



CANADA'S LARGEST
MANUFACTURING CONSORTIUM



Industry Pulse Survey 2024: Green Manufacturing and Clean Technology Adoption Report



Green Manufacturing and Clean Technology Adoption Report

An EMC Energy & Green Consortium Initiative, in collaboration with Next Generation Canada (NGen)

Introduction:

Navigating the Path to Green Manufacturing and Clean Technology Adoption

The transformation of Canada's manufacturing sector towards Net Zero and more environmentally conscious, yet productive green manufacturing practices demands a holistic approach, encompassing People, Plant, and Processes.

This transition relies on a skilled workforce and the integration of clean technologies, essential for establishing an efficient and eco-friendly production ecosystem. What to do and how to do are critical next steps for Canada's manufacturing sector to build Green Manufacturing Capabilities for the future.

Through EMC's Energy & Green Consortium and GreenMFG Network initiatives, we undertook an Industry Pulse Survey to gain deeper insights into manufacturers' requirements for Net Zero readiness and their preparedness to embrace Clean Technologies (CleanTech) and Green Manufacturing. In collaboration with Next Generation Manufacturing Canada (NGen), Excellence in Manufacturing Consortium (EMC) is pleased to present the **2024 Green Manufacturing and Clean Technology Adoption Report**.



In completing this survey and report, active participation from EMC and NGen manufacturing members and engagement from a diverse sector audience has facilitated the collection of this valuable data. Thousands of Canadian manufacturers were invited to participate, covering all manufacturing sub-sectors (NAICS 31-33). Ultimately, 692 manufacturing firms were engaged, providing the benefit of their experience, expertise and insights.

Survey respondents, predominantly senior manufacturing leaders, spanned various roles, including C-level executives, plant management, production, quality, energy, engineering, environmental health and safety (EHS), human resources, and information technology (IT). Thank-you to all who generously participated.

Our industry pulse survey was designed to elicit quick feedback, enabling a rapid understanding and quantification of key issues, concerns, and broader challenges faced by the Canadian manufacturing sector in its transition to a low carbon economy. This report aims to spotlight these findings, shed light on industry priorities, outline specific needs for green manufacturing capabilities and clean technologies, analyze current sector utilization, and inform the development of pertinent solutions that can empower manufacturers to expand their future capabilities.

Beyond the survey and this report, EMC is committed to offering more in-depth briefings, workshops, roundtable consultations through its **GreenMFG Network** and **Green Skills in Manufacturing Certification training** throughout 2024. These initiatives are designed to further assist manufacturers in adapting to emerging needs. Your valuable input and active participation play a pivotal role in identifying capabilities, practices, strengths, and areas for improvement, ultimately contributing to the enhanced development of resources, support, and programming for Canada's dynamic manufacturing sector.

For more information on this industry pulse survey and report, please contact:

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Sector Study Report Assistance by Dandly.

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Advancing Manufacturing in Canada

Energy Solutions saved members \$115 Million since 2008!

EMC's Energy & Green Consortium

Through Canada's largest and only not-for-profit energy buying group for manufacturers, EMC is helping hundreds of manufacturers and processors to mitigate energy price volatility and access savings, driving waste and costs out of their supply chain.

Celebrating over \$27,000,000 in WSIB rebates for our EMC Health & Safety Excellence Program members, since 2002.

Health & Safety Excellence Program

For over 20 years, EMC has offered the WSIB recognition program to Ontario manufacturers. We are a WSIB-approved HSEp provider that will help you along the journey to Health and Safety excellence.

Canada's premiere resource for manufacturing skills and knowledge.

EMC's Learning Centre

Developed in collaboration with the country's leading manufacturers, the Learning Centre provides an extensive catalogue of learning options to suit the needs of all employees, including self-directed online, virtually facilitated and in person training.



Building on EMC's extensive Energy and Green Manufacturing Consortium and spanning over two decades of experience in energy management and sustainability, EMC has launched its **GreenMFG Network** in 2024, providing Canadian manufacturers, sector stakeholders, technology and solution providers, community and government partners with a unique forum for accelerating the transition to a low-carbon economy.

EMC's GreenMFG Network is a targeted national initiative designed to prepare Canada's manufacturing sector, particularly SMEs, for a more rapid transition to a green, low-carbon economy while achieving measurable progress towards Net Zero. By enabling small and medium-sized manufacturers (SMEs) access to expertise, tools and resources needed to transition to a green and low-carbon production ecosystem, we anticipate measurable increases in productivity and competitiveness. EMC is estimating that participating SMEs will identify significant opportunities to reduce related operational costs, GHG emissions reductions, energy efficiencies and management, translating to millions of dollars in annual savings for the entire sector.



EMC's GreenMFG Network will be hosting monthly virtual events enabling manufacturers to better understand Green Manufacturing and Clean Technology adoption terminology, subject-matter and the importance of tracking and benchmarking their energy and carbon footprint, mapping opportunities for future continuous and sustainable improvements, clean technology and retrofit opportunities, and process improvements. These events will also engage subject-matter-expert speakers and technology leaders to help raise awareness and understanding needed to measure and implement efficiency solutions and GHG reduction opportunities, Clean Technology solutions and the necessary steps for CleanTech adoption.

Building Partnerships in Energy, Green and Clean Technology

Through its Energy & Green Consortium and GreenMFG Network, EMC is connecting industry stakeholders and community partners, to support your organization's current efforts towards sustainability and Net Zero and how you are approaching Green Manufacturing and Clean Technology Adoptions.

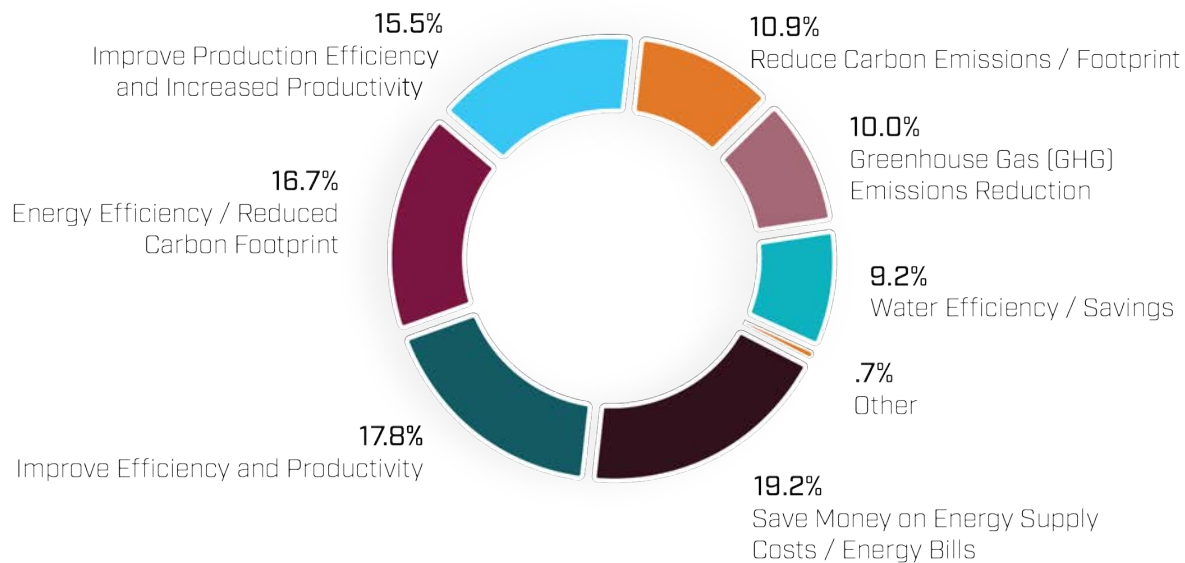
To find out more or to join EMC's GreenMFG Network, please contact:

Leah Nacua, Manufacturing Consortium Manager / GreenMFG Network Facilitator
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1) Main Motivations for Adopting Clean Technology and Processes

Manufacturing companies were surveyed to understand their main motivations for adopting clean technology and processes.

Figure 1: Main Motivations for Adopting Clean Technology and Processes



These results indicate that manufacturing companies are looking at the ways in which they can increase or maximize profits as they transition to net-zero emissions. The US EPA states that “a growing number of companies are treating ‘sustainability’ as an important objective in their strategy and operations to increase growth and global competitiveness”¹, while Deloitte indicates that there can be no conflict between a sustainable business model and sustainable manufacturing. Instead of companies looking towards sustainability, they should be looking towards continuous improvements to innovation and the manufacturing process.²

Provincial and federal governments have invested funding in the form of tax credits that aim to support manufacturer’s investments in sustainable, clean manufacturing. For example, the Government of Canada’s 2023 budget offers five different tax credits which total over \$60 billion in the next 10 years to support green innovation.³

These credits support investments in;

- clean electricity,
- clean technology manufacturing,
- clean hydrogen,
- carbon capture,
- utilization,
- and storage,
- and clean technology.

Canadian manufacturers need to recognize that the move towards net-zero can be a move towards increased profits and productivity. When coupled with the lowest motivations for moving towards net-zero, (water efficiency/savings, GHG emissions reduction, and carbon emissions/footprint reduction), the move towards profitability means focusing on the lowest motivational factors.

¹<https://www.epa.gov/sustainability/sustainable-manufacturing>

²<https://www2.deloitte.com/ch/en/pages/risk/articles/sustainable-manufacturing.html>

³<https://www.canada.ca/en/environment-climate-change/news/2023/04/minister-guilbeault-highlights-the-big-five-new-clean-investment-tax-credits-in-budget-2023-to-support-sustainable-made-in-canada-clean-economy.html>

The background of the slide is a solid blue color with a faint, abstract graphic. It features several upward-pointing arrows of varying sizes and orientations, some overlapping. There are also faint outlines of bar charts and circular patterns, suggesting a data-driven or analytical theme. The overall aesthetic is clean and modern.

The top three (3) reasons that companies indicated were the following:

- 1. To save money on energy supply costs/energy bills (19.2%);**
- 2. To improve efficiency and production (17.8%); and**
- 3. For energy efficiency/reduced carbon footprint (16.7%).**

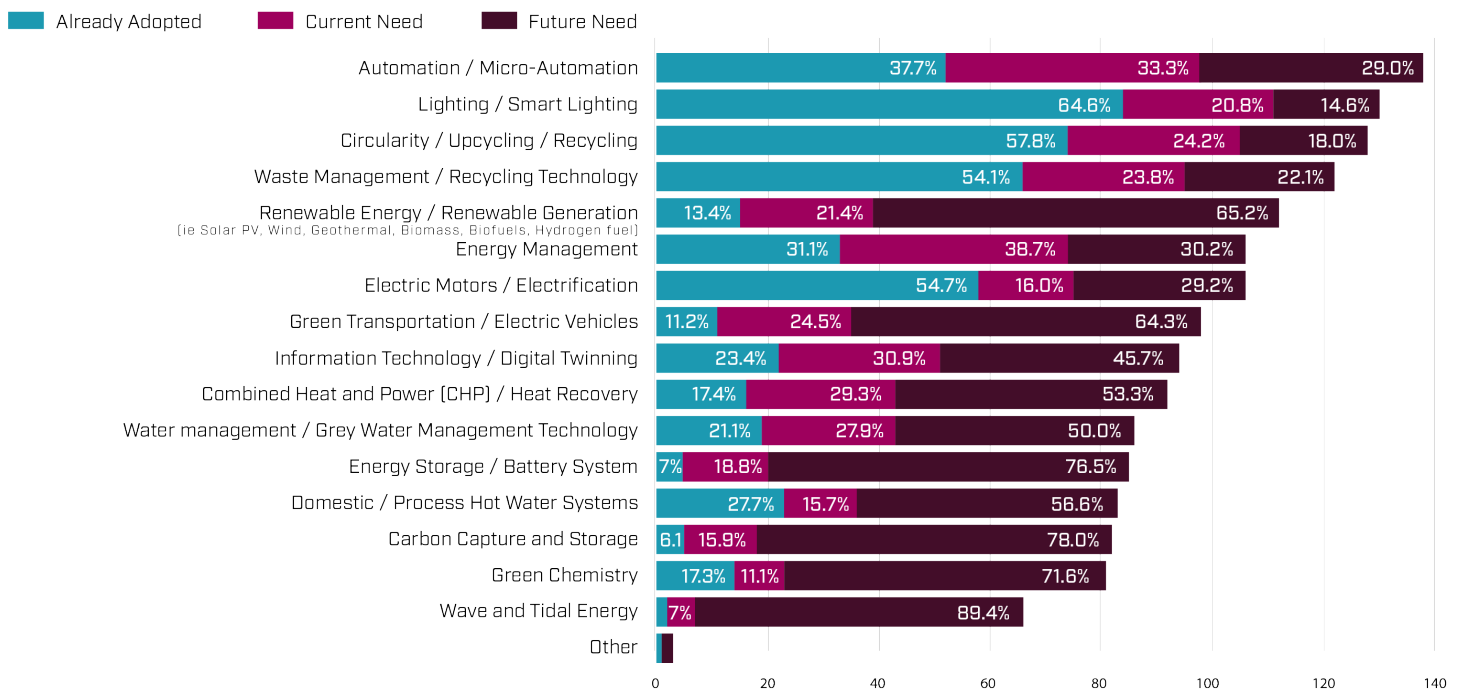
2) Top Clean Technologies Adopted, Currently Need or Future Need

Between 54 and 64 % of manufacturers indicated that they have made the transition to cleantech when it came to lighting, recycling and waste management, and electrification (replacing technologies that use fossil fuels with those that use electricity as an energy source).

Context is key for the technologies that have already been adopted by manufacturers. Lighting and recycling make up the top two overall, however this transition has been mostly driven by early adoption, legislated requirements and incentives. Additionally, many manufacturers are currently upcycling/recycling due to mandated legislation. Related to recycling / upcycling is waste management.

Many manufacturers are not yet recognizing the value of waste and must learn that discarding items in the dumpster is not the cheapest option when considering embedded costs and greenhouse gas (GHG) emissions. By viewing the current/future needs alongside those that have already been adopted, we can see what the priority items will be moving forward.

Figure 2: Top Clean Technologies Adopted, Currently Needed, or Needed in the Future



When it comes to renewable energy, including storage, this is a priority future focus area for most manufacturers. The cost of renewable energy is currently prohibitive and many times that of more traditional (less environmentally friendly) sources (i.e., coal, natural gas). However, manufacturers are inquiring more frequently about the use of renewable energy and renewable energy generation, as indicated by the fact that renewable energy/generation is in the top three future needs.

While prices for renewable / green energy remains high, there is insufficient renewable energy supply to meet demand. EMC's Energy Supply & Procurement team is focused on helping members with the best options, pricing and security of supply. In fact, EMC remains Canada's largest and only not-for-profit energy buying group for manufacturers; helping hundreds of manufacturers and processors to mitigate energy price volatility and access savings, driving waste costs out of their supply chain.

Energy management is a constant priority that EMC's Energy Consortium has been delivering since 2008. EMC helps manufacturers cut costs and reduce their carbon footprint by providing them with resources, expertise, and connections for achieving optimization and sustainability, better carbon management, using energy more efficiently, seeking alternative and renewable energy sources, implementing net-zero strategies, and deploying projects that help create a better production ecosystem.

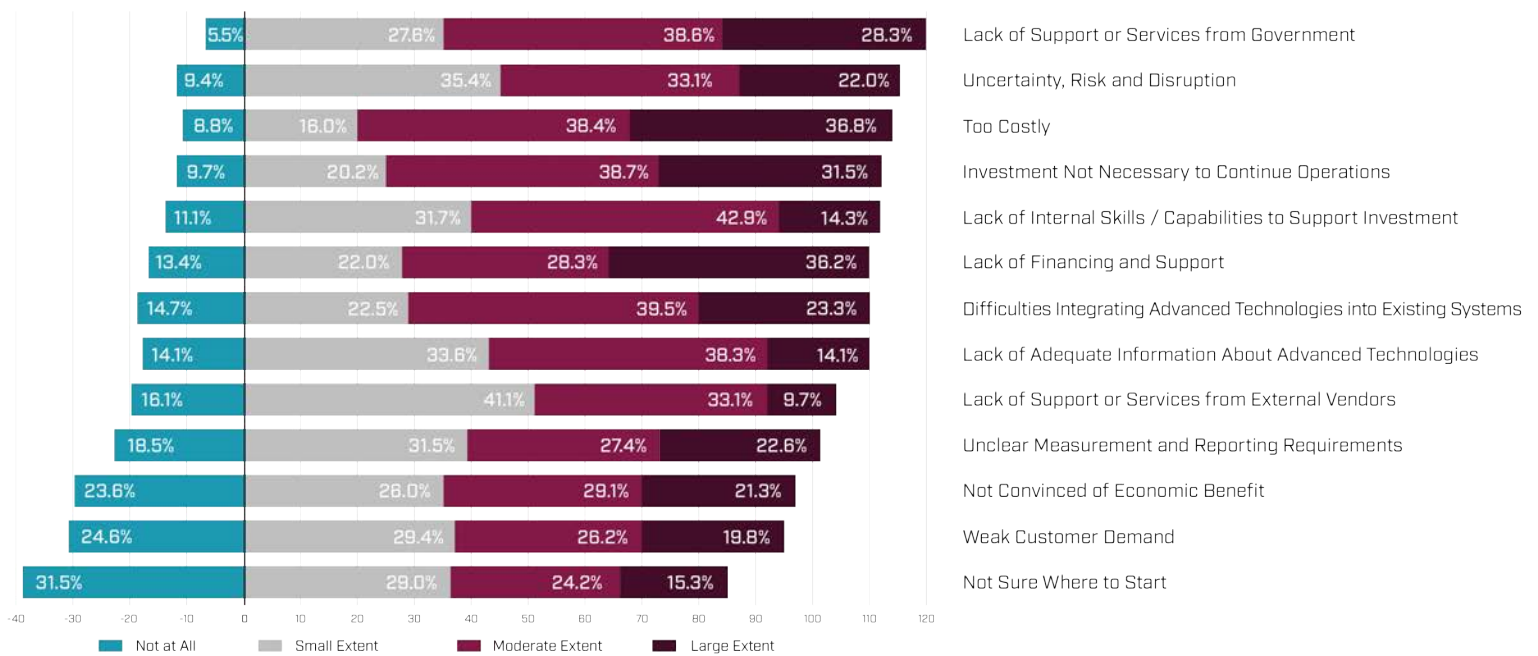
Technologies for the Future

The top three technologies that are identified as a future need are the following:

- 1. Carbon Capture and Storage (78%);**
- 2. Energy Storage/Battery System (76.5%);
and**
- 3. Renewable Energy/Renewable
Generation (65.2%).**

3) Reasons for Not Adopting Technology / CleanTech

Figure 3: Reasons for not adopting CleanTech, sorted by impact ranking



Each of the 13 identified issues can be sorted into categories: approach, cost, production, and stakeholders. Table X shows the categories and their respective issues.

Table 1: Identified issues sorted by category.

| Approach | Cost | Production | Stakeholders & Personnel |
|---|---|--|---|
| <ul style="list-style-type: none"> Not sure where to start Unclear measurement and reporting requirements Lack of adequate information about advanced technologies | <ul style="list-style-type: none"> too costly, lack of financing and support not convinced of economic benefit | <ul style="list-style-type: none"> Uncertainty, risk, and disruption Investment not necessary to continue operations Difficulties integrating advanced technologies into existing systems | <ul style="list-style-type: none"> Lack of services from the government Lack of services and support from external vendors Weak customer demand Lack of internal skills/ capabilities to support investment |

We can see which areas of manufacturing are most affected by the determining factors that manufacturers see as barriers to transitioning to CleanTech. In this year's survey, TOO COSTLY topped the chart with a moderate and large impact total of 75.2%.

Through industry consultations, EMC notes that 'Lack of Support or Services from Government' most often refers to a less favourable tax / tax credit environment for acquiring new technology and equipment.

When sorted into categories, we can see which areas of manufacturing are most affected by the determining factors that manufacturers see as barriers to transitioning to cleantech. Table 2 displays the percentage of manufacturers that responded with Moderate Extent or Large Extent to each issue.

Table 2: Barriers to transitioning to cleantech in manufacturing

| Category | Issue | Percentage (Moderate and Large Extent) |
|----------------------------|--|---|
| Approach | Not sure where to start | 39.5 |
| | Unclear measurement and reporting requirements | 50 |
| | Lack of adequate information about advanced technologies | 52.3 |
| Cost | Too costly | 75.2 |
| | Lack of financing and support | 64.6 |
| | Not convinced of economic benefit | 50.4 |
| Production | Uncertainty, risk, and disruption | 55.1 |
| | Investment not necessary to continue operations | 70.2 |
| | Difficulties integrating advanced technologies into existing systems | 62.8 |
| Stakeholders and Personnel | Lack of services from the government | 66.9 |
| | Lack of services and supports from external vendors | 42.7 |
| | Weak customer demand | 46 |
| | Lack of internal skills/capabilities to support investment | 57.1 |

When operations can continue as normal without manufacturers spending additional money on converting to clean technologies, there is hesitation to move forward with green technologies and motivation to maintain the status quo. Notably, more than 60% of manufacturers understand or mostly understand where to start when adopting green technologies, however the data shows that more than 50% are not convinced of the economic benefit, while nearly half feel that there is weak customer demand.

When looking at this data and relating it to the lack of government support, there appears to be a disconnect. If manufacturers are aware of the financial incentives offered by both federal and provincial governments, do they have the capability/capacity or desire to apply for the funding that will allow them to transition to cleantech, and are the incentives sufficient to adequately offset the costs for making the switch. If manufacturers are unaware of the government incentives, what more can be done to distribute this information and provide support to manufacturers interested in applying for the funding.

Internal Skills and Labour

Lack of internal skills and workforce capabilities necessary to implement, utilize and maintain new technologies has been a key barrier to adoption, for manufacturers through several years of EMC studies.

This year, nearly 60% of respondents indicated Moderate or Large Extent for Lack of Internal Skills/Capabilities to Support Investments, and a further 31.7% indicated this was a Small Extent of the reason for not switching to cleantech. This leaves only 11% of respondents feeling they have the skilled labour to continue the move towards technology/cleantech.

Taken at face value, it is an indication that manufacturers are continuing to struggle to attract and retain skilled workers to the sector. The manufacturing sector has seen significant losses in workers over the past 20 years and manufacturing requires more skills than it once did. There is a skills shortage; workers no longer see the value in the manufacturing sector, or are attracted to other, often similar sectors [such as trucking, construction, warehousing] ⁴.

As some manufacturers make the shift to cleantech, the gap is widening between traditional manufacturing plants, and smarter, digital factories. Coupled with a slew of traditional manufacturing workers who will likely retire in the next 10 years, and a younger workforce that is more discerning (especially post-pandemic), it has become increasingly difficult for

manufacturers to attract new workers who have different expectations for jobs and careers.⁵⁶ However, if manufacturers adapt to more innovative and sustainable processes, they can become more attractive and competitive to workers seeking more challenging positions.

Manufacturers need to consider how they will manage the shift to more digital and clean technologies, but they also need to balance the desire that a new generation of workers has for more flexibility and adaptability within their operations.

Costs and Production uncertainty dominate the reasoning for manufacturers not adopting technology/cleantech. The top three issues affecting manufacturer's use of cleantech, aside from government support, are the following:

- 1. Too Costly (75.2%);**
- 2. Investment Not Necessary to Continue Operations (70.2%); and**
- 3. Lack of Financing and Support (64.6%).**

⁴https://www.torontomu.ca/diversity/reports/The_Big_Shift_Executive_Summary.pdf

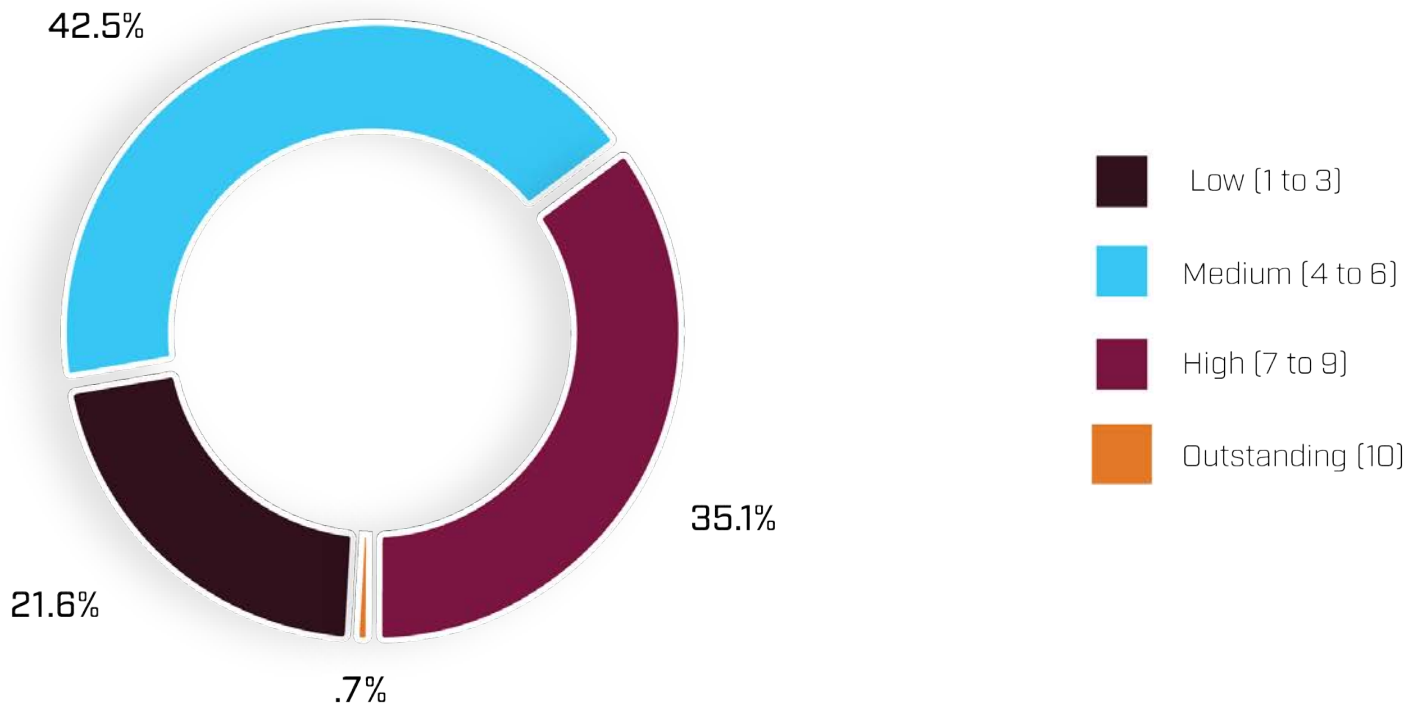
⁵Ibid.

⁶<https://www2.deloitte.com/us/en/insights/industry/manufacturing/manufacturing-industry-diversity.html/#understanding-potential>

4) Overall Capabilities for Technology Adoption, Clean Technology and Green Manufacturing

Manufacturers were asked to indicate on a scale of 1 to 10 the company's overall capabilities for technology adoption, clean technology, and green manufacturing.

Figure 4: Overall Capabilities for Technology Adoption, Clean Technology, and Green Manufacturing



“To achieve ‘Net Zero by 2050’ Canadian manufacturers face several challenges, especially SMEs. Transitioning to a low-carbon production ecosystem – while at the same time increasing their capacity, quality and speed to market all requires investment in People, Plant and Process. Unfortunately, the feedback indicates high costs and lack of internal skills and technical capabilities necessary are significant barriers. EMC is working with our manufacturers to address these capability needs and to connect industry with the resources needed to adopt Green manufacturing and CleanTech.”

Jean-Pierre (JP) Giroux
President / Président, EMC

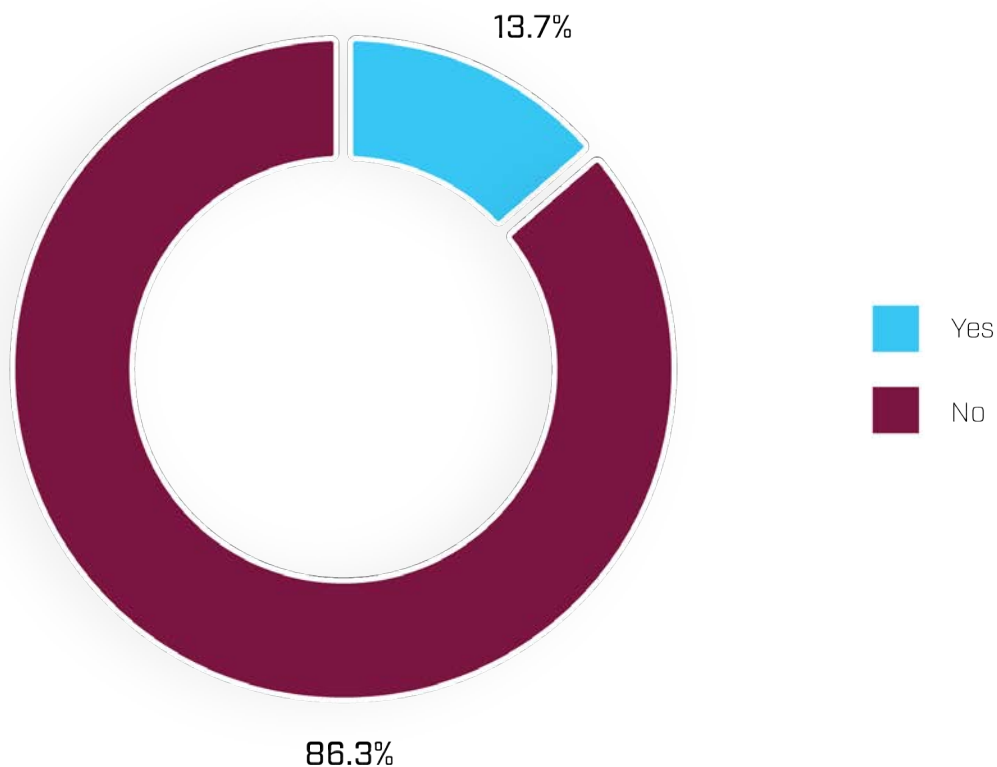
5) Manufacturing Awareness – Insurance and Banking Requirements for Carbon Footprint Tracking

Of the manufacturers surveyed, only 13.7 % were aware that insurance and banks will require carbon footprint tracking by the end of 2024 to get coverage or financing. Currently, the pressure is on the federally regulated financial institutions (FRFIs) [i.e., the banking and insurance industry] to ensure that they are meeting carbon emissions standards, as they will be required to publish climate disclosures beginning in 2024.

According to the Canadian Office of the Superintendent of Financial Institutions (OSFI), FRFIs will need to build resilience to address vulnerabilities in their business models: “Building resilience against climate-related risks requires FRFIs to address vulnerabilities in their business model, their overall operations, and ultimately on their balance sheet. This entails forward-looking approaches that are holistic, integrated, and built on reliable empirical data and sound analyses. It also necessitates FRFIs to continuously monitor and incorporate developments in climate-related risk management, such as improving data quality and evolving risk measurement methodologies, into their governance and risk management practices.”⁷

Given that nearly 70% of manufacturers indicated they do not currently track their GHG emissions or carbon footprint, they will need to be prepared to submit this information in the foreseeable future.

Figure 5: Manufacturer awareness of bank and insurance tracking requirements.



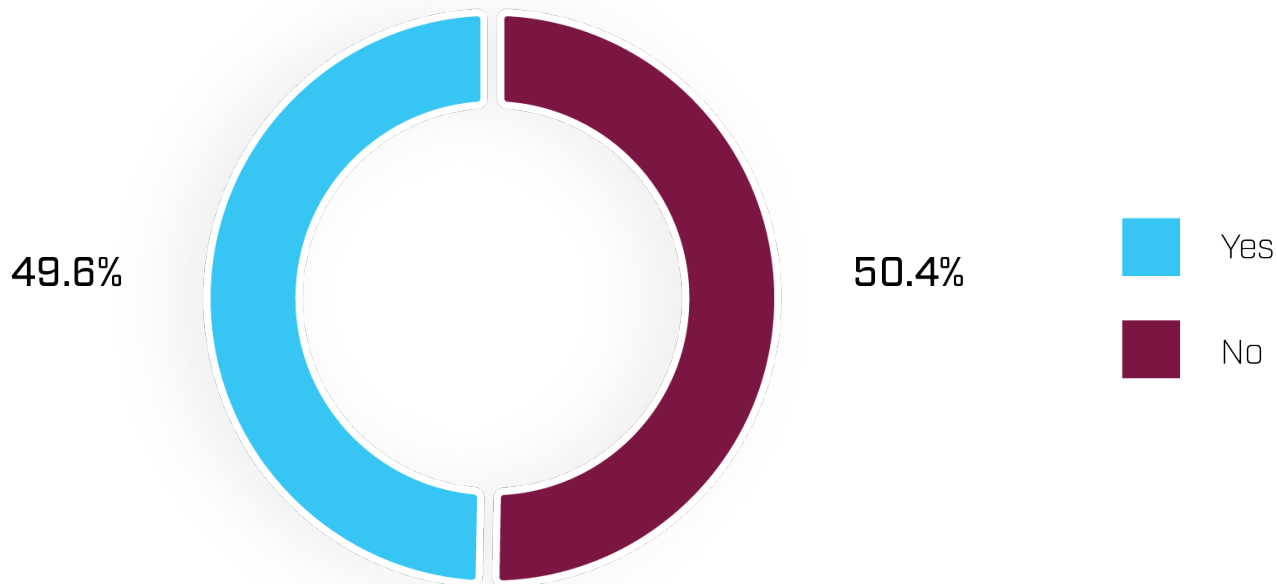
⁷<https://www.osfi-bsif.gc.ca/Eng/fi-if/rg-ro/gdn-ort/gl-ld/Pages/b15-dft.aspx>

6) Manufacturing Optimization

When asked if their “manufacturing processes are optimized to minimize waste, utilize alternative energy, and improve waste disposal through recycling, reuse, and composting?”, more than 50% indicated no.

50.4% of manufacturers said they do not have manufacturing processes optimized to minimize waste, utilize alternative energy, and improve waste disposal through recycling, re-use, and composting.

Figure 6: Percentage of manufacturers with processes optimized to minimize waste, utilize alternative energy, and improve waste disposal.



The key here is process optimization: without processes being optimized for these services, manufacturers cannot fully and successfully take advantage of the savings that come from implementing them. That is, even if manufacturers currently utilize alternative energy or improve their waste disposal through recycling, re-use, and composting, they cannot fully benefit from the savings they might experience by optimizing their processes.

Thus, for the successful implementation of future adopted technologies (as outlined in Figure 2), manufacturers will need to make significant efforts towards optimization to get the most out of their future technologies. EMC plays a role in supporting manufacturers to become process ready through helping them develop and implement plans for optimization of energy and resource efficiency. EMC offers resources and guidance, including expertise and connections for achieving optimization and sustainability, better carbon management, using energy more efficiently, and deploying projects that help create a better production ecosystem.

These resources help manufacturers to cut costs and reduce their carbon footprint in the process.

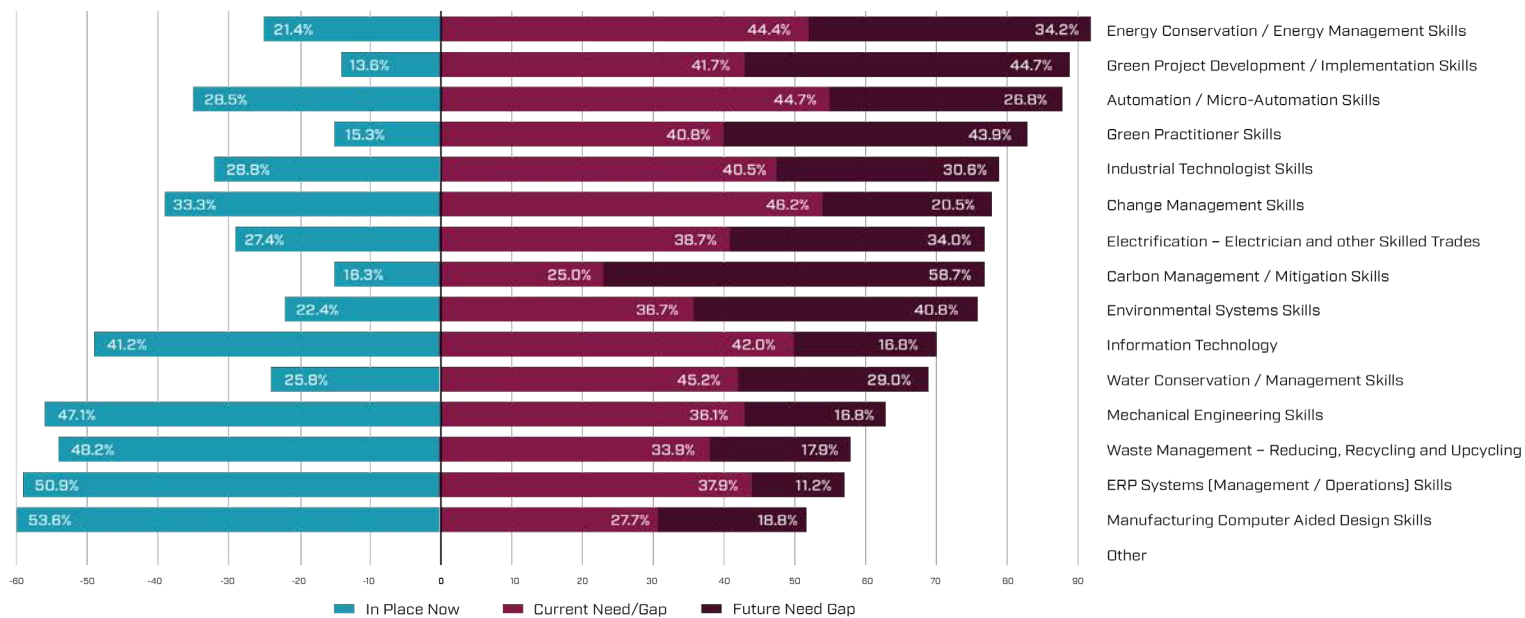
7) In-Demand Internal Workforce Capabilities for Technology Adoption, CleanTech and Green Manufacturing

Manufacturers were asked to indicate what their most in-demand internal workforce capabilities for technology adoption, clean technology, and green technology.

When coupled with the responses manufacturers gave for processes that are optimized to minimize waste, use alternative energy, and improve waste disposal (section 8.0), it is possible to see that part of that lack of readiness could be attributed to lack of skills in the sector. Even if manufacturers are to adopt cleantech, they require workers skilled in operating these areas.

Additionally, 83.7% of respondents indicated that carbon management/mitigation skills were a current or future need. This may account for the highest identified future need that manufacturers identified for carbon capture and storage (section 3.3). Should manufacturers make the switch to carbon capture, they will also require the workers to operate and manage that technology.

Figure 7: In-demand internal workforce capabilities for technology adoption, cleantech and green technology, sorted by current and future needs.



Internal workforce capabilities are a key requirement for Green and Clean Technology Adoption.

Subsequent years reflect the same woes: workforce has remained a top challenge manufacturers continue to face, particularly when implementing technology. EMC's Advanced Manufacturing Report for 2021, 2022, 2023, all show that between 45% and

47% of manufacturers are not implementing technology due to lack of skilled talent.

EMC's latest Advanced Manufacturing Report (2024) shows the same issues; however, the question has changed to focus on investments in Industry 4.0. Lack of skills to support investment shifted to third place, at 25%, with the top two reasons for not investing being difficulties integrating advanced technologies in existing systems and too costly, (37% and 34% respectively).¹⁰

⁸ Plant. July/August 2021

⁹ Ibid.

EMC's 2022 ManufacturingGPS Foundations report provides some insights for why vacancies are hard to fill: the top reason that manufacturers indicated was the low number of applicants applying, followed by applicants lack the skills required, and lack of good work ethic and job commitment.¹¹ To address some of these issues, the industry faces the challenge of looking more attractive to top talent. Many manufacturers have begun to invest in educational courses and certifications for their workers. The 2021 EMC Salary Survey shows that 61% of companies are investing in educational courses for their workers, and 48% in professional certification courses.¹² This indicates that manufacturers are taking steps to unblock the barriers to adopting cleantech by investing in their workforce. EMC's continued focus on education helps to support workers in gaining the skills necessary for technology adoption: the Learning Centre, and micro-credentials in certification streams and training courses, are just some the areas that manufacturers can use to increase the internal workforce capabilities.

The top three (3) identified needs/gaps for current and highest need are the following:

- 1. Energy Conservation/Energy Management Skills (78.6%);**
- 2. Green Project Development/Implementation Skills (86.4%); and**
- 3. Automation/Micro-Automation Skills (71.5%)**

¹⁰ 2024 Advanced Manufacturing Report. EMC

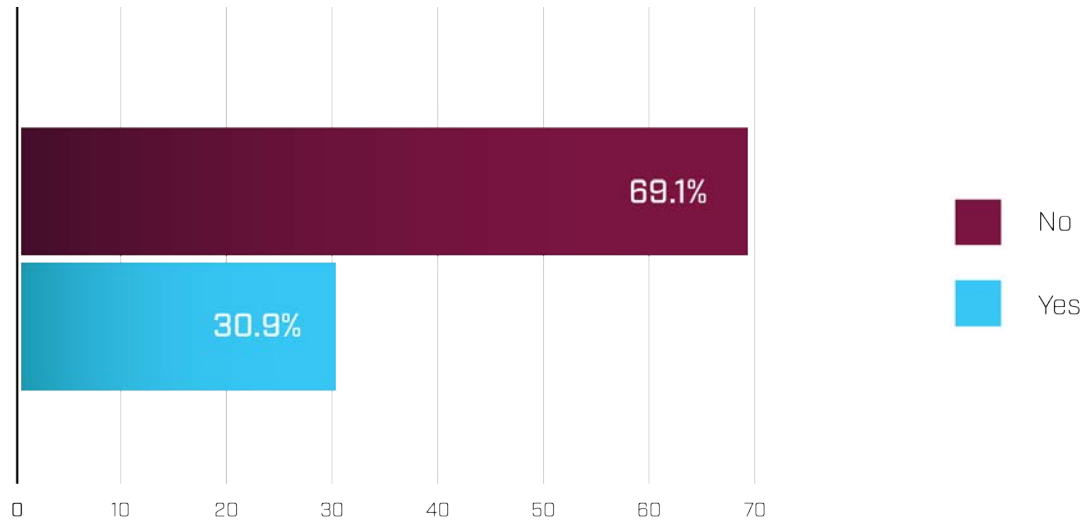
¹¹ State of Canada's Manufacturing Sector: A Map of the Manufacturing Workforce. ManufacturingGPS. 2022

¹² Plant. July/August 2021

8) GHG Emissions and Carbon Footprint Tracking

Federally, Canada requires the reporting of GHG emissions. Additionally, each province and territory have legislation that requires GHG reporting, with a varying reportable amount. For example, under the Greenhouse Gas Emissions: Quantification, Reporting and Verification Regulation (O. Reg. 390/18) of the Environmental Protection Act, the Government of Ontario requires that all facilities that emit 10,000 tonnes per year or more of GHG emissions must submit a report to Environment and Climate Change Canada for the calendar year.¹³ Facilities that do not emit those conditions may voluntarily report their GHG emissions.

Figure 8: Companies that track GHG emissions and carbon footprint.



69% of responding manufacturers indicated they do not track GHG emissions or their carbon footprint. Of the 30.9% who do track GHG emissions, 66% of manufacturers rely on internal capabilities to complete.

Figure 9: Internal versus external tracking for manufacturers that track their GHG emissions and carbon footprint.



Small and medium-sized manufacturers are typically low GHG emitters; as such, they are not required to track their emissions and carbon footprint. Additionally, many manufacturers have other priorities to address. For those manufacturers that are already tracking, they are often doing this for the clients they serve.

¹³ <https://www.ontario.ca/page/report-greenhouse-gas-ghg-emissions>

9) Manufacturing Sector Preparedness: “Net Zero by 2050”

Depending on your vantage point, 94.1% of manufacturers indicated that they are NOT/SLIGHTLY/SOMEWHAT prepared to meet Canada’s legislated “Net-Zero by 2050” emissions target.

With less than 6% of manufacturers confident they are ready to meet this requirement, the manufacturing sector has a long journey ahead, with much work to-do before achieving Net Zero by 2050.

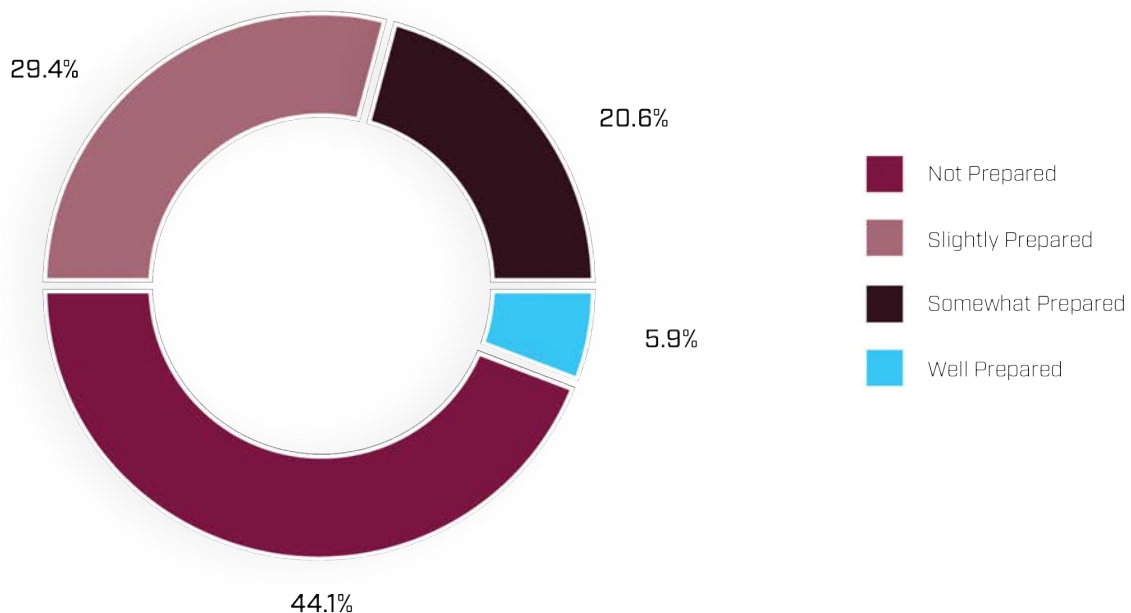
With less than 6% of manufacturers confident they are ready to meet this requirement, the manufacturing sector has a long journey ahead, with much work needed to achieve Net Zero by 2050. It is important for manufacturers to recognize the first step for improvement is understanding the current state. Tracking their GHG emissions and carbon footprint can benefit them.

Outside of the environmental advantages (and legislated requirements), businesses can benefit in the following ways:

- Enhance brand reputation through greater corporate transparency and accountability for consumers (avoid greenwashing);
- Understand the source of their emissions, to help increase efficiency and lower unnecessary energy costs;
- Measure and plan for emissions over time to drive cost savings; and
- Remove the risk of price volatility by reducing energy demand and shifting to renewable energy sources.

Additionally, with more policies shifting towards mandatory GHG limits and customers requesting reporting, manufacturers who proactively track their GHG emissions and carbon footprint will benefit. As banks and insurance companies implement requirements for tracking emissions related to their clients and investments, manufacturers will soon need to provide this information when looking to secure financing and liability coverage.

Figure 10: Manufacturer preparedness for meeting Net-Zero by 2050 legislation.



The feedback raises several questions:

- 1. Do manufacturers have the internal skills necessary to track their own emissions or must they rely on external sources?**
- 2. Is it more cost effective (cheaper) for manufacturers to rely on external expertise for tracking their own emissions?**
- 3. If the goal is to do it internally, how likely are they to attract and retain skilled workers to complete the work?**

10) Conclusion

Manufacturing is a cornerstone of Canada's economy, making substantial contributions to GDP and employing over 1.8 million individuals across diverse sectors. EMC, as Canada's largest manufacturing consortium, adopts a multifaceted approach with the goal of 'Advancing Manufacturing in Canada.'

In our 2024 Green Manufacturing and Clean Technology Adoption Report, EMC collaborated with Next Generation Manufacturing Canada (NGen), bringing together significant national manufacturing audiences, covering many thousands of manufacturers across all industry sectors. Ultimately the survey and resulting report engaged nearly 700 firms in six weeks, shedding light on the challenges and opportunities faced by Canadian SMEs in embracing green manufacturing and clean/advanced technologies.

While the report underscores the significance of clean technology, it emphasizes that technology alone cannot address all challenges. The path to green and sustainable manufacturing necessitates investments in People, Plant, and Process, providing a foundation for the adoption of green manufacturing practices and clean technology.

On the people side, the report identifies a lack of awareness and capabilities required, posing barriers to implementation. Understanding the magnitude and benefits of sustainable manufacturing for senior leadership is crucial, as is comprehending the business case for achieving Environmental Social Governance (ESG) objectives.

Despite cost being a significant barrier for SMEs, there is an opportunity to leverage investments for both financial and environmental benefits. Recent manufacturing outlook studies by EMC and Deloitte highlight top technology investment trends, including advanced analytics, AI modeling and simulation, and Industrial Internet of Things (IIoT) platforms.

Government legislation notwithstanding, the manufacturing sector's key drivers remain centered on increasing competitiveness, speed, quality, and profitability. Doing so with a smaller carbon footprint is the next piece, however many Canadian manufacturers have yet to embark on their Green Manufacturing/Net Zero journey.

A key takeaway for senior manufacturing leaders is to get started:

- **Understand what sustainable manufacturing means and how to develop green and sustainable initiatives;**
- **Design a credible and affordable path to achieve your organization's ESG targets;**
- **Identify and quantify strategic opportunities for improvement; and**
- **How to increase employee alignment, workforce engagement and shift organizational culture.**

EMC's initiatives, including the Energy and Green Manufacturing Consortium, GreenMFG Network, Green Skills in Manufacturing Certification training, and Green Manufacturing Management Workshops, aim to support the entire workforce in transitioning rapidly toward a green, low-carbon, net-zero, and clean manufacturing ecosystem. Your feedback has informed the development of these initiatives and resources to facilitate sector-wide transformation.

In conclusion, EMC would like to thank all participating manufacturers and partners for their valuable input in this year's survey and report. Your feedback guides EMC in developing industry-driven solutions to meet manufacturers' evolving needs. We encourage manufacturers to take full advantage of the available resources and programs as we collectively work towards a sustainable manufacturing future.

Terminology

What is Cleantech?

Cleantech refers to any products, services, and production processes that reduce or eliminate negative environmental impacts through environmental protection activities, resource management activities, and goods that have been modified to use less energy or resources than industry standards. It is designed to reduce costs, inputs, energy consumption, waste, or pollution. Cleantech is often focused on the investment avenues of the industry (e.g., eco-efficient production techniques, green technology, renewable energy, sustainable business, etc.), rather than the specific technologies in which the industry invests. Natural Resources Canada has developed an overview of the number of pureplay Cleantech companies (those that are predominantly engaged in developing and/or using technologies that provide environmental benefits) split by industry and province. Of the 2427 Cleantech companies in Canada, the top three provinces with the greatest number are Ontario, Quebec, and British Columbia. However, when looking at the mining, processing, materials, manufacturing and industry industries, Ontario and British Columbia only have 25 cleantech companies, while Alberta (fourth for the number of cleantech companies) has 17.¹⁵

What is Green Manufacturing?

The United States (US) Environmental Protection Agency (EPA) defines green manufacturing (also known as sustainable manufacturing) as “the creation of manufactured products through economically-sound processes that minimize negative environmental impacts while conserving energy and natural resources. Sustainable manufacturing also enhances employee, community, and product safety.”¹⁶

Green manufacturing uses processes and materials that decrease waste and greenhouse gas (GHG) emissions through eco-efficient practices and encourages adopting new environmental technologies. Among the resources provided by the Government of Canada website, EMC is dedicated to helping manufacturers move towards green manufacturing through enabling ways to optimize and sustain manufacturing processes and to manage carbon emissions.

What is Technology Adoption

Technology adoption is the design and successful implementation of new technology into a business or society. The new technology can be anything that is specific to the areas for which it was created. These technologies have the potential to transform the way companies operate, but are susceptible to the Technology Adoption Life Cycle, where groups of people within an organization or society adopt the new technology in stages based on how they will react to it. The stages represent a bell curve with the adopters as follows:

- innovators (the first to learn about and utilize the technology; they are often willing to take risks);
- early adopters (those interested and willing to learn and try new technologies);
- early majority (adopt early, after careful consideration and observation of the early adopters; they are the key to market share growth for a product);
- late majority (adopt technology after it is being widely used and tested); and
- laggards (those that tend to be resistant to change, and often wait until the innovation is entirely mainstream before adoption or reject adoption completely).^{17 18}

¹⁵ <https://ised-isde.canada.ca/site/clean-growth-hub/en/clean-technology-data-strategy/cleantech-companies>

¹⁶ <https://www.epa.gov/sustainability/sustainable-manufacturing>

¹⁷ <https://www.apty.io/blog/technology-adoption-explained/>

¹⁸ <https://www.gainsight.com/glossary/what-is-the-technology-adoption-lifecycle/>

For manufacturing businesses, technology adoption is an ongoing process with several phases that includes defining and setting goals for the technology, selection and planning to choose the correct technology, communicating, training, testing and deployment, monitoring through evaluation, and adjusting the approach as needed to achieve the adoption goals. Adopting new technologies helps to facilitate efficiency and productivity when it is leveraged to its full potential, and, as such, means that all employees or groups must adopt the new technology in order for it to be the most effective.¹⁹

Canada's Legislated Net-Zero by 2050

Canada has indicated that a cleaner, more prosperous economy needs to be both an immediate priority and sustained effort and has committed to achieving net-zero emissions by 2050.²⁰ In addition to legislation, it has issued to manufacturers the Net-Zero Challenge, which encourages businesses to develop and implement plans to transition their facilities and operations to net-zero emission by 2050. While reducing emissions, the use of net-zero plans can help in the following ways:

- reduce business costs through the use of renewable energy sources by lowering resource and production costs;
- provide a competitive position in a decarbonizing world (embed sustainability to drive value);
- attract new investment from stakeholders;
- improve sales and brand recognition;
- greater access to financing and capital;
- lower regulatory compliance costs;
- gain more resiliency against market disruptions; and
- help with easier employee hiring and retention.^{21 22}

Companies are experiencing increasing pressure to switch to Cleantech. In addition to compliance risks, businesses must be able to answer questions from investors and customers about how they manage their environmental, social, and governance (ESG) reporting frameworks. If they cannot manage these in a satisfactory manner, they risk losing market share and access to financing.²³ Many Canadian companies must soon file ESG disclosures under multiple ESG standards, including in Europe and the United States (US). Additionally, Canada is reviewing its global baseline for sustainability to determine if and under what timeline these baselines should be mandated.²⁴

As manufacturers begin to make the transition to Net-zero, they must be aware that banks and insurance companies will require carbon footprint reporting by 2024. As well, investors want to know that manufacturers are making the switch to green technology but lack confidence in much of the information they receive about how companies are manufacturing sustainability and emerging technologies (such as AI).²⁵

As manufacturers move towards Cleantech, they must be aware that it represents an unprecedented business opportunity for Canadian manufactures. Global demand for clean innovations will continue to increase for the foreseeable future.²⁶

¹⁹ <https://www.linkedin.com/pulse/what-digital-transformation-technology-adoption-varsha-goel>

²⁰ <https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/net-zero-emissions-2050.html>

²¹ <https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/net-zero-emissions-2050/challenge.html>

²² <https://www.epa.gov/sustainability/sustainable-manufacturing>

²³ <https://www.pwc.com/ca/en/today-s-issues/environmental-social-and-governance/esg-reporting-insights.html#sign-up-content>

²⁴ Ibid.

²⁵ <https://www.pwc.com/gx/en/issues/c-suite-insights/global-investor-survey.html>

²⁶ <https://www.mnp.ca/en/insights/directory/federal-clean-technology-manufacturing-tax-credit-valuable-catalyst-for-green-initiatives>



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