

Perspective™



ONTARIO

AUTO SECTOR IS OPEN FOR BUSINESS



NEXT GEN AUTO INNOVATION

Markham is home to
GM's Canadian
Technical Centre

FUTURE OF AUTO MOBILITY

Windsor-Essex
growing Canada's
autonomous & mobility

AUTO'S SMART STEEL

ArcelorMittal's advanced
solutions focus on
performance and safety

Steel: the energizing material



ArcelorMittal

Our industry-leading steel products and solutions for electric vehicles help car makers to create sustainable solutions by reducing vehicle weight, while increasing safety performance. Our world leading steel products and solutions coupled with our net zero carbon targets make ArcelorMittal a key partner for the global automotive industry.

**Smarter steels
for people and planet.**

automotive.arcelormittal.com





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Perspective™

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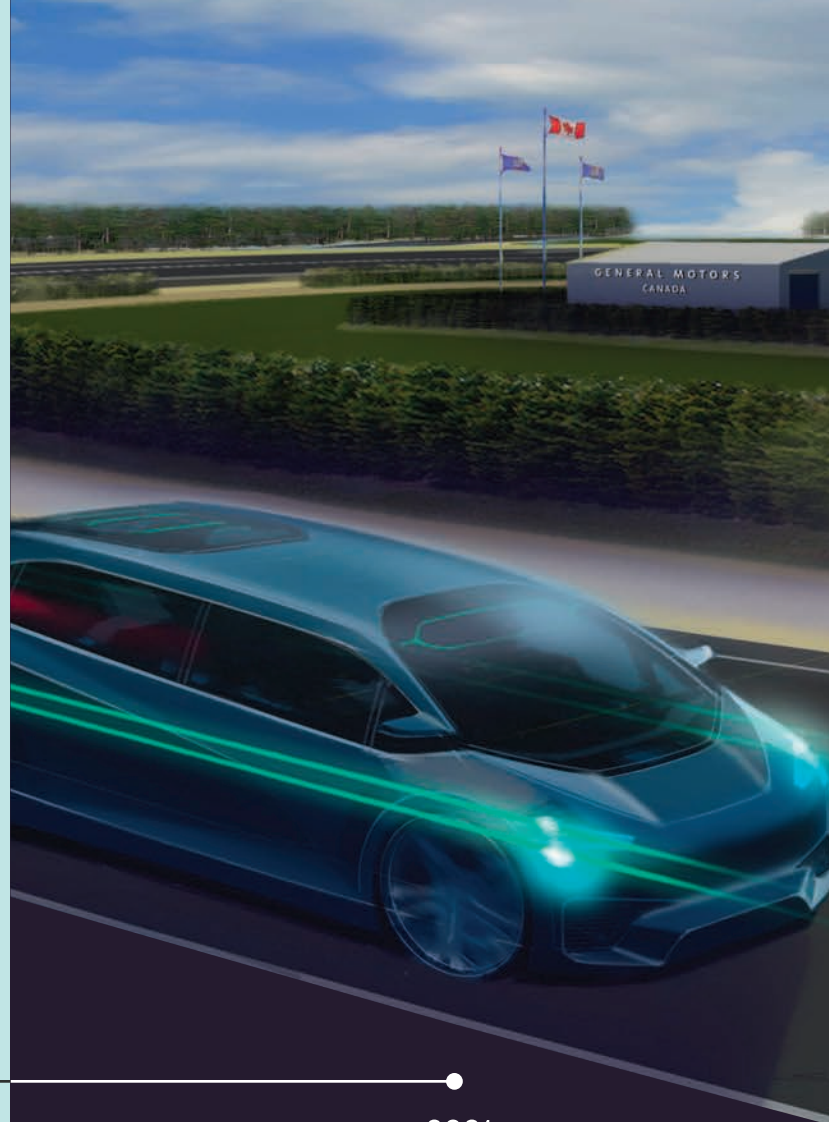
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1864




2021



Here in Durham Region we're not just innovating; we're innovating to solve big problems. We're confident our innovation community will continue to change the world.

Since 1864, when Robert McLaughlin started his journey to transform human mobility, businesses in Durham Region have committed to improve lives—not just for local residents—but also for the world.

 **Durham Region, Ontario, Canada**

Left image courtesy of Oshawa Public Libraries. Right image courtesy of General Motors Canada.



WHY ONTARIO? TRACK RECORD, TECHNOLOGY AND TALENT

The North American automotive industry is big. According to the Canadian Vehicle Manufacturers' Association Auto manufacturing contributes over \$16 billion to Canadian GDP and Vehicles are the second largest Canadian export by value at \$42.9 billion in 2020 of which 93% was exported to the U.S. Auto is Ontario's top export at 21.6% of all exports (2019).

This is why firms looking to invest or expand within the auto sector are steering towards Ontario Canada.

The province of Ontario is open to work collaboratively to harness Ontario's strengths, expertise and assets in auto and tech which will position the auto industry for even more success.

There are already a lot of great things happening in the Ontario ecosystem.

Ontario is attracting major investments from global leading automotive and technology companies that are redefining mobility. For example:

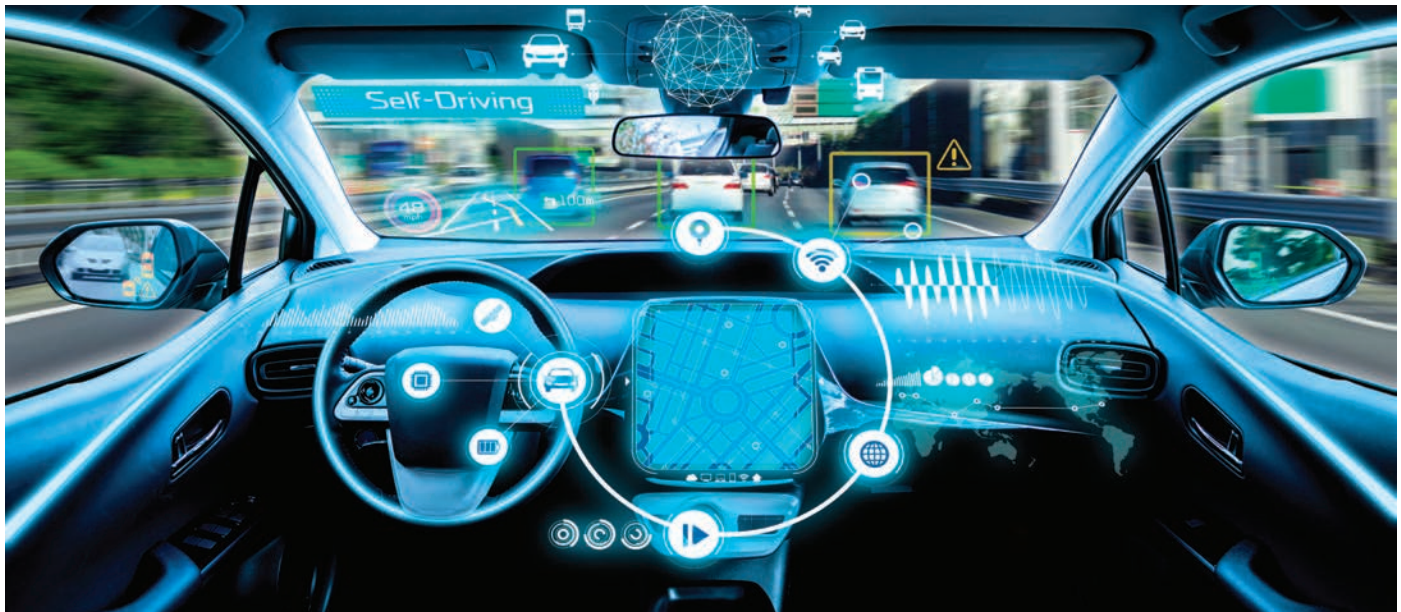
- Ford established a new Research and Engineering Centre in Ottawa, with a focus on connectivity and mobile technologies.
- GM officially opened its Canadian Technical Centre in Markham (just north of Toronto) capable of housing 1,000 engineers focused on

advanced driver assistance features, its fully autonomous vehicle program, and infotainment centre design and improvements.

- Uber announced a US\$150 million investment in Toronto to expand its Advanced Technology Group and establish a new engineering hub.
- British AV Shuttle Company, RDM, announced it would set up its North American headquarters for its Aurigo brand in Ottawa to take advantage of the amazing ecosystem growing in the region with BlackBerry, Ford, Nokia and many other key global players.
- Chinese mobility giant DiDi launched its second North American R&D lab in the Toronto-Waterloo corridor to take advantage of world class AI talent and leading university research.

To learn more about investing within the Automotive Industry of Ontario please visit <https://www.investontario.ca/automotive>

Content courtesy of Ontario Ministry of Economic Development, Job Creation and Trade www.investontario.ca and the Canadian Vehicle Manufacturers' Association www.cvma.ca/industry/facts/



WINDSOR-ESSEX THE AUTOMOBILITY CAPITAL OF CANADA

The Windsor-Essex region is situated at the heart of the richest consumer market in the world, with over 200 million people located within a 13-hour drive. Windsor-Essex is directly linked to the busiest commercial Canada-U.S. border crossing, handling approximately one third of all Canada-U.S. trade of nearly C\$1 billion daily. The region's prime location, quality of life, great economic prospects and highly skilled workforce make it an easy decision when considering an ideal place to start or expand your business.

Building on the region's rich history in the development and production of the automobile, Windsor-Essex is now looking toward future trends of the automotive industry, including the development and production of connected, autonomous and electric vehicles.

Organizations across the Windsor-Essex region have partnered to develop a coordinated approach to grow and sustain an automobility cluster. This includes fostering an entrepreneurial network and advancing the development of technologies and infrastructure.

Automobility is the secure, zero-emission movement of people, goods and services using advanced information technologies. It is the future of mobility, and it has arrived in Windsor-Essex.

Entrepreneurial Support Networks in Automobility

The Invest WindsorEssex Automobility and Innovation department aims to support new and existing businesses by offering resources that help companies achieve their goals. There are several support networks that help foster excellence in the connected and autonomous vehicle development industry which including the Ontario Vehicle Innovation Network (OVIN), the Invest WindsorEssex Virtual Reality (VR) CAVE and the recently launched Canadian Automobility Hub.

As a proud partner of OVIN, Windsor-Essex hosts a Regional Technology Development Site, focusing on cross-border technologies and cybersecurity. Through this partnership, OVIN capitalizes on automotive technologies and mobility solutions and enables infrastructure networks across Ontario to adapt to this evolution. OVIN provides a competitive advantage allowing Ontario

(including Windsor-Essex) to reinforce its position as a North American leader in automotive technologies.

Windsor-Essex is also home to Canada's largest publicly accessible VR CAVE which serves as a commercialization tool to support connected and autonomous vehicle development through virtual reality and prototyping. Virtual reality provides many opportunities to aid in product development, including simulation, skills training and collaboration. Virtual prototyping allows processes to be tested before final verification with physical prototypes is performed. This resource is accessible to companies throughout the Windsor-Essex region and beyond and helps expand research and testing capabilities.

Canada's First EV Ramp-up Factory

The Canadian Automobility Hub was launched in Windsor-Essex in late 2021. The facility provides an all-in-one solution for industry and research. A first for Canada, the Automobility Hub is "a great milestone contributing to the necessary economic evolution of our region. It offers a suite of resources and services, including a state-of-the-art ramp-up factory, to enable and support a network of innovative entrepreneurs and businesses interested in advancing the market for electric, zero-emission, as well as connected and automated vehicle technology and infrastructure." says Stephen MacKenzie, President and CEO of Invest WindsorEssex, the lead economic development agency for the region.

Electric Vehicles

The Windsor-Essex region is emerging as a North American leader in low carbon and zero-emission transportation. The region is not only adopting the electric vehicle infrastructure to support the plan's targets, but both Stellantis and Ford have committed to investing billions into their Windsor operations. These investments will help build electric vehicles, including manufacturing Hybrid Pacifica Minivans and advance the region in conducting electric vehicle research and development.



Research & Development

Windsor-Essex is home to two internationally recognized post-secondary institutions, the University of Windsor and St. Clair College.

Located at the University of Windsor, the Centre for Hybrid Automotive Research and Green Energy (CHARGE Labs) is an internationally recognized R&D facility that fosters cross-disciplinary research collaboration among materials, mechanical, electrical and software engineers.

Further strategic research opportunities at the University of Windsor include:

- Autonomous mobile robots and systems
- Cybersecurity
- Internet of Vehicles (IoV)

- Sensor communication and fusion
- Simulation emulation and test beds
- Vehicle-to-vehicle for autonomous vehicles

St. Clair College's Windsor campus is home to the Ford Centre for Excellence in Manufacturing and delivers high-quality training in engineering and manufacturing using some of the world's most sophisticated technology.

Now is the perfect time to be part of the "Automobility Capital of Canada", Windsor-Essex. Whether you are gearing up to start a new business or growing your company, Windsor-Essex has the right resources to ensure your success. Join us for the ride!

**Built on manufacturing,
driven by innovation.**

Windsor-Essex is the Automobility Capital of Canada.

Did you know that Windsor-Essex, Ontario, situated at the heart of the richest consumer market in the world, has emerged as an international hub for automation and mobility? Now is the perfect time to be part of the Automobility Capital of Canada!

Join us for the ride!

Learn more: automobilitycapital.ca

INVEST WINDSOR ESSEX

Major Automotive Investments in Windsor-Essex

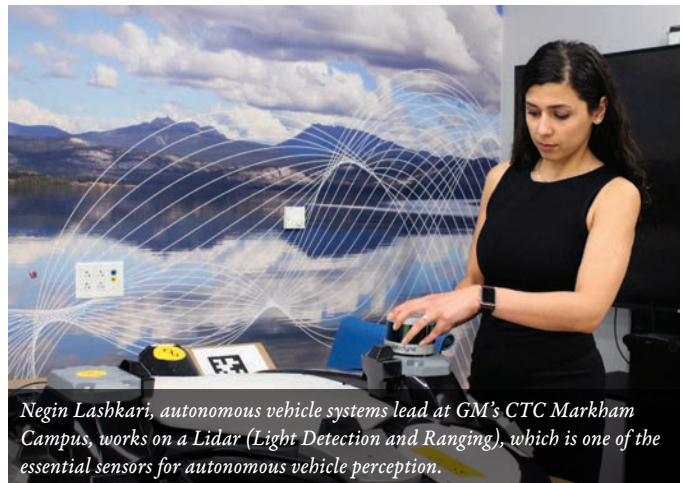
Stellantis and LG Energy Solution announced they would invest \$5 billion CAD (\$4.1 billion USD) to build an electric vehicle battery plant. It will be the first large-scale, domestic electric vehicle battery manufacturing facility in Canada. It will be located in Windsor, Canada's automobility capital.

Construction on the 4.5-million-square-foot plant is expected to begin later this year with an expected launch in the first quarter of 2024. An estimated 2,500 jobs are expected to be created.

Officials hope the new project will be a catalyst for the creation of a strong battery supply chain in the region.

"Through this joint venture, LG Energy Solution will be able to position itself as a critical player in building green energy value chains in the region," said Youngsoo Kwon, CEO of LG Energy Solution. "Creating a joint venture battery manufacturing company in Canada, recognized as one of the leading nations in renewable energy resources, is key for LG Energy Solution as we aim to power more electric vehicles around the world."

Stellantis has also announced a major investment of \$3.6 billion in electric vehicle manufacturing. The investment includes the retooling of Windsor Assembly Plant and building two new research and development centres in the Windsor-Essex region.



Negin Lashkari, autonomous vehicle systems lead at GM's CTC Markham Campus, works on a Lidar (Light Detection and Ranging), which is one of the essential sensors for autonomous vehicle perception.

MARKHAM: POWERING NEXT-GENERATION AUTO INNOVATION

Markham, a dynamic, diverse and fast-growing city in the heart of the Greater Toronto Area, is home to powerful cluster of automotive innovation that is bringing the future to life.

Combining excellence as Canada's second-largest technology hub with the presence of a growing number of automotive leaders, Markham brings together world-class talent, a culture of research and collaboration and a reputation as a business-friendly city within a diversified and thriving economy.

"Innovation is our central way of life in Markham, with one of the greatest number of patents per capita in Canada, according to the World City Council on Data. The city has a highly educated and skilled workforce in technology, automotive, life sciences, financial services, design and engineering, science, and information and cultural sectors," said Markham Mayor Frank Scarpitti.

The city is a leader in attracting foreign direct investment, with more than 240 international companies.

The city's automotive sector includes 440 businesses, employing about 6,000 people in parts manufacturing, distribution, wholesaling and dealership, and innovation.

Prominent automotive employers include Honda Canada, Hyundai, Mitsubishi, Tesla, Multomatic, Magna Pullmatic, Weins Canada, NOVO Plastic, Murata Power Solutions, Mobis, Veoneer, NGK, and Racetrax.

On the innovation front, major auto manufacturers are leveraging Markham's technology infrastructure and ecosystem to produce cutting-edge advances in

electric vehicles, next-generation self-driving cars, sustainable batteries, green energy, and advanced manufacturing.

Local innovation leaders include GM Canada, Qualcomm and Bluewrist.

And the city's new employment district Markham Innovation Exchange (also called MiX), which connects knowledge to production by attracting high-tech collaborators and manufacturers devoted to future growth, will provide exciting growth opportunities for Markham's advanced auto industry.

MiX's expansive size (1,920 acres), scope and location in the core of Canada's biggest economic region makes it unlike any other industrial park in the country.

GM's Canadian Technical Centre

The Canadian Technical Centre is General Motors' second largest automotive software engineering and development cluster in North America.

Its engineers and software developers in Markham are focused on automated driving, electrification, next-generation infotainment systems, and new technologies for mobility solutions.

"We saw a clear path to innovation and execution in Markham," says Ted Graham, head of open innovation at GM Canada.

In his role, Graham works with start-ups, universities, incubators, and accelerators to further the future of mobility. There is a rich ecosystem in Markham to draw from, he says, and there is ready access to high-quality engineering and software development experts.

Nearly 700 employees belong to the CTC Markham campus, a 150,000-square-foot site that features state-of-the-art labs and innovation spaces.

Key projects in Markham include software development for BrightDrop, GM's technology startup helping decarbonize last-mile deliveries, as well as hands-free driver assistance systems like Super Cruise and active safety features like Lane Keep Assist, which is tested on the CTC McLaughlin Advanced Technology Track in nearby Oshawa.

"The future is zero crashes, zero congestion and zero emissions," said Graham. "That future is closer than many people think."

More at <https://www.gm.ca/en/home.html>



www.business.markham.ca



Advanced robotic guidance solution utilizing Unblink3D Robotics 3D Vision Toolbox to automate wheel installation.

Qualcomm Technologies Inc.

Known for its system-on-a-chip semiconductor products found in billions of mobile devices, Qualcomm Canada is applying that expertise to the automotive sector through its Markham office.

The company, which employs 41,000 people worldwide, has been advancing technology in in-vehicle communications, entertainment and Advanced Driver Assist Systems (ADAS) in Markham since 2009. Qualcomm currently has an automotive design-win pipeline of US\$13 billion.

"A big story for Qualcomm is automotive," said Sai-Kit Eng, senior director of engineering operations at Qualcomm Canada.

"We are the No. 1 semiconductor supplier for telematics, automotive connectivity and infotainment systems and a leading provider of ADAS solutions. All the systems that allow you to make phone calls or be navigated by GPS or to play music, all of that comes through chips."

Virtually every carmaker in the world uses Qualcomm products.

Not even a global pandemic has slowed growth at the Markham facility, which grew from 300 to 470 employees over the last two years.

"Markham provides excellent access to government research and development incentives and high-quality opportunities that attracts engineering talent from around the world," said Eng.

"That allowed the creation of a centre of excellence in artificial intelligence and machine learning and automotive applications here in Markham. We believe demand is only going to grow in this space as 5G and artificial intelligence combine to connect vehicles to each other and to the road."

More at <https://www.qualcomm.com>



Bluewrist

Bluewrist provides 3D-vision-based robotics platforms for automated quality control systems and advanced guidance systems in the automotive sector. It is deploying its solutions around the world to components manufacturers and OEMs, including licensing its proprietary software through a new subsidiary Unblink3D.

Bluewrist platforms use 3D vision and AI to look for defects in welds, surfaces, connectors and fasteners that, if left undetected, could lead to critical safety issues and costly recalls. Vision-based robotic guidance solutions also automate many dangerous and repetitive tasks and help improve factory productivity and output.

"Our technology is leading class and field tested," said CEO Najah Ayadi.

The company was founded in 2006 and has been in Markham for 12 years. Ayadi says moving to Markham was an easy decision.

"Markham is the innovation capital of Canada. It's the Silicon Valley of Canada," he said. "It's also a great place to work, to live, to have fun and to play."

Most of Bluewrist's 50 employees live in the city, which has great connectivity to the region, offers a highly skilled workforce and is home to a strong automotive technology sector, he says.

"We have found many businesses in Markham that want to partner with us."

Bluewrist has been recognized for four straight years as one of Canada's Top Growing Companies, achieving three-year revenue growth of 142 per cent.

More at <https://bluewrist.com>



www.business.markham.ca



HAMILTON - CANADA'S SMART TRANSPORTATION & MOBILITY HUB

Hamilton, Ontario is Connected,
Electric and Automated for the
Next Wave of Smart Transportation.

Innovators test smart mobility
technologies on a multi-site network
that includes private AND public
roadways, a combination of
4G/5G networks.



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AHEAD OF THE CURVE

HAMILTON HAS A PLAN TO REVOLUTIONIZE AUTONOMOUS VEHICLES



The Centre for Integrated Transportation & Mobility (CITM) in Hamilton is advancing real-world research, development, validation, and commercialization of next generation smart mobility solutions.

CITM is an integral part of regional accelerator Innovation Factory and located at the McMaster Innovation Park (MIP). It is one of seven regional technology development sites in the Ontario Vehicle Innovation Network (OVIN) that supports start-ups, scale-ups and companies looking to develop smart mobility and electrified vehicle technologies.

CITM offers innovators a multi-site test network that includes private and public roadways, 4G and 5G networks, hardware and software integration, compute-at-the-edge capability, and a data repository that features rich datasets collected from in-vehicle and roadside sensors. This technical resource is available for companies looking to validate technologies within autonomous, connected, and electric vehicles and the infrastructure to support them.

“That real-world testing isn’t found everywhere. We offer real streets, with real people and real vehicles,” said Richard Dunda, Director of CITM. “At some point, you have to leave the lab and our testing environments allow for that. We collect anonymized data – about traffic patterns, speed, pedestrians, road and weather conditions and aggregate it. This helps companies using AI and machine learning to build software like collision avoidance systems, traffic management systems and other safety solutions. Having good data is what helps make AI and machine learning systems smarter.”

One test site consisting of Internet of Things (IoT) sensors and devices is found on a long stretch of street on Hamilton’s east Mountain, thanks to a partnership with the City of Hamilton, and another is within MIP. Additional test environments are in development with CITM partners and will further support product and solution testing across a greater variety of use-cases.

CITM also helps entrepreneurs pursue market and funding opportunities, manage their technical, business, and growth challenges, access valuable training, and connect with expert advisors and mentors.

Underpinning everything is a skilled workforce in the Hamilton region, and the talent generation and applied research power of McMaster University and Mohawk College, notes Dunda. CITM facilitates research collaborations, coop and work placements and supports students starting companies at The Forge.

Hamilton is home to a number of key research facilities working in the realm of electric, connected and autonomous vehicles, including the McMaster Automotive Resource Centre, the McMaster Institute for Transportation and Logistics, the Centre for Automotive Materials and Corrosion, the McMaster Manufacturing Research Institute, and CanmetMATERIALS. All of this activity also aligns with the City’s Goods Movement focus sector.

Major automotive suppliers, including ArcelorMittal Dofasco, Tiercon and Stackpole, are also located in Hamilton.

The city’s multi-modal transportation network is also crucial to the work of CITM, says Dunda. It is helping the Hamilton-Oshawa Port Authority maximize the potential of a test facility on its property to optimize traffic flow and efficiency. It’s also in conversations with the Hamilton International Airport about an autonomous system for cargo movement.

There is a growing list of success stories among CITM clients. Iris, which develops automated systems to monitor road infrastructure and report problems, was recently named the winner of InfraChallenge, a global infrastructure competition, received a 2021 Excellence in Innovation and Technology award, and has implemented multiple smart city technology projects with municipalities throughout Ontario. It was most recently named Best-in-Class CleanTech for Transportation by the Ontario Sustainable Energy Association.

Gatik is working with major retailers, including Walmart and Loblaw Companies, to develop autonomous trucks that run between distribution centres and stores using short, predictable, non-complicated routes.

Accession Technologies is working on a flagship platform that allows people with disabilities to operate vehicles safely and effectively using facial gestures.



**INVEST
IN HAMILTON**



ONTARIO

Ontario companies, universities, research centres and innovation hubs are developing new technologies that are transforming the next generation of vehicles and transportation experiences.

Highlights from the cutting edge of auto innovation include:

- Canada's largest automotive company, Magna International based in Aurora, has increased its R&D investment to position itself at the forefront of vehicle electrification and autonomous driving.
- CanmetMATERIALS Lab, in Hamilton, is dedicated to innovation in metals and materials fabrication, processing and evaluation.
- The Fraunhofer Project Centre for Composites Research at Western University in London is developing materials that are lightweight or have low life-cycle impact for manufacturers in the automotive sector.

- Global auto assembler Infiniti launched its first North American Innovation Lab program in Toronto to take advantage of the vibrant start-up ecosystem at the intersection of automotive and technology.
- The Windsor, Ontario-built Chrysler Pacifica is the only available hybrid option in the minivan segment and has received numerous industry awards since its launch.
- Ottawa has established one of North America's leading all-weather test environments for connected and autonomous vehicles.

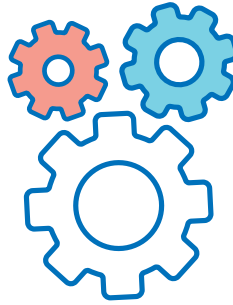
Content courtesy of Ontario Ministry of Economic Development, Job Creation and Trade www.investontario.ca

ONTARIO'S AUTO INDUSTRY — FACTS AND FIGURES

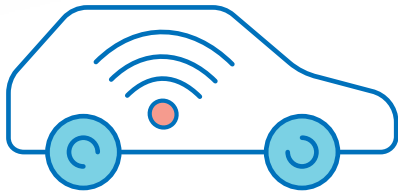
Ontario has a strong track record of building cars and car parts. The auto industry is a key element of Ontario's economy:

100,000+ DIRECT JOBS

plus thousands more spin-off jobs in communities across the province

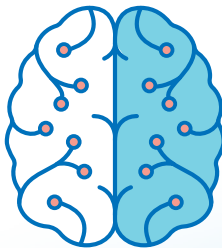


With five automakers (Toyota, Honda, GM, Ford, Fiat Chrysler Automobiles) as the anchor for economic activity up and down the value chain, Ontario's auto industry remains strong overall, with the province ranking **AS NORTH AMERICA'S TOP AUTO-PRODUCING REGION FOR 2017, BUILDING ALMOST 2.2 MILLION VEHICLES.**



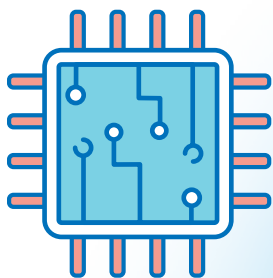
200+

companies including GM, Ford, Google, Uber, Apple and BlackBerry QNX are developing connected and autonomous vehicle technologies in Ontario



24

Ontario colleges and 11 Ontario universities offer auto-related research initiatives and training programs



INTEGRATED SUPPLY CHAIN —

700+ parts firms and 500+ tool, die and mold makers



A LONG HISTORY AND A DYNAMIC FUTURE FOR THE AUTOMOTIVE SECTOR IN DURHAM REGION

Durham region is known for its strength in the automotive sector and as a leader in energy innovation. Today, these sectors are converging and creating new opportunities.

Durham region has long been at the forefront of the automotive industry, with a history of innovation that dates back to 1832, when R.S. "Sam" McLaughlin launched his horse-drawn sleigh and carriage company in Oshawa. Over time, carriages made way for automobiles, as Robert McLaughlin & Sons rebranded to McLaughlin Motor Company—which later merged with Chevrolet to become General Motors of Canada (GM). Today, the General Motors Canadian Technical Centre in Oshawa serves as an integral part of GM's Global Engineering operations. Volkswagen Canada, Lear, and other large manufacturers continue to call Durham region home and recent significant investments have strengthened Durham region's position in advanced automotive and parts manufacturing.

Talent & Research

Durham region's post-secondary schools are graduating the top-tier talent needed to support the industry, especially at Ontario Tech University. Their involvement in the future of automotive includes:

- Home to the only accredited automotive engineering program in Canada
- The Creation of ACE Aerodynamic Climatic Wind Tunnel. This is a world class facility used by major manufacturers, Industry/Academic collaborative R&D, and academic research to test and develop their products and bring ideas to market. ACE provides a full range of testing facilities, including one of the largest Aerodynamic climatic wind tunnels in the world, that can be used to run multiple weather simulations. They can recreate any weather conditions a vehicle will experience anywhere in the world, from the blistering heat in Death Valley to the frigid conditions in the Arctic. Vehicles can be tested operating under full load with cross-winds and wind speeds up to 280 km/hr.

“ACE is a solutions provider that drives innovation. Our most recent enhancements include a unique plug and play system of swapping a moving ground plane (MGP) with a dynamometer. We are the only tunnel in the world to share the same airflow for full vehicle powertrain / HVAC development on a dynamometer and world class aerodynamic force measurement system using a custom MGP.”

– John Komar, ACE Executive Director

Ontario Tech University is also involved with the Automotive Parts Manufacturing Association (APMA) of Canada. They launched the first original, full build, zero emission concept vehicle named Project Arrow. This was a joint effort of the world class automotive supply sector in Canada and post secondary institutions. Ontario Tech University will be the lead academic institution for Phase 2 of Project Arrow, with engineering specifications and aerodynamic testing to take place at the ACE Climatic Aerodynamic Facility.

Research and Innovation are also centralized in Durham region. The region is home to General Motor's Canada Canadian Technical Centre (CTC) and the McLaughlin Advanced Technology Test Track. The track will be used

for the development integration of software and hardware for a variety of new technologies and advanced vehicle systems, including vehicle motion embedded controls, advanced driver assist features, autonomous research, all-electric propulsion, and infotainment. The facility spans some 55 acres and joins GM Canada's technology operations to bring the total to four sites, three of which are in Durham region. The CTC is now GM's largest software engineering and development center outside the United States.

Other Innovative highlights in the region include being home to one of the six Regional Technology Development Sites (RTDS) across the Province of Ontario. The Durham site has a focus on Human Machine Interface and User Experience.

In addition to RTDS the region can showcase sector start ups including Accession Technologies - A facial gesture-based Driver Assistance System, for drivers with disabilities who are unsatisfied with existing vehicle adaptations. Plus Korechi innovations' RoamIO, an autonomous robot enabled with AI and high precision spatial awareness to automate tasks and address shortage of skilled labour for fruit and vegetable farmers.

Durham region has always been an automotive leader and now is becoming an important location for innovations in electric and autonomous mobility.



Photos courtesy Ontario Tech University

STEEL IS DRIVING ONTARIO'S AUTOMOTIVE PROSPERITY FORWARD WITH ADVANCED MANUFACTURING AND EMERGING PRODUCTS

ArcelorMittal, a multi-national steel and mining company, has a significant footprint in Ontario with plants producing flat, long and tubular steels, as well as tailored blanks. Its advanced steel solutions are an integral element of key supply chains, including those within the automotive sector that make vehicles design-forward, performance-driven and safety-superior, all at the lowest cost.

A network of global research and development teams across several science disciplines both work directly with customers to develop steel products for next-generation vehicles, and design, develop and continuously improve advanced manufacturing processes.

Building on past investments in its steelmaking and finishing assets in Ontario, two recent announcements demonstrate the company's leadership position in product and process technologies that result in smarter steels for people and planet.

In 2021, ArcelorMittal announced its intention for an extraordinary investment in its Dofasco steelmaking complex in Hamilton, ON that will change the way the company makes steel and significantly reduce its greenhouse gas emissions. In addition, ArcelorMittal Tailored Blanks announced it will invest in new equipment and modifications to its Woodstock, ON facility to produce advanced tailor welded blanks for door ring applications used in the automotive sector.

The Tailored Blanks investment of \$17.4 million CAD will receive \$15 million from the Southwestern Ontario Development Fund and address increased production demands stemming from investments in the battery electric vehicle market. Todd Baker, president and CEO of ArcelorMittal Tailored Blanks says the company's solutions are helping to shape Ontario's next-generation automotive industry and the province's low carbon economy. "Specifically, this investment enables ArcelorMittal Tailored Blanks to produce one million door ring blanks annually for the electric vehicle market."

Tailored blanks are semi-finished parts that feature the laser welding of two or more separate steel shapes together to make one piece. In fact, most laser-welded blanks are made from two unique pieces but some are made from six or more different pieces of steel. This allows the part to have optimized thickness, strength or

corrosion protection only where it's needed. The laser-welded blanks produced in Woodstock are then sent to the automotive manufacturer or supplier to be hot-stamped, then control-cooled to create the final shape and strength of the part. The ArcelorMittal Tailored Blanks Usibor® door-ring blank is a weight-saving, award-winning solution that provides superior crash performance to protect vehicle occupants in a collision, while increasing vehicle stiffness to improve the vehicle's driving characteristics.

In the second half of 2022, ArcelorMittal Dofasco will begin producing the Alusi®-coated Usibor® press hardenable steel used in a variety of parts critical for passenger protection in vehicle collisions, including the door ring. The \$24 million CAD coating addition at its No.5 Hot-Dipped Galvanizing Line will make the company the only producer of Alusi®-coated Usibor® in Canada.

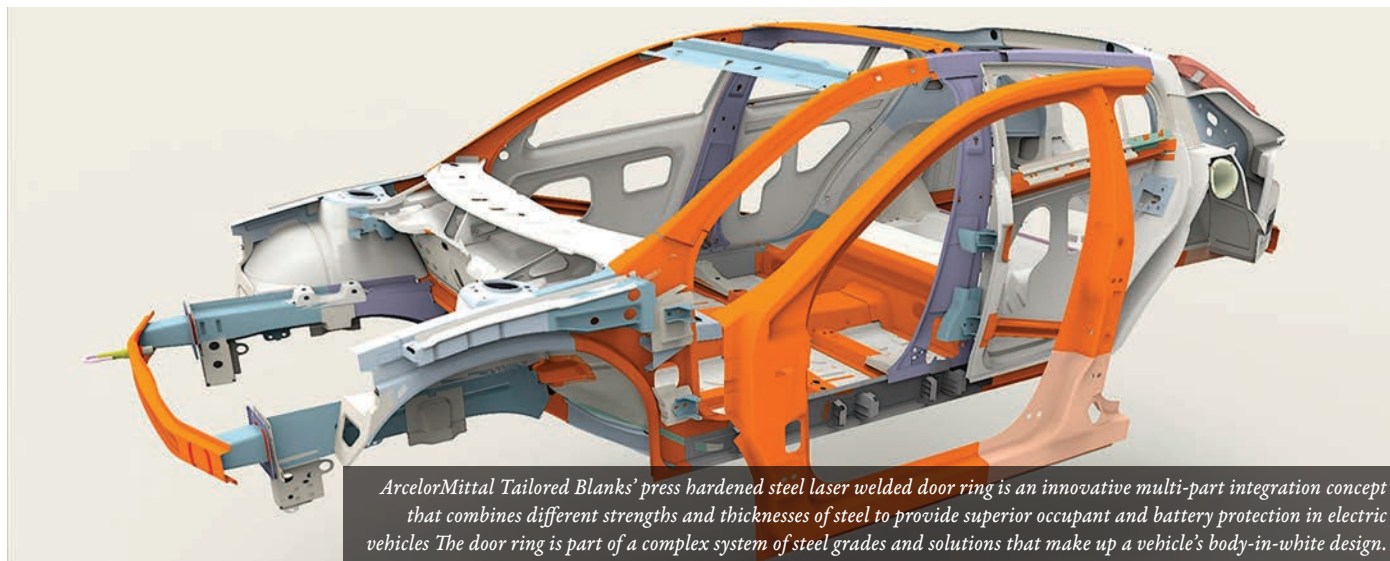
Also in Hamilton, the extraordinary planned investment for new steelmaking methods will cut annual greenhouse gas emissions by approximately 60 per cent, before 2028. The approximately \$1.8 billion CAD project, which is supported by a \$500-million investment from the Government of Ontario and a \$400-million investment from the Government of Canada, will see the plant transition its fossil fuel dominant coke plant – blast furnace – basic oxygen furnace steelmaking process to direct reduced iron (DRI) – electric arc furnace (EAF) production. While cutting carbon dioxide emissions and eliminating the need to transport coke and coal, the shift will also reduce environmental impact from the operations.

Across its global operations, ArcelorMittal is committed to a 25 per cent reduction in carbon dioxide emissions by 2030.

"ArcelorMittal's ambition is to lead the steel industry in decarbonization. The planned investment in Hamilton puts us well on the path to reaching our target to be net zero by 2050," said Tony Valeri, vice president, corporate affairs at ArcelorMittal Dofasco.

"The investment plan sends a strong signal that Hamilton is a centre of steel-making excellence and a key part of Canada's economy."

Valeri says further research is underway into other clean technologies and materials like hydrogen, biocarbon, and carbon capture utilization and storage.



ArcelorMittal Tailored Blanks' press hardened steel laser welded door ring is an innovative multi-part integration concept that combines different strengths and thicknesses of steel to provide superior occupant and battery protection in electric vehicles. The door ring is part of a complex system of steel grades and solutions that make up a vehicle's body-in-white design.



LONDON: A LEADER IN ONTARIO'S THRIVING AUTOMOTIVE INDUSTRY

Boasting more than 100 auto parts supply plants, access to automation expertise, and a commitment to research and development, London continues to be a leader in advanced automotive technologies and manufacturing. With 34,000 auto workers employed in the region, London remains a significant contributor to Ontario's ranking as the second-largest vehicle producer in North America. With new advancements and high daily production rates, both new and established businesses aren't showing any signs of slowing down. In fact, they are ramping up and preparing to meet the demand for Ontario-made vehicles and vehicle components.

A Diverse Network of Auto Parts Supply Plants

With big players like General Motors, CAMI Automotive, and Magna calling the region home, London has long been known for excellence in the advanced manufacturing auto sector. This success is due mainly to the diverse network of auto parts supply plants in London and surrounding areas. Companies like Martinrea Automotive Systems Ltd., Autoneum Canada Ltd., Kaiser Aluminum Canada, Means Transform Products, and Canada Mold Technology Inc. are just some of the businesses working to meet the demand for materials, auto parts, tools, and equipment that drive production in Ontario's auto industry.

This established network also attracts global companies like Sodecia, a full-service supplier that works with the largest auto original equipment manufacturers (OEMs) to develop new products and ideas for the future. With 39 worldwide locations, there is no question why they chose London to expand their tools and equipment division.

Access to Automation Expertise

London's auto sector also benefits from easy access to automation solutions due to companies like BOS Innovations, which provides custom manufacturing solutions that help auto manufacturers achieve greater productivity through automation integration and robotics. With their expertise in assembly, welding, and custom automation, BOS Innovations is an integral part of supporting

other auto industry leaders in the area. The company also contributes jobs to the region and was recognized in 2022 as one of Canada's Best Employers for Recent Grads. Growth List and Growth 500 awards in 2018, 2019, 2020 precede this accolade, acknowledging the exponential growth of the automation powerhouse in London. In addition, JPM Solutions and ElectroZad have also set up shop in London and continue to make outstanding contributions to supporting the automation needs of the industry.

Innovations in All-Solid State Batteries

Due to the presence of Western University, London attracts bright students and brilliant researchers from around the world. For example, the Fraunhofer Innovation Platform for Composites Research (FIP at Western) currently leads in all-solid state battery innovation. These batteries are regarded as the most promising for energy storage, making them ideal solutions for electrical vehicle applications.

Robust Support for Research and Development

Through the FIP at Western, new and established businesses can also take advantage of press centre trials, analytical testing services, scientific and engineering services, and training/educational opportunities to support their research and development. These resources allow for material and formulation development, manufacturing process investigation, part development, and access to many other research facilities.

Starting Up and Scaling Up in London

Auto sector companies seeking to start-up or scale-up in London are well served by the diverse community of auto sector leaders, automation experts, and research institutions dedicated to meeting demands now and in the future. Whether for internal combustion engines or electric vehicles applications, auto sector companies that choose London have the access to materials, components, services, and support they need to thrive.

DRIVING A CARBON-FREE FUTURE

FACULTY AND STUDENTS AT MOHAWK COLLEGE ARE DEVELOPING AND TESTING NEW BIOFUELS

Mohawk College is finding solutions to real-world problems for its automotive industry partners thanks to cutting-edge investments, expert faculty and the work of students, who will be the future talent desperately needed in the industry.

Mohawk's chemical engineering technology program, the largest by enrolment in Ontario, is uniquely positioned to prepare students for a career in clean technology, says George Miltenburg, Associate Dean of the School of Engineering Technology.

A key aspect of the clean-tech future in automotive is biofuels, which is a focus in the college's three-year chemical engineering technology program.

"There are a lot of internal combustion engines in all kinds of vehicles, equipment and industrial systems and it's unrealistic to think that they all be converted to electric in any reasonable timeframe that will help address climate change," said Miltenburg.

"But what we can do is replace fossil fuels with much better options."

While battery-powered electric has garnered the most attention in next-generation automotive, there is growing recognition among some automakers that the future also includes vehicles fuelled by biofuels and hydrogen.

"Anyone that uses fuel is ready to cut their carbon emissions and can benefit from exploring biofuels. They are natural products, less energy intensive, are biodegradable and can even incorporate materials that are otherwise waste," said Miltenburg.

Producing next-generation biofuels

Beginning five years ago, senior Mohawk chemical engineering technology students have produced bio-ethanol in one-litre, bench-scale fermentations in glass reactors, says chemical engineering professor Greg Matzke. The resulting liquid is separated from any solids and then goes through a distillation process to produce ethanol.

The college has now made an investment in a standalone biofuel pilot plant in the chemical engineering lab at Mohawk's main campus. It requires a batch production process that will be managed by paid students, producing formulations in 30 litre quantities using the ethanol produced at the college.

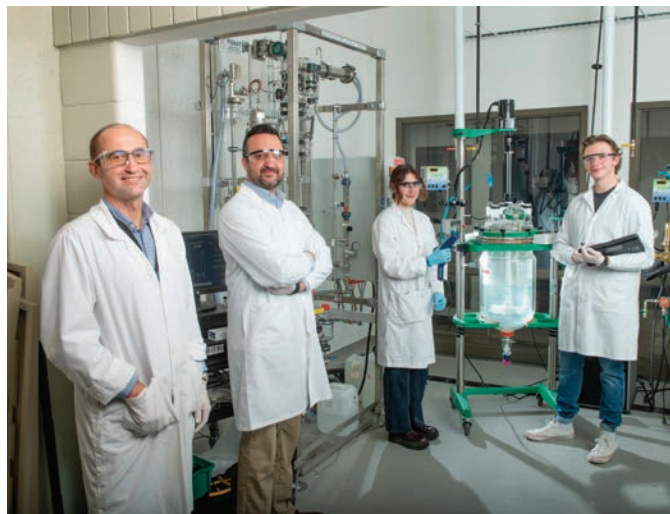
Matzke says the goal is to find materials from which to produce biofuels that doesn't come from products that are food for people, but rather from waste materials such as cellulose or starches that are going to landfill.

"Sustainability is important to our students and it's going to be important throughout their careers in whatever industry they work in," said Matzke.

In the pilot plant, students will combine the ethanol they produce with the waste oil from campus restaurants to produce biodiesel, says chemical engineering professor Pouria Baghaei. Faculty and staff will also explore using algae grown at the college as a source material.

"That's a new technology being pursued in industry right now. It can grow anywhere and doesn't need fertile land, so there is no competition with land used to produce food," said Baghaei.

As well, Mohawk will research using enzymes in the production of biofuels in order to reduce the energy needed and lower carbon dioxide emissions.



"We are giving students the hands-on experience in using real equipment in pilot-scale production and they are learning how to adjust the process or the materials to maximize optimization of the biofuel," said Baghaei.

"They will have roles in commissioning the equipment and running the processes. By the time they graduate they will have knowledge of biofuel production from start to finish," said Matzke.

Working with industry

The pilot plant will create biofuels that will be tested by motive power students using advanced equipment located at the college's Stoney Creek Campus for Skilled Trades that measures engine performance, fuel economy, engine wear, and emissions.

Mohawk's Vehicle Technology Centre has deep capabilities in the measurement of the performance of biofuels. That includes: systems to measure emissions (carbon monoxide, carbon dioxide, total hydrocarbons, volatile organic compounds, nitrogen oxides); particulate analysis; fuel economy; and chassis and engine dynamometers that calculate performance in terms of the conversion of combustion into power.

The college is also undertaking applied research projects with industry partners, including large petrochemical producers, that are exploring new opportunities with biofuels.

"They want independent testing and verification of performance and emissions. This will be the first step in the testing of a potential new product," said Miltenburg.

The talent difference

Mohawk's mechanical, electrical and mechatronics engineering graduates are working in automotive assembly and components plants, with particular skills in production design and automation.

The automotive industry is rapidly changing, says Wayne Ostermaier, Dean of the Marshall School of Trades and Apprenticeship.

"We work with our program advisory committees, industry and government to ensure we are always staying ahead. Our faculty have great expertise and are very invested in what is happening in industry," he said. "Our graduates are always in demand."



Engineer Ali Emadi founded Enedym to commercialize technologies born out of his research in transportation electrification, with the goal of supplying the world's need for lower cost and more sustainable electric motors.

MCMASTER AUTOMOTIVE RESOURCE CENTRE HELPING HAMILTON TRANSFORM A SECOND TIME

Hamilton is “Electric City” once again, thanks to the cutting-edge work of a research team at McMaster University that is powering the path to next-generation mobility.

Dr. Ali Emadi’s research group – the Canada Excellence Research Chair (CERC) Laureate Program at McMaster Automotive Resource Centre (MARC) – in Hamilton is one of the world’s leading academic research programs in transportation electrification and smart mobility with more than 250 graduate and undergraduate students, post-doctoral research fellows, and engineers.

MARC is a 90,000-square-foot purpose-built facility at McMaster Innovation Park where researchers work directly with industry to develop and test new technologies.

“Our model at MARC is to go big and go deep with industry partnerships. Our strategic alliances with the sector mean we are embedded with them right from the beginning of design,” said Emadi, who is a professor of electrical and computer engineering and mechanical engineering.

“We also have one of the best testing environments in the world. We can test electric motors, battery cells and packs, entire powertrains and entire vehicles.”

Emadi’s group works with companies of all sizes, from Ontario’s largest automotive manufacturer Stellantis (formerly Fiat Chrysler Automobiles), Ford, and GM to small, medium and start-up enterprises.

PhD and master’s graduates from Emadi’s team are in high demand all around the world.

“If we graduated 400 more of them today, they would all have jobs yesterday. There is an unbelievable need out there for talent and companies are investing where they know that expertise is centred,” said Emadi.

“Ontario is training engineers at a much higher rate than many other jurisdictions in North America and companies are realizing that. With government support, there is a tremendous opportunity to land more automotive investment in Ontario.”

Emadi, whose long list of academic, industry and investment achievements has established him as one of the leaders in his field, believes Ontario can be at the forefront of production of next-generation electric powertrains for automotive, industrial, consumer and micro-mobility sectors.

“The province has a massive advantage in intellectual property, expertise, testing, manufacturing capacity and talent generation in this field. There is a monumental opportunity at hand. MARC is an anchor of all of that.”

Emadi has created four spin-off companies out of his work, including two at McMaster University: Enedym, which is developing electric motors for a range of industries; and Menlolab, which is creating software tools for the design of electric and autonomous cars.

More than 15 million electric motors are manufactured worldwide every day, powering everything from household appliances to industrial and agricultural equipment to e-bikes, e-scooters and electrified vehicles of all shapes and sizes.

So while the market is huge and the need to transition away from internal combustion engines is immediate, a long-standing challenge is the cost of producing motors that require rare earth metals in permanent magnets. That can account for 30 to 40 per cent of the cost of the motor.

Enedym’s patented disruptive technology removes the need for the magnets, substantially reducing the cost, while providing powerful, efficient and high-performance operation.

The company, which is partially owned by McMaster, holds more than 50 patents or patents pending.

Enedym, which currently employs 35 people, is on a trajectory of rapid growth after attracting international strategic investors and licensing deals in 2021.

Other research groups at MARC include the Centre for Automotive Materials and Corrosion, the Centre for Mechatronics and Hybrid Technology and the McMaster Centre for Software Certification (McSCert). Soon, the McMaster Manufacturing Research Institute will move to the MARC facility to further amplify collaboration.

In June 2021, the university received \$10 million from FedDev Ontario to support an integrated automotive, aerospace, and advanced manufacturing electrification network known as iHub that leverages another \$16.8 million from industry partners.

When Emadi was offered a \$10-million Canada Excellence Research Chair in Hybrid Powertrain at McMaster in 2011, he says what really sold him was Hamilton’s history as Electric City. It was one of the first cities on the continent to be electrified by hydro power in 1898 thanks to the transmission technology of Nikola Tesla. That shaped the city’s industrial legacy, including all the powerful innovation of Westinghouse on the very site where MARC stands today.

Says Emadi: “Hamilton is the home of manufacturing and electricity and we believe electrification can transform Hamilton a second time.”



**Middlesex is sparking
a lot of **auto investment**
interest these days.**

Powering the path to next-generation mobility

Researchers at the McMaster Automotive Resource Centre (MARC) are partnering with industry and government to fuel innovative solutions, develop new technologies and train the high-demand talent required for the sector's future.

Home to one of the world's most advanced testing environments, MARC is the go-to place for leaders in the automotive sector – from start-ups to large manufacturers.

Together, through research and innovation, we're driving Ontario's economy.

Ali Emadi, engineering professor and Canada Research Chair in Transportation Electrification and Smart Mobility, McMaster University



BRIGHTER WORLD

