

Great Opportunities for Smart Transportation in Greater Montréal



Jacques Cartier Bridge



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10+1 reasons to invest in Greater Montréal in electric and smart transportation

1 Specialized ecosystem

- Ground transportation expertise
- Vehicle electrification value chain
- A world-class hub in Artificial Intelligence

4 Proactive city

- Smart Cities Challenge 2019 Winner
- Smart and Digital City Office
- Intelligent Transportation Institute

7 Leading talent pool

- 64,000 engineers
- 34,000 engineering students
- Research chairs in transportation electrification
- Bilingual population

10 Intermodal platform

- International airports
- The second-largest container port in Canada
- A railway network that extends all the way to Mexico

2 Affordable and clean electricity

- One of the world's largest producers of hydro power
- 99%+ electricity from renewable sources
- The lowest electricity rates among major North American cities

5 World-class research centres

- IREQ, Hydro-Québec's research institute: 800 patents and 40 licences
- Leading artificial intelligence research
- World recognized researchers

8 Competitive costs and incentives

- Cost advantage over other North American cities
- Generous R&D tax credits
- Financial support

3 Québec's electrification strategy

- Ambitious targets to drive the industry forward
- A budget of \$420M
- 5,000 new jobs by 2020

6 Testing areas and conditions

- Favorable climate
- Presence of a test center for Canadian and U.S. standards
- Semi-controlled and real-world testing areas
- Temporary imports of non-certified vehicles

9 Market access

- Direct access to 1.5B consumers due to NAFTA, CETA, CPTPP and 12 other trade agreements in force



**Montréal International's
strategic support**

01

A Booming Smart Transportation Hub



Québec's Smart transportation ecosystem at a glance



Source : Investissement Québec, 2019.

A strong transportation manufacturing industry



32,000
jobs



620
companies

A wide range of manufacturing, design and assembly activities for transportation equipment and vehicles

Québec has been developing its expertise in **specialized vehicles**:

- *Buses, motor coaches;*
- *Trucks; Garbage trucks;*
- *Armoured cars, ambulances, police cars;*
- *Motorcycles, snowmobiles, three-wheeled sports vehicles.*

A specialization strengthened customer base made up of industry giants

NOVABUS

BOMBARDIER
l'évolution de la mobilité

PACCAR

PREVOST

VOLVO





Greater Montréal, a smart and digital city

- **Smart Cities Challenge 2019 winner** for its proposal to improve mobility with a prize of \$50M
- **2019 Electromobile City Winner from Canada Electric Mobility**
- **First among the big smart cities**
 - Intelligent Community Forum (2018)
- Presence of the **Smart and Digital City Office** and **the Institute of Intelligent Transportation**
- **\$400M** invested into Canada's **5G public-private ENCQOR project Network** to enable better-sustained connection and communication between technologies
- **Many ambitious Intelligent Transportation System** projects: Urban Mobility Management Center, Smart Parking Project, Geo-Traffic Dynamic Database

World-class research centres

Recognized for its expertise in batteries and R&D



- **Hydro-Québec's research institute, IREQ** is recognized for its **expertise in batteries**
- Close to 30 research groups and research centres
- **800 patents and 40 licences** held by IREQ, Hydro-Québec's research institute
- Yearly average of \$100M in its innovation projects
- 500 specialists pool their efforts and expertise to support Hydro-Québec in every facet of its operations, from electricity generation to consumption.



**National Research
Centre of Canada**



**Electrical energy
innovation**



**Interuniversity Research
Centre on Enterprise
Networks, Logistics
and Transportation**



**Innovative Vehicle
Institute**

Collaborative cluster organizations to support companies and investors



Electric and smart vehicles



Transport and logistics



Clean technologies



Information and communications technologies



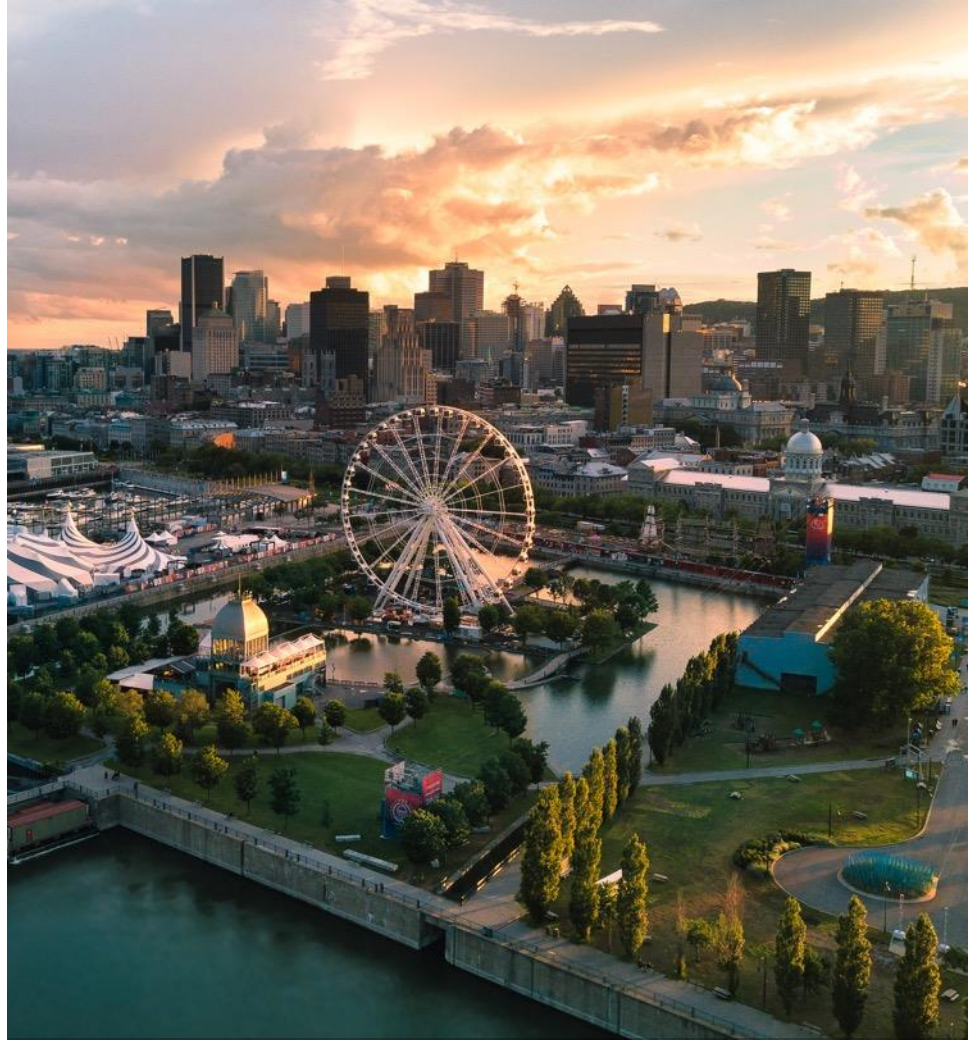
Ground transportation



Artificial Intelligence



AI-Powered Supply Chains



Old Port, Grande-Rue and downtown Montréal © Loïc Romer

Established local and global players thriving in Greater Montréal



Johnson Matthey

Production of lithium iron phosphate (LiFePO₄) for Lithium-Ion batteries to meet North American demand.



Blue Solutions

A company specializing in energy and automation technologies and opening a North American centre of excellence for transportation infrastructure in Montréal



TM4

A company designing **motors and power converters**.



AddÉnergie

1st in Canada and 2nd in North America in **charging solutions** for electric vehicles. It will provide New York City with charging stations for electric vehicles.



Varitron

One of the top five electronic manufacturing services companies in Canada.



Verbom

A leading **manufacturer of sheet metal parts** for the transportation industry.



ABB

A company specializing in **energy and automation technologies** and opening a North American centre of excellence for transportation infrastructure in Montréal.



Lion Bus

A Québec-based OEM that caters to the needs of the North American school bus industry.

A culture of partnerships and commitment



Dana Incorporated and Hydro-Québec announced a strategic joint-venture in which TM4 Inc., a subsidiary of Hydro-Québec, will become Dana's source for electric motors, power inverters, and control systems. (2018)



Michelin acquires Camso and strengthens its position in the manufacture of specialty tires and tracks for off-road vehicles (2018)



Kéolis launches the first **NAVYA** autonomous shuttle on the roads of Quebec (2018)



PSA (FreetoMove) invests in Communauto to eventually provide car-sharing vehicles, thus preparing for its eventual return to the North American market (2016)



Daimler and Blue Solutions a subsidiary of Bolloré, enter into an agreement to equip Daimler's E-Citaro buses with Lithium Metal Polymer (LMP®) batteries from Blue Solutions, exclusive supplier of full solid batteries for electric buses (2018)



Mobilizing project between Lion Bus, TM4, AddÉnergie Technologies, Adetel Solution and Alcoa Canada from electric heavy-duty vehicles prototypes (2016) to launching of All-Electric Class 8 Urban Truck (2019)

Political momentum for the industry



- **2015-2020 Transportation Electrification Strategy**
 - A budget of over \$420M and 35 measures, including \$86.5M to develop the industry
- **Other government strategies that will have a positive impact on the transportation sector:**
 - Sustainable Development Strategy (2015–2020)
 - Maritime Strategy (until 2030) ▪ Aluminum Development Strategy (2015–2025) ▪ Aerospace Strategy (2016–2026)
 - Digital Strategy (effective 2017) ▪ Plan Nord 2015-2035
 - Energy Policy 2030



- **2016–2020 Transportation Electrification Strategy**
 - Institut de l'électrification et des transports intelligents (Institute for Electrification and Smart Transportation)
 - Planned urban test corridor in a real-world setting
 - Assessment of the feasibility of an urban distribution centre for last-mile deliveries using small electric vehicles



- **IVÉO**, dedicated to real-world experimentation of new technologies in the field of smart and sustainable transport for small and medium cities, such as: Boucherville, Brossard, Candiac, Deux-Montagnes, Granby, Hampstead, Lac Mégantic, La Prairie, L'Assomption, Longueuil, Sherbrooke, etc.

Québec's transportation electrification strategy

2020 Targets

- Create **5,000 jobs** in the electric vehicle industry
- Provide **\$500M** to stimulate investments
- Reach the mark of **100,000 plug-in hybrids and electric vehicles** registered in Québec
- **Reduce** annual GHG emissions from transportation **by 150,000 tonnes**
- **Reduce** annual fuel consumption in Québec **by 66 million litres**

Transportation stands on a strong IT industry

- **107,500** qualified employees in IT, and **5,240** companies
- **A GDP of \$11.6B**
- **Lowest operating costs in North America** for software development, ahead of Toronto, Boston, New York, and San Francisco
- **Broadly diversified industry:**



5th

highest tech jobs concentration
among the largest metropolitan areas in Canada & U.S.



1st

in Canada and a world leader in VFX & animation



5th

video game development hub in the world



Building transportation with AI

- Over **\$2 billion in AI investments** announced in Greater Montréal since 2016
- The Canadian government chose Montréal as the headquarters for **SCALE AI**, Canada's AI supply chain super cluster
- All major players present and a thriving community aiming for a better world



Made-in-Québec electric vehicles



BOMBARDIER RECREATIONAL PRODUCTS (BRP)

A new, fully electric Spyder with a 170-km range. 70% of BRP recreational products are exported to the U.S.



POSI

MOVERA
An iconic shuttle vehicle developed by a consortium for Calgary International Airport.



LION BUS

The first OEM to sell a fully electric school bus. Its vehicles are also available in California, Massachusetts and New York.



BOMBARDIER-ALSTOM



KARGO

A vehicle that is 90% aluminum. 30% of all vehicles produced go to mines outside North America.



DOPPLEMAYR



NOVABUS

Volvo is making the most of Greater Montréal's position as the only centre of expertise in transportation electrification in North America.



PACCAR



MOTREC



LITO GREEN MOTION

A culture of innovative, sustainable urban mobility



Société de transport de Montréal (STM) planning to go fully electric

- Ranked 9th in the 2018 **Best 50 Corporate Citizens in Canada**
- Goals: **acquire only electric vehicles as of 2025** and **achieve zero emissions for vehicles by 2040**



Réseau Express Métropolitain (REM) is a light rail network under construction in Greater Montréal

- **67 km, with 26 stations**
- Initiated by Caisse de dépôt et placement du Québec (CDPQ Infra) for an estimated **investment of \$6.3B**



Communauto, one of the largest companies of its kind in the world, and North America's car-sharing pioneer

- **3,000 vehicles**
- A fleet including **hybrid and electric cars**
- Serves 13 Canadian cities and Paris in France



BIXI, the bike sharing system that has taken over the world

- **7,250 bikes** and **600 stations** in Montréal
- Urban mobility and environmental responsibility
- A system used in **33 cities around the world**: NYC, London, Chicago, Toronto, Barcelona, Sao Paulo, etc.



02

All the Building Blocks for the Future of Mobility



Clean, renewable, reliable and affordable electricity



1st place

in North America for the lowest Electricity prices for large-power customers

Total installed capacity
of **47 222 MW**



With its rich renewable, green and stable supply of **low-cost hydropower**, Greater Montréal boasts one of the lowest electricity rates in North America:
CA¢3.98/kwh*

* Rate LG: large power with minimum billing demand of 5,000 kW, transmission and distribution included, for 120-kV supply with 95% load factor, and including the Economic Development Rate reduction (if eligible).



Carillon generating station © Hydro-Québec

- **Stable electricity rates:** Thanks to the collective wealth represented by our water resource, the rates are not subject to the volatility of oil and gas prices
- Hydro-Québec generates more than **99% of clean, renewable energy**
- The **quality** and **reliability** of the power grid are also two major advantages

Favorable conditions for vehicle testing



Québec's weather is perfect for testing

- Harsh winter conditions
- Heavy precipitation and wide temperature variations

Dedicated organisms
for the experimentation
of new technologies in
the field of smart and
sustainable transport



One of the most modern motor vehicle test centres (MVTC)

- Transport Canada's only motor vehicle test and research centre; run by PMG Technologies
- The only Canadian motor vehicle test centre and one of the few in North America that conducts testing to Canadian and U.S. standards (CMVSS and FMVSS)
- Test vehicle preparation lab and crash lab
- 25 km (15.5 mi.) of test tracks and proving grounds
- Environmental chambers for tests at temperatures ranging between -55°C and $+85^{\circ}\text{C}$



PMG Technologies' test tracks

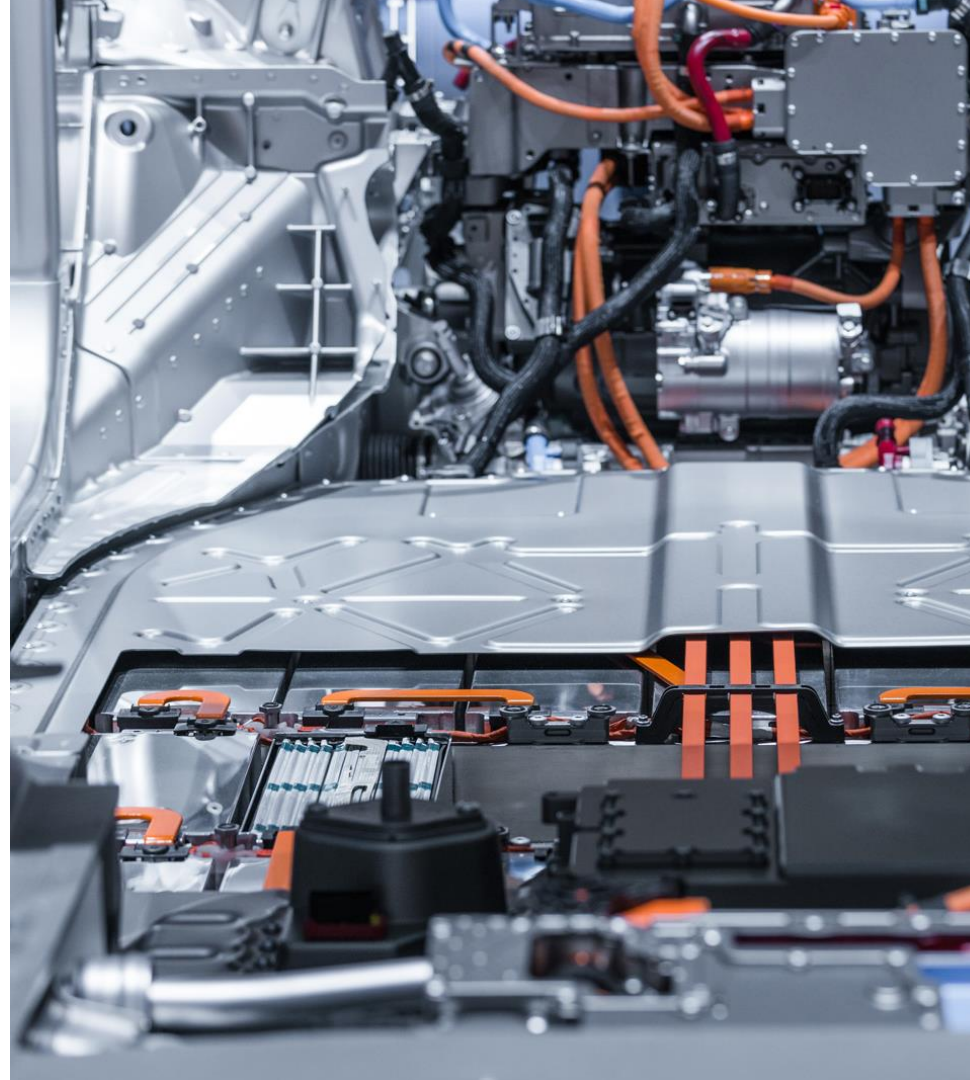
Abundant natural resources needed for battery production

Geological diversity

- Availability of **metals needed** to manufacture batteries and special alloys for lighter vehicles
- **Lithium, graphite, titanium, phosphate, cobalt, niobium and vanadium reserves**
- **3rd world lithium deposit** is in Québec

Global aluminum producer

- **Nine aluminum smelters** in Québec, with a production capacity of 2.9 million tonnes
- Canada, the **world's third-largest producer** of primary aluminum, 90% of which is produced in Québec
- The major producers are **Rio Tinto** and **Alcoa**
- **Aluminum processors serving the transportation industry:**
 - Bombardier (metro) ▪ Fabrication Powercast (mold cast parts)
 - Fourgons Transit (truck bodies) ▪ Cambli Group (armoured trucks) ▪ Tremcar (tank trailers) ▪ Remtec (special vehicles/tanks) ▪ Raufoss (formed aluminum products)
 - Équipements Labrie Manac (waste collection equipment)



03

A Strategic Market Access



Montréal
International





A gateway to 70% of the world's GDP

Thanks to **NAFTA, CETA, CPTPP**
and 12 other free trade agreements in force*

Direct access to **1.5 billion wealthy consumers**
and a **combined GDP of US\$55 trillion**
(70% of the world's output of goods and services)

**Only Canada has free trade agreements
with all G7 countries**

No tariffs on **steel** and **aluminum** products

*North American Free Trade Agreement (NAFTA), Comprehensive Economic and Trade Agreement (CETA) and Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP)

Source: Global Affairs Canada, 2019; Invest in Canada, 2019; The World Bank, 2017.

A true logistics and intermodal hub



- **Two international airports:** Montréal–Trudeau and Montréal–Mirabel
- **19.4M passengers** in 2018 (+6,9%)
- Direct flights from Montréal–Trudeau airport to **more than 150 destinations**, including 119 international destinations



- The **2nd largest port** in Canada and **1st container port** in Eastern Canada
- Dubbed the port for Québec and Ontario shippers
- More than 2,700 ships/year, 2,500 trucks/day and 60–80 trains/week
- Access to 40M consumers in **one day by truck** and 70M consumers in **less than two days by train**



A rail network that extends across Canada and the U.S. all the way to Mexico:
over **42,557 km of track in Canada**



Canadian National Railway Company (CN)

Headquarters located in Montréal. Tracks stretching across Canada from the Atlantic to the Pacific coast and following the Mississippi River all the way to the Gulf of Mexico



Canadian Pacific Railway (CP)

22,500 km of track in 6 Canadian provinces and 13 U.S. states



CSX

More than 34,000 km of track in 23 U.S. states, the District of Columbia, Ontario and Québec

04

A Deep and Growing Pool of Highly Qualified Talent



The best student city in the Americas and Canada's university capital

- **Canada's university capital:** 11 university institutions and 60 colleges
- **320,000 post-secondary students**, including **201,000 university students** and **35,500 international university students**
- **More than \$1B in funding dedicated to university research**
- **Best student city in the Americas:**



1	Montréal
2	Boston
3	Toronto
4	Vancouver
5	New York



Source: QS Best Student Cities in the World, 2018; Ministère de l'Éducation, du Loisir et du Sport du Québec, 2016; Research Infosource Inc., 2018.



The metropolitan area with the most bilingual and trilingual population in Canada

- **2.5 million residents speak English**, that's 9% more than in Vancouver
- **55% of the population is bilingual** (English and French), compared to 8% in Toronto and 7% in Vancouver
- **Almost 20% of the population is fluent in three or more languages** compared to 4% in Toronto and 3% in Vancouver

The engineering advantage

Top-ranked mobility engineering programs



- 1st in Québec for the number of students and the scope of research activities
- 120 programs, 20 Industrial Chairs (including 13 NSERC), 25 Canada Research Chairs and 1 Canada Excellence Research Chair



Le génie pour l'industrie

- 10,700 students, including 2,800 graduate students
- \$27,2M in R&D research funds
- 60% of research activities carried out in partnership with the industry



- Highly ranked electrical engineering and software engineering departments
- A Canada Research Chair in Efficient Electric Vehicles with Hybridized Energy Storage Systems
- World recognized laboratory on Intelligent Vehicles



- A Canada Research Chair in Energy Sources for the Vehicles of the Future



- A new electric vehicle technology program
- A new mechanical program for buses and electric vehicles in collaboration with the Saint-Jérôme Road Transport Training Center



Close to **24,000 students** in engineering programs

9,500+ graduates

Close to **14,000 students** enrolled in post-secondary IT programs

Over **64,000+** members Of the Ordre des Ingénieurs du Québec

University research expertise in electric and smart transportation



JOAO PEDRO FERNANDEZ
Université de Sherbrooke



Canada Research Chair in Efficient Electric Vehicles with Hybridized Energy Storage Systems
Efficiency and driving range of electric vehicles by **improving their energy storage capacity**



RENÉ JR. LANDRY
École de Technologie Supérieure



LASSEN (Laboratory of Space Technologies, Embedded Systems, Navigation and Avionic)
Applications in electronics and transportation such as **autonomous vehicles** (UAVs), software defined radio, robust systems and high-precision navigational and reliable, **secure wireless communication**



LOIC BOULON
Université du Québec à Trois Rivières



Canada Research Chair in Energy Sources for the Vehicles of the Future
Designing **clean, efficient energy sources** for vehicles



YOU MIN ZHANG
Concordia University



Networked Autonomous Vehicles (NAV) Lab
Advanced technologies for autonomous vehicles (FDD System, System FTC, Sense & Avoid)



MIGUEL ANJOS
Polytechnique Montréal



Canada Research Chair in Discrete Nonlinear Optimization in Engineering
Optimization methods that make the best use of **renewable sources of energy** and **smoothly run** the electricity smart grid



BENOÎT BOULET
McGill University



Industrial Automation Lab, Centre for Intelligent Machines
Design and control of **electric vehicle drivetrains** and green energy systems

University research expertise in electric and smart transportation



MAAROUF SAAD
École de Technologie Supérieure



Groupe de recherche en électronique de puissance et commande industrielle (GRÉPCI)
Applications in **mobile robotics** (hardware infrastructure, trajectory generation algorithms, electrical circuits)



CATHERINE MORENCY
Polytechnique Montréal



Canada Research Chair on personal mobility
Chaire de recherche (industrielle) MOBILITÉ
Transportation engineering: Interactions between urban travel behaviour and spatial dynamics, Spatial data analysis methods applied to urban microdata



KE WU
Polytechnique Montréal



Advanced Research Centre In Microwaves And Space Electronics (Poly-grames)
Electronic materials and components, **Energy conversion and distribution**, Wireless communication systems



ANDRÉA LODDI
Polytechnique Montréal



Canada Excellence Research Chair in Data Science for Real-time Decision making
Models and algorithms for quickly and efficiently processing large amounts of data from multiple sources eg. electricity market, **rail transportation logistics** and health care planning



JÉRÔME LE NY
Polytechnique Montréal



Mobile Robotics And Autonomous Systems Laboratory
Autonomous systems and mobile robotics, Navigation systems, Design and verification of networked, distributed and embedded control systems

05

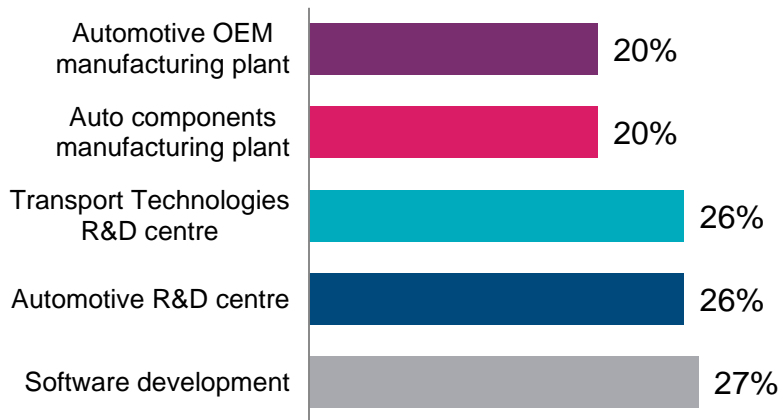
Competitive Operating Costs and Incentives



Lowest operating costs for the smart transportation industry

Greater Montréal's cost advantage In six sectors related to the smart transportation industry (%)

Compared to four other
North American metropolitan areas,* 2019



Business operating costs are lower in Greater Montréal:

- Montréal has a **24% cost advantage** over the following four North American metropolitan areas: **Austin (TX), Columbus (OH), Detroit (MI) and San Francisco (CA)**
- A **cost model developed by fDi Benchmark** to compare operating costs for different locations and types of businesses (labour, property and utility costs)

Source: fDi Benchmark, 2019.

* The four metropolitan areas are Austin (TX), Columbus (OH), Detroit (MI) and San Francisco (CA). Exchange rate 20.05.2019: 1.3635 CAD per USD

Most competitive salaries

Medium base annual salaries* (US\$) for six typical professions

Five major North American cities, 2019

	Montréal	Columbus (OH)	Austin (TX)	Detroit (MI)	San Francisco (CA)
Electrical Engineer	\$70,007	\$95,226	\$103,820	\$102,982	\$120,657
Electrical Engineering Technician	\$49,240	\$62,466	\$65,376	\$67,108	\$78,670
Automotive Engineer	\$63,908	\$83,863	\$90,902	\$91,183	\$106,229
Software Developer	\$69,650	\$96,907	\$99,723	\$99,125	\$121,991
Manager (Manufacturing)	\$68,506	\$94,265	\$98,805	\$99,304	\$121,635
R&D Manager (Technical)	\$88,593	\$126,350	\$132,757	\$132,479	\$160,976

Salaries based on 5 years of experience, all industries combined.

Exchange rate based on the average for April 2018: 1.00 US\$= 1.3368 \$CA .

Source: Economic Research Institute Inc., May 2019.

Funding for the smart transportation industry



Partnership-building transportation electrification projects

- Intended to encourage universities, public research centres and SMEs to work together by providing funding for the development of innovative products and processes



Strategic Innovation Fund (SIF)

- Repayable or non-repayable contributions up to **50% of eligible costs for projects up to \$500M**
- All industrial and technological sectors to support innovation



ESSOR (innovative manufacturer)

- Refundable (interest-free & low interest loans) and non-refundable contributions
- Up to 15% of the capitalizable expenses

Source: Ministère de l'Économie et de l'Innovation du Québec, 2019; Innovation, Science and Economic Development Canada, 2019; Investissement Québec, 2019;



Mural painting representing Leonard Cohen © Tourisme Montréal - Madore - Daphné CARON

Programs that foster innovation

Scientific research and experimental development (SR&ED) tax credit program

- A **15% tax credit from the Government of Canada** and a **14% refundable tax credit from the Government of Québec**

InnoVÉÉ/PROMPT

- Calls for projects and grants for R&D **collaborative projects** involving at least one academic partner and one industry partner
- Subsidies that could cover up to **40% of eligible expenses and combinable with federal programs**
- Examples of funded projects:
 - Development of a range extender for industrial electric vehicles
 - Development of a navigation system for electric vehicles (off-road)

INNOV-R

- Dedicated to projects reducing GHG emissions in Québec
- Funds up to 50% of eligible expenses for partnerships that include at least:
 - a company established in Québec, a university, a CCTT or a public research center
- By combining programs with other funding programs (such as NSERC, etc.), up to 90% of eligible expenditures can be covered by public funding

Other organizations that support research and innovation



06

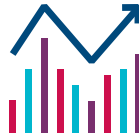
Montréal International's Personalized, Free and Confidential Services



Montréal International, a single contact point for a series of personalized, free and confidential services



**Long-term
strategic support**



**Economic data
and communications
services**



**Government
relations facilitation**



**Incentive programs
assistance**



**Foreign workers
immigration
assistance**



**International
recruiting missions**



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