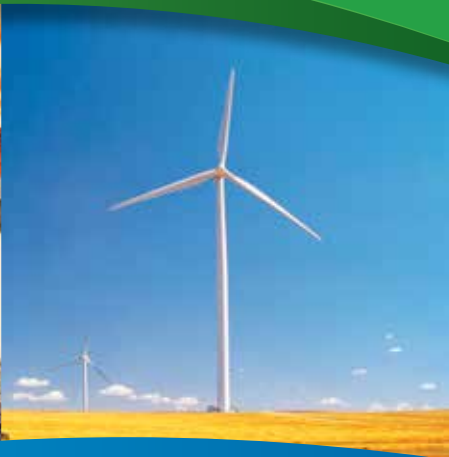


Focused on What
Matters Most:

Manitoba's Clean Energy Strategy







MESSAGE FROM THE MINISTER

Manitoba is in the unique position of having the resources, experience and wherewithal to become Canada's renewable energy powerhouse. Already a leader in developing one of the cleanest and greenest electricity systems in the world, Manitoba plans to build on those successes and move farther down the path towards fossil fuel freedom.

To help chart that path our government is pleased to release the Manitoba Clean Energy Strategy. This strategy focuses on made-in-Manitoba solutions to harness our water, wind, solar and biomass resources in ways necessary to help provide electricity to power our homes, businesses and industries; energy to heat our buildings; and fuel to drive our vehicles. This strategy is consistent with the principles behind Tomorrow Now – Manitoba's Green Plan, which focuses on protecting the environment while ensuring a prosperous and environmentally conscious economy.

Not only does energy play a critical role in almost every part of our society, but in Manitoba's case, it has become a major cornerstone of our economy. Plans for new hydroelectric generation and transmission require a bold capital program of \$20 billion over the next decade. If they are approved after environmental and economic reviews, these projects will create thousands of jobs, provide us with affordable power well into the future and support our neighbours' needs for clean electricity in the shorter term.

We recognize that fossil fuels like oil and natural gas will continue to be an important part of our society, but our goal is to reduce our reliance on these imported, greenhouse gas emitting and unpredictably priced commodities sooner rather than later. While most jurisdictions can only set 30, 40 or 50 year targets to reduce reliance on fossil fuels, Manitoba has a head start in developing our renewable energy resources in a sustainable way that is good for the economy and benefits the environment.

Our strategy focuses on building new generation hydro; expanding transmission that improves electricity reliability and security; adding more wind power as economics allow; promoting geothermal, biomass and solar for heating needs; developing our biobased fuels; and leading in new cutting edge electric transportation solutions.

Our government will do this in a way that benefits all Manitobans and ensures that our energy is affordable and clean, that it contributes to job creation and business expansion and allows opportunities for greater First Nation partnerships. As Canada's leader in energy efficiency, our government will also continue to balance new energy generation with strong demand side management programs, including Canada's first Pay-As-You-Save, on-meter financing program for efficiency retrofits.

This strategy is all about making energy choices today that will create a stronger economy and a cleaner environment for our future. Is fossil fuel freedom achievable? We're closer than you might think.

Original signed by

Dave Chomiak

Minister of Innovation, Energy and Mines

HIGHLIGHTS

Highlights of Manitoba's Clean Energy Priority Actions include the following.

Building New Hydro

- Ensure that the planning, design, consultations and negotiations necessary for developing substantial new hydroelectric generation, including Keeyask (695 MW) and Conawapa (1485 MW), proceed through environmental and economic review. These new generation hydro projects are being designed to greatly reduce environmental impacts and will be developed in partnership with First Nations.
- Improve Manitoba's transmission system reliability, increase export capabilities, and enhance the development of new hydro and wind energy by constructing a new Bipole III line, expanding interconnections to the US, strengthening the Dorsey convertor station, adding the new Riel Station and advocating for a stronger east-west Canadian grid.
- Work to eliminate the dependence of northern off-grid communities on diesel generation and ensure all Manitoba communities have access to clean renewable power.
- Maximize the economic benefits and job creation from new hydro and transmission developments through the \$30 million Renewable Energy Jobs Fund, a new Energy Opportunities Office, and training support for northern and Aboriginal communities.

Leading Canada in Energy Efficiency

- Through Manitoba Hydro, implement a new On-Meter Financing program that overcomes the high upfront costs that prevent households from implementing energy saving retrofit measures.
- Enhance Manitoba's successful Low Income Energy Efficiency programming, in partnership with social enterprises, to help build community capacity, create jobs and maximize economic benefits.
- Expand The Green Building Policy so that more government funded building construction, renovation and operations are subject to energy efficiency requirements.
- Expedite adoption of National Building Code energy efficiency updates to ensure Manitoba homes and businesses achieve the lowest lifetime costs for energy.
- Advance vehicle-related efficiency through green fleet purchasing policies, support for higher vehicle fuel efficiency standards and promotion of active transportation.
- Support the expansion of voluntary programs to benchmark, rate and label building energy performance. Manitoba will explore and pilot programs that disclose the energy performance of buildings offered for sale or lease.
- Pursue minimum energy efficiency standards for high-energy consuming products where federal standards are deemed inadequate.
- Develop and publish an annual energy efficiency plan that establishes stronger efficiency targets; identifies an expanded range of programming options; sets out costs and benefits; and reports on performance.

Keeping Rates Low

- Place Bill 18 – *The Affordable Utility Rate Accountability Act* – into law to ensure the lowest cost in Canada for a bundle of utility services – that is, the combined rates for electricity for home use, natural gas for home heating and automobile insurance.
- Within the context of *The Affordable Utility Rate Accountability Act*, support predictable, moderate rate increases for Manitoba Hydro over the coming years. The rates should be sufficient to fund the renewal of existing infrastructure; develop new generation, transmission and distribution capacity to serve growing demand; and assure continued reliable service to Manitobans.



Growing Renewable Energy Alternatives

- Continue to develop 1000 MWs of wind power as economically viable. In total, 1,000 MWs is expected to generate \$2 billion in new investment and \$400 million in lifetime revenues to rural communities.
- Accelerate adoption of geothermal heating and cooling systems through Manitoba's Green Building policy, available financial incentives and by promoting community scale district heating opportunities.
- Grow the province's biomass heat industry by directing revenue from the Emissions Tax on Coal to the Manitoba Biomass Energy Support Program.

- Evaluate new production opportunities and increased biofuels content requirements to pursue reductions in gasoline and diesel imports even beyond the \$100 million value currently realized in Manitoba each year.
- Prepare for and accelerate the adoption of electric vehicles in Manitoba by supporting informed decision making by consumers; incorporating electric vehicles into provincial and Crown corporation fleets; providing charging infrastructure support; and expanding electric vehicle demonstration projects.
- Continue to support development of the all-electric battery transit bus and expand the project into a multi-bus and charging demonstration.

Freedom From Fossil Fuels

- Launch a Fossil Fuel Freedom campaign that promotes a path for families to move away from fossil fuel use to clean energy sources for their electricity, heating and transportation needs. This path would help more and more Manitoba families reap the benefits of lower bills, create more local jobs and improve the environment.



TABLE OF CONTENTS

Message from the Minister of Innovation, Energy and Mines	01	3 Keeping Rates Low	26
Highlights	02	Today's Keeping Rates Low Priority Actions	27
Introduction	06	4 Growing Renewable Energy Alternatives	28
The Case for Moving Forward and Today's Priority Actions	09	Today's Wind Priority Actions	29
1 Building New Hydro	09	Today's Geothermal Priority Actions	31
Today's Hydroelectric Priority Actions	13	Today's Wood, Biomass and Solar Priority Actions	33
Today's Transmission Priority Actions	15	Today's Biofuel Priority Actions	35
Today's Gas, Coal and Import Priority Actions	16	Today's Electric Vehicle Priority Actions	37
Today's Off-Grid Community Priority Actions	17	Today's Alternative-Powered Bus Priority Actions	38
Today's Energy for Jobs Priority Actions	17	5 Freedom from Fossil Fuels	39
2 Leading Canada in Energy Efficiency	18	Today's Fossil Fuel Freedom Priority Actions	41
Today's Energy Efficiency Priority Actions	21	Conclusion	42
Today's Active Transportation Priority Actions	23	Appendix I – What is Energy?	43
Today's Auto Efficiency Priority Actions	25	Appendix II – Energy Abbreviations	44
Today's Heavy Duty Freight Transportation	25		

INTRODUCTION

Energy is critical to contemporary society. How we supply energy and how we use it has a major impact both on the prosperity of our economy and on the future health of our planet.

Since the industrial revolution and the advancement of the coal burning steam engine, the world has relied primarily on fossil fuels – coal, oil and natural gas – to meet its energy needs. Today, recognizing the need to reduce the impacts of climate change and better protect the environment, human health and the well-being of their own economies, more and more countries are committed to reducing their dependence on fossil fuels and developing cleaner energy sources. Manitoba is not a mere follower in this movement, but rather a recognized leader for its efforts to become fossil fuel free.

To build on Manitoba's clean energy successes, an energy strategy must incorporate both a clear plan for the future, while at the same time meeting current needs for electric power, heat and transportation fuels. This strategy charts that path forward for Manitoba, setting out practical, clean energy steps and strengthening our position as a renewable energy powerhouse.

The Strategic Objectives

- Supply sufficient energy for our needs and deliver it reliably and securely.
- Provide affordable energy, particularly for those in low income, remote or vulnerable situations.
- Produce and use that energy cleanly, sustainably and in ways which reduce our greenhouse gas

(GHG) emissions. This means in ways which do not degrade the world, at home or abroad, either today or for future generations.

- Ensure that energy is used efficiently, for environmental and economic reasons.

Looking Forward

Manitoba will capitalize on its renewable energy strengths and through innovation, will tap its homegrown clean energy resources allowing more Manitobans to transition to fossil fuel freedom, beginning today, and in the decades to come. It will do this by encouraging more efficient use of energy and by increasing production of clean, renewable energy sources. It will do so while growing its clean energy economy for the benefit of its own citizens as well as neighboring customers.

- Maximize the economic benefits from: constructing and operating energy generation facilities; manufacturing energy related equipment; low rates and improved efficiency; selling energy and expertise abroad; and reducing the economic leakage from the overall Manitoban economy due to imported fossil fuels.

- Increase local control. The value of energy independence and the need for more made-in-Manitoba energy has been made clear by recent decades of volatile energy prices.

Manitoba's clean energy strategy is a focused strategy, one which will demonstrate the government's commitment to build on our underlying and historic comparative advantage in low cost, renewable hydro electricity. It will also build on

our newly arrived advantages in ground-source heat pumps, plug-in electric vehicles and other emerging renewable sources. Together, as these energy sources grow, they will offer Manitobans an increasing array of clean, cost effective, non-fossil alternatives for heating our homes, powering industry and fuelling our vehicles. Finally, woven through these power, heating and transportation initiatives is the constant need to increase energy efficiency and reduce the costs of energy waste.

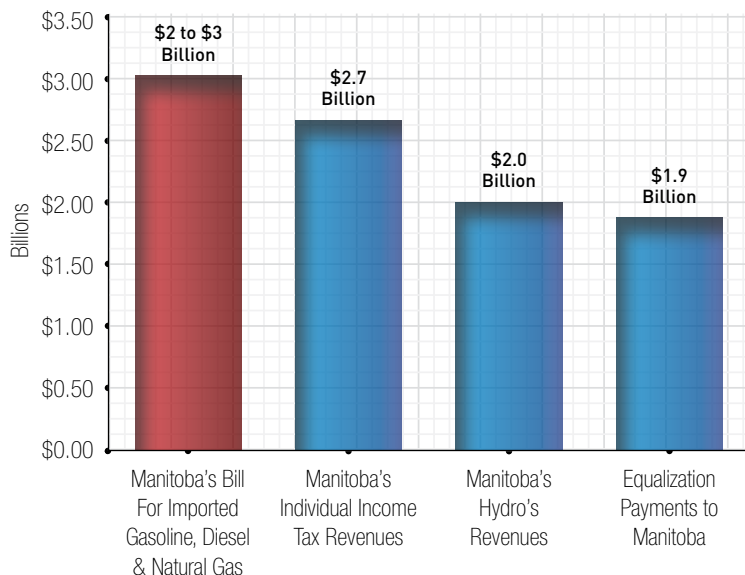
We have the resources. We have the knowledge. We have the infrastructure. And we're already on the move.

Global Challenges

The world's energy supplies have become exceedingly complicated and volatile, with four global forces in particular having significant implications:

1. Oil and natural gas prices have been enormously volatile in the 2000s. For example, natural gas prices fluctuated by as much as 600 per cent in the past decade. The rise of Asia's industrial powerhouses, with their energy needs, make it unlikely that these pressures will lessen in the years to come.
2. Economic leakage from high energy prices has challenged economies globally, with jurisdictions around the world responding by pursuing greater energy independence.

The Annual High Cost of Manitoba's Gasoline, Diesel & Natural Gas Imports



Manitoba has significant oil production in the southwest portion of the province. This oil is not refined in Manitoba but is exported as a commodity for processing. Although this oil is not directly used in Manitoba as an energy source, the industry is a significant contributor to the provincial economy. The industry pays over \$100 million annually to private oil and gas rights owners and has seen investment in the province rise to \$1 billion annually.

3. Energy security has frayed as grid black-outs, oil blow-outs, wars, hurricanes and tsunamis have threatened energy supplies and repeatedly triggered price spikes.
4. Climate change has been accelerated by the GHG emissions from continued fossil fuel use.

Many jurisdictions throughout the world struggle with these forces. While Manitoba has been somewhat insulated because of our strength in renewable hydroelectricity, we all still feel the effects of these forces when it comes time to heat our homes and refuel our vehicles.

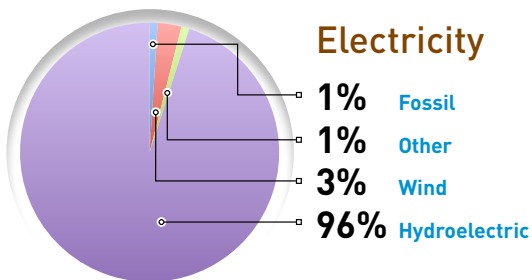
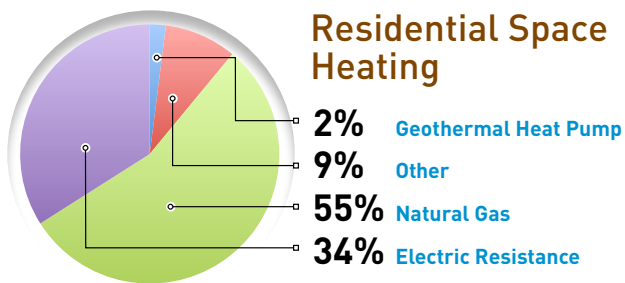
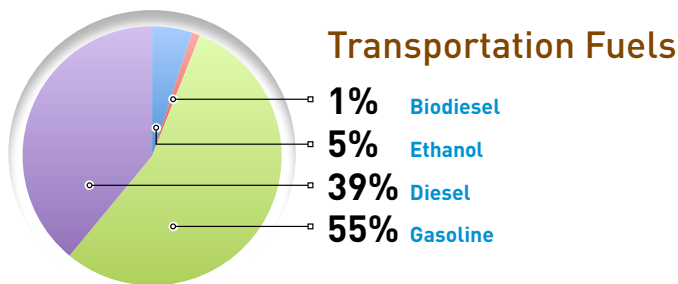
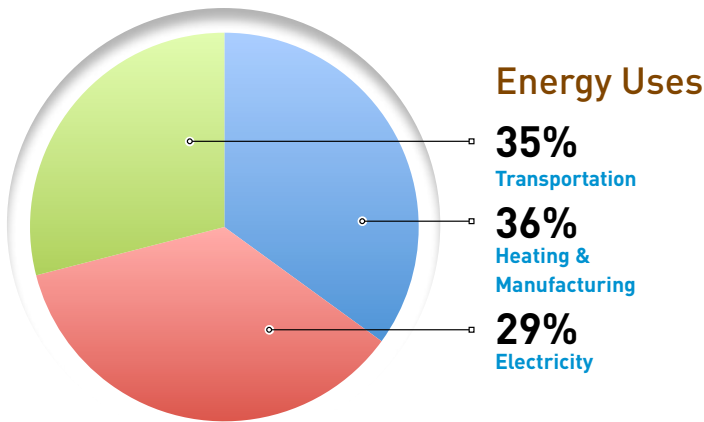
Fortunately, at precisely the same time as these global energy forces have arisen, a series of global clean energy tools and innovations have begun to emerge into the mainstream. For example:

- › In electricity, the past decade saw more wind-power capacity added in the US and in Europe than new coal, nuclear and hydro combined.
- › In transportation, four million hybrid, plug-in hybrid and electric vehicles hit global roads.
- › In heating, more than three million heat pumps have been installed globally since 2005.



Energy in Manitoba

The following charts provide a snapshot of how we use energy in Manitoba.



Notes: i) "Other" in residential space heating represents a mix of renewable wood/biomass, as well as heating oil and propane. ii) The top chart on Energy Uses reflects overall energy use within Manitoba, as outlined by data from Statistics Canada. iii) The lower charts provide energy source breakdowns for selected application uses only.

Because of extreme climate conditions, a relatively large land area, growing population and significant resource based industries, energy is critical to our way of life. Like other jurisdictions, fossil fuel use is woven into that way of life and will continue to be for decades to come. This is because vehicles, heating systems and buildings have lifespans lasting decades, which makes a too rapid change-out uneconomic. However, this timespan also provides Manitobans with the opportunity to customize the shape and timing of their own personal shifts, allowing them to choose clean energy and fossil fuel free technologies when and as they feel the time is right.

Although fossil fuels will be with us for decades to come and we will continue to maintain access to those fuels, Manitoba is in the enviable position of reducing our dependence on them and becoming a renewable energy powerhouse.

- Manitoba has already taken bold steps to ensure our electricity production is more than 98 per cent renewable using hydro and wind resources.
- Manitoba is a Canadian leader in terms of renewable heat (and cooling) with 11,000 geothermal installations.
- Manitoba took early steps with biofuels in terms of production and use to reduce reliance on imported gasoline and diesel.
- Manitoba consistently rates number 1 in Canada in energy efficiency programs and policies.
- Manitoba is breaking new ground in the electrification of transportation, from hybrid taxis to the first plug-in hybrid conversions through to advanced electric bus designs.
- Manitoba is home to well positioned manufacturing and energy service sectors as well as academic institutions that will help produce the innovative technologies and services needed going forward.

Manitoba will not rest on its past accomplishments, but will focus on five strategic areas that will strengthen our position as a renewable energy powerhouse and move us down the pathway towards fossil fuel-freedom. With so much at stake with our energy future, it is important to understand the case for moving forward.

THE CASE FOR MOVING FORWARD AND TODAY'S PRIORITY ACTIONS

1 BUILDING NEW HYDRO

When Manitoba made the long term, strategic decision to develop its own northern hydroelectric assets – rather than going for the quick fix of expanding the use of low cost, but imported and polluting coal – it faced potentially higher costs, as well as a series of risks that seemed, at the time, insurmountable.

Manitoba Hydro Meets and Overcomes the Challenges

Through innovation and determination, Manitoba Hydro met the challenges and constructed a series of new, northern hydroelectric sites, in the face of some of the world's harshest climates. They opted to develop new technology employing the long, high-voltage, DC transmission lines that reliably deliver Manitoba's power over enormous distances. They produced dependable power from highly variable hydraulic flows. And they managed and financed multi-billion dollar, decade-long megaprojects.

Benefits for Manitobans

The benefits we enjoy today were built on these decades of hard work and innovation. But, at their source, was the long term, strategic decision to build on Manitoba's own renewable resources, rather than consume imported fossil fuels. The benefits of that decision have been many and have risen steadily over the years.

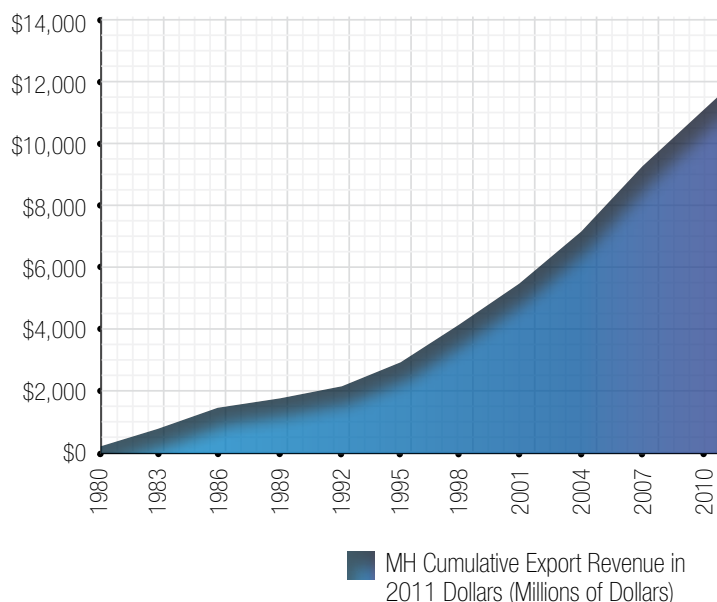
- Manitoba Hydro's rates have been among the lowest on the continent, saving Manitoba families and businesses \$13 billion on their bills since 1998, compared to the average Canadian's rates.
- Through its operations, Manitoba Hydro annually creates 16,580 person-years of employment and adds \$1.4 billion to Manitoba's GDP.
- More than 98 per cent of Manitoba's electricity is renewable, GHGs have been slashed at home; and electricity exports cut 178 million extra tonnes of GHGs from our neighbours' emissions.



Manitoba Hydro's performance provides strong evidence for the value of a fossil fuel free strategy. Using made-in-Manitoba, renewable energy, the province minimizes the need for fossil fuels to generate electricity, while creating huge economic and environmental benefits.

Manitoba Hydro's exports don't just benefit others. Since 1980, export revenues have risen to more than \$11 billion, funds which have helped pay down the costs of the hydro projects themselves and kept rates low for Manitobans. For comparison, this amount is many times the \$1.43 billion cost of the Limestone Generating Station, the last large hydro development prior to the Waskwatim dam.

MH Cumulative Export Revenues 1980 to 2011



Why Build New Hydro?

More electric generation is needed to meet Manitoba's rising demand. Even with the addition of the Wuskwatim dam, wind projects and energy efficiency measures, electricity load growth in Manitoba has outpaced the growth of new supply since the Limestone Generating Station came on stream in 1990.

This situation places increasing pressure on Manitoba's hard won energy independence in electricity. It makes us more dependent on fossil fuel imports during droughts and reduces export surpluses even in higher water years.

Manitoba's electricity demand today is growing by approximately 80 MWs per year. This rising demand requires the equivalent of a new Wuskwatim every two and a half years. Given the historic and sustained upsurge in Manitoba's population and housing starts, as well as continued economic growth, the pressure from rising load appears likely to continue. As domestic demand increases, exports are decreased and the revenue derived from exports – that aids in reducing domestic electricity rates – erodes over time.

Many of Manitoba's export customers have also experienced growth in electrical demand, but they too no longer view coal fired generation as a desirable alternative, whereas hydroelectricity from Manitoba is seen to be clean, renewable and stably priced. However, for export customers to be able to buy new hydro in the future, they often require lead times of many years to build the necessary new transmission.

Manitoba needs new generation to supply rising domestic load, while export customers wish to buy new hydro from Manitoba. By advancing the construction of new hydro plants ahead of domestic needs, Manitoba can both earn additional export revenues and expand valuable interconnection transmission, while also building the plants it will need to meet its own future requirements.

Windows of Opportunity

There are limited windows of opportunity within which Manitoba can sign new, long term export contracts, and receive vital new transmission links. If these windows are missed, customers will lock in with other suppliers, new transmission along with its market expansion and domestic reliability benefits will not be built and the window will close and be lost.

The past few years have offered just such a window, with the decision now before Manitoba.

Why Not Fossil Fuels, Like Coal or Natural Gas, Instead?

Decades ago, the largest fuel source used to generate electricity in North America and the world was coal. It was thought North America possessed endless coal reserves at unbeatable low prices. Manitoba Hydro, at the time, took a minority stand in the region with its decision not to use coal to generate most of its electricity. Over the decades, Manitoba's choice of hydroelectricity has proven itself to be the better one – for the environment, the global climate and the economy.

Manitoba Hydro's electricity is made from more than 98 per cent clean, renewable sources.

Today, the use of coal for electricity generation is being replaced by a new fossil fuel source—shale gas. Although coal plants still generate 44 per cent of the electricity in the United States, power generated by natural gas has doubled to 21 per cent. It is now the dominant source of new electricity in the United States and is rising quickly as old coal burning plants are shut down.

As once was said about coal, natural gas is said today to be available in the same near-endless quantities, and at the same unbeatable low prices. Natural gas has even been positioned as a cleaner fossil fuel than coal.

Manitoba's hydroelectric advantages over natural gas - jobs, stability and sustainability

When considering options, Manitoba's hydroelectricity has clear cut advantages over natural gas:

- Construction of new hydro power will create more jobs and more new business activity for Manitoba than natural gas fired imports or local plants.
- New hydro will emit far fewer GHGs than natural gas over its lifetime.
- While a natural gas plant has a life of 25 to 30 years, a key advantage of hydroelectric plants is that, once built, they will generate power for 100 years. For example, a new project like Keeyask, would likely still be generating power in the year 2100.
- Locally generated hydro will provide greater energy security for Manitoba than imported natural gas.

On the other hand: At 2012's natural gas prices of \$2 to \$3 per gigajoule (GJ), it can be used to produce electric power more cheaply than Manitoba's new hydro plants. But the price of natural gas is extremely volatile – the most volatile of any electricity source, cycling through a range of 600 per cent just over the past decade.

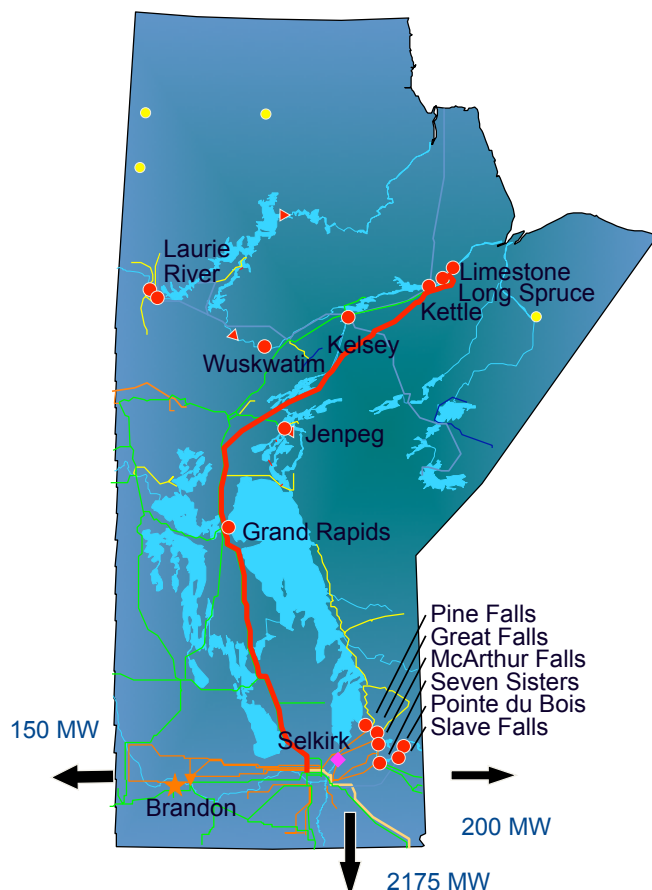
While prices are currently low, natural gas suppliers can't guarantee today's prices for the next 10 years, much less for the next 20 or 30 years or beyond – the years when Manitoba wishes to add new power. The difficulties this poses for long term energy planning in Manitoba can be seen clearly in the forecasts of the major energy planning bodies in North America. These bodies forecast natural gas prices ranging from \$5 to \$11 per GJ in the coming decades. With today's prices at \$2 to \$3 GJ, and Manitoba potentially looking at billions of dollars in investments, this uncertainty leaves Manitoba facing the risk of price swings of hundreds of percentage points if it chooses natural gas supplied projects.

Additional uncertainties surrounding natural gas and in particular shale gas include:

- the level of increased demand flowing from natural gas-powered electricity generation, expanded industrial end uses, transportation and Liquefied Natural Gas (LNG) exports

- the accuracy of estimates of shale gas reserves, production and depletion rates
- the long term sustainability of today's exploration and development business model, in the face of extremely low natural gas prices
- GHG emissions from shale gas exploration and production

With Manitoba's next two major hydro projects potentially coming online from 2019 to 2025, and then earning their major revenues in the decades to follow, natural gas prices in 2012 are of less relevance than the prices in 2032 or 2042. In the long term, Manitoba expects that hydroelectricity will continue to be the better option. Hydro's wide and long-lasting range of benefits – lower GHGs, more jobs and business in Manitoba, more stable prices and greater energy security – will still make hydroelectricity the superior choice.



Generating Stations and Interconnections

2011/12 - Energy

- 80% Nelson River
- 9% Winnipeg River
- 7% Saskatchewan River
- 3% Wind
- 1% Thermal & Imports

- HVDC
- Other Transmission
- ◆ Selkirk - Natural Gas
- ▼ Brandon - Coal
- ★ Brandon - Gas Combustion Turbine
- ▲ Control Structures
- Diesel Sites
- Hydraulic G.S.'s

Today's Hydroelectric Priority Actions

Clean Energy Portfolio

Given the high costs of focusing development on a single new project at a time, Manitoba has made the decision to move a portfolio of diverse, new hydro projects through to the readiness stages. As a result, the province and Manitoba Hydro are taking several projects forward through planning and design, consultation and negotiation with Aboriginal communities, environmental approvals, licensing and permitting.

This means that as and when Manitoba's load or forecast load passes certain thresholds, and as sufficient, firm export contracts are signed, and the economic case moves in favour of approving new supply, Manitoba will be equipped with at least one, and potentially more, projects ready for development. In the same way, if domestic load declines or proposed export contracts are altered or capital costs escalate, Manitoba has the tools to flexibly adapt.

Adopting a Clean Energy Portfolio has also enabled Manitoba to add wind power and other emerging, renewable energies – as well as energy efficiency, improved transmission and the

rehabilitation of older hydro projects – to its potential new supply-side projects.

Finally, use of a portfolio approach allows Manitoba to develop its hydro construction in a staged manner that promotes stability of training and employment opportunities for northern and Aboriginal communities. This allows the province to maximize the overall economic and social benefits.

New Generation Hydro

Each new hydro project has been redesigned to better meet the needs in Manitoba's northern communities and also in a way that ensures projects meet and exceed customer expectations not just today, but over the next 40 or more years. Recent years have made clear that changing customer expectations and political debate elsewhere can dramatically impact Manitoba's long term access to export markets. A new hydro project intending to sell into export markets over a period of decades could lose hundreds of millions of dollars – not by failing to meet the legal standards in place when the contract was signed, but by failing to consider long term future issues and trends.

Manitoba export earnings have surpassed \$11 billion, keeping rates low and supporting the cost of hydro projects.

With this long term view in mind, Manitoba's New Generation Hydro projects embody two major shifts from historic practices:

1. Aboriginal communities are engaged from the earliest stages of planning, as participants during construction, as well as standing to become long term, financial beneficiaries. Aboriginal people are also consulted through the province's Crown consultation process on any action or decision that might affect an Aboriginal or treaty right.



2. The Manitoba government is responsible for environmental and water licensing processes that outline the responsibilities of Manitoba Hydro to be good stewards of the environment. With that in mind, each project has been redesigned to dramatically reduce its environmental impact. Wuskwatim, for example, experienced just 50 hectares (or half a square kilometre) of additional flooding – a fraction of the size of an average Manitoban farm, while Conawapa will flood an area about the same size as an average farm (500 hectares). Many modern shopping malls, residential developments and energy plants take as much or more land than is lost through a New Generation Hydro project.

The New Generation Hydro components of the Clean Energy Portfolio that are under development or potentially available for development include:

- Wuskwatim – a 200 MW project that saw construction launched in 2008 and began generating power in 2012.
- Keeyask – a 695 MW project awaiting final licensing. Construction could run from 2014 to 2021, with first power potentially flowing in 2019.
- Conawapa – a 1,485 MW project, if approved, would see full project construction run from 2018 to 2026, with first power potentially flowing in 2025.

This expansion, of as much as 2,300 MWs, would be large enough to replace the demand growth of recent decades and to meet the expected domestic demand beyond 2020. It would also provide Manitoba with a surplus large enough to support large long term firm contract sales and to gain other revenues from the opportunity export markets.

The potential economic benefits of the total expansion are as impressive, as in previous generations of hydro development.

- The province is looking at \$20 billion in new economic activity over the next decade, with Keeyask and Bipole III alone expected to create 18,000 person years of direct and indirect employment.
- New export contracts worth over \$4 billion are already on offer, with the potential to be added to, if desired. The proceeds will help pay down the cost of the projects, while helping sustain Manitoba's low rates for decades.
- This path offers a reduction in any long term dependency on coal or natural gas, and will reduce long term payments to fossil fuel producers.
- Manitoba's clean, stably priced, hydro exports would add real value to neighbouring systems – being available on-peak if desired, offering greater price stability and reducing their GHG emissions by millions of tonnes a year.

Transmission - Moving Power to Market

Manitoba Hydro's transmission network is large with 11,700 kilometres of transmission lines and 75,000 kilometres of distribution lines. The transmission facilities are developed and operated as an integrated system, with the backbone being two 800-kilometre, high voltage, direct current (HVdc) transmission lines (Bipole I and II). The lines were historically located in a common corridor and transmit over 70 per cent of Manitoba Hydro's annual energy production from its northern hydro stations on the Nelson to southern load centres. The direct current is converted back to alternating current at Dorsey station, northwest of Winnipeg, before being transmitted to the transmission and distribution system, as well as to Ontario, Saskatchewan and the US.

Most of the transmission and distribution facilities are exposed to the elements and can be affected by severe winds, lightning, ice storms and forest fires. The system is planned and built to achieve a high degree of reliability and maintain the delivery of power to its customers.

Manitoba's electric system is dependent on its two backbone HVdc facilities. Should these two facilities suffer a simultaneous catastrophic loss, it could result in extensive, wide spread, lengthy power outages. The number of customers affected, and the duration of their interruption of electrical service, would mainly depend on outside temperatures, with the most severe and extensive power outages occurring during the coldest winter months. Should such a loss occur at the winter peak, Manitoba Hydro has estimated that it could result in a supply interruption of up to 300,000 customers until repairs are completed. As a result, a third HVdc transmission facility, Bipole III, has been proposed to be constructed to assure the reliability of delivery of power to Manitobans.

More widely, new interconnection capacity to electricity markets increases both the reliability of Manitoba's own system, as well as Manitoba's reach into export markets. Should new generation to service additional sales in Minnesota and Wisconsin be approved, new interconnection transmission would be also be required.

Today's Transmission Priority Actions

Manitoba Hydro's transmission work includes developing Bipole III for reliability purposes (expected to be commissioned in 2017), as well as new export transmission interconnections, of different sizes and configurations, to the United States (to be available by 2019.) In addition, strengthening the Dorsey Converter Station will increase reliability, and developing a new Riel Converter Station will provide a second delivery point for northern power.

Manitoba has also forged a national leadership position by advancing the idea of a stronger east-west Canadian grid. The timing and size of Manitoba's enhanced, east-west grid interconnections with Saskatchewan and other provinces will ultimately be determined by the results of ongoing power sale talks. Manitoba will continue to advocate for an improved national electrical grid that can transport clean, renewable energy to every region in Canada.

Taken together, these transmission projects will:

- dramatically improve the long term reliability of Manitoba's system in the face of climatic instability and extreme weather
- enhance the development of new northern hydro as well as southern wind development
- reduce the potential cost of imports by achieving greater market access
- boost both the range and the scale of Manitoba's exports
- strengthen Canada's east-west ties

Reducing Coal Fired Power

In recent years, Manitoba closed most of its old, polluting coal fired capacity. Some units were converted to burn natural gas, while two new natural gas generators were installed. In order to reduce GHGs, *The Climate Change and Emissions Reductions Act* stipulated that by 2010, coal fired generation was capped under normal conditions and could only be used in emergency situations. Today, of Manitoba Hydro's 5,500 MWs of capacity, there are 364 MWs of natural gas fired capacity in Selkirk and Brandon, and just 97 MWs of emergency, coal fired backup in Brandon.

Natural Gas to Complement Clean Energies

Manitoba's natural gas based generation is used for a range of purposes: generate power during emergencies and droughts; help during transmission outages; and respond to short term variations in the output of our renewable generation. Used in these complementary ways, natural gas not only helps the system run more smoothly, but can actually increase Manitoba's installed capacity of new hydro and wind energy. By integrating, backing up and stabilizing new hydro or wind, natural gas generation can ultimately allow more renewable energy to be produced here.

Store It Away for Another Day

Manitoba has historically used imported power during droughts. Manitoba Hydro also buys off-peak, imported power at a low cost, stores it, then resells the power back to our trading partners at lower rates than they could make it for themselves – and earns a profit performing the service. This exchange is built on another Manitoba advantage – the large storage capability of our system's reservoirs – an asset which new hydro and new wind also need as they are further developed. The province has also, traditionally, shared these storage and support services with neighbouring utilities, helping the regional grid to run smoothly and supporting wind development in the US. At the same time, Manitoba's first priority moving forward is to use these assets to ensure the development of made-in-Manitoba new hydro and new wind, thus maximizing economic benefits for Manitoba and strengthening its energy security.

Today's Gas, Coal and Import Priority Actions

Coal

The remaining coal fired electricity generator in Brandon will continue to be used only in emergency situations and droughts. The generator will need to be "exercised" on a very limited basis to ensure it is operational when needed in emergencies. Manitoba will also comply with the federal government's new regulations that will phase out the use of conventional coal generation across the country.

Natural Gas

Manitoba's existing natural gas generating capacity continues to play a number of complementary roles in the system and will be maintained. Similarly, new natural gas plants will only be added to respond to short-term variations in renewable output, thus allowing Manitoba to integrate more new hydro and wind – or to augment the complementary roles described. Decisions on whether to add natural gas will also depend on consumer demand, renewable supplies and market conditions.

Imports

Imported power can provide value to Manitoba during droughts and through sales related to peak shifting and similar variations. However, given the limits of Manitoba's system to integrate, store, firm and shape energy, these capabilities will be used in ways which do not inhibit the development of Manitoba's own high priority hydro, wind and other renewable resources.

Off-Grid Diesel Communities

The northern communities of Brochet, Lac Brochet, Shamattawa and Tadoule Lake are currently not connected to the Manitoba Hydro transmission grid. They are supplied by stand alone, diesel generating facilities. For too long, these communities have struggled with high operating costs and the environmental concerns associated with the diesel generation.

All Manitoba communities deserve access to clean, renewable power – especially those in northern Manitoba, the heart of the province’s renewable generation. As with many off-grid communities across Canada, the cost of grid connection is very high. However, depending on the local situation and advantages, the addition of small scale renewable energy could potentially help reduce their reliance on diesel generation.

Today’s Off-Grid Community Priority Actions

Working closely with the off-grid communities, and the Canadian government and other partners, Manitoba Hydro will reduce dependency on diesel fuel by implementing renewable alternatives to diesel generation and improving energy efficiency. Manitoba will also show national leadership on this complex issue, working with our counterparts in other territories and provinces that have off-grid communities to share best practices and seek solutions.

Energy for Jobs

With the major expansion of hydro generation and transmission over the next decade, new economic opportunities will unfold for Manitoba companies and those looking to invest here. Capital expenditures, estimated at \$20 billion by Manitoba Hydro, represent a significant opportunity to increase local job creation – in the construction of new generation and transmission capacity, but also in the supply of equipment, components and construction materials for these projects.

Today’s Energy for Jobs - Priority Actions

In April 2012, Manitoba established a \$30 million Renewable Energy Jobs Fund to help maximize industrial benefits (including local content and industrial offsets) from these major projects. The fund will provide loans to eligible manufacturers of equipment, components or construction materials used in the generation, or transmission, of renewable energy. This includes hydro, geothermal, wind, next generation biofuels, biomass heating, solar and smart grid technologies.

An Energy Opportunities Office will also be created to work with companies looking to expand, or locate for the first time, in Manitoba. This office will serve as a one-stop business support centre for companies wishing to tap these opportunities, and seek out partnerships with other companies in the renewable energy supply chain. In addition, the Manitoba government and Manitoba Hydro will work together to ensure that northern hydro developments result in good jobs for Aboriginal communities.

Premier Greg Selinger announces the Energy Jobs Fund at Winnipeg-based Crompton Greaves (CG) Power Systems, one of the top electric transformer manufacturers in the world.



2 LEADING CANADA IN ENERGY EFFICIENCY

Manitoba Leads Canada in Energy-Efficiency

As energy prices began to rise in the early 2000s, the Manitoba government and Manitoba Hydro fast-tracked an expansion of the Power Smart program. They launched new programs to cover all sectors, regions, income groups and fuels. By the end of the decade, 350,000 families, businesses, schools, churches and farms had participated in the newly expanded Power Smart programs. One example is Manitoba Hydro's Power Smart Loan, which provided \$267 million in financing to over 65,000 Manitoban customers.

The government launched its new Green Building Policy in 2007. The policy requires that provincially funded new buildings and major renovation projects meet energy and environmental requirements including: a minimum level of energy efficiency that is 33 per cent better than the Model National Energy Code for Buildings (MNECB.) To date, approximately 297,000 square meters (3.2 million square feet) of new construction in Manitoba incorporates green building standards and practices affecting almost 40 per cent of the industrial/ commercial/ institutional construction sector.

Building codes have also been improved on an ongoing basis, provincial energy efficiency standards for gas furnaces have been raised and incentives by the province and Manitoba Hydro helped many thousands of Manitoba families retrofit their homes.

Manitoba's Power Smart Program saved Manitoba families, firms, facilities and farms more than \$600 million on their utility bills since it was launched.



Manitoba Seizes # 1 Ranking in Canada

In two short years, Manitoba's energy efficiency programs shot up in the Canadian Energy Efficiency Alliance (CEEA) rankings, from 9th place in 2002 to 1st place in 2004 – a ranking Manitoba has successfully maintained for nearly a decade. In environmental terms, these energy efficiency improvements brought a reduction of 1,350,000 tonnes of GHGs in Manitoba and its export customers, annually. This is equal to taking 250,000 cars off the road.

\$600 Million in Bill Savings for Manitobans

Perhaps even more importantly, Manitoba's homes and businesses have achieved direct, energy bill savings which surpassed the \$600 million mark in 2011. This amount continues to rise and, in another testament to Manitoba's long term thinking on energy, is expected to exceed \$2 billion by the next decade.

Manitoba Hydro's forecast energy and power savings achieved through energy efficiency are included in its planning as a resource option

alongside hydro, wind and other resource options. Today, the energy saved by the Power Smart efficiency power plant is more than 575 MWs – equal to that of all the hydro projects on the Winnipeg River.

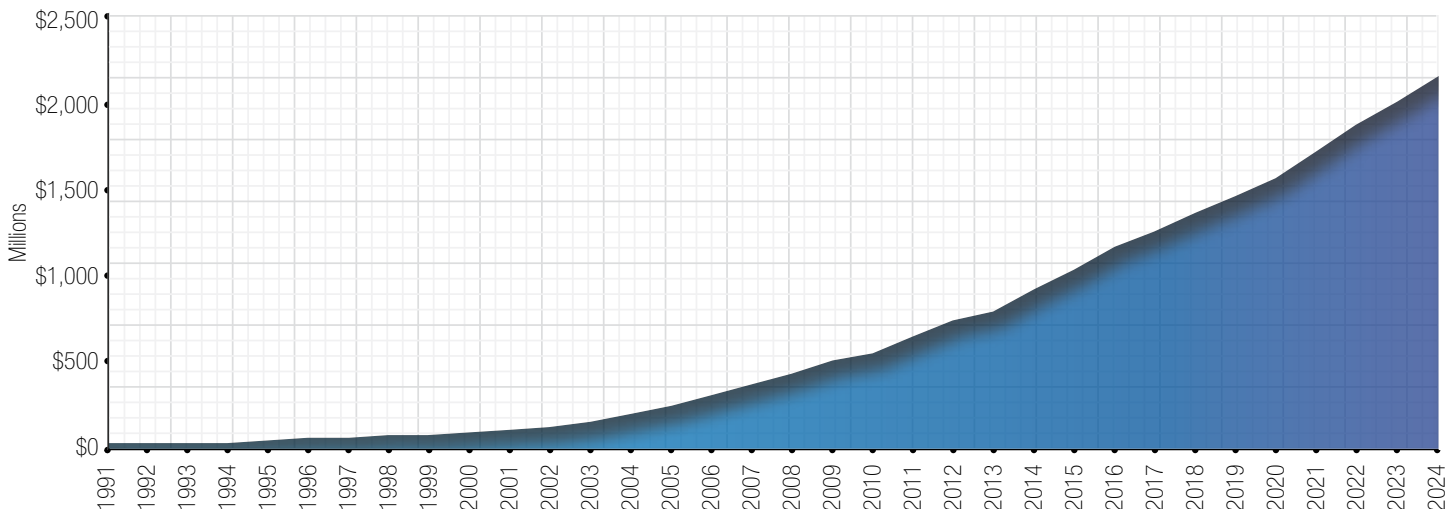
These efficiency savings have cost Manitoba Hydro, on average, just 1.9 ¢/kWh (kilowatt hour), well below the cost of other methods. This saved energy is then resold on the export market by Manitoba Hydro, earning profits and helping keep domestic rates down.

Incentives and Standards Have Cut Manitoba's Natural Gas Use

Manitoba's energy efficiency achievements are also seen in our natural gas sector through the use of incentives for high efficiency gas furnaces and insulation, higher product standards for furnaces and incentives for heat pumps. This effort more than offset any new demand from Manitoba's population increase, so that natural gas use has fallen by 17 per cent in our homes and nine per cent in the commercial sector. As a result, GHGs from residential and commercial natural gas use have fallen by 700,000 tonnes this past decade.

Manitoba ranked number one in Canada for energy efficiency.

Manitoba's Cumulative Bill Savings From Power Smart Programming



Low Income Communities – More Than Meeting the Challenge

Energy efficiency is a major opportunity in low income areas, where homes are often poorly insulated, and energy and water bills take a high share of family income. Social enterprises such as Building Urban Industries for Local Development (BUILD), and the Brandon Energy Efficiency Project (BEEP) in partnership with the Manitoba government and Manitoba Hydro, developed a successful business model that combines social, economic and environmental objectives.

These enterprises sought not only to address energy waste and unnecessary high bills, but also to employ local people with barriers to employment. Once trained, these employees have conducted the energy and water retrofits in their own neighbourhoods. The benefits have been huge – lowering utility bills for thousands of low income families and providing training and jobs for more than 150 Aboriginal youth and others marginalized from the mainstream labour market.

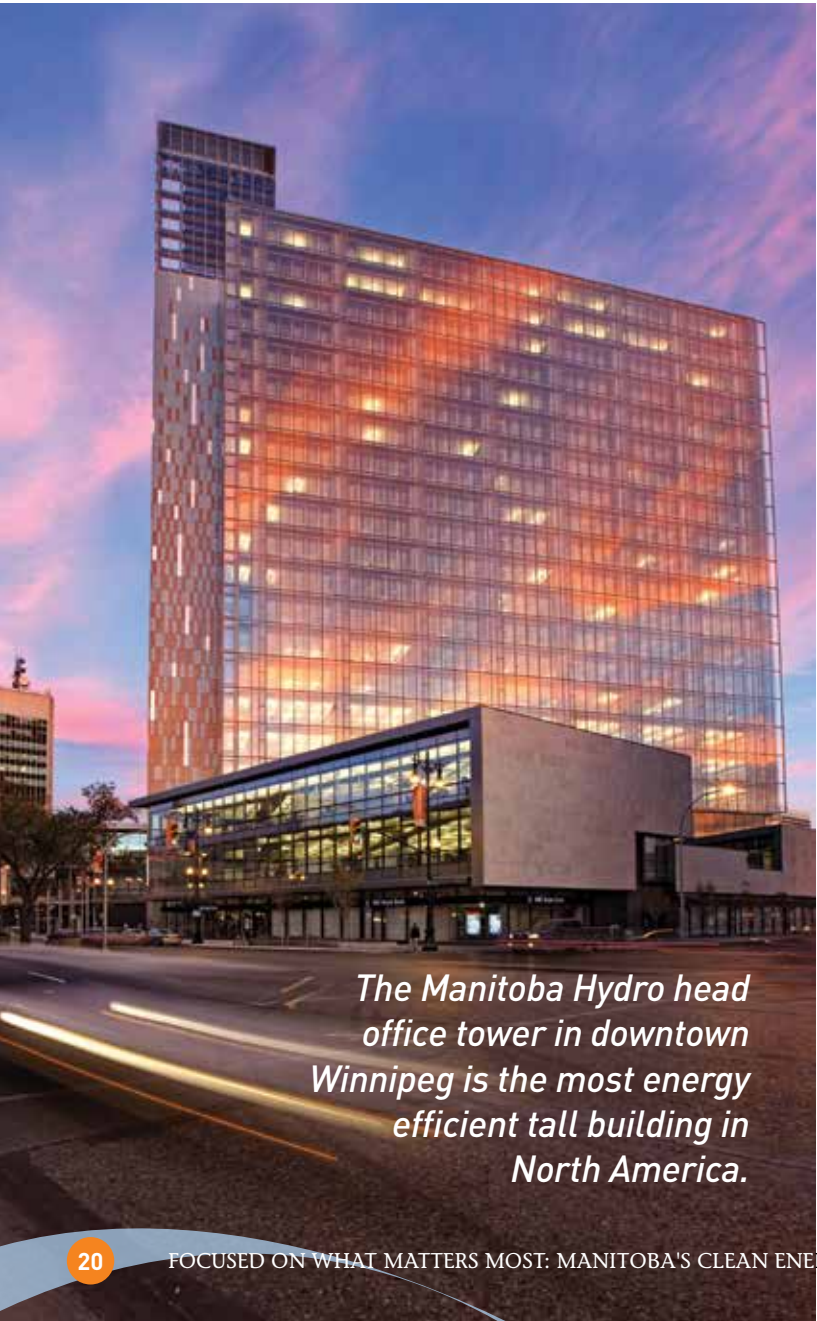
BUILD's Made-in-Manitoba Model Wins Scotiabank Award for Business Leadership

In 2011, BUILD's made-In-Manitoba model of community development was recognized by Scotiabank and awarded the national EcoLiving Award in Business Leadership. The Manitoba government and Manitoba Hydro backed BUILD and BEEP, and are aiming to raise the bar further by working with the Manitoba Housing Authority on 400 single-family units – each of which is expected to see utility bills cut by \$450 a year.

Manitoba Hydro's New Head Office - An Energy Efficient and Architectural Showpiece

Perhaps the high point of the recent decade's efficiency efforts has been Manitoba Hydro's new, 22-storey, head office in downtown Winnipeg. After setting world leading performance targets, Manitoba Hydro challenged Manitoba's architectural, design, engineering and construction sectors to meet them. The result is an edifice that not only has a stunning appearance, but one that uses 70 per cent less energy than a conventional building.

Most of its remaining energy needs are met by heat pumps which draw heat and cooling from 280 bore holes – each drilled 122 metres beneath the site – as well as its many solar features. The new facility has been named North America's most energy efficient tall building. It is also the first large office tower in Canada to receive the LEED® Platinum certification from the Canada Green Building Council.



The Manitoba Hydro head office tower in downtown Winnipeg is the most energy efficient tall building in North America.

Today's Energy Efficiency Priority Actions

The Energy Savings Act

Even with significant achievements in energy efficiency, Manitobans are still using large amounts of energy, as a result of our climate, distances and building age. This means efficiency opportunities remain. As a result, Manitoba passed *The Energy Savings Act* (ESA) to ensure that investment in efficiency continues to expand and Manitobans continue to save more.

• On-Meter Finance

The most powerful new tool the ESA enables Manitoba to use is On-Meter Finance. For decades, the number one barrier to energy efficiency savings has been the difficulty of financing the upfront capital costs. Most homes have energy and water savings opportunities. The problem has been that many of these opportunities are not acted upon because of high, upfront costs. Because of this, households paid higher bills than necessary, local retrofit jobs were lost and more money flowed out of Manitoba to pay for fossil fuels.

The new financial tool developed to overcome this sees energy saving retrofit measures paid for upfront, but by the utility directly. The retrofit cost is then repaid by the residents on their regular utility bill utilizing energy savings to pay for the difference. The ongoing repayments are tied to the meter, not the individuals – thus the name, on-meter financing. This means families can make large and long-lasting efficiency investments, such as in-home insulation or on heat pumps – knowing the investment will be paid off over the measure's lifetime, by whoever is living in the home.

The program includes plans not just for owner occupied, single family dwellings, but also for the low income sector, rental accommodations and public sector buildings.

More than 350,000 Manitoba families, firms, schools, farms and churches have participated in Power Smart programs.

• An Energy Efficiency Plan

The new ESA requires Manitoba Hydro to set energy efficiency targets for the future. The act will ensure that Manitoba Hydro, the province, industry, community partners and the public are on the same page, by publishing an annual Provincial Energy Efficiency Plan. This plan will include details of stronger efficiency targets for electricity and natural gas use and an expanded range of programs; set out costs and benefits; and report on performance.

• The Affordable Energy Fund

The ESA also extended the Affordable Energy Fund, to make sure all Manitobans, regardless of region, income or fuel source, are able to reap their share of energy and water savings.

Green Building Policy

Manitoba's Green Building Policy will be expanded to include provincially funded residential construction and renovation projects, operation and maintenance of provincially funded existing buildings and government leased accommodations and will include expanded program support.



Low Income Energy Efficiency

Manitoba Hydro's On-Meter Financing program and the Affordable Energy Fund will provide significant support to social enterprises in efforts to make deep retrofits in homes and buildings in low income areas. Manitoba Hydro will work closely with these community groups on a street-by-street approach to retrofit neighbourhoods, rather than one home at a time. Similar to the partnership approach Manitoba Hydro has taken with First Nations on new dam developments (but smaller scale), their partnership with social enterprises will help build community capacity, create jobs and maximize economic benefits.

Green Schools and Education for Sustainability

A centerpiece of the government's longer term energy efficiency efforts is its commitment to make every school a green school. While the Green Building Policy has led the way in building energy savings into new school construction and major renovations, efforts will also be supported to make school grounds green and access energy saving opportunities in school transportation (ex: walk to school, idle-free zones, biodiesel buses). Daily operations of schools are expected to become more energy and water efficient as sustainability school plans, including energy efficiency measures, will be encouraged to be in every school in Manitoba by 2015.

Building Codes

Building codes ensure that homes and businesses achieve the lowest costs for energy over their lifetimes. Subject to completion of consultations and upon final review and approval, Manitoba will adopt the 2011 National Energy Code for Buildings (NECB) to make new construction and major renovations in the commercial and institutional sector more energy efficient. Following this work, Manitoba will review and consider potential adoption of interim amendments to the 2010 National Building Code of Canada (NBC) related to energy and water efficiency in new homes and small buildings.

Net Zero Energy Homes

A growing number of new homes built worldwide are designed to use (or approach) net zero energy. This means they aim to generate as much energy onsite as they draw from the grid. Manitoba supports this direction, but needs to take into consideration our severe climate. The province will promote the design, building and monitoring of net zero energy and near net zero energy homes by Manitobans – for use in Manitoba conditions.

Provincial Buildings Audits

The province owns, controls or funds many public housing units, schools and public buildings, which hold significant opportunities for energy and water savings and renewable heat expansions. Energy and water audits will be encouraged in these buildings to help identify measures to increase energy savings and the use of renewable heating and cooling options such as geothermal.

Disclosure of Energy Performance

Manitoba supports the expansion of voluntary programs to benchmark, rate and label building energy performance. Manitoba will explore and test pilot programs that disclose the energy performance of buildings offered for sale or lease.

Minimum Standards for Energy-using products

Manitoba will pursue minimum energy efficiency standards for high energy consuming products where federal standards are deemed to be insufficient or unlikely.

Active Transportation

The consequences of an ever expanding dependence on car use, and ever increasing vehicle miles travelled, are also seen to be unsustainable over the long term. User friendly alternatives must increasingly be put in place to help support a shift toward reduced travel demand.

Active transportation methods (ex: walking, cycling) can make a real contribution here, while also generating a range of wider benefits. They can improve our quality of life, lower the costs of traffic congestion, enhance our environment and strengthen our economy. They also support Manitoba's energy goals by reducing our reliance on fossil fuels, lowering GHG emissions and helping the overall transport network work more efficiently.

Getting Active - A Smarter Approach

While active transportation embraces several modes of travel, cycling and walking are the most popular. Creating a strong cycling and walking culture, where existing barriers are addressed, convenience is emphasized and safety is vital, is pivotal to advancing Manitoba's active transportation objectives. Manitoba is already making strides by expanding walking trails and cycling paths, putting in better racks and facilities for cyclists, through walk-to-school programs and the Commuter Challenge.

In addition to cycling and walking, Manitobans are using other methods to reduce their fuel use from transportation. And since commuting by car to work each day is the single largest source of GHGs in Manitoba, these actions are often the single largest GHG reduction action individuals can take. Manitoba supports a range of these initiatives:

- › car pooling, ride sharing and car sharing through matching and information web sites
- › use of Drive Green methods, where drivers learn to reduce sudden accelerations and stops and idling and improve vehicle maintenance
- › increased public transit use that has seen Manitoba accelerate its long term investment in transit
- › development of technology that supports working from home and telecommuting systems



Today's Active Transportation Priority Actions

Manitoba's three-year action plan, intended to improve the policies, programs and infrastructure that support active transportation, includes the following:

- developing and adopting a provincial active transportation policy including design guidelines for active transportation infrastructure
- launching a new online portal with active transportation resources and an inventory of routes
- working to complete the Borders to Beaches section of the Trans-Canada Trail
- commencing a new active transportation overpass at the north Perimeter Highway in Winnipeg to extend the popular northeast Pioneers Greenway
- providing new funding and technical support to help municipalities integrate active transportation planning, design and use with land use and transportation planning
- working with Manitoba Public Insurance to continue raising awareness of safety issues affecting vulnerable road users (ex: cyclists, pedestrians, children, seniors)



Auto Efficiency

Energy efficiency opportunities extend well outside the home – with one of the greatest opportunities being Manitoba’s current fleet of 600,000 to 700,000 light duty vehicles. The fuel consumption of Manitoba’s vehicles is relatively high, around 15 litres per 100 kilometres (16 miles per gallon (mpg) US) – about 20 per cent higher than the Canadian average.

This low vehicle efficiency means our drivers pay more for fuel, increased GHG emissions and the Manitoba economy leaks hundreds of millions of extra dollars each year to pay for unnecessary

gasoline. While a shift to electric vehicles and plug-in hybrid electric vehicles could potentially change this situation over the longer term, Manitobans’ purchase of 40,000 to 50,000 new vehicles each year offers perhaps the fastest way to improve overall fleet efficiency, reduce fuel imports and cut our gasoline bills.

Manitoba Helps Drive North America to Higher Standards

Manitoba decided to help move auto efficiency in the mid-2000s, as consumers were hit by rising prices and oil consuming economies lost billions of dollars to oil producing regions. There had long been debate around increasing auto efficiency standards, but rising oil prices gave more weight to the effort. Since auto manufacturing is integrated continentally, and vehicle standards tend to move hand-in-hand in Canada and the US, Manitoba moved to support a cross-border alliance of states and provinces working toward higher standards.

This alliance won a major victory in 2009, when the US agreed to raise its auto efficiency targets from 25 mpg today to 35.5 mpg by 2016. The arrival and rapid progress of hybrids, EVs and PHEVs has since spurred a further increase, all the way to 54.5 mpg by 2025. The US Government expects that this change will save the average car buyer \$8,000 each, and – as Canada shifts its own vehicle standards – will likely save Manitoban drivers a similar amount as they purchase the more efficient models available in years to come.

This doubling of fleet efficiency targets would not have been possible without the growth of hybrids and electric vehicle technologies. Manitoba played a key role, by identifying these technologies as game-changers early on, and launching Canada’s first \$2,000 consumer-incentive targeting hybrids. The province’s taxi companies then put a large number of hybrids to the ultimate test – in Manitoba weather. The Manitoba government also purchased and tested many different models in its own fleet.

In 2010, Canada introduced the Passenger Automobile and Light Truck Greenhouse Gas Emission Regulations, modeled after the US's Corporate Average Fuel Economy standard. The same kind of progressively improved emissions standards will be applied to Canada's cars and light trucks between 2011 and 2016, with efforts to bring in higher standards for 2017. Further efforts regarding heavy duty vehicles are also underway within Canada.

Over time, these higher auto efficiency standards should reduce the amount of fuel used by new cars in Manitoba annually. However, with the province's recent shift to a higher rate of population growth, the number of cars may also rise quickly. As a result, Manitoba is pushing not only for higher auto efficiency standards, but also for a step change away from gasoline and toward electric vehicles over the medium and longer term.

Today's Auto Efficiency Priority Actions

Just as Manitoba helped support the effort for higher vehicle efficiency standards in the past, it will do so in the future. Higher auto efficiency standards will save Manitoba drivers thousands of dollars in the coming years, while reducing GHGs and increasing our energy security. The province will also work to help those Manitobans who wish to take bolder steps toward using more clean energy and moving off fossil fuels, through the rollout of its Fossil Fuel Freedom initiative.

Green Fleet Purchasing

Manitoba will lead by example by implementing a Green Fleet fuel efficiency standard regulation under *The Climate Change and Emission Reduction Act*. The regulation will apply to new vehicles purchased for use by the Manitoba government. Departments will be guided by a Green Fleet procurement manual that will help them achieve efficiency objectives.

Heavy-Duty Freight Transportation

The freight transportation sector, particularly heavy trucking, is a key contributor to Manitoba's economy. This sector depends on energy to transport people and goods to, from and through Manitoba. The sector operates in a tightly meshed North American operational and regulatory context, and has had to rely primarily on conventional diesel as fuel. Although fossil fuels will be a dominant source of the energy needed for heavy, freight transportation into the foreseeable future, fuel efficiency will be critical in reducing GHG emissions and keeping costs down.

Today's Heavy-Duty Freight Transportation Priority Actions

Manitoba will continue to pursue freight fuel efficiency measures which help reduce fossil fuel use and its associated emissions. Manitoba will also evaluate the potential benefits of alternative fuel options to diesel, while ensuring that any alternatives meet the necessary vehicle performance, economic, environmental, jurisdictional as well as infrastructure requirements.



3 KEEPING RATES LOW

Historically, the cost of electricity in Manitoba has been either the lowest, or among the lowest, in Canada. Manitoba is committed to maintaining this low utility rate advantage.

When Manitoba's Bill 18, *The Affordable Utility Rate Accountability Act*, becomes law, it will include a requirement that Manitoba work to maintain the lowest cost, in Canada, for a bundle of utility services – that is, the combined rates for electricity for home use, natural gas for home heating and automobile insurance.

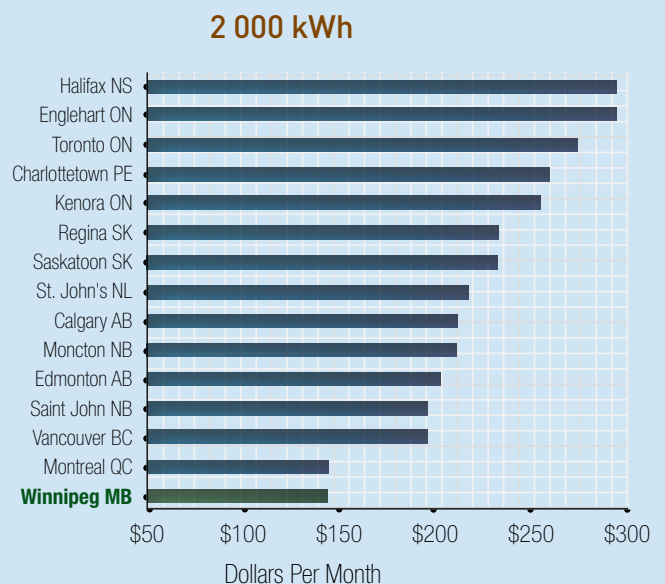


At each fiscal year end, after 2012, the minister of finance must use an independent accounting firm to prepare a report for each province, listing a comparable cost for the same bundle of utility services. For any year in which the cost of the same utility bundle is lower than that of Manitoba, the minister of finance must prepare a plan to return Manitoba to the lowest cost position.

Lowest Rates in Canada

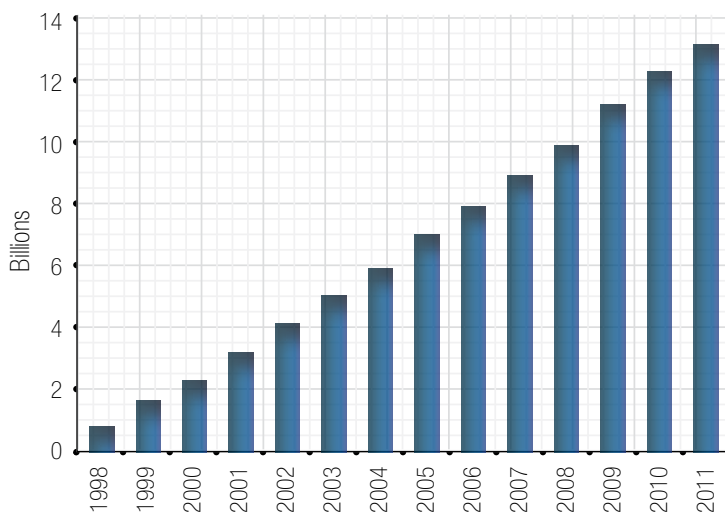
In the past, Manitoba Hydro has used export sales to help finance the cost of large, hydroelectric generating stations. This has helped ensure the low electricity rates Manitobans enjoy today. The average rates in our two neighbouring provinces, Saskatchewan and Ontario, are significantly higher than in Manitoba – approximately 90 per cent higher in Ontario and 40 per cent to 60 per cent higher in Saskatchewan, depending on the class of service. In other low cost jurisdictions in Canada, the general average rates are still higher – in Quebec, about eight per cent higher; and in British Columbia, about 17 per cent higher.

Manitobans enjoy some of the lowest electricity rates in Canada and in North America. The chart below shows the comparative monthly cost of service to residential customers in various larger cities in Canada.



The long term benefits to Manitobans of the strategic decisions to invest in hydroelectric power (as well as greater efficiency) include cumulative savings to Manitoba families and businesses of \$13 billion on their utility bills, when compared to the average Canadian's rates for the period 1998 to 2011.

Manitoba's Cumulative Hydro Bill Savings 1998-2011 (vs Average Canadian Rates)



Renewal of the Electrical System Assets

Like other electric utilities in Canada, many of Manitoba's electrical system assets were purchased and installed in decades past, and therefore now need to be renewed. However, the system must be renewed and developed at today's costs – which are significantly higher than the capital cost associated with Manitoba Hydro's legacy assets (ex: some of these assets, such as Point du Bois generating station, have been in place for as long as 100 years).

Low electricity rates have provided Manitoba families, firms and farms with savings of \$13 billion – more than \$10,000 per Manitoban.

Today's Keeping Rates Low Priority Actions

Placing Bill 18 Into Law

Manitoba will move to proclaim Manitoba's Bill 18, *The Affordable Utility Rate Accountability Act*. This act will ensure the provided bundle of combined electricity, natural gas, and automobile insurance rates remains the lowest in Canada.

Predictable Rate Increases

Manitoba Hydro expects it will need predictable and moderate rate increases over the next decade to fund asset renewal, which can still be done in the context of *The Affordability Utility Rate Accountability Act*. These increases will fund the renewal of its existing infrastructure; develop new generation, transmission and distribution infrastructure to serve growing demand; and assure continued reliable service to Manitobans.



4 GROWING RENEWABLE ENERGY ALTERNATIVES

Recent years have seen a range of new, renewable energy technologies emerge globally (ex: wind power, heat pumps, electric vehicles). As these technologies fell in cost and grew in global sales, it became clear that Manitoba not only held a competitive advantage in clean, renewable hydroelectricity, but increasingly, across a broad range of emerging renewable energy sources.

Manitoba's Emerging Clean Energy Portfolio

Manitoba has taken a leadership role in developing emerging energy sources across all three primary energy uses: electricity, heating and transportation:

- In electricity, Manitoba saw two of Canada's larger, and lowest cost, wind farms constructed at St. Leon and St. Joseph.
- In heating, Manitoba became the Canadian leader in heat pumps, installing 11,000 units to date (including the new Manitoba Hydro head office building).

St. Leon and St. Joseph wind farms produce enough energy to meet the needs of 90,000 homes.

- In transportation, Manitoba led Canada by:
 - building a 130-million-litre ethanol plant in Minnedosa
 - creating one of Canada's first plug in hybrid electric vehicle demonstrations
 - launching world leading hydrogen and electric bus projects

Manitoba's desire to develop its clean energy resources was accelerated by the global fossil fuel price surges of the 2000s, when Manitoba's annual, out of province payments for fossil fuel consumption began to reach into the \$2 billion to \$3 billion range.

Today, Manitoba has the opportunity to harness its significant breadth and depth of clean, renewable, energy resources and to use them year by year to reduce the province's reliance on expensive, polluting and volatile imported fossil fuels. At the same time, Manitoba can create new, green jobs and business activity at home.



Wind Power in Manitoba

Wind power has long been known to emit almost no GHGs, to have stable prices, and – unlike natural gas or coal – to require no payments to outside fuel suppliers. Beginning in the 1990s, when the global wind industry grew by 20 per cent to 30 per cent each year, it drove the cost of wind down from 40 cents per kWh in the 1980s, to five to seven cents per kWh on the Prairies today.

Just a few years after putting up the first monitoring towers, Manitoba's developers built the 103.5 MW St. Leon project in 2005. Within months, St. Leon proved itself to be one of Canada's lowest cost wind farms (and did so without provincial subsidy). Following St. Leon's success, the province established a long term strategic target of 1,000 MWs, equal to 10 per cent of Manitoba Hydro's average annual generation. Since then, Manitoba has developed its second wind farm – the 138 MW St. Joseph project and the St. Leon facility have been expanded by 16.5 MWs.

The results of Manitoba's two wind farms have been stellar, producing benefits by:

- adding 258 MWs of new capacity and producing 880 GWhs of energy annually – more than the Pine Falls hydro plant, Brandon coal plant and Selkirk gas plant combined
- beginning to generate the more than \$100 million in royalties and local taxes that will flow to rural landowners and rural municipalities (RMs) over the projects' working lifetimes – more than \$10,000 per rural municipality resident
- creating more than 500 new construction jobs in these rural areas
- triggering \$586 million in new capital investment

St. Leon and St. Joseph wind farms will provide more than \$100 million in local and school taxes and royalties to local farmers and citizens over their lifetimes, \$10,000 per person in these rural areas.

Today's Wind Priority Actions

Manitoba's 1,000 MWs of new wind will add almost 3,000 GWhs of dependable energy to the system – a substantial contribution. Economically, developing these 1,000 MWs will generate more than \$2 billion in new investment, and \$400 million in lifetime revenues to rural communities.

The location, scale and timing of future utility and community scale wind development in Manitoba will be shaped by circumstances such as exchange rates and export prices, federal support, global turbine prices, rural economic conditions and Manitoba Hydro's evaluation of its supply and demand situation.

A single 300-700 MW wind farm would provide the electricity required to shift every Manitoba passenger car and truck from gasoline to electricity.

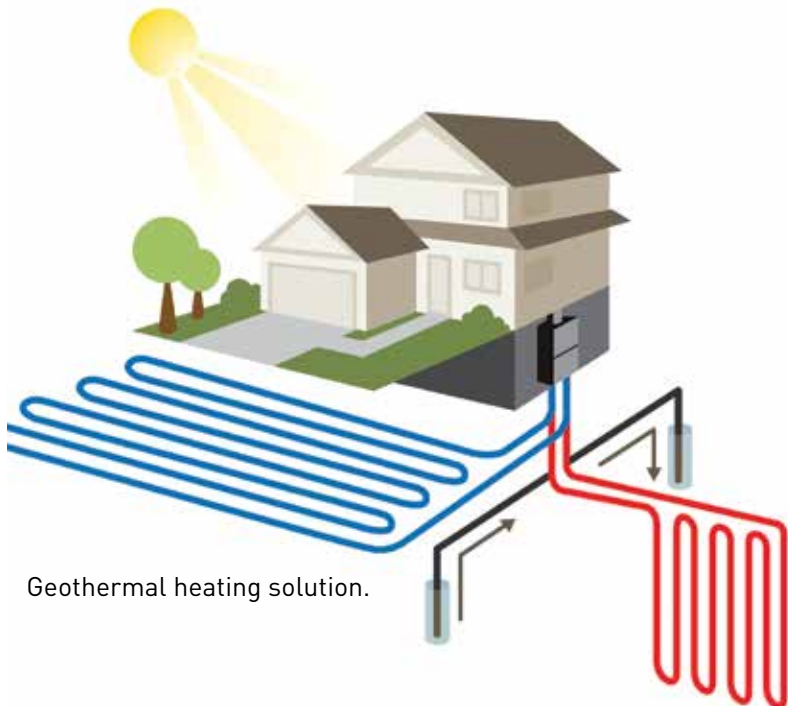


Green Heat

Manitobans in search of clean, low cost, stably priced sources of heating have long faced a dilemma. While natural gas (and propane and heating oil) offered a convenient source for heating space and water, it was also an imported fossil fuel, one which emitted GHGs – and one with highly volatile prices.

While Manitoba Hydro is responsible for most natural gas distribution, it has no direct control over the price of the natural gas itself, which is set outside the province. As a result, 270,000 Manitoban families and businesses pay prices set elsewhere, prices which can be low, but which have also been highly volatile over the past decade.

In fact, \$300 million to \$600 million leaves the Manitoban economy each year just to pay for natural gas. This money, if redirected and spent locally, would create and support thousands of Manitoba jobs. In addition, the combustion of this fossil fuel results in 2.4 million tonnes of GHG emissions in Manitoba – a full 15 per cent of all the GHGs emitted in the province – and an area needing to be reduced if Manitoba’s domestic emissions are to fall.



Geothermal heating solution.

Electric Space and Water Heating – Not the Best Solution

Historically, electric heat was the main alternative for those Manitobans who needed a stably-priced alternative to natural gas. As a result, 130,000 families use all electric heat (especially in rural areas and apartments) today and 230,000 use electric hot water. Even so, using electricity – a high value energy form – to raise air or water temperatures by only a few degrees is considered a wasteful way to create heat. It is often termed, “using a chainsaw to cut butter.” As a result, the conversion of buildings heated all-electrically (many of which are in rural areas) to use geothermal heat pumps, biomass or solar sources of renewable energy can produce multiple benefits (ex: lower energy costs, new local jobs, freeing up more electricity for Manitoba Hydro exports).

Heat Pumps– All the Energy You Could Want, Right Beneath Your Feet

Manitobans have increasingly been turning to popular alternatives, often called renewable or “green” heat sources, such as heat pumps, which draw energy from the ground, water or air. A heat pump, for example, can turn one kWh of electricity into three to five kWhs of heat, offering a way to take Manitoba’s clean electricity and multiply the benefits. And with almost half of all solar energy reaching the earth being stored in the ground itself, a geothermal heat pump uses the ground beneath our feet to provide a clean, renewable source of heat, or cooling and all at a stable price.

Geothermal Heat Pumps – Once Again, Manitoba Leads the Way in Canada

Beginning in the year 2000, Manitoba began to back this technology and became a Canadian leader by raising its geothermal heat pump installation rate by 400 per cent. Contributing to the industry’s rapid growth are innovative policy tools like the province’s Green Energy Equipment Tax Credit and Geothermal Grant, the Green Building Policy, support for industry training, quality assurance and education, and Manitoba Hydro’s Earth Power loan program.

The result is: as households and businesses had to replace heating systems, more found that their particular circumstances enabled them to invest in heat pumps. There were 11,000 units installed in Manitoba as of 2012. The industry has proven its capabilities by supplying not just family homes, but apartment buildings, arenas, churches, schools, head offices, university residences, credit unions and car dealerships. In particular, Manitoba's pioneering efforts to use heat pumps to supply multi-unit apartments, district systems and commercial projects is opening up a cost effective niche, offering not only lower per unit costs, but long term energy price stability. Today, Manitoba's heat pump industry has annual sales over \$35 million, and provides system drilling and installation, design and engineering, component manufacturing and system integration.

Some of the industry's more innovative, showpiece projects in Manitoba include:

- the IKEA store and mall, the largest geothermal installation in Manitoba
- Manitoba Hydro's award winning, 22 storey head office – which has, at its core, 280 heat pump bore holes, each drilled 122 metres beneath the site
- 20 storey, multi-unit apartment towers in Winnipeg
- The Forks Market harnessing heat and cooling from the ground, a well, and a river to heat and cool a central 100 year heritage building, restaurants, offices and retail shops
- Award winning, district geothermal system at Île-des-Chênes, serving the local community centre, arena and fire hall

Moving forward, while individual circumstances and site specific economics will see natural gas fuelled heating systems continued to be installed, a rising percentage of Manitoba's stock of heating systems will likely consist of heat pumps. For those Manitobans, heat pumps offer a tested, made-at-home solution – able to draw on renewable heat and cooling from the ground, water or air; to supply single family homes, apartment blocks and commercial buildings; without emitting GHGs; and all at a stable price.

Today's Geothermal Priority Actions

Manitoba has been accelerating the growth of the geothermal heat pump industry through its Green Building policy, Earth Power Loans and the Green Energy Equipment Tax Credit. The creation of Manitoba Hydro's new On-Meter Finance tool will also provide Manitoba's home and building owners with a new tool to overcome the upfront cost barrier, and to generate a positive cash flow from day one.

The On-Meter financing tool is likely to be of particular value to the 150,000 rural Manitobans who lack access to natural gas and still must rely on fuel oil, propane and all electric heat. Manitoba Hydro estimates that a geothermal heat pump will save these homeowners \$750 to \$2,500 each year, when compared to these older systems – offering perhaps the single largest energy bill saving available to these families.

Manitoba will continue to provide the popular Green Energy Equipment Tax Credit for geothermal installations throughout the province where equipment is purchased before 2019. It is a refundable tax credit where all Manitobans and eligible corporations can claim this credit, whether tax-paying or tax-exempt (ex: non-profit organizations), to help offset the upfront investment of geothermal.

Recognizing that district heating presents a major opportunity for geothermal and other green heat sources such as biomass, the Manitoba government will work with municipal governments and industry stakeholders to identify and break down barriers to district heating and large scale multi-unit installations, and create a supportive environment that enables community scale and multi-unit biomass and geothermal heating.



The IKEA building is heated and cooled by one of the largest geothermal systems in Manitoba.

Wood

Wood is another renewable heat source widely used in Manitoba, with more than 20,000 homes – especially in rural areas – using wood, often combined with electricity, natural gas, fuel oil or propane. Modern wood stoves have greatly improved their efficiency and now produce more heat with fewer particulates, reducing the volume of wood needed by homeowners as well as the volume of any ash to be disposed.



Biomass – Manitoba's Natural Advantage

Biomass represents a broader and more strategic opportunity for Manitoba, offering the chance to boost economic growth, environmental sustainability and rural diversification. Agricultural residues and forestry waste can be converted into biofuels suitable for heat, electricity or transport. Manitoba has a natural advantage in biomass production with 7.6 million hectares (18.8 million acres) of agricultural land, already producing four million tonnes of biomass each year.

Biomass pellets from wood waste and crop residues have achieved strong growth in Europe, rural eastern Canada and the US, often out competing fuel oil and electricity. Compared to raw wood, pellets are more easily transported, burn more cleanly and produce less ash, create new income streams for farmers, while reducing in-field burning.

The growth of Manitoba's pellet industry will depend on its ability to cut costs along the supply chain – to gather and pack biomass from crop residue or woody debris left after harvest; transform the materials into pellets; install pellet combustion, storage and ash-handling systems in buildings; distribute the pellets; and remove the ash. As a result, the industry is most likely to expand in markets such as on-farm space heating and agricultural drying and processing.

Solar Energy

Solar energy is also on the rise globally, with 200 million buildings now using solar thermal systems for hot water and heat – and solar photovoltaic sales exceeding \$90 billion.

In Manitoba, solar thermal heating applications have been found to be most cost effective when built into the design of new buildings (ex: Buhler Versatile tractor manufacturing plant). There, solar energy is captured, stored and transferred throughout the building, to complement other heating sources. Solar walls can also be used to preheat air and have been installed cost effectively at more than 50 Manitoba schools, housing complexes and industrial buildings.



Fred Douglas Place, a multi-unit high rise residential building in the heart of downtown Winnipeg, was retrofitted with a solar thermal wall that compliments its existing exterior brick facade.

47 per cent of solar energy is absorbed by the ground.

Today's Wood, Biomass and Solar Priority Actions

Coal Use Ends in 2014

Manitoba has already established the Emissions Tax on Coal, with revenues being invested to speed the development of systems provided by Manitoba's new, clean energy from biomass industry. Coal was identified because it was the most GHG intensive fossil fuel, but also because many clean energy alternatives were available. Because of the speed at which the few remaining coal burning establishments are converting to cleaner energy, a target end-date on the use of coal for heat has been set for 2014.

Growing Harvest Operations for Biomass Markets

The province's wood and biomass heat industries will continue to grow through the Manitoba Biomass Energy Support Program, which helps develop biomass processing capacity, conversion technology and research and development. Using revenue generated by the Emissions Tax on Coal, Manitoba will support coal users to transition to renewable biomass and work with the forestry and agricultural industries to increase the use of debris from harvesting operations to produce biomass for these emerging markets.

New Technologies Entering Mainstream

Solar will continue to be supported through the Provincial Green Energy Equipment Tax Credit. As wood, biomass and solar technologies move into the mainstream, they will become eligible under Manitoba Hydro's On-Meter Finance program.

Taken together, the shift towards green heat technologies – heat pumps, biomass pellets and solar – should see a growing share of the \$300-\$600 million that currently leaves the province to pay for natural gas, instead being re-injected at home, creating permanent, new green jobs.

Manitoba's Rural Advantage

Rural Manitoba has been a clear leader in developing new and emerging renewable energy sources. It has not only attracted substantial new investment and created new employment, its entrepreneurs have developed new green businesses and it has shown itself a leader in implementing the new technologies at home and at work.

Examples of this leadership include the exceptional role that local RMs and landowners have taken in partnering with the new wind-farms at St. Leon and St. Joseph (and landing more than \$500 million in new investment); the development of Minnedosa's \$200 million ethanol plant, including the co-operation of local grain and canola suppliers; the prevalence of heat pumps being installed in rural areas (ex: Île-des-Chênes), as well as the enormous future opportunity On-Meter Finance offers to those using electricity, propane and oil for heat; the rapid conversion off coal by Manitoba's Hutterite colonies; and the research and development work currently going into developing biomass, biofuel and bioproduct applications.



Cleaner Transportation

It is in transportation that fossil fuels have forced Manitobans to pay the greatest cost, with rising global oil prices doubling Manitobans' bills, to \$2 billion and more each year. This is money which simply leaves the Manitoban economy. The need for a long term transition off these fossil fuels is particularly underlined by the fact that every 20 cent per litre rise in the price of gasoline and diesel requires Manitobans to pay an extra \$500 million – more than Manitoba Hydro's annual export earnings.

By using made-in-Manitoba biofuels and electricity to fuel its vehicles, Manitoba has begun to reclaim the billions of dollars flowing out of province, re-injecting them back into our local economy. Continuing to do so will create thousands of long term, sustainable, local jobs – while enabling more Manitoban families and businesses to regain control over their family budgets.

Homegrown Biofuels

Ethanol – a Cleaner Burning Fuel

Manitoba was home to Canada's first modern ethanol plant, at Minnedosa, in the early 1980s. After 2000, when oil prices rose and ethanol became cheaper to produce, Manitoba worked with industry to create an ethanol strategy designed to help grow local economic opportunities, increase energy security and reduce GHGs. Manitoba has since become a Canadian leader with *The Biofuels Act*, which mandated that 8.5 per cent of gasoline be replaced with ethanol. The province also created an eight year, declining incentive for new ethanol producers, to ensure there would be no impact on drivers at the pumps.

Husky's ethanol plant in Minnedosa produces 130 million litres of ethanol annually.



The results were impressive, and included:

- an investment of \$200 million in the construction of Husky's new 130-million litres per year, world class, ethanol plant in Minnedosa
- the creation of a new market for 350,000 tonnes of Manitoba wheat and corn annually.
- the production of 130,000 tonnes of high protein distiller's grain (which livestock producers now use to replace imported soybean meal)
- the re-injection of \$100 million that previously leaked away for gasoline payments
- a reduction in transportation emissions of more than 330,000 tonnes of GHG emissions per year

Biodiesel – a Cleaner Burning Fuel

Manitoba developed a strategy for biodiesel in 2005, which led to the creation of a biodiesel testing facility in Selkirk, incentives for producers and demonstration projects in Winnipeg school buses, trucks and underground mines. In 2009, Manitoba again led Canada by introducing its mandate of two per cent biodiesel.

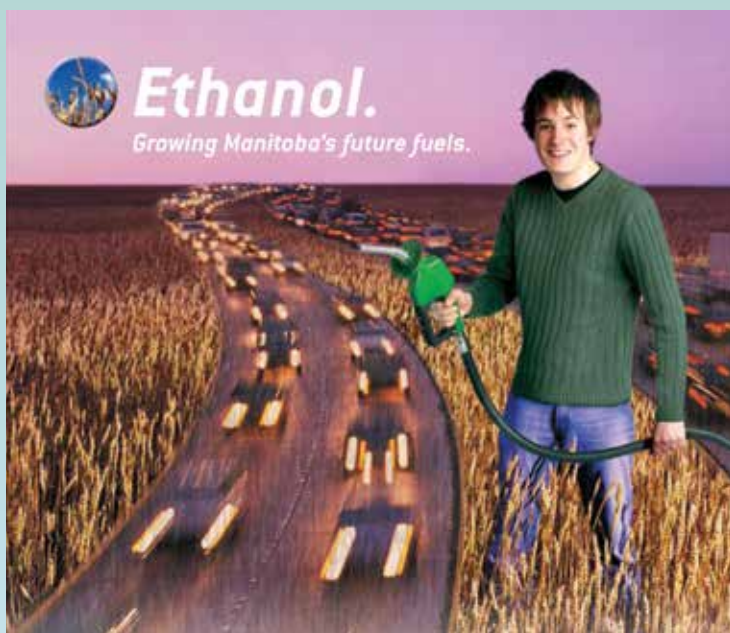
Future Biofuel Technologies

Combined use of these Manitoban biofuels now reduces gasoline and diesel imports by \$100 million each year, and cuts GHGs by nearly 400,000 tonnes annually. The next step for the industry is the creation of advanced biofuels from feedstocks such as straw, crop residues, wood waste or algae. There are also new technologies being commercialized today that can produce next generation biodiesel with cold weather properties similar to conventional diesel. Manitoba also now possesses a well equipped biofuel tool kit to help support its development, including fiscal incentives, lab capabilities and mandates.



Today's Biofuel Priority Actions

Manitoba's investment in its biofuel industries over the past decade means that six per cent of our gasoline and diesel fuel is now derived from renewable sources. In the near future, biofuels could grow to supply up to 10 per cent of Manitoba's total liquid fuel consumption. Manitoba, in consultation with stakeholders, will pursue new production opportunities and increased biofuels content requirements. Manitoba will also look for opportunities to increase the production and use of second generation biofuels such as cellulosic ethanol and renewable diesel.



The Electric Transportation Revolution

The electrification of transportation has been described as, potentially, the greatest energy revolution in 100 years. Even though oil still contributes well over 90 per cent of all energy for vehicles and is more energy dense and easier to store, electricity itself has a strong set of advantages:

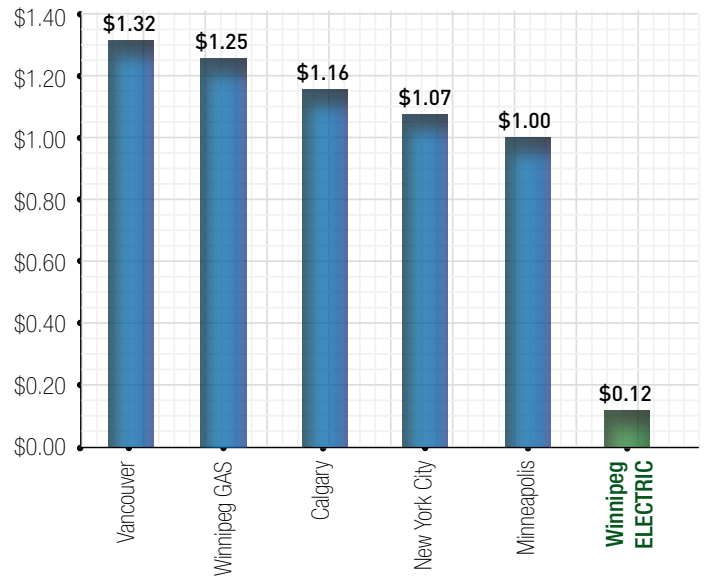
- Electricity can be made from more sources than oil, including from renewable sources.
- Almost every jurisdiction can make its own electricity.
- Electricity costs just a fraction of the price of gasoline.
- When made from renewable sources, electricity emits almost no air pollutants or GHGs.

As a result, electrified transport increasingly offers the world a way out of the energy insecurity, high prices, GHG emissions and economic damage of oil use. Driven in part by these forces, the major automakers have in recent years moved rapidly into this field, making a range of hybrid, plug-in hybrid electric vehicles and all electric vehicles commercially available to the public.

Technological Advances Ongoing

More hybrids and electric vehicles are forecast to be on North American roads in the medium to longer term, with the exact number in any given year heavily influenced by oil prices and battery progress. The major automakers and battery manufacturers have invested tens of billions in developing the new batteries, and have cut prices in half in just the past three years – and with a further halving forecast by 2017 to 2020. This progress means that, with each new model year, more Manitobans will find themselves entering a vehicle sales market with a greater range of hybrid, plug-in and all electric vehicle models, at lower cost and with improved performance. As their personal circumstances dictate, Manitobans who choose to access these vehicles will find the benefits available to them in Manitoba are particularly strong:

The Cost of Vehicle Fuel - At The Pump vs At The Plug



- Manitoban drivers will have North America's lowest-cost vehicle fuel – electricity from Manitoba Hydro – at approximately 12 cents per litre gasoline equivalent
- A young family shifting from two gasoline driven vehicles to two electric ones could therefore expect to save over \$100,000 in vehicle fuel payments over their lifetimes.
- For Manitoba as a whole, a shift from gasoline to electricity in the decades to come will:
 - Re-inject a rising share of the \$1 billion in gasoline bills back into Manitoba's economy – comparable to Manitobans receiving a \$1 billion per year tax cut.
 - Create more than 10,000 new, long term jobs in the economy.
 - Reduce Manitoba's GHG emissions by three million to four million tonnes a year.
 - Convert Manitoba's number one energy weakness (the import of expensive fossil fuel) to its number one strength (its wealth of low cost, renewable electricity)

Switching from gasoline to electricity for vehicles would stop leaks of more than \$1 billion from Manitoba's economy each year.

Manitoba's Advantage in Electric Vehicles

This opportunity also stands out for Manitoba because it has such strong assets in this sector:

- The province has an abundance of low cost, clean electricity. For example, given the much higher efficiencies of electric motors versus gasoline engines, a single 300 MW to 700 MW wind farm would provide enough electricity to shift every Manitoba passenger car and truck from gasoline to electricity.
- Manitoba has a prebuilt electric vehicle infrastructure of more than 500,000 plugs in our garages and parking lots. Now used for block heaters, they can also be used for recharging. If Manitoba had to build this infrastructure new (as others do), it would cost \$1 billion.
- While others face cultural barriers to plugging in, Manitobans already have a well established plug in culture, driven by the need for block heaters during our winters.

Moving Towards Electrically Powered Vehicles

Manitoba has acted by creating plug in partnerships with automakers like Nissan, Toyota and Mitsubishi, Manitoba Hydro and academic institutions, to better demonstrate plug-in hybrid and electric vehicles under our climatic conditions and ensure that these options are available.

A new Electric Vehicle Technology and Education Centre (EV-TEC) was created at Red River College in Winnipeg, to demonstrate new plug-in hybrids and electric vehicles to Manitobans and train students for the future.

In 2011 Manitoba's Electric Vehicle Road Map identified ways to maximize out-of-the-gate use of Manitoba's \$1 billion recharging infrastructure, identified issues around the integration of vehicle charging and the grid, and making links to northern vehicle cold weather testing in Thompson.

Every 20 cent per litre rise in the price of gasoline and diesel drains \$500 million from Manitobans.

Today's Electric Vehicle Priority Actions

Building on what we've learned from our early demonstrations, plug in partnerships and work of the Electric Vehicle Advisory Committee – Manitoba will:

- Expand existing, and form new, plug-in partnerships.
- Actively promote at home charging, an option which already exists for 95 per cent of Manitobans; while working with Manitoba Hydro and other partners to ensure parking lots are capable of recharging vehicles, and providing incentives to install some Level-2 recharging systems.
- Expand fleet procurement by the province, the Crowns and others.
- Develop communication strategies to provide objective information to the public and corporations to help make informed electric vehicle purchase and operation decisions in the Manitoba context.
- Launch public participation campaigns to speed the adoption of new generation vehicles, spear headed by the Fossil Fuel Freedom program.

For Manitobans refilling with electricity, it costs just 12 cents for the equivalent of a litre of gasoline.



Hydrogen, Hybrid and Battery Powered Buses

Buses and heavy duty vehicles offer a special opportunity for hydrogen and battery power. This sector is especially significant to Manitoba, as Winnipeg is the bus manufacturing centre of North America. We are home to New Flyer Industries, the leading maker of transit buses, and Motor Coach Industries, the leader in inter city buses. New Flyer has emerged as the number one supplier of alternative fuelled buses, with hybrids, hydrogen, and most recently – in partnership with Mitsubishi Heavy Industries, the Province of Manitoba, Manitoba Hydro, and Red River College – electric buses.

Electric Bus Project – Showcase for North America

The new electric bus project will develop and demonstrate an advanced, battery electric, transit bus plus rapid charge technologies under Manitoba's highly variable climatic conditions. The \$3 million project aims to validate the bus's operational capabilities and act as a showcase for potential markets. It has taken one year to develop the prototype bus (including integrating battery technologies from Mitsubishi) that will be followed by two years of operational testing.

Today's Alternative Powered Bus Priority Actions

Manitoba will continue to support development of the electric bus, and work with partners to expand the project into a multi-bus and charging system demonstration. Priority will be placed on seeking value added technology development and component manufacturing. The timing is right for such projects as US transit authorities are considering electric buses in tenders, albeit starting on a small scale. The pathway forward for this ground breaking technology was blazed by hybrid diesel/electric buses, considered cutting edge less than 10 years ago but now making up a significant portion of new bus sales throughout North America.

Hydrogen

In 2003, Manitoba launched its hydrogen strategy, leading to a Winnipeg demonstration of an advanced, fuel cell bus, as well as a bus with a hydrogen hybrid, internal combustion engine. Since then, research partnerships with regions such as Iceland have developed. As well, New Flyer Industries has gained considerable expertise in hydrogen technologies, supplying 20 fuel-cell buses for the 2010 Vancouver Olympics – buses that are still operating today.




5 FREEDOM FROM FOSSIL FUELS

Over the coming years, a number of Manitobans will be among the first in the industrial world to live their lives without requiring substantial quantities of fossil fuels. Instead, they can meet the vast majority of their three core, daily, energy needs (for electricity, heat and transportation) by using clean, renewable energy and by being energy efficient – not by burning coal, natural gas, gasoline or diesel. These first fossil fuel free Manitobans will be pioneering a path that most nations are hoping their citizens will get to take in future decades – toward a daily life no longer dependent on fossil fuels.

These Manitobans will achieve fossil fuel freedom through a simple three-step process:

1. Their electricity from Manitoba Hydro will already be clean, more than 98 per cent or more fossil fuel free. It will supply their lighting, appliances and other power needs. A clean electricity supply, though difficult to obtain in most other nations, is already here for Manitobans.
2. Their heat will be provided – as it already is for thousands of Manitobans – through clean, renewable, energy systems (ex: heat pumps, biomass, solar), which eliminate the need for fossil fuels like natural gas. While all electric heat is also fossil free, heat pumps use 50 per cent to 70 per cent less electricity, so they're a more efficient choice.
3. The biggest step for most Manitobans will be in transportation. An option chosen by some will be to buy an electric or plug-in hybrid vehicle, which will shift their vehicle energy over to clean electricity, while cutting their gasoline use by 65 per cent to 100 per cent. Others may choose to cut their fossil fuel use by taking public transit, car pooling or ride sharing, while others opt for walking or cycling.



Manitoba currently has more than 500,000 plug in points in garages, parking lots and at businesses. This is a \$1 billion infrastructure already in place.

Taken together, these Manitobans will have effectively reduced their use of fossil fuels by more than 90 per cent across the three major energy end uses. They will also have begun to generate a range of benefits for themselves, the environment and the Manitoban economy:

- By moving off gasoline, they will slash their pump price worries and gain the lowest cost vehicle fuel in North America – electricity from Manitoba Hydro at approximately the equivalent of 12 cents per litre.
- By changing to heat pumps and electric and plug-in hybrid vehicles, they will save \$3,000 to \$5,000 in fuel costs each year. Over a lifetime, this can reach to well over \$100,000 per family.
- They will cut their direct GHGs to residual levels (zero to two tonnes.) This can be compared to today's families in North Dakota or Saskatchewan, many of whom emit 15 to 40 tonnes of GHGs a year by using coal fired power, gas heat and gasoline.

When a two gasoline driven vehicle family shifts to using two electric vehicles, they can expect to save more than \$100,000 over their lifetimes in vehicle fuel costs.

Fossil Fuel Freedom – A Movement Towards a Healthy Future

Many nations can only set fossil fuel freedom as a visionary goal, for the years 2040 or 2050.

But in Manitoba, a significant number of its citizens can choose to achieve this freedom today. Any such transition, as we have seen, would require decades to move through a society's energy infrastructure. For example, our vehicle fleets alone requires 15 to 20 years to turn over; our furnaces and heating systems require 20 to 30 years; and our building stock and energy generating infrastructure can last another 50 to 100 years.

Nonetheless, for most Manitobans, the opportunity to move from conventional fossil fuel use to clean energy, and even on to fossil fuel freedom is increasingly a reality. More and more Manitobans are taking the quiet steps they need to ensure that their lives are less exposed to the risks and costs of fossil fuels.

And the reason Manitobans are so well positioned to make this transition, and able to consider it now, in an atmosphere free of any particular energy crisis, is because of the strong clean energy economy and infrastructure which we have come together to create, starting decades ago.

But today's good news is that for Manitobans, the fossil fuel free future starts here...and it starts now.

Today's Fossil Fuel Freedom Priority Actions

The province will support a Fossil Fuel Freedom campaign that will initially focus on families. It is expected that many companies, offices, farms and schools, etc. will want to follow in a similar fashion. The campaign will:

- A. Create a public path open to all Manitobans, rather than a program designed just for a few. This will enable more and more families to participate, and reap the full benefits of lower bills, more local jobs and an improved environment.
- B. Consist of three simple steps:
 - Step 1: Use clean electricity – a step Manitoba Hydro has already taken for you.**
 - Step 2: Use a green heating system – such as heat pumps (or biomass or solar).**
 - Step 3: Use clean transport – such as an electric or plug-in hybrid vehicle, public transit, car pooling or ride sharing, or active transportation methods like walking, skating and cycling.**
- C. Focus on promoting a positive, money saving path forward for households.
 - Real world stories of fossil fuel freedom will be communicated to schools and the public, and may include tours as well as special technology demonstrations.

A plug-in hybrid can reduce the number of times you need to refill with gasoline to less than once every two months.

- D. Connect to an online fossil fuel free social network, designed to support both early members, as well as to inform and engage those in the next wave who may be interested in joining.
 - Families who participate in programs early on may wish to use the network to exchange experiences, discuss the process with experts, engage with those interested but who have not yet joined, and to organize peer-group activities.
- E. Support these families through financial incentives and expert help.
 - A number of organizations – the Manitoba government, Manitoba Hydro, private suppliers and retailers, universities etc. – already offer incentives and supports. These incentives will be brought together (and can be topped up) through the Fossil Fuel Freedom campaign.
 - Support from experts is also valuable to people who adopt new technologies early on. The province, Manitoba Hydro and other partners will make sure these families have access to services and expertise in plug-in hybrid and electric vehicles, heat pumps and home retrofits, through in-home visits, expert support and other assistance.
 - For those at an earlier stage, partners can provide opportunities to see these new technologies demonstrated, or to speak directly with experts and participants.



CONCLUSION

Our energy future, in many ways, underpins our economic future. Managing the way we source, deliver and use energy in the years ahead will be key to growing our economy, keeping energy affordable, meeting the province's commitments to sustainability and reducing our impact on global climate change. Manitoba's strategic direction is clear – by seizing our own Manitoba domestic energy advantages we can reduce our exposure to fossil fuels while expanding our clean energy resources, all across the electricity, heat and transportation sectors.

Capturing the economic and environmental opportunities this clean energy strategy provides will require innovation and commitment, as well as a willingness to adjust as our energy options evolve. Most importantly, we need to work together to reach our goal.

With the co-operation and participation of the public sector, the private sector, our farms and our schools, industry experts and informed citizens, Manitoba is leading the way into a clean energy, and – for some pioneers – into a fossil fuel free future.

Although the goal of building on our renewable energy advantages is long term in nature, this strategy will be reviewed and updated on a regular basis and progress reports provided annually. As energy technologies evolve, environmental drivers intensify, and market conditions change, it will be important to be flexible enough to adapt as necessary.

It is equally important that Manitobans have an opportunity to provide input into this living strategy and therefore it will remain open to reflect the views of Manitobans.

To provide advice and comments about the Manitoba Clean Energy Strategy please respond in writing to:

Manitoba Innovation, Energy and Mines

Energy Division
1200-155 Carlton Street
Winnipeg, Manitoba, R3C 3H8

www.manitobaenergy.ca

Or by email to:

mbenergy@gov.mb.ca



APPENDIX I – WHAT IS ENERGY?

The term energy comes from the ancient Greek *energeia*, meaning activity or to cause activity. Literally, energy is what makes things work, and joules (J) are the official units of energy, whatever the form. Abbreviations are used for short form:

1 kilojoule (kJ) = 1,000 J

1 megajoule (MJ) = 1,000,000 J

1 gigajoule (GJ) = 1,000,000,000 J

Power is defined as the flow of energy, and watts (W) are the official units of power.

Watts and joules are related in that:

1 W = 1 J per second

Natural gas is sold in units of cubic metres (m³) (at standard temperature and pressure conditions) with a typical energy content of 37.8 MJ per m³.

Gasoline and diesel liquid fuels are sold in volumetric units of Litres (L) referenced to a standard temperature.

Gasoline typically has an energy content of about 35 MJ/L

Diesel fuel typically has an energy content of about 37 MJ/L

Vehicle fuel consumption is typically expressed in units of Litres per 100 kilometre (L/100 km). Lower numbers are better in this case.

Fuel economy in the United States is expressed in units of miles per U.S. Gallon (MPG). Higher numbers are better in this case. The conversion between L/100 km and MPG is more complicated given they use different units and are inverse. A fuel consumption of 15 L/100 km equates to fuel economy of 16 MPG.

1 U.S. Gallon = 3.78 L

1 mile = 1.6 km

Electricity in terms of energy is sold in units of kilowatthours (kWh). This has been used for convenience and is an official unit for electricity.

There is a simple relationship to official energy units as follows:

1 kWh = 3,600,000 J = 3.6 MJ

APPENDIX II – ENERGY ABBREVIATIONS

List of Commonly-used Acronyms

AT	active transportation
BEEP	Brandon Energy Efficiency Project (social enterprise organization)
BUILD	Building Urban Industries for Local Development (social enterprise organization)
CAFE	U.S. Corporate Average Fuel Economy standard
CEEA	Canadian Energy Efficiency Alliance
DC	direct current
ESA	<i>Energy Savings Act</i>
EV	electric vehicle
EVTEC	Electric Vehicle Technology and Education Centre (at Red River College)
FFF	fossil-fuel free family
GDP	gross domestic product
GEMTC	Green Energy Manufacturing Tax Credit
GHG	greenhouse gas
GJ	gigajoule

GW	gigawatt
HVdc	high voltage direct current
km	kilometre
kWh	kilowatt-hours
LEED	Leadership in Energy and Environmental Design
LNG	liquefied natural gas
MB	Manitoba
MHI	Mitsubishi Heavy Industries
MNECB	Model National Energy Code for Buildings
MPG	miles per U.S. gallon
MW	megawatt
NBC	National Building Code
NECB	National Energy Code for Buildings
PHEV	plug-in hybrid electric vehicle
PV	(solar) photovoltaic
US	United States





Manitoba Innovation, Energy and Mines
Energy Division

1200-155 Carlton Street
Winnipeg, Manitoba, R3C 3H8
www.manitobaenergy.ca

Aussi disponible en français.