in Toronto.

Marc Pascoli has been appointed senior vice president and district manager of PCL Toronto, assuming overall responsibilities for PCL's operations in the Greater Toronto Area and southwestern Ontario and **Myke Badry**, as district manager in Toronto.

Pascoli succeeds **Bruce Sonnenberg** who has been promoted to regional vice president, Central Canada, responsible for PCL operations in Winnipeg (overseeing Sudbury) and in Ottawa (overseeing Atlantic Canada).


Matt Weaver


Sue Howson

J.L. Richards & Associates Limited (JLR) announced the appointments of **Matt Weaver** as chief of project delivery and **Sue Howson** as manager, project delivery.

Formerly manager, project delivery, Weaver brings 15 years of electrical engineering and technical project management experience to the role. Weaver will oversee the project management, proposal, marketing and communications, and design technology teams.

Howson will oversee a team of project managers, project coordinators, and project administrators. She previously held the role of senior project manager.

Howson brings close to 30 years of related experience in architectural, construction, project management, estimating, health and safety, and teaching.


Rod Conde

AECOM announced **Rod Conde** has been appointed as operations manager for its Buildings + Places business in Calgary. Conde is an award-winning architect with over 22 years of diverse experience, leadership, and expertise.

Prior to joining AECOM, Conde was an associate and senior project manager with a Canadian architectural, engineering, interior design, and planning firm. In this role, he led a multi-disciplinary energy team that delivered retail projects for major oil and gas clients, including serving as team lead on an electric vehicle charger upgrade program for one of Canada's largest integrated oil companies.

"I am thrilled to join AECOM and look forward to expanding the strengths and presence of our Buildings + Places business in Calgary and throughout Alberta," said Conde. "I am excited to collaborate with colleagues across business lines and geographies, drawing upon the company's best-in-class knowledge pool and global resources to help my team succeed."


Mathieu Bélanger

The Federation of Canadian Municipalities announced **Mathieu Bélanger** as its new executive director of Policy and Public Affairs.

An urban planner with more than 15 years of policy experience in green cities development, urban resilience and adaptation, and stakeholder engagement, Bélanger has led the Planning Department for the City of Gatineau since 2018, managing a team of more than 130 staff in a department responsible for strategic planning, urban development, and social housing and more. Bélanger also spent time on Parliament Hill as a chief of staff and director to key federal Ministers on the Infrastructure and Communities file, where he worked on the development of Canada's multi-year infrastructure investment plan, and the Disaster Mitigation and Adaptation Fund.


Carl Abdallah

Carl Abdallah joined Stantect as an aviation engineering manager responsible for leading aviation infrastructure work in Canada.

With 17 years of experience, Abdallah has successfully executed and managed numerous projects in the fields of construction and design engineering, specifically relating to airport infrastructure. His projects span nine different countries and various active airfields including large international airports, military airports, and local general aviation facilities.


Mathieu Goetzke

The Region of Waterloo announced that **Mathieu Goetzke** is joining the organization, taking up the position of commissioner for Transportation Services.

Building on the success of ION light rail and the Region's continued focus on providing active transportation choices, Goetzke will lead a team that will prioritize the resident experience, while building neighbourhoods that are safe, accessible, and healthy and an economy that continues to thrive.

"In my new role, I am looking forward to serving dynamic and growing communities by providing safe and sustainable transportation options for everyone," said Goetzke. "I am excited to work with my new colleagues to deliver transportation services and support the transition to an equitable, prosperous, resilient and low carbon Region of Waterloo."

Previously, Goetzke was vice president of planning with Metrolinx, where he led the early planning stages of the transformational provincial investment program in the Greater Golden Horseshoe's transit systems.

Dawn MacDonald

Dawn MacDonald has joined infrastructure consulting firm AECOM as global offshore wind market sector lead.

A professional engineer by trade and energy industry veteran with more than 20 years' experience, MacDonald joins AECOM from the Maple Power joint venture (JV) in Europe, where she oversaw the development, construction, and operation of offshore wind power facilities. She originally studied industrial engineering at the University of Manitoba before working for Solectron, Wi-LAN, IMV Projects (now Wood) and Enbridge, which took her from Calgary to Paris, France.

In her new role at AECOM, she will strive to advance integrated offshore wind offerings around the world, leveraging the firm's experience in environmental and port infrastructure to serve new and existing clients.

"I am delighted to join AECOM and work closely with technical experts to deliver large-scale projects," she said. "With governments moving quickly to boost renewable energy capacity and meet their carbon reduction goals, I am also looking forward to helping clients accelerate delivery and significantly de-risk these projects by reducing complexities through extensive collaboration with developers, key suppliers, contractors, local ports and agencies."

"We are excited to welcome Dawn as we continue to advance our 'sustainable legacies' strategy and extend our capabilities in the growing offshore wind energy market," says Lara Poloni, AECOM's president. "Her industry-leading experience will further enhance our track record of delivering best-in-class environmental services and leadership in the ports and marine design sector."

Karen Mesa

Moses Structural Engineers named **Karen Mesa** as an associate.

"Mesa has been an integral part of our team since 2010, providing clients with high quality, detailed and accurate drawings. We are excited to have her take on this new role as associate-CAD/BIM manager," stated the company.

"I'm proud to have been a part of the MSE family since our beginnings in 2010 and honoured to be a part of our company's growth and success. MSE is more than just a workplace, it's a joining of hearts and minds all passionate about what we do. I think that's evident in the quality of our product, and I couldn't be happier to be part of a team always striving for greatness."

PLANNING A PATH TO ZERO CARBON

By Chirstian Cianfrone

Major retrofit projects are difficult to scale as a decarbonization strategy since their primary drivers are financial decisions rather than emissions reductions.

In June 2022, Canada released its first-ever Emissions Reduction Plan, indicating a building sector-specific GHG emissions reduction target of 37 per cent relative to 2005 levels (or 42 per cent relative to 2019) and net-zero by 2050. Similar targets have been echoed by levels of government and corporations across Canada. Following closely behind these commitments are regulations; the City of Vancouver will start regulating emissions in existing buildings in 2026. The City of Toronto is expected to follow a similar path if it heeds its council-approved Net-Zero Existing Buildings Strategy recommendations.

Even in the absence of imminent regulation, investors are becoming increasingly concerned with the possibility of climate related stranded assets. While the drivers are clear, the path to success is still murky. Canada's building sector emissions have increased by 10 per cent since 1990—we have no historical context for the speed, scale, and persistence needed to reduce emissions; we must deploy new, creative strategies.

One approach is *strategic decarbonization*, which recognizes a building's ongoing renewal cycles as opportunities or triggers to implement solutions to deliver a zero carbon over time. Buildings must develop a Decarbonization Transition Plan (DTP) to seize these opportunities successfully. A DTP will initially benchmark a building's performance and propose an emissions reduction timeline based on internal goals and external factors. Then, based on a review of the building's equipment and systems, will propose a capital plan that strategically leverages the timing and investment for planned renewal projects to implement solutions that align with low carbon outcomes over time.

This approach contrasts with major retrofits which may simultaneously replace or renew building systems as part of one major project, typically as part of an asset renewal, change in use, or repositioning for sale. Major retrofit projects are difficult to scale as a decarbonization strategy since their primary drivers are financial decisions rather than emissions reductions. On the other hand, strategic decarbonization is integrated into existing asset management processes, consolidating organizational sustainability goals, capital and life cycle plans, facility management practices, and overall asset or portfolio financial metrics—a much more scalable solution.

A DTP must also consider the implementation of recommended projects to minimize a building owner's risk. Existing buildings bring along many constraints and nuances that, without proper consideration, can lead to grossly inaccurate budgeting and logistics. This can derail the project's financial viability and negatively impact tenants during construction. Consider a typical decarbonization solution to understand the possible complexity of the recommended solutions. Most buildings will follow an electrification pathway to zero carbon, which converts emissions-intensive, fossil fuel-based heating and hot water systems, to lower carbon, electricity-based solutions. The government has committed to a net-zero electricity grid by 2035 to align with the electrification of the economy, including buildings, so that electrified buildings can achieve zero emissions without future upgrades.

While it may sound simple to replace fossil fuel boilers with electric heat pumps and electric boilers, there are further considerations. Electrified mechanical systems may require more space, increase electrical capacity, and cost more to operate unless the proper technology and smart, effective operations are employed. For older, inefficient buildings, these constraints can quickly derail an electrification strategy without implementing key energy efficiency improvements. Building envelope upgrades and lighting efficiencies may be implemented to reduce the size of electrified mechanical equipment and free up room on the electrical panel. Intelligent building infrastructure will also support measurement and verification for progress reporting and optimized operations to maintain low carbon outcomes. Seemingly unconnected capital improvement projects and building operation strategies will transform into a coordinated series of projects towards a common goal.

The rapid decarbonization of buildings can feel daunting. Successful and integrated planning with a DTP can remove uncertainty and provide a clear roadmap to success. The only current risk is delaying that plan—every future action in an existing building should embody net-zero if we are to have a chance to meet our emissions reduction goals.

Christian Cianfrone, director of decarbonization, leads EllisDon's initiative for existing building decarbonization.

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