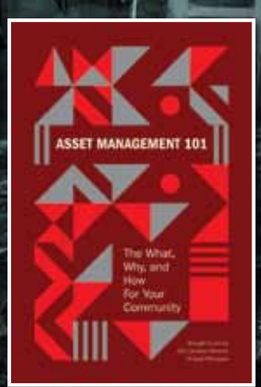
March/April 2018

ReNew CANADA

The Infrastructure Magazine

+ Are All P3s Created Equal?
+ Valuing Natural Assets
+ Top100 Projects: Celebrating $199 Billion

Managing Climate Infrastructure Financial RISK



SPECIAL INSERT:
Brought to you by the Canadian Network of Asset Managers

renewcanada.net

GLOBE
FORUM 2018

The Leadership Summit for Sustainable Business

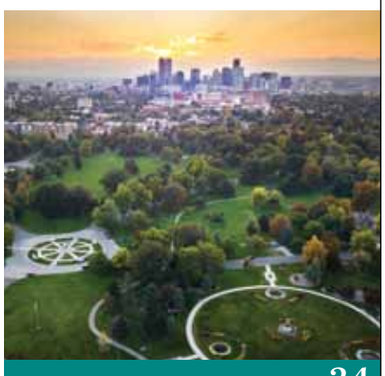
14-16 March | Vancouver, Canada

@GLOBE_Series #GLOBEforum globeseries.com/forum

12

14

28



34

20

ReNew CANADA
The Infrastructure Magazine

MARCH/APRIL 2018

SPECIAL INSERT

RISK MANAGEMENT

ASSET MANAGEMENT

PROJECT MANAGEMENT

ENERGY MANAGEMENT

WATER MANAGEMENT

GREEN ASSETS

TOP100 PROJECTS

DEPARTMENTS

IS THIS JUST THE BEGINNING?

By Andrew Macklin

In early January, Pattern Development announced that financing had been completed for the $1-billion Henvey Inlet Wind project, located on the northeast shores of Ontario's Georgian Bay. The project, which ranks #52 on our 2018 Top100 Projects report, is being developed through a partnership of Pattern and Nigig Alternative Power LP, a wholly-owned subsidiary of the Henvey Inlet First Nation.

With 87 3.45-megawatt turbines in place some 15-18 months from now, this new project is expected to provide power for upwards of 100,000 homes each year. With a population of just 450 on and off reserve, that means the power supplied to the grid via Ontario's Independent Electricity System Operator will go well beyond the borders of the community.

But what this project represents is far more than just a smart, renewable energy solution for central Ontario. It represents a new model for how Canada might successfully replace diesel-based power generation in remote communities with clean, renewable energy resources.

Of course, the choice for the renewable resource will not always be wind. The issues surrounding the expired Softwood Lumber Agreement might push the government to explore subsidies for forest residuals, which could then be used in heat and power generation in remote communities through biomass boilers or pellet stoves. And where vast tracts of unforested land are available, solar power could provide a cost-effective alternative. There is also research that suggests that geothermal energy could be part of the solution as well.

Beyond the energy shift, the partnership structure that has been created with the Henvey Inlet Wind project is worth noting. Environmentally, it is estimated that the wind farm will result in 851,000 less tonnes of CO2 per year. Economically, it is estimated that more than $10 million will be annually generated for the Band, and more than 20 permanent jobs will be created. That's a win-win situation for any community.

This isn't a perfect picture though. The Nigig Alternative Energy LP was incorporated in 2010, and it has taken until January 2018 to reach financial close on the project. That makes 10 years from partnership to power generation, which is not a timeline that works well with the need to reduce diesel emissions.

But every process can be refined, and hopefully, the team from Pattern and Nigig will be able to share the lessons learned to help shrink the 10-year gap for future Indigenous-private partnerships.

Billions of dollars in new opportunities exist in First Nations communities across Canada. But to do so, you must be prepared to work WITH the communities to create economic benefits for all parties involved.

Andrew Macklin is the editor of ReNew Canada magazine.

andrew@actualmedia.ca

Join the conversation. **Search "ReNew Canada" on LinkedIn.**

For daily news and discussion, visit **@ReNewCanada** **/ReNewCanada**

ReNew CANADA
The Infrastructure Magazine

March/April 2018 Volume 16 Number 2

EDITOR	Andrew Macklin
PUBLISHER	Todd Latham
DIRECTOR OF BUSINESS DEVELOPMENT	Elena Langlois
CONTRIBUTORS	Stephen Bauld, Donna Chiarelli, Dan Ferguson, Valiant Ip, Eve Krakow, Gail Krantzberg, Michael Maher, Bradley McLellan, Jeff Parker, Steven W. Peck, Dale Sands, Connie Vitello
ART DIRECTOR AND DESIGNER	Donna Endacott
ASSOCIATE EDITOR	Katherine Balpataky
CONTENT AND MARKETING MANAGER	Todd Westcott
AUDIENCE ENGAGEMENT INTERN	Jacquelyn Mayo
ADVERTISING	Elena Langlois elena@actualmedia.ca
ADVISORS	Nick Reid, James Sbrolla

actualmedia

ReNew Canada is published six times a year by Actual Media Inc.

147 Spadina Avenue, Unit 208, Toronto, ON M5V 2L7

Phone: 416-444-5842

Subscription/customer services: 416-444-5842, ext 211

ReNew Canada subscriptions are available for $39.95/year or $64.95/two years and include the annual Top100 Projects report.

Printed in Canada

"ReNew Canada" and "ReThink. ReBuild. ReNew" are Trademarks of Actual Media Inc.

MIX Paper from responsible sources FSC® C006860

Undeliverable mail return to:
147 Spadina Avenue, Unit 208
Toronto, ON M5V 2L7

Canadian Publications Mail Product Sales Agreement 40854046
ISSN 1715-6734

Proud members of

ONEIA CNAM CPWA URBAN

renewcanada.net

ABOUT THE COVER

Failing to manage the risk of infrastructure development can have disastrous consequences in the future.

NEW BRUNSWICK COMMITS $670 MILLION TO BRIDGE WORK

The Government of New Brunswick is investing $670 million in bridge restoration and construction around the province over the next five years.

As part of its long-term capital planning, the government has committed $670 million between now and 2021-22 for the construction, replacement and restoration of bridges. This funding includes:

$181.6 million for bridge replacements, including the Tetagouche River No. 1 Bridge in Bathurst;

$107.3 million for the restoration of bridges, such as the Reversing Falls Bridge in Saint John;

$226.5 million for federal-provincial bridge projects, including the Centennial Bridge in Miramichi and the Petitcodiac Bridge;

$90.5 million for bridges that are part of federal-provincial highway renewal projects, such as Route 11 from Shediac River to Cocagne River and the Tait Brook on the Fundy Trail;

$29.6 million for pre-engineering work on bridge projects; and

$34.3 million for large culverts.

The government estimates that this investment will contribute about **$500 million in GDP** between now and 2021-22 and will support about **1,600 jobs** annually.

NEXT ISSUE: MAY/JUNE THE GOVERNANCE ISSUE

Top100 Update	Failed Remediation	Bi-national Energy
News and updates on Canada's biggest projects.	Who's at fault when containment fails?	Creating policy to share power.

Send your letters to the editor to andrew@actualmedia.ca

PROJECT LABOUR AGREEMENTS: INFLATING COSTS AND WASTING TAX DOLLARS

It's like a bad episode of Let's Make a Deal. An everyday B.C. taxpayer holds their winnings so far: a red-hot construction job market, fair deals for both workers and owners, a stable labour environment, and billions of dollars in savings.

But Premier John Horgan doesn't want that deal. He is poking and prodding the poor taxpayer to throw it all away and choose whatever is hidden behind door "number two."

In an effort to please his union donors, Horgan recently signaled his government's intention to return to Project Labour Agreements (PLAs) for public infrastructure construction. This antiquated business model inflates project costs, removes flexibility, causes needless delays, and wastes tax dollars.

Horgan's PLA pitch ignores the fact that the construction industry has changed and improved significantly over the past two decades. The new economy isn't just found in tech or green industries—it's arrived in construction too. The construction sector accounts for about 10 per cent of B.C.'s economy and is more dynamic, vibrant and flexible than it's ever been.

Nearly a quarter million men and women work in construction today. Horgan's friends in the B.C. building trades unions lay claim to about 20 per cent of that workforce, down from about a third in the 1990s. Their model has been in decline for the past 30 years for a reason—they have failed to address the needs of construction workers and have refused to respond to changes in the new economy.

The hard, cold truth is that the vast majority of construction workers under age 50 simply do not see value in belonging to building trades affiliated unions. Most of them just want to go to work and earn a living to support their families. They aren't interested in being pigeon-holed into rigid, restrictive union-defined roles. They want the best people to get the work, not the longest tenured.

Horgan's vision is to use sweetheart deals to tilt the playing field in favour of 20 per cent of the construction workforce. He has trotted out arguments about PLAs fostering labour relations stability and boosting apprenticeship training. But history shows PLAs do nothing to enhance the quality of work on the job site, do not make the workplace safer, and do not result in better training outcomes. They cost more and deliver less.

No one can remember the last significant construction labour dispute in B.C. for a good reason; we have enjoyed a prolonged period of labour peace. For nearly two decades, construction workers have worked together—more often than not side-by-side regardless of whether they were members of a union, employee association, or non-union—to build our great province.

And contrary to building trade union assertions, more apprenticeship training occurs in an open market construction market than within the closed, constrained confines of PLAs.

In the interests of fairness, transparency, and value for taxpayers, Horgan and his new government should abandon the return to the antiquated PLA approach to procurement and labour relations. Instead, the government should embrace open and competitive procurement and workplace arrangements for public infrastructure projects that deliver fairness and opportunity for everyone in the construction sector.

British Columbians don't need what Horgan is hiding behind door "number two"—favouritism and higher costs for taxpayers.

Chris Gardner is the president of the Independent Contractors and Businesses Association of British Columbia (ICBA).

ONTARIO INVESTS $170 MILLION IN LONDON BRT

The Government of Ontario has announced a commitment of $170 million towards the London Bus Rapid Transit (BRT) system

The BRT system will provide commuters with 23.7 kilometres of rapid transit along London's busiest corridors, connecting neighbourhoods, businesses and post-secondary institutions in the city to the downtown core.

The total estimated cost for London's BRT system is $498 million. The City of London has committed $130 million towards the capital costs. The City of London will be responsible for all the ongoing operating and maintenance costs of the project.

"It is a huge day for London. This is going to provide Londoners with better transit everywhere, this system is the cornerstone of The London Plan and will change the way we move and grow," said Matt Brown, mayor of London. "This $170-million represents the single largest investment our provincial partners have ever made in our community. Thank you to our partners at Queen's Park for sharing council's vision for our city."

Construction is phased and estimated to begin on the east corridor in 2020 and on the north corridor in 2022, with the opening of these corridors in 2023 and 2026 respectively. Construction would then begin on the south corridor in 2023 and on the west corridor in 2025, and open by 2026 and 2028.

Lafarge to test lower-carbon fuels

Lafarge Canada Inc. and its partners—University of Calgary, Queen's University, and Pembina Institute—are conducting a million-dollar study on the environmental benefits of introducing lower carbon fuels at its Exshaw Cement Plant in Alberta. Building from previous research, this multi-partner, multi-site lower carbon fuels project is the most significant of its kind in Canada.

"Our estimates show each 20 per cent incremental replacement of natural gas at the Exshaw Cement Plant with lower carbon fuels could result in the elimination of nearly 75,000 tonnes per year of CO2. This is the equivalent of taking over 16,000 cars off the road annually. While these are preliminary estimates, this research project will assess these figures precisely and in the local context," said Rob Cumming, environmental director at Lafarge.

Eight lower carbon fuels will be researched, including construction renovation/demolition waste, non-recyclable plastic, carpets and textiles, shingles, treated wood products, wood products, rubber, and tire-derived fuels. These sources of fuel have been successfully used at other Lafarge cement plants in Canada and around the world.

Air quality and traffic impact studies predict minimal changes with introducing lower carbon fuels at the Exshaw Cement Plant. Additional research by the partners will measure the environmental components associated with the sourcing, processing and full-scale commercial operation of each lower carbon fuel compared to fossil fuels. The project will also measure the benefits of diverting materials from landfills and determine optimal points in the cement manufacturing process to inject each fuel.

"Lab simulations, environmental studies, economics, and logistics reviews are already underway. All research will be finalized by December 2019 with regular updates provided to the neighbouring communities via a Public Advisory Committee," comments Jim Bachmann, Exshaw plant manager.

In addition to Lafarge's support, research funding is being provided by Alberta Innovates, Ontario Centres of Excellence (OCE), Emissions Reduction Alberta (ERA), and the Natural Sciences and Engineering Research Council of Canada (NSERC). It includes research by Millennium EMS Solutions Ltd., Geocycle, and WSP Global Inc.

In alignment with LafargeHolcim's 2030 Sustainability Plan, Lafarge aims to replace 30 to 50 per cent of fossil fuel use at its Canadian cement plants with lower carbon fuels by 2020.

Online at renewcanada.net

NEWS: RFQ issued for Corner Brook Hospital. **bit.ly/HealthRFQ**

NEWS: SWIFT issues RFP for broadband network. **bit.ly/SWIFTNet**

NEWS: Next phase of Highway 407 completed. **bit.ly/407Phase2**

VIDEO: Evaluating designs for intersections. **bit.ly/CarFlow**

Ensuring the best outcomes in municipal infrastructure development.

By Daniel P. Ferguson and Bradley N. McLellan

Municipalities must carefully consider the structure and documentation of their municipal infrastructure projects to ensure that the public interest is served and that their projects achieve value for money and success.

Municipal infrastructure projects require contracts between the municipality and an entity responsible for the design, build, operation, and maintenance of the infrastructure (the DBOM Entity), often in the form of a long-term project agreement, ground lease, or municipal capital facility agreement. Private finance and senior government funding may require contracts between the providers of finance or funding and either or both of the municipality and the DBOM Entity. The design-builder will subcontract with numerous other speciality subcontractors, and those operations and maintenance providers will in turn sublease or license with various major tenants. Contracts with these tenants, which may include an OHL hockey team, licensee or operator of a convention or performing arts centre, or a provider of other municipal services, will also be required.

No matter what specific structure and documentation a municipal infrastructure project requires, there are certain fundamental objectives that must be met to in order to achieve value for money and success. Firstly, the municipality should strive to ensure that the project structure and documentation achieve a comprehensive, fully integrated, and long-term life cycle approach to the project.

> Project planning and documentation in a municipal infrastructure project should seek to achieve optimal risk allocation.

Each and every phase of the project needs to be dealt with comprehensively and they need to be connected through a seamless transition from one phase to another. The municipality should have one single point of accountability to look to at its private sector partner for all phases of the project.

If the municipality breaks up the accountability for the various phases of the project, it may be needlessly involving itself in conflicts between the providers of different phases of the project. For instance, if a problem in the project arises, the constructor may seek in its dealings with the municipality to blame the designer, and vice versa. The municipality may be confronted by an operator arguing that a problem in operations is not its responsibility because of deficiencies in the design or construction of the facility. While these problems and conflicts will invariably arise in any project, they should be dealt with within the private sector and the municipality should be left out of these disputes.

Optimal risk allocation

Project planning and documentation in a municipal infrastructure project should seek to achieve optimal risk allocation. Optimal risk allocation is a recognized term of art in the infrastructure area. It is defined simply as: "the allocation of risk to the party best able to address and manage the risk." Optimal risk allocation must be achieved in

order for a project to attain value for money. However, while optimal risk allocation is easy to define, it is difficult to achieve.

In order to achieve optimal risk allocation project planning and documentation must do all of the following:

1. Clearly and comprehensively identify and define all risks;
2. Unequivocally allocate each risk without ambiguity or uncertainty;
3. Provide for the party assuming the risk to be properly compensated for the assumption of that risk; and
4. Equip the party who is to assume the risk with the power and authority to manage the risk.

There are various challenges to achieving optimal risk allocation in municipal infrastructure projects involving the private sector. Will the project generate sufficient revenues such that the risks to be imposed on the private sector can be properly compensated? This can be especially difficult in the delivery of many municipal projects which, typically, will be challenged to generate sufficient revenues.

Can sufficient power and authority be transferred to the private sector to enable it to manage the risks that it is being asked to take? This can be a challenge in municipal projects where there may be political or public policy sensitivity in transferring authority and control to the private sector. This challenge may be increased where ownership of assets has to be retained in the public sector or remain with senior government funders who are funding the construction of the project.

Does the project lend itself to defined service and performance standards to serve as benchmarks for performance bonuses and penalties? Often, it is difficult for the parties to define and commit to such benchmarks in the early stages of project planning or project documentation.

While addressing risk allocation for any municipal infrastructure project is a complex and large task, managing it can be greatly assisted by understanding that the numerous and complex risks involved in these projects fall into five major categories of risks and by developing an understanding of these categories.

Risks typically retained by the public sector

There are a number of risks that are almost always retained by the municipality. These are risks which the municipality has exclusive control over or can easily manage, or otherwise should be accountable for. They include the following:

1. Political risk (such as a change in municipal council or government after an election which results in a material change to or termination of the project);
2. Change in law (such as the passing by municipal council of more stringent by-laws impacting the price or schedule of the project); and
3. First Nations claims or cultural heritage claims.

Risks typically assumed by the private sector

Assumption of these risks are the very reason why the municipality wishes to engage a private sector participant and agrees to hire and pay them. The private sector should, in almost all cases, retain these risks:

1. Delivery on time and on budget;
2. Designing, constructing, commissioning, and operating to defined standards; and
3. Industrial relations and labour issues (dealing with unions, employees and the labour force).

Risks that can be undertaken by the private sector or public sector

The allocation of these risks will be determined by what makes the most sense and is economically justifiable given the nature of the project and its specific circumstances. A good example of this is the risk of responsibility for existing site conditions, whether environmental, geotechnical, or hydrogeological. The likelihood of adverse conditions and the specifics of the project site, the number and comprehensiveness of existing site condition studies and who may rely on them, and the time available for due diligence on the part of the private sector participant and its ability to carry out its own studies, will all factor into the allocation of these risks. For example, where a site has a long history of complex and material environmental issues, there are few available studies and no ability for the private sector to conduct its own independent investigations, the public sector may retain more risk concerning environmental conditions than for a site with a less complex environmental history, numerous existing reports that the private sector may rely on and time and opportunity for the private sector to conduct its own independent investigations prior to committing to price and schedule for the construction of the project.

Risks that are shared

Certain risks for major projects are shared, because neither party has full control of these types of risks and it is fair that they be shared. The most commonly understood example of this type of is a "force majeure," or a risk associated with an event that is beyond the control of either participant that gives rise to a delay or increased cost to the project.

Risks that are transferred at a defined point in time in the project

A well-known risk of that is transferred from the private sector to the municipality is the risk of damage or destruction to the infrastructure from an insurable event. The private sector is typically responsible for damage to the infrastructure during the course of its construction and its control of the construction site. Risk of damage, and the obligation to secure and maintain appropriate insurance coverage, typically transfers to the municipality once the project is substantially completed and otherwise handed over to the municipality. For this type of risk, it is critically important to precisely define the conditions of, and when, handover and the transfer of such risk occurs. If an insurable event takes place, the parties will want no ambiguity whatsoever as to whether or not, and, if so, when the transfer of this risk has taken place.

Understanding each of the five major categories of risks and careful attention to them in project planning and documents, followed up by diligent oversight of contract performance, will greatly enhance a municipality's ability to ensure a successful municipal infrastructure project.

Bradley N. McLellan and Daniel P. Ferguson are co-chairs of the Infrastructure and Public Projects Practice Group at WeirFoulds LLP.

BRIDGING THE GAP

• Connecting to the Future of Asset Management •

CNAM 2018 Conference

May 14-17 Windsor, Ontario

CNAM is the association of public infrastructure asset management in Canada. Our government and private sector members develop policy, tools and technologies which improve the level of service for public infrastructure assets in every province and territory. CNAM shares that knowledge with other members and stakeholders through our CNAMpedia online resource, the annual conference and various committees and events.

Join us in Windsor in May as we look at "Bridging the Gap" in infrastructure finance, engineering and public policy that sometimes exists within the asset management profession in Canada, and around the world. Now in it's 12th year, the CNAM Conference and Tradeshow will continue to deliver leading edge professional development, idea sharing, workshops and fun networking opportunities with your peers and new players in government, academia and industry. CNAM is growing and poised to help you and your organization connect to the future of asset management, so mark your calendars for **May 14-17, 2018** and we'll see you then!

Register now at **cnam.ca**

Meander through 100 miles of waterfront, find your thrill at Canada's largest casino resort Caesars Windsor, and enjoy the warmth of Canada's southernmost destination located just South of Detroit, Michigan. The birthplace of whisky and wine in Canada, Windsor Essex invites you to uncover our fascinating rum-running past and explore our award-winning wineries along the North shores of Lake Erie.

CNAM 2018 Social Events and Awards

- CNAM Annual Golf Tournament
- Windsor International Aquatics and Training Centre
- Art Gallery of Windsor
- The Chimczuk Museum
- Whisky and Brews Tour: Walkerville Brewery & Wiser's Distillery
- Welcome Reception at Willistead Manor
- Stay and Play Fun Tour: Wine & Whisky

- **Tereo Awards**
- **NEW Pioneer Award**
- **NEW Ambassador Award**

CNAM Canadian Network of Asset Managers

cnam.ca

Ground Floor Sponsor

POWERPLAN

Fourth Floor Sponsors

assetic

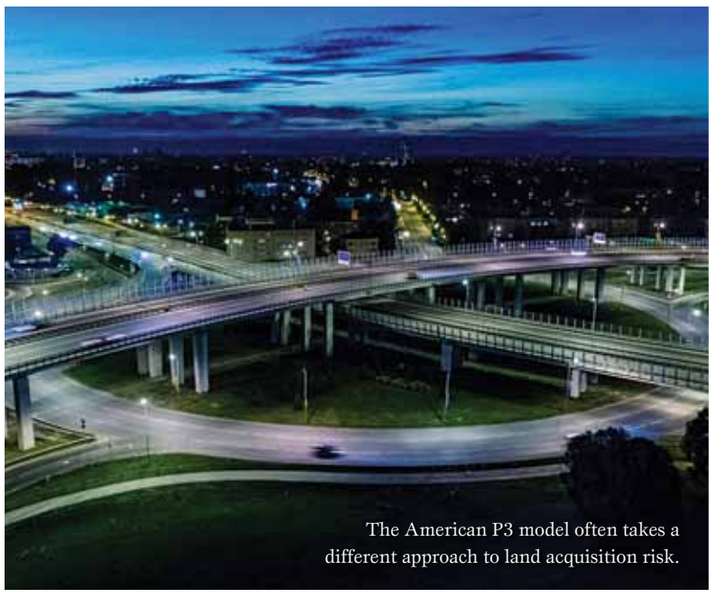
esri Canada

GHD

Media Sponsors

ReNew CANADA The Infrastructure Magazine

PSD



The American P3 model often takes a different approach to land acquisition risk.

For a typical road project, some of the primary risks in construction are land acquisition and geotechnical risks.

ARE ALL P3s CREATED EQUAL?

Understanding risk allocation across differing jurisdictions.

By Valiant Ip

The contractual relationship between the public-sector counterparty (or the authority) and the issuer (ProjectCo) is underpinned by the partnership agreement (PA) that allocates risks, assigns responsibilities, and governs the contractual relationship between the public-sector counterparty and ProjectCo for the duration of the project term. The typical structure of a public-private partnership (P3) entails a reasonably standard risk allocation across the construction and service phases of the project as between a public-sector counterparty and ProjectCo.

For a standard design-build-finance-operate-maintain (DBFOM) project, ProjectCo is typically responsible for the design, construction, financing, maintenance, and rehabilitation of the infrastructure asset in accordance with the stipulations of the PA over the course of its term. ProjectCo is structured as a special-purpose vehicle and takes on the role of managing its subcontractors (i.e., construction, operations, maintenance, and rehabilitation contractors) and the relationship between the authority and the subcontractors during construction and operations. Thus, ProjectCo's role is critical in maintaining a good contractual relationship and ensuring that the project gets built on time. Nonetheless, DBRS believes the key to managing risk in a PPP project is to ensure the extent of risk transfer or the allocation of key risks and responsibilities are appropriately passed down to the parties that have the technical knowledge, financial resources, and experience to proactively manage and mitigate risks.

Based on DBRS's observations in past and recent transactions, there are similarities and differences in the Canadian and the U.S. P3 construction risk allocation frameworks. For a typical road project, some of the primary risks in construction are land acquisition and geotechnical risks. In its study group, our company included two greenfield road projects located in Ontario and Alberta and two brownfield projects in the United States.

> In past and recent transactions, there are similarities and differences in the Canadian and the U.S. P3 construction risk allocation frameworks.

Unsurprisingly, within a given jurisdiction the allocation of risks between the public and private sector did not vary widely for assets of a particular class. The Ontario projects have similar contractual obligations and the risk allocation during the construction phase are in line with each other given that the Government of Ontario is the public-sector counterparty for both projects. Under the Ontario framework, ProjectCo typically accepts the site on an "as is, where is" basis, and as such, geotechnical risks are retained by ProjectCo. In turn, this responsibility has been passed to the construction and service contractors with no entitlement for relief or compensation if the contractors encounter either known or unknown geotechnical issues. In addition, the authority is responsible for the provision of non-exclusive access to the project lands, which is typically sufficient to provide enough space and laydown areas to complete the construction task without the need to procure any additional land. In instances where this access is not provided at commercial close, land access will often be granted in accordance with a pre-agreed schedule that provides time and/or monetary compensation to ProjectCo in the event the authority is unable to meet its commitments in this regard.

For the Alberta projects in the peer group, geotechnical and land acquisition risk allocation was similar to that of Ontario. For these projects, geotechnical risks are retained by the construction contractors with no time or compensation relief. In a similar vein, the authority provides land access that is sufficient to complete the project and alleviates the risk of land acquisition.

The American PPP model contains some notable differences in the approach to managing these risks. DBRS has examined

two U.S.-based brownfield road projects, one of which involves road widening and conversion of the existing high-occupancy vehicle lanes to high-occupancy toll lanes. In each case, the construction risk allocation is generally similar to Canadian P3s, although geotechnical risk is not fully retained by the construction contractors and the public-sector counterparty retains some of the geotechnical risk if subsurface conditions materially vary from those stated in the project documents. However, the American P3 model often takes a different approach to land acquisition risk. In some cases, the land allocated to ProjectCo in the project's right of way are known to be insufficient to complete the construction and the risk of land acquisition remains with the private sector.

While the additional parcels of land may be relatively small in number and cost, the process of land acquisition introduces potential delays or monetary shortfalls, particularly where the risk is not passed down to the contractor, but retained by ProjectCo. This is potentially more problematic for highly-rated transactions and is felt to be more permissible for transactions in the BBB-rating range. To assist in alleviating this particular risk, specialized consultants are often employed to advise ProjectCo on appropriate procedures, valuations, and timing that are required in order to procure additional lands. The schedule can also frequently offer some flexibility given that components of the construction task can often be completed in parallel rather than sequentially, although land acquisition may still rest on the critical path.

DBRS surmises that the differences in the geotechnical risk provision in the Canadian and American PAs could be a result of the type of construction project (i.e., greenfield projects versus brownfield projects), as well as by differences in the application of the model as between some state and provinces. New build or greenfield projects typically entail a different construction task than brownfield projects because they could be exposed to unknown geotechnical challenges, unknown hazardous materials, long lead-times, and other challenges such as managing any existing species-at-risk in the surrounding construction area.

On the other hand, while brownfield projects are still exposed to geotechnical risks, they are typically identified (based on previous construction) and quantified such that the contractors are able to utilize the data and manage the risk appropriately. Thus, the historical information that is available to the contractors mitigates the risk of any unknown geotechnical risks. Conversely, the approach taken with respect to land acquisition will more frequently place land acquisition risk with the private sector, which has potential cost impacts.

While DBRS has considered these details generally, it notes that the approaches taken by the authorities in Canada continue to evolve, while the PPP framework in some American jurisdictions is still developing. As across the study group however, DBRS notes that each of the approaches has some benefits for the private and public sector. Ultimately, the private sector and project investors will price the differing risk levels accordingly and the procurement authorities will determine their own level of comfort with the risk transferred.

Valiant Ip is the vice-president of infrastructure finance, global corporates, for DBRS Limited.

PROTECTING YOUR INVESTMENTS

Chronic stresses on the environment are increasing the need to build more resilient infrastructure assets.

Ten ways to reduce infrastructure risk and increase resiliency.

By Dale Sands

Resilience is the ability of human settlements and organizations to withstand, recover quickly from, and continue to prosper in the context of increasing impacts of natural and human-caused hazards or disasters. This includes chronic stresses such as those from climate change and acute shocks from disasters. Acute shocks, such as storms and flash floods, cause increased devastation due to increasing intensity and urbanization. Chronic stresses such as drought and elevated ambient temperatures expand the threat of fire, further elevating the fire hazard. Thus, populations that live on the fringe of heavily-forested areas face increasing danger from forest fires.

The United Nations International Strategy for Disaster Risk Reduction notes that 700,000 people have lost their lives from disasters during the period 2005 to 2015 and $1.3 trillion in losses were incurred globally. Clearly the time to act is now.

Resilience is an inescapable attribute of a smarter planet. Resilience requires planning and adaptation in advance of a peril. Natural disasters in Canada, or all of North America for that matter, are of increasing concern because of extensive population migration to metropolitan areas, increased frequency and intensity of natural disasters, and increasingly large capital losses in recent years. While insurance is one partial remedy to limit capital losses, it is important to note that only slightly over half of the natural disasters in North America are covered by insurance, according to MunichRE Nat Cat Service. The devastating fires in Fort McMurray, Alta. (with capital losses of $4 billion, of which $2.9 billion was insured per MunichRE), and most recently in Northern California, remind us of this growing and expanding threat.

To ensure that risk is minimized in our infrastructure assets, and to improve the resiliency of these assets, there are ten core considerations that must be evaluated:

1 Risk evaluation is a natural part of capital investment decisions made by the public and private sector. It is less common to understand the future disaster risks from acute shocks or chronic stresses. Threats are unique to each location. To manage risk effectively, and build sustained resilience, requires an understanding of risk-reward trade-offs and current trends to anticipate threats over the next 50 years. To better prepare for, respond to, and recover from disaster events, we must bring together the resources of the public and private sector as the need has never been greater. Untapped expertise and decades of experience are available to collaborate and contribute to better prepare for, and recover from, these disaster events.

2 The intensity and frequency of disaster events, and chronic stresses to our environment, is increasing around the world. There is no shortage of evidence in Canada and North America—from increasing fires from drought conditions to more intense severe weather events such as tornados, hurricanes, floods, and extreme weather events. ARISE, the private sector organization formed in 2015 by the UN Office for Disaster Reduction (UNISDR) to focus on the implementation of the Sendai Framework 2015-2030, stated that, "recent years have seen a significant increase in disasters with economic losses running close to $300 billion a year. Urbanization is adding to this risk by further concentrating populations and economic activities." The Canadian ARISE Network was kicked off in March 2017 in Montreal.

3 The risk of disasters must be a greater consideration in the investment, planning, development, design, and building of infrastructure. Unless public and private investments become more risk-informed, and produce structures and environments that are designed to withstand current and future acute shocks and chronic stresses, we will continue to experience increasing loss of life and degradation to capital assets. As part of this, a commitment is needed to stop building in high-risk areas where mitigation is not possible, and to build with tomorrow's weather conditions in mind. Building codes need to be updated on a periodic basis, and then regularly enforced to meet the challenges from Mother Nature both today and tomorrow.

4 An investment in disaster risk reduction through structural and non-structural measures is essential.

This must be done to enhance the economic, social, health, and cultural resilience of persons, communities, countries, and their assets, as well as the protection of the environment—particularly in water quality and agricultural concerns. If targeted correctly, investments in risk reduction will reward businesses and governments alike with better financial performance over the long term, and serve as an attraction for urbanization, business growth, and more prosperous, sustainable communities. Investment must be resilience-focused for businesses and government facilities and critical infrastructure such as schools, hospitals, and other critical care facilities.

5 With so many community needs and stresses on government resources, it is a challenge to create a compelling argument to invest capital today for an event that might happen tomorrow. Public-private partners must recognize this funding gap, not just in understanding of quantified benefits of disaster risk reduction, but also in the incentivising resilient investments for both retrofitting existing structures as well as design requirements for new investments.

6 There are pockets of innovation and breakthrough investments, but much more must be done. Activities such as low- or no-interest loans or tax incentives for those who retrofit infrastructure, or the use of 'resilience or green bonds' to finance risk-reducing interventions are important offerings. With the trillions of dollars to be invested in future infrastructure, it is imperative to establish resilient infrastructure. Solutions must be feasible from an engineering point of view, must be affordable, and ultimately, be politically acceptable. The Rockefeller RC-100 Program, for example, has been instrumental in four Canadian cities (Montreal, Toronto, Calgary, Vancouver) and 24 U.S. cities in providing funding for the hiring of a chief resilience officer and the creation of a resiliency plan.

7 Work remains to create the right enabling environment for risk-reducing investments. Much disaster risk reduction work focuses on vulnerable areas (e.g., coastlines), and with good reason. Extreme weather events however are not limited to coastal environments. Flash floods, chronic droughts, extreme temperatures, and wildfires occur across continents. Beyond environmental risks, resiliency investment must consider disaster risk reduction for industries (e.g., tourism, supply chains) as well as resource development. Here, visionary private sector companies are leading this effort, with much to be learned from them.

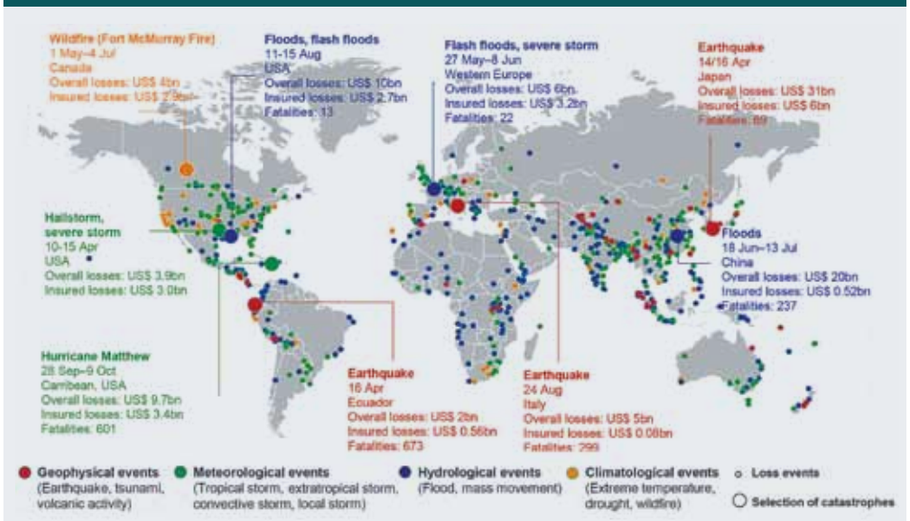
8 A systematic application of technology will deliver faster improvements. Items such as early warning systems, resilience analytics, and innovative regulation in the form of updated building codes are needed and must be enforced. Lessons learned must be effectively shared locally, regionally, nationally, and globally. Many tools are available today, like the UNISDR Disaster Risk Reduction Scorecard, which can be much more fully applied to identify priority needs to improve resilience.

9 To date, too few private sector experts have been included in the disaster risk reduction activities at the local, regional, or national level. Private sector companies, in some cases, are larger than many countries. Leveraging the private sector expertise is essential to addressing these issues, and governments must take advantage of this resource.

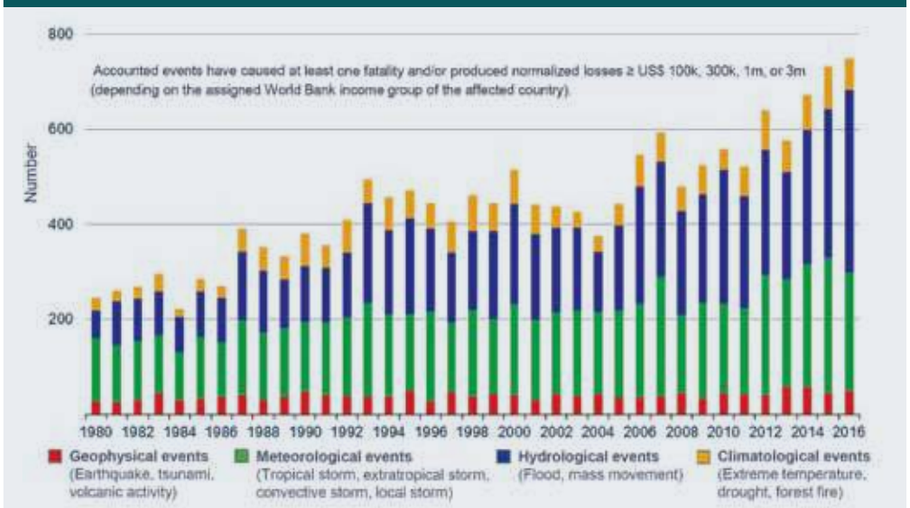
10 The implementation of the Sendai Framework 2015-2030 does reference participation by the private sector, but now we must operationalize this intent. We must strengthen risk governance to sharpen the measurement and articulation of resilience, track improvements over time, accelerate public-private collaboration, and share lessons learned. These efforts will help reduce losses and the impact of disasters on people, governments, and economies to achieve the goals of the Sendai Framework.

Looking forward to developing community and business resiliency plans across Canada, it will be important to capitalize on the tools and resources available. The support to hire resiliency officers and develop resiliency plans in major cities across Canada and the U.S. is a positive step forward, but more work needs to be done in order to reduce risk and improve resiliency in our infrastructure assets.

Loss events worldwide 2016: Geographical overview



Loss events worldwide 1980-2016: Number of relevant events by peril



Source: 2017 Münchener Rückversicherungs-Gesellschaft, NatCatSERVICE

Dale Sands is the former senior vice president and global practice director, private sector, for CH2M.

As part of its infrastructure renewal program, the City of Fredericton has been upsizing all of its major culverts to prepare for more frequent major storm events.

Flood marker art installed on the city's riverfront reminds shows elevations of past floods of record. On the right, the same markers are shown during flooding in April of 2017.

Photos: City of Fredericton

PLANNING FOR THE UNKNOWN

Factoring climate change into asset management strategies.

By Eve Krakow

A few winters ago, the City of Fredericton was hit by a deep cold spell, coupled with exceptionally heavy snowfall. Not only did this tax snowplowing operations, but its water and sewer system experienced a record number of freeze-ups. "Crews were out all winter thawing frozen pipes," recalled Sean Lee, assistant director of engineering and operations. "We often talk about climate impacts in terms of things getting warmer. This was a bit of an eye-opener."

It just goes to show how many unknowns there are with climate change. Although this particular issue hasn't (yet) affected the city's infrastructure renewal plans, other aspects of climate change have. In fact, the City of Fredericton is one of the municipalities leading the way when it comes to integrating climate change concerns into asset management planning.

Asset management involves looking at infrastructure holistically, over its full life cycle, in terms of the services it provides. Part of this process is looking at the risks your infrastructure faces, in order to decide on what investments to make and when. From this perspective, the effects of climate change are just another set of data to be factored in. It's not about trying to replace all your infrastructure, managers explain, but about determining priorities and flagging vulnerable aspects so that when it comes time to do retrofits, upgrades, or replacements, those adaptive changes are part of the plan.

City of Fredericton

Built at the confluence of the Saint John and Nashwaak rivers, the City of Fredericton is subject to river flooding, flooding from intense rainfall events, and may eventually be affected by tide changes from sea level rise.

Like many cities, its infrastructure is old, but Fredericton has a strong infrastructure renewal plan. "We have a pretty good understanding of the age, condition, and life cycle of our assets, and we have a plan to move ahead to reduce our overall infrastructure debt over the next twenty years," said Lee. "As part of that, in trying to get the best value for the residents of our city, we add in a climate change filter."

For example, over the last 15–20 years the city has been increasing the size of all its major culverts. They've also raised key sections of roadway to keep important transportation links open during spring flooding, and raised the minimum elevation for new housing.

The key to getting things done however, has been integrating the work into long-term strategic plans, with all departments working together. Alicia Keating, assistant director of finance and administration, believes strength lies in this holistic approach. "We have financial plans to target our infrastructure renewal, and as we do that, we're planning ahead to make sure we incorporate aspects of climate change, changes in demographics, in the types of buildings, *et cetera*."

While climate change holds many unknowns, various models and tools are

being developed. For example, the City of Fredericton worked with the Insurance Bureau of Canada (IBC) and the Western University to create forward-looking rainfall Intensity-Duration-Frequency curves specific to Fredericton. The city has also worked with the INTACT Centre on Climate Adaptation and the University of Waterloo on the development of a national standard for Flood Resilient

Subdivisions in Canada.

Fredericton is also one of three original communities that piloted the Municipal Risk Assessment Tool. Originally developed by IBC in collaboration with Tesera Systems, the application uses analytics and municipal and climate data to identify areas and infrastructure at risk from climate change. Fredericton continues to work with Tesera Systems as the firm seeks to develop a more advanced version that will incorporate asset management components to help municipalities identify priorities and make cost-effective decisions.

Assessing vulnerabilities

Guy Félio is a senior advisor for asset management solutions and infrastructure resilience at Stantec Consulting and a member of the CWWA National Climate Change Committee.

"When we talk about resilience, from an asset management perspective, we look at the level of service that will be maintained during an extreme event and how fast it will recover afterward," he explained. In the asset management process, a municipality identifies its level of service objectives. "Then you establish the risks of partially or completely losing that service and how to protect it; that helps prioritize where to invest."

Traditionally, risk has been associated primarily with deteriorating infrastructure. Climate change adds a new set of hazards—whether it's stronger winds, sea level rise, changing tides, more frequent and higher intensity rainfall, or more wild fires.

For identifying how infrastructure will be affected by climate change, Félio is a strong advocate of the Public Infrastructure Engineering Vulnerability Committee Protocol developed by Engineers Canada in 2007. "It can be applied to any type of infrastructure, in any size community, at the system level or asset level. You don't get bogged down in the process, because you're missing climate data."

Last year, Félio worked with Elmer Lickers of the Ontario First Nations Technical Services Corporation (OFNTSC) to do a high-level risk screening of the water and wastewater infrastructure for the Mohawk Council of Akwesasne near Cornwall, Ont. "Using the PIEVC assessment, we found that if the infrastructure is maintained in a state of good repair, they could mitigate about 25 per cent of extreme risks." MCA indicated that the assessment provided recommendations for adjustments to design, operations and maintenance that will help preserve their vital infrastructure. Félio is now working with OFNTSC to develop a First Nations PIEVC/Asset Management toolkit.

City of Ottawa

Like Fredericton, the City of Ottawa does not have a stand-alone department for climate change adaptation, but integrates theses concerns across all departments. Hiran Sandanayake is a senior engineer in water resources and asset management. "We've always had to think of climate within water resources, and there's always been uncertainty," he said. "Adding climate change to what we do is just an incremental addition."

Over the past few years, the city has been conducting studies to better understand flood risks in different neighbourhoods. Sandanayake, who also chairs the CWWA Climate Change Committee, is now trying to leverage the information obtained for specific neighbourhoods to fill out flood-risk information city wide, in order to determine high-risk areas and set priorities for decision-making. He's hoping to build a model that other cities can use as well.

Last year, Ottawa used the PIEVC Protocol to analyze a series of culverts that had been identified as high risk. The analysis also enhanced the city's asset management process by allowing them to see impacts of extreme weather events that they might have otherwise overlooked. "Sometimes if you break things up too much into silos, you miss the big picture," said Sandanayake.

Ultimately, says Sandanayake, "you can't design everything for every possibility. The tools of asset management are good for dealing with risk and adaptation. What are the highest risks? What risks are acceptable? What can we afford? What's the right time to do it so we can stretch those dollars as far as possible?"

Natural assets

In some cases, natural resources are far more resilient than man-made structures. This is just one of the reasons that the Town of Gibsons, British Columbia, (population 4,400) has been attracting attention for its incorporation of natural assets into its asset management planning.

"We see natural capital as the bridge between climate change and asset management," said Emanuel Machado, chief administrative officer for the Town of Gibsons.

As part of its asset management planning, Gibsons considers the services provided by natural assets, such as forests, aquifers, creeks, wetlands, and foreshores. For example, while the Gibsons aquifer supplies the town's drinking water, creeks and woodlands convey and treat rain water run-off, and the foreshore provides a vital seawall to protect the waterfront from storm surges and sea level rise.

Part of the process to gain a thorough understanding of the value provided by its eco-assets involves putting dollar figures to these services and looking at what it would cost to replace the natural asset with an engineered alternative if it were degraded or destroyed. To do this, the town has been using open-source modelling software called Invest, developed by the U.S. based Natural Capital Coalition and used under license by the David Suzuki Foundation.

Equipped with this formation, the town will be able to determine what actions, timelines, and costs are needed to properly maintain its natural assets and include them in its asset management plan to ensure that sufficient funds are in place to do so.

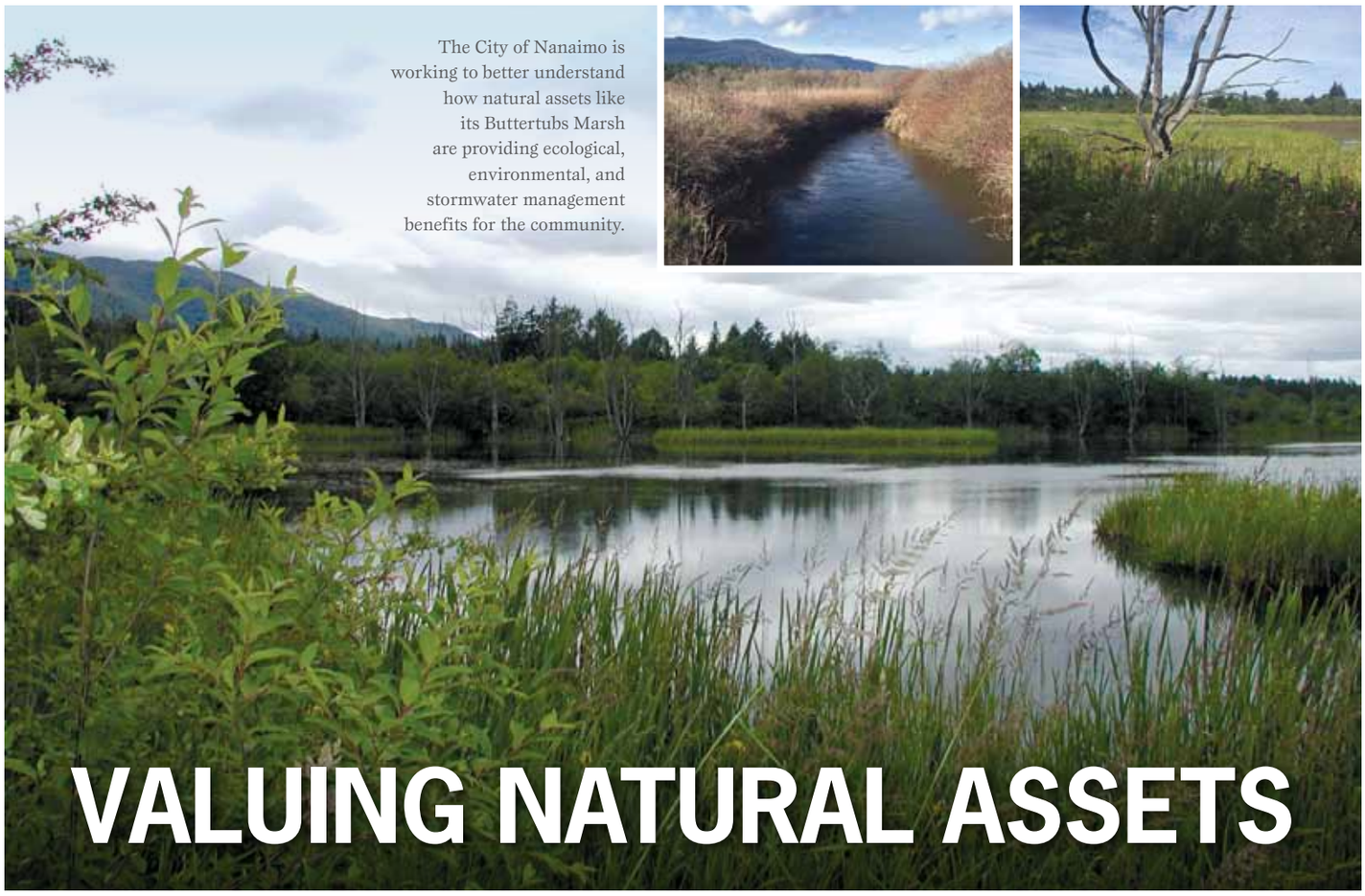
Gibsons has also partnered with the David Suzuki Foundation, Sustainable Prosperity, and Brooke and Associates Consulting to create a framework for other municipalities to follow.

If there's one common piece of advice from these municipalities, it's don't wait to start integrating climate change concerns into your planning. "There's enough data out there," said Fredericton's Alicia Keating. "You can't wait for a perfect delineation of what's to come, or the perfect time. You have to just jump in and start."

This was first published in the September/October 2017 edition of Water Canada.

Eve Krakow is a freelance writer based in Ottawa, Ont.

Look for the CNAM Asset Management booklet included with this issue of ReNew Canada.



The City of Nanaimo is working to better understand how natural assets like its Buttertubs Marsh are providing ecological, environmental, and stormwater management benefits for the community.

Photos: City of Nanaimo

VALUING NATURAL ASSETS

Nature takes its seat at the management table.

By Donna Chiarelli

This past year may be remembered as the year that Mother Nature took a seat at the management table. Some might even argue that she took the helm as chair of the board given that she had full attention of all levels of government who were dealing with wildfires, hurricanes, and flooding across North America.

Late last year Moody's, one of the world's biggest credit rating agencies, warned cities that their ratings could be downgraded if they don't demonstrate they are readying themselves for climate change. The message was clear: municipalities should understand their vulnerabilities to climate change, and make sure their decisions are reducing their exposure to risks.

Aside from legislation, a market signal like the one from Moody's is one of the more powerful forces that can catalyze a change in how municipalities do business. Downgraded ratings have real implications for the financial sustainability of municipalities, because they could be faced with paying higher interest rates for their debt. At a time when cities and towns across Canada are making significant investments in renewing aging infrastructure or managing growth, affordable financing is essential.

The good news is that the warning from Moody's has come at a time when some leading municipalities in Canada and internationally are already recognizing the power of nature, not only as a risk to manage or force to be reckoned with, but also as an asset that can be leveraged as an integral part of their infrastructure systems. A big part of the reason is greater recognition of the value of natural assets in reducing the risks to infrastructure caused by climate change. And in some cases, they can be used to deliver services more inexpensively than if a big piece of grey infrastructure were used to deliver a comparable service instead.

Smart solutions

A good example of leveraging natural assets to manage stormwater comes from Pickering, a small, downstream town of less than 7,000 people in northern England. Frequently ravaged by floods, and now made even more vulnerable as the climate changes, Pickering desperately needed to find a way to manage heavy rains. When the town didn't qualify for funding for the proposed conventional solution—a concrete wall through the centre of town that would cost 20 million British pounds to build—it turned to a nature-based solution that a beaver would love, for one-tenth the cost. The town built 167 leaky dams of logs and branches in the becks above the town, as well as 187 smaller blockages made of bales of heather to manage the flow through smaller drains and gullies. The solution also included planting 29 hectares of woodland and building a bund that could store and slowly release up to 120,000 cubic metres of floodwater. The plan has worked, so much so that it was one of the only towns saved from flooding in January 2016, when the rest of northern England was inundated.

What the example from Pickering highlights is a fundamental shift in how some municipalities are thinking about the infrastructure that supports service delivery, especially when it comes to managing stormwater and adapting to climate change. Rather than building infrastructure around nature, or simply exploiting it to deliver services to the community, they are bringing nature to the table in their planning, management, and operations as an asset that in its own right needs to be respected, conserved, and valued to ensure the long-term sustainability of communities.

New York City provides another good example. In April of 2017, the city released new climate resiliency design guidelines for its parks and open spaces, through which it recognizes that its natural assets, particularly along the waterfront, will be critical in supporting NYC to adapt to climate change. The implications of this shift will be

significant and far-reaching, and will likely impact all aspects of city-building, from where to build (or not, if it's on a floodplain), to what to build and how to build.

A different viewpoint

Natural resource management and a green infrastructure are two lenses that municipalities can use to better value and integrate natural assets into service delivery. Municipalities can use a natural resource management lens to evaluate how their existing natural assets already support service delivery, or how they could if they were to be acquired. Natural assets like wetlands, forests, parks, lakes, rivers, streams, and even fields and soil can provide essential municipal services. For example, wetlands help to support stormwater management and filtration, while protecting biodiversity. In the Town of Gibsons, B.C., a pristine aquifer provides drinking water to a large portion of residents at a fraction of the cost of the water treatment plant that would be required if the aquifer ever became compromised or polluted.

Municipalities can use an engineering lens to evaluate how, by leveraging or enhancing natural assets, they can build green infrastructure that optimizes the social, environmental, and economic value of their infrastructure. Green infrastructure definitions vary, and can include anything from engineered assets like permeable pavement, green roofs, rain barrels, and green walls, to enhanced natural assets like rain gardens, bioswales, urban forests, parks, and stormwater ponds. Green infrastructure is not a new approach, but it's fair to say that its various forms are still being piloted or used by innovators and early adopters. To bring it to scale, more work is needed to test new approaches and to develop standards, incentives and procurement practices that work for developers, the construction industry, and communities of all sizes.

One innovative way that municipalities are integrating natural assets is by including them within the scope of their asset management systems. The cities of Dieppe, N.B., Revelstoke, B.C., and Windsor, Ont. are examples of cities whose councils adopted asset management policies that include natural assets in 2017. They are among 17 municipalities from across Canada that participated in a pilot initiative of the Federation of Canadian Municipalities Green Municipal Fund called the Leadership in Asset Management Program (LAMP). The participating municipalities collaborated to develop guiding principles that would better integrate sustainability and resilience considerations into their asset management practices. All agreed with the principle that natural assets should be included within the scope of their asset management systems. These leading municipalities are sending a clear signal that natural assets are essential for service delivery and need to be managed just like other core infrastructure assets like roads, bridges, and water treatment plants.

Council-approved asset management policies are an important way to set direction and hold municipalities accountable for their infrastructure decisions. The municipal sector is at a very early stage in developing a truly integrated and holistic approach that values natural assets as it does other core infrastructure. Limitations include gaps in data and analysis about the full scope of services that natural assets provide, limited knowledge of climate risks, and standard accounting practices that don't yet have a framework to put a value on nature. The Municipal Natural Assets Initiative (MNAI) is spearheading progress in this area. Established by four convening partners—the Town of Gibsons, B.C., the David Suzuki Foundation, the Smart Prosperity Institute, and consultant Roy Brooke and Associates—MNAI has been working with five pilot communities in Ontario and B.C. to adopt municipal natural asset management, through which they protect, restore and manage natural assets such as forests, wetlands, creeks, and foreshores to provide services such as stormwater management and flood protection.

One of the MNAI pilot communities is the City of Nanaimo, B.C., also a participant of FCM's LAMP initiative. Nanaimo is working with MNAI to better understand the full scope of services provided by its Buttertubs Marsh Conservation Area, a 55-hectare reclaimed wetland/floodplain located in the centre of the city. Before the city joined MNAI, it had seen Buttertubs Marsh as a natural feature that provided the public with aesthetic and recreational enjoyment, but it had not fully considered its value related to managing stormwater or providing other municipal services. Doris Fournier, Nanaimo's manager of municipal infrastructure, hopes the pilot will result in improved management options for the marsh. She expects their analysis could help justify future capital expenditures, like land acquisition and further ecological restoration efforts, and support the development of operations and maintenance plans that enhance water quality and improve the city's flood management capacity, to better prepare for changing climate conditions. Those initiatives are more likely to be realized if contained in Nanaimo's asset management plans.

> The message was clear: municipalities should understand their vulnerabilities to climate change, and make sure their decisions are reducing their exposure to risks.

The pioneering work of MNAI is clearly resonating in the municipal sector, as it now has five additional communities on board to undertake pilots this year, and more on the horizon. According to Roy Brooke, director of the MNAI, "The evidence from local governments to date is that natural assets can deliver many of the same services as engineered assets at lower cost. This can mean benefits for local governments' ability to deliver service reliably and cost-effectively, community resilience to climate change and ecosystem health. Accordingly, a wide range of partners and funders are interested in helping local governments to experiment with this emerging approach."

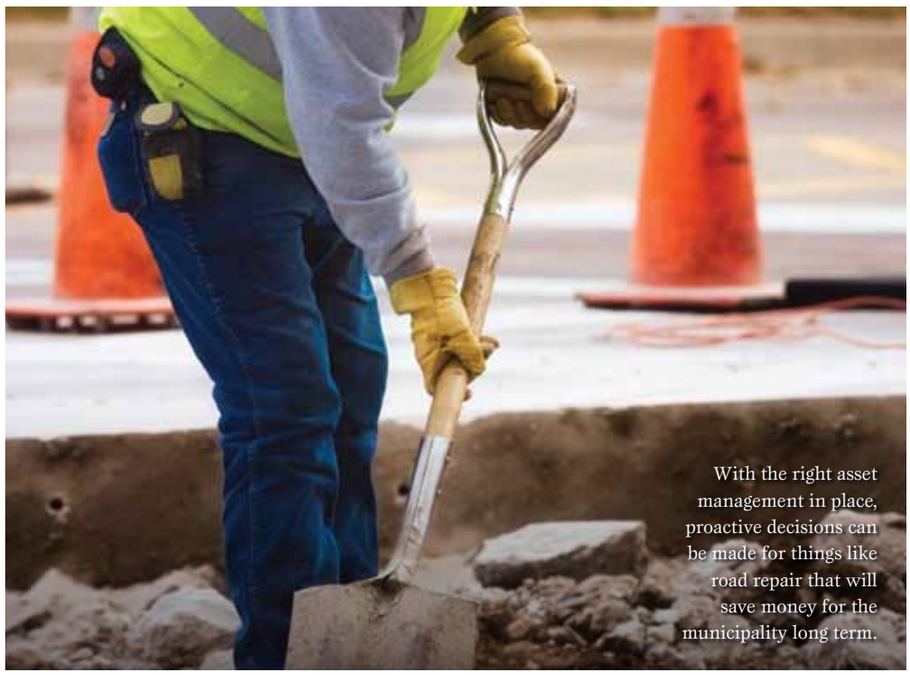
In 2017, it seemed that every week there was a new article, report, or initiative that demonstrates that cities are looking to natural assets and green infrastructure to support them in building more resilient communities in the face of climate change. This fundamental shift is sure to affect everyone involved in planning, building, and managing infrastructure and service delivery in communities. Those that embrace it will likely flourish, while those that don't may suffer the consequences in terms of social, economic, and environmental costs that may have otherwise been avoided. Mother Nature has taken her seat at the management table, and there's no doubt she'll have considerable influence in the years to come.

Donna Chiarelli led FCM`s Leadership in Asset Management Program. All views expressed in this article are those of the author and do not necessarily reflect the views of the Federation of Canadian Municipalities.

SAVING PUBLIC ROADS II

Capital planning tool pays off for municipalities.

By Michael Maher



With the right asset management in place, proactive decisions can be made for things like road repair that will save money for the municipality long term.

A recent Canada-wide survey of municipal road maintenance practices found that while 98 per cent of respondents perceive preventive maintenance as an important and cost-effective approach to extend the service life of their pavements, a majority of the municipalities do not apply preventive maintenance treatments, and have no clear understanding of when these treatments should be applied.

Infrastructure Canada is providing grants through the Federation of Canadian Municipalities to assist Canadian municipalities in improving their asset management expertise and process. It is a much-needed program. Municipalities have limited sources of revenue to work with, and need to build strategies around attaining the highest return on investment. In the Nov./Dec. edition of ReNew Canada, I wrote an article on the long-term consequence of ignoring road network preventive maintenance, the pervasive practice of 'worst first' roadway rehabilitation, and the need for better capital planning tools based on sound engineering and the latest in decision optimization technology. Providing an implementable, defensible road network capital plan can stretch dollars, removes politics from the equation, and maximizes the level of service to the community.

As a social entrepreneurial project to help municipalities build road network capital plans, Golder Associates Ltd. and Infrastructure Solutions Inc. (ISI) formed a strategic partnership to develop a capital planning tool, built on a depth of engineering research and analysis. The resulting road deterioration models, life cycle gains and inventory of available road maintenance treatments are weighted in favour of preventive maintenance. A major component of the challenge of building a better road capital planning tool was to incorporate the latest research in optimization algorithms that could quickly determine the best spend from a financial and community benefit perspective. The result is the creation of DOT (Decision Optimization Technology) Roads. DOT Roads was built with the support of 50 Canadian municipal beta clients, Natural Sciences and Engineering Research Council of Canada (NSERC), and Ontario Centres of Excellence grants.

The DOT Roads software can maximize the overall performance of a road network in terms of physical condition (or any other criteria) over a multi-year analysis horizon, and provides municipalities with the best possible course of action in terms of timing and selection of different maintenance, rehabilitation, or reconstruction treatments considering all municipal goals and constraints. The improvements achieved can be translated into substantial savings or increased socio-economic benefit or both.

Tillsonburg

"The town was looking for a technology solution that would aid in the selection of asset management best practices for road renewal," explains Anthony Tomlin, asset management technologist for the Town of Tillsonburg, a two-hour drive southwest of Toronto. "In the past, road segments were selected by the municipalities' institutional knowledge or fueled by concerns from the public. This method resulted in some segments being selected for maintenance that did not fully maximize a cost-benefit ratio. As a municipality that adheres to asset management best practices, we were intrigued by the idea of a software program that removed a large portion of the subjective nature of selecting the right treatment method for the right road segment at the right time in its lifecycle.

It is known that during the lifecycle of a roadway, there are certain trigger points that call for preventative and/or routine maintenance to help extend and fully maximize the lifecycle of the road. This is what asset management is all about: managing your municipality's assets in the most cost-effective way, to fully maximize their lifecycles and maintain a level of service designated by the municipality. Using the DOT software, municipalities can run multiple optimization cases with different objectives and policy settings to perform a detailed 'what-if' scenario analysis. For example, a municipality can use the software to determine the minimum cost required to maintain the current level of service or to achieve a certain performance level based on long-term community objectives. At the same time, a user can define multiple constraints, such as minimum serviceability criteria or annual budget limits to run an optimization analysis with the objective of maximizing network overall performance. This enables municipalities to run multiple scenarios and perform a detailed comparison using various visual outputs to arrive at the best possible solution that satisfies their objectives and policy considerations.

Utilizing this software has helped the town achieve its road asset management goals. Decisions made are now optimized and we are confident that the road segments selected and the applied treatment methods have the greatest cost-benefit to the town and its residents.

"We still look at our own data spreadsheets regarding the condition of our roadways and cross-reference our data with the software. More often than not, many of the roads we've selected for maintenance are also selected by the software. This is valuable evidence that the software is working by looking at the same factors that we, and most municipalities look for when determining which roads should be prioritized for maintenance. Having software to determine which preventive maintenance method to use on which roadway really maximizes the cost-benefit of allocating funds to these segments."

Tillsonburg has been using the software for about two years, during which they have witnessed its evolution, including the addition of the GIS road segment visualization capability. "We have experienced the strength and versatility of this tool," said Tomlin. "The software really helps stretch the dollar to keep a good level of service or Pavement Condition Index (PCI) which is used to rate the condition of a paved road surface. Tillsonburg likes to maintain a PCI of 75 or above. We can give the software parameters, such as how much money we have to spend this year, and run the scenario. The software identifies the best places to allocate these funds to maximize the road lifecycle and the value. The software really helps us make sound decisions."

Sarnia's solution

"The challenge has always been to determine what rehabilitation strategy do we need to apply to fix the road," explains Lydia Fisher, municipal engineering specialist for the City of Sarnia.

"One person can look at a road and might think we can patch it, others say it's best to crack seal it, another point of view says completely replace it. However, when it comes to important infrastructure decisions, only science can truly tell us the best approach for the safety and cost-benefit."

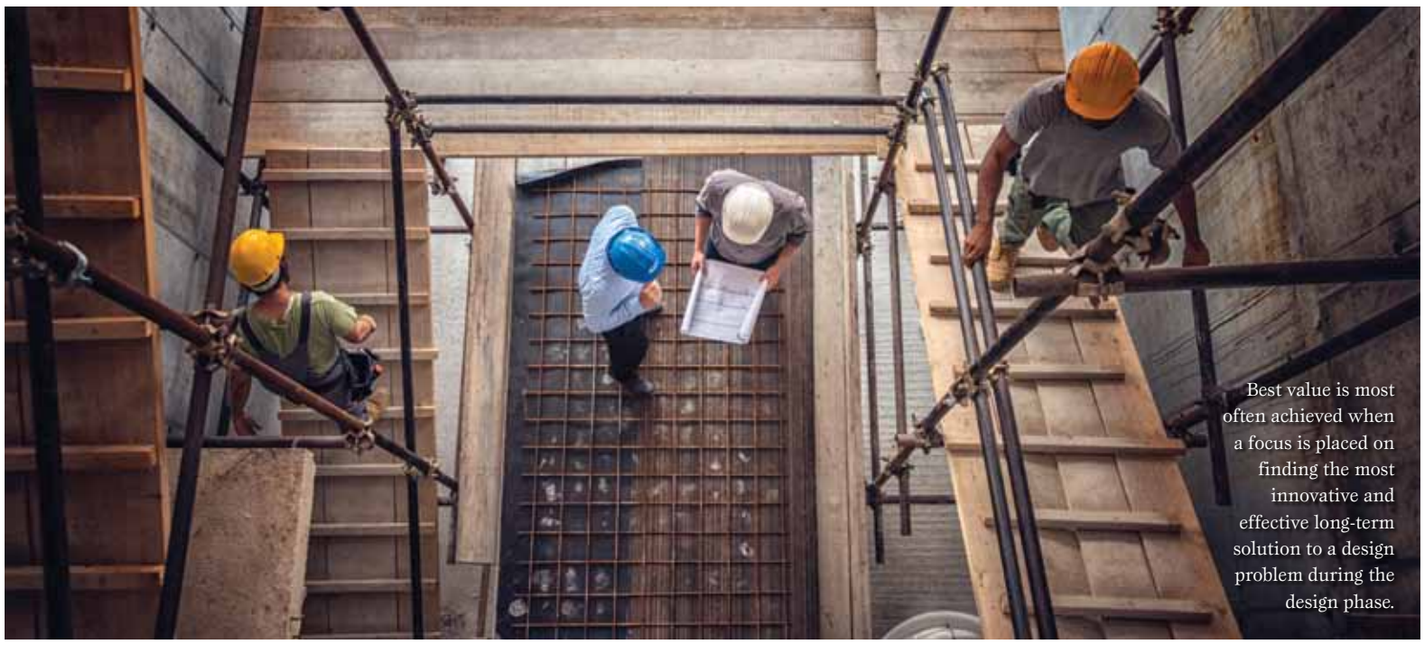
The software provides something that has never been available before: a system that considers all of the factors a municipality has to work with, plus the road asset management science. Based on user input, the software models a scenario for each point in a road's life and tells what needs to be done in five years, 10 years, and so on. It can take into consideration factors including soil conditions, road conditions, traffic, etc., and generate a highly specific action plan based on science plus a municipality's unique needs and budget.

"I really appreciate that it provides an accurate cost-per-meter for the suggested maintenance activities," said Fisher. "It's […] saving Sarnia time and money, while pointing us in the right direction for road asset management. Being able to identify different kinds of technology solution that we can apply to our roads that are cheaper or last longer, is extremely beneficial."

"All municipalities want to know how much money is needed to keep roads at a certain quality level. We can run those scenarios through the software and quickly get the answers we're looking for."

Thanks to technological developments such as the solution we have helped to create, municipalities across Canada are afforded better opportunities to spend their limited resources on the right maintenance for the right projects at the right time.

Dr. Michael Maher is a principal and specialist pavement and materials engineer with Golder Associates Ltd., based in their Greater Toronto Area office in Whitby, Ont.



Best value is most often achieved when a focus is placed on finding the most innovative and effective long-term solution to a design problem during the design phase.

QUALITY BASED SELECTION

Stop thinking about cost and start thinking about value.

By John Stephenson

Oscar Wilde once wrote that a cynic was "a man who knows the price of everything and the value of nothing." With the country's 150th anniversary, Canadians were reminded of the great infrastructure projects that helped shape our nation. Transformative megaprojects like the Transcontinental Railway and the St. Lawrence Seaway were driven by the vision of building a better nation and, though they certainly cost a great deal, they provided immeasurable value that is still being delivered today.

Unfortunately, there is a trend in the building community for the procurement of public and private projects to be driven by a desire to secure the lowest cost instead of delivering the greatest value. This has been problematic in the past, as deteriorating infrastructure designed and delivered by the lowest-cost bidder illustrates, and it will be increasingly unsustainable going forward as the need for environmentally-responsible design grows with accelerating climate change.

The risks of focusing on price, instead of value, are no more acute than in the earliest stages of a project when the creative talent that guides these projects are retained. An incredibly small variance in consulting fees for architects, engineers, and their design teams can easily make a hundredfold difference in the value and public benefit of the project that gets delivered. For this reason, a shift to a process of Quality Based Selection (QBS) for the design teams that produce important public infrastructure projects is long overdue.

New evaluation

At its most basic, QBS is a competitive procurement process in which firms submit qualifications to an owner who evaluates and selects the most qualified firm based on the specified needs of a project, and not according to the lowest bid submitted. This allows architects and engineers to compete based on an understanding of client needs, incentivizing them to discuss design innovation, and helping to ensure that the most qualified bidder who will produce the best technical design solution is selected.

The risks of focusing on price, instead of value, are no more acute than in the earliest stages of a project.

Although many professional bodies recommend QBS, and both Public Works & Government Services Canada and Industry Canada have confirmed their support in principle, most of Canada still lags far behind other countries, with only Quebec mandating QBS for provincial agencies. In the United States, meanwhile, QBS has been required by law for the procurement of architectural and engineering services for all federal projects since 1972, while 47 states and hundreds of municipalities have adopted similar legislation.

The U.S. push for QBS came with the realization that the fee-first model often led to poor outcomes, particularly for public works projects. Making up-front costs the top selection criteria encourages and incentivizes architects and engineers to cut fees to below the point where services can be provided at an acceptable level of quality. This undermines the ability of professionals to respond appropriately to the many indeterminate challenges faced in delivering on a project in a way that advances the public interest.

QBS is sometimes misunderstood to be a driver of cost, as it is generally believed that the public is best served when the lowest price is obtained, but this common misperception confuses the "cheapest price" with the "best value" or even the "lowest cost." A focus on lowest price ignores the fact that architectural and engineering services are not commodities, and their procurement cannot effectively be obtained in this manner; architects are creative professionals who develop solutions to design problems. Best value and even lowest cost, especially when considering the very long life of public infrastructure, is in fact most often achieved when a focus is placed on finding the most innovative and effective long-term solution

to a design problem, one that considers the widest range of socio-economic project goals. This takes time and effort.

Decisions made by architects and engineers have an impact on the entire life of a project. The standard range for fees for architectural services are a micro-sliver of the total project's cost, and it has been consistently demonstrated that an upfront investment in design services can deliver a significant return over the life of a building.

In contrast, primarily fee-based selection rewards firms for using fewer resources—such as less experienced and less senior staff, or fewer hours—which can translate into reduced service, utility, and sustainability. By rewarding the lowest bidder, firms with a greater appreciation of client needs are disadvantaged, as are firms that accurately anticipate complications and propose innovation. This inevitably compounds costs on the client and end-user side.

It should also be noted that QBS does not preclude the consideration of price in the overall process. Instead, it allows for it to take place at the most appropriate and meaningful stage of the selection process, when the scope of services has been decided upon with a preferred candidate who has a clear understanding of the project.

Canadian and U.S. studies report that design typically represents less than one per cent of a project's lifecycle cost, with construction accounting for six to 18 per cent. The remaining bulk of costs are taken up by operations, maintenance, refurbishment, and decommissioning—all items that can be reduced significantly by increased investment in front-end architectural design. And this does not even begin to consider the broader environmental and societal costs of badly designed public buildings and infrastructure.

In its guide on selecting a consultant for sustainable municipal infrastructure, developed jointly with the federal government, the Federation of Canadian Municipalities noted that the return on investment of 11:1 when a lifecycle analysis is applied. As such, investing an additional $40,000 into design can result in lifecycle savings of more than $400,000.

While the benefits of QBS are evident from case studies in jurisdictions where it is required for public projects, the federal, provincial, and municipal levels of government have been slow to adopt a bidding system that is clearly in the public's best interest. According to the World Economic Forum (WEF) 2017 Global Competitiveness Index, over the past five years Canada's ranking on the overall quality of its infrastructure has steadily declined from 15th place in 2012, to 23rd this year. The WEF also warns that 20 per cent of our country's buildings and transportation infrastructure are now in critical condition.

Governments at all levels should make the adoption of Quality Based Selection for architects and engineers a priority, especially as the need for major new investment in public infrastructure are both evident and urgent. As Canada seeks to build for the future, a shift toward QBS would help ensure that public funds are well spent and that future generations are well served. This would be a first step towards keeping the procurement cynics away from the obtaining of valuable design services for the benefit of public projects.

John Stephenson is the president of the Ontario Association of Architects.

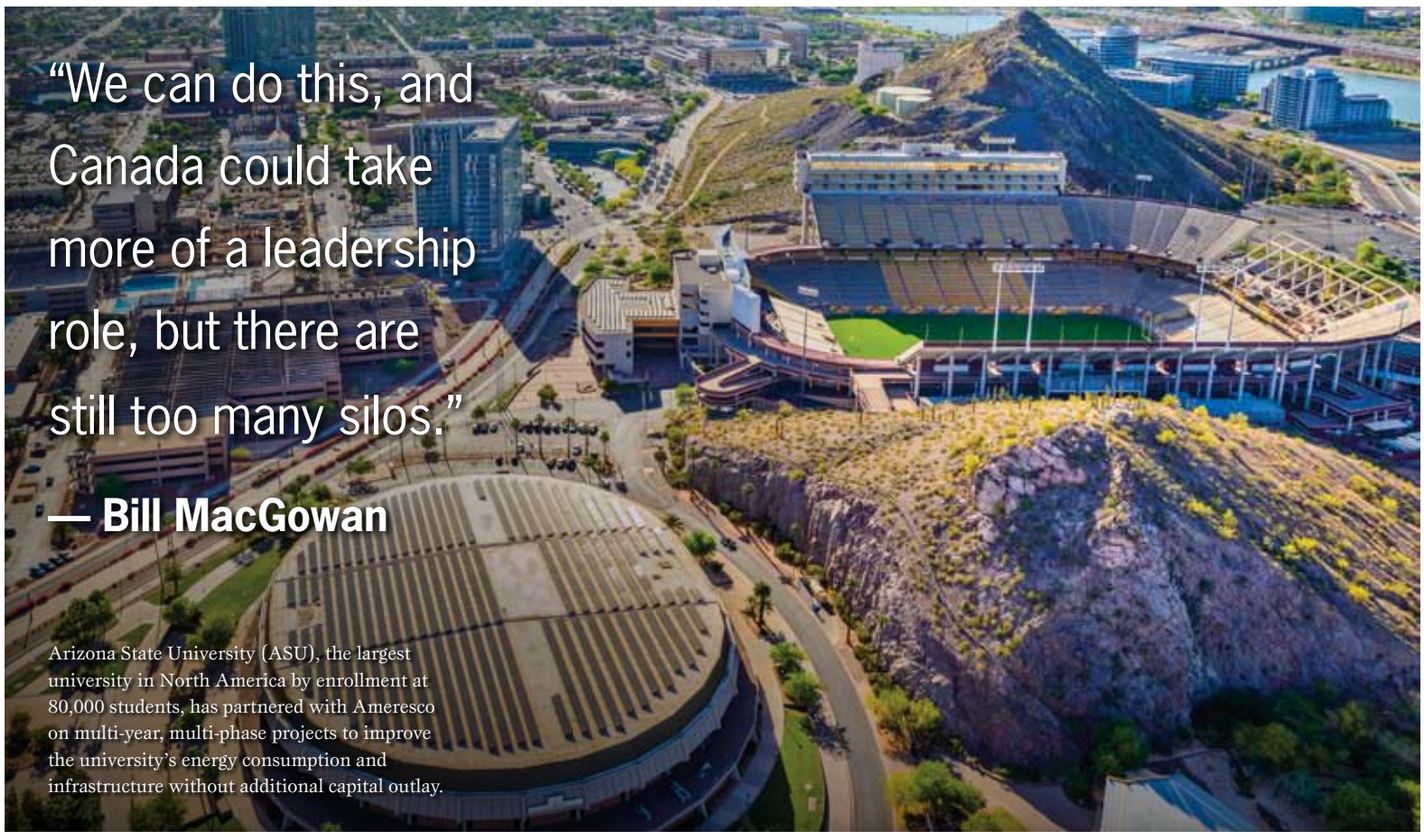
Credit: Manitoba Hydro

Erosion Prevention

Workers install a draft tube liner at the Keeyask Generating Station to prevent concrete erosion.

— Staff

Send us your best infrastructure image, and you see it featured here. Email editor Andrew Macklin at **andrew@actualmedia.ca** for details.



Arizona State University (ASU), the largest university in North America by enrollment at 80,000 students, has partnered with Ameresco on multi-year, multi-phase projects to improve the university's energy consumption and infrastructure without additional capital outlay.

THE ROAD TO CARBON REDUCTION

Fostering a discussion on the need for smart retrofits.

By Connie Vitello

How is the industry responding to the Canadian framework for carbon targets and the related efforts to reduce emissions?

Stakeholders should be aware that targets have been set with the aim to reduce emissions 30 per cent by 2030 as compared to 2005 emissions levels. The government's Pan-Canadian Approach to Pricing Carbon Pollution, released on October 3, 2016, outlines the principles on which the approach to pricing carbon pollution is based. It also states that a federal carbon pollution pricing backstop will begin to apply in all jurisdictions that do not have a carbon polluting system in place that meets the elements of the benchmark by 2018.

The time to implement changes to reduce energy use and curb carbon is now, but there are still several barriers in the commercial building sector that are hindering the advancement of progress and holding up the investment into refrofits.

A recent roundtable discussion amongst industry stakeholders shared insights on an increasing number of solutions available to reduce energy consumption and comply with carbon accounting. But the discussion also revealed the extent of the obstacles and the enormity of what needs to be done to meet targets in time. If their expert opinions are any indication, property owners across the country are in for a bumpy ride ahead.

Standards, plans, and policy

While the federal targets are quite clear, there can be a bit of confusion over the labyrinth of standards and policies surrounding carbon reduction strategies and resources. Tony Fanous, manager of technical services at Infrastructure Ontario, emphasized the importance of standardizing sustainable product delivery across the provinces. "This standardization aspect is very important and should be supported through energy audits and commissioning toward smart building retrofit."

Fanous cited a new report released on November 28, 2017. Infrastructure Ontario's Building Better Lives: Ontario's Long-Term Infrastructure Plan, 2017 includes the initial findings of the Province of Ontario's first-ever asset inventory. This tool is designed to provide information that the province will need to help get the real estate portfolio in a state of good repair. In addition, the report outlines a new phased approach to introduce Life Cycle Assessment (LCA) into the province's infrastructure planning and procurement processes. This will lead to the identification of some potential infrastructure projects to demonstrate the LCA approach, and could involve the procurement of some "large, complex projects in 2018" and provide guidelines "to be incorporated into ministries' business cases for infrastructure investments in 2018."

Jeffrey Ranson, the Canada Green Building Council's (CaGBC) regional director for the Greater Toronto Area (GTA), is working toward raising awareness about standards across the country. The CaGBC organization is known for building certifications like LEED and for helping establish a framework for performance levels.

The CaGBC recently announced its support for the Federal Standing Committee on Finance and its recommendations for zero carbon buildings, targeted retrofits for federally-owned buildings, and green skills development. The government is recommending adopting zero carbon building standards, creating opportunities for targeted retrofit investments for federally-owned buildings, and buying zero carbon technology in bulk. CaGBC released a Retrofit Roadmap report in spring 2017 which outlines high priority opportunities in Canada to help meet Federal targets for emissions reductions.

Quality Urban Energy Systems of Tomorrow (QUEST) is also a non-profit leader in the development of smart energy communities

across Canada. Senior associate Richard Laszlo is busy with work on technology and policy issues around innovative urban planning and has an experienced opinion on the situation. "It's become very exciting over past couple of years with federal and provincial policies, but companies don't know where to start or how to assess the options. There's a huge opportunity with all the innovations happening but we have to make sure they address regulatory and policy changes."

It seems some private firms and their properties are already on board.

Pioneering projects

Joseph Valente, vice president of Ameresco Canada, is keen to see the standardization of building retrofits across the country. Valente has worked with both public and private sector companies throughout North America to help meet retrofit goals and reduce greenhouse gas emissions. Having implemented more than $5-billion worth of work so far in North America, Ameresco has some extensive experience in the market.

Valente recalls a commercial project that Ameresco was involved with in recent years and how they helped a Toronto landmark execute an energy efficient transformation. The Class A building is a historical landmark in the heart of the Toronto business district but was deemed to be "long in the tooth in terms of infrastructure and technologies" and had a high operating cost.

"We looked at it holistically and carefully analyzed all their building systems," said Valente. "From a marketing perspective they wanted to attract new tenants and keep the tenants they have. We were able to implement comprehensive improvements simultaneously and assist them in saving them more than $4.5-million per year."

Valente pointed to another Ameresco project that is blazing a path in the United States and is expected to have a positive impact on the Canadian market. Ameresco has helped Arizona State University (ASU) develop a carbon neutral road map that will enable ASU to be carbon neutral (not including transportation) by 2025 and fully carbon neutral (including transportation) by 2035. The retrofit employs a cost-effective combination of traditional upgrades and renewable energy technologies such as solar power and thermal storage for multiple residences, classrooms, and office units as well as some key recreational facilities.

Meyer reflected on the initial challenges in 2003 when the ASU president first declared that they were going to be carbon neutral. "It was early days for the carbon neutral conversation. The naysayers said we couldn't do it, especially because it was the largest university in the U.S. by enrolment at the time," said Meyer. "But the president has helped move the market. It took a solid road map to make it happen."

All photos: ReNew Canada

L-R: Rodney McDonald, principal at Avison Young with Joseph Meyer, business development manager, sustainability and renewables, Ameresco.

L-R: Richard Laszlo, senior associate at QUEST and Greg Williams, director of canadian corporate finance - Manulife Financial.

Jeffrey Ranson, regional director for the Greater Toronto Area for the CaGBC.

Elliot Cappell, chief resilience officer for the City of Toronto.

Philippe Bernier, senior director of sustainability & innovation at Triovest Realty Advisors Inc.

L-R: Bill MacGowan, senior director and business development manager at Cisco Systems Canada.

L-R: Joe Valente, vice-president at Ameresco with Tony Fanous, manager of technical services, Infrastructure Ontario.

Credit: Amaresco

The LEED Platinum-certified Nova Scotia Power (NSP) Corporate Headquarters occupies a decommissioned generating plant on the Halifax Harbour. The project involved the retention and adaptive re-use of the former generating plant.

Ameresco encourages clients to look at the "three Cs": capacity, capability, and capital. They are working to help educate the industry on smart city platforms and the ability of taking on these projects with "little or no financial risk when provided with the right backing and road map."

Educational facilities seem to be the leaders in carbon neutral retrofits so far. It's Greg Williams' job to manage finance and investments for infrastructure construction for Manulife Financial Real Estate. He said they have been busier than ever with the retrofit of institutional facilities, with schools especially. "From our standpoint we look at the particulars of the client. In the past, the approach was more simplified and standard, and mainly focussed on the credit quality. Now there are more factors to consider in terms of technical aspects of retrofit and how to improve service quality."

But this kind of thinking is slowly taking hold in the commercial real estate market as well. Phillipe Bernier, senior director of sustainability and innovation at Triovest Realty Advisors Inc., is helping create sustainable cities that enhance communities. The company manages 380 properties across Canada valued at more than $8 billion. "Approximately 75 per cent of assets under management have at least some operation certification. We're beginning to make some progress and in many cases Triovest recommends some sort of green building certification."

Similarly, Cisco Systems Canada is engaged in industry transformation as company visionaries such as William (Bill) MacGowan, senior director and business development manager, work to find solutions with smart city strategies in both new construction and retrofit in the commercial, education, and healthcare sectors.

MacGowan stressed the importance of determining what customer's business problems are and using technology as an enabler to deliver some value with a metrics that can be used to continuously manage progress. He pointed to the impressive retrofit of the Nova Scotia Power Corporate Headquarters in Halifax as an example of what can be done.

"We can do this, and Canada could take more of a leadership role, but there are still too many silos," said MacGowan. "We need to get IT department, the facilities reps, and the construction associations in the same room. Technology can be an enabler of connective architecture and changing design."

Deloitte LLP also works with clients in the public and private sector to define and advance their real estate strategy, which often encompasses elements like smart building design. Their research indicates that developers, owners, and tenants need to move beyond smart buildings to the concept of "intelligent" or even "cognitive buildings" to drive greater efficiency, increase occupant satisfaction, and enable higher returns for investors.

"Intelligent buildings are the next step along the evolution of digital disruption of building occupancy," said Debbie Baxter, director of National Leader Corporate Real Estate Advisory at Deloitte. "They allow for a greater degree of interaction between occupants and the building automation systems that provide comfort and amenities."

According to Baxter, a further evolution to cognitive buildings occurs when concepts of artificial intelligence are introduced to allow the building to monitor its own performance. For example, where a valve allows for fresh air intake and is specified to be open to a certain standard the air intake greater than the standard will create inefficiency. The sensors allow the building to monitor compliance and adjust the intake when necessary without requiring human interaction.

Deloitte implemented an intelligent building solution for its campus in Amsterdam with much success. The building is called The Edge and was awarded the Corenet Global Innovation award in 2016. Staff members are able to interact and modify their environment with the use of a smart phone app.

But Baxter said the best example of smart design in recent months in the Canadian market is the work that Deloitte has done with their building in Toronto. While the building is LEED Platinum and includes all the energy efficiency elements that one would expect to see in a new large office tower (light sensors, modern energy efficient appliances, demand dispatch elevators) they have advanced a step beyond this with an occupancy strategy. "We've adopted a policy of 100 per cent unassigned seating so that none of our 5,000 plus employees have an assigned seat," said Baxter. "This allows for higher levels of density within the building and therefore a more efficient model of energy use."

In addition, there's a sensor based feedback program that monitors occupancy and usage of buildings. The feedback is accessible through a large display in the lobby or from a smart phone or tablet. The information demonstrates which floors have the greatest occupancy and reflects information on usage levels for high demand amenities like coffee, wellness classes, and IT support.

Business opportunities

The discussion on pioneering projects and lessons learned led to some groundbreaking discussion about the need for elevated planning of public-private models to address financial, environmental, and social challenges.

Avison Young is a full service commercial real estate firm that manages close to 100 million square feet of building space. Principal Rodney McDonald is optimistic yet realistic about progress in energy efficiency retrofits.

"From my perspective, an investor isn't going to invest in a green commercial building because it's green," said McDonald. "They are going to invest in it because of the cash flow it will generate." He added that an increasing number of owners and tenants are appreciating the value of green, healthy, and premium locations with quality transit and connectivity.

Chief resilience officer for the City of Toronto Elliot Cappell is focused more on the residential real estate sector. The city property manages approximately 11,000 buildings that were built more than 40 years ago.

"They are the furthest thing from smart and they house more than one in four Torontonians," said Cappell. He discussed the growing gap between high and low-income earners and the resulting challenges in the residential market and the older buildings that are "bleeding energy." However, with the rising price of carbon and the value of land in

the City of Toronto, he figures there's a real opportunity to make a difference.

Ranson agreed. He pointed out that many of these units are the biggest offenders, with electrical heating and lack of proper insulation. "These buildings will need major retrofits and financing that can be amortized over a longer period of time. The one thing that cities have that private lenders do not is the ability to assess and tie in financing risk to property tax through Local Improvement Charges."

Generally, he added, energy conservation loans could be amortized over 25 years. "But the big risk in the commercial real estate industry is that you're probably not holding that value for 25 years, can't easily capture the value of the retrofit during a sale" said Ranson. "Through local improvement charges the financing could be held by the government and tied to the property deed which transfers with ownership." He said this strategy presents an option for long-term assurance and less risk.

However, Cappell said he's concerned about the social ramifications. "If a retrofit is financially and technically feasible but it displaces 100,000 people then it's not feasible." He argued that Toronto's model has to take into account the social model by possibly creating more rental opportunities.

Bernier reported that in the case of an industrial owner with a single tenant it's perhaps more conducive to split the costs of retrofit such as lighting upgrades. "We are starting to get more creative with contracts so that the owner is less likely to be on the hook."

Valente concurs with this shift in thinking. In the past, owners might question why they should make upgrades if the tenant is paying the utility bills. "But now we all realize it's important to make these investments sooner rather than later. The private sector can fill that gap and match the capital investment with well-crafted mechanisms." He explained that Ameresco's model can match the capital investment to the savings, so the tenant doesn't have to see a change in rate.

Moving the meter

Cities across the country are going to have to dig deep to find resources to retrofit their buildings accordingly, and certainly some cities will have more of a challenge or opportunity, depending on the perspective. "In the City of Toronto about 50 per cent of our emissions come from buildings so they're going to go at buildings hard," said Ranson. "Yet when I ask building owners in Toronto how they're going to get there in time most of them don't know. Some have a five-year goal. Not many have a 25-year goal."

Ranson said building owners and managers should be asking themselves "Is that the boiler that I need to have in my 2030 building? Am I banking the money for it now?" In a past role, he assisted a Brookfield property that wanted a ballpark energy use intensity (EUI) assessment that reflected 2030 Provincial emissions targets. Ranson said it turned out to be a valuable exercise in designing strategies and about deciding when to make retrofits.

Bernier is optimistic that if the institutional players keep doing well there will be a trickle-down effect to private owners. But some raised concerns about the "performance perception gap" in LEED certified buildings. They referenced to the expense of an ASHRAE level energy audit is expensive and flagged the need for virtual or online energy assessment tools. "Benchmarking by asset type would also be beneficial and anything we can do to understand current performance and help offset costs would be important and help create a snowball effect for progress," said Ranson.

> "There needs to be a more instrumental approach that includes environmental benchmarking and energy targets and provides a more transformational outcome." — Joe Valente

Some blame the delay in progress on the ability to get good data. "It's one of the biggest challenges. Rather than having owners of buildings spend tens of thousands, wouldn't it be nice if the utility companies who make so much could provide this information freely and clearly?" asked Bernier. McDonald agreed that the data should come from utilities. "Assets trade and the data doesn't always get transferred. The data can reside with the utility."

There seem to be certain organizations looking into data collaboration projects. According to Ranson, Ontario Utilities are spending millions to spend on energy conservation programs without comprehensive data on who and what to target. They need an integrated data framework that provides them market intelligence, while ensuring confidentially for their customers.

Valente said the data would help inform the budgeting process. He's noticed that the budgeting process in the commercial space is currently too incremental. "There needs to be a more instrumental approach that includes environmental benchmarking and energy targets over the long term. This would be an approach that provides a more transformational outcome."

Cappell thinks there are many parallels between residential and commercial buildings and so various forums that might benefit both. But there's a clear need to bring together federal, provincial, and municipal governments together to help provide a more focused action plan.

BOMA (Building Owners and Managers Association) Canada may help inform that plan. They recently released the new 2017 BOMA Best National Green Building report that highlights a number of current case studies and best practices across the country.

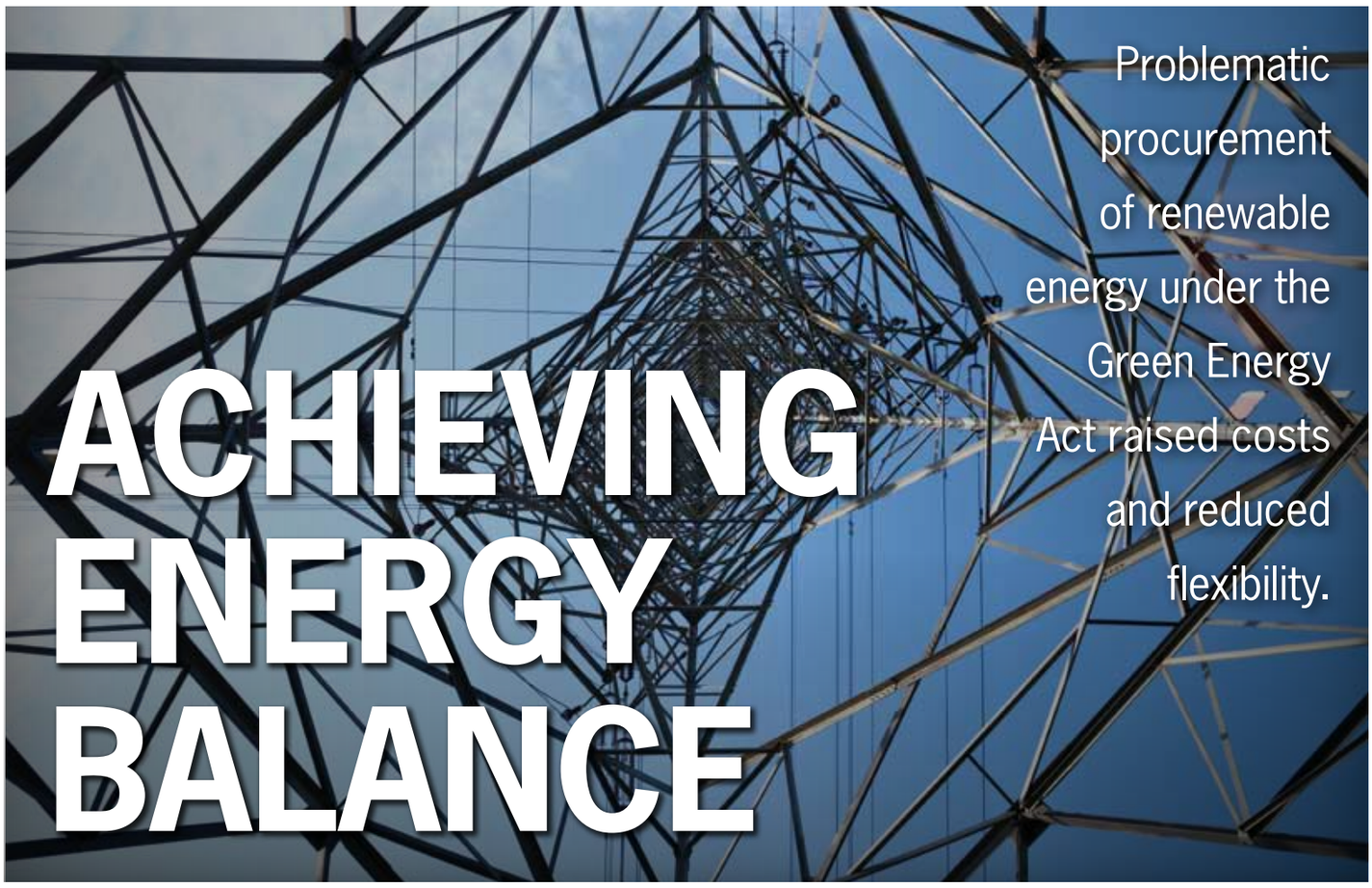
"We've seen an increase in buildings going through the verification program and using certification to drive performance and help buildings operate at the highest level of performance," said John Smiciklas, director of energy and environment at BOMA Canada. According to BOMA's data, certified buildings consume up to 52 per cent less water and have an 18 per cent higher occupancy rate while re-certified buildings average a 15 per cent reduction in energy use.

In 2018, in light of the upcoming carbon tax, BOMA is launching an awards program supported by Natural Resources Canada that is looking to recognize buildings that are outstanding performers.

While there are different ideas about how to retrofit the road to reduction, the roundtable succeeded in identifying some of the drivers and solutions available—and the need for a cohesive transformation. The prevailing consensus was that there's an urgent need to address the large gap between the few award-winning zero carbon buildings and the many energy wasters. Building owners must plan today for the carbon reckoning that's coming tomorrow.

This feature was developed from a ReNew Canada led VIP Roundtable Discussion with building industry stakeholders in Toronto on Nov. 28, 2017.

Connie Vitello is a freelance writer based in Toronto.



ACHIEVING ENERGY BALANCE

Problematic procurement of renewable energy under the Green Energy Act raised costs and reduced flexibility.

Bringing Ontario's energy system back into balance.

By Jeff Parker

An ideal energy system carefully balances three qualities: affordability, reliability, and sustainability. However, maintaining this equilibrium is difficult and has proven to be a significant challenge in Ontario for decades to the detriment of businesses, residents, and the broader economy. Political decisions made without transparency or oversight, rather than by energy professionals or market forces, has resulted in an expensive system for consumers.

Ontario's electricity prices increased dramatically in the decade ending in 2016. According to the Ontario Energy Board (OEB), on-peak prices for residents and small businesses rose 71 per cent, from 10.5 cents per kilowatt hour (¢/kWh) to 18¢/kWh. The rise in off-peak prices were even more significant: from 3.5 ¢/kWh to 8.7, or 149 per cent. Dramatic annual increases in pricing—many times the rate of inflation—have occurred over the past five years.

Industrial consumers and other large users also face rising pricing pressures. According to the Association of Major Power Consumers in Ontario (AMPCO), wholesale power rates have risen to the highest in Canada and are among the highest in North America, with particularly large increases for mid-range (Class B) consumers.

How we got here

Ontario's current system is a combination of high prices, inflexible and uncompetitive contracts, and political risk. It is the result of necessary investments, but also some poor decision-making.

After decades of underinvestment, Ontario is playing catch-up by spending billions repairing, replacing, and expanding generation, transmission, and distribution infrastructure. These investments come at the same time as a policy decision to close Ontario's coal plants. While this environmentally-minded decision was popular and significantly reduced pollution, it also required Ontario to replace more than 20 per cent of its generation capacity.

Problematic procurement of renewable energy under the *Green Energy Act* raised costs and reduced flexibility. The government paid well-above-market prices in long-term contracts to wind and solar providers, sometimes as much as 10 times the price of electricity from other sources.

These changes, coupled with declining demand for power, have resulted in an oversupply of electricity. While predicting future demand for energy is difficult, this extra generation infrastructure costs billions to build and maintain, increasing prices for ratepayers who do not need the power.

Finally, governments of all parties have contributed to Ontario's energy price challenges. In some cases, they have frozen prices, leading to underinvestment or expensive borrowing. At other times, political decisions, such as the cancellation and relocation of gas plants, has harmed the cost and reliability of the system.

A better way forward

There are no simple solutions to the problem of high power prices. Ontario's Fair Hydro Plan promises substantial reductions for residents and small businesses, but only by borrowing billions future ratepayers will need to repay.

The Toronto Region Board of Trade believes Ontario's energy system has fallen out of balance. To help the system regain balance, the board is putting forward five recommendations.

1 Improve oversight and governance

Governments often make short-term decisions which put politics first and system needs second. Recent changes to provincial law have further reduced the independence of the Ontario Energy Board (OEB) and Independent Electricity System Operator (IESO). Instead, governance should move

towards increased independence and greater oversight of government decision-makers. This can be accomplished by: debating energy policy in the legislature, empowering independent agencies to implement policy, and tasking a legislative officer with providing the public an unbiased cost-benefit analysis of major energy decisions.

2 Reform Ontario's electricity procurement

Ontario has a history of politicized, uncompetitive procurement. It has created an expensive and inflexible system where above-market prices are entrenched through long contracts. While some large procurement projects—notably nuclear—will continue to involve a role for government, the remainder of the market would greatly benefit from less centralized decision-making and increased competition. The government's Market Renewal proposal is an encouraging step, but conflicting signals such as recent negotiations to purchase sole-sourced electricity from Quebec are a concern.

- Procurement should prioritize competition and not require specific technologies, allowing for innovations such as energy storage, district energy systems, and small modular nuclear reactors. Through such reforms, Ontario's electricity market can become more like the markets for gasoline and natural gas which have a greater degree of competition, transparency, and lower costs.

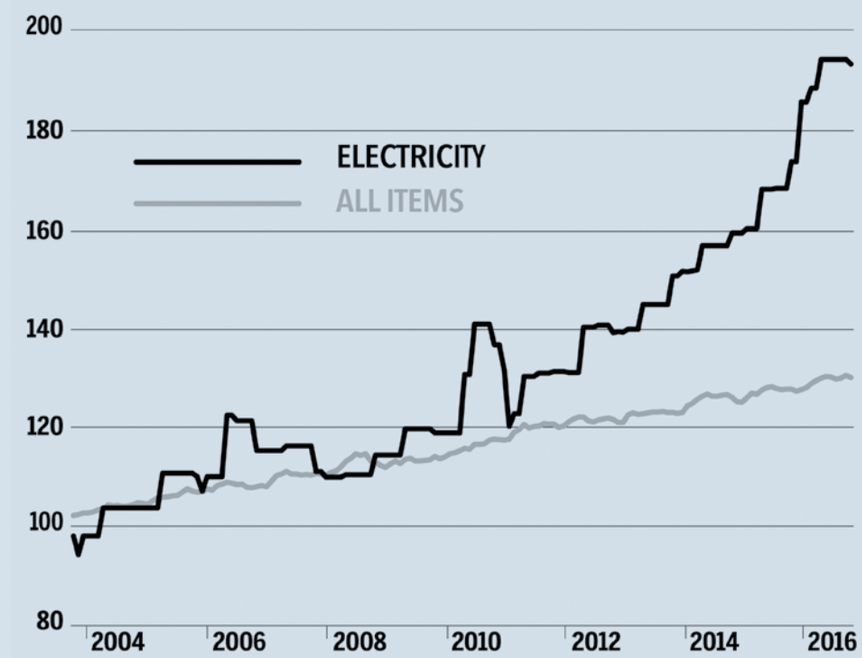
3 Reform electricity pricing

A lack of transparency in how energy prices are determined, whether through the Regulated Price Plan or Global Adjustment, make it difficult for interested consumers to understand their costs and hold decision-makers accountable. Costs not directly related to the generation, transmission, and distribution should be moved out of electricity prices and either funded by the tax base or cancelled. The government's recent decision to fund electricity support programs from tax dollars was a positive step in this direction. Remaining costs should be clearly itemized.

4 Expand the private sector's role

A successful role exists for the private sector in fuels and electricity generation. However, the transmission and distribution sectors were virtually devoid of private investment until the recent sale of shares in Hydro One. This model should be emulated by municipalities. Full public ownership may appear to benefit some consumers, but in reality has led to costly decisions and a lack of innovation and investment.

ONTARIO CONSUMER PRICE INDEX: ELECTRICITY VERSUS ALL ITEMS



Source: Statscan

- The sale of shares in local distribution companies (LDCs) provides the investment and expertise needed to introduce new technology and develop new lines of business. Presently, most municipalities do not have funds or risk appetite necessary to invest in new ventures, and LDCs cannot divert revenues from their core operations as these are strictly regulated by the OEB. Edmonton's EPCOR and Newfoundland's Fortis Energy are examples of LDCs that have successfully brought in private capital to improve operations and returns for local governments. To enable this, the provincial government must eliminate departure taxes, under which cities would pay a hefty tax bill for an LDC share sale and allow municipalities to reap the full benefits. To make up for lost revenue, Ontario could negotiate an arrangement under which the federal government would temporarily pay the province any corporate tax revenue it earns from municipally-owned distributors. Canada does not currently receive any corporate taxes from LDCs, so it would not lose revenue.

5 Price Carbon

The most effective approach to maintaining the sustainability of the energy system is through a carbon price, not costly regulations or uncompetitive green energy procurement. In contrast to other approaches, a carbon price allows companies, residents, non-governmental organizations, researchers, and entrepreneurs to find the best ways to reduce pollution. This price can be achieved through either a cap and trade system or a carbon tax, and should slowly and predictably rise over time to encourage emissions reductions. A successful carbon price should also be fully transparent, provide special support for emissions intensive, trade exposed industries, and return all revenues to businesses and residents through tax cuts and rebates.

The road ahead

The role energy plays in our society is often taken for granted. Energy is expected to be cheap, always available and—where possible—environmentally friendly. As Ontario's example demonstrates, this is only achievable through consistent and thoughtful energy policy. While the province has faltered in recent years, adopting these recommendations would provide a boost that would help businesses and residents. The board's recommendations will enable Ontario's energy system to achieve balance over the long-term.

Jeff Parker is the manager of policy for the Toronto Region Board of Trade.

COLLECTING ENERGY DATA

Hidden tools for addressing climate change.

By Bruce Cameron

Energy data management: in many households that would set the eyes to glaze. But when we talk about greenhouse gas emissions (GHG) reduction, it is the foundation of both making and measuring progress.It also may not be top of mind when we talk about moving to a low carbon future through a transition to renewable energy, more energy conservation and efficiency, developing alternative transportation, integrating conventional energy networks, and sustainable land use discussions; but it should be.

The truth is, data is at the heart of all decision-making because we can't change our behaviour if we don't know where we are now, and we can't meet our targets if we can't measure them.

Nationally, Statistics Canada measures total energy demand and GHG emissions changes, but today's measurement tools lack sufficient detail when it comes to regional, sub-regional (including municipal-level), or program level measurement.

Three key questions need to be understood in order to measure progress on GHG reduction objectives:

- Who needs access to energy use data?
- How should privacy be protected when the data is shared?
- What are the benefits that arise when we collect, analyze, and share information on how we use energy and create GHG emission?

Stakeholders in the energy sector in Atlantic Canada have helped identify a long list of their energy data needs:

- Energy consumers want to better manage their energy use and carbon footprint;
- Energy providers want to improve service delivery, reliability, and plan for the future;
- Governments and planners want to improve accountability, measure progress and develop new goals and objectives for a lower carbon economy and Smart Energy Communities;
- Public efficiency agencies and programmers want to improve accountability on program outcomes and program design;
- Regulators want to obtain more evidence of utility and programmer effectiveness;
- Technology developers want to create new tools to report on energy use and advising on opportunities for improvement;
- Researchers want to understand social and economic trends and report on them to assist in public policy development; and
- Commercial Interests want to seek new markets for goods and services.

What We Learned

Through a project funded by the Governments of Canada, New Brunswick, and Nova Scotia as well as two utilities, NB Power and EfficiencyOne, QUEST has been able to establish a common vision that identifies the characteristics of a shared energy information system, and sets out policy options, model legislation, and tools to help us better collect, measure, and use energy data in the Atlantic Canada. We call it the Atlantic Canada Energy Data Roadmap.

The vision adopted calls for an energy information system that collects data in a comprehensive manner and regularly reports on an aggregated basis for community energy and emissions inventories. In achieving that vision, the roadmap is guided by a series of values.

Those values include:

- The need for society to make informed and good energy and environmental policy, program and investment decisions, and measure success;
- The protection of personal information by requiring the de-identification of energy use data before public reporting;
- The right of consumers to decide if they want to share personal energy data, and enable them to do so in an informed, secure, and simple manner;

- Technology solutions that use common standards and operate with simplicity, clarity, and enhanced accountability for users and efficiency programmers;
- Technology solutions that improve operations; and
- Regional and national cooperation and linkages to other information initiatives.

To protect privacy, the roadmap suggests choices that depend upon governments deciding where a balance between energy consumer privacy and the collection and analysis of useful information should be set. Trust is an important element in the decision of who should be responsible for managing, analyzing, and reporting on energy and related data sets that will help us measure as a society, and manage as energy users. Regardless of the system to be chosen though, the roadmap suggests publications or reports using energy data should be consolidated or de-identified, unless there has been explicit permission granted by the energy user. Government also needs to determine whether all these interests can be best protected by voluntary compliance through the adoption of industry recommended best practices or by developing legislative compliance requirements.

Through the roadmap, we have outlined a series of policy and program options for governments and stakeholders to consider. In many cases they offer a choice between voluntary requests to energy providers for more data, or legislative requirements. In either case it is recognized that the reporting would be staged and sensitive to the economic costs of implementation. More specifically, we have suggested that governments adopt the following outcomes:

- The rights and obligations of consumers and energy providers are fully supported by policy and program direction, and if required, new law;
- Laws surrounding energy data reflect a flexible and staged implementation through regulations and by regulators consistent with the roadmap timelines;
- To the greatest extent possible, governments and regulators should strive for a coordinated and consistent approach to definitions, standards, and expected outcomes, with the understanding that not all provinces will move at the same pace;
- The framework establishes roles and responsibilities and delegates to regulators and agencies wherever possible; and
- The framework anticipates the possibility of a Canadian Energy Information Agency and allows for the delegation to that entity when and if it emerges.

It is also necessary to improve the presentation of energy data in a more efficient and useful form. The options to organize data in standard and easy to use formats include computer application development by the private sector, by efficiency agencies, and/or by regional cooperation. For Atlantic Canada, it may be more effective to have a public investment in a common platform such as subscription services for data analysis which may only be cost-effective for larger energy users/savers. We have offered suggestions on how governments could play a role in developing technology that improves the operations of energy providers.

We have also suggested that energy providers collaborate with governments and other stakeholders to develop cost-effective implementation of the roadmap, and work together to establish details such as standards for the classification of energy use by customer and building type, as well as standards for de-identification of energy use and related data.

Finally, we have considered actions that could enhance regional cooperation and linkages to other initiatives such as climate change legislation and regulation and the potential creation of a Pan-Canadian Energy Information Agency.

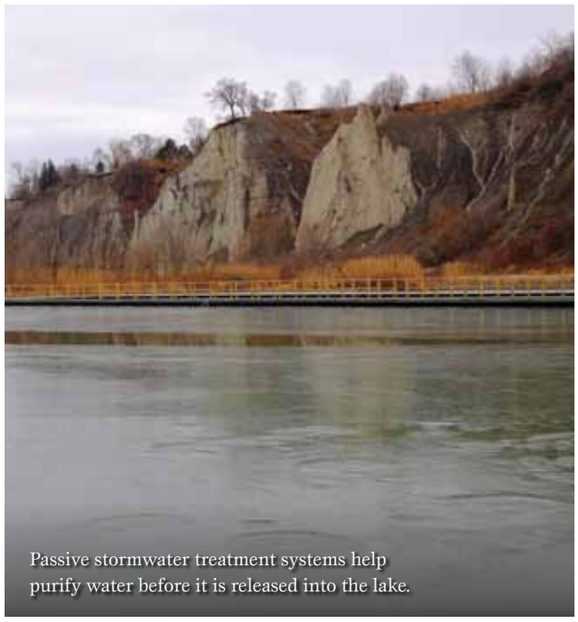
To guide the implementation of the roadmap, a timeline for when to enact the suggested policies and programs over the course of the coming decade to balance between public interest and consumer costs is presented. The timeline is flexible in order to reflect the reality that some parts of Atlantic Canada will take longer to enact the options recommended as a result of differences in needs, priorities, and due to past investment decisions.

What Next?

The need for better energy and GHG data to support public policy development, research advances, and new technology and business opportunities is not unique to Atlantic Canada. It is a priority across Canada. The Atlantic Canada Energy Data Roadmap likely provides insights for everyone trying to address this pressing public policy and business priority and provide highly timely and relevant research and guidance that can be directly applied across the country.

Bruce Cameron is the principal consultant at Envigour Policy Consulting Inc. and a senior associate at QUEST.

Download the Roadmap at
questcanada.org/Roadmap



Passive stormwater treatment systems help purify water before it is released into the lake.

Man-made wetlands in urban environments can help treat stormwater runoff.

STORMWATER AS AN ASSET

Perspectives on climate change resilience and infrastructure innovations.

By Gail Krantzberg

In 1972, the United States and Canada signed the Great Lakes Water Quality Agreement (GLWQA) to protect and restore the waters of the Great Lakes basin ecosystem. Since the original version, the agreement has been revised several times, most recently in 2012. Its strengths include a structure and process that place focus on strategies for restoring and protecting the ecosystem rather than prioritizing national agendas. The responsibility of meeting these goals falls to the governments and agencies of the two nations jointly.

For the first time in the history of the GLWQA, the 2012 version includes the objective to ''enhance the long-term effectiveness of management strategies for restoring and protecting Great Lakes water quality by understanding and considering climate change impacts.'' The climate annex commits to key activities including: to develop and improve regional climate models and link them to chemical, physical, and biological models; to enhance monitoring of climate predictions, changes, and impacts; and to develop and improve tools to predict the impacts, risks, and vulnerabilities associated with climate change.

The development of the climate annex illustrates the importance of considering the future of the state of the Great Lakes climate when planning adaptation initiatives. Here, adaptation measures are defined as those actions which may be taken to prevent or reduce damage from climate change by responding to the risks posed to human economic and social activities, and to natural environment, making them more climate resilient.

Adaptation actions may involve behavioural changes, operational modifications, technological interventions, revised planning, as well as improved regulations and legislation. In most circumstances, anticipatory planned adaptation will incur lower long-term costs and be more effective than reactive adaptation or rapid action plans. Furthermore, many adaptation measures are no-regrets options, characterized by measures that would generate net social and/or economic benefits irrespective of whether or not climate change occurs. They generally have the double benefit of reducing short-term exposure to climate. Examples of water no-regrets adaptation measures include increased efficiency in the use of water, the designation of flood hazards, and measures to reduce water demand.

The impacts of climate change have the potential to amplify and counteract existing environmental stressors in the Great Lakes region and particularly these vulnerable areas. It is clear that higher temperatures, increased events of intense precipitation and storms, as well as increased evaporation will impact water levels, and water quality, as well as exacerbate the introduction of new aquatic invasive species.

With more intense precipitation events and storms, more pollutants reach watercourses directly and rapidly through surface runoff. Stormwater can carry with it human and animal bacteria as well as pathogens particularly when sewage treatment plants overflow. Runoff that carries with it harmful pollutants or pesticides can cause ecosystem damage including degradation of fish and wildlife populations and beach closings. Important wetlands may become degraded and lose the ability to support species. Intense precipitation also leads to soil erosion, land and water quality degradation, and infrastructure failure requiring dredging in greatly affected areas.

Many communities are now implementing smart growth and low impact development (LID) practices to meet stormwater management goals. A fundamental purpose of LID is to increase onsite retention and infiltration of stormwater. In 2011, Christopher Pike published a study summarizing some common practices including higher density development, installation of green infrastructure such as pervious pavement and grassy swales, preservation of natural lands, and re-use of already developed lands.

In an article on adapting cities to climate change, published in the Journal of Environmental Planning and Management, J. R. Carter et al elaborate on the notion of utilizing natural and semi-natural green infrastructure landscapes to reduce extreme weather and climate risk in urban centres.

Interventions upstream in a river catchment, including tree planting in agricultural and urban areas, have the potential to reduce the threat of flooding downstream.

The research presented by T. Moore et al on stormwater management and climate change in 2016, reviews elements of soft engineering that mitigate flooding associated with severe storm event, such as routing impervious runoff to lawns or engineered stormwater infiltration systems, the potential for natural vegetative cover to mitigate surface runoff and flooding, and the need for municipalities to address urban green infrastructure as an integral component of adaptation planning.

Actions for inclusions of climate change adaptation strategy to address runoff concerns are:

1. Strategies to reduce sewage overflows by increasing vegetation in runoff interfaces, permeable pavement to reduce sewer overflows in key watersheds and re-routing or separating rainwater from sewage drains.
2. Sewage plant and sewage treatment upgrades in infrastructure and technology to accommodate higher hydraulic loads and prevent overflows and bypasses.
3. Pre-treatment or alternative storage of manure to eliminate pathogens and toxic gases from entering the Great Lakes.

Credit Valley Conservation details how best management practices (BMPs), are the building blocks of LID. Almost all components of the urban environment have the potential to serve as BMPs. This includes not only open space, but rooftops, streetscapes, parking lots, sidewalks, and medians. Examples of BMPs in urban low impact development inlcude:

- **Rain Gardens:** Depressions that contain soil amendments and appropriate plants that promote both infiltration of stormwater and treatment of pollutants.
- **Grassy Swales:** Vegetated channels that slow stormwater runoff and promote infiltration, trap sediment, and help treat pollutants.
- **Downspout redirect:** Extension or bend in an existing gutter which redirects rain water to a grassy or permeable area.
- **Rain Barrels:** Tanks that attach to the end of downspouts to collect rain water your roofs
- **Porous Pavement:** Concrete or asphalt that allows rain to infiltrate, thereby reducing runoff and promoting groundwater recharge.

The adaptive capacity of human management systems is the basis for resilience to future threats. The capacity to adapt relies on the building of knowledge and understanding so as to predict and respond to new conditions and effectively supports decision making.

Approaches that embody resilience require efforts to reduce exposure to hazards, thereby reducing risk to human populations and the economy. It also requires more flexible governance system that can adapt more readily and find innovative solutions. As the climate changes, so to must our behaviour to mitigate potential ecological, social, and economic harm.

Dr. Gail Krantzberg is a professor in the Engineering and Public Policy Program at the Booth School of Engineering Practice and Technology at McMaster University.

The analysis showed that after 15 years of I-300's implementation, an estimated 57.5 million square feet of green roofs would be built in Denver.

RESURFACING CITIES

A missing key to climate resilience and social equity.

By Steven W. Peck

When breaking free from the seemingly hypnotic grip of the ongoing saga in the White House and the U.S. Congress, one can find cause for optimism in cities! In Denver, Colorado for example, the citizen-led I-300 Green Roof Ballot Initiative in November 2017 was supported by more than 54 per cent of voters, despite a well-funded campaign against the initiative. The new policy promises to resurface many buildings in Denver contributing significantly to its future resilience and social equity.

Frustrated with his attempts to convince officials to implement policies to address climate change, restaurant manager Brandon Riethemer led the Green Roof Ballot Initiative by collecting more than 7,000 signatures to put a mandatory green roof/solar requirement on the ballot. It is the first time in Denver's history that unpaid, volunteer power resulted in a successful ballot initiative: an example of direct democracy in action.

Despite initial opposition from Mayor Michael B. Hancock, who now supports the will of the people and the initiative, Denver now requires green roofs and/or solar panels on new and existing buildings of 25,000 square feet or more of floor space. This is currently the most progressive green roof legislation in North America, exceeding the new requirements for green roofs on buildings in San Francisco under its Better Roofs Ordinance and Toronto's Green Roof Bylaw.

Depending on the final recommendations of an expert technical committee, and a stakeholder committee charged with making refinements to the voter-approved policy, the new law has the potential to significantly resurface much of Denver in the coming decades. And not a moment too soon, as Denverites currently suffer from living with the third worst urban heat island effect in the U.S. The overheating of urban and suburban areas is primarily the result of removing vegetation to provide needed space for buildings, roads, and parking lots, which convert sunlight into heat. The urban heat island has many negative impacts on human health, drives up energy and water consumption, and even results in a reduction of tourism during the hottest months. The urban heat island may also be an important source of global warming according to Chinese researchers. Paving over vegetated areas contributes to the warming of surface waters which impairs water quality, and these impervious surfaces are the major cause of drainage and flooding issues which result billions of dollars in property damages across North America annually.

Generating ROI

New economic studies affirm that the resurfacing of our cities, using technologies such as green roofs, walls, solar panels, reflective roofs, wetlands, and urban forests delivers a significant return on investment while also contributing solutions to climate change and social justice. To help counteract a misinformation campaign against the Denver Green Roof Ballot Initiative, Green Roofs for Healthy Cities took action. They partnered with the Green Infrastructure Foundation, and teamed up with several experts from San Francisco and Denver to develop a cost-benefit analysis for the green roof requirement. Making Informed Decisions: A Green Roof Cost and Benefit Study for Denver was released in October 2017. The study looked at a single example of a green roof on an office building as well as a city-wide implementation scenario for widespread green roof implementation. It used conservative assumptions including high average costs of installation and low applicability of the initiative to existing buildings (many existing buildings will be exempted for lack of loading capacity to support a green roof).

The analysis showed that after 15 years of I-300's implementation, an estimated 57.5 million square feet of green roofs would be built in Denver, at a total installation and maintenance cost of US$1.34 billion (NPV). Over 15 years, these roofs would generate a net present value of $50 million, derived from many public and private benefits including:

- $573 million in savings due to increased membrane durability;
- $445 million in rooftop food production;
- $171 million in savings due to the reduced urban heat island effect;
- $59 million in direct energy savings;
- $37 million in benefits associated with improved productivity and reduced absenteeism;
- $95 million in real estate benefits associated with lower vacancy rates and turnover;
- Generation of almost 25,000 years of full-time employment; and
- $38 million in community economic benefits from increased tax revenues associated with expanded employment.

In forty years, as the roofs built in the first 15 years continue to generate annual benefits,

but costs are limited to maintenance, their net present value rises to US$1.85 billion by 2058. The results are conservative. The study did not quantify additional benefits for which data is unavailable, such as positive health impacts, reduced flooding, and the potential insurance savings on roofs that are regularly damaged by hailstorms, and would be protected from such damage by green roofs.

Another economic study, Achieving Urban Resilience, released in January 2018 by Greg Kats and Keith Glassbrook of Capital E, quantifies the large scale economic, environmental, and health effects of widespread implementation of smart surface technologies such as reflective roofs, green roofs, solar PV, reflective pavements, and urban trees. Kats, Glassbrook, and their team analyzed the costs and benefits of widespread smart surface technology adoption in three cities: Washington D.C., Philadelphia, and El Paso. The results of their 40-year data analysis demonstrate a significant potential return on investment resulting from the wise management of rain and sun in these cities. Tangible benefits include employment, greenhouse gas emissions, energy, stormwater, and some positive health impacts. Moreover, when the positive impacts of tourism are factored in, the net present value in Washington D.C. jumps to $4.9 billion from $1.8 billion, and from $3.57 billion to $8.4 billion in Philadelphia.

The economic case

These results, the authors note, although impressive, are very conservative because many tangible benefits are not quantified due to a lack of data. For example, many of the negative impacts of inaction, or the benefits of action to improve urban surfaces, fall upon the poorest citizens in cities. All too often poorer communities are lacking in living green infrastructure, and suffer disproportionately from impaired air quality. Many citizens don't have the means to protect themselves against extreme heat. Economically disadvantaged members of communities will likely have much to gain if there are investments in widespread green roofs, solar panels, urban forests, wetlands, and other smart surface technologies, particularly when local employment goals are built into implementation and maintenance programming. Reducing the urban heat island by just one degree Celsius with these technologies, can result in a reduction in peak load energy demand in cities for air conditioning by approximately four per cent, saving everyone money on their summertime energy bills.

Over the last decade, local and state governments worldwide have begun to implement programs to resurface cities through infrastructure investment and/or policy requirements. Paris, France for example, has a goal of one million square meters of green roofs and walls implemented by 2020, which includes food production targets. This policy was instituted in response to terrible 2003 heat waves which killed more than 70,000 people in Europe.

In Singapore, if a building has a footprint of 1,000 square metres or greater, there is a policy requiring designers to restore this area entirely on the roof and/or walls of the building. As a result, Singapore is considered by many to be the greenest major city on earth and it is a major tourist destination.

Philadelphia is working to implement its Green City, Clean Waters Plan, which will transform one-third of its impervious surface areas into 'greened acres' over 25 years, using a wide variety of technologies including rain gardens, bioswales, porous pavement, trees, and green roofs.

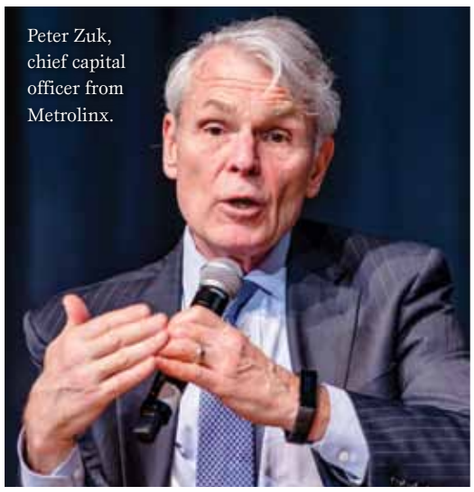
The need is now

While many cities have programs that support the resurfacing of cities, most do not. In cities that have policies and programs, the initiatives are often fragmented and limited in scope due to underfunding. There is limited funding from senior levels of government, and as a result, programs are often not implemented rigorously. The rigorous implementation of the resurfacing of cities with trees, green roofs and solar panels and other smart surface technologies is required for them to have significant impact or to mitigate losses. For example, the Green Infrastructure Ontario Coalition in its State of the Urban Forest in the Greater Toronto Area (GTA), shows the GTA is currently moving in the wrong direction. The GTA's urban forest currently covers 26 per cent of the region's surface area and its replacement cost is estimated at CA$14.2 billion. This important green infrastructure asset however, is in decline with overall losses of coverage and diversity projected in the coming decade, in part due to development pressures and the emerald ash borer infestation. What is needed for the GTA is a multi-billion-dollar, multi-year infrastructure program of investment to increase forestry cover, and other smart surface technologies across the region.

By using the lens of smart surface technologies, policy-makers should set aside infrastructure spending and support policies that result in vigorous, widespread implementation. There are bountiful opportunities to address multiple problems by resurfacing cities, from generating more value for money from public infrastructure investment to increasing employment, while at the same time, improving resilience and social equity. In addition, the positive health care impacts from this kind of infrastructure investment are likely to be in the billions, and lessen the strain on health care infrastructure. Widespread resurfacing technology implementation is currently an overlooked opportunity to achieve healthier, more prosperous, resilient, and livable cities in Canada. Given the tens of billions of planned expenditures on infrastructure being negotiated between the federal government and provinces in Canada, senior policy makers would benefit from including investments in resurfacing our cities in the mix, grabbing the key to multiple long term benefits for all Canadians.

Steven W. Peck is the founder and president of Green Roofs for Healthy Cities.

All photos: Josh Fee



Peter Zuk, chief capital officer from Metrolinx.

JP Gladu, president and CEO of the Canadian Council for Aboriginal Business.

Ehren Cory, chief executive officer at Infrastructure Ontario.

Top100 Canada's Biggest Infrastructure Projects

Key Players and Owners Dinner

CELEBRATING THE BIGGEST INFRASTRUCTURE PROJECTS IN CANADA

There were over 285 infrastructure industry executives and their guests at The Carlu in Toronto on February 20th for ReNew Canada's 2018 Top100 Projects Key Players and Owners Dinner. The 2018 report featured $1.99 billion in total investment across multiple sectors, up from $186.4 billion in the 2017 report.

For the first time, the Top100 Projects Dinner featured a keynote panel discussion, which was moderated by ReNew Canada editor **Andrew Macklin**, on the subject of next horizon of Canadian infrastructure. The panelists were Infrastructure Ontario CEO **Ehren Cory**, Canadian Council for Aboriginal Business president and CEO **JP Gladu**, and Metrolinx chief capital officer **Peter Zuk**. Among the subjects discussed were the expected needs for investment 10-to-20 years from now, business opportunities in building partnerships with First Nations and remote communities, improving infrastructure resiliency for weather of the 2030s and 2040s, and innovations that could enhance or disrupt infrastructure development.

Rob Oliphant, Member of Parliament for Don Valley West, whose riding is part of the Eglinton LRT development, provided remarks on behalf of the federal government. Oliphant highlighted new investment opportunities like the Smart Cities Challenge and Canada Infrastructure Bank that will help to build innovative new infrastructure in communities across Canada.

ReNew Canada would like to thank Platinum Partner WSP, Elite Partners EXP and PCL, and Select Partners Infrastructure Ontario, Ontario Power Generation, AECOM, and Parsons for their continued support of the Top100 Projects Dinner.

Work on the 2019 report is already underway. Submit your project updates at any time to editor Andrew Macklin at *andrew@actualmedia.ca*.

TOP100PROJECTS.CA/CELEBRATE

All photos: Josh Fee


The 8th annual Top100 Projects Dinner gets underway on Feb. 20, 2018.


Marc Trudell, VP corporate development, from Englobe and Mario Cantin, senior VP strategic business development.


Rob Oliphant, MP for Don Valley West.


Marcello Lu, Andrew Biksa, and Shervan Khanna from BASF.


Eric Peissel, national business line executive - transportation at WSP.


Wanda Richardson, Patrick Leong, and Paul Murray from AECOM.

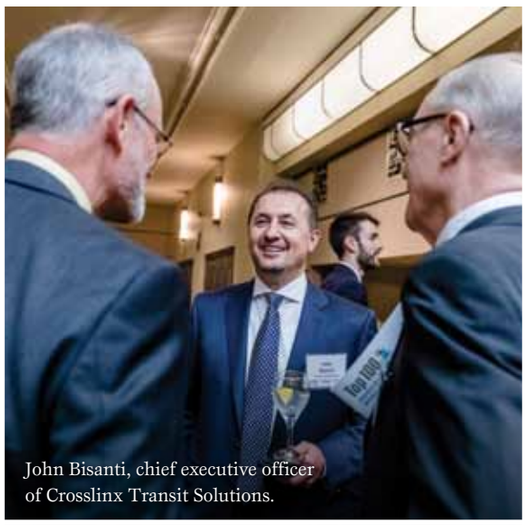

Donald Fernandes, GM - nuclear operations, eastern Canada region for Cumming Canada Ltd.


EXP's principal of structural engineering Li Ming Tang and senior vice president Lloyd Gonsalves.


Michael Chiu of WSP in conversation with Guy-Philippe Decarie of CIMA+.


Tewfik Atia, vice-president of operations for Ontario at Englobe.


Abigail Tulloch, senior legal counsel at Infrastructure Ontario.


John Bisanti, chief executive officer of Crosslinx Transit Solutions.


Yousef Kimiagar, vice president at Gannett Fleming and Susan Neil, senior vice president at Hanscomb.


Carl Bodimeade, senior vice president at Hatch.


Bruce MacPherson, project director at PCL Constructors Canada Ltd.


The panel, moderated by ReNew Canada editor Andrew Macklin, discusses the next horizon of Canadian infrastructure.


City of Toronto Deputy Mayor Denzil Minnan-Wong with the Top100 Projects report.


The team from Parsons with their 2018 Top100 Projects platinum partner plaque.


Brad Chin, manager rail transportation, associate partner at WSP.


Ontario Minister of Infrastructure Bob Chiarelli and MP Michael Chong, infrastructure critic for the Conservative Party of Canada.

APPOINTED

André Juneau

André Juneau has been named interim chief executive officer of the Windsor-Detroit Bridge Authority.

The appointment follows the resignation of **Michael Cautillo**, who had been on a personal leave of absence since August. Juneau was initially appointed as an interim member of the board of WDBA in February 2017. In October 2017 he resigned from the board and took on the role of chief operating officer, absorbing the responsibilities of WDBA's day-to-day operations while Cautillo was on leave.

"We are pleased that Mr. André Juneau is taking on the role of interim CEO of WDBA, and continuing to provide skilled guidance and seamless oversight to deliver the Gordie Howe International Bridge project," said **Amarjeet Sohi**, Minister of Infrastructure and Communities.

Bruno Guilmette

The Canada Infrastructure Bank has welcomed **Bruno Guilmette** as interim chief investment officer (CIO).

"The board recognized the need to move quickly and Bruno Guilmette agreed to start the build up of our infrastructure investment capacity as interim CIO, so that we can look forward to engaging with stakeholders," said **Janice Fukakusa**, chair of the board of directors of the Canada Infrastructure Bank.

Guilmette, who was named to the inaugural Board of Directors on November 16, 2017, will step down from his board position while serving in the CIO position.

Fred Eisenberger

Intelligent Community Forum (ICF) Canada has announced the election of **Fred Eisenberger**, Mayor of Hamilton, as the organization's new chair, effective January 1, 2018.

The national association currently represents 37 towns, cities and regions across Canada that have been evaluated as an ICF-qualified SMART21 or TOP7 Intelligent Community, as well as private sector and institutional members that are involved in smart city and Intelligent Community activities.

Fred Eisenberger was elected mayor of the City of Hamilton on December 1, 2014. This is his second term, having previously served from 2006 to 2010.

Kevin G. Lynch

SNC-Lavalin has announced that the board of directors has appointed **Kevin G. Lynch** as chairman of the board, effective January 1, 2018. Dr. Lynch will replace **Lawrence N. Stevenson**, who had previously announced his upcoming retirement from the board.

Elected as director and appointed as vice-chairman in May 2017, Lynch has been vice-chair of BMO Financial Group since 2010. Prior to that, he served as clerk of the privy council, secretary to the cabinet, and head of the Public Service of Canada.

Gerard McDonald

Engineers Canada have announced the selection of **Gerard McDonald** as the organization's new chief executive officer, effective February 12, 2018.

Most recently the registrar at Professional Engineers Ontario (PEO), McDonald is a seasoned senior executive with over thirty years in public service roles primarily within the country's transportation sector.

"I am delighted to have been given the opportunity to help guide Engineers Canada at this critical stage in its organizational development," said McDonald.

The board would also like to thank **Stephanie Price**, who has served as interim chief executive officer since February 2017 and will continue to be a key member of the senior leadership team.

Ray Robinson

The Canadian Electricity Association (CEA) and its board of directors announced the appointment of **Ray Robinson**, president and chief executive officer of Saint John Energy, as chair of the Association. Robinson will succeed **Scott Thon** who has held the position since January 2016.

Robinson is an electrical engineer with over 30 years of executive and management experience in electrical utilities throughout North America. He has five years' tenure on CEA's Board, including his current role serving as vice chair.

RETIRED

Barry Steinberg

Barry Steinberg announced his retirement as chief executive officer of the Consulting Engineers of Ontario (CEO).

Steinberg had served as the leader of CEO for the past eight years, taking over for **John Gamble** in January of 2010. Early in his tenure, he established a strategic plan for the organization, one that has caused exponential growth of CEO.

Prior to joining CEO, Steinberg had served as the director of marketing for the Ontario Real Estate Association.

A new chief executive officer has not yet been named.

OPWA ANNUAL CONFERENCE MISSISSAUGA, ONT.

Photos: ReNew Canada

The 2018 OPWA Board of Directors.

Indra Marjaran of the Ontario Clean Water Agency provides a presentation on renewable natural gas.

On January 25, 2018, the Ontario Public Works Association hosted is annual conference. Future Focus, and the 2018 Awards program at the Mississauga Grand Banquet & Event Centre. Plenary speakers included, **Michelle Albert**, president of OPWA; **Indra Maharjan**, who spoke about the potential of natural gas capture in wastewater treatment; and the Honourable **Amarjeet Sohi** from Infrastructure Canada, who spoke about the Smart Cities Challenge.

The OPWA Awards, established to recognize outstanding individuals, groups, and organizations in the public works profession, celebrated numerous projects across the province, including the Keswick Water Treatment Plant Upgrades (Regional Municipality of York, Associated Engineering, North American Construction; the Nonquon Water Pollution Control Plant (Regional Municipality of Durham, CH2M HILL, Romag Contracting Ltd.); and the Peterborough Wastewater Treatment Water Storage Reservoirs (Peterborough Utilities Commission, R.V. Anderson Associates, North American Construction, Thomas Fuller Construction Co.).

Photos: ReNew Canada

The Superlinx panel (left to right): RCBI's Cherise Burda, Iain Dobson of the Strategic Regional Research Alliance, and KPMG's Clark Savolaine.


Move the GTHA Coordinator Michelle German moderated the Superlinx panel discussion.

SUPERLINX: A WAY FORWARD FOR REGIONAL TRANSIT? TORONTO, ONT.

In November of 2017, the Toronto Region Board of Trade (TRBoT) released its Superlinx document, providing new ideas for a regional transportation model in the Toronto-Waterloo corridor. The document, originally submitted as input for Metrolinx's regional transportation planning efforts, has taken on a life of its own following the release of the Ontario Progressive Conservatives' plan for regional transit as part of its 2018 election platform.

In response to the fervour the Superlinx concept has created, TRBoT convened a panel to discuss the recommendations put forward, including the need for a unified authority that takes a regional perspective and makes recommendations based on evidence-based planning.

The Superlinx report suggests that multiple new avenues for revenue can be realized as a result of greater utilization of transit-oriented development:

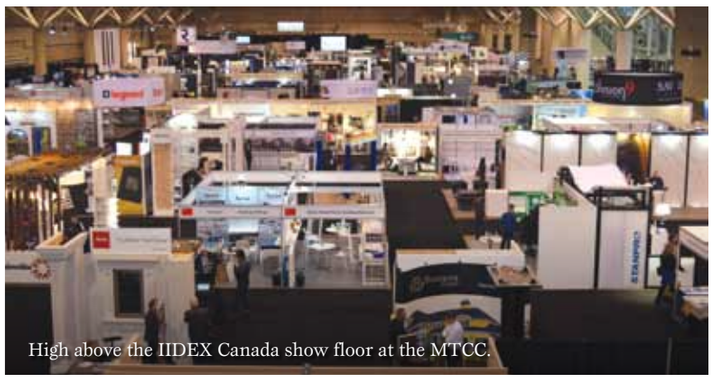
"The Corridor's transit-related real estate assets are an untapped source of commercial revenues. The substantial revenues that could be generated from air rights, lease agreements, property development and asset sales could substantially pay for new lines and superior service enhancements—not new taxes."

Instead, as **Cherise Burda** pointed out, we "need to align growth planning and transit planning." That includes the need to focus on widespread opportunities for transit-oriented development, which still hasn't completely gained traction in the region. There are some areas where this is being embraced in the Toronto-Waterloo corridor, such as the plans for the area surrounding the Vaughan Metropolitan Centre at the top of the new Line 1 subway extension.

Whether or not Superlinx has the right answers for fixing the region's transit is still up for debate, but it does emphasize the need to get municipalities to start thinking in a different way. With so many people living, working, and playing in multiple jurisdictions throughout the Toronto-Waterloo corridor, the need for regional solutions to support this lifestyle has never been greater.

Photos: ReNew Canada


Carpenters in Action gave attendees the opportunity to see modern construction techniques incorporated into a live building project.


High above the IIDEX Canada show floor at the MTCC.

THE BUILDINGS SHOW TORONTO, ONT.

The Buildings Show returned to the Metro Toronto Convention Centre (MTCC) from November 29 to December 1st. The show featured five tradeshows under one roof, Construct Canada, PM Expo, IIDEXCanada, HomeBuilder & Renovator Expo and World of Concrete Pavilion all part of North America's largest exposition, networking and educational event for design, architecture, construction, and real estate industries.

The 2017 edition featured over 1,600 exhibitors across the shows, along with over 500 speakers taking part in more than 350 accredited seminars. The event provides the opportunity to learn about the newest technology for every part of the physical asset structure, from doors and windows, to HVAC and living walls. Premier manufacturers from across Canada and around the world can be found on the show floor with their latest innovation for building, operating and maintaining infrastructure.

Among the seminars at the 2017 event was a discussion on a paradigm shift to accelerated building construction. In the presentation from Hanscomb team leader **Ken King**, he discussed how incorporating prefab and modular construction methods can help to minimize mobility impacts and help clients meet strict deadlines for projects.

Similar to what municipalities are already using with precast concrete for bridges and tunnels, the use of precast concrete building sections can work in a "plug and play" style building design, rapidly decreasing the time and personnel it takes to build a building, while also improving the accuracy of the construction. Prefabricated building sections, built in factory, have the ability to meet stricter design measurements than can be done using traditional construction methods.

While this type of construction is still gaining traction in the Canadian market, the concept could provide a valuable option for affordable housing, long-term care facilities, and other forms of municipal housing solutions that need to meet strict specifications and tight construction deadlines.

The 2018 edition of The Buildings Show takes place November 28-30 at the MTCC. For more information, visit *thebuildingsshow.com*.

By Stephen Bauld

I think it would be a fair statement to say that all levels of government strive to improve the process and procedures related to their procurement policies.

While we can all agree that the identification of problems is important, listing problems is not in itself the identification of a comprehensive solution. It is however, a start. A comprehensive solution will require coordination and sustained attack on several levels: legal, political, and technocratic.

Sounds simple enough, however, the government's solution has often been to make the RFQ and RFP documents more complicated, and has therefore created a reverse effect on the overall costs resulting in an increase to infrastructure spending. By reducing the pool of bidders, due to extremely complicated documents, the costs of construction have escalated, resulting in fewer bids by contractors and a smaller number of projects getting completed per year at the municipal level. Just to prepare a prequalification document for a large construction project has become very difficult. The government has made it virtually impossible for even large contractors to bid, unless they partner with even larger contractors to form a consortium. The overwhelming costs involved in trying to make it into the top three qualified bidders is staggering. Then to spend more money on the RFP, makes it a tough business decision for any contractor to want to take such a risk. Due to the strict specific experience required to complete these complex projects, the same handful of consortiums win the bulk of the bids, which further discourages new contractors from participating in the process.

I want to be clear on this point. I am not trying to blame any specific municipality or other government agency for the problems of the existing system. Over the last several years it has just morphed into something that has added to the time frame and costs of all major construction projects that are awarded. When I mentioned earlier about a three-pronged approach to fixing the issues, legal, political, and the procurement staff that would be required to implement the changes, we still fall short of fixing the problem. It would be critical for all three parties to agree on a comprehensive solution related to the changes and that rarely happens.

> The government's solution has often been to make the RFQ and RFP documents more complicated

Having said all this, I am still very optimistic the system can be changed and improved for the betterment of everyone related to government procurement, as well as all the industry partners. For example, some municipalities have set up meetings between government procurement staff and a cross section of associations and contractors to try and work through the most critical issues. The problem with this process is that the meetings take place three or four times a year and nothing gets accomplished, or changed for the advancement of a better system. In an odd way, the optics of governments continued attempts to try to fix a broken process often gets in the way of actually fixing the problems.

In my opinion, the most effective way to resolve these issues would be for the provincial government, or a large municipality to set up one "impartial" task force, with an allocated budget to produce and publish a report on the findings and solutions. This team would consist of expert purchasing consultants, construction lawyers, a cross section of contractors and related construction associations from across the industry, and government sectors for the sole purpose of improving the government procurement process. This group would meet on a regular basis with a set agenda and measurable goals, as well as established timelines for completion. The findings from this committee would then be implemented, or at the very least be available to every municipality as well as all government agencies, to create a standard set of rules and regulations, policies and procedures for everyone to understand and follow.

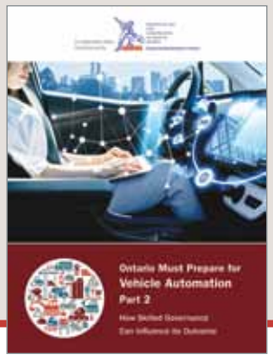
Until we all take steps to truly reform the system of infrastructure spending, nothing will change except for different people promoting arguments that are one sided in nature to enhance their own agendas.

Stephen Bauld is a procurement specialist with over 40 years' experience working in the public and private sector.

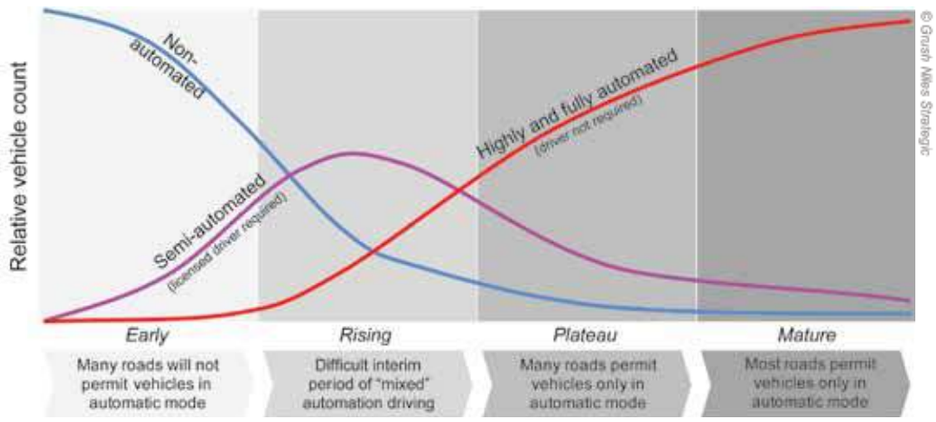
RESIDENTIAL AND
CIVIL
CONSTRUCTION
ALLIANCE OF
ONTARIO

RCCAO

Constructing Ontario's Future



Download this report and view video at rccao.com



Is Ontario (or Canada) prepared for rise of automated vehicles?

Systems engineer Bern Grush recently completed a report on automated vehicle (AV) deployment entitled "Ontario Must Prepare for Vehicle Automation: How Skilled Governance Can Influence its Outcome."

Commissioned by RCCAO, this report identifies the AV as a disruptive technology that must be deployed strategically with the introduction of highly automated robo-taxis, micro-transit and ride sharing. As these systems will be more reliable and affordable than taxis, buses and personal ownership, Grush says the percentage of travel in North America in non-personally owned vehicles will soar from 10 per cent currently to 25 per cent by 2030.

Grush encourages governments to influence the role AVs will have by preparing for their deployment. He believes that the Autonomous Vehicle Integration Network – launched in Stratford, Ont., last November – is a good first step for Ontario in that it influences the *development* of AVs. Unfortunately, AVIN does not encompass *deployment* considerations.

The key to harnessing the societal value of highly automated vehicles is for governments and the private sector to collaborate on a regulatory approach that will enhance mobility for all. That's where Grush's concept, the Harmonization Management System, comes into play. It provides the digital tools to incorporate a subsidy and pricing system which, in turn, optimizes the distribution and social performance of commercial fleets. He stresses that these services must be inclusive and accessible – ensuring that low-income, disabled and elderly people are not left out of the new mobility paradigm.

As illustrated above, Grush does not expect the rise of fully autonomous vehicles until after 2050, when the full range of complexities have been dealt with.

Andy Manahan, executive director of RCCAO, says: "Vehicle automation will greatly impact society, and governments have an important role to play in determining how these new technologies fit with our infrastructure and mobility planning."

Grush has presented his research findings to top officials on Parliament Hill and at Queen's Park, and encourages all municipalities in Canada to prepare for this issue.

"I have selected Grush as Toronto Star Wheels' Newsmaker of the Year."

Norris McDonald, Toronto Star columnist

"… supporting the development of a regulatory framework for new transportation technologies, including CV/AVs, is a key goal of Transportation 2030 (Canada's strategic plan)."

Michael Keenan, Transport Canada Deputy Minister

p: 905-760-7777
e: media@rccao.com

rccao.com

@_RCCAO

Question today
Imagine tomorrow
Create for the future

We must all hold ourselves accountable for tomorrow. For us, that means engineering innovative solutions to the challenges the future will bring. Can we design a place where our communities can thrive?

We think we can.

wsp.com