

Running on Green Power!

Electric Vehicles: 2011-2020 Québec Action Plan



vehiculeselectriques.gouv.qc.ca/english



Message from the Premier

An Envable Position

It can't be emphasized enough: Québec is blessed with abundant energy resources. Our prodigious reserves of hydroelectricity—a clean, renewable energy source—allow us to meet a large part of our energy needs.

Thanks to this hydroelectric power, Québec has the lowest per-capita greenhouse gas emissions in Canada. We are also world leaders in the fight against climate change.

We use hydroelectricity to heat our homes, light our stores and offices, and make our businesses run. And now, with our **Electric Vehicles 2011–2020 Action Plan**, we will put hydroelectricity to work for ground transportation.

Québec already has the electricity to power at least a million electric cars. Now the **Electric Vehicles 2011–2020 Action Plan** will make transportation electrification a centerpiece of Québec's efforts to develop a new sustainable mobility system, one less harmful for the environment and less dependent on oil.

It is our duty to act now for the benefit of future generations. Our enviable energy position makes it possible.

A Green Technology Revolution

We are calling on pioneers in the field and far-sighted businesses to join us in developing this industry. You, as a stakeholder in our **Electric Vehicles 2011–2020 Action Plan**, have a role to play.

We are ready to support researchers and entrepreneurs willing to pool their efforts to build a new sustainable mobility system centered on electricity. We will stand behind those firms ready to develop foreign markets.

Together, we can build a thriving, green economy.
Let's set the wheels in motion.

A handwritten signature in black ink, which appears to read 'Jean Charest'. The signature is fluid and stylized.

Jean Charest



Message from the Deputy Premier, Minister of Natural Resources and Wildlife, and Minister responsible for the Plan Nord

Thanks to our abundant hydroelectricity, and certain prescient decisions made over 50 years ago, we are now well positioned to reap the benefits of the emerging electric vehicle industry.

Québec is the fourth-largest hydroelectricity producer in the world, after the United States, China, and Brazil. With a population of just 7.9 million, we are among the world's top four players in terms of green, renewable energy.

And while electricity already plays a big role in public transit, finding new ways to use it for ground transportation in place of petroleum will fundamentally alter our energy landscape. It is our duty to grasp this opportunity.

A Wealth of Resources

Québec is exceedingly well positioned to electrify transportation. Our large reserves of electricity to power electric vehicles place us in a unique position in North America.

Our electricity is clean and renewable, because it is almost entirely produced hydroelectrically. What is more, it is available at affordable rates. This puts Quebecers at a distinct advantage when it comes to replacing conventional vehicles with electric vehicles.

Québec now has the opportunity to make electricity the fuel of choice for cars, buses, and trains. The day may come when our citizens use electricity for all their transportation needs. This is the goal of our **Electric Vehicles 2011–2020 Action Plan**.

A Responsibility to Fulfill

With its wealth of resources, Québec is positioned to create new business opportunities.

We are already laying the groundwork for electric vehicles. Now it is time to step up our efforts and show a real reduction in our greenhouse gas emissions, decrease our oil consumption in the transportation sector and improve our energy performance.

Our extensive use of hydroelectricity already makes Québec a leader in the fight against climate change. By committing to significant reductions in the use of oil for transportation—from 38% to 32% in the next ten years—we are also stressing the strategic importance of the electric vehicle industry in meeting these commitments.

A Shared Challenge

Only by working together can we make the most of the exceptional opportunities that will come with the arrival of electric vehicles. With this action plan, the government is offering both a guiding vision and concrete support measures for citizens and partners eager to make the most of every opportunity.

The success of the 2011-2020 Action Plan will thus depend on everyone working together to help put Québec at the forefront of sustainable mobility in North America through the use of hydroelectricity.

Nathalie Normandeau



Message from the Minister of Economic Development, Innovation and Export Trade

A Singular Opportunity

Ground transportation will undergo a sea change in coming years, spurred by global economic conditions and efforts to reduce the environmental impact of transportation.

Industrially, Québec has many advantages. Aggressive Québec businesses have been attracting attention with their involvement in electric vehicle development. Québec is also a leader in innovation and R&D.

The arrival of electric vehicles on the market is an opportunity not to be missed.

One of the goals of the **Electric Vehicles 2011–2020 Action Plan** is to spur the development of innovative, market-driving products and thus the creation of a world-class industry.

The government is hard at work on development tools to unite efforts and provide support for innovation and R&D, and to attract foreign businesses while continuing to support homegrown industry.

Staking Our Claim

At a time when important decisions are being made and alliances forged, it is important for Québec to grasp this business opportunity and stake its claim as a leader in the industry.

Already the major automakers are deciding where to invest and setting strategic priorities. Partnerships are coming together. The car industry is being reshaped. It is vital for Québec to find its place in this dynamic, to play its trump cards. For Québec to effectively position itself, it must harness the synergy of partners throughout the industry, from the initial phases of research to the market launch of world-class products.

For the plan to succeed we must all work together.

Our goal is to make Québec a leading player in the development of electric vehicle technology, using these vehicles to spark employment, showcase our talents, and create wealth for all Quebecers, now and in the future.

A handwritten signature in black ink, appearing to read 'Clément Gignac'.

Clément Gignac



Message from the Minister of Sustainable Development, Environment and Parks

An Economy Less Dependent on Petroleum

With the release of the **Electric Vehicles 2011–2020 Action Plan**, Québec is once again demonstrating its commitment to reduce greenhouse gas (GHG) and take action in the transportation sector, which generates 43% of Québec GHG, up 28% since 1990.

This action plan is a milestone along the road to the Québec government's target of a 20% reduction of 1990 emissions levels by 2020—the most ambitious target in North America. The **Electric Vehicles 2011–2020 Action Plan** is a cornerstone of Québec's strategy.

An Action Plan to Help Drive the New Economy

The efforts required to effectively counter climate change on a global scale represent both an unprecedented challenge and a unique opportunity to rethink the prevailing economic development model based on non-renewable resources.

The future depends on our society's ability to adapt to new ways of doing things, breaking new ground and developing new green transportation technologies. These behavioral changes will require both a daring vision and concerted action.

Implementation of the plan will create green jobs in Québec through support for business growth and the development of research facilities specialized in batteries and the design and manufacture of electric vehicles and their parts.

The **Electric Vehicles 2011–2020 Action Plan** is part of the new outlook driving Québec forward to a thriving, green economy.

A stylized, handwritten signature in black ink, appearing to read 'Pierre Arcand'.

Pierre Arcand



Message from the Minister of Transport

Sustainable Mobility at the Heart of Québec's Socioeconomic Development

Whether to get to work or to support the leisure society, the mobility of people is intrinsically tied to Québec's economic development. Indeed, how could a prosperous economy emerge without an efficient and effective transportation system?

Providing for efficient, diversified, and integrated transportation systems is an essential objective in achieving sustainable development for Québec and its various regions.

This action plan on electric vehicles stands out as a crucial cornerstone in the transition of transportation systems and modal shift. The strategy will make it possible to considerably reduce our greenhouse-gas (GHG) emissions generated by the transportation sector.

Moreover, the government has taken a firm position on reducing GHG emissions and intends to step up its efforts. One example illustrating this is the Québec Policy on Public Transit, which has nearly achieved its target of an 8% increase in public-transit ridership. This policy will be reviewed, giving a prominent role to the new directions related to electrification of transportation systems. Furthermore, the implementation of territorial sustainable-mobility plans across Québec will enable regions to work together guided by a sustainable-mobility strategy in which electrification is an indispensable foundation.

Seizing the Opportunity

The action plan on electric vehicles is a critical link in changing our travel and transportation habits. The shift towards electrification of transportation will impact on personal vehicles as well as on the renewal of mass-transit infrastructure. In this respect, Québec isn't starting from scratch, since 50% of all trips on the public-transit system already involves electrically powered equipment.

We must take advantage of this growing momentum and of Québec's leadership role in this area. We find ourselves at a crossroads at a critical time characterized by a major shift in the transportation industry influenced by major issues. Our response to these issues will determine the heritage that we leave to the next generation.

Today and tomorrow, as Québec enters the era of electric vehicles, all of society is called upon to take up the challenge of sustainable mobility and to break new ground for a future commensurate with our commitment to sustainable development.

Although ambitious, this plan is consistent with sustainable development and forward-looking. In other words, it reflects Québec and Quebecers.

Sam Hamad

Table of contents

VISION ACTIONS

1. HYDROELECTRICITY FOR TRANSPORTATION

- 1.1 Why an Action Plan?
- 1.2 Putting Québec's Strengths to Work?
- 1.3 The Action Plan's Scope
- 1.4 Making Québec a Sustainable Mobility Leader
- 1.5 Québec's Target

2. QUÉBEC IS ALREADY IN THE GAME

- 2.1 Tools Already in Place
- 2.2 Preparations for Electric Vehicles are Underway
- 2.3 Public Transit gets Ready to go Electric
- 2.4 The Electric Vehicle Industry is well Positioned

3. TAKING ACTION TODAY TO GO FURTHER TOMORROW

- 3.1 Drivers can Switch to Electric Vehicles
- 3.2 Electric Vehicles are Almost Here
- 3.3 Québec Electricity for Public Transit
- 3.4 Québec's Electric Vehicles Industry: Enviably Prospects

CONCLUSION

APPENDIX

- Appendix 1 Existing Measures
- Appendix 2 New Measures Introduced by the Electric Vehicles 2011–2020 Action Plan

LISTS OF TEXT BOXES

Text Box 1	Next Action Plan on Climate Change	8
Text Box 2	EV20 – Québec Joins International Coalition on Electric Vehicles	9
Text Box 3	Hydro-Québec's 2009–2013 Strategic Plan	12
Text Box 4	Electric Buses in Old Québec	14
Text Box 5	Québec Research Centers Specializing in Fields Related to Electric Vehicles	16
Text Box 6	Examples of Companies in the Electric Vehicle Industry	18
Text Box 7	Main Terms and Conditions, Rebate for the Purchase or Lease of a Hybrid or Electric Vehicle	21
Text Box 8	Surveys on Electric Vehicles	22
Text Box 9	AddÉnergie Technologies: A Made-in-Québec Charging System	23
Text Box 10	Categories of Charging Facilities	24
Text Box 11	Government Guidelines for the Deployment of Public Charging Infrastructure	25
Text Box 12	Areas of Expertise in the Ground Transportation Industry	29

LISTS OF FIGURES AND ILLUSTRATIONS

Figure 1	Petroleum Product Consumption, by Sector (2008)	4
Figure 2	Operating Costs, Various Vehicle Power Options	4
Figure 3	Available Power Systems	6
Figure 4	Public Charging Infrastructure	25
Illustration 1	Range of movement fed by electricity	7
Illustration 2	Possible charging stations	23



visionactions

The Government of Québec has reached an inescapable conclusion: transportation electrification cannot wait. It has therefore prepared this **Electric Vehicles 2011–2020 Action Plan** to start working now to make a much bigger place in Québec's transportation system for electric vehicles.

RUNNING ON GREEN ENERGY

This action is also motivated by a desire to replace petroleum with renewable energy. Québec more than anyone else can use its hydroelectricity—a clean and renewable energy source — for transportation purposes. Hydroelectricity has already made Québec a leader in the fight against climate change. Now it will be an energy source for electric vehicles.

A BROAD AND UNIQUE VISION

Our vision encompasses more than just cars and subways which can be electric. Whether Quebecers travel by bus, by commuter train, by metro they will use electricity. And so will the consumer products Quebecers buy—they will be transported to market in hybrid or electric trucks.

This broad and inclusive vision of electric vehicles is what makes Québec's approach unique.

GAINS FOR ALL

“Filling up” on electricity will benefit each and every Quebecer. Individuals, businesses, transit authorities, and municipalities will cut their annual petroleum purchases by thousands of dollars.

The arrival of electric vehicles will improve air quality and reduce greenhouse gas emissions.

Hydroelectricity has long been a big driver of economic development in Québec. By developing an electric vehicle industry, we can benefit even more. With more researchers, more businesses, and more jobs, there will be more wealth for all of us to share.

BALANCING THE ENVIRONMENT AND ECONOMIC DEVELOPMENT

With the **Electric Vehicles 2011–2020 Action Plan**, the Government of Québec has once again proven that it is possible to balance natural resource development, environmental protection, and economic growth.

We must ensure a sustainable future for Québec. The **Electric Vehicles 2011–2020 Action Plan** makes it possible.

1

Hydroelectricity for Transportation



1.1 Why an Action Plan?

The **Electric Vehicles 2011–2020 Action Plan** is of great strategic importance to Québec for three major reasons, each of which demands immediate action: the environment, the economy, and energy self-sufficiency.

The Environment: Lowering Greenhouse Gas Emissions

OBJECTIVE: Contribute 6% of Québec's targeted GHG reductions for 2020

Greenhouse gas emissions from transportation in Québec rose by more than 28% between 1990 and 2008. These emissions are largely responsible for the overall rise in GHG emissions during this period. As hydroelectricity is already a major source of energy in a number of sectors, transportation is the area with the greatest potential for improved environmental performance in terms of lower greenhouse gas emissions.

Electric vehicles are essential in reaching our new target for greenhouse gas emissions: 20% of 1990 levels by 2020. The environment is the first main reason for our action plan.

The Economy: Leveraging Industrial Development Opportunities

OBJECTIVE: Double the number of direct and indirect jobs from 1,500 to 5,000

The action plan's second purpose is industrial in nature. The electric vehicle industry is growing rapidly throughout North America, Asia, and Europe. It is creating wealth, employment opportunities, and trade possibilities that stand to benefit Québec.

In a number of areas, Québec-based businesses have attracted note with their contributions to technological development at a time when the international automotive industry is making strategic choices. Québec also has a thriving research environment with top-flight research centers working on tomorrow's technology especially at Hydro-Québec. The opportunities are there for Québec to seize, by leveraging its strengths in targeted industry niches.

Energy Self-Sufficiency: Reducing Dependence on Oil

OBJECTIVE: Contribute 20% toward our objective of reducing petroleum product use from 38% to 32% of Québec's total energy consumption by 2020

Québec spent \$11 billion on oil in 2010, making it our number one import.

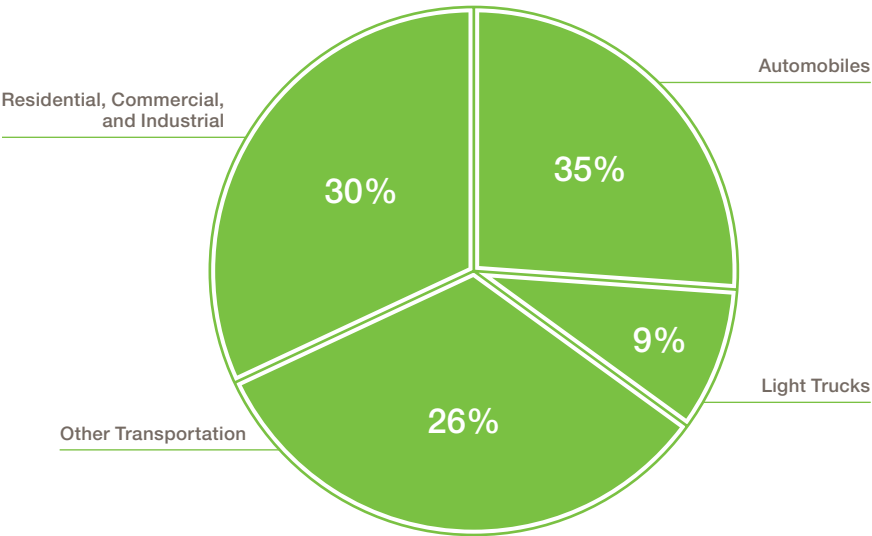
There is no doubt that reducing our oil imports would help reduce our trade deficit and have a positive impact on Québec's gross domestic product. In other words, each dollar spent on hydroelectricity to fill the tank is a dollar that stays in Québec instead of going to oil producers elsewhere.

As indicated in Figure 1, automobiles and light trucks accounted for 44% of oil consumption for energy purposes in 2008. This goes a long way toward explaining our dependence on oil, and represents a not insignificant portion of our total imports.

Using electric vehicles will help shield Quebecers from the hard-to-predict swings in petroleum prices.




Using oil for transportation is thus a major drain on our wealth and the third major reason for this action plan. Switching to electric vehicles powered by Québec-produced electricity will contribute directly to redressing this imbalance.

FIGURE 1
Petroleum Product Consumption, by Sector (2008)



Sources: Ministère des Ressources naturelles et de la Faune, Statistics Canada.

FIGURE 2
Operating Costs, Various Vehicle Power Options

POWER SOURCE			
COST PER FILLUP, GASOLINE OR ELECTRICITY ¹	 Gasoline	 Electric with extended range generator	 All-Electric
For 100 km	\$11.50	\$2.76	\$1.24
Per week	\$44.23	\$7.40	\$4.78
Weekly savings versus a gas-powered vehicle	-	\$36.83	\$39.45
Annual savings versus a gas-powered vehicle	-	\$1,915	\$2,051

Source: Hydro-Québec for electricity consumption (www.hydroquebec.com/electrification-transport/cout.html) and Ministère des Ressources naturelles et de la Faune.

¹ Energy consumption: 10 l/100 km for the gas-powered vehicle; 16 kWh/100 km in electrical mode and 2.4 l/100 km when using the generator (45% of travel time) for the electric vehicle with a extended range generator. Price: \$1.15/l for gas and \$0.0776/kWh for electricity, including taxes.

1.2 Putting Québec’s Strengths to Work

The **Electric Vehicles 2011-2020 Action Plan** aims first and foremost to leverage the considerable strengths Québec already possesses.

Running on Green Energy

Québec’s electricity is mostly produced using water, unlike in the majority of the industrialized countries where nonrenewable resources like coal must be used. What is more, in many parts of the world, limits to electrical production and distribution can curb electric vehicle development. This is far from the case in Québec.

For example, replacing 25% of Québec’s current vehicle fleet of 4.5 million vehicles with electric vehicles would raise electricity consumption by 3 TWh per year less than 2% of Hydro-Québec’s 2010 electricity sales.

A Dependable Grid

Quebecers are also fortunate to have a robust, dependable electricity grid run by a distributor of world repute. Hydro-Québec is already busy conducting studies to deepen its understanding of the impacts of transportation electrification on the power grid. Preliminary results show that we already have the capacity to handle at least one million electric vehicles. Hydro-Québec is a leading electricity provider and one of the best positioned anywhere to integrate electric vehicles into the power supply grid.

A Gas–Electricity Price Differential: One More Reason to Go Electric

In all of North America, Québec drivers stand to gain the most financially by switching from internal combustion to electric vehicles. Comparing Hydro-Québec's very competitive rates to the price of gasoline, we find that Quebecers could save \$37 per week by replacing their gas-powered vehicles with plug-in hybrids electric, and \$39 per week with all-electric vehicles (see Figure 2). It's just basic math: it costs around seven times less to run a vehicle on electricity.

An Active Industry

On top of these major advantages, Québec has recognized know-how in the manufacture of electric vehicle parts, especially key components such as batteries, electrical power systems, and lightweight materials. In these fields, Québec boasts experts both in private business and research centers.

Few societies in the world can conceive of replacing imported oil with their own electricity to power ground transportation the way Québec can—and already have a solidly established industrial supply chain.

1.3 The Action Plan's Scope

It is important here to define what is meant by *electric vehicle* and to set forth the various categories of electric vehicle covered under the action plan.

Personal Vehicles

There are currently 4.5 million personal vehicles in operation in Québec. These vehicles represent 35% of the province's oil product consumption. The action plan is thus aimed mainly at electric vehicles used for personal transportation, i.e., that plug directly into the electrical grid for charging—plug-in hybrids such as the Toyota Prius, electric vehicles with extended range generators such as the GM Volt, and all-electric vehicles such as the Nissan Leaf and the Mitsubishi iMiEV.

Figure 3 illustrates the available power systems for cars, taxis, and light trucks, their respective electricity and/or gasoline consumption, and their GHG emissions.

Truck for Urban delivery
















The last few years have seen a noticeable rise in fuel consumption in the freight transportation industry. Yet hybrid and electric urban delivery and service trucks are already on the market. These trucks offer the potential for substantial energy savings—the frequent starts and stops characteristic of urban driving enable users to make the most of hybrid and electric technologies. PACCAR, based in Sainte-Thérèse, assembles hybrid delivery trucks.

Public Transit

The **Electric Vehicles 2011–2020 Action Plan** includes a focus on hybrid and electric buses which, like hybrid trucks, deliver noticeable reductions in petroleum consumption on urban routes. Novabus, based in Saint-Eustache, assembles hybrid buses.

The **Electric Vehicles 2011–2020 Action Plan** also covers other electrically powered modes of public transit such as commuter trains, tramways, and trolleybuses. Bombardier Transport and Alstom design and build subway cars in Québec, while Bombardier Transport also builds commuter-train cars in the province.

FIGURE 3
Available Power Systems

	AVAILABLE POWER SYSTEMS			
	 Gas Powered	 Hybrid	 Plug-in Hybrid	 All-electric
Energy Source				
Consumption				
Emissions				Zero emissions



A Kenworth hybrid truck assembled by PACCAR

1.4 Making Québec a Sustainable Mobility Leader

Considering the divers types of vehicles used today, Québec’s **Electric Vehicles 2011–2020 Action Plan** offers a broader vision of electric vehicles than just light passenger vehicles. It will include electrification initiatives aimed at both personal travel and mass transit as well as freight transportation.

Moreover the **Electric Vehicles 2011–2020 Action Plan**’s aims are consistent with existing initiatives to encourage people to give up single-passenger travel, promote a shift in transportation mode, and foster public transit.

The ultimate goal is for people to get where they want to go using a seamless mix of private and public transportation. For example, a resident of Oka could park an electric vehicle at an AMT parking lot in Deux-Montagnes, continue on to Montréal aboard an electric commuter train, then use the metro (also electric) to get around downtown. At the end of the day, this commuter could return to

his or her electric car, which would have recharged over the course of the day, as illustrated in Illustration 1. This is how Québec intends to ensure it is...

At the Forefront of Sustainable Mobility in North America through the Use of Hydroelectricity.


The **Electric Vehicles 2011–2020 Action Plan** will play an important role in cutting Quebecers’ oil consumption, but other measures in addition to electrification will be necessary to further lower greenhouse gas emissions. The next action plan on climate change, which is briefly described in Text Box 1, will examine these questions.

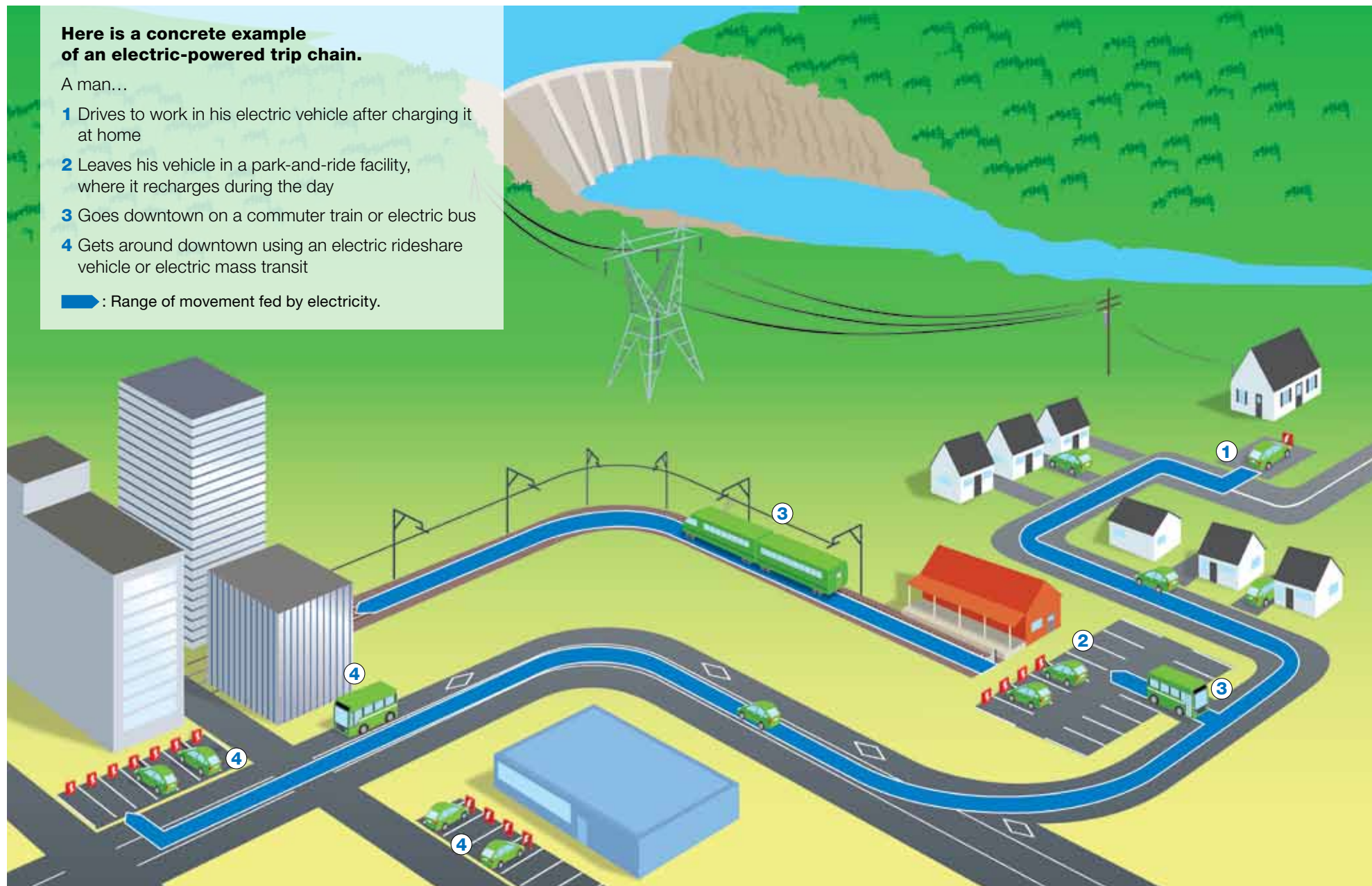
ILLUSTRATION 1
Range of movement fed by electricity

**Here is a concrete example
of an electric-powered trip chain.**

A man...

- 1** Drives to work in his electric vehicle after charging it at home
- 2** Leaves his vehicle in a park-and-ride facility, where it recharges during the day
- 3** Goes downtown on a commuter train or electric bus
- 4** Gets around downtown using an electric rideshare vehicle or electric mass transit

 : Range of movement fed by electricity.



Text Box 1

Next Action Plan on Climate Change

On November 23, 2009, the Premier announced a new target in Québec's efforts to fight climate change: cut greenhouse gas emissions 20% from 1990 levels by 2020. This highly ambitious target has made Québec a leader in the fight against climate change.

To meet our 2020 target, the 2013–2020 Action Plan on Climate Change is under development. The potential for reducing greenhouse gas emissions in various industrial sectors will be analyzed with special emphasis on land-use planning to help curb urban sprawl and make our cities and transportation systems more dense.

The transportation industry already plays and will continue to play a leading role in reaching greenhouse gas reduction targets in Québec. There are a number of ways to reduce emissions in the transportation of both people and freight, whether by land, sea, rail, or air.

To achieve these goals, a host of measures will have to be put in place, behavioral changes instigated, and new technologies implemented. The **Electric Vehicles 2011–2020 Action Plan** is part of a broader process to reduce greenhouse gas emissions from transportation by using electricity.

1.5 Québec's Target

Québec's ambitious objectives in reducing greenhouse gas emissions, and the strategic importance of reducing our dependence on petroleum products make it necessary to set an ambitious target in the **Electric Vehicles 2011–2020 Action Plan**. We are thus setting the following target for 2020:

25% of new light passenger vehicle sales will be electric vehicles (plug-in hybrids or all-electric vehicles)

This target is ambitious but realistic. It would mean selling 118,000 new electric vehicles in 2020. Counting electric vehicles sold in earlier years, there will be a total of 300,000 electric vehicles operating in Québec by 2020.

These 300,000 vehicles will cut greenhouse gas emissions by 900,000 tons in 2020. That's 6% of Québec's total required cuts to attain its targets for that year.

These vehicles will save 384 million liters of petroleum—20% of the savings needed to reduce petroleum product use from 38% to 32% of Québec's total energy consumption within 10 years, as announced in the February 23, 2011 inaugural address.

In 2030, there will be 1.2 million electric vehicles on Québec's roads, for total savings of 3.5 million tons of GHG emissions and 1.5 billion liters of fuel.

Québec is also joining forces with other global players passionate about electric vehicle development and whose efforts encourage people to switch from single-passenger car travel to public transit. Text Box 2 discusses Québec's support for the international EV20 initiative.

A low speed electric vehicle manufactured by Prêcad



Reaching this target will require a well-thought-out strategic approach. The **Electric Vehicles 2011–2020 Action Plan** is thus built around four goals:

- Educate potential **users** and encourage them to pick electric and hybrid power systems.
- Accelerate **the rollout of electric vehicles**, with special emphasis on charging facilities.
- Use electricity as an energy source in **public transit**, with support measures for transit authorities, Agence métropolitaine de transport (AMT), and other public transit organizations.
- Support the **electric vehicle industry** in developing and manufacturing innovative, market-driving products that make it a global leader.

Existing and future actions described in subsequent sections will be organized according to these goals.

Text Box 2

EV20 – Québec Joins International Coalition on Electric Vehicles

While in Copenhagen in December 2009 for the 15th Conference of the Parties of the UN Framework Convention on Climate Change, Premier Jean Charest announced Québec's support for the EV20 initiative. Under this initiative, the leaders of 20 cities, states, and nations have joined together with vehicle manufacturers, fleet owners, and financiers to promote the launch of the electric vehicle industry and accelerate the development of this market.

In September 2010 the members of EV20 agreed to work together toward a targeted electric vehicle market share of 20% of global new vehicle sales. The **Electric Vehicles 2011–2020 Action Plan** sets an even more ambitious target: 25%.

The formation of EV20 is an initiative of The Climate Group, an international not-for-profit group dedicated to fighting climate change.

2

Québec is Already in the Game



The rechargeable Ford Escape hybrid tested by Hydro-Québec

Even before launching this action plan, the Government of Québec was working hard to pave the way for electric vehicles. Financial support for vehicle users, plans for charging stations, research into electric vehicle use in winter, public transit electrification, and industry funding are all areas where the Québec government has been taking concrete action for some time now. Appendix 1 outlines these measures.

2.1 Tools Already in Place

Three measures are already in place to introduce Québec individuals, municipalities, and businesses to electric and hybrid vehicles with a view to having them make further use of these vehicles once they become more widely available.

A Tax Credit for New Fuel-Efficient Vehicles

Most users of personal electric and hybrid vehicles already receive financial assistance from the Québec government.

In March 2009, the Québec Government announced a **refundable tax credit for the acquisition or lease of new fuel-efficient vehicles**. This tax credit, in effect since January 1, 2009, offers credits of \$3,000 for plug-in hybrid vehicles, and \$8,000 for all-electric vehicles other than low-speed vehicles. Québec thus became the first province in Canada to announce a tax measure that paid a portion of the higher purchase price of electric vehicles. The measure, for individuals or businesses wishing to purchase or lease a light vehicle, is expected to provide \$9.6 million in financial support by December 31, 2011.

Québec's initiative is in keeping with similar initiatives in the United States. The United States government offers financial assistance of up to US\$7,500 for the purchase of light electric vehicles.

A rebate at the time of purchase or lease will replace Québec's tax credit as of January 1, 2012.

Financial Assistance for Hybrid and Electric Trucks

The **Government Assistance Program for Improving Energy Efficiency in Freight Transportation**, announced in June 2009, includes a subsidy for the purchase of hybrid or electric trucks equivalent to 30% of the price differential versus a gas-powered vehicle, up to a total of \$15,000 per vehicle. Businesses and municipalities are eligible.

This five-year program has an overall budget of \$45 million, including \$27 million for trucks. Ten million dollars is expected to go toward the purchase of hybrid and electric vehicles in the coming years.

In fact, financial assistance of \$100,000 has been granted to FPInnovations to study the energy performance of two hybrid trucks, one used by Agropur and the other by Société des alcools du Québec.

Tax Incentives for New Truck Power Systems

In March 2010 the Government of Québec announced a new 60% amortization rate for new trucks weighing over 11,778 kg used primarily for freight transportation. The rate was previously 40%.

Hybrid and electric trucks are eligible for this amortization rate. This measure provides financial support to help the trucking industry cover the high purchase price of the new generation of motors, and secure the industry's cooperation in efforts to reduce GHG emissions.



A truck equipped with an electric-hydraulic man lift developed by Posi-Plus

Text Box 3

Hydro-Québec's 2009–2013 Strategic Plan: A Major Contribution to the Electric Vehicle Industry and the Electrification of Transportation

Hydro-Québec's action plan for transportation electrification, part of its Strategic Plan 2009–2013, includes four major thrusts:

- Financial support for the development of electrical infrastructure for public transit
- Development and marketing of advanced technologies, in particular:
 - Manufacturers of TM4's MØTIVE^{MC} series electric engines
 - New battery materials, including lithium-iron-phosphate
- Test-driving of plug-in vehicles and experimenting with their integration into the power grid
- Planning of support infrastructure for vehicle charging (home and public charge spots)

Given the rapid changes in electric transportation, the action plan will be updated on the basis of market conditions and technological advances.

2.2 Preparations for Electric Vehicles are Underway

As with every new technology, the introduction of electric vehicles will require the creation of an environment conducive to their use. In particular, charging stations must be set up. In Québec, this has been underway for some time now through a number of projects.

As set out in its Strategic Plan 2009–2013 (Text Box 3), Hydro-Québec is participating in a number of electric vehicle test and pilot projects aiming to assess the impact of vehicle charging on the power grid and test electric vehicle winter performance.

Ford Project

In collaboration with the Electric Power Research Institute (EPRI), a consortium of American electricity providers and research interests, Hydro-Québec is using two plug-in hybrid electric Ford Escapes to assess the impact of charging on the power grid. Hydro-Québec is the only electricity provider in Canada involved in such a project.

An Integrated Electric Vehicle Pilot Project with Mitsubishi

This pilot project, announced in January 2010 by Hydro-Québec and Mitsubishi, is a trial of 50 all-electric Mitsubishi iMiEVs in Boucherville. This is the largest project of its kind in Canada. Its objectives are to assess user recharging behavior and vehicle performance in winter.

Nissan–Communauto Project

In June 2010 Communauto, a car-sharing service, announced it would add 50 all-electric Nissan LEAFs to its Montréal fleet. This project, carried out with funding and cooperation from Hydro-Québec, will provide valuable data on these vehicles' energy performance and the cost of setting up charging stations. The project will begin in summer 2011. Infrastructure implementation costs are estimated at \$1 million. The Québec government's financial assistance programs—**the Refundable Tax Credit for the Acquisition or Lease of a New Fuel-Efficient Vehicle** and **the Government Assistance Program for Improving Energy Efficiency in Private Ground Transportation**—will make up for any additional costs incurred in acquiring these electric vehicles.

Toyota Project

On July 14, 2010, Université Laval began a collaborative project with the Québec government and Hydro-Québec, conducting trials on five rechargeable Toyota Prius made available for testing by the manufacturer. To better assess how charging needs change in response to varying driving habits, different drivers have used the vehicles for their day-to-day transportation needs during the test period.

Chevrolet Volt Project

On December 3, 2010, Hydro-Québec announced a partnership with Chevrolet Canada to add 20 Chevrolet Volts to its fleet in 2011. This will enable the public corporation to measure the vehicles' energy efficiency and add a new power system technology to those already under trial in Québec.

In total Hydro-Québec is spending \$9.4 million on these projects and on studying the impact of electric vehicle charging on the power grid.

Pilot Project of low-speed Vehicles

Since 2008, low-speed vehicles have been circulating in areas where there are 50km/hr limits or less, and will until the project ends in July 2011. More than 50 of these vehicles are registered in Québec.

The Government of Québec is also collaborating on these projects to gather essential planning information for charging station development and determine how to ensure optimal winter performance. Some of these projects have also been conducted in partnership with major cities and touched on related issues, such as dedicated electric vehicle parking and charging station integration into the urban landscape.

Ministère des Ressources naturelles et de la Faune, the Renault–Nissan Alliance, Hydro-Québec, Agence de l'efficacité énergétique, Ville de Montréal, and Ville de Québec are all active participants in a working group on the planning of charging infrastructures for electric vehicles and the general public's needs. The creation of this working group was announced in June 2010, and a progress report is slated for release in spring 2011.

Text Box 4

Electric Buses in Old Québec

The eight Écolobus transit buses operated by Réseau de transport de la Capitale (RTC) as part of a pilot project constitute Canada's first urban electric minibus system. This system, which provides service to the historic district of Old Québec, allows these vehicles to be tested in actual day-to-day use. RTC has shared its experience with other transit authorities to help them introduce these types of vehicles into their fleets in the future.

These buses were built in Italy and adapted for Québec weather conditions. The Québec government contributed \$2.3 million to this project.



2.3 Public Transit gets Ready to go Electric

With its financial assistance programs, Québec is already encouraging the use of hybrid and electric vehicles for public transit.

Existing assistance programs

- **FOR TAXI OWNERS AND CAR-SHARING ORGANIZATIONS**

Taxi owners and car-sharing organizations are eligible for funding of up to \$2,000 toward the acquisition of hybrid or electric vehicles. This assistance is provided through the **Government Assistance Program for Improving Energy Efficiency in Private Ground Transportation**, which has \$5 million in annual funding.

- **FOR THE PURCHASE OF HYBRID OR ELECTRIC BUSES BY TRANSIT AUTHORITIES**

Transit authorities are eligible for the **Government Mass Transit Assistance Program**, covering up to 75% of the extra cost of purchasing electric powered or hybrid buses, and the **Government Assistance Program for Improving Energy Efficiency in Private Ground Transportation**, which cover up to 50% of the purchase price of electric or hybrid buses, up to a maximum of \$500,000.

- **FOR TRANSIT AUTHORITY SERVICE VEHICLES**

The **Government Mass Transit Assistance Program** subsidizes 50% of the purchase cost of hybrid or electric service vehicles for transit authorities, up to a maximum of \$30,000 per vehicle. The **Transit Capital Program run by Société de financement des infrastructures locales du Québec** subsidizes 85% of eligible expenses.

Major Upcoming Projects

In Québec, electricity already plays a major role in public transit operations. In the area served by Société de transport de Montréal (STM), 67% of all trips are on the electrically powered metro. Total subway trips account for half of all mass-transit trips in Québec. The subway represents a strong argument in favor of electrification of mass transit. The Québec government has made huge investments to improve and extend these transportation systems. A number of major electrically powered public transit projects are under study, all of them entailing complex technological choices. The Québec government and Hydro-Québec support these initiatives in the aim of guiding future decisions on the electrification of public transit.

A number of major projects of this type are currently underway in the Montréal region:

- **AN INCREASE IN METRO CAPACITY**

By gradually putting into service the 468 new subway cars ordered from the Bombardier Transport–Alstom consortium, the STM will be able to increase its passenger capacity by 25% over that provided by the cars slated for replacement.

- **ELECTRIFICATION OF THE COMMUTER TRAIN NETWORK**

The current network of commuter trains consumes some 10,000,000 liters of petroleum and emits over 27,000 tons of greenhouse gases annually. The commuter train network includes five lines, only one of which (the Deux-Montagnes line) is currently powered by electricity. Electrifying commuter trains would thus lower petroleum costs and GHG emissions.

The government has authorized AMT to carry out its Train de l'Est project to create a rail link between downtown Montréal and the northeast ring of the metropolitan area to Mascouche. When operations begin in 2012, a quarter of the 51 km stretch will be ready for electric catenary systems.²

Taken together, the Deux-Montagnes train line (30 km in length and Canada's only electric line) and the six lines in the AMT system (including the future Train de l'Est line) represent nearly 243 km of track and 18 million trips annually.

In 2009 AMT signed an agreement with Hydro-Québec and ordered a study to identify the drawbacks and benefits of the most promising stretches of the railway network. This was the first step toward electrifying the rail system.

A final report by AMT is expected in spring 2011. Once complete, it will identify which lines and stretches should be prioritized for electrification. Starting in 2012, AMT will have to put 20 new bimode (diesel-electric) locomotives into service.

The cost of these feasibility studies is estimated at \$6.5 million for 2011 and 2012, 20% of which will be covered by Hydro-Québec.

- **BOULEVARD PIE-IX MONTRÉAL AND LAVAL**

As part of preliminary studies on creating reserved bus lanes along Boulevard Pie-IX in Montréal and Laval, a joint AMT/Hydro-Québec study will be carried out in 2011 to assess the costs and other requirements involved in using electric power along this corridor, particularly for trolleybuses.

- **TRAMWAY LINES ON THE ISLAND OF MONTRÉAL**

Hydro-Québec is taking part in a \$2.9 million feasibility study with the City of Montréal on the introduction of tramway lines.

- **MONTRÉAL METRO EXTENSION**

The government is spending \$12 million on feasibility studies on the extension of Montréal's metro. These studies are being carried out by a dedicated project office under the authority of AMT and Ministère des Transports.

In total the Québec government and Hydro-Québec will spend a total of \$23.5 million on these mass transit electrification study projects with AMT allocating \$2.1 million.

Eventually, these projects will give Quebecers access to an unbroken network of modes of transportation powered by electricity.³

² Cable providing power to electric locomotive.

³ Electric car, electric commuter train, metro.

Text Box 5

Québec Research Centers Specializing in Fields Related to Electric Vehicles

- Hydro-Québec's research institute (IREQ) has carried out promising trials on materials that could increase the lifespan of batteries (30,000 charging cycles) and provide quicker recharging.
 - IREQ has partnership agreements to develop new battery materials and is leveraging its knowledge by assigning user rights for its intellectual property to key players in the battery sector, including Sony, Sud Chémie, BASF, MERCK, PHET, and Sovonic.
 - Hydro-Québec holds a big portfolio of patents, including most of the world's intellectual property in the field of molten salts, which hold great promise as electrolytes for lithium-ion batteries.
- At least three Québec universities are involved in research projects:
 - University of Montreal and its Chair of Research in storing and converting energy which are perfecting storage of energy.
 - At Université de Sherbrooke, a multidisciplinary team of researchers is working toward breakthroughs in fields of innovation related to electric vehicles.
 - At Université Laval, research on a quick charge station is underway.
- The Québec Advanced Transportation Institute (ITAQ) in Saint-Jérôme offers specialty services to businesses and researchers and carries out applied research directly related to electric vehicles.

2.4 The Electric Vehicle Industry is well Positioned

Past efforts to electrify transportation have laid the groundwork for further electric vehicle industry growth. It is important to create the right conditions to ensure Québec products and knowledge can secure a strong position in this new industrial sector, which currently generates 1,500 direct and indirect jobs.

An Envable Position on the World Stage

Québec already has a solid international reputation in the research and manufacture of electric vehicle batteries, an important key to the future of these vehicles. For example, Hydro-Québec's research institute (IREQ) boasts a group of internationally renowned experts who may be the ones to develop the next generation of ultrafast rechargeable batteries.

Outstanding Research Centers

Québec's electric vehicle industry also includes other research centers of world repute.

Some thirty Québec research centers (Text Box 5) specialize in fields related to electric vehicles, including Université de Montréal's Industrial Research Chair in Energy Storage and Conversion, and the Québec Advanced Transportation Institute (ITAQ).

Government Support for Existing Research and Innovation

Since March 2010 the Québec government has announced its support for six existing new research and innovation projects, including plans for a Québec-built electric bus through partnerships among industry specialists.

This latter project will leverage Québec's industrial strengths in the manufacture of city buses and composite and aluminum structures, electric motors, smart transportation systems, and high performance batteries. It provides support at the concept, development, and prototype demonstration stages for fully electric city buses of various sizes.

The project represents a total outlay of \$60 million, funded in equal parts by the government and the private sector. It is currently planned to have two different-sized prototype electric buses in operation in Québec in the next three years.



Work underway at IREQ on eutectic salts for lithium-ion battery production

Extensive Support for Existing Research and Innovation

A number of financial assistance programs and fiscal measures like the **Tax Credit for Scientific Research and Experimental Development**, the **Research Assistance Program**, and the **Technology Development and Transfer Support Program** contribute to Québec's innovation system and spur development of emerging sectors of Québec's economy like electric vehicles. These programs help support projects like the one at Université Laval to develop ultrafast rechargeable batteries.

Innovative Québec Companies

The arrival of electric vehicles heralds new market opportunities. Some Québec companies are entering the commercialization phase of their products, while others have already made headway in the market (Text Box 6).

Québec is well positioned to be a leader in the development of certain components. This is the case with TM4, a Hydro-Québec subsidiary chosen by Indian company Tata Motors to provide 150 MØTIVE^{MC} electric motor systems. TM4 electric motors are used in electric vehicles tested in Norway and the United Kingdom. These motors are recognized as being among the top performers of their kind. In the mid-90s breakthroughs in electric motors demonstrated the strength of Québec expertise in the field.

Programs to Support Industrial Development

A variety of government programs are available for the electric vehicle industry depending on the type of project and can take the form of investment, staffing support, or market diversification.

The Laurentides Region Contributes to Québec Leadership

The Québec government has identified the Laurentides region as best positioned in advanced land transportation in Québec as home not only to major manufacturers of hybrid vehicles like Nova Bus and Paccar, but also to other leading organizations, including

- Centre national du transport avancé (CNTA), a major player in the promotion of electric vehicles, with cutting edge expertise in electric motors.
- The Québec Advanced Transportation Institute (ITAQ), a technology transfer center linked to Cégep de Saint-Jérôme whose development laboratory for electric and hybrid traction, energy efficiency, and biofuels is unlike any other in Canada.

Text Box 6

Examples of Companies in the Electric Vehicle Industry

Some 30 companies in Québec assemble electric vehicles or manufacture parts and systems for electric vehicles.

- Manufacturers of complete electric power systems.
 - CVTech in Drummondville
 - TM4 in Boucherville
- Manufacturers of batteries and battery materials.
 - Bathium in Boucherville manufactures lithium-metal-polymer batteries.
 - Phostech Lithium in Saint-Bruno-de-Montarville markets to customers all over the world a lithium iron phosphate preparation (LiFePO₄) that holds out great promise for the lithium ion batteries that will equip tomorrow's electric vehicles.
- Lightweight materials
 - Québec manufacturers are known for their use of lightweight materials such as aluminum, plastics, composites, and rubber, all of which are used in electric vehicles. These materials allow for lower vehicle weight for increased range.
- Parts and systems for electric vehicles
 - Spectra Premium, in Boucherville, makes fuel tanks for the GM Volt.
- Low-speed electric vehicles
 - Précicad is a Québec City company specializing in industrial design. The firm has developed a low speed electric vehicle and has it manufactured. A dozen of its small modular vehicles are currently in service.
 - Lico, based in the Beauce region, also produces low-speed electric vehicles.
- Hydraulic systems for electric aerial shuttles and ladder truck systems
 - Robert Hydraulique in Repentigny and Posi-Plus in Victoriaville have each developed hydraulic systems for aerial shuttles and ladder trucks that operate on power from the electric grid, eliminating the need for internal combustion engines, generating significant fuel savings, and cutting greenhouse gas.
- Hybrid vehicle assembly
 - Bombardier Recreational Products (BRP) assembles recreational vehicles in Valcourt and is currently working plug-in hybrid three-wheeled roadster (Can-Am Spyder).
 - Nova Bus, a division of Volvo Canada, designs and manufactures hybrid buses in Saint-Eustache.
 - Paccar, in Sainte-Thérèse, assembles hybrid trucks.
- Rail vehicles
 - Bombardier Transport, located in La Pocatière and Saint-Bruno-de-Montarville, is a global leader in the railway transportation sector. It offers a wide range of rail products and services, from subways to commuter trains, light rails, tramways, monorails, and high speed trains.
- Charging stations
 - AddÉnergie in Québec City has developed smart refill stations that are designed for the Québec climate and offer energy management adaptable to client needs and future technological developments.

3

Taking Action Today To go Further Tomorrow



The latest generation TM4 electric motor

In recent years the Québec government has shown a strong interest and determination to make electric vehicles a regular and usual means of transportation. To reach the ambitious goals of the **Electric Vehicles 2011–2020 Action Plan**, the government is now resolved to going further and strengthening its commitments by introducing a series of new measures aimed at each of the action plan's four objectives.

These new measures represent total investments of \$165 million. Appendix 2 presents these new measures.



3.1 Drivers can Switch to Electric Vehicles

Rebate for the Purchase or Lease of a Hybrid or Electric Vehicle

On January 1, 2012, the refundable tax credit for the purchase or lease of fuel-efficient vehicles will be replaced to rebates for the first purchasers of hybrid or eco-electric vehicles. The rebate will be deducted from the after-tax purchase or lease price. Consumers will thus see their savings right on their vehicle bills of sale or lease.

In the case of electric vehicles, the amount of the rebate will depend on the battery's electrical storage capacity.

The program's main terms and conditions are explained in Text Box 7.

Refundable Tax Credit for the Purchase or Lease of New Fuel-Efficient Vehicles

On March 17, 2011, the government announced it was increasing the tax credit for vehicle categories eligible for higher purchase rebates than the current tax credit. This means individuals who wish to purchase or lease an electric vehicle in 2011 can receive the same amount of financial assistance without waiting for the rebate program to take effect.

Residential Charging Grant

It will soon be possible to purchase 240 volt residential charging stations that cut charging times in half. But these more powerful charging stations are more expensive.

To help Quebecers reduce their charging times, those who purchase or lease vehicles eligible for rebates will also be eligible for grants for purchasing and installing home charging stations.

Grants will be available starting January 1, 2012. Québec is the first province in Canada to provide financial assistance for home charging stations.

A total of \$50 million will be set aside for the purchase/lease rebates for hybrid and electric vehicles and financial assistance for home charging stations.

Education and Promotion Program

The upcoming arrival of electric vehicles is creating tangible interest on the part of Quebecers, who see this as an exciting way to help protect the environment by reducing greenhouse gas emissions. While Quebecers identify strongly with hydroelectricity and have come to associate it increasingly with electric vehicles, there remains a certain amount of uncertainty and a lack of awareness of the technology used in these vehicles (Text Box 8).

To encourage Quebecers to choose electric vehicles, the government intends to undertake a promotional and educational campaign to answer their questions and also address issues of interest to industry partners such as municipalities, parking lot managers, and fleet owners.

The government will work with Fédération québécoise des municipalités (FQM) and the Union of Quebec Municipalities (UMQ) to raise awareness of electric vehicles, encourage municipal governments to adopt them, and inform driving schools of their arrival.

A total of \$1.5 million has been earmarked for these promotional and educational actions during the first year of the action plan. Hydro-Québec will also do its part.

A Web portal has also been set up to provide ready information on electric vehicles: www.vehiculeselectriques.gouv.qc.ca/english

A Green License Plate for Electric Vehicles

Société de l'assurance automobile du Québec (SAAQ) is introducing a special new license plate for electric vehicles. This “green” plate will be a way to make sure that only electric vehicles park in spots with charging stations. It will also be very helpful for municipal initiatives like the creation of reserved parking spaces or lanes.

Text Box 7

Main Terms and Conditions, Rebate for the Purchase or Lease of a Hybrid or Electric Vehicle

Eligible vehicles:

New all-electric and plug-in hybrid vehicles equipped with a minimum 4 kilowatt-hour (kWh) battery; new hybrid vehicles with energy consumption not exceeding 5.27 liters/100km if gas-powered and 4.54 liters/100km if diesel-powered; new low-speed electric vehicles.

Eligible recipients:

Individuals, businesses, nonprofit organizations, municipalities.

Rebate amount per vehicle type:

	2012	2013	2014	2015
All-electric and plug-in hybrids with minimum 4 kWh battery (e.g.: Nissan LEAF, Chevrolet Volt)	\$5,000–8,000	\$4,500–8,000	\$3,000–4,000	\$2,000–3,000
Low-speed electric vehicles (LSVs)	\$1,000	\$1,000	\$800	\$600
Hybrids (e.g.: Toyota Prius, Honda Civic Hybrid)	\$1,000	\$500	-	-

The rebate program has two ceilings for the maximum number of eligible vehicles: 10,000 for all-electric vehicle and plug-in hybrids and 5,000 for hybrids.

Text Box 8

Surveys on Electric Vehicles

A September 2009 Hydro-Québec survey of Québec households that owned or intended to purchase a vehicle revealed the following:

- The two most common factors considered on the purchase of a traditional vehicle were price (including perceived value for the money) and fuel consumption.
- The vast majority of respondents were aware of the concept of electric vehicles. Less than 10% of them, however, were able to correctly name a make of electric vehicle.
- Three-quarters of those surveyed said they were prepared to consider electric vehicles for their next vehicle purchases. Their motives were both environmental and financial. However, \$5,000 was the maximum acceptable price differential. The biggest reservation was reluctance to adopt new technology.

Another survey (Pollution Probe, Canadian Perception of Electric Vehicle Technology, Environics, March 2009) indicated that public perception of electric vehicle recharging were mistaken.

The majority of those surveyed were unaware that the outdoor electrical outlets already found at most Québec homes could be used to charge electric vehicle batteries.

3.2 Electric Vehicles are Almost Here

Thanks to the trials and pilot projects currently underway, Québec is actively preparing to deploy an electric vehicle charging infrastructure.

These projects clearly identify Québec as an electric vehicle-friendly place. They are also spurring development of Québec expertise in charging infrastructure. Text Box 9 provides the example of Québec company AddÉnergie Technologies, which develops and markets a charging station system.

Major Electric Vehicle Projects

The Québec government is determined to accelerate deployment of electric vehicles. Its clean and renewable electricity and numerous other advantages make Québec the perfect place to carry out actual projects with multiple users under a variety of conditions.

In conjunction with municipal and private partners, the Government of Québec will call for tenders in the next year for the purchase of at least 400 electric vehicles. FQM and UMQ will be involved in this project. Location Bleu Pelican, Restaurants Normandin, and Rôtisseries St-Hubert are the first private partners to join.

Likewise the Québec government will set a leadership example by stipulating that at least 25% of its passenger vehicle purchases in 2020 be electric vehicles.

Up to \$10 million will be set aside for these projects.

Electric Vehicles and the Electric Power Grid

The Hydro-Québec electricity grid is already powerful enough to meet the charge requirements of at least a million electric vehicles.

To make sure the introduction of electric vehicles goes smoothly, Hydro-Québec will carry out studies throughout 2011 as well as a more in-depth analysis of the interface with the power grid based on the results of pilot projects and collaboration with other electric power suppliers.

An exciting Outlook

Hydro-Québec also plans to continue leading the way by developing innovative support infrastructure for electric vehicles. As part of a research and development project led by its research institute, Hydro-Québec will work with Québec partners to identify the technological and economic repercussions of the vehicle-to-grid (V2G) energy exchange concept and carry out initial experiments.

Deploying the Charging Infrastructure

The deployment of the infrastructure must first take into account the different categories of charging technology described in Text Box 10.

Charging stations will be located in places where electric vehicles are parked long enough to recharge (e.g., homes, offices, restaurants, and shopping malls).

Around 80% of the demand for vehicle charging will be where drivers live and work, which is where vehicles are parked for the longest time during the day. With technology quickly developing and prices dropping, quick chargers could soon appear in strategic locations. Charging infrastructure will be deployed in pace with the arrival of electric vehicles and as user needs develop.

Illustration 2 indicates the different types of locations.

Residential Charging

According to the September 2009 Hydro-Québec survey, 94% of Québec households owning or intending to acquire a vehicle already have parking spaces at home, and 89% of those households already have access to a Level 1 (120 volt) charging station at those parking spaces. Québec is therefore already at a very good starting point for meeting residential charging demand.

To give Quebecers an incentive to use electric vehicles, the Québec government will support the residential purchase and installation of Level 2 (240 volt) stations, which will cut charging times. These grants will be available as of January 1, 2012.

ILLUSTRATION 2
Possible charging stations



Text Box 9

AddÉnergie Technologies: A Made-in-Québec Charging System

Québec's AddÉnergie Technologies designs, develops, and markets smart charging station systems in conjunction with Gentec. With the help of the Québec government it will carry out a project, mainly in Québec City, to demonstrate electric and hybrid vehicle charging facilities.

The goals of the project are to adapt, manufacture, install, and operate charging facilities under real use conditions. Performance data collected in controlled environments and during real-world trials will help the company make the necessary adjustments to ensure maximum efficiency.

Thanks to this project, charging facilities that are safe, reliable, and adapted to a northern climate will be developed right here in Québec.

AddÉnergie Technologies will receive a total of \$763,000 from the Green Energy Technology Development Assistance Program, the Energy Innovation Assistance Program, and the Business Assistance Program, design & innovation component.

Gentec is a Québec City-based company that designs and manufactures electronic equipment.



Text Box 10

Categories of Charging Facilities

- Level 1 corresponds to standard 120 volt outlets, which most Québec residences have either somewhere outside or in the garage. Level 1 offers a 6 to 8 hour charge time for a plug-in hybrid and 11 to 16 hours for a fully electric vehicle when the battery is completely dead.
- A Level 2 station operates at 240 volts, cutting charging time in half to only a few hours. This type of outlet is used for things like domestic clothes dryers. With these stations, charging times are 3 to 4 hours for hybrid vehicles and 6 to 8 hours for fully electric vehicles.
- DC chargers, generally referred to as quick chargers, operate at a minimum of 400 volts. These stations are already on the market in the U.S. and are being accredited in Canada. In 10 minutes, a quick charger can provide enough electricity to run a fully electric vehicle for 50 kilometers.

Public Charging Stations

In some cases drivers of electric vehicles will need to charge their vehicles away from home. This will initially be at work, where vehicles are usually parked for several hours or, for example, at one of AMT's 61 park-and-ride lots providing 31,000 daily parking spaces.

The public charging network will be for occasional use by drivers in order to extend travel distance. The network will be deployed in business sectors where visitors stay for extended periods, like restaurants, retail stores, and movie theaters. Level 2 (240 volt) stations will be sufficient to meet demand.

Figure 4 illustrates the locations and types of stations based on anticipated demand.

Public Charging Infrastructure Deployment Strategy

Deployment of the public charging infrastructure raises a series of questions regarding the number, location, and types of the facilities as well as the financial responsibilities and timelines involved in setting up the infrastructure.

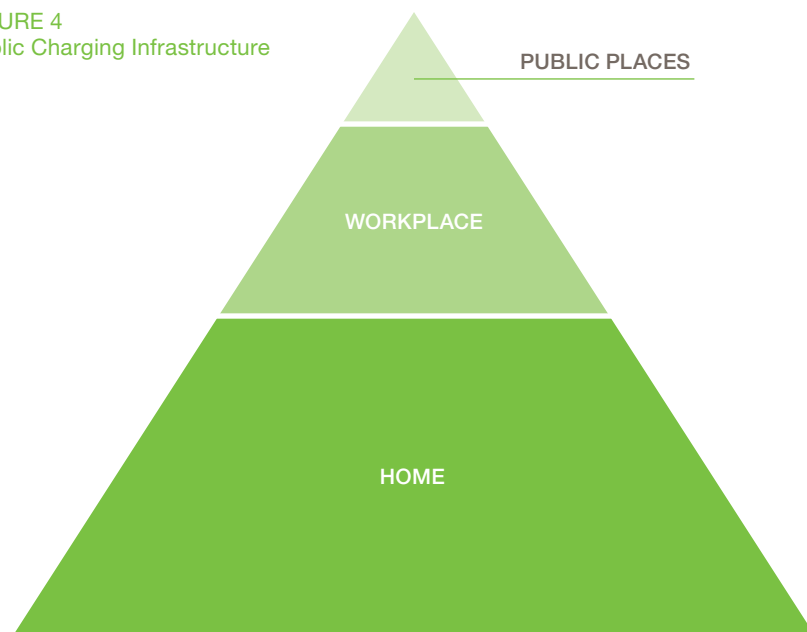
A public charging infrastructure deployment strategy will help address these questions and ensure they are set up in accordance with government guidelines, and that this action plan is a success. Text Box 11 presents these guidelines.

Hydro-Québec has been asked to formulate this strategy and coordinating implementation with all interested parties. The strategy will be released by summer 2011.

Practical Guide to Charging

Technical advice and information would be useful to businesses and parking lot owners. In 2011, Hydro-Québec will produce and distribute a practical guide which will address real estate promoters, electricians and other municipality authorities. This guide will answer various questions brought up about the charging of electric vehicles.

FIGURE 4
Public Charging Infrastructure



Changes to the Québec Building Code for New Buildings

The Québec Building Code already requires outdoor electric outlets to be available at every vehicle parking space at new residential housing units. This is why there is already a good residential base to build on. However, these outlets are not required in certain types of residences and buildings where electric vehicles are to be charged. Unfortunately, it is more complicated to add charging facilities after construction is complete.

In addition, since 240 volt outlets reduce charging times, the Building Code will be amended to contribute to the deployment of electric vehicles in this regard.

The amended Building Code will require the wiring in new construction to provide for the eventual installation of 240 volt charging stations.

In spring 2011 following study and consultations, Régie du bâtiment will draw up a report on changes to the Québec Building Code.

Text Box 11

Government Guidelines for the Deployment of Public Charging Infrastructure

Charging facilities must be set up according to the following guidelines:

- Infrastructure deployment cost: The number and location of public charging stations will be determined so as to maximize use.
- Scalability: The deployment plan must adapt to developments in quick charge technology and battery efficiency, which will allow for longer trips.
- New business models: New business models must be developed with input from Hydro-Québec and the private sector to meet the demand for public charging facilities in order to ensure a variety of charging service options on the market.
- Spinoff benefits: Québec must maximize technological innovation and spinoff benefits from the design and manufacture of charging facilities.

3.3 Québec Electricity for Public Transit

If we see the use of electricity for private vehicles, we will eventually see the same for the public transport. In fact, Québec's public transit sector already uses electricity and there is a strong desire among public transit corporations and AMT to expand its use. In light of recent events, feasibility studies have been announced for electrifying certain commuter trains and for building tramways or extending the subway. In light of current knowledge, Société de transport de Montréal has undertaken to acquire only all-electric buses beginning in 2025.

The Québec government is therefore announcing the following public transit measures:

Increased Support for Public-Transit Agencies in Switching to Electricity

The government will step up its support of public-transit agencies in planning and financing electrification: guided electric-powered modes (trains, subway, etc.); new types of vehicles; infrastructure development; use of new technologies; and monitoring the experiences of public-transit agencies around the world.

For the sake of efficacy, this support could target one aspect or another pertaining to public transit requiring electricity, whether in an urban, rural, interurban, or interregional setting:

- Deployment of new modes of electric-powered public transit on high-traffic corridors (such as Boulevard Pie IX and the Champlain Bridge)
- Rechargeable electric or hybrid buses
- Maximum electrification of the commuter-train system
- Installation of charging stations at park-and-ride facilities
- Development of the subway system

The government will foster maximizing the proportion of fully electric buses in public-transit fleets and will provide for, if need be, an electricity-related component for each financial-aid program. The government aims at having 95% of trips on the province's public-transit system on electric-powered vehicles by 2030.

Lastly, based on technological change and the development of the new public-transit policy, the government will ensure that its financial programs are adjusted, redeployed, or restructured. As a result, these programs could be better focused, target the infrastructure or equipment best suited to regional needs, and increase the mobility of the various types of public-transit users, including people with reduced mobility and the elderly.

Government Guidelines on the Electrification of Public Transit

In June 2006 the government released the **Québec Public Transit Policy 2007–2011**. With this policy, the government intends to increase public transit availability and ridership across the province.

As part of the review of this policy, the government will submit its guidelines for consultation in order to accelerate electrification of public transit in Québec.

Hybrid Buses

A pilot project on hybrid bus use conducted by the Montréal and Outaouais transit corporations showed that, under certain conditions, the fuel consumption of hybrid vehicles could be up to 30% lower than that of internal combustion vehicles.

Based on this data, the government intends to authorize public transit corporations to include hybrid buses in calls for tender and thereby make them eligible for government funding.

The next call for tenders by public transit corporations, which is currently being developed, will be directed mainly at the acquisition of hybrid buses, thus initiating the process of converting their fleets of buses to vehicles that consume less fuel and emit fewer greenhouse gases.

Public Transit Corporation Service Vehicles

The government intends to boost funding eligibility for the purchase of hybrid or electric service vehicles by public transit corporations from \$30,000 to \$40,000 under the following assistance programs:

- The **Government Mass Transit Assistance Program**, which covers 50% of eligible expenses
- The **Transit Capital Program** run by **Société de financement des infrastructures locales du Québec**, which covers 85% of eligible expenses. This increase will come into effect with the next Québec public transit policy and will entail an investment of \$3 million.

Thanks to this measure, public transit corporations can continue improving the fuel efficiency of their service vehicles (e.g., network supervisors' cars) and test new technology.

Electric Bus Technology Watch by Public Transit Corporations

AVT Société de gestion et d'acquisition de véhicules de transport, a collective made up of nine transit authorities, has overall responsibility for coordinating public transit electrification. AVT provides an opportunity for transit authorities to work together toward shared goals.

Québec's public transit authorities are responsible for 80% of public transportation in the province. They share a vision: top-to-bottom electrification of the nine transit systems at the earliest opportunity and by all available means, using the technologies best suited to Québec's climate and individual authorities' needs.

To assist in this regard, the government will facilitate AVT's efforts to learn about, test, and become more familiar with new technologies leading to the inclusion of electric buses in public transit fleets. A financial contribution covering 50% of eligible expenses up to \$5 million over three years is planned. Hydro-Québec is contributing \$500,000.

Taxis

Given how big the taxi industry is and that financial assistance to improve vehicle fuel efficiency in the sector is available, the government wishes to discuss an action plan of financial help with representatives of this industry to make taxis more eco-friendly.

Electric Vehicle Sharing

Certain areas are less well served by public transit because of lower passenger volumes and could benefit from a car-share service provided in transit-owned rechargeable vehicles. Hydro-Québec, AMT, Société de transport Laval (STL), and the private sector are working to launch an electric car-sharing project in the coming months to get a precise idea how this promising solution could work.

3.4 Québec's Electric Vehicle Industry: Envable Prospects

Québec is already a leading supplier of the critically important batteries, battery materials, electric motors, and light materials used in electric vehicles. Québec also boasts hybrid and electric vehicle assemblers like Nova Bus and Précicad.

With the previously mentioned Québec electric bus development project and the measures announced in this action plan, it will be possible to develop a critical mass of innovative businesses and research centers that will allow Québec to occupy attractive niche positions in the new electric vehicle market.

Bombardier Recreational Products (BRP), for example, is designing a plug-in hybrid version of its popular Can-Am Spyder vehicle. The performance goals for this new vehicle are a 30 kilometer range in electric mode and a 50% reduction in fuel consumption and CO₂ emissions.

This project by BRP–Université de Sherbrooke Advanced Technology Center is the only one of its kind in the world and involves the development of a brand new propulsion system. It will result in the training of 20 highly qualified doctoral and other students and strengthen Québec's electric motor know-how.



The Can-Am Spyder rechargeable roadster, manufactured by Bombardier Recreational Products

A Innovative Products That Drive Development

The **Electric Vehicles 2011–2020 Action Plan** includes three new R&D and innovation initiatives that have been added to the electric bus project mentioned above.

Confirmation of Support for Research, Development and Innovation

The government has set aside a further \$36 million from existing government programs to support research, development, and innovation in the electric vehicle industry:

- Eligible companies can receive support for their pilot projects on new technology, like AddÉnergie for charging stations.
- The government will seek to ensure that the results of applied research conducted in Québec are in fact commercialized in Québec whenever possible.
- Development of new technology and innovative processes will be encouraged.

Research, development, and innovation in the electric vehicle industry could therefore qualify for substantial support.

Industry Research Group

The electric vehicle industry will also receive the support available to priority sectors for the creation of innovative, active industry research groups.

One of the main purposes of the electric vehicle industry group will be to carry out applied research on identified business needs through universities and research centers.

Examples of similar groups in other sectors include the Québec Aerospace and Innovation Consortium (CRIAQ); Prompt, a research partnership in microelectronics, photonics, and telecommunications; and Hexagram, a design and research institute in the arts and media technology.

Based on these successful models, the government has set aside \$4 million for the creation of this sectoral group dedicated to electric vehicles.

The Creation of a Québec Electric Vehicle Cluster

Likewise, the government will seek to bring together the main players in the electric vehicle industry—businesses, research centers, related organizations, ministries—to concentrate know-how in the field.

The mission of this Québec electric vehicle cluster will be to have all industry partners working together toward the goal of greater competitiveness.

The various players in the electric vehicle industry will need to join with the representatives of the Specialty Vehicles and Transportation Equipment Manufacturers' Association (AMETVS) and leaders of initiatives in the ACCORD sectors involved (Text Box 12) to coordinate their efforts and network together to provide a competitive business environment conducive to development of the industry.

B Building a World Class Industry

In further support of the measures it has put forward to promote research and innovation, the government intends to step up efforts to keep innovative new products in the pipeline. The goal is to ensure that maximum use is made of Québec know-how and products to electrify transportation, whether in Québec or elsewhere.

With this in mind, the government will intervene strategically by targeting sectors where Québec already has a leg up, in order to strengthen and develop the existing industrial base. The following markets will be priorities:

- Manufacturers of
 - Electric motors
 - Batteries and battery materials
 - Lightweight components
 - Charging facilities
- Hybrid and electric vehicle assemblers

Support for Investment in Québec

Because Québec's clean and renewable electricity provides ideal conditions for the introduction of electric vehicles, the government will offer support to hybrid and electric vehicle assemblers and parts and systems manufacturers. This support will be available both to Québec-based assemblers and the subsidiaries of multinationals in Québec.

A \$30 million budget has been set aside to provide assistance and support to eligible companies drawing up and implementing development strategies.



Attracting International Manufacturers to Québec

Based on the vitality of the electric vehicle industry and the availability of a green source of electricity, it is possible to strengthen Québec's hand by attracting international manufacturers.

With its abundant hydroelectric resources — a clean and renewable energy source — Québec can attract companies in new green technology sectors like electric vehicles. Use of hydroelectricity in the manufacture of these products would help improve their environmental performance over their life cycle. These advantages are known as "Québec's green electrons."

A \$25 million budget will be set aside to attract foreign investment in Québec's electric vehicle industry.

The Québec government will set aside a total of \$55 million to develop and strengthen the industrial sector in Québec and thus generate a potential \$500 million in private investments, helping to double the number of direct and indirect jobs from 1,500 to 5,000.

Text Box 12

Areas of Expertise in the Ground Transportation Industry

The ACCORD (concerted action for regional development cooperation) project aims to build an internationally competitive production system in each Québec region by identifying and developing areas of expertise that could become their brand image.

The following four regions boast a critical mass of expertise in transportation:

- Montérégie – Advanced transport equipment technology and logistics
- Centre-du-Québec – Suppliers and manufacturers of commercial, specialty, and recreational vehicles
- Laurentides – Advanced ground transportation
- Estrie – Transportation equipment and elastomers

These regions have joined together to create the Interregional ACCORD Table in Transportation for the purpose of developing this industry cluster together.

The aluminum cluster in the Saguenay–Lac-Saint-Jean region and Centre National du Transport Avancé (CNTA) are working together to improve Québec's capacity to integrate aluminum into the manufacture of plug-in electric vehicles.

Conclusion

A Promising Future

Electric vehicles offer Québec a unique opportunity to make significant environmental, economic, and energy gains. Not only that, all the conditions are in place to take advantage of this valuable opportunity.

Québec has abundant hydroelectric resources, an enviable capacity for research, development, and innovation, and a growing network of specialized companies whose know-how bodes well for the future.

The combination of so many advantages is the inspiration behind this **Electric Vehicles 2011–2020 Action Plan**. This plan paves the way for the introduction of electric vehicles and the electrification of public transit.

The measures proposed here will contribute significantly to meeting key government goals of energy self-sufficiency by promoting the replacement of fossil fuels with electricity produced in Québec. They will therefore play a decisive role in greenhouse gas reduction and the fight against climate change. By supporting research, development, and innovation and helping companies do business in the electric transportation industry, the action plan will also help create jobs and wealth in Québec.

In total, this action plan makes \$250 million available in the short term to develop and promote electric vehicles and get them on the road faster.

The **Electric Vehicles 2011–2020 Action Plan** sets a target: electric vehicles will make up 25% of new light passenger vehicle sales in 2020, and their technology will serve to reduce greenhouse gas emissions. This means 300,000 electric vehicles operating in Québec by 2020, saving 384 million liters of fuel and lowering GHG emissions by 900,000 tons — 6% of Québec's required efforts to meet 2020 emissions targets.

A Role for Everyone

The action plan is intended for many different people and players, including individuals, the public sector, municipalities, business, Hydro-Québec, transit corporations, the broad swath of businesses active in the industry, and many more. Whatever their role, everyone will be called upon to contribute actively to the action plan, and everyone will benefit from its success.

A Work in Progress

The **Electric Vehicles 2011–2020 Action Plan** is a work in progress. It is a first step, and will be updated periodically as technological progress leaves its mark in this rapidly evolving industry. Other steps will follow that will gradually turn Québec into a powerhouse in the electrification of transportation in North America and elsewhere in the world.

Appendix 1

Existing Measures

MEASURE	MINISTRY OR ORGANIZATION IN CHARGE	BUDGET IMPACT (in millions of dollars)
ELECTRIC VEHICLE USERS		
Refundable income tax credit for fuel-efficient vehicles	MFQ	9.6 (estimate as at December 31, 2011)
Rebate for hybrid and electric trucks	MTQ	10.0
Depreciation rate for hybrid and electric heavy trucks	MFQ	-
MAJOR PROJECTS INVOLVING ELECTRIC VEHICLES		
Trials and pilot projects	Hydro-Québec	9.4
PUBLIC TRANSIT		
Subsidy of \$2,000 to taxi owners and car-share companies for the purchase of hybrid or electric vehicles	MTQ	2.5
Programs to purchase hybrid or electric buses		
Electrification of public transit: feasibility studies, project office of the subway	MTQ	18.5
	Hydro-Québec	5.0
INDUSTRY DEVELOPMENT		
Development of a Québec electric bus	MDEIE	30
TOTAL OF EXISTING MEASURES		85
TOTAL OF NEW MEASURES		165

Appendix 2

New Measures Introduced by the Electric Vehicles 2011–2020 Action Plan

MEASURE	MINISTRY OR ORGANIZATION IN CHARGE	BUDGET IMPACT (in millions of dollars)
ELECTRIC VEHICLE USERS		
Rebate on purchase or lease of a hybrid or electric vehicle	MRNF	50.0
Financial aid for the purchase and installation of residential charging stations	MRNF	
Education and promotional actions	MRNF / MDDEP	1.5
Green license plate	SAAQ	-
MAJOR PROJECTS INVOLVING ELECTRIC VEHICLES		
Major projects: government, municipalities, private companies	MRNF	10.0
Deployment strategy for public charging infrastructure	Hydro-Québec	Depends on the amount of infrastructure required
Practical guide to charging	Hydro-Québec	-
Amendments to the <i>Building Code</i> for new buildings	Régie du bâtiment	-
PUBLIC TRANSIT		
Increased support for transit authorities in their shift to electricity	MTQ	-
Government guidelines to step up the electrification of public transit	MTQ / AMT	Depending on which projects are carried out
Acquisition of hybrid buses by public transit corporations	MTQ	Will be known after a supplier is selected
Transit corporation service vehicles	MTQ	3.0
Technology watch, electric buses	MTQ / Hydro-Québec	5.5
Taxis	MTQ	-
Electric vehicle sharing	Hydro-Québec / STL / AMT	-
INDUSTRY DEVELOPMENT		
Support for research, development, and innovation	MDEIE	36.0
Industry research group	MDEIE	4.0
Québec electric vehicle cluster	MDEIE	-
Support for investment projects in Québec	MDEIE	30.0
Attracting international manufacturers	MDEIE	25.0
TOTAL OF NEW MEASURES		165

The action plan therefore calls for measures totaling \$250 million!



100%