SHAPING THE FUTURE OF ENERGY AND BUILDINGS

POWERED BY INNOVATION & SUSTAINABILITY

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ENERGY & BUILDINGS

Future proofing energy, buildings and communities in today's increasingly disruptive climate is not just a good thing to do. It's critical. The sustainability and resiliency of humanity depends on it. Why focus on buildings? They consume 30% of energy in Canada and provide a tangible and cost-effective means for advancing a low-carbon, zero-net-energy future.

CHANGING THE FUTURE, TOGETHER
THE RSI

From the RSI Chair

RSI's 2019 Leadership Dinner and Dialogue series provides an exclusive platform for leaders to see what's ahead and share ways to shape the future. Each event focuses on real-world approaches to one grand challenge, be it the increasing intensity of weather events or the roles of artificial intelligence (AI) to transform our world for the better.

At RSI we believe that the future depends on knowledge, insight, and shared solutions. We invite you to join us in our quest to future-proof our communities and economies.

Given the diverse forces affecting our future, RSI aligns all of its activities with the United Nations' Sustainable Development Goals. We are constantly exploring strategies and solutions to enhance the resiliency and sustainability of business and society.

This report, primarily based on insights from our June 2019 Leadership Dinner Dialogue, focuses on innovative solutions for reducing energy consumption and future-proofing buildings. It represents the views of manufacturers, architects, developers, energy experts, financiers, economists and influencers. We thank these experts for taking the time to explore how we can all better prepare for what's ahead.

Their bold prescriptions remind us that in today's fast-changing environment, business leaders need to think differently about growth and innovation. By welcoming change, sharing resources, adopting new technologies and future readying strategies, we can not only solve old problems, but create better outcomes for customers, partners and society.

In my organization, Lendified.com, we use AI and new technology to "clear the fog" in business lending and improve decision-making. That leads to better results for ourselves, for our clients across Canada, and for our global partners. There's a saying that "Data is the new gold." This confirms our thinking that business leaders who study the future first and develop meaningful solutions will have better outcomes than those who sit back and wait for the dust to "settle."

Every leader must explore opportunities in their own field to harness these new ways of thinking and operating. Resilience, sustainability and future vision are not just environmental goals, but basic values that all businesses should embrace.

I hope you enjoy this report. And that you'll join RSI in our quest to change the future – for the better.

Troy Wright
Rethink Sustainability Initiatives (RSI) Chair

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CONNECTING THE DOTS

Overview

On June 10, 2019, more than 100 senior business leaders, investors, architects, engineers, scientists and board directors came together to discuss a crucial but often-overlooked phase in Canada's journey to reduce energy consumption and meet the United Nations' 17 Sustainable Development Goals (SDG): **the global opportunities for improving energy efficiency and other future-proofing solutions for new and existing buildings.**

Created by Toronto-based Rethink Sustainability Initiatives (RSI), the interactive Leadership Dinner Dialogue was designed to introduce key decision-makers to the latest thinking, research and technologies in building design, development and improvement, and motivate them to take immediate action in their own organizations and in their personal lives.

This report, the third in the 2019 series of RSI Thought Leadership reports, summarizes the key insights and recommendations of each of the speakers, as well as comments from the guests during our Open Forum Q&A, and other expert contributions from RSI.

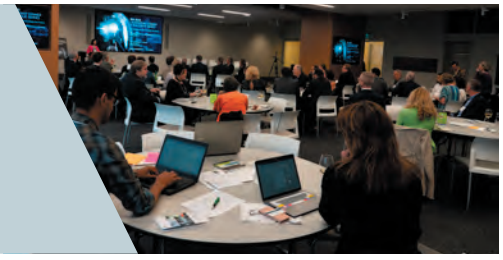
To kick-start the conversation, Darla Campbell, an RSI Board Director, noted that RSI's Leadership series are designed to connect leaders to shape a more positive future, share evidence-based insights, and encourage feedback, thoughtful reflection, and personal action. While climate change and sustainability can be daunting topics, RSI aims to simplify the conversation with actionable solutions to specific challenges and use cases. She urged everyone present to "Engage, Listen, Learn and Act."

FOUR NUMBERS

On behalf of the board, a founding RSI director Peter Love, president of Love Energy Consultants, connected the dots on the big opportunity in energy and buildings. He succinctly framed the challenge by citing four statistics and recommendations:

1. **81% of anthropogenic greenhouse gas (GHG) emissions in Canada come from the production and consumption of energy.** "So if we want to focus on climate change, it's essential that we focus on energy."
2. **Two-thirds of energy in Canada is wasted, mainly through transportation and conversion of energy from one form to another** (e.g., from chemical energy into thermal energy, as with a boiler or furnace). "Canada is an extremely wasteful society," Love said. "We will always have conversion losses, but it doesn't have to be two-thirds."
3. **30% of energy in Canada is consumed by buildings**. Modifying the design of new and existing buildings has been identified as probably the most cost-effective way to achieve GHG emission reductions.
4. **Every year Canada increases its stock of buildings by just 1% to 1 ½% (net)**. To reduce GHG, Peter Love noted, we need to refit existing buildings, because it will take a very long time to renew the country's entire building stock.

Peter Love's challenge: "Working together, we could reduce energy consumption in our buildings by 50%." He said the evening's speakers would demonstrate that this goal is not just achievable – but possibly too modest.



GLOBAL CONTEXT

Keynote Speaker: Dr. Yannick Beaudoin

Director-General for Ontario and Northern Canada, The David Suzuki Foundation, Vancouver

With a masters in economics and a PhD in marine biology, Yannick Beaudoin chose to analyze the climate challenge from a systemic perspective: Why is it so hard for societies to see the economic inevitability of adopting more sustainable practices?

Beaudoin's answer: Our economic system undervalues the benefits of sustainability. Governments gauge economic growth using gross domestic product (GDP), which measures the annual production of a country's goods and services. Yet this key indicator, whose ups and downs influence macroeconomic policies, counts only consumption, and not the value of assets such as clear air and water, or health and well-being.

In other words, he says, **"We have a foundational operating system that is not designed to deliver what we actually want."**

To truly become a society that prioritizes environmental health, social justice and real well-being, Beaudoin says we must "update our economic software" rather than continue to bolt-on external "Band-Aid" social and environmental policies.

"To create a more sustainable future, we must challenge the entrenched, outdated beliefs that prevent us from truly thriving."

HIGHLIGHTS OF BEAUDOIN'S REVOLUTIONARY THINKING:

- Societal ills such as poverty, hunger and climate change are the products of choices we have made. "Our system transcends the laws of nature. We confuse needs and wants."
- "I am not anti-growth, I am growth-agnostic. I would say that I'm anti-stagnation."
- "Unsustainability is cheaper... but only because of old rules"
- Simon Kuznets, a Nobel-winning Russian-American economist, created GDP as an economic-measurement. "But", says Beaudoin, "he warned never to use it to determine if you're doing well."
- Beaudoin also quoted Joseph Stiglitz, former chief economist with the World Bank, who noted that "A lot of what is called economics is not economics. It is more ideology or religion."
- Problems such as climate change persist due to siloed thinking in government and business. "We need to go to systems thinking we now have the technology to allow us to look at system-level pictures."
- In New Zealand, government ministries have just been ordered to plan budgets together to reduce silos and encourage a more integrated, "person-centred approach" to social policy.

We can develop a more human, inclusive society, "Are we innovative enough? Bold enough? Creative enough?" – Dr. Yannick Beaudoin

PART III

ACHIEVING SUSTAINABILITY WITH NEW BUILDINGS

REVOLUTIONIZING BUILDING DESIGN FOR A NET-POSITIVE FUTURE: "EVOLV1," CANADA'S FIRST ZERO-CARBON BUILDING

MODERATOR: Rachel Bannon-Godfrey
Principal, Sustainability Discipline Leader, Stantec

Adrian Conrad
Chief Operating Officer, Cora Group, Developer of Evolv1

Richard Williams
Principal, Stantec

SHIFTING THE CARBON PROBLEM FROM THE ABSTRACT TO THE CONCRETE

Rachel Bannon-Godfrey set the scene by noting that "Climate change is a big, scary, complex, daunting problem. How can we as people start to move the needle on this massive problem? How can we as business leaders move it from the abstract to something tangible, something actionable?"

Bannon-Godfrey said Stantec's solution is to design projects with community in mind. "By breaking down significant design challenges to the scale of how individuals are impacted, problems of great magnitude become solvable." She says the building blocks of such solutions are at our fingertips: the 17 United Nations Sustainable Development Goals (SDG).

Stantec has identified which goals it can directly impact through its projects, an initiative that was recognized in 2018 with an SDG leadership award from the UN's Global Compact Network Canada. As Stantec tracked and quantified its SDG impact, it identified carbon as the common thread – and its greatest opportunity to make a difference.

Sustainable communities are looking to net-zero models for master plans and housing. These incorporate innovative ways to modernize the grid, including on-site renewable energy sources and battery storage. As demand grows, these technologies will become more affordable, leading to higher air and water quality, thus even addressing the SDG goals related to public-health issues.

FIVE REASONS WHY NOW IS THE TIME TO INVEST IN ZERO-CARBON BUILDINGS, FROM BANNON-GODFREY:

- Costs of solar energy and energy storage are declining, making these technologies much more feasible;
- Building codes are becoming more stringent and demanding higher-performance projects;
- Big data is giving us the feedback to design more efficient buildings, because we can now better understand how buildings are actually being used;
- Creative financing structures are being developed that leverage the savings from lower energy consumption;
- "Bragging rights", says Bannon-Godfrey. "There is significant social currency to be able to say you have a zero-carbon building."

EVOLV 1: PURPOSE, VISION AND VALUES

As chief operating officer for The Cora Group, a family-owned developer of Class A office space, Adrian Conrad is passionate about preserving the environment for future generations, and a strong proponent of LEED and sustainable development. He says Cora has made a "lifelong commitment" to putting sustainability and climate action at the centre of all of its decision-making. After all, he said, "Climate change is the greatest threat to our world."

Conceived in 2015 and completed in November 2018, the 104,000 square-foot evolv1 is Canada's first certified zero-carbon tech community. Power is generated through an innovative geothermal-well system, and by more than 2,000 solar panels on the roof and in the parking lots. Located in the David Johnston Research + Technology Park in Waterloo's "Idea Quarter," evolv1 is now a net-positive energy building, generating 105% of the energy it consumes. Conrad noted it is also fully leased, which means Cora can start work across the street on evolv2.

Conrad, whose father founded The Cora Group, spoke of his personal experience with climate change. A few years ago, his family enjoyed a scuba-diving trip in the British Virgin Islands. He spoke glowingly of the giant tarpon teeming on the reef and said, "the whole place was like a movie." When Conrad returned to this paradise in May 2018, he was sad to learn that those reefs are in decline and this is what might become of reefs globally. This was especially concerning because coral reefs are home to over 25 percent of all marine life and are one of the most fragile and endangered ecosystems in the world.

Scientists have linked the increasing reef decline to ocean warming and increasing levels of carbon dioxide in seawater, due to climate change. "Coral reefs are the start of the food chain. If we lose the reefs, we lose the oceans," Conrad warned. "I know we can solve this crisis. But we've got to act now."

NAVIGATING ZERO-CARBON BUILDING DESIGN

While "Net Zero" is becoming the new focus for advanced building design, "Net Zero" cannot be business as usual," said Stantec Principal Richard Williams. "Our practices, participants and processes will need to change," he said, citing as a model Stantec's recent work with The Cora Group, the Waterloo, Ontario-based developer that recently completed evolv1, Canada's first zero-carbon office building.

TO BENEFIT FROM THE BEST NEW TECHNOLOGY AND DESIGN, WILLIAMS CITED THE DEVELOPMENT PROCESSES THAT HAVE TO CHANGE:

- Clear goal-setting must be the starting point. For evolv1, Cora Group established that the building would have to produce net-positive energy – yet still serve the local market at competitive lease rates. "This focused the viewpoint of the entire Stantec project team," said Williams. "Zero is zero. There is no close enough."
- A new vision of the design team. High performance is based on professional interaction and interdependence (like nature's ecosystems). A multi-disciplinary team is needed to identify and optimize dependencies – and is often the source of many innovations.
- A rigorous and deliberate design process. The process evolved through focused progression from passive-energy strategies to active strategies and then renewable strategies. Passive came first: What could we embed in the design that would reduce energy demand for the life of the building? Next came active systems, mechanical and electrical, with a focus on the most energy and carbon-efficient, and innovative integrated solutions. If the first two strategies are conducted effectively, then the final step renewable can lead to net zero (or even net positive energy).
- New tools. On evolv1, Stantec's parametric modeling tool enabled the modeling of a thousand iterations of diverse, interdependent parameters to identify optimal solutions.
- Don't forget the building tenants. To provide a healthy, productive workplace, designers need to understand the people inside, their needs and their potential energy demands. Tenants must also be given the tools to manage and optimize their own energy use so that they become an active, visible part of the solution.

This process, says Williams, allowed Stantec and Cora to create a building that gets its energy directly from the sun and the earth. It meets economic targets and can be widely replicated. Williams adds: "It is no longer business as usual."

Q&A

The question-and-answer session, moderated by Rachel Bannon-Godfrey, following these presentations elicited many illuminating comments.

Sustainability challenges that Adrian Conrad encountered on evolv1?

Conrad cited his concern that it would be hard to get the whole team – including contractors and sub-contractors – to be passionate about this project, but that proved the easy part. The tough part was getting approvals for the project's innovative systems: "We came up with concepts that the regulators hadn't seen before."

Given that many real estate clients talk about sustainability values, but don't incorporate them into their buildings, what is it like to have a client like Cora that's committed to net-zero?

Williams said that "It aligns the whole team. Too often, sustainability is this thing running along the side. Achieve as much as you can. That then leads to the easy path of tradeoffs, and you lose that commitment."

How can the building industry play a bigger part in addressing climate change?

"You have to start with sustainability as one of your key goals," said Conrad. "We all look to our clients, and sustainability may not be high on their priority list. I think that is changing, though. But the design industry has the tools – we just have to use them."

Are you seeing any signs that financial institutions are becoming more helpful on sustainability initiatives?

Conrad: "You see the banks saying that sustainability is important to them, culturally. But as a client looking to borrow money to finance projects, I have not found any more aggressive appetite to assist on the part of the banks."

After evolv1, what's next for you?

Conrad: "For me the exercise will be, how to more efficiently do a zero-carbon building. What can we learn from what we've done, and are there things we didn't have to do? For example, we may not have needed to do triple-pane windows to satisfy the zero-carbon rating. We want to build as efficiently as possible."

Williams: "Stantec is now finding a lot of interest from other clients in potentially net-zero projects. With what Adrian has proven with evolv1, it has really prodded the industry into moving forward."

PART IV

ACHIEVING SUSTAINABILITY WITH EXISTING BUILDINGS

MODERATOR: Marianne Lefever

Architect; Managing Partner, Healthy City Global

Jenn McArthur

Associate Professor, Department of Architectural Science, Ryerson University

Pratik Sharma

Global Director, Services and Performance Management, Armstrong Fluid Technology

EVERYTHING OLD IS NEW AGAIN

Over the next 30 years, new buildings such as evolv1 will showcase what's new and exciting in design and engineering, noted Marianne Lefever. But it's the retrofitting of older buildings that will produce the biggest impact on Canada's GHG emissions. Lefever is managing partner of Healthy City Global, an international consulting firm that produces healthier physical environments using data analytics and spatial strategies. In kicking off a panel on reducing the energy consumption of older buildings, she warned, "The majority of the building stock in 2050 will be buildings that exist today. We will not meet net-zero carbon emission without upgrading these buildings."

Fortunately, she said, new technologies enable innovative property owners, designers and suppliers to achieve deep energy retrofits that reduce energy consumption more significantly – and more economically – than we dreamed just a few years ago. As an example, she cited Energiesprong (translation: Energy Jump, Energiesprong.eu), a Dutch coalition of contractors, manufacturers, and housing corporations that uses 3D-printing technologies, pre-fabricated facades, advanced heating and cooling systems, and insulated solar rooftops to retrofit existing housing to net-zero emission status. Working with climate related financiers and local councils, Energiesprong uses a PACE financing model where the up-front costs are financed by subsequent energy savings.

Energiesprong's process even solves one of the biggest problems in energy retrofits: the need to vacate the building while renovations take place. Its energy makeovers take just a week and don't require residents to move out. Energiesprong has completed projects in the Netherlands, the U.K., Germany and France, and is now developing projects in New York State, Ontario and British Columbia. In 2018, Energiesprong won the World Green Building Council's Global Green Building Entrepreneurship Award.

"What I really like about this is how they looked at energy retrofits on a systems level," said Lefever. "It's not just insulation, or HVAC systems. It's the whole thing, combined with financing and operational costs. The whole package."

IMPROVING THE BUILT ENVIRONMENT: CURRENT RESEARCH TRENDS AND FINDINGS

Ryerson University architecture professor (and mechanical engineer) Jenn McArthur explores how to reduce the environmental impact of buildings through data analytics. To show what's possible today, she offered a "tasting menu" of her most cutting-edge research.

First, McArthur demonstrated sample political messages that indicate how some government figures no longer care to incent people to take steps to contain climate change. "So, what's the business incentive?" she asked. "Why should we make these decisions?"

She answered that question by revealing the results of a 2017 survey of major real-estate investors conducted by McArthur and her team. Asked what is motivating them to invest in energy efficiency, these developers said their biggest driver was "brand." Other major incentives were financial returns, the payback period, and tenant attraction – demonstrating that sustainability investments are already very attractive, both financially and reputationally. "We're seeing a shift," she said. "As people want to occupy sustainable buildings, and as people want to work for companies that have stated purposes, we're seeing that corporate sustainability actually has meaning behind it that goes beyond the bottom line."

McArthur cited Toronto2030Platform.ca as a promising joint initiative of Toronto private and public sector property owners. Given their shared goal of achieving 50% GHG reductions in all retrofit projects by 2030, the Canadian Urban Institute developed a digital map of central Toronto to monitor the changing energy consumption of buildings, and encourage energy conservation and innovation by individual property owners. While funding for the project was canceled by the Conservative government, McArthur hopes the project will continue in some form.

The need is huge. McArthur noted that four out of five buildings need renovation. And since five of every seven buildings in Canada in 2050 are already standing, this is a huge opportunity to reduce the country's carbon footprint. In fact, she said a colleague calculated that if all of Canada's worst-performing buildings could just be brought up to meet the average, "we could meet our Kyoto targets."

To show how easy this can be, McArthur cited her own work with Toronto startup Parity Go Inc. to make older residential buildings smarter. By putting sensors into condos and analyzing the data, they have created an "intelligent algorithm" that understands how each building performs, and uses weather forecasts to calculate the optimal control points for each site. Initial results were very revealing: "We got between 25% and 40% savings in real life, without touching anything but the controller on the boiler.

That was with a couple hundred dollars for sensors, some cloud-computing hardware and a few really great post-doctoral students."

"Five years ago, it was inconceivable we could do this," says McArthur. "This for me is the promise of AI. You don't have to go and buy millions of dollars' worth of sensors and integrated systems. There's a lot of things you can do as a starting point."

One more case: As building owners know, the efficiency of their systems degrades over time. McArthur says "smart and continuous commissioning" can produce more cost-effective system performance. "We're working on building an online system that can diagnose these problems, so you can actually address issues as they come up. You can't have to wait five or 10 years to realize your boiler has started to scale. You can actually see it in the data."

ACTIVE PERFORMANCE MANAGEMENT AND INTELLIGENT CONTROLS

Armstrong Fluid Technology is an 85-year-old Canadian supplier of innovative pumps and performance-management services, with more than 1,000 employees and offices on five continents. Headquartered in Scarborough, "we're one of Canada's best-kept secrets," says global director Pratik Sharma.

Based on Armstrong's cutting-edge technologies, it won't be secret much longer. The company's goal is to cut carbon emissions by making energy upgrades a no-brainer for building owners. "We can reduce clients' GHG footprint while keeping them cash-flow positive from the start," says Sharma. In 2018, Armstrong went a step further by committing itself to reduce its clients' GHG emissions by two million tons by 2022 – the equivalent of taking 600,000 cars off the road for a year.

Sharma went straight to the point: he wanted to show how upgrading and digitizing their mechanical plants can help building owners achieve their sustainability targets in one-third the time they'd normally expect. Like McArthur, Sharma says new technologies eliminate many of the costs and delays associated with energy retrofits. "You don't have to spend more or incur a loss to be sustainable."

Currently, up to 40% of buildings operate inefficiently, having "drifted" from their optimal performance or having never been properly commissioned in the first place. Whenever an operator hears from an angry tenant and adjusts the temperature manually, efficiency goes out the window. "This plant-energy drift costs the U.S. alone about $11 billion a year," says Sharma.

Why is this still a problem? Sharma and other Armstrong leaders interviewed building owners to find out why they feel locked into this cycle of waste. They identified five key concerns: the cost of capital; technology risks; system implications; tenant disruption; and, most importantly, a lack of transparency when new initiatives failed to produce the desired results.

To solve these problems, Armstrong's experts re-examined the "flow" through the HVAC system. "Knowledge and understanding of the fluid can actually give you a lot of insight," says Sharma. "We took all those learnings and added them into our products." Armstrong achieved such product "firsts" such as parallel sensor-less pumping and individual fingerprinting of each pump as it leaves the factory, providing what Sharma calls "feed-forward control" (rather than feedback control).

This predicts problems and fixes them before they happen. Armstrong then worked with IBM's Watson AI to shift these new data flows to the cloud, enabling what it calls "active performance management." With these analytics, "mechanical drift" becomes a thing of the past.

Armstrong's smart pumps help building owners maximize energy efficiency without hefty capital investments. When property managers decide to upgrade their HVAC systems, they often start with the biggest, most expensive components: their boilers and chillers. But without addressing the systemic problems, the savings you achieve on commissioning a new boiler will be lost in a few years.

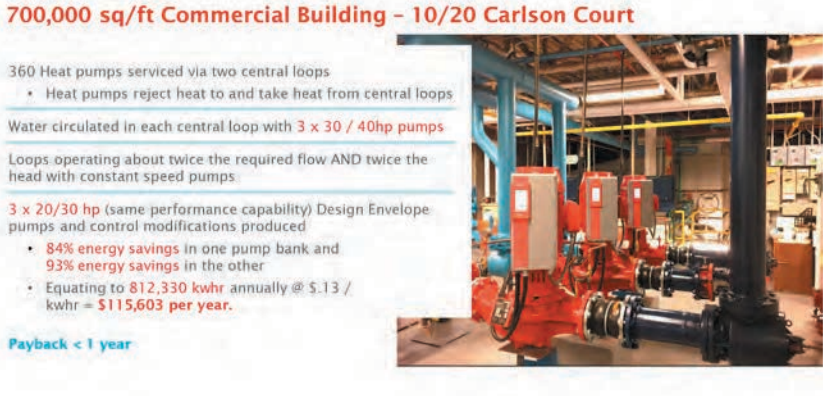
Armstrong's idea: start instead with the pumps, using sensors and AI to achieve instant (and ongoing) efficiencies that could cut your energy costs by up to 40%. Sharma says this journey triggers four new benefits:

- Your pump performance becomes more transparent;
- Managing the flow makes your tower and chillers more effective;
- Your investment is immediately cash-flow positive;
- You can use those savings to finance more expensive upgrades.

Noting that one event participant had asked for specific results, Sharma shared some case studies:

- A commercial building in suburban Toronto saves $115,000 a year, "just by starting with the intelligent pump." The payback: less than a year.
- Pump-first clients achieved annual energy savings ranging from 25% to 87%.
- A prominent Texas hospital adopted new pumps and Armstrong's plant-optimization processes, and saved over $300,000 a year. It recovered its costs in 1.5 years.

Final takeaways: Sharma says it's essential that environmental solutions tie in with the dollars: "A lot of times, economics seems to trump sustainability initiatives." He also recommends making energy-related investments cash-flow positive from day one. "That's very, very important because it makes decision-making a lot easier for building owners. And it makes things easier for a wider ownership base, not just those that have free access to capital. That is important if we are going to achieve our sustainability goals."



"Traditional, chiller-first retrofits don't work," says Sharma. "They don't free up cash flow for more projects." In fact, based on the savings his customers achieve, "more often than not, clients find that the chiller they need is actually a lot smaller than the chiller they had planned. And that makes a big, big difference."

Q&A

A short question-and-answer session was moderated by Marianne Lefever.

Many of the buildings we've discussed are vertical in orientation. How do your concepts apply to more horizontal buildings (such as shopping centres and industrial buildings)?

Jenn McArthur described work done by a thesis student at a big-box store in suburban Toronto that demonstrated the effectiveness of hybrid photovoltaic thermal panels (PVT), which combine solar cells that convert sunlight into electricity with solar thermal collectors, which transfer waste heat away from the PV module. They realized that creating a "district energy loop" could enable large horizontal buildings to generate heat for neighboring residential towers. "We're looking to pilot that out and see if it actually has legs," said McArthur. "As much as those of us who are more oriented to high-density development might loathe big-box stores, they might actually be our weapon against climate change."

Replacing pumps isn't taking a deep-retrofit approach. It's great to have a quick payback, but isn't that small compared to the total potential of existing building savings?

Pratik Sharma agreed that his presentation dealt mainly with low-hanging fruit. He noted that most building owners are happy to look for an "easy way out" when it comes to energy efficiency: "Changing out to LED lightbulbs is a lot easier than looking at the mechanical plant of a building." Lefever commented, "I think this shows how complicated energy retrofitting is. It's an and/and/and story, not an either/or."

With all our automation and building modeling, is there a risk that we might drown our good sustainability intentions in data? How can we make sure we use data to achieve better buildings?

McArthur said her first two post-doc students had phenomenal backgrounds in math and computer science – but were "absolutely the wrong people to be doing the job. We need people who understand buildings. You can learn machine learning, but if you don't instinctively understand how a building works, you're going to miss options." "The flood of data is real," Sharma noted. A smart building is triggering alarms at three or four times the rate of non-automated systems. "We need to figure out a way to humanize the data. And we need to make sure that systems and equipment are able to talk to each other." "Raw data is our enemy," McArthur agreed.

How can we leverage our sustainability efforts to make sure that people's health and well-being are taken into account in redesigning buildings?

Sharma responded that sustainability is a tool, not necessarily an end in itself. "We have to ask ourselves, how can we solve day-today problems with solutions that are sustainable?" McArthur noted that building engineers are often taught that healthy solutions – such as outdoor air – are "the enemy of sustainability." She had a student study building economics across North America and calculated there is a 10- to 40-times payback in productivity from investing in increased ventilation using fresh air. "It's even net positive in the Yukon." She concluded: "Let's not design for more sustainability. Let's just design better."

OPEN FORUM DIALOGUE

COMMUNICATION IS THE KEY!

MODERATOR: Yasmin Glanville

Founder and Board Director of RSI; Chief Innovation Strategist, Re-Ignite.ca

"First, I would define and share the problem," Fitzgerald said. "I would look for people who could help me. I would ask other people working in a similar vein and explore it myself."

Marianne Lefever noted that her data-analytics company, offers solutions that most business people don't know exist: "What do you do if you need something, but don't know that you need it yet? How do you let these very creative startups come to you?"

Today, Fitzgerald said, business thinking has to embrace two perspectives: "We can stand in the present, and deal with the issues we have, or we can stand in the future and look at the possibilities for the company we are running, and what the new solutions might be. I don't have the resources to define that, but I would want to go out and ask, 'Who are the people who can help me to find what that possibility is?'" You have to start within your own strategy and say, 'What's the sustainability of our business, and what's required to drive that forward?'"

Yannick Beaudoin of the Suzuki Foundation (DSF) noted that standard business conversations aren't enough. In his days as a marine scientist working with the United Nations, he said his organization created a series of "innovation labs" that included CEOs, government, academics, scientists and people from the arts. Each cohort met three times over the course of a year. Over time, trust built up and participants started interacting as people, not as their roles or the organizations they represent. By the third meeting they were really breaking through a lot of barriers of old thinking and getting on that 'edge' where they're learning not from the past but from the future.

Jenn McArthur of Ryerson added that, in six years working overseas in rural development, she learned that "the way to get things done is to figure out what the beneficiaries actually believe that they need. You don't start with building planning – because they have long paybacks, and nobody's going to start with that. You have to start with what they think they need – and that is usually, 'What is my low-hanging fruit?'" Vendors need to understand what clients really want: "Prove to me that if I give you a little bit of money, you can give me a little bit of savings." "It's a matter of taking the time to really understand people," McArthur said.

Peter Love of Love Energy Consultants linked the conversation to McArthur's earlier point, that reputation is a growing route to sustainability. "A lot of the people in the industry have been focusing on the dollars, ROI, or tonnes [of carbon] – which are all important. But I think most businesses are really interested in reputation." He also challenged the industry to demonstrate more links between energy performance and business productivity.

Much of the ensuing dialogue revolved around the role that pricing and taxation play in increasing the demand for energy conservation. But Pratik Sharma from Armstrong Fluid Technology noted that price is just one part of the equation. "It's not always the price of energy that is the tipping point. At the C-suite level, it may be the legacy they want to leave behind. Or it may be that the plant is so badly out of shape that it has to be upgraded."

Finally, Glanville asked each speaker for one key takeaway message. Here are some of the best:

Adrian Conrad of Cora Group said he has struggled with how to best market sustainability, so he was impressed with the evening's focus on branding and reputation as drivers of business demand. Now his job is to figure out how to communicate that message.

Marianne Lefever: "I hope in the near future we can design our cities for people and not for cars. Think of green spaces, think of air pollution, think of sound. What if our cities could sound more like forests than a car-manufacturing plant?"

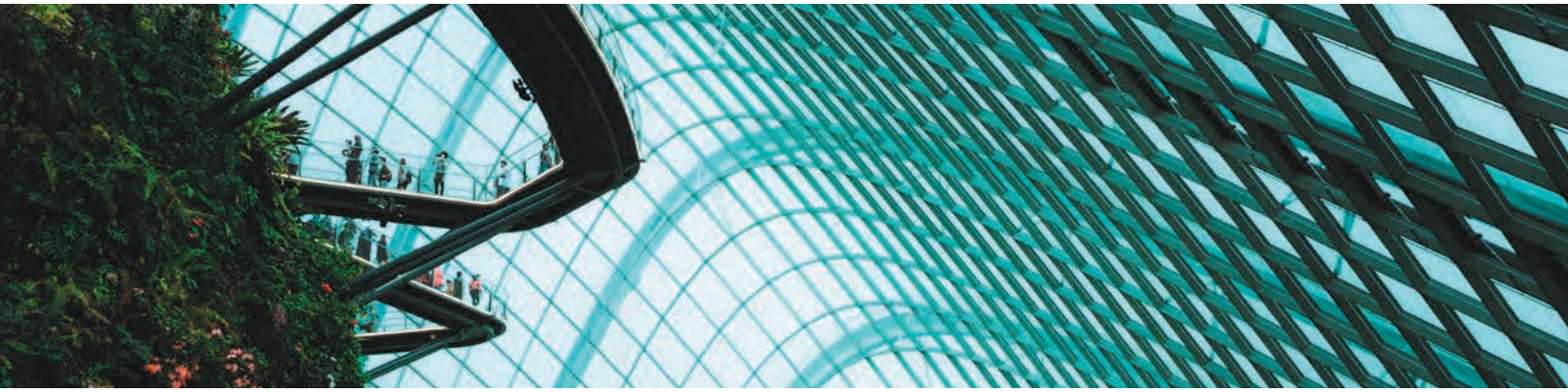
Jenn McArthur wished more people could develop impulse control. Her example: the marshmallow test, in which researchers offer four-year-olds a marshmallow but promise that if they wait 10 minutes before eating it, they will get a second one. Long-term research shows that those subjects who defer gratification had more successful lives, based on indicators such as better high-school scores, lower drug use and decreased teen pregnancies. "I wish every single human on this planet could pass the marshmallow test," said McArthur, so more people would make tough decisions today to create a better future.

Rachel Bannon-Godfrey said she wished she had learned earlier that climate change is a human-rights issue. "Climate change threatens every single basic human right that we have as people. We cannot talk about equity or human rights unless we address climate change."

Peter Love: "I think there's an important role for government to play. But they are only going to play it if they are forced to. We have to hold the politicians accountable." How to do that? "Bring it up at campaign meetings, talk to the people who come to your door, write to the papers, talk to your kids, be an influencer in your community."

Darla Campbell: "My wish is that in five years' time, there would be no more barriers to innovation in the energy space. A lot of gatekeepers don't let us do what we need to do because they haven't been done before. It's time for us to stop defending what we did in the past. We did the best with whatever resources we had. So, my hope is that we begin today, collaboratively working together, to move forward in this more positive light."

FUTURE OUTLOOK



This section provides additional insights from Cristian Hurtado and Peter Love on Energy and Job Creation; and Paul Dowsett on Cutting Carbon out of Construction.

JOBS, JOBS, JOBS: The human side of energy efficiency

Special economic preview by Cristian Hurtado and Peter Love

While climate change threatens the entire globe, it also presents an opportunity to change for the better. At the same time, as we upgrade our processes and clean up our environment, these activities will also create thousands of new and highly skilled jobs.

According to Clean Energy Canada, Canada's clean-energy sector grew 33% more than the broader national economy during the seven years prior to 2017. A new study from the Environmental Careers Organization of Canada, which defined the energy efficiency industry more broadly by including the construction, manufacturing, wholesale trade, professional and business services, utilities, and other services industries found the energy efficiency industry employed 436,000 people across Canada in 2018. Today, 1 in 50 Canadians are working in the energy-efficiency industry.

And we're just getting started. A 2018 study from Dunsky Energy Consulting, commissioned by Efficiency Canada, concluded that the 2016-2030 period would see average annual job creation of 118,000 in Canada's energy-efficiency industry alone. (Note that these figures represent net jobs, taking into account job losses in other industries.)

The Pan-Canadian Framework on Clean Growth and Climate Change (PCF) encourages creating jobs in sustainable industries, such as energy efficiency. In fact, the Environmental Commissioner of Ontario estimates that the PCF's energy-efficiency recommendations will yield net growth of about

53,000 jobs by 2030 in Ontario alone. Ontario currently ranks behind Alberta based on the number of people employed in the energy sector, but that may be shifting. There are already more people employed in direct clean energy than in the oil sands, according to the Ontario Ministry of Economic Development, Job Creation and Trade, and employment across the full cleantech sector continues to climb.

However, this article is about more than just Ontario. Energy efficiency's positive impact on the job market is being felt Canada-wide. Energy Efficiency Alberta reports that in 2017, Alberta saw over 2,300 jobs created through investments in energy efficiency. On the east coast, more than 1,400 people were working on Efficiency Nova Scotia projects in the same year, with more than 200 local businesses receiving training and support for their employees.

As Canadians seize more opportunities in energy efficiency, the momentum must be maintained. If a transition to a more financially resilient, environmentally friendly, and socially equitable Canadian economy is to happen in time to mitigate the effects of climate change and social injustice, sustained action is needed on the efficiency front. We call on you, the reader, to join Efficiency Canada by signing up for its energy-efficiency initiative, Our Human Energy (https://ohe.efficiencycanada.org/join/). You'll become part of an engaged efficiency community, and you'll be reminding policymakers that energy efficiency needs to become a political priority.

Figure ES-1: Total annual net employment in Canada by industry segment (2017-2030) – PCF Scenario

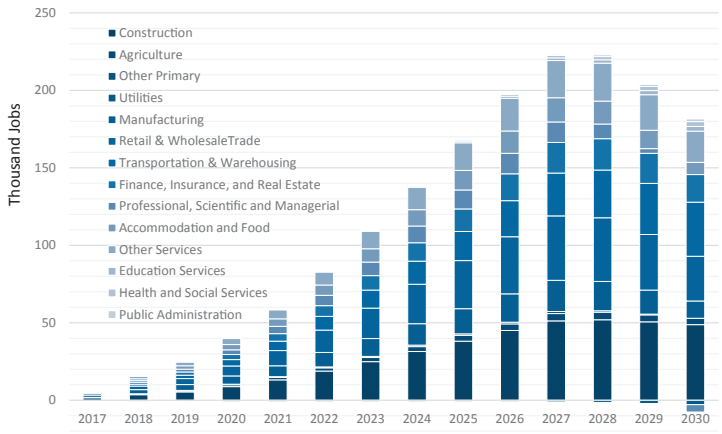


Figure 1: Total annual net employment in Canada by industry segment based on the Pan-Canadian Framework requirements (2017-2027) (Dunsky Energy Consulting, 2018)

Cristian Hurtado is a recent graduate of York University's Master of Environmental Studies program with a Business & Environment specialization from the Schulich School of Business. He is a volunteer researcher for RSI. Peter Love is an adjunct professor at York University where he has designed and taught a course on energy efficiency policies and programs. He is active on a number of boards, and is a founding director of RSI.

WE MUST CUT CARBON OUT OF CONSTRUCTION – NOW!

By Paul Dowsett, OAA, FRAIC, LEED AP

Principal Architect, Sustainable. Architecture for a Healthy Planet.

Five months. That's all we have to transform as an industry. Seventeen months if we're being generous.

And transform we must! There is no Option (or Planet) B.

Being an architect, I look at my own industry, to determine the state we're in and, more importantly, to propose how we can and must change.

The act of city-building would not be possible without the entire construction industry: building owners and managers, architects and engineers, general contractors and tradespeople, and material manufacturers and suppliers. And when it comes to the climate crisis, all of us as "city builders" have an important role to play.

But that role has to change. We must cut carbon out of construction – now!

"Pollution" from the construction industry looks like this: Massive amounts of carbon dioxide emitted into the atmosphere, during both the construction of a building (embodied carbon) and during the lifetime operation of a building (operational carbon).

We as a group must do our part to mitigate the climate crisis. These massive carbon emissions must stop. Here's why and how.

WHY WE MUST CHANGE

According to a 2017 report by the World Green Building Council (WorldGBC), the global construction industry, which is responsible for 30% of global greenhouse gas emissions (roughly equivalent to those of China) must operate at "net zero carbon" by 2050 if growth in global warming is to remain under two degrees Celsius, the limit enshrined in the Paris Agreement.

Not only that, but – according to the report – "Every building on the planet must be 'net zero carbon' by 2050 to keep global warming below 2°C." This means every building… new or existing.

Further, it is likely that in 2017 the WorldGBC was only considering operational carbon, and not embodied carbon.

How can we transform both the operation of existing buildings and the construction of new buildings to emit no carbon?

HOW WE WILL CHANGE – EXISTING BUILDINGS AND ADAPTIVE REUSE

There is nothing we can do to reduce the embodied carbon in existing buildings; it was emitted during construction. But we can respect that carbon was emitted, and maintain the building's structure by retaining it as-is or transforming it through adaptive reuse. To demolish that structure would only emit more carbon through construction of a replacement building.

Further, we can retrofit an existing building so that it is optimally energy-efficient, thus reducing its operational carbon going forward.

To reduce operational carbon, in Ontario we could electrify everything — both new and existing buildings. We have one of the planet's most carbon-clean electrical grids.

EMBODIED CARBON IS BECOMING SIGNIFICANT

WE'RE CATCHING ON TO THE IDEA THAT EMBODIED CARBON IS SIGNIFICANT, ESPECIALLY AS WE DEVELOP MORE ENERGY-EFFICIENT BUILDINGS.

I appreciate architect Lloyd Alter's April 2019 blogpost at Treehugger, in which he reveals he is not a fan of the term "embodied carbon," because it hides the urgent need to deal with the carbon emitted in the construction process. Instead, he suggests we all use the term "upfront carbon emissions," because "that's what they are."

In an article in Canadian Architect magazine, Anthony Pak states that "The importance of embodied carbon becomes even more evident when you consider that, according to the Intergovernmental Panel on Climate Change, to limit global warming to 1.5°C, carbon emissions

would need to peak next year in 2020 and then go to net zero globally by 2050. Given that embodied carbon will make up almost half of total new construction emissions between now and 2050, we cannot ignore embodied carbon if we want to have any chance of hitting our climate targets."

2020 is just a few months away now. We have only a year to reverse the growth of global carbon emissions!

We cannot ignore any longer that the processes of manufacturing concrete, steel, and asphalt — the assumed foundations of our construction industry — are huge emitters of carbon. Writing in The Guardian, Jonathan Watts calls concrete "the most destructive material on earth."

What can we use instead? A forest — the "wood factory," if you will — is a carbon-sink, drawing carbon from the atmosphere, thus helping reduce carbon emissions. According to Project Drawdown, citing a 2014 study, "Building with wood could reduce annual global emissions of carbon dioxide by 14% to 31%."

The construction industry can, and must, change.

Getting designers and builders to convince the concrete, steel, and asphalt industries to give up their predominant positions, however, will be a challenge on par with persuading petroleum producers to give up theirs. They are all big and powerful, and not terribly willing to change.

But there is hope! A promo piece by Sweden's Skanska, the world's largest construction firm, encourages us to: "Think of a world where fantastic buildings … are created … giving [people] great places to live and work in, and where the CO2 impact during construction is … well. There isn't one. That would be a future we could really look forward to."

ATTENTION: CITY REBUILDERS!

Bringing the embodied and operational carbon of buildings to zero is hard, but it is necessary for our survival. We must embark on a program of city REbuilding, and we must do it now!

In a recent post at Medium.com, writer Marta Brzosko said it best:

"We are all on this sinking ship together — and we are afraid. That's only natural. But this is precisely why it's the time to find courage. The courage for acting and speaking about the climate crisis, no matter how uncomfortable it may be. Because, as Greta Thunberg says, our house is on fire. And to ignore the fact that your own house is burning is just ridiculous."

Read more here:

https://www.sustainable.to/blog/2019/8/12/we-must-cut-carbon-out-of-construction-now

CLOSING STATEMENTS

As with all RSI thought-leadership reports, we welcome comments and other inputs from all senior and emerging investors, entrepreneurs, experts and influencers who believe in the vision of a more sustainable and resilient future.

The insights featured in this report provide scalable, actionable solutions for advancing a low-carbon, net-zero-energy future in the context of energy, buildings and communities. Although the primary focus is Canada, some of the referenced case studies and best practices come from other parts of the world too.

The cited strategies and solutions also support relevant UN Sustainable Development Goals (SDGs).

In addition to this report, all of our RSI projects and services support the UN SDGs, with a common focus on **climate action and building partnerships** within and across different sectors and places to drive those goals.

CONTINUING THE CONVERSATION – MOBILIZED BY ACTION.

RSI calls on decision-makers and experts across all sectors of business and society to join the mission to promote, imagine and create a smarter, more sustainable future.

Be open to collaborating with other partners to accelerate the discovery, creation, use and advancement of sustainability and future readiness solutions.

Step up to the Sustainability leadership challenge within our circles of influence.

Translate solutions into action from the inside out. Within our organizations and communities. In the buildings and energy systems we invest in, design, build and/or manage and improve.

So how is RSI positioned to support climate action and to partner with leaders to shape a better future?

RSI is a trusted "think-do" knowledge exchange and connector for leaders and influencers across all sectors and disciplines, and influencers to support ONE MISSION: to discover resiliency, and prosperity to thrive into the future.

BECOME AN ACTION PARTNER:
ONE MISSION. TOGETHER!

INNOVATION ZONE

These three forward-thinking organizations showcased future-ready energy and building solution products and services in the RSI Innovation Zone, highlighted below. More information about these companies and their solutions is available from their websites and contacts.

ARMSTRONG FLUID TECHNOLOGY

For more information:
www.armstrongfluidtechnology.com

HONEYWELL

Honeywell Building Technologies (HBT) creates products, software, and technologies found in more than 10 million buildings worldwide. Commercial building owners and occupants use our technologies to ensure their facilities are safe, energy efficient, sustainable and productive. We bring together the physical and digital worlds to tackle some of the toughest business and societal challenges. We specialize in the things that are critically connected. Beyond smart phones and laptops, we make the connections that keep cities working, planes flying, factories running and workers safe.

For more information:
www.honeywell.com

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As designers, performance is at the heart of what we do. We help clients realize the full potential of their project life cycle cost, energy efficiency, carbon reduction, and human health and wellness. We believe sustainable design can defy expectations and propel our communities into the future. Informed by data and the market, we design to support human resilience, health, and wellness while delivering value through life cycle cost analysis and reduction of energy and carbon use.

Our integrated approach considers climate and site, performance modeling, passive and net-zero design, WELL Building criteria, LEED® certification, and post-occupancy assessment.

Dillon is an established, employee-owned professional consulting firm at the intersection of planning, management, engineering, and environmental science. With 18 offices and over 800 employees across Canada, Dillon offers a wide range of services related to building and improving facilities and infrastructure, protecting the environment, and developing communities. Dillon is committed to sustainability and social responsibility. Dillon has been carbon neutral since 2008; and, is committed to the UN Global Compact to align our operations with universal principles such as the Paris Climate Agreement and the 17 Sustainable Development Goals.

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MSI Group Ltd. is an energy engineering firm, specializing in energy data analytics and management – backed by a proven track record of helping clients optimize the value of their energy investments with a comprehensive energy strategy to drive results. Our Core expertise centers around in Building Systems & Asset Optimization: Clean Energy, Energy Strategy & Planning and Future Readiness.

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Enwave Energy Corporation, together with its affiliates, is a fully integrated, sustainable energy services provider owned by Brookfield Infrastructure and its institutional partners. With assets in Toronto, Chicago, New Orleans, Houston, Las Vegas, Los Angeles, Seattle, Portland, Windsor, London, and Charlottetown, Enwave operates intelligent thermal energy systems that generate, store, distribute and share energy in its different forms across all of its communities.

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CONNECTING LEADERS TO SHAPE THE FUTURE

FOR MORE INFORMATION AND TO CONTINUE THE DISCUSSION

If you are interested in discussing this report, engaging our RSI and Partner experts to be a speaker for your events and/or to learn about Rethink Sustainability, send us a note at: **Communications@rethinksustainability.ca**

For more information about RSI: **www.rethinksustainability.ca**

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