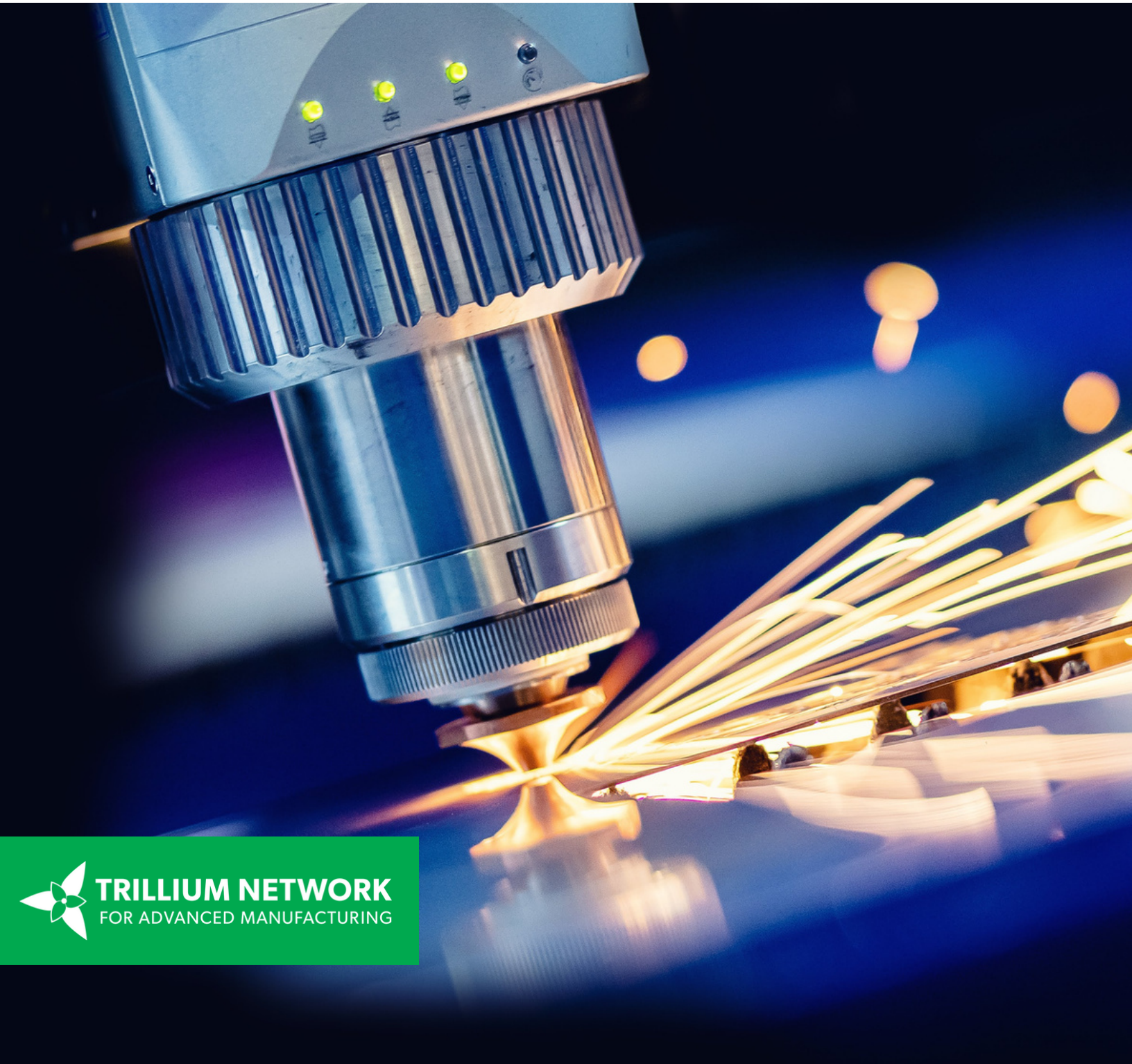


ANNUAL REPORT 2022-2023



TRILLIUM NETWORK
FOR ADVANCED MANUFACTURING

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MESSAGE FROM THE CHAIR

Watching the Trillium Network for Advanced Manufacturing evolve over the four years I have served as the chair of the organization's board of directors has been greatly rewarding. These short four years spanned a global pandemic and two of the most significant generational investments in our province's history. The Trillium Network's board, and team members, have emerged as the preeminent source of independent, authoritative, and forward-looking research and thought leadership on Ontario's advanced manufacturing ecosystem.

The Trillium Network has achieved this distinction through its ongoing company profiles, asset mapping, collaboration with Ontario Global 100, and more recently through the organization's economic impact analysis and podcast, 'Making it in Ontario.' These initiatives have served Ontario manufacturers, governments, and ecosystem partners well, and will continue to do so moving forward.

I would like to take this opportunity to thank our excellent board members for their hard work and dedication. This was on display throughout 2022 as we underwent a strategic planning exercise to help chart our path forward.

I would also like to thank Ian Howcroft, the CEO of Skills Ontario and a Trillium Network board member since its inception, for his efforts over the years. Ian is stepping down this Spring, although we all suspect we will continue collaborating.

As the Trillium Network nears its 10th anniversary, its impact is clear. The importance is clear of supporting decision makers charting the way forward for the advanced manufacturing ecosystem in Ontario.

Here's to a great year ahead,

BEN WHITNEY

Chair of the Board

Trillium Network for Advanced Manufacturing



MESSAGE FROM THE MANAGING DIRECTOR

What a year it was for the Trillium Network for Advanced Manufacturing, and for Ontario's advanced manufacturing ecosystem. As we emerged from the COVID-19 pandemic, our ability to engage with partners and stakeholders in real life propelled our organization to its most productive period yet. This was also made possible by our dedicated staff and board, and by the ongoing support of the Ontario Ministry of Economic Development, Job Creation and Trade.

After years of uncertainty regarding the future of advanced manufacturing in Ontario, the unprecedented number of investments announced by existing and incumbent companies is evidence of a bright future. We are excited to have played a role in supporting these efforts through our growing body of knowledge. That said, it is important to remember that when it comes to advanced manufacturing, there is always work to do. This is much better than having none.

I am proud of our team and our achievements over the past year. The listenership of our podcast, Making it in Ontario, continues to grow as we engage with guests from companies such as MDA, Linamar, and Eclipse Automation.

Our augmented TrilliumGIS remains the most comprehensive and accessible source of information about manufacturers in Ontario. We have made a name for ourselves through collaborative efforts with NGen, Clean Energy Canada, and the APMA to support the transition to electric vehicle manufacturing.

While looking back at our recent accomplishments is important, it is even more important to look ahead. We are especially excited about leveraging our automotive industry expertise to support Ontario's world-class aerospace and beverage industries, contribute to developing a manufacturing strategy for the province, and continue supporting our partners.

Until soon,

BRENDAN SWEENEY

Managing Director

Trillium Network for Advanced Manufacturing

VISION

To be the preeminent source of independent, credible, and forward-looking research and thought leadership related to Ontario's advanced manufacturing ecosystem.

MISSION

To produce and disseminate objective data-driven research to raise awareness of emerging trends in Ontario's advanced manufacturing ecosystem and to facilitate and lead collaboration among industry stakeholders and ecosystem partners.

VALUES

- Objective and innovative approaches to research and collaboration that are free from bias;
- Accessible, responsive, collaborative, and transparent;
- Respectful of the diversity of perspectives among stakeholders and partners

The Trillium Team

BOARD OF DIRECTORS:

The Trillium Network for Advanced Manufacturing is governed by a Board of Directors chaired by Ben Whitney. Board members include Ian Howcroft, Paul Madden, Jayson Myers, Alison Newton, Scott MacKenzie, and Darryl Spector.

STAFF (2022-2023):

Natasha Bartlett, Program Manager
Denise Deschênes-McKay, Associate Director (Operations)
Andrew Horne, Program Officer
Danielle Gagnon, Financial Administrator
Greg Keenan, Editor and Strategic Adviser
Riley Kemp, Program Officer (GIS Specialist)
Shannon Miller, Program Officer
Luiza Moczarski, Marketing & Communications Manager
Samy Otero, Senior Website Developer
Cliff Patterson, Strategic Data Manager
Nick Persichilli, Communications Officer
Erman Sener, Associate Director (Research)
Brendan Sweeney, Managing Director

WHAT WE DO:

Our work focuses on the following areas:

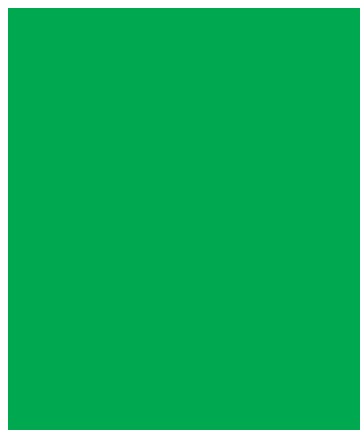
Industry 4.0: how manufacturers are adopting and developing technologies such as digital twins and artificial intelligence.

The Manufacturing Workforce: DEI and best practices among Ontario manufacturers.

EVs and the Automotive Industry: the impact of electrification on Ontario's automotive industry.

Success Stories: profiles and podcasts featuring innovative Ontario manufacturers.

Asset Mapping: building the most comprehensive and accessible database of Ontario manufacturers and ecosystem partners.





Partners & Stakeholders

2022-2023 PERFORMANCE REPORT

The past year was the Trillium Network’s most productive ever. Some of our feature initiatives included:

- Engaging with manufacturers and ecosystem partners through company profiles and our podcast, ‘Making it in Ontario’;
- Several reports focused on a range of subjects, including the EV supply chain, Industry 4.0, and Ontario’s craft brewing industry;
- A series of data bulletins that draw upon manufacturing-related statistics, including workforce demographics, technology adoption, and economic multipliers;
- A revamped version of TrilliumGIS, the organization’s online asset mapping platform, and;
- A series of data-related projects to support MEDJCT automotive and aerospace investment attraction and business retention initiatives.
- An economic model and analysis of Canada’s EV battery supply chain, in collaboration with Clean Energy Canada; and
- A report that examines the strengths, gaps, and opportunities for Brampton’s food and beverage industry.

Our ability to draw upon our body of knowledge and expertise to support partners and stakeholders at a fraction of the cost charged by private sector consultants has emerged as a unique competitive advantage.



Data Bulletin

What is advanced manufacturing?

A recent report from Canada's Economic Strategy Tables recommends that 'All manufacturing in Canada should be advanced manufacturing!' We tend to agree.

The report, however, does not actually define advanced manufacturing despite invoking the term no less than 42 times. The practice of using the term 'advanced manufacturing' without defining it is common. Last year, the Trillium Network pointed out that, at best, no consensus definition of advanced manufacturing exists. In light of this, our board of directors encouraged us to define advanced manufacturing on our terms to guide our efforts and those of our partners that seek to support manufacturers throughout Ontario and across Canada.

At the highest level, advanced manufacturing is “the use of innovative technologies to improve products or processes, with the relevant technology being described as ‘advanced’.” (Thanks, Wikipedia). Innovative technologies are central to advanced manufacturing. Agreed.

A BCG report provides more insight: ‘The term advanced manufacturing has been around for decades and means many things to many people. We define advanced-manufacturing technologies as a set of highly flexible, data-enabled, and cost-efficient manufacturing processes.’ There are three important points here. First, the term advanced manufacturing is not new. Second, no consensus definition exists. Third, contemporary advanced manufacturing involves using data-enabled technologies, many of which are synonymous with Industry 4.0.

The U.S. Food and Drug Administration (FDA) recently provided some valuable perspective on the question. From that vantage point, advanced manufacturing is ‘a collective term for new medical product manufacturing technologies that can improve drug quality, address shortages of medicine, and speed time-to-market.’ They also note that ‘Every field has a different set of production techniques that are considered advanced. They often: 1) integrate novel technological approaches, 2) use established techniques in a new or innovative way, or 3) apply production methods in a new domain where there are no defined best practices or experience.’

Three concepts within the FDA’s definition are welcome and apply to advanced manufacturing more broadly. First, there must be something new or novel about a technology or its application for it to be considered advanced. Second, advanced manufacturing techniques differ based on context or industry. What may be advanced in pharmaceutical manufacturing may not be advanced in aerospace, and vice-versa. Third, advanced manufacturing technologies are those applied to solve a particular problem. In the FDA’s case, these are related to drug quality and shortages of medicine. The idea that advanced manufacturing technologies should be developed and deployed purposefully—to address problems, and improve societal well-being—is central to our definition.

Although the Economic Strategy Table report does not define advanced manufacturing, it offers two important takeaways. First, the report assumes that not all manufacturing is advanced. Some manufacturers, and some industries, are far more advanced than others. Second, it concludes that advanced manufacturing is ‘innovative, fair, and sustainable.’ We take this to mean that in addition to technological innovation, advanced manufacturers treat employees well and adhere to good ESG practices.

Advanced manufacturing therefore involves the successful achievement of business objectives by developing, producing, or adopting new and novel technologies. Today, many of these technologies are digitally-based and associated with Industry 4.0. In the future they may build on a foundation of digital manufacturing and include technologies associated with cognitive computing and Industry 5.0. These technologies are related to manufacturing process innovation, to product and material innovation, or to other elements of the business, such as human resources, logistics, or finances. It is important to note that advanced manufacturers do not develop, produce, or adopt these technologies for technology’s sake. Rather, they do so to achieve specific business objectives and, similar to the FDA’s definition, to address a particular problem or achieve progress with societal well-being in mind. Finally, advanced manufacturers adhere to good ESG and employment practices.

In short, our definition of advanced manufacturing features three pillars:

1. Technological innovation that is new and novel in pursuit of business objectives that aims to;
2. Solve problems that improve societal well-being, while;
3. Adhering to good ESG and employment practices.

Measuring all of this can be challenging. We have, however, developed a technique to do so at an industry level. The primary metrics that we focus on include productivity, investment, R&D intensity, STEM intensity, and employee earnings. This helps locate Ontario's advanced manufacturing strengths and identify those industries that require more support.

Based on our analysis, the industries where advanced manufacturing is most common include pharmaceuticals, chemicals, aerospace, petroleum (i.e. oil refineries), and machinery (i.e. the companies that design, produce, and integrate advanced manufacturing technologies).

This does not mean that advanced manufacturing is absent in other industries. In fact, the Trillium Network aims to identify and learn from leading advanced manufacturers in these very industries, as evidenced by our profiles of such companies as Myant, QTK Fine Cabinetry, and Ozery Bakery.



If the Trillium Network and our partners hope to raise awareness of advanced manufacturing in Ontario, support the growth and competitiveness of advanced manufacturers, and promote advanced manufacturing as a career choice, it is important to clearly define what advanced manufacturing is (and what it is not). Ontario manufacturers face challenges related to productivity and tight labour markets. Advanced manufacturing technologies offer a solution to both challenges in that they simultaneously increase productivity and business performance while improving job quality. Moreover, advanced manufacturing technologies are being deployed throughout the province to address a series of societal issues, including housing, pollution, food insecurity, and shortages of medicine and PPE.

We welcome further discussion and debate related to our definition of advanced manufacturing, especially when that discussion and debate is informed by data. Please contact us to learn more.

Advanced Manufacturing Metrics, Select Industries

Industry	Productivity	Productivity Δ	CapEx	R&D	STEM	Earnings
Pharmaceuticals	✓	✓	✓	✓	✓	✓
Chemical	✓	✓	✓	✓	✓	✓
Aerospace	✓		✓	✓	✓	✓
Machinery	✓	✓		✓	✓	✓
Petroleum	✓		✓	✓	✓	✓
Primary Metals	✓		✓	✓		✓
Vehicle Assembly	✓		✓	✓		✓
Electronics		✓		✓	✓	✓
Non-Metallics	✓	✓				✓
Automotive Parts	✓	✓			✓	
Other Transportation	✓					✓
Food	✓	✓				
Wood Products		✓		✓		
Paper	✓					✓
Beverage	✓					
Textiles				✓		
Clothing		✓				
Furniture		✓				
Miscellaneous		✓				
Printing						
Plastics and Rubber						
Fabricated Metal						

Key Initiatives

‘Making it in Ontario’ Podcast

‘Making it in Ontario,’ the official podcast of the Trillium Network for Advanced Manufacturing, entered its second year. Over the course of the year, the podcast featured prominent guests from Ontario manufacturers and ecosystem partners from diverse industries. Listenership increased as the year went on, as did the quality of the conversations.

Some of the guests on ‘Making it in Ontario’ over the past year included:

- Mike Greenley, MDA (Brampton);
- Jeff Cowling, Yorkville Sound (Pickering);
- Derek Vella, Guelph Food Innovation Centre (Guelph);
- Diane Burchett & Sarah McKenzie-Picot, Kepler Communications (Toronto); and
- Paul Miller, Precision Record Pressing (Burlington).

There is much more in store for the upcoming season of ‘Making it in Ontario,’ featuring guests from major Tier 1 automotive parts manufacturers, nuclear automation equipment manufacturers, and senior public sector leaders.



Key Initiatives

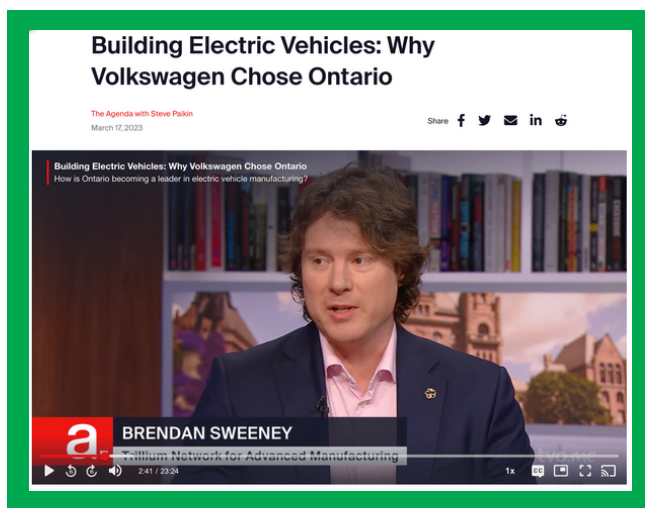
The Economic Impact of the Transition to EVs

Over the past year, a series of new investments in the electric vehicle (EV) battery supply chain were announced, seemingly on a monthly basis. The most prominent of these included battery cell and module manufacturing investments announced by NextStar Energy (a joint venture between Stellantis and LG) in Windsor and PowerCo (a subsidiary of Volkswagen) in St. Thomas. All signs point to further investments in EV assembly, component manufacturing, battery materials, and mining in the near future.

To better understand the impact of these investments and the broader transition, the Trillium Network for Advanced Manufacturing developed an economic model of the EV supply chain in collaboration with our partner Clean Energy Canada. The model, and the report on which it was based, have become the preeminent source of information for stakeholders seeking to better understand the economic impact of the broader EV battery supply chain and its various nodes.

The outputs of this collaboration have received considerable attention from the media and government alike. These include Brendan Sweeney's second appearance on TVO's The Agenda in as many years and our analysis being cited publicly by federal Minister François-Phillipe Champagne at the recent Volkswagen investment announcement in St. Thomas.

We look forward to continuing to draw upon our economic model to support and inform ongoing investment initiatives and programs.



Firm Profile

Mitrex



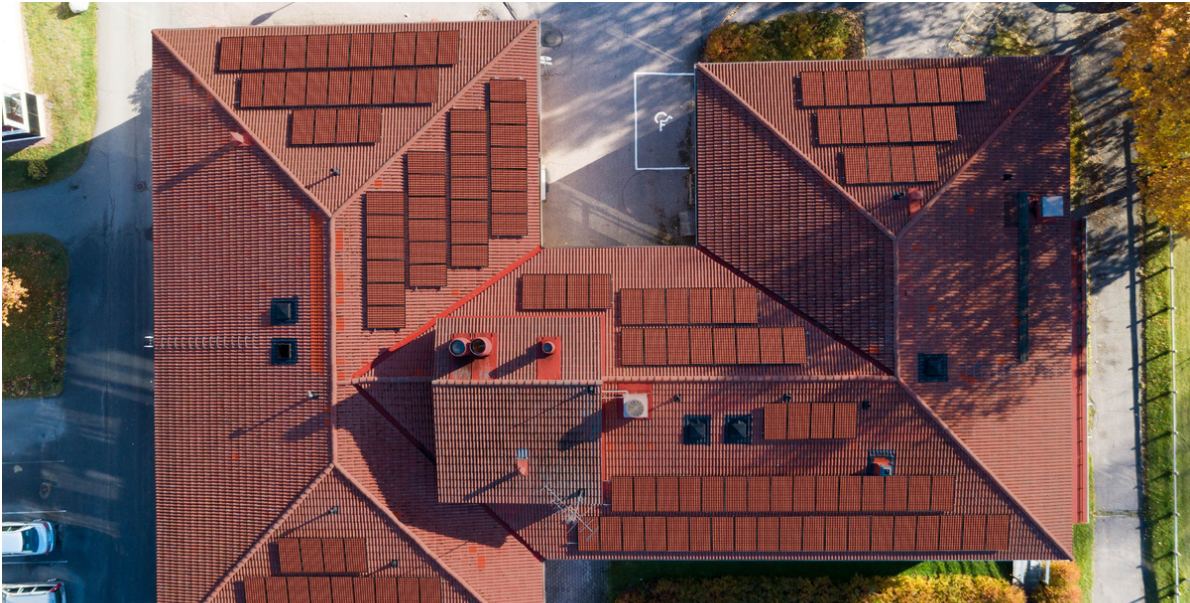
Founded in 2019, Mitrex brings together two well-established products—solar panels and building cladding—and combines them to build something novel. The product, which is called building-integrated photovoltaics (BIPV), was launched after four years of research and development. Now employing 100 people at its near-fully automated facility in the Toronto suburb of Etobicoke, the company is the world’s largest manufacturer of BIPV.

“Construction has a vital role in creating sustainable cities,” Mitrex CEO Danial Hadizadeh says. There is a growing pressure on residential and commercial developments to become more sustainable, he explains. The path to achieving that involves reducing grid energy consumption through use of solar power. But negative perceptions about the appearance of traditional solar panels and the limited space roofs provide for their application put barriers on harnessing that power.

The idea behind Mitrex was to overcome these barriers through innovation. The company’s first key innovation was the development of photovoltaic panels that can be mounted on walls the same way as cladding. This allows a building’s vertical surfaces, which are often vastly larger than the roof areas traditionally associated with solar panel applications, to generate electricity.

The second key innovation was customizing the appearance of photovoltaic panels. Using state-of-the-art equipment and a proprietary technique, the company can infuse virtually any kind of colour and pattern into the tempered glass that covers the panel. Efficiency loss resulting from this integration was a concern. In response, the company invested heavily in R&D to limit that loss to about 10 per cent compared to traditional solar panels. That loss is often offset by the additional solar power generated through the use of a building's vertical surfaces.

Competing in the photovoltaic products market as a North American manufacturer is not easy considering that a majority of these products are currently produced in jurisdictions with extremely low labour costs such as China. But Mitrex is a testament that a Canadian company can compete in this market. The requirements: a high degree of production automation and products that have innovative features and superior safety and quality standards.



■ Image Credit - Mitrex

The current setup at Mitrex's facility contains three separate production lines that together achieve close to 95 per cent automation. Achieving that high level of automation was made possible through a \$200 million upfront investment in state-of-the-art machines and technologies purchased from suppliers all across the world, mostly from companies outside North America. Hadizadeh says that a facility comparable in size would normally require about 300 production employees but his company is able to generate the same output with 50.

In addition to the labour cost savings and resulting price-competitiveness, automation ensures that Mitrex's photovoltaic products can meet some of the world's most stringent quality and safety requirements. Because the products are both solar panels and building materials, the company needs to meet the safety requirements in both categories. Notable certifications Mitrex achieved so far include such industry gold standards as the California Energy Commission listing for solar panels and Miami Dade County approval for building materials.



■ Image Credit - Mitrex

“Mitrex provides this ‘unicorn product’ which people don’t believe can exist. But our product is, in fact, real,” Hadizadeh says. Mitrex has already completed a number of projects, including a courthouse retrofit in Midland, a church on Bond Avenue in the Toronto suburb of North York, and a commercial office in Oshawa. Mitrex is also involved in the development of the tallest BIPV residential building in North America at the St. Mary's University in Halifax, Nova Scotia. More projects are in the hopper, including several new multi-storey building developments in the GTA and a high-profile building in Dubai. At home, the company is also working with the Ministry of Transportation on solar noise barriers for highways as well as projects with universities and Toronto Community Housing.

Hadizadeh notes that demand in Canada has a lot more room to grow with better policy incentives for the adoption of green energy technologies. Mitrex already sees strong demand for its products in the Middle East and a growing interest in the United States, boosted by new incentives for solar adoption in the Biden administration's Inflation Reduction Act (IRA).

The company management believes the IRA will support a much faster solar adoption in the United States than Canada, along with stronger support for domestic manufacturing of solar products. That was one reason why Mitrex decided last year that its second manufacturing plant will be located in Rochester, NY. The company initially considered expanding in Canada but the anticipated effects of the IRA, cheaper real estate, competitive energy and labour costs as well as investment incentives in the form of tax breaks south of the border were difficult to turn down.



■ Image Credit - Mitrex

Mark Gebrail, the company's chief strategy officer says that, with the inception of the IRA, the United States has become a much attractive green energy market. He adds that Canadian manufacturers find it difficult to showcase their products domestically even when internationally, they are received with open arms.

"The government of Canada could lead by example, by retrofitting its own buildings" Gebrail says. He calls for the City of Toronto to make the Toronto Green Standard criteria more ambitious too: "Right now, they can easily be met by installing only a few solar panels, which has minimal environmental benefits." Hadizadeh adds, even "net-zero" is not a sufficient target anymore: "Negative carbon footprints are the future. We put out enough carbon as is—we should be helping to remove it."

Hadizadeh also recommends all levels of Canadian governments align their climate change adaptation goals with the evaluation criteria for incentive programs that support domestic manufacturing. Besides direct job creation targets for incentive programs, a higher emphasis could be placed on the jobs created across the entire supply chain or what those jobs support, i.e. transition to green energy.

Statement of Financial Position as of March 31, 2023

ASSETS CURRENT		2023	2022
Cash	\$	97,600	116,855
Short-term Investments	\$	110,018	160,236
Grants Receivable	\$	-	19,040
Accounts Receivable	\$	29,631	21,295
HST Rebate Recoverable	\$	7,549	8,212
Prepaid Expenses	\$	8,433	4,400
	\$	253,231	330,038
Capital Assets	\$	6,752	10,552
	\$	259,983	340,590
LIABILITIES AND NET ASSETS CURRENT			
Accounts Payable	\$	32,335	23,242
HST Payable	\$	9,849	15,757
Source Deductions Payable	\$	19,723	13,980
	\$	61,907	52,979
Deferred Contributions Related to Capital Assets	\$	6,752	10,552
	\$	68,659	63,531
Net Assets	\$	191,324	277,059
	\$	259,983	340,590

Auditor's Statement

The financial summary is an excerpt from the complete Financial Statements of the organization, which were audited by BDO Canada LLP, dated May 24, 2023 and as such does not contain all disclosures required under Canadian accounting standards for not-for-profit organizations. A copy of the complete audited Financial Statements is available from the organization upon request.

Statement of Operations as of March 31, 2023

REVENUE		2023	2022
Grants	\$	499,225	533,967
Consulting	\$	95,942	346,832
Amortization of Deferred Contributions Related to Capital Assets	\$	3,800	3,369
Interest - MEDJCT	\$	260	445
Interest - Other	\$	3,135	-
	\$	602,362	884,613
EXPENSES		2023	2022
Salaries, Benefits, and Consulting Fees	\$	565,821	591,086
Software, Website, and TrilliumGIS	\$	17,453	27,205
IT Consulting	\$	-	24,316
Professional Fees	\$	19,067	20,741
OG100 Membership Fees	\$	15,591	15,591
Publications and Promotions	\$	12,997	13,920
Rent	\$	16,320	9,620
Office and General	\$	-	5,437
Meetings and Travel	\$	28,239	4,267
Amortization of Capital Assets	\$	3,800	2,269
Insurance	\$	2,111	1,689
Bank Charges, Interest and Penalties	\$	1,513	325
	\$	688,097	717,460
Excess of Revenue Over Expenses from Operations	\$	(85,735)	167,153

2023-24 Operating Plan

We will continue our ongoing work related to company profiles, TrilliumGIS, podcasts, research-based bulletins and reports.

We will contribute to events and initiatives organized by or held in collaboration with stakeholders.

We will focus on the following objectives over the course of the fiscal year:

- Leverage our automotive industry experience to develop expertise related to Ontario's aerospace industry. We will continue to pursue this work, which includes economic impact analysis, and engage other stakeholders as we make progress.
- Continue our work on a manufacturing strategy for Ontario. We hope to be in a position to share this work and a related communication plan in October 2023.
- Continue to support MEDJCT, Invest Ontario, ISED, and FedDev Ontario with research, investment attraction, and business retention initiatives.
- Develop a training module for Ontario EDOs who are responsible for manufacturing in their respective jurisdictions.

Trillium Network 2023-2025 Financial Plan

REVENUE		2024	2025	2026
MEDJCT	\$	499,740	398,000	100,000
Interest on Provincial Funding	\$	260	2,000	0
HST Rebate	\$	7,783	11,000	10,000
Other Revenue	\$	50,000	50,000	0
Other Carry-Forward	\$	191,324	176,922	73,102
Interest on Carry-Forward	\$	3,135	3,500	2,200
Total Revenue	\$	752,242	641,422	185,302
EXPENSES		2024	2025	2026
Staff	\$	430,000	440,000	150,000
Accommodations	\$	16,320	16,320	8,160
Operating Expenses	\$	29,000	29,000	15,000
Memberships	\$	20,000	20,000	0
Travel and Event Expenses	\$	40,000	30,000	0
Project and Initiative Expenses	\$	20,000	15,000	7,500
Miscellaneous Expenses	\$	5,000	5,000	1,642
HST Expenses	\$	15,000	13,000	3,000
Total Expenses	\$	575,320	568,320	185,302
Surplus	\$	176,922	73,102	0



TRILLIUM NETWORK
FOR ADVANCED MANUFACTURING

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