

# POWERING ONTARIO'S ELECTRIC VEHICLE ECOSYSTEM



**The Issue:** As Ontario continues to build its electric vehicle (EV) supply chain and bolster economic prosperity across the province, it will need strong auto, tech and mining sectors that are supported by highly skilled talent, increased manufacturing capacity and ground-breaking research and innovation. As Canada's auto-hub and leader in innovation and technology, Ontario has the homegrown resources and talent to lead in the global EV marketplace.

## Background

- With growing global demand for EVs, Ontario is uniquely positioned to leverage its production capacity and innovation ecosystem and establish itself as an industry leader. To develop an attractive investment environment for the industry, Ontario needs to foster the highly skilled innovators and manufacturers needed to support end-to-end EV production.
- As EVs continue to maintain a significant share of the market, [Clean Energy Canada](#) projects that jobs in EV technology will increase by nearly 40 per cent each year up to 2030, when 184,000 people will be employed in the sector. These highly skilled positions are key to developing an attractive, well-rounded and holistic market for EV investment. Many of these positions, including those in product design, research and engineering, will need to be filled by talent with a university degree.
- Leveraging strengths across the province – critical minerals in the north and manufacturing in the south – will attract investment, support a competitive economy and create more jobs for Ontarians. [KPMG](#) has identified Ontario's supply of critical minerals as an asset which puts the province in a unique position to develop an EV battery ecosystem necessary to support a comprehensive EV sector.
- Developing Ontario's EV talent pipeline and innovation ecosystem is critical to building the province's economic future, enhancing the commercial availability of zero-emissions vehicles, creating gainful employment for Ontarians, and supporting the transition to a green economy.

## How Universities are Supporting Ontario

Ontario's universities are supporting the growth, development and innovation of the province's EV industry by developing ground-breaking research across the EV lifecycle – from testing to battery recycling – and training the highly skilled talent needed to bolster and develop Ontario-made EV innovations.

- Universities are building the in-demand STEM workforce required to support a growing EV market, including designers, programmers and engineers. In fact, 38 per cent of students at Ontario's universities were enrolled in STEM programs in 2021-22, up from 30 per cent in 2011-12, according to Ontario's universities enrolment data.

- Students are gaining valuable hands-on experience in the automotive industry. Many universities are partnering with EV leaders, such as Volkswagen, Tesla, BMW, Honda and Toyota, to offer work-integrated learning opportunities and help them gain in-demand skills that meet the needs of employers.
- Universities are also leading ground-breaking EV research through dedicated automotive research centres and individual research programs. For example, researchers and students from one Ontario university played a leading role in testing and developing Project Arrow – Canada's first zero-emission concept EV – through the university's Automotive Centre of Excellence.
- Seven Ontario universities are located in three North American tech hubs, including Toronto, Ottawa and Waterloo Region, that are outperforming competitive markets by many metrics, according to a recent study by [Coldwell Banker Richard Ellis](#). These regions are among the strongest tech markets in North America with Ontario's universities supplying top talent and research expertise to these growing fields.

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Ontario universities offer auto-related research initiatives and training programs.

## Partnering to Build a Stronger Ontario

A vibrant and healthy university sector is critical to meeting the needs of students, fostering community economic growth, driving research and innovation and developing the highly skilled talent critical to Ontario's economy.

**It is why, in order to fully unleash their potential, Ontario's universities are asking for support – to allow greater flexibility to increase their revenue sources.**

It is now more important than ever for government and universities to continue to work together to allow Ontario's universities to build the better and brighter future for our province that we all want to see.

# PARTNERING TO DRIVE THE FUTURE OF ONTARIO'S ELECTRIC VEHICLE INDUSTRY



As Ontario continues to position itself as an electric vehicle (EV) manufacturing leader, the province will need a strong and steady supply of highly skilled talent across sectors to build a province-wide EV supply chain that can meet the growing global demand for EVs.

Ground-breaking research and innovation in infrastructure, manufacturing and critical minerals will also be key to attracting investment, advancing cleantech solutions and staying globally competitive.

Below are just some of the many ways Ontario's universities are helping position the province as a global EV leader – from STEM talent development to commercializing Ontario-made EV innovations.



## ● Building Ontario's EV talent pipeline

● Through an experiential learning opportunity in partnership with Ontario's Ministry of Transportation (MTO), students at **Brock University** researched and presented policy solutions to address a series of challenges facing MTO. One example of the topics groups were tasked with, was EV policy, speed and road safety, helping students gain valuable hands-on experience as they tackle some of Ontario's most complex EV challenges.

● Transitioning to a green economy requires highly skilled engineering talent to design new technologies in energy production and transmission. Through undergraduate programs in sustainable energy, **Carleton University** is providing students the opportunity to explore a range of cleantech applications, such as smart technologies for power generation and distribution, providing a strong foundation for understanding the challenges and opportunities of wide-spread EV use.

● To help advance transport electrification in mining, **Laurentian University** is giving engineering students the opportunity to learn how to design battery electric vehicles (BEVs) for use in underground mining through the Battery Electric Mine Equipment course. Through the course, students gain a foundational understanding of the advantages and disadvantages of existing BEV designs and the processes required for innovation.

● As EV technology becomes more sophisticated, more data scientists will be needed to analyze the data generated from new information systems and conduct insightful research to optimize EVs. Through work-integrated learning and research opportunities, **Nipissing University** is training the next-generation of data scientists through its data science undergraduate program.

● With the rising popularity EVs, the Centre for Urban Energy at **Toronto Metropolitan University** (TMU) has been working on a number of research projects that provide solutions to the anticipated increase in demand and access for charging stations. From informing a policy framework that can help cities determine their EV system strategies to designing a fast-charging station that reduces the impact on Ontario's electricity grid, TMU is bringing together students, researchers and industry partners to solve EV-related challenges.

● Smart cities have the potential to provide critical insight into municipal EV integration. Through the Smart Cities micro-credential, **Wilfrid Laurier University** is helping learners upskill and gain a foundational understanding of connected devices and how these new technologies can be leveraged to develop sustainable infrastructure and coordinate city resources, such as EV charging stations.



## ● Partnering to commercialize Ontario-made solutions

● With the long-term goal of electrifying all forms of transportation, one researcher at **McMaster University** is designing and commercializing next-generation EV motors through his university research program and start-up company, Enedym Inc. His research program focuses on switched reluctance motor technologies, which offers electric drive system solutions with simpler construction, lower cost, higher efficiency and a more stable supply chain.

● Developing an end-to-end EV manufacturing ecosystem will help Ontario foster a globally competitive EV market. Through **Ontario Tech University's** Automotive Centre of Excellence, researchers and students partnered with Canada's Automotive Parts Manufacturers' Association to build all components of Project Arrow – the first Canadian-made zero-emissions vehicle.

● A partnership between Professor Olivier Trescases of the Faculty of Applied Science & Engineering at the **University of Toronto** and Ontario-based Litens Automotive Group is unlocking new levels of performance for EVs. Litens decided to transition their product engineering groups to the EV space in 2019, and have since validated battery management systems that have great potential to improve overall performance. The partnership is supported in part by funding from the Ontario Centre of Innovation.

● To help bring new, Canadian EVs to market, **Trent University** has signed an MOU with Trouvé Victory Inc., an emerging EV manufacturer. The MOU opens up opportunities to explore joint projects that leverage the expertise of researchers in fields such as biomaterials and chemistry; to develop sustainable solutions and approaches to innovations in EV design and production

● Safe, Affordable, Reliable, Innovative Transit (SARIT) micro-mobility EVs have the potential to transform the way we travel. In partnership with Canadian auto entrepreneur Frank Stronach, **York University** has become a living lab for testing this ground-breaking technology and conducting market research to determine consumer preferences and how the vehicles can be used beyond campus to meet global sustainability goals.

### ● Transforming Ontario's EV ecosystem through research

● Alongside EV technology, the Internet of Vehicles (IOV) is an emerging technology that could transform the auto sector. **Algoma University** is undertaking research into IOV technologies to advance the development of machine learning algorithms and lay the groundwork for real-world applications of IOV technology, including the transfer of real-time information between vehicles to improve road safety and optimize traffic flow.

● The high cost of batteries is one of the main barriers to widespread adoption of EVs in the consumer market, and expanding their lifespan is one of the most critical steps in improving the commercial viability of the technology. Engineering researchers at the **University of Guelph** are studying the impacts of vibration on the heat and lifespan of lithium-ion batteries commonly used in EVs to develop a basis for affordable, long-lasting batteries.

● As EV companies look for new ways to improve reliability and reduce upkeep costs for owners, **Lakehead University** is undertaking research to develop new techniques and tools for intelligent diagnostics and prognostics for EVs. This research will optimize the function of EVs, increase their reliability, and reduce maintenance and repair costs by improving the effectiveness of inspections.

● As Canada looks to adopt more sustainable transit solutions, researchers at **OCAD University** partnered with the Canadian Urban Transit Research & Innovation Consortium to assess Canada's capacity for investment and implementation of Zero-Emissions Buses. The team's research report provides actionable policy and planning recommendations to help government deliver on clean energy growth goals while also supporting healthier communities.

● Increase in consumer demand for EVs will mean greater demand for public charging stations. Recognizing the pressures this will place on local power grids, researchers at the **University of Ottawa** addressed this challenge by analyzing the EV interaction with the modern power grid to identify sustainable solutions to managing power demand, helping ensure EVs remain a viable option for cities and consumers.

● Power electronics play a key role in EVs – processing and controlling the flow and conversion of electrical energy. A researcher at **Queen's University** is leading the development of new energy-efficient and smart-grid-ready power electronics technology for use in EVs. Once commercialized, this technology will make EVs more efficient and help harness electricity in a more cost-effective and sustainable way.

● By analyzing the application of artificial intelligence (AI) in EVs, researchers at the **University of Waterloo** have proposed several advantages to AI adoption in EVs that will make them a more attractive consumer option. This includes improved charging stations, energy consumption and more accurate range estimation.

● Transforming cities into smart cities will help municipalities better integrate sustainable transportation systems. A researcher at **Western University** is exploring how energy, transportation and telecom networks can work together to support the wide-spread adoption and integration of public and private electrified transport.

● Many end-of-life EV batteries still have up to 70 per cent of their capacity left when they end up at recycling facilities. Researchers at the **University of Windsor** are partnering with industry to find new ways of repurposing these batteries for use in home electrification, e-bikes and microgrids as another route to battery disposal that could offer cost-effective solutions to EV adaptation.

