



Manitoba's ELECTRIC VEHICLE ROAD MAP

Driving toward
Fossil Fuel Freedom



ELECTRICITY IN MOTION

Replacing gas vehicles with electric vehicles? Driving cars you plug in instead of gas up? Isn't this concept too far down the road to think about? The answer is no.

You may be surprised to know that Manitoba was one of the first jurisdictions in the world to roll out a comprehensive plug-in hybrid electric vehicle demonstration. And Manitoba is now well-positioned to take advantage of what could be the greatest energy revolution in 100 years – electricity-powered transportation. Manitoba's Electric Vehicle Road Map puts the province on the pathway towards this energy and transportation transformation.

As the new technology unfolds, Manitoba can't afford to take a back seat. The new energy revolution offers the potential to take our number-one

energy weakness – fossil fuel imports, and replace it with our number-one energy strength – renewable hydroelectricity.

Because our situation and conditions are unique, we must take a measured approach that is right for Manitoba. We need to gain a specific, local understanding of the technological and economic impact of electric vehicles before making major, across-the-board investments. We also need to identify the best ways to increase the availability, and accelerate the use of these vehicles in our everyday lives, benefitting both the economy and our environment.

WHAT'S IN IT FOR MANITOBANS?

Electric transportation — the potential benefits to Manitobans over the coming decades:

- Manitoba would have the least expensive vehicle fuel (electricity) on the continent — estimated at 6¢ to 20¢ per litre, gasoline equivalent.
- Each year, thousands of dollars in savings could go back in the pockets of average Manitoban families.
- Manitoba's economy, as a whole, could save more than \$1 billion that's going out of province — money which could be spent at home, creating jobs and generating new business.
- Since Manitoba's electricity is almost completely greenhouse gas (GHG)-free, switching from a fossil fuel like gasoline to electricity would create large-scale GHG reductions.

THE CHANGING GLOBAL ENERGY EQUATION

Our energy world is changing. Global demand for energy is expected to increase by 50 per cent by 2035. Global demand for cars and other vehicles is also increasing. Easy-to-reach, inexpensive petroleum, which the world depends on to operate its vehicles, is dwindling, while new supplies come from sources more and more difficult to access. The result — higher oil prices. Today's geopolitical uncertainty in different parts of the world is also causing upward

pressure on oil prices. Rising oil prices do not only affect individual Manitobans and their families, but also, the growth prospects of our economy as a whole.

Fossil fuels are not just an economic problem. Their domination of the world's energy continues to cause serious environmental problems worldwide. Climate change, a by-product of GHG emissions, continues to threaten and disrupt our natural world, and possibly, even our



*This connector for the charger cord makes filling up your car as simple as plugging it in.
Photo courtesy of Mitsubishi Motors Canada*

own existence. Every day, the smog in the air is harming our health and our cities. Oil, gas and other toxic chemical spills are poisoning our water, our wildlife and our citizens. These are not small problems.

THE SHIFT TO CLEANER TRANSPORTATION HAS BEGUN



*New Flyer Industries sets the standard with its Xcelsior hybrid bus.
Photo courtesy of New Flyer Industries*

The changing energy equation has increased the need for more efficient and cleaner forms of transportation. Automakers around the world have embraced this demand and are developing many models of electric and plug-in hybrid electric vehicles. They are also improving conventional vehicle fuel-

efficiency and expanding the capacity to use higher blends of biofuels.

But the demand for cleaner transportation extends beyond the automobile. The race is also on to produce electric drive buses, and use advanced battery systems to provide auxiliary power for heavy-duty vehicles.

THE NUMBERS GAME: HOW MANITOBA STACKS UP

There are currently more than 700,000 motorized vehicles operating in Manitoba. All but a select few require fossil fuels (gasoline or diesel) to operate. Manitobans use about 1.5 billion litres of gasoline and one billion litres of diesel fuel annually.

Our overall fuel consumption per vehicle is also fairly high. For example, the average gasoline-powered vehicle uses around 15 litres per one-hundred kilometres. This high fuel consumption is due, in part, to Manitoba's cold winter conditions. As well, a great many light trucks and SUVs are purchased by Manitobans, particularly in urban areas.

Manitoba does produce some crude oil, but quantities are limited, and it's exported for further processing. The key fact is, all refined gasoline and diesel bought at the pump is imported into Manitoba, so the payment for these fuels flows out of province.

Paying for our reliance on fossil fuel has become Manitoba's number-one energy weakness. By the mid-1990s, the money leaving Manitoba to pay for all imported fossil fuels was about \$1 billion annually. In 2011, this amount has more than doubled – it's in the range of \$2 to \$3 billion annually.

That money is lost to Manitoba's economy. As the costs of fossil fuels increases, those losses will continue to grow. Every 20-cent increase at the pump equates to roughly \$500 million more leaking from the Manitoba economy. This is enough to pay the entire annual electricity bill of every Manitoba family.

The fossil fuel used for transportation is also one of the largest sources of GHG emissions in Manitoba – more than seven million tonnes. Transportation represents more than one-third of all the Manitoba GHG emissions.

MANITOBA'S ELECTRIFYING ADVANTAGES

It only makes sense for Manitobans to use electric and plug-in hybrid electric vehicles to the greatest extent possible.

We have "green" fuel

Manitoba Hydro is well-recognized for having the highest proportion of renewable electricity generation (98 per cent-plus) in its grid-mix in all of North America. With new hydroelectric and wind projects, we can even surpass that.

Manitoba drivers will not only save money by refueling with electricity, they will also make deep, sustainable cuts in the associated emissions. If all 10 billion vehicle-kilometres now travelled in Manitoba using gasoline, were electrically powered, it would require somewhere in the range of a 300 to 700 MW wind farm. And it would result in 3 to 4 million tonnes of GHG emission reductions.

We have the right price

Manitoba has among the lowest electricity rates in North America. This means that for electric and plug-in hybrid electric vehicles, we have the lowest priced elec-

tric fuel on the continent. We could easily convert one of our greatest energy weaknesses (imported fossil fuels) to one of our greatest strengths (hydroelectricity).

The cost to "fill 'er up" with electricity has been estimated in the range of 6¢ to 20¢ per litre, gasoline equivalent. (Note: Gasoline-equivalent costs also depend on the vehicle.) As well, electricity prices are stable and predictable – the price doesn't spike because it's a long weekend, or summer, or because of events in the Middle East.

We have the infrastructure

Manitoba has more than half-a-million plug-in points in our homes, garages, businesses and parking lots. These are already used for block heaters and preheating vehicles. They can easily be used for electric vehicle recharging. That existing infrastructure accommo-

dates what's referred to as "Level 1" charging. While slower than higher voltage "Level 2" charging systems, "Level 1" can be a practical solution in the near term for electric and plug-in electric vehicles used primarily for commuting shorter distances.

For other jurisdictions to put in place 500,000 recharging systems would cost them over \$1 billion. Manitoba has this recharging infrastructure already in place today, offering a significant advantage and substantial investment savings.

We know how to "plug in"

Manitoba also has a well-established plug-in culture for vehicles – it's called winter. We don't need special training courses to teach people how to plug in their vehicles. We've been doing it since we learned to drive.



Westward Industries' made-in-Manitoba hybrid Go4 Interceptor III.
Photo courtesy of Westward Industries

MANITOBA'S ELECTRIC VEHICLE ROAD MAP: SHIFTING INTO DRIVE

What we know:

- the scale of the opportunity before Manitoba is clear
- Manitoba has many assets to speed the transition from fossil fuel to clean, renewable transportation energy
- this transition will not happen overnight
- we can't control the pace at which electric vehicles are made available in the marketplace

What we can do:

- focus on maximizing our advantages
- create the relationships and environment necessary to fast track electric vehicles into Manitoba as they become available
- make the transition as swift, cost-effective and comprehensive as possible

As this energy revolution begins to unfold, Manitoba's early actions on the road to electric vehicles will include:

1. Plug-in Partnerships

Manitoba will facilitate partnerships with automakers, electric technology providers, Manitoba Hydro, Manitoba companies, academic institutions and others to:

- demonstrate vehicles under real-world conditions, and to better understand how they perform in Manitoba's unique climatic conditions (ex: cold-weather performance)
- help speed up adoption by ensuring widespread availability of vehicles and recharging equipment
- promote Manitoba's advantages as a location for business development, including opportunities in the development, testing and, potentially, manufacturing of electric vehicle technologies
- raise public awareness of electric vehicle technologies

2. Electric Vehicle Advisory Committee

An advisory committee will be created to provide recommendations to government on the best ways to prepare for, and speed adoption of, electric and hybrid-vehicles. Areas to be addressed include:

- maximizing out-of-the-gate use of Manitoba's existing \$1 billion recharging infrastructure
- identifying recharging infrastructure requirements beyond our extensive existing system (ex: the need for localized, faster charging infrastructure)

- large-scale integration of electric vehicle charging into the electrical grid
- consideration of upfront fiscal support mechanisms and/or innovative financing mechanisms for car, battery and recharging infrastructure
- vehicle insurance implications
- public outreach
- cold weather performance and adaptation
- battery life and secondary use or battery repurposing
- training and education requirements for vehicle servicing
- building code implications for recharging equipment
- electric vehicle codes, standards and regulations

3. Electric Vehicle Learning and Demonstration Centre

A centre will be created to help demonstrate various electric and plug-in electric vehicles and associated recharging equipment that will soon be commercially available to Manitobans. Not only will performance of the vehicles be monitored, but the public will have a first-hand opportunity to learn more about this transitional technology before they decide to buy.

FOSSIL FUEL FREEDOM

While it's unlikely that one method for powering vehicles will monopolize the future, the road signs point to the rapid expansion of electric transportation as a cleaner and more affordable path. Manitoba stands to reap an enormous harvest as progress is made.

Here are two simple ways to quantify the value of making this transition swiftly and comprehensively:

- Each Manitoba family shifting to electric vehicles is on the path towards \$100,000 in economic benefit -- for themselves and Manitoba.

- Every one per cent share of the Manitoba vehicle market that moves to electric vehicles equates to \$10 million injected back to the provincial economy, and 30,000 tonnes in GHG emission reductions.

And freedom from fossil fuels? While electric vehicles are only part of that larger equation, the next year could see Manitoba's first families becoming virtually fossil fuel free -- utilizing clean, renewable hydro for their electricity needs; heat pumps for home heating; and driving an emission-free electrical vehicle powered by our hydroelectricity. Fossil Fuel Freedom, perhaps closer than we think.

This information provided by:

**Manitoba Innovation, Energy and Mines
Energy Development Initiative**
www.manitobaenergy.ca

Manitoba Vehicle Facts

- 700,000 vehicles (all types) currently in Manitoba
- 40,000 to 50,000 new vehicles sold annually
- over 1,600 hybrid electric vehicles (HEV) licensed in Manitoba since 2006
- about 1.5 billion Litres of gasoline and 1.0 billion Litres of diesel fuel used annually in Manitoba
- average gasoline fuel consumption
 - > 15 Litres per 100 km in Manitoba
 - > 12.5 Litres per 100 km rough average for all of Canada
- transportation represents more than one third of Manitoba's GHG emissions
- average Manitoba vehicle travels about 16,000 km per year, or about 43 km per day
- currently between 15 to 25 all-electric and plug-in hybrid electric (PHE) vehicles in Manitoba, with the numbers quickly rising

World Vehicle/Energy Facts

- world demand for automobiles is roughly 60 million vehicles annually
- by 2035, world energy demand will be more than 50 per cent higher than 2007
- price of oil has been rebounding from a low of around \$40 per barrel in early 2009 back to roughly \$110 per barrel in April 2011

Commercial Release of Electric Vehicles: 2011 to 2016

- factory-built models such as the Mitsubishi IMiEV, Nissan Leaf and Chevrolet Volt just being commercially released
- initial electric vehicle prices \$30,000 to \$45,000
- prices will fall as more vehicles become available
- thirty models of all-electric and PHEV under development for potential release within five years
- all major vehicle manufacturers involved

Recharging Systems

Recharging time depends on charge required and level of charging. Estimated time required

to charge a 8 kWh battery:

- Level 1 charge (110 VAC, 15 A) about 8 hours (or overnight)
- Level 2 charge (220 VAC, 40 A) about 3 to 4 hours
- Level 3 charge (high voltage DC charge) about 15 to 30 minutes

Manitoba's Recharging Infrastructure

- Manitoba already has more than 500,000 plug-points at homes, businesses and parking lots that could be used for Level 1 charging of electric vehicles
- for another jurisdiction to build this infrastructure today from scratch would cost upwards of \$1 billion

Cost of Recharging Systems

- Level 1 charging can be done almost anywhere with access to a regular electrical outlet. No additional cost.
- Installing a home-based Level 2 charger depends on wiring services available, but is in the range of \$2,000 to \$4,000.
- A commercial or "public pay" Level 2 charging station is more costly.
- A Level 3 charging system is very expensive, currently averaging more than \$30,000 per charging point.

Electrical Load for Vehicles

- Manitoba Hydro estimates that by 2030 the load for electric vehicles could reach 195 GWh, with this considered as a relatively modest load. This compares to total annual generation of roughly 23,000 GWh and extra-provincial exports of about 10,000 GWh.
- Assuming all gasoline vehicles in Manitoba were converted to electricity, we would require 1,200 GWh to 2,500 GWh annually, (depending on vehicles size and efficiency).
- As a new load, this would require new wind farms ranging from 300 MW to 700 MW.