



## **Budget Paper A**

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# **THE ECONOMY**

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# THE ECONOMY

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## CANADIAN ECONOMY

The Canadian economy grew 1.7% last year, about half the 2002 rate and below that of the U.S. for the first time since 1998 (see Chart 1).

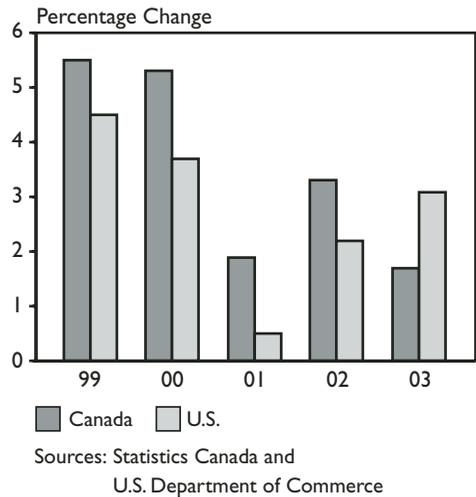
A number of factors combined to weaken Canada's economic performance last year. Several "shocks" affected the economy, including the outbreak of SARS in Ontario, the closure of the U.S. border to Canadian cattle due to the single case of Bovine Spongiform Encephalopathy (BSE) in Alberta, and severe forest fires that affected several regions of Canada – including Manitoba, where forest fires were the second-worst ever recorded.

More significant, however, was the rapid appreciation of the Canadian dollar relative to the U.S. currency. From the beginning of 2003 to the end of the year, the Canadian-U.S. exchange rate increased by 20% (see Chart 2). Such a significant currency appreciation over a short period of time was unprecedented in modern times. While the increase in the exchange rate reduced the price of most imports to Canada, the higher dollar also reduced the competitiveness of Canadian goods exported into the U.S. market. This is significant since the U.S. accounts for 86% of Canada's merchandise exports.

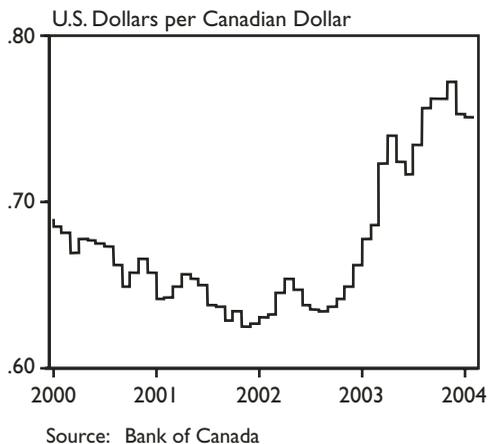
The stronger Canadian dollar, combined with a weak U.S. economy in the first half of 2003 and U.S. restrictions on the import of cattle and wheat, pushed Canada's real exports down 2.1% in 2003. This was the third consecutive annual decline in real exports. Prior to 2001, Canada's real exports had increased for 17 consecutive years.

Canadian corporate profits reached a record high in 2003, surpassing their previous peak set in 2000. Profits rose 10.1% last year, led by the strong performance of oil and gas producers, retailers and wholesalers. Canadian businesses also boosted investment in 2003, as real spending on plant and equipment rose 3.4% after a 6.0% drop in 2002.

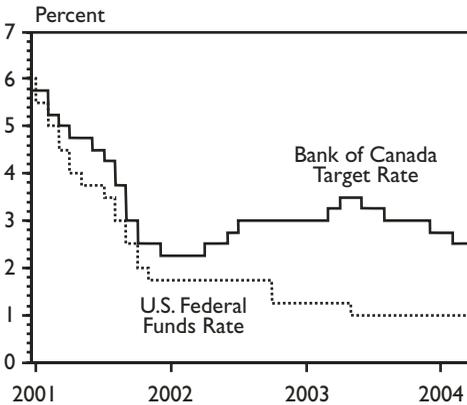
**Chart 1**  
**Real Gross Domestic Product**  
**At Market Prices**



**Chart 2**  
**Canada and U.S. Exchange Rate,**  
**January 2000 to March 2004**

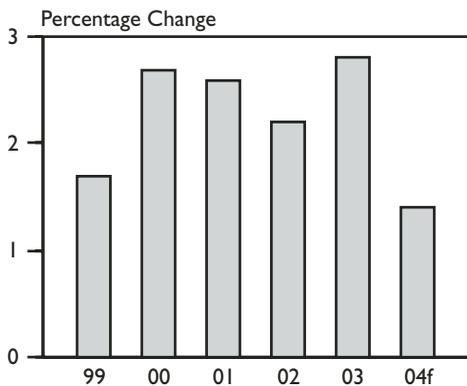


**Chart 3**  
**Canada and U.S. Interest Rates**



Source: Bank of Canada

**Chart 4**  
**Canada Consumer Price Index**



f - Forecast

Sources: 1999-2003: Statistics Canada  
2004: average of economic forecasters

Total labour income grew 3.4% in 2003, the smallest increase since 1996. Total personal disposable income grew 2.8%. While income growth was more modest last year, personal expenditures rose 5.1%, supported in part by continuing low interest rates.

Total employment grew 2.2%, the same increase as in 2002. With the labour force increasing 2.1%, the unemployment rate edged down only 0.1 percentage points to 7.6%. Both the participation rate and the employment rate climbed last year to all-time highs. Manitoba Finance's survey of economic forecasters indicates that Canada's employment is expected to grow by 1.7% in 2004. The unemployment rate is expected to remain relatively high at 7.4%.

Monetary policy changed course during 2003 as the Bank of Canada first increased, then cut, interest rates. The Bank raised rates by 50 basis points in the first half of 2003 in response to perceived inflationary pressures. As these apparent pressures dissipated, the Bank implemented four consecutive rate cuts starting in July, bringing the overnight target rate down 100 basis points to 2.25% in March 2004. These rate reductions helped narrow interest rate spreads with the United States which had grown substantially from early 2002. In the U.S., the Federal Reserve Board introduced one rate change in 2003 – a 25 basis point cut in the Fed Funds rate to 1.00% in June (see Chart 3).

Large increases in energy prices early in 2003, combined with escalating alcohol and tobacco prices, boosted growth in the overall Consumer Price Index (CPI) to 2.8% in 2003, up from 2.2% in 2002. CPI increases moderated through the year, however, with year-over-year inflation in the last quarter of 2003 averaging less than 2.0%. The declining cost of imported goods helped ease price pressures in Canada's economy last year. For example, import prices for machinery and equipment fell 15.2%,

while those for consumer goods declined 12.6%. The survey of economic forecasters shows that Canada's consumer price inflation is projected to average 1.4% in 2004 (see Chart 4). This remains well within the Bank of Canada's inflation control target range of 1% to 3%.

The consensus among economic forecasters is that Canada's real GDP growth will increase moderately in 2004, but remain well below potential. Strong growth in the U.S. economy and continued high prices for primary products are expected to contribute to a stronger Canadian economy in 2004. However, growth will be tempered by the continuing strength of the Canadian dollar relative to the U.S. Currently, Manitoba Finance's survey of economic forecasters shows that Canada's real GDP is projected to increase by 2.9% in 2004.

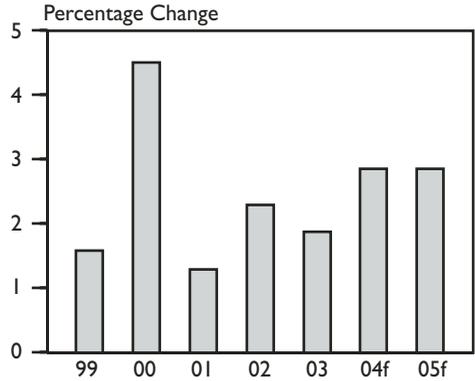
## **MANITOBA ECONOMY**

Manitoba's economy grew 1.9% in real terms in 2003, just ahead of Canada's increase of 1.7% and down slightly from the 2.3% increase posted in 2002 (see Chart 5). Nominal GDP in Manitoba grew 4.0% to \$38.5 billion.

Real business investment rose 7.6% last year, led by an 8.1% increase in residential construction investment and an 8.9% increase in machinery and equipment purchases. Real personal expenditure increased 2.2%, while total (international plus interprovincial) exports slipped 1.3%.

Almost all industries posted real growth last year (see Chart 6). The few exceptions include mining, where a mine closure depressed production in 2003, and utilities, where low-water levels reduced hydro-electricity production. GDP in construction jumped 7.2% with strong growth in residential and non-residential construction. GDP in manufacturing, Manitoba's largest industry, increased 2.3%. The value of Manitoba's manufacturing shipments increased last year, while Canada's manufacturing shipments declined.

**Chart 5**  
**Manitoba Real**  
**Gross Domestic Product**

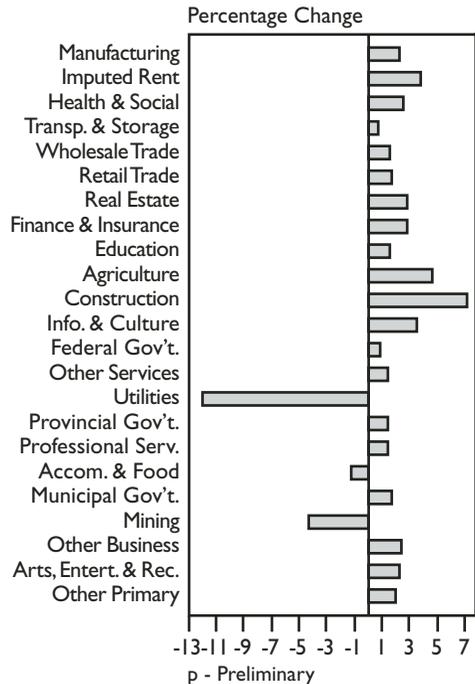


f - Forecast

Sources: 1999-2003: Statistics Canada

2004-2005: average of economic forecasters

**Product, at Basic Prices by**  
**Industry, 2003p**



Source: Manitoba Bureau of Statistics

## Manitoba Real Gross Domestic Product at Basic Prices by Industry, 2002 and 2003p

(Millions of Chained 1997 Dollars)

	2002	2003p	% Change
<b>Goods</b>	<b>8,449</b>	<b>8,564</b>	<b>1.4</b>
Agriculture	1,425	1,491	4.6
Mining	606	580	-4.3
Other Primary	102	104	2.0
Manufacturing	3,992	4,084	2.3
Construction	1,347	1,444	7.2
Utilities	977	861	-11.9
<b>Services</b>	<b>23,014</b>	<b>23,481</b>	<b>2.0</b>
Transportation & Storage	2,096	2,111	0.7
Information & Culture	1,088	1,122	3.5
Wholesale Trade	2,047	2,077	1.5
Retail Trade	1,945	1,979	1.7
Finance & Insurance	1,711	1,759	2.8
Real Estate	1,761	1,811	2.8
Imputed Rent	2,872	2,981	3.8
Professional Services	764	775	1.4
Other Business Services	509	521	2.4
Federal Government	986	995	0.9
Provincial Government	788	801	1.6
Municipal Government	576	586	1.7
Education	1,584	1,608	1.5
Health & Social Services	2,248	2,304	2.5
Arts, Entertainment & Recreational Services	360	368	2.2
Accommodation & Food	780	771	-1.2
Other Services	899	912	1.4
<b>GDP at Basic Prices</b>	<b>31,463</b>	<b>32,049</b>	<b>1.9</b>

p – Preliminary

Source: Manitoba Bureau of Statistics

For the fifth time in six years, Manitoba's unemployment rate was the lowest among provinces last year. The rate declined to 5.0% from 5.2% in 2002, and remained well below the national rate of 7.6%. Manitoba's youth unemployment rate declined by 0.4 percentage points to 9.8%, the second-lowest rate among the provinces and well below the national rate of 13.8%. Total employment increased 0.3%, with a 0.7% increase in full-time

employment partly offset by a 1.1% reduction in part-time jobs. Manitoba's employment rate – the ratio of employed to the total of the working-age population – slipped from its record-high 2002 level, but remained second-highest among provinces.

Manitoba's official July 1 estimate of population was 1,162,800 in 2003, up 0.63% from 2002. This was the fourth-best growth among the provinces and Manitoba's largest population increase since 1986. Manitoba benefited from strong net immigration in 2003. The net inflow of people to Manitoba reached 3,873, the most significant gain since 1983.

Housing starts increased 16.3% in 2003, more than double the national increase. Starts of single-family dwellings rose 4.9%, while multiple housing starts rose 73.2% to their highest level since 1989. The value of building permits issued last year rose 19.8% as residential building permits increased 19.2%, and non-residential permits rose 20.4%.

Manitoba retail sales increased 2.3% in 2003, down from the 7.2% growth of 2002. All retail categories posted increases last year except motor vehicles, which was down 1.4% following a cumulative 22% increase in the preceding two years.

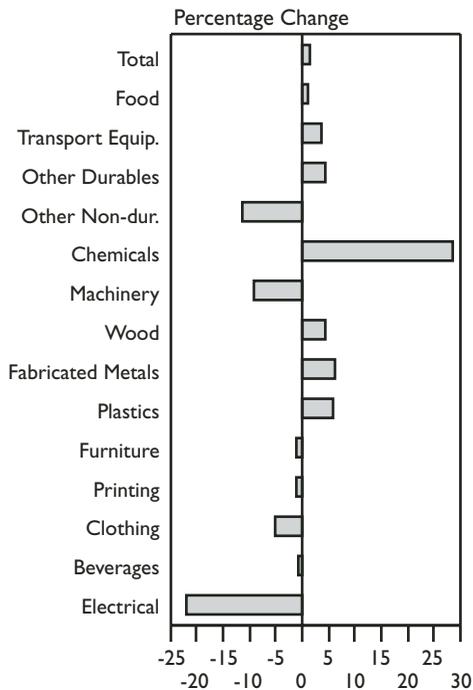
Manitoba consumer price inflation in 2003 was 1.8%, up slightly from 1.6% in 2002. It was the lowest inflation among provinces. One of the principal reasons for the low inflation was the modest 0.3% increase in automobile insurance premiums, the lowest increase in Canada and well below the national increase of 23.6%. According to Manitoba Finance's survey of economic forecasters, Manitoba's CPI inflation is expected to remain moderate with an increase of 1.1% in 2004, slightly lower than the national average increase.

Based on Manitoba Finance's survey of economic forecasters, Manitoba's rate of real economic growth is projected to rise to 2.9% for both 2004 and 2005.

*Manitoba benefited from strong net immigration in 2003. The net inflow of people to Manitoba reached 3,873, the most significant gain since 1983.*

*Housing starts increased 16.3% in 2003, more than double the national increase.*

**Chart 7**  
**Manitoba Manufacturing**  
**Shipments by Industry, 2003**



Note: Ranked by size in descending order.

Source: Statistics Canada

## ■ Manufacturing

Shipments from Manitoba's manufacturing sector rose 1.3% last year. This compares favourably with a national decline of 0.8%. Seven of Manitoba's fourteen manufacturing sectors posted higher shipments in 2003.

The value of shipments from Manitoba's two largest manufacturing industries, processed foods and transportation equipment, both increased. Shipments from Manitoba's chemicals sector – which includes pharmaceuticals, industrial chemicals and fertilizers – rose 28.5%, the most significant increase among Manitoba's manufacturing industries. Among the declines, the largest reductions occurred in electrical equipment (-22.0%) and other non-durable goods (-11.4%) (see Chart 7).

Shipments from Manitoba's food processing industry increased by 1.0% last year. Food processing is Manitoba's largest manufacturing industry, and shipments have increased 15% since 1998. Processed food products are an important export category, accounting for 11.9% of Manitoba's total foreign merchandise exports. Linked to Manitoba's large and diversified agriculture sector, principal processed food products include processed meats, dairy products, potato products and other prepared vegetables.

Manitoba's second-largest manufacturing sector is transportation equipment. It accounts for 14.9% of total manufacturing shipments. This sector is divided into two industry categories: aerospace manufacturing, which includes production by four large firms (Air Canada Technical Services, Bristol Aerospace Inc., Boeing Canada Technology and Standard Aero Limited) and motor vehicle manufacturing, which is dominated by North America's largest transit and intercity bus producers, New Flyer Industries and Motor Coach Industries. Despite challenging market conditions,

transportation equipment shipments posted a 3.6% increase in 2003.

Manufacturing is Manitoba's largest industry, accounting for approximately 13% of Manitoba's GDP. The majority of Manitoba's manufactured goods are exported. These exports include a diverse mix of industrial and consumer goods, including buses, furniture, food products, newsprint, aerospace equipment, printing and publishing, agricultural machinery, and chemicals. Manufactured goods account for 68% of total foreign merchandise exports.

Weak demand conditions in the U.S. through early 2003, and the sharp increase in the value of the Canadian dollar, depressed manufacturing exports by 1.4% last year. Manufactured exports to the U.S., which accounts for 86% of Manitoba's foreign market for manufactured goods, fell 1.7%, while exports to non-U.S. markets increased 0.3%.

Manitoba's manufacturing employment rose 0.6% last year. Nationally, manufacturing employment slipped by 1.4%. Manufacturing accounts for 12.2% of total employment in Manitoba.

## ■ Agriculture

Like the provincial economy overall, Manitoba's agriculture sector is highly diversified. In 2003, crops accounted for 52% of total market receipts in agriculture, while livestock accounted for 48%. Within these broad categories of production, Manitoba producers market a wide range of livestock and crop commodities.

Agriculture accounts for about one-fifth of Manitoba's foreign commodity exports, and 4.7% of Manitoba GDP. In 2003, the agriculture sector directly employed 31,400 persons, or 5.5% of the total employed labour force.

Manitoba's agriculture producers saw weaker results in 2003. Total farm cash receipts declined 6.4%.

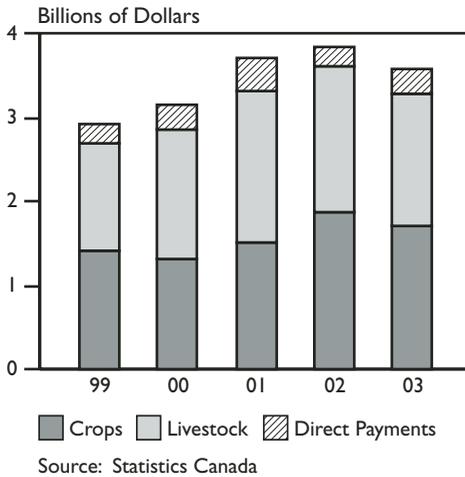
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**“Manitoba retains its status as one of the better performing provincial economies.”**

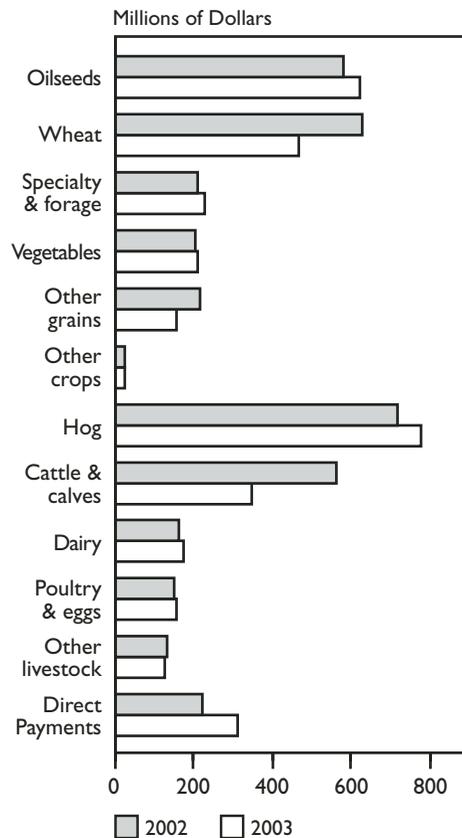
**RBC Financial  
March 2004**

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**Chart 8**  
**Manitoba Farm**  
**Cash Receipts**



**Chart 9**  
**Manitoba Farm Cash Receipts**  
**by Product, 2002 and 2003**



Receipts from crops were down 10% due to a 25.5% decline in wheat receipts. Livestock receipts shrank by 8.4% as a large decline in cattle receipts offset gains in most other livestock categories. Overall market receipts declined by 9.3%, while direct payments (various types of insurance payments, income stabilization payments, etc.) rose 40.8% (see Chart 8).

The major development in the livestock industry was the imposition of a worldwide ban on the import of Canadian beef products following the discovery of Bovine Spongiform Encephalopathy (BSE) in a single cow in Alberta. Prior to the ban, Canada was the third-largest exporter of beef in the world, with about half of the cattle produced in Canada exported as live animals or as meat. About 90% of these exports went to the U.S. Manitoba accounted for 10.8% of Canadian cattle production in 2002.

In September 2003, the U.S., Mexico and several other countries opened their borders to imports of Canadian boneless beef from animals younger than 30 months of age under a permit process. The U.S. Department of Agriculture has requested public input regarding its proposal that the border be re-opened to Canadian cattle imports and certain cuts of beef, a process that could lead to the resumption of live cattle exports into the U.S. in 2004. The Province has adopted a number of measures to assist Manitoba cattle producers deal with the difficulties caused by the U.S. cattle ban.

Farm cash receipts from cattle and calves declined by \$215 million, or 38.4%, in 2003. Foreign exports of live bovine animals – principally cattle – fell by \$116 million. At the same time, the export market collapse sharply increased the inventory of cattle on Manitoba farms.

In contrast, Manitoba hog producers saw cash receipts climb by 7.9% to \$777 million in 2003. While Canadian hog producers were adversely affected by the stronger Canadian dollar, the

total value of Manitoba hogs sold abroad jumped by 12.4%. Manitoba currently accounts for approximately one-quarter of Canada's hog production. Hogs accounted for about half of Manitoba's total livestock receipts last year.

Most other livestock categories, which together account for 29% of Manitoba's livestock receipts, posted gains last year, with good results for dairy, poultry and egg producers.

Manitoba producers enjoyed excellent yields for wheat and canola in 2003. The total volume of production for all wheat varieties rose 24%, while canola production rose 21% to the highest level in five years. Nevertheless, overall crop receipts declined as higher deliveries were offset by lower prices for most major grains and oilseeds.

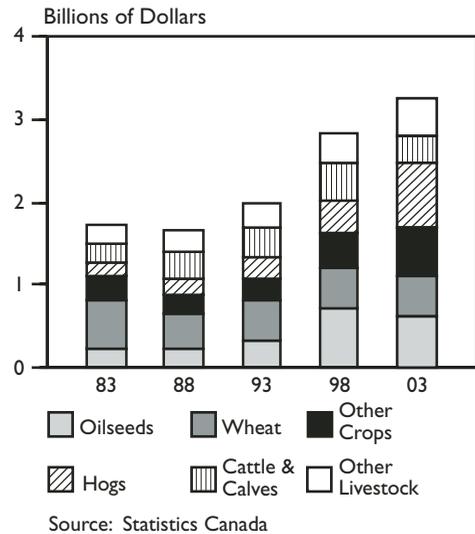
Wheat receipts declined sharply in 2003. Stronger supply conditions overtook the market as Canada, the U.S. and Argentina increased production. Sharply higher ocean freight rate costs and the significantly higher Canadian-U.S. dollar exchange rate also undermined producer prices last year.

Receipts from oilseeds – principally canola – rose 6.6% to the second-highest level on record. The drop in wheat receipts allowed canola to move ahead as Manitoba's principal crop by value last year.

Manitoba producers market a growing variety of other products, including barley, soybeans, sunflower, mustard seed, flax and vegetables. The growth of a number of non-traditional crop products underscores the continuing diversification of Manitoba's agricultural base (see Chart 10). For example, in the last decade, Manitoba's share of Canada's dry bean production has increased from just 6% in 1993 to 48% in 2003. Manitoba continues to be the country's largest producer of sunflower, with approximately 85% of Canada's total.

Potato production has increased from just \$10 million in 1993 to \$138 million last year. Manitoba has gone from being a minor producer

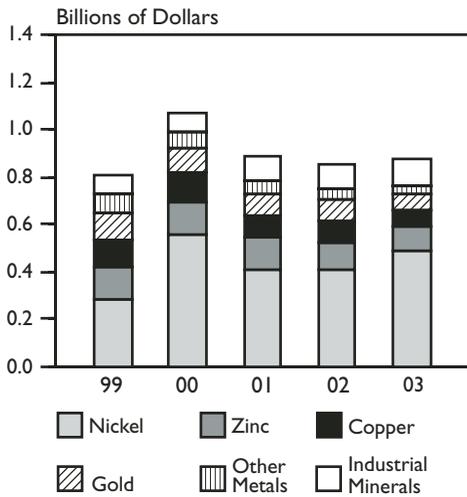
**Chart 10**  
**Manitoba Market Receipts**  
**by Type**



*Manitoba's share of Canada's dry bean production has increased from just 6% in 1993 to 48% in 2003.*

*Manitoba continues to be the country's largest producer of sunflower, with approximately 85% of Canada's total.*

**Chart 11  
Manitoba Mineral Production**



Source: Natural Resources Canada

of potatoes to being the second-largest in Canada, behind Prince Edward Island, with 20% of Canada’s total potato area. The growth of potato processing in the province, producing products like frozen potato chips for world markets, has not only boosted potato growing in the province, it has substantially increased the higher value-added food processing activity undertaken in Manitoba.

Total exports of potatoes and potato products reached \$174 million in 2002 and are expected to climb further over the coming years. The completion of Simplot’s new \$130 million potato processing plant in Portage La Prairie in 2003 enhances Manitoba’s position as a major international food processing centre, and will further diversify the agri-food sector.

The Manitoba Bureau of Statistics estimates that lower farm cash receipts for both livestock and crops in 2003 reduced net cash income (that is, farm income after operating expenses and direct payments) by 40.5% to \$535 million. Realized net income (after deducting depreciation charges) declined by 74.9% to \$127 million.

## ■ Mining

The value of Manitoba’s mineral production increased by 2.4% last year. Production of metals increased by 2.0%, while non-metallic mineral production rose by 6.2% (see Chart 11).

The value of nickel production increased by 22% in 2003 as a result of higher production volumes and a sharp 20.8% increase in average price. The strengthening of world nickel prices throughout 2003 and into early 2004 bodes well for this industry. At \$493 million, nickel is Manitoba’s most important mineral product, accounting for 57% of the total value of mineral production.

The closure of the Ruttan mine at Leaf Rapids in mid-2002 continued to reduce annual production volumes of both copper and zinc in 2003. The

value of copper produced in Manitoba declined by 27% to \$70.3 million due to lower production volumes. Similarly, the value of zinc produced in Manitoba fell by 18% to \$96.7 million. Copper and zinc accounted for 8% and 11% of Manitoba mineral production, respectively.

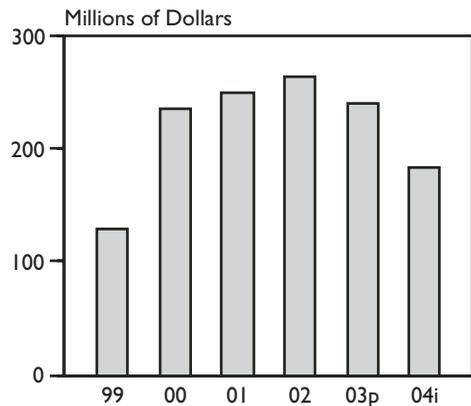
Lower volumes of gold production more than offset a 5% increase in average price, pushing the value of gold produced in Manitoba down by 25% to \$64.5 million.

Weak international prices for several metals has resulted in two Manitoba mine closures over the past few years. In June 2002, Hudson Bay Mining and Smelting closed the Ruttan mine in Leaf Rapids. The mine had produced copper and zinc. In 2001, the Harmony Gold Mining Company operation ceased production. The gold mine, located near Bissett, was placed in “care and maintenance” mode. In March 2004, the mine was purchased by a joint venture of San Gold Resources and Gold Cities Industries. The new owners plan to renew production at the mine.

Manitoba has several non-metal mining operations producing limestone, sand and gravel, marble, peat and other minerals. The total value of non-metallic minerals produced last year increased by 6.2% to \$102.5 million.

Mining investment in Manitoba declined by 8.9% last year to \$241 million (see Chart 12). Mining investment is expected to slip further in 2004, with Statistics Canada’s Survey of Private and Public Investment estimating a 23.8% reduction in investment spending. Several major investment projects have been undertaken over the past several years, with corresponding large increases in mining investment. Most recently, the Hudson Bay Mining and Smelting “777 project” in Flin Flon is expected to reach full production in August 2004. Inco’s Birchtree project, which involved mine shaft deepening to extend the mine life by 15 years, was completed in 2003 and has significantly boosted ore production at the facility.

**Chart 12**  
**Manitoba Mining Investment**



p - Preliminary i - Intentions

Source: Statistics Canada

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**“Broad-based strength... will be reflected in service-sector performance over the medium term, with the wholesale and retail trade, community, business, and personal service industries expected to perform quite strongly.”**

Conference Board of Canada  
February 2004

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Sustaining the level of mineral production requires new exploration to secure reserves. In Manitoba, 2002 exploration and deposit appraisal expenditures were estimated at \$29.8 million, 4% above the 2001 level. Exploration expenditures in 2003 are estimated at \$30 million, up slightly from 2002. Exploration is currently under way in several regions of Manitoba, focussing on several minerals including gold, platinum, nickel, copper, rare earth metals and tantalum.

Overall, mining accounted for 1.8% of Manitoba's GDP in 2003. Nickel, copper and other metals represent over 8% of the province's total foreign merchandise exports. Mining employs approximately 3,700 persons in Manitoba, with several thousand more employed in related services, such as transportation and business services.

## ■ Hydro-Electricity

Manitoba Hydro is Manitoba's largest utility and accounts for virtually all electricity generation, transmission and distribution in the province. Almost all of Manitoba Hydro's electricity is produced by water, a renewable source of energy. Currently, Manitoba Hydro has a generating capability of more than 5,000 MW, with the potential for further economical hydro-generating capacity in excess of 5,000 MW.

The value of hydro-electricity sales in Manitoba declined 5.8% in calendar year 2003 to \$1.28 billion (see Chart 13). This was the second annual decline in hydro energy sales and comes after more than a decade of annual sales increases. The decline was largely due to the reduced out-of-province electricity sales, reflecting the impact of reduced water flow for hydraulic generation last year.

The value of Manitoba sales, which accounted for 70% of the total, increased 1.4% in 2003. Total gross exports, which account for the remainder of sales, declined 19.4%. The value of export sales had

more than doubled between 1997 and 2001, driven by strong increases in exports to the United States and good water flows. Electricity exports to the U.S. account for about 83% of total out-of-province sales.

Manitoba Hydro is currently working closely with Northern Aboriginal communities in respect of potential new generating facilities. Two such facilities are under active consideration. The proposed Wuskwatim generating station would be built on the Burntwood River in Northern Manitoba and would generate 200 MW of power, with the earliest in-service date being 2010. The Gull (Keeyask) generating facility is another potential generating site. The Gull station would produce about 620 MW of power. Construction of the Gull facility would also require the construction of a transmission line to deliver power to Southern Manitoba. The combined cost of these two generating projects, as well as the required transmission facilities, is approximately \$4 billion.

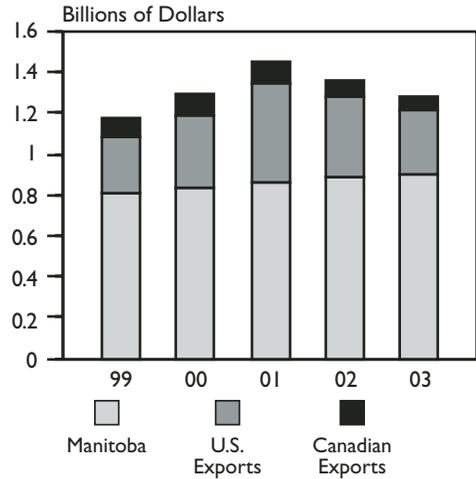
Another option under active consideration is the development of the Conawapa site. This 1,250 MW generating facility project would be similar in magnitude to Manitoba's Limestone facility, currently the largest generating station in the province. This project would assist in meeting the needs of out-of-province customers who would contract for the delivery of power from Manitoba Hydro.

Manitoba Hydro continues to make significant investments in infrastructure to maintain the highest customer satisfaction by providing high system reliability along with the lowest rates in North America.

Manitoba Hydro is a founding member of the Chicago Climate Exchange, a voluntary private pilot program for trading Kyoto greenhouse gases throughout the U.S. Trading will enable Hydro to gain practical experience in emissions trading on an international scale.

Several companies are gauging the strength of Manitoba wind resources including Manitoba

**Chart 13**  
**Manitoba Hydro-Electricity Sales**



*Manitoba Hydro is currently working closely with Northern Aboriginal communities in respect of potential new generating facilities.*

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**“Low-cost hydroelectricity-based generating capacity accounts for approximately 95% of installed capacity and results in one of the lowest variable cost structures in Canada.”**

**Dominion Bond Rating Service  
September 2003**

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Hydro, which has installed seven wind-monitoring sites throughout the province. Manitoba offers both a strong wind resource and the capability to “firm” wind power through the electricity system. Manitoba Hydro is currently negotiating with an independent wind producer for the purchase of output of a 99 MW wind farm near St. Leon. These negotiations are expected to be completed in the near future.

In August 2002, Manitoba Hydro signed a 10-year agreement with Xcel Energy of Minnesota for the export of 500 MW of electricity from Manitoba to Minnesota, starting in 2005. The agreement builds on the long-standing arrangements with Xcel Energy and is expected to produce \$1.7 billion in revenue over the life of the contract.

Manitoba Hydro continues to strengthen its position as a leader among Canadian utilities in voluntarily reducing greenhouse gas emissions. In the future, Manitoba Hydro is prepared to play an increasingly important role in meeting more of North America’s electrical energy needs through environmentally desirable hydro-electric resources. In so doing, it will continue to reduce global greenhouse gas emissions.

Manitoba has been successful in employing demand-side management programs to meet energy needs. Since its inception in 1991, the Power Smart program has promoted a wide variety of energy efficient programs, products and services. In 2003, the program was providing annual energy savings equal to the energy output of the 77 MW Point Du Bois generating station.

## ■ Housing

Manitoba’s housing sector posted another year of strong growth. Low interest rates and high consumer confidence levels helped push the number of housing starts in Manitoba up 16.3%, the third consecutive year of double-digit growth. This brings the increase over this period to 64%

(see Chart 14). Last year's growth was third-best among the provinces. Similarly, the total value of residential building permits issued last year was up 19.2% to \$526 million.

The number of single family dwellings built last year increased by 4.9% to 3,165, the highest level since 1988. Just over half of these were in Winnipeg. The strongest increases were for homes in the \$200,000 to \$250,000 and the \$250,000 plus categories. These categories accounted for approximately 40% of total new homes built in Winnipeg last year.

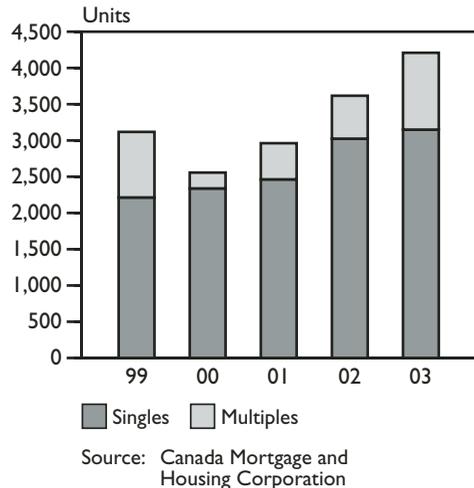
The number of multiple starts (apartments, row housing and duplexes) rose by 73.2% to 1,041 last year. This was the highest level of multiple starts since 1989 and almost double the average level of the past five years. The rental market vacancy rate rose slightly to 1.3%, and is expected to increase further to 1.5% in 2004. Canada Mortgage and Housing Corporation (CMHC) forecasts that 600 multiple-family housing starts will begin in Winnipeg in 2004.

While new home construction posted another banner year, the Winnipeg Real Estate Board reported that Multiple Listings Service sales in 2003 totalled 10,770 units, the highest level since 1992. This was the Board's best year on record as dollar volume exceeded \$1.1 billion, up 13% from 2002.

As in many cities in Canada, strong demand for housing resulted in higher housing prices over the past several years. Since 1999, the average Manitoba house price has increased 23.6%, while the average Winnipeg price has increased by 24.5%.

The CMHC projects that, as interest rates are expected to rise later in 2004, Manitoba's housing market will approach levels closer to historical norms. Single-family starts are expected to decline by 11.5% to 2,800, while multi-family starts will slip to 700, down by a third from the 2003 level. For the 2004 provincial resale market, CMHC forecasts virtually no change in the total number of sales.

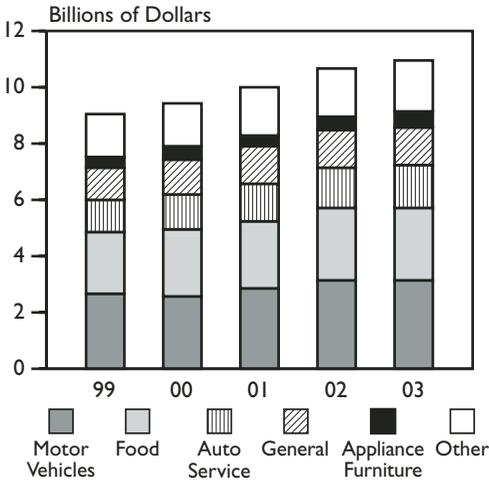
**Chart 14**  
**Manitoba Housing Starts**



**“Winnipeg’s diversified local economy has recorded solid economic performances in the long term, with low unemployment rates and a robust residential construction sector.”**

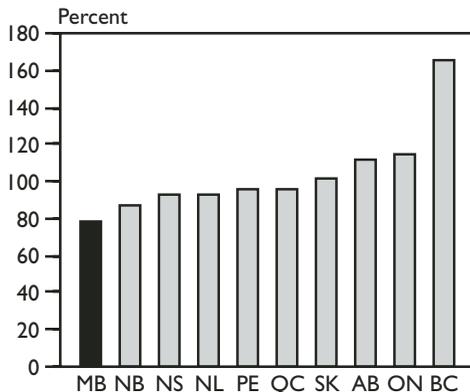
Standard & Poor’s  
April 2004

**Chart 15**  
**Manitoba Retail Trade by Type**



Source: Statistics Canada

**Chart 16**  
**Household Debt as a Percentage of Personal Disposable Income, 2001**



Source: TD Bank Financial Group

## ■ Retail Sales

Manitoba retail sales increased 2.3% last year, below the national increase of 3.0% and down from the 7.2% growth posted in 2002 (see Chart 15).

Manitoba's lower growth can largely be attributed to lower motor vehicle sales. The value of retail trade by motor vehicle establishments slipped 1.4% after significant increases of 8.5% and 12.1% in 2001 and 2002, respectively.

In the same vein, the number of new motor vehicles sold in Manitoba declined 6.6% in 2003. This follows a 13.9% increase in 2002, as Manitoba led the country in vehicle sales. The volume of motor vehicle sales in 2002 was at its highest level since 1987.

While motor vehicle sales declined in 2003, retail trade in other categories increased by 3.8%. Strong housing market activity helped boost sales of furniture and appliances by 3.4%, bringing the gains over the past three years to 21%. Food store sales rose 3.0%, while auto service sales jumped 4.2%.

Most economic forecasters project that interest rates in Canada will increase later in 2004 and in 2005. In an environment of rising interest rates, Manitoba's lower debt levels will help support personal expenditure growth relative to higher-debt regions. Among provinces, Manitobans have the lowest debt-to-income levels in Canada. In 2001, the ratio of household debt to personal disposable income was 78%, well below the national average of 113% (see Chart 16).

## ■ Tourism

Tourism receipts in Manitoba rose to approximately \$1.4 billion in 2002, an increase of 11.1%. About 60% of tourism expenditures were made by Manitobans in their own province, while 17% were made by Canadians from other provinces, and 17% by visitors from the U.S.

A number of factors adversely affected the tourism sector in 2003. Global markets were sensitive to issues related to infectious disease that marred tourism across Canada: SARS, West Nile and BSE. Similarly, the threats of global instability proved significant in deterring international travel.

These factors, combined with the rapid and significant appreciation of the Canadian dollar relative to the U.S. currency, contributed to the 4.6% reduction in overnight direct entries from the U.S. into Manitoba last year. Same-day entries declined 8.1%. In both categories, Manitoba fared somewhat better than Canada overall, which recorded declines of 12.4% and 13.6%, respectively.

Weaker tourism expenditure contributed to a decline in Manitoba's accommodation and food services industries. Real GDP in this sector declined 1.1% in Manitoba, compared to a 2.4% decline for Canada.

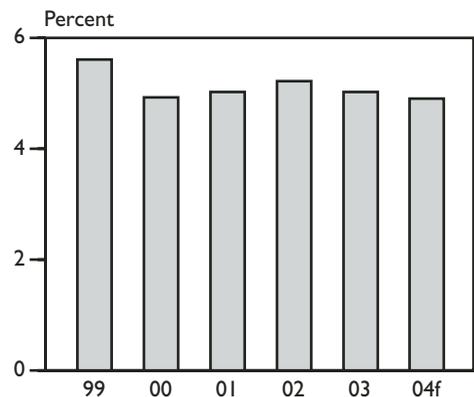
Manitoba will host a number of major conventions and meetings in 2004. These include 6,500 delegates to the Canadian Federation for the Humanities and Social Sciences in late May and June; 1,200 visitors to the Canadian Bar Association's Canadian Legal Conference and Expo 2004; 1,000 delegates for the Disabled Peoples' International World Summit 2004; and over 2,000 visitors for the National Aboriginal Health Organization's National Conference.

## ■ Labour Market

Manitoba's unemployment rate last year declined to 5.0% from 5.2% in 2002 (see Chart 17). This rate was the lowest in Canada, and remained well below the national rate of 7.6%. Total unemployment in the province fell to 29,900, a decline of 1,100, or 3.5%.

Manitoba's youth unemployment rate declined by 0.4 percentage points to 9.8%, the second-lowest rate among provinces and well below the national rate of 13.8%.

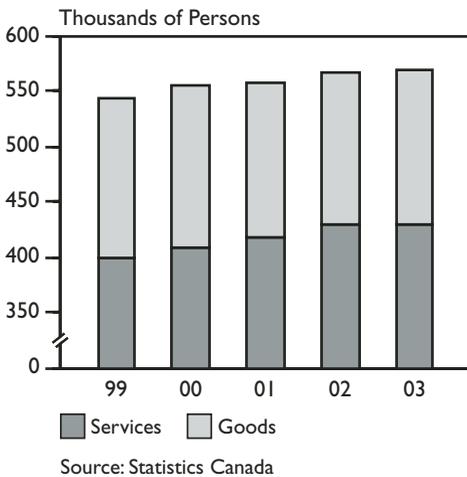
**Chart 17**  
**Manitoba Unemployment Rate**



f - Forecast

Sources: 1999-2003: Statistics Canada  
2004: average of economic forecasts

Chart 18

**Manitoba Employment**

Total employment increased 0.3%, with a 0.7% increase in full-time employment partly offset by a 1.1% reduction in part-time jobs. Total employment reached an all-time high of 568,700. Manitoba's goods-producing industries led employment growth, with solid gains in construction, utilities and manufacturing. Overall, goods-producing industries posted a 1.2% gain in employment while service sector employment increased only marginally (see Chart 18).

Manitoba's labour force grew only 0.1% last year. This comes on the heels of exceptional labour force growth in 2002, when it increased 1.9%, the strongest increase since 1986. Overall, tight labour market conditions persisted through the year.

The labour force participation rate edged down in 2003 by 0.2 percentage points to 69.0%. Manitoba continued to have the second-highest participation rate in Canada. Canada's labour force participation rate in 2003 was 67.5%.

Manitoba's employment rate – the ratio of employed to the total of the working-age population 15 and over – also slipped from its record-high 2002 level by 0.1 percentage points to 65.5% (see Chart 19). Like the participation rate, Manitoba's employment rate is the second-highest among provinces, and significantly above both Canada and the U.S.

**Labour Market Definitions**

**Employment:** Non-institutionalized, civilian working-age adults (15 years of age and older) that work at paid jobs plus those who are self-employed, including unpaid workers who contribute to the family's farm or other business.

**Unemployment:** People without work who are available for work and are actively looking for jobs, or have looked for work in the previous four weeks.

**Labour Force:** The sum of employment and unemployment. Excludes those who are not employed and who are not looking for work.

**Participation Rate:** Labour Force as a percentage of working-age adults.

**Employment Rate:** Employment as a percentage of working-age adults.

Manitoba Finance's survey of economic forecasters shows that Manitoba's annual employment growth rate is projected to rebound to 1.2% in 2004 and 1.1% in 2005. Manitoba's unemployment rate is forecast to stay at 4.9% in 2004, and drop to 4.7% in 2005.

## ■ Investment

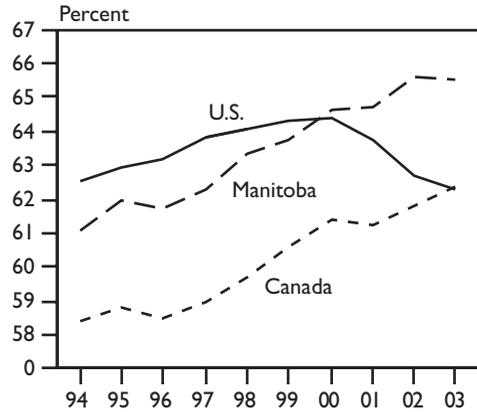
Total new capital investment in Manitoba is estimated to have increased by 0.7% in 2003, according to the Statistics Canada Survey of Private and Public Investment. Total investment is forecast to rise further to a record-high level of \$6.3 billion in 2004, an increase of \$323 million, or 5.4%. Growth is projected to be third-best among provinces and somewhat stronger than the projected national average gain of 3.1% (see Chart 20).

After three years of solid growth, private capital investment declined 3.3% in 2003. Over the 1999–2002 period, the level of private investment in Manitoba climbed 16.7%. Statistics Canada estimates that private investment will increase by 2.2% in 2004, slightly above the projected growth for Canada of 2.0%. Private investment accounts for approximately 72% of capital investment in Manitoba.

Public capital investment in Manitoba by the federal, provincial and local governments rose by 14.1% last year, almost double the national increase and second-strongest in Canada. For 2004, public investment is projected to increase 14.4%, double the national rate of public investment growth.

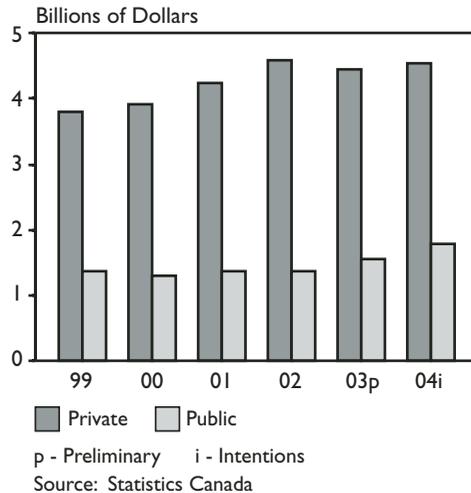
According to the Manitoba Bureau of Statistics, real (inflation-adjusted) business investment in Manitoba climbed 7.6% in 2003 with a 4.5% increase in non-residential structures and an 8.9% increase in real machinery and equipment spending (see Chart 21).

**Chart 19**  
**Manitoba, Canada and U.S.**  
**Employment Rate**

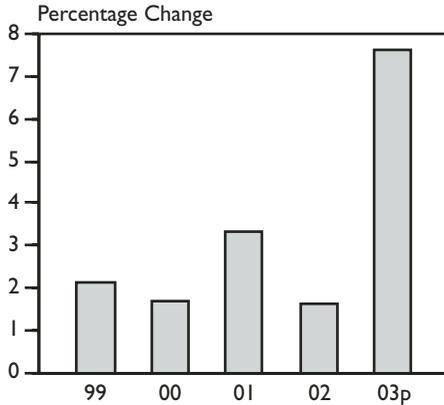


Sources: Statistics Canada and U.S. Department of Commerce

**Chart 20**  
**Manitoba Capital Investment**



**Chart 21**  
**Manitoba Real Business Investment**



p - Preliminary

Source: Statistics Canada

Several major capital projects are under way or being planned. Examples include the following projects.

- Construction continues on the 15,000-seat **MTS Centre**, a \$135 million arena and entertainment centre in downtown Winnipeg. The centre is scheduled to open in November 2004.
- \$3 million in improvements to **Kildonan Place Mall** now under way will boost total investment in the facility to \$5.5 million. The multi-phase project will be completed in July.
- A new \$15 million office complex in downtown Winnipeg will begin this spring. With completion late in 2005, the 90,000 square foot building will be home to the **Credit Union Central of Manitoba** as well as other tenants.
- **Manitoba Hydro** will be constructing a new 400,000 square foot head office in downtown Winnipeg starting later in 2004. Approximately 1,800 Manitoba Hydro staff will be located at the new headquarters. Completion of the project is expected in 2006.
- An agreement is in place for the construction of a \$20 million, 11-storey **office and luxury rental tower**. Construction is expected to start early in 2005 with completion in 2006.
- The \$17 million **Millennium Library** project in downtown Winnipeg will increase access to technology, boost collections, enhance services and expand facilities at Winnipeg's largest library.
- The **Health Sciences Centre** redevelopment is under way, providing \$100 million in capital investment as part of Manitoba's largest-ever health-related capital project.
- Plans are under way for the **Red River Floodway Expansion**, with construction to begin in 2005 and completion expected in 2009. This \$660 million project will increase flood protection and create thousands of local jobs.
- Construction of the **Richardson Centre for Functional Foods and Nutraceuticals** will begin

at the University of Manitoba's SMARTpark in the summer of 2004, with completion expected by the summer of 2005. This \$25 million facility will bring together researchers from the agriculture, foods sciences, human nutrition, medicine, and pharmacology disciplines, along with their industry partners, to study and develop functional foods and nutraceuticals.

- The new \$14 million, 55,000 square foot **Centre for Commercialization of Biomedical Technology** will be built adjacent to the National Research Centre's **Institute for Biodiagnostics**. The new facility will incubate start-up companies from the high tech medical technology sector and spinoffs from the NRC, assisting them to become self-sustaining.
- An environmental licence has been granted to **Bison Wind** to erect a 99 MW wind farm at St. Leon. This project, about a \$190 million investment, would be the largest single wind farm in Canada.
- In February, the federal government announced that **Husky Energy** was a successful applicant for \$6.4 million in financial support for an 80 million litre/yr ethanol production facility expansion in Manitoba. Manitoba passed *The Biofuels Act* in December 2003 that establishes a mandate requiring eventually all of the gasoline sold in Manitoba contain 10 percent ethanol.
- A \$52 million state-of-the-art **engineering and information technology complex** is under construction at the **University of Manitoba**, with completion slated for 2005.

Manitoba is home to two Labour Sponsored Investment Funds – professionally managed private equity funds that raise capital on a retail basis from individual Manitobans, with the assistance of federal and Provincial Government tax credits. The Province has also directly assisted the development of five venture capital corporations, which raise capital without the assistance of government tax credits. These Funds are generally structured as limited

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## Manitoba Venture Capital Corporations\*

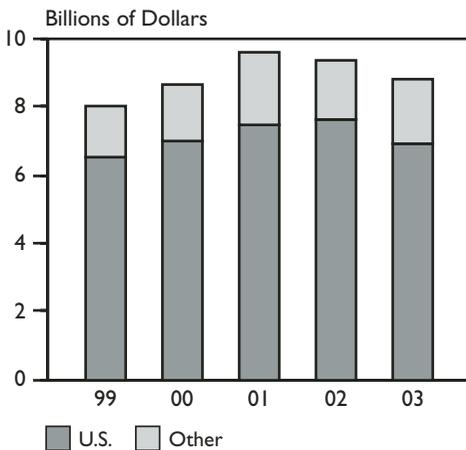
Manitoba Science & Technology Fund  
 Western Life Sciences Venture Fund  
 Renaissance Capital Manitoba Ventures Fund  
 Vision Capital Fund  
 Manitoba Capital Fund

\* Funds with Province as a partner

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*Manitoba has a lower relative dependence on the U.S. market than Canada as a whole. Higher diversification in export markets tends to make overall export performance more stable.*

**Chart 22**  
**Manitoba Foreign Exports**



Source: Statistics Canada

partnerships, with the Province typically being one of the minority limited partners. To date, the Province's participation in these Funds has assisted in leveraging a total investment pool of approximately \$135 million, which was subsequently invested into a wide variety of earlier-stage high-growth Manitoba companies. In 2003, the Premier's Economic Advisory Council created the Local Investment Council. The Council is comprised of community leaders and is mandated to explore the benefits and risks of Manitoba pension and insurance funds investing locally. The Council has been considering the issue and is developing options.

## ■ Foreign Markets

Manitoba's foreign merchandise exports declined 6.4% last year, the second consecutive annual decrease. A stronger Canadian dollar versus the U.S. currency, lower hydro exports and sharply lower cattle exports due to the U.S. ban on live cattle imports, all contributed to lower exports last year (see Chart 22).

Merchandise exports to the U.S. declined 8.8% last year. This was the first decline in merchandise exports to the U.S. since 1990. By industry, major reductions in U.S. exports were posted in agriculture industries (-20.9%) and electrical energy (-33.3%). Reduced exports of electricity, live bovine animals (mostly cattle) and crude petroleum (which passes through Manitoba to the U.S. and is recorded as an import to, and an export from, the province) accounted for 84% of the decline in exports to the U.S. in 2003.

Exports to non-U.S. markets increased by 3.6% last year. Merchandise exports to Japan (Manitoba's second-most important foreign market) declined by 17.3%. However, this decline was more than offset by increased exports to Manitoba's other major markets: Mexico, Hong Kong and the People's Republic of China.

## Manitoba Foreign Exports

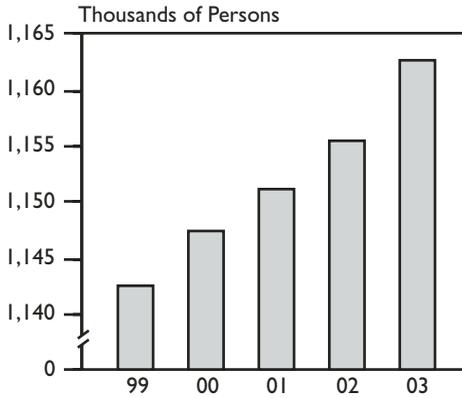
BY INDUSTRY	1999	2000	2001	2002	2003(p)	2003(p)
						Share
	(Millions of Dollars)					(%)
Manufacturing						
Food	834.2	830.1	996.0	1,058.6	1,051.3	11.9
Transportation Equip.	1,229.6	1,053.0	1,139.7	944.9	878.0	10.0
Primary Metals	608.1	745.8	803.5	847.1	870.0	9.9
Machinery	503.9	584.8	535.9	679.8	618.4	7.0
Wood	505.6	540.6	531.4	573.3	552.8	6.3
Chemicals & Chem. Prod.	333.6	359.2	418.1	398.1	459.6	5.2
Paper and Allied	240.9	268.6	254.9	267.1	298.0	3.4
Plastic Products	170.0	178.5	210.5	221.4	229.1	2.6
Electrical & Electronic Prod.	235.7	274.7	273.8	188.2	187.3	2.1
Refined Petroleum and Coal Products	88.5	205.8	118.7	135.4	186.1	2.1
Printing, Publishing & Allied	101.4	124.8	165.6	195.2	182.3	2.1
Furniture and Fixtures	128.0	158.2	171.5	166.8	125.1	1.4
Clothing and Textiles	157.7	194.4	155.5	144.6	117.7	1.3
Fabricated Metal	72.0	95.1	126.1	119.2	116.1	1.3
Other Manufacturing	138.4	134.4	127.1	164.5	142.2	1.6
<b>Total Manufacturing</b>	<b>5,347.6</b>	<b>5,746.8</b>	<b>6,029.3</b>	<b>6,104.8</b>	<b>6,018.8</b>	<b>68.4</b>
Agriculture	1,575.0	1,594.1	2,030.0	1,839.0	1,724.5	19.6
Electricity	343.0	442.7	534.7	390.5	260.6	3.0
Other Primary	550.5	639.8	714.5	792.3	518.1	5.9
Other Exports	222.9	255.4	267.8	279.5	278.2	3.2
<b>Total Exports</b>	<b>8,039.1</b>	<b>8,678.8</b>	<b>9,576.2</b>	<b>9,406.2</b>	<b>8,800.1</b>	<b>100.0</b>
<b>BY DESTINATION</b>						
United States	6,495.3	6,973.5	7,517.8	7,604.7	6,933.0	78.8
Japan	378.3	370.3	454.7	475.0	393.0	4.5
Mexico	105.5	124.8	177.3	148.1	159.7	1.8
Hong Kong	57.1	128.6	140.2	112.1	128.8	1.5
China, P. Rep.	161.0	108.5	167.9	79.5	123.2	1.4
Belgium	88.2	127.5	147.5	117.9	103.4	1.2
United Kingdom	68.3	61.3	56.1	72.7	63.7	0.7
Taiwan	33.8	55.2	52.1	57.6	53.8	0.6
Australia	18.8	27.4	39.5	47.8	51.5	0.6
Korea, South	29.8	24.9	34.3	8.4	48.8	0.6
Other Countries	603.0	676.9	788.8	682.3	741.2	8.4
<b>Total Exports</b>	<b>8,039.1</b>	<b>8,678.8</b>	<b>9,576.2</b>	<b>9,406.2</b>	<b>8,800.1</b>	<b>100.0</b>

Note: Adjustments to coin exports to the United States of \$989 million in 2000.

Totals may not add due to rounding.

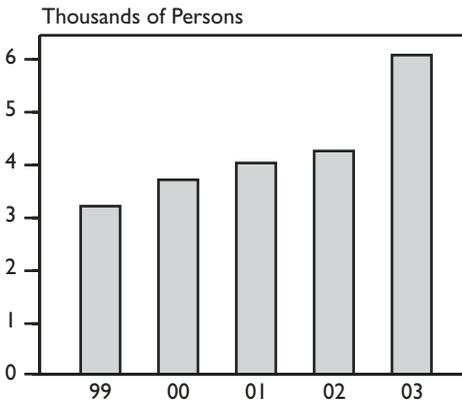
Source: Manitoba Bureau of Statistics

**Chart 23**  
**Manitoba Population**



Source: Statistics Canada

**Chart 24**  
**Manitoba Net International Migration**



Source: Statistics Canada

Manitoba has a lower relative dependence on the U.S. market than Canada as a whole. Higher diversification in export markets tends to make overall export performance more stable. 79% of Manitoba's foreign commodity exports are destined for the U.S. compared to 86% for Canada. About 68% of Manitoba's total foreign merchandise exports are manufactured goods, while 20% are agriculture products.

Manitoba is the only province in Canada where exports of goods and services to other provinces are consistently higher than foreign exports. This has a further stabilizing influence on the Manitoba economy. According to the Manitoba Bureau of Statistics, total exports of goods and services to other Canadian provinces in 2003 was \$12.1 billion, higher than the foreign export total of \$10.6 billion.

## ■ Population

Manitoba's total population was estimated at 1,162,800 as of July 1, 2003. This is Manitoba's "official" population for the year. The population growth from 2002 was 7,300 persons, or 0.63% (see Chart 23). This was the province's largest annual growth since 1986.

On a calendar year basis, Manitoba's total population grew by 7,584 in 2003, with total net immigration of 3,873 combined with natural population growth (births minus deaths) of 3,711. This was the best calendar year increase since 1986 (see Chart 24).

Total net migration last year increased to 3,873, the second consecutive year of net population growth through migration. This was the first back-to-back population increase through migration since 1984-1985. Total international net migration was 6,126, up 43% from 2002 largely because of a sharp increase in international immigration.

In large part, the increase in international migration reflected the success of the Manitoba

Provincial Nominee Program, a Program that targets immigration of skilled workers and business persons to Manitoba. Nominees accounted for 83% of the increase in international immigrants in 2003, and accounted for about half of all international immigrants to Manitoba last year.

Total net interprovincial out-migration was -2,253 in 2003. This is the second-best year performance for Manitoba interprovincial migration since 1985. Interprovincial net out-migration over the past two years has been considerably better than the average out-migration through the 1990s of -5,111 annually.

## **MANITOBA ECONOMIC OUTLOOK**

Overall, Manitoba's economy is expected to grow at rates near the national average in 2004 and 2005. Most forecasters anticipate that the U.S. economy will continue to strengthen, supporting demand for Canadian exports, although the continuing high Canadian dollar exchange rate will mute growth somewhat next year.

Manitoba Finance's survey of economic forecasters shows that real GDP in Manitoba is projected to increase by 2.9% in both 2004 and 2005. This is in line with the survey's projected national increases of 2.9% in 2004 and 3.4% in 2005.

Manitoba's nominal GDP is projected to increase by 4.5% in 2004 and by 4.6% in 2005. This compares with projected national growth of 5.0% in 2004 and 5.4% in 2005.

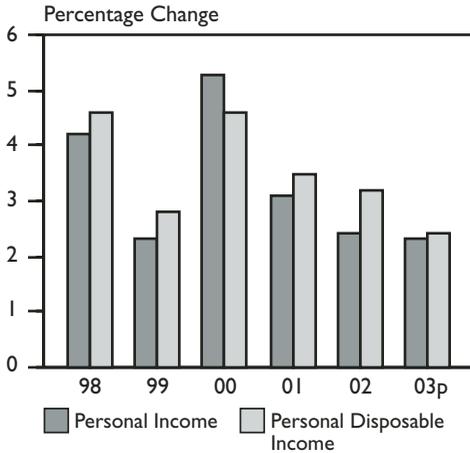
Manitoba's employment is expected to grow by 1.2% in 2004 and 1.1% in 2005. Manitoba's unemployment rate is projected to decline to 4.9% in 2004, declining further to 4.7% in 2005.

### **Manitoba Outlook at a Glance**

	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>
	(Percentage Change Except as Noted)			
Gross Domestic Product				
Real	2.3	1.9	2.9	2.9
Nominal	5.0	4.0	4.5	4.6
Employment	1.6	0.3	1.2	1.1
Unemployment Rate (%)	5.2	5.0	4.9	4.7
CPI	1.6	1.8	1.1	1.3

Sources: 2002 and 2003 are from Statistics Canada and Manitoba Bureau of Statistics; 2004 and 2005 are average of economic forecasters based on Manitoba Finance survey

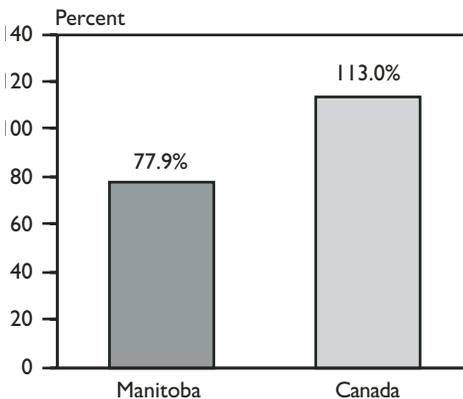
**Chart 25**  
**Manitoba's Personal Income Per Capita and Personal Disposable Income Per Capita, 1998 to 2003**



p - Preliminary

Sources: Statistics Canada and  
 Manitoba Bureau of Statistics

**Chart 26**  
**Household Debt as a Percentage of Personal Disposable Income, 2001**



Source: TD Bank Financial Group

## **HIGHER INCOMES**

One of the principal benefits of a growing economy is growing incomes. Higher incomes promote savings and investment, along with personal consumption and increased living standards.

Personal income and personal disposable income are two principal measures of overall economic well-being. Personal income includes wages and salaries, investment income and transfers from government (for example, employment insurance benefits and CPP income). Personal disposable income is personal income less personal income taxes and social security program contributions. Broadly, personal disposable income is the income left to individuals after their personal taxes have been paid.

Manitoba has posted a strong record of per capita income growth in recent years. In each year from 1998 through 2002, Manitoba's per capita personal disposable income level ranked fourth-highest among the provinces, behind Alberta, Ontario and British Columbia.

In 2003, Manitoba's per capita personal disposable income grew by 2.4%, ahead of the national average increase of 1.9%, and above the inflation rate of 1.8% (see Chart 25). Similarly, in per capita terms, Manitoba's personal income grew by 2.3% in 2003, higher than the national average growth of 1.9%. Manitoba's per capita personal income grew by 16.3% from 1998 through 2003, close to the national average increase of 18.2%.

## **THE MANITOBA ECONOMY: STRENGTH IN DIVERSITY**

Manitoba's economy continues to be recognized as one of the most diversified in Canada. Reports by Moody's Investors Service, Standard & Poor's, Dominion Bond Rating Service and CIBC all cite economic diversity as one of the province's major economic strengths.

Diversity provides long-term stability, as periodic weaknesses in some industries are balanced by strengths in others. No one industry dominates the province's economy. In fact, Statistics Canada data shows that Manitoba's economy posted the most stable growth performance among provinces over the past five years.

Even within the current industrial structure there is growing diversity, providing Manitoba businesses and workers with a more stable environment to grow and work. New developments in traditional industries have provided opportunities for Manitoba businesses to diversify into new markets, and bring new products to existing markets. This continual broadening and renewal of Manitoba's economic base offers the prospect of even greater stability and certainty for Manitobans in the future.

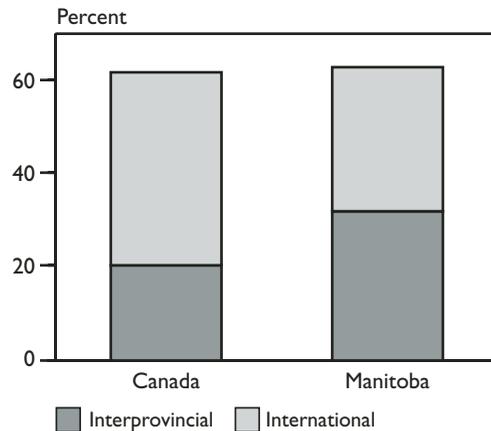
Manitoba is one of Canada's most export-oriented provinces. As Chart 27 indicates, total exports as a percentage of GDP were 62.5% in 2002, slightly ahead of the 61.2% national average. Manitoba's exports are split almost equally between interprovincial and international exports.

Manitoba companies have worked to take advantage of the province's central geographic location to maximize opportunities for trade with other provinces. The high volume of interprovincial trade has been recognized as an important contributing factor in maintaining stable economic growth. Being significantly less dependent on foreign trade has helped Manitoba's

**“Strong fundamentals support the stability of Manitoba's economy, including one of Canada's most diversified business mixes, reduced dependence on primary sectors, below average dependence on foreign markets and one of the lowest provincial unemployment rates.”**

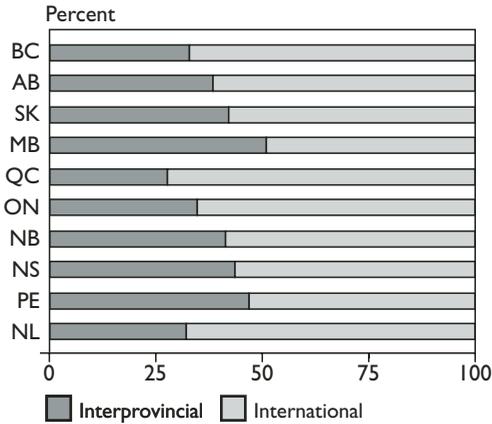
**Dominion Bond Rating Service  
Credit Rating Report  
Province of Manitoba  
September 30, 2003**

**Chart 27**  
**Ratio of Exports to Gross Domestic Product,  
Canada and Manitoba, 2002**



Source: Statistics Canada

**Chart 28**  
**Ratio of Interprovincial to International Exports, By Province, 2002**



Source: Statistics Canada

**Composition of Manitoba Foreign Commodity Exports, 1996 & 2003**

	1996	2003
	(Percent of Total)	
Manufacturing.....	57	68
Agriculture.....	28	20
Other Primary .....	9	6
Electricity .....	5	3
All Other.....	1	3

export industries avoid, to a greater degree, the overall declines in exports recorded in many other provinces over the last few years. It is worth noting that Manitoba’s export base is the most evenly balanced between domestic and foreign markets of any province (see Chart 28). In the rest of Canada the ratio of foreign to domestic exports is 2:1.

Manitoba’s foreign commodity exports have increased dramatically over the past several years and the diversification of the economy into increased value-added production can be best illustrated by the change in the shares of exports among major industries. In particular, manufacturing, which in 1997 accounted for about 56% of Manitoba’s foreign commodity exports, has grown steadily to account for over 68% of foreign exports in 2003. New product lines in areas such as furniture, prepared meats, potato products, industrial chemicals, plastic products, pharmaceuticals, and printing and publishing goods increased dramatically.

As noted above, Manitoba’s industry portfolio is broadly based, which helps manage the risk associated with a downturn in any particular industry (see Chart 29). Manufacturing is Manitoba’s largest sector, accounting for about 13% of total GDP. Manitoba is home to Canada’s largest furniture plant and is a major location for the manufacture of aerospace equipment, machinery, clothing and processed foods. Home to Motor Coach Industries and New Flyer Industries, Manitoba is also North America’s largest producer of intercity and urban buses.

Primary industries have historically played an important role in Manitoba’s economic growth and development. Agriculture, mining and other primary industries directly contribute about 7% to Provincial GDP. Manitoba’s agriculture sector has diversified significantly over the past several years, and now produces a broader range of crop and livestock varieties.

Relative to most provinces, Manitoba's service sector is large – a factor which provides added stability to the Manitoba economy. This sector encompasses a wide range of private and public activity, including wholesale and retail trade, finance and insurance, transportation, health care, education and real estate. Service industries accounted for approximately 73% of Manitoba's economy in 2003, higher than the 69% for Canada as a whole. The service sector also accounts for about 75% of jobs in the province.

Service industries tend to be less susceptible to fluctuations through the business cycle than most goods-producing industries. The province is home to many major service sector operations, including the head offices of two of Canada's major financial corporations – Great-West Life and Investors Group – the International Institute for Sustainable Development, the Canadian Wheat Board, and CanWest Global Communications. Winnipeg is also a major centre for several other service industries, including transportation and storage industries, business call centres and wholesale trade.

Manitoba anchors the northern end of the mid-continent trade corridor that connects Canada to the central U.S. and Mexico. The main lines of the two national railways and three railway lines to the U.S. meet in Winnipeg. This, coupled with major air and road transport links, has spawned a large cargo and freight transportation sector. Three of the ten largest employers in the country's for-hire trucking industry are headquartered in Winnipeg. The international border crossing at Emerson is the second-busiest in Western Canada.

Research and innovation has been pivotal in promoting the diversification of Manitoba's industries. The development and diffusion of new technologies and processes have strengthened industry in the province, and a number of major research establishments are located here. A large part of the research activities under way in the province are centered in our higher education institutions.

**Chart 29**  
**Shares of Manitoba Gross Domestic Product, 2003p**



**Manufacturing Exports, Major Growth Categories, 1996-2003**

	Percent Change
Chemicals.....	295.2
Printing & Publishing.....	292.0
Wood.....	166.9
Primary Metals.....	142.6
Plastics .....	132.1
Fabricated Metals .....	100.8
Food .....	93.0

## Manitoba Economic Statistics, 1999 to 2003

	1999	2000	2001	2002	2003
	(Millions of Dollars)				
<b>SECTORS</b>					
Farm Cash Receipts	2,908	3,151	3,697	3,826	3,581
Crops	1,401	1,313	1,519	1,884	1,695
Livestock	1,291	1,551	1,796	1,723	1,578
Direct Payments	216	287	382	219	308
Manufacturing Shipments	10,918	11,439	11,372	11,263	11,412
Mineral Production	811	1,069	885	850	871
Electric Power Sales	1,179	1,295	1,458	1,361	1,282
Export Sales	363	454	596	472	380
Housing Starts (no. of units)	3,133	2,560	2,963	3,617	4,206
Retail Trade	9,026	9,396	9,937	10,649	10,890
<b>FOREIGN EXPORTS</b>					
Total Exports	8,039	8,679	9,576	9,406	8,800
U.S.	6,495	6,974	7,518	7,605	6,933
<b>GROSS DOMESTIC PRODUCT</b>					
Nominal	31,925	34,085	35,219	36,997	38,491
Real	31,442	32,866	33,277	34,031	34,676
<b>BASE RATE WAGE SETTLEMENTS (%)</b>					
Public	2.4	2.5	2.4	4.6	3.0
Private	2.9	3.3	2.5	1.3	0.3
Total	2.5	2.6	2.4	4.0	2.8
<b>INVESTMENT</b>					
Total	5,186	5,198	5,591	5,963	6,005
Private	3,807	3,909	4,233	4,593	4,442
Public	1,379	1,289	1,358	1,370	1,563
Non-residential	4,332	4,286	4,578	4,767	4,702
Housing	854	912	1,013	1,195	1,303
<b>POPULATION</b>					
July 1 (000's)	1,143	1,147	1,151	1,156	1,163
<b>LABOUR MARKET</b>					
Labour Force (000's)	574.8	583.2	587.1	598.0	598.6
Employment (000's)	542.7	554.4	557.9	567.0	568.7
Participation Rate (%)	67.5	67.9	68.1	69.2	69.0
Unemployment Rate (%)	5.6	4.9	5.0	5.2	5.0
<b>CONSUMER PRICE INDEX</b>					
(Index, 1992=100)	115.2	118.1	121.2	123.1	125.3
<b>BANKRUPTCIES</b>					
Business	216	253	300	249	243
Farm	29	18	19	41	28
Personal	2,466	2,475	2,493	2,437	2,609

Sources: Statistics Canada, Industry Canada and Manitoba Bureau of Statistics

1999	2000	2001	2002	2003	
(Annual Percentage Change)					
-1.0	8.3	17.4	3.5	-6.4	<b>SECTORS</b>
-14.0	-6.3	15.8	24.0	-10.0	Farm Cash Receipts
6.1	20.2	15.8	-4.1	-8.4	Crops
134.5	32.9	33.1	-42.7	40.8	Livestock
5.3	4.8	-0.6	-1.0	1.3	Direct Payments
-9.2	31.9	-17.2	-3.9	2.4	Manufacturing Shipments
4.4	9.8	12.6	-6.6	-5.8	Mineral Production
13.0	24.9	31.4	-20.8	-19.4	Electric Power Sales
8.2	-18.3	15.7	22.1	16.3	Export Sales
2.9	4.1	5.7	7.2	2.3	Housing Starts (no. of units)
					Retail Trade
					<b>FOREIGN EXPORTS</b>
-0.4	8.0	10.3	-1.8	-6.4	Total Exports
7.0	7.4	7.8	1.2	-8.8	U.S.
					<b>GROSS DOMESTIC PRODUCT</b>
3.3	6.8	3.3	5.0	4.0	Nominal
1.6	4.5	1.3	2.3	1.9	Real
					<b>BASE RATE WAGE SETTLEMENTS (%)</b>
-	-	-	-	-	Public
-	-	-	-	-	Private
-	-	-	-	-	Total
					<b>INVESTMENT</b>
3.7	0.2	7.6	6.6	0.7	Total
-3.2	2.7	8.3	8.5	-3.3	Private
28.9	-6.5	5.4	0.8	14.1	Public
4.8	-1.1	6.8	4.1	-1.4	Non-residential
-1.4	6.8	11.1	18.0	9.0	Housing
					<b>POPULATION</b>
0.4	0.4	0.3	0.4	0.6	July 1 (000's)
					<b>LABOUR MARKET</b>
1.4	1.5	0.7	1.9	0.1	Labour Force (000's)
1.3	2.2	0.6	1.6	0.3	Employment (000's)
-	-	-	-	-	Participation Rate (%)
-	-	-	-	-	Unemployment Rate (%)
					<b>CONSUMER PRICE INDEX</b>
1.9	2.5	2.6	1.6	1.8	(Index, 1992=100)
					<b>BANKRUPTCIES</b>
-18.8	17.1	18.6	-17.0	-2.4	Business
7.4	-37.9	5.6	115.8	-31.7	Farm
1.8	0.4	0.7	-2.2	7.1	Personal

## Appendix I: RESEARCH AND INNOVATION

Innovation is a key element of economic growth and development. Innovation opens the door to higher productivity, higher living standards and a better quality of life.

A principal element of the innovation process is research and development (R&D). R&D creates the knowledge that ultimately can lead to innovation. Knowledge gained through research can produce new or substantially improved materials, devices, products or services, new processes or systems, or commercial applications. The discovery and application of research knowledge is necessary if the economy is to compete and prosper.

In Manitoba, fostering R&D and innovation is undertaken by a partnership of industry, higher education, the non-profit sector and governments. With this partnership, investments in research, innovation and in developing a skilled work force for knowledge-based industries will continue to grow.

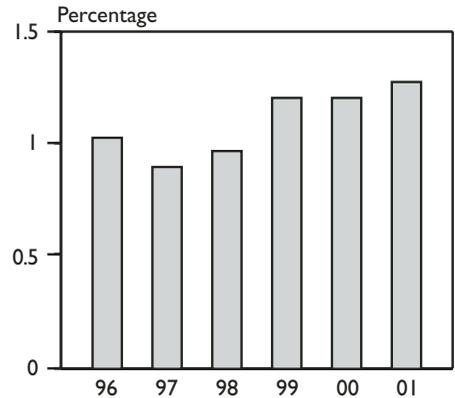
### ■ Manitoba's Research Environment

One of the principal measures of R&D effort is the ratio of R&D expenditure relative to GDP. In Manitoba, the current level of gross expenditure on research and development was estimated to be equal to about 1.3% of GDP in 2001. This is the fourth-highest ratio among the provinces and is an all-time high level of research activity in the province (see Chart 30).

Statistics Canada estimates that total gross expenditure on R&D in Manitoba in 2001 was \$453 million, up 70% over four years and the highest level of R&D spending ever recorded (see Chart 31). About 3,700 personnel are engaged in R&D in Manitoba, three-quarters of them in higher education and private businesses.

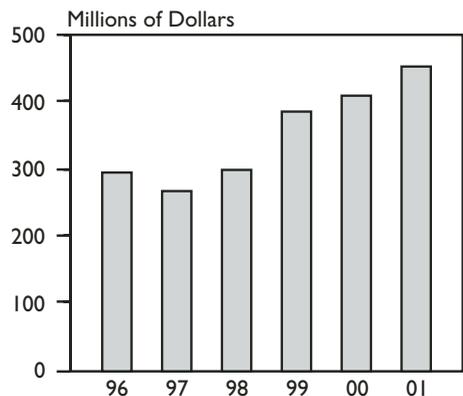
Industry is an important component of the Manitoba R&D environment. Approximately 230 Manitoba businesses were involved in R&D programs across

**Chart 30**  
**R&D Expenditure as a Percentage of Gross Domestic Product, Manitoba**



Source: Statistics Canada

**Chart 31**  
**Gross Expenditure on R&D in Manitoba**



Source: Statistics Canada

a variety of economic sectors. These firms performed \$161 million in in-house R&D in 2001, up from \$132 million in 2000. Private industry also employed over 1,400 personnel in R&D activities in the province in 2001.

Research and innovation in Manitoba spans a broad range of industries, including engineering, medicine, pharmaceuticals, agriculture and agri-food, aerospace products and other transportation equipment. The list of firms undertaking research in the province include Apotex, Cangene Corporation, Novadaq Technologies Inc., Biovail Corporation, Advanta Seeds, Brett-Young Seeds, BASF, Agricore United, Vansco Electronics, Xerox Canada, Inco Ltd., New Flyer Industries, Boeing Canada and Bristol Aerospace.

One of Manitoba's widely recognized research strengths is in the fast-growing biotechnology sector. The province is home to 37 biotechnology companies. One in ten of Canada's biotechnology companies currently undertake research in Manitoba, and approximately 6% of Canada's industrial biotechnology employees work in Manitoba. Biomedical, environmental and agricultural biotechnology are the primary research areas, with a specific focus on cardiac and vascular diseases, infectious diseases, cell biology and gene technology, nutraceuticals, disease resistance and quality enhancement in cereal and oilseed crops. The province is home to 20 research centres and groups that undertake biotechnology research.

Manitoba is also home to a number of major public research and development facilities. These include the University of Manitoba, the St. Boniface General Hospital Research Centre, the Canadian Science Centre for Human and Animal Health, the National Research Council's Institute for Biodiagnostics, the Manitoba Industrial Technology Centre, TRILabs, the Food Development Centre, the National Centre for Agri-Food Research in Medicine, Agriculture and Agri-Food Canada's Cereal Research Centre, Canadian International Grains Institute and the Prairie Agricultural Machinery Institute.

While the province is widely recognized for its current research facilities and programs, a number of significant new projects will further add to the province's R&D networks.

- Construction has just been completed on the 100,000 square foot, \$25 million **I.H. Asper Clinical Research Institute**, adjacent to the existing St. Boniface General Hospital Research Centre. The Institute will establish a new clinical research capacity designed to bridge the gap between the hospital's world-class cardiovascular research teams and patient care delivery. While improved health care delivery is a key aim, the project is also driven by a mandate to create more opportunities for high-tech product development, global marketing and export, skills development, recruitment of new specialized expertise, venture capital investment, public/private partnerships, contract research, intellectual property development and education. The new facility will include clinical research infrastructure, biomedical engineering facilities and a technology commercialization incubator.

- Construction of the **Richardson Centre for Functional Foods and Nutraceuticals** will begin at the University of Manitoba's SMARTpark in July 2004 with completion expected by the summer of 2005. This \$25 million facility will bring together researchers from the agriculture, food sciences, human nutrition, medicine and pharmacology disciplines, along with their industry partners to study and develop functional foods and nutraceuticals.
- The new \$14 million 55,000 square foot **Centre for Commercialization of Biomedical Technology** will be built adjacent to the National Research Centre's **Institute for Biodiagnostics** (IBD). The new facility will incubate start-up companies from the high-tech medical technology sector and spinoffs from the NRC, assisting them to become self-sustaining.
- An \$11 million renovation and expansion project at the **Food Development Centre** in Portage la Prairie will be completed in the autumn of 2004. The Centre provides a timely and cost-effective way for the agri-food industry and entrepreneurs to produce safe, high-quality food products. Supporting greater value-added processing of agricultural commodities, the facility provides applied research and development in processing and packaging of all types of food produced in Manitoba.

The federal government continues to have a major presence in science and technology funding in Canada. In Manitoba, federal funding for R&D was estimated at \$133 million for 2001/02, about 2.9% of the federal government's total commitment to R&D nationally. This share of national R&D investment is lower than Manitoba's share of national population, and the Government of Manitoba has encouraged the federal government to boost R&D funding in the province to recognize the funding deficiency.

The federal government supports science activities performed by federal departments and agencies, universities, businesses or other organizations. Federal departments and agencies conducting research in Manitoba include Agriculture Canada, Environment Canada, Fisheries and Oceans, Health Canada and the National Research Council. About 58% of the federal expenditures on R&D in Manitoba are for work carried out by these departments and agencies, while another 30% of the federally funded R&D is conducted by universities.

## ■ Provincial Support for Research and Innovation

The Province supports research and innovation both through direct spending programs, and through the Manitoba Research and Development Tax Credit.

Manitoba's direct expenditures on R&D include internal departmental spending, support to business enterprises, R&D support to universities and health care organizations, and support through the activities of the Industrial Technology Centre.

Manitoba's Research and Development Tax Credit encourages private sector R&D activity in Manitoba. The Tax Credit Program provides a 15% non-refundable Credit for qualifying R&D expenditures (see "Manitoba Research and Development Tax Credit", page A37).

In 2002/03, direct expenditure on R&D by the Provincial Government is estimated at \$19.4 million, up 3.7% from 2001/02 (see Chart 32). Most of the Provincial Government’s direct expenditure commitment to R&D is provided to universities, hospitals and other health organizations, including the Manitoba Health Research Council. The balance of Provincial R&D support is provided through the work of Government Departments, private businesses and other parties.

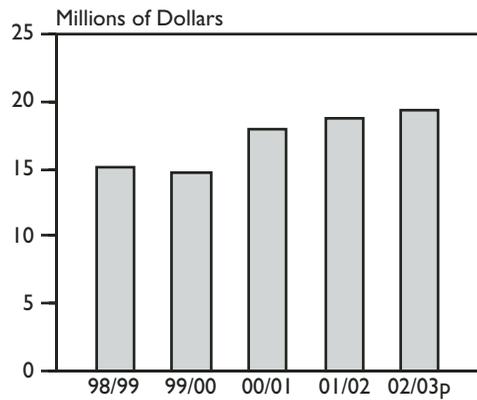
Manitoba partners with the federal government through the Manitoba Research and Innovation Fund (MRIF). The MRIF was established to assist in increasing the capabilities of Manitoba universities, colleges, hospitals and not-for-profit sector to conduct scientific research and product development. The Fund also enhances the ability of Manitoba research institutions to attract and retain world-class researchers and technicians, and increases Manitoba’s capacity to innovate through such means as supporting science awareness and technology commercialization.

This program, in part, leverages funds from outside sources, such as the Canada Foundation for Innovation (CFI), Genome Canada and the Canadian Institutes of Health Research (CIHR) Regional Partnerships Program (RPP). Funding in 2003/04 leveraged over \$14 million from other public and private sources.

In 2003/04, dozens of projects were funded through the MRIF, including several funded in partnership with the Canada Foundation for Innovation, which provides support for research infrastructure. The MRIF supported various research projects in several areas including infectious diseases, micro-electronics, and genomics at a number of Manitoba institutions including Red River College, Brandon University and the University of Manitoba. The table “Manitoba Research and Innovation Fund Projects, 2003/04” on page A36 provides a list of some of the projects funded last year.

As well as providing health research support through the various MRIF subcomponent programs, Manitoba has implemented the Health Research Initiative. The objectives of the Initiative are to assist Manitoba’s health research centres to increase R&D activities in Manitoba and facilitate sustained economic growth and the creation of high-quality jobs. The program is an incentive-based initiative with the distribution of funds tied to the amount of research revenue each Manitoba health research centre attracts from private industry and from non-governmental granting agencies outside the province. In 2003/04, the Health Research Initiative provided \$2 million to support operating costs for five health research centres in Manitoba.

**Chart 32**  
**Provincial Government**  
**Expenditure on R&D,**  
**1998/99 - 2002/03**



p - Preliminary

Source: Statistics Canada

## Manitoba Research and Innovation Fund Projects, 2003/04

	<b>Funding</b> (Thousands of Dollars)
200 kV Field Emission Gun – Electron Microscope .....	599
600 MHz NMR Spectrometer for Solids and Liquids .....	418
Canada – Kenya Infectious Disease Research .....	250
Canada Research Chairs – Infrastructure Grants (10 projects) .....	1,177
Centre for Agroecological Livestock Production Systems .....	1,100
Centre for Applied Research in Sustainable Infrastructure .....	275
Facility for the Study of Supercritical Water Flow .....	136
Fundamental Geonomics of Abiotic Stress in Crop Projects .....	190
Health Research Initiative.....	2,000
High Volume Combinatorial Drug Synthesis.....	161
Infrastructure for Neurobiology Laboratory .....	168
Manitoba Breast Cancer Research and Diagnosis Centre .....	604
Manitoba Centre for Health Policy Endowed Child Health Chair.....	400
National Micro-electronics and Photonics Testing Collaboratory .....	130
Richardson Centre for Functional Foods and Nutraceuticals.....	1,375
Regional Partnership Program.....	367
TRLabs .....	480
All Other .....	2,217
<b>Total .....</b>	<b>\$12,045</b>

Source: Department of Energy, Science and Technology

The Province provides additional health research support through grants to the Manitoba Health Research Council (MHRC) and the Manitoba Centre for Health Policy (MCHP). Support to the Council of almost \$2 million in 2003/04 enabled the MHRC to increase its activities. The Council promotes and assists basic, clinical and applied health sciences in Manitoba, and advises the Ministers of Health, and Energy, Science and Technology on health research matters referred to the MHRC. The Council operates a number of funding programs, including awards to post-doctoral and graduate students, Ph.D dissertation awards, and operating and establishment grants.

The MCHP is a research unit in the University of Manitoba's Faculty of Medicine. The MCHP provides population-based health services research and policy analysis to support health care decision makers and providers in offering the most effective and efficient services to maintain and improve the health of Manitobans.

## ■ MANITOBA RESEARCH & DEVELOPMENT TAX CREDIT

In 1992, Manitoba introduced a 15% non-refundable Corporation Income Tax credit for scientific research and experimental development undertaken in Manitoba by a taxable corporation with a permanent establishment in Manitoba. The incentive is tied to the criteria used to determine eligibility for the federal investment tax credit on qualifying R&D expenses and supplements the federal credit.

The federal and provincial R&D credits are broadly targeted insofar as both incentives are activity based, and apply to all sectors and industries. Both current expenditures, which include remuneration of persons engaged in research and the cost of materials and prescribed capital expenditures, which includes the cost of machinery and equipment, are eligible expenses for purposes of Manitoba R&D tax credit amounts.

From the inception of the Manitoba R&D tax credit through to the 2002 taxation year (the latest year for which data is available), firms conducting R&D in Manitoba earned \$77.2 million in Provincial tax credits.

Further detail in respect of the Research and Development Tax Credit programs is available at <http://www.cra-adrc.gc.ca/taxcredit/sred/menu-e.html>.

Over the years, studies by various agencies have repeatedly confirmed that Canada's income tax treatment of research is among the most generous in the world, especially when coupled with Provincial incentives. The following table shows the after-tax cost associated with R&D current expenses for a large corporation and a small privately-owned corporation, based on 2003 income tax rates.

### After-Tax Cost of \$100 R&D Expenditure, 2004

	<u>Large Corporation</u>	<u>Small Private Corporation</u>
Eligible R&D expenditure	\$100.00	\$100.00
(less) Manitoba tax credit	15.00	15.00
(less) Federal tax credit	<u>17.00</u>	<u>29.75</u>
Deductible Amount	68.00	55.25
<b>Tax Savings:</b>		
Manitoba	10.54	2.76
Federal	<u>15.04</u>	<u>7.25</u>
<b>Net after-tax cost</b>	<b>42.42</b>	<b>45.24</b>

A newly created endowed Chair in Child Health will provide a focus on understanding the links between child development and human development.

The Government of Manitoba is also a partner with the federal government in the Networks of Centres of Excellence program. This program was established several years ago to support research at universities and hospitals in partnership with the private sector. Manitoba's objectives in developing the Manitoba Centres of Excellence Fund (MCEF) are to attract and maintain world-class R&D activity to Manitoba and to generate related spinoff benefits for local companies and non-profit institutions.

In 2003/04, 12 Manitoba Network of Centres of Excellence research programs received support totalling \$484,000 through the MCEF. Grants were provided to research programs such as the Canadian Genetic Diseases Network, the Canadian Institute for Telecommunications Research, Intelligent Sensing for Innovative Structures, the Canadian Stroke Network and Sustainable Forest Management.

Manitoba continues to support a number of major research initiatives in the province related to agriculture. The Agri-food Research and Development Initiative (ARDI) provided \$1 million in funding for research and development aimed at enhancing diversification, value-added opportunities and export capabilities in the province's large agri-food sector.

The Province supports a special operating agency, the Food Development Centre, to undertake R&D and related services to bring new Manitoba food products to market. The Centre provides support to clients in product development, food processing and packaging, and shelf-life testing. The Centre is undertaking an \$11 million expansion, which should further support the diversification of the agri-food sector in Manitoba and move more new products from the province into the international marketplace.

Portage la Prairie is also home to the Prairie Agricultural Machinery Institute (PAMI) Manitoba testing and development station. Established over 25 years ago, PAMI is jointly sponsored by the governments of Manitoba and Saskatchewan. PAMI tests machinery for a wide range of clients, including equipment manufacturers, farm producers, commodity groups and governments. Although the Provincial Government provides some financial support to the Institute, PAMI has been a largely self-supporting research organization through fee-for-service arrangements.

Another special operating agency of the Manitoba Government is the Industrial Technology Centre (ITC). ITC facilitates technological change and innovation by providing advanced technical research and testing for a variety of manufacturers, inventors and other clients. Facilities and services include a calibration laboratory, noise and vibration analysis, mechanical testing, advanced document examination and administrative support for product development and related activities. For the past two years, ITC has operated a \$1.5 million Virtual Reality Centre, which allows businesses to realistically simulate new products before they are built. Manufacturers can use the virtual technology to design any product with computer images that show how two-dimensional models will actually look and feel in a three-dimensional world. The Centre is the only one of its kind in Canada.

Manitoba is home to one of five TRILabs applied research laboratories. Sponsored by university, government and industry partnerships and funded in part by the Department of Energy, Science and Technology, it is Canada's largest not-for-profit information and communications technology research consortium. TRILabs Winnipeg was established in 1994 and employs 58 people in the area of data networking – research aimed at improving the speed, reliability and efficiency of the communications network. TRILabs creates innovative technologies and trains students to enhance ITC expertise and improve Canada's global competitiveness.

As well as direct sponsorship of research and innovation programs in the province, the Manitoba Government has supported several investment capital supply programs. Some have provided venture capital support to new and innovative companies, including the Manitoba Science and Technology Fund and Renaissance Capital Fund. Established in 2002, the \$45 million Western Life Sciences Venture Fund focusses on bringing life sciences research and new knowledge to commercial development. Two labour-sponsored venture capital corporations, the Crocus Investment Fund and Ensis Growth Fund Inc., are an active, ongoing source of investment capital for growing Manitoba companies.

Manitoba Hydro commits approximately \$5 million per annum to a research and development program to assist in providing higher system reliability, lower electricity rates, increased safety of the system infrastructure and improved customer quality of service. Some of this research is undertaken in-house, while the company sponsors other research at universities and other external research facilities. Last year, Manitoba Hydro helped support 110 individual research projects.

Manitoba Hydro also operates the HVDC Research Centre. The Centre, established in 1981, performs innovative research and development in high voltage DC and power electronic technologies, instrumentation and simulation. The Centre has become a world leader in the technology of electric power system simulation, applied power systems analysis and related technologies.

## ■ University of Manitoba

Universities and other post-secondary institutions play a critical role in Canadian R&D activities. These institutions provide the knowledge and the skilled labour force necessary for innovation, and serve as incubators for new ideas in basic and applied research.

In Canada, higher-education institutions account for about one-third of the R&D work performed. In Manitoba, the role of higher education is even more important as higher education (including related institutes, clinics and research stations) accounts for half of the R&D activity.

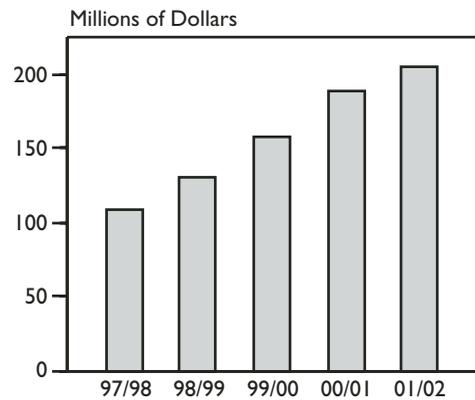
Statistics Canada estimates that R&D expenditures by Manitoba's higher-education sector in 2001/02 totalled \$205.8 million, up from \$189.6 million in 2000/01 (see Chart 33). Natural sciences and engineering (including health sciences) accounted for approximately three-quarters of this total, while social sciences accounted for the remainder.

The University of Manitoba is one of Canada's major research universities. The University has enrollment of 26,600 students with more than 3,000 academic and support staff. The University's reputation for outstanding research has earned it national and international recognition, and helps it to earn over \$100 million annually in grants and contracts. Many of the research projects conducted at the University involve collaboration and partnership with other higher education institutions, private firms, community organizations and governments. The University is home to more than 20 research centres and affiliated institutes ranging in scope from defense and security studies to cardiovascular sciences.

The University is an active participant in the national Networks of Centres of Excellence program. Currently, the University's researchers participate in 16 of the 21 networks created under this program, and the University is the network leader of Intelligent Sensing for Innovative Structures Canada, the national network focussing on "smart" civil infrastructure.

The University of Manitoba has established 28 Canada Research Chairs to ensure its leadership role in areas of established excellence. The research programs of these Chairs focus on such important fields as infection and immunity, aerospace materials, protein chemistry, natural resource management and Canadian social history. The University's life sciences research activities are further strengthened through active partnerships with several major provincial medical research organizations, including CancerCare Manitoba, the Health Sciences Centre, St. Boniface General Hospital Research Centre, the Manitoba Institute of Child Health and the Canadian Science Centre for Human and Animal Health.

**Chart 33**  
**R&D Expenditure in Manitoba**  
**Higher Education**  
**1997/98-2001/02**



Source: Statistics Canada

Construction is beginning on the University's new Engineering and Information Technology Complex, which will provide leading-edge research and teaching facilities for engineering and computer science. New laboratories and equipment will help build on all current areas of research expertise – including advanced manufacturing, advanced materials, biomedical engineering, civil infrastructure, electrical power systems and information technology/communications – and create new research opportunities. In addition to building innovative links between the engineering and computer science disciplines, the complex will strengthen research collaboration with industry.

SMARTpark, the research and innovation park located at the University of Manitoba, continues to grow. SMARTpark brings together industry and the University to promote R&D and the development of knowledge-based industry. One of the key features of the park is its proximity and access to the extensive resources of the University.

2003 saw the completion of a second 30,000 square foot multi-tenant research facility at SMARTpark. Several independent firms and a business incubator facility, "Incubat," have now made the SMARTpark facility home. Incubat is intended to promote the development and commercialization of research from the information technology and biotechnology sectors in Manitoba through mentoring, technology transfer and knowledge-based economic development.

Cangene Corporation, a world leader in the development, manufacture and commercialization of specialty hyperimmune plasma and biotechnology products, recently completed an \$8.5 million, 65,000 square foot expansion of a pharmaceuticals facility at SMARTpark. Construction of the Richardson Centre for Functional Foods and Nutraceuticals will begin at SMARTpark in the summer.

## **University Of Manitoba National Centres of Excellence**

- Intelligent Sensing for Innovative Structures (Leader)
- genetic diseases
- arthritis research
- stroke research
- robotics and intelligent systems
- bacterial diseases
- protein engineering
- water research
- sustainable forest management
- photonic innovations
- microelectronic devices and systems
- automobile design and engineering
- vaccines and immunotherapeutics
- mathematics of information technology
- advanced food and materials
- arctic research

## **Appendix 2:**

# **CLEAN ENERGY, CLIMATE CHANGE AND ECONOMIC DEVELOPMENT**

### **■ Introduction**

The world's second-largest reinsurance company, Swiss Re, reported that the negative impact of climate change cost the world \$80 billion in damages in 2003, and warned that the annual costs of climate change could reach \$200 billion within ten years – hitting insurers every year with claims equal to a World Trade Centre attack. The single most costly item was the European heat wave of 2003, the worst in Europe's recorded history. It claimed more than 35,000 lives, cost farmers \$13 billion in lost production, saw British temperatures reach 38°C for the first time, closed nuclear plants in Italy due to a lack of cooling water, saw wildfires sweep France and Portugal as temperatures reached above 45° Celsius, and triggered dozens of avalanches in the Alps. All this just a year after record-breaking floods swept across Central Europe. These events help explain why Swiss Re concluded, "Today, global warming is a fact. The climate has changed: visibly, tangibly, measurably."

Western Canada has also been facing more frequent extreme climatic events. Forest fires stretched across every Western province, and while Kelowna was the most visible example, Manitoba was actually the most heavily affected. Drought continued to hit large areas of the West, hurting farmers and lowering hydro-electric production. British Columbia's increasingly warm winters have freed the mountain pine beetle from winterkill – unleashing the worst insect-related forest disaster in our history, with 4.2 million hectares of pine forest already infested.

Meanwhile, scientists at the U.S. observatory at Mauna Loa measured the highest global CO<sub>2</sub> levels yet recorded (379 ppm vs. 316 ppm when the site opened in 1958). Britain's Chief Scientific Advisor, Sir David King, toured the U.S., explaining Britain's commitment not just to the Kyoto targets, but to achieving a 50% cut by 2050, and asserting, "Climate change is the biggest issue for us to face this century. It's man-made. And the science is done."

The debate over the science of climate change is likely to continue for many years, as will international political debate. But perhaps more important than the state of the scientific debate is the fact that the last few years have witnessed an extraordinary accelerated rollout of new, clean technologies and products – the fruit of large-scale Research & Development (R&D) and investment efforts by major corporations, investors, scientists, governments and communities.

While the development and rollout of these new technologies have been accelerated by climate change policies, they have also been driven by other powerful factors – technological innovation, the need for cleaner air and water, volatile global oil and gas prices, and changing customer preferences. Perhaps the three most visible innovations today are:

- Hybrids. The first hybrid vehicle arrived in North America in 2001, promising to improve fuel efficiency by 30% to 60%. This year, the Toyota Prius hybrid won Motor Trend's Car

of the Year award, and global sales of hybrids reached \$5 billion. Within two years, 17 models with hybrid engines will be available to North American buyers. Global sales are projected at \$30-\$70 billion within a decade.

- **Wind power.** Wind power has been the world's fastest-growing source of electricity generation for a decade, and now sustains annual sales of \$12 billion. Individual turbines manufactured by firms such as GE and Mitsubishi now reach 80 metres in hub-height, and have blades larger than the wings of a Boeing 747. Global sales are projected at \$90 billion annually within a decade.
- **Ethanol.** U.S. ethanol production has tripled over eight years, with annual sales reaching \$8 billion. Eighty North American ethanol plants now produce 13 billion litres of fuel – the equivalent of 75 million barrels of oil annually. Canadian production is expected to triple within two years, while the U.S. plans to add another seven billion litres.

Across the globe, investors, researchers and governments are racing to expand their shares of these exponentially growing markets – some focussing on the automobile, fuel cells and the “hydrogen economy;” others on wind power, solar photovoltaic panels, and the “emerging renewables.” Rural areas are sites for “biofuels and bioproducts” such as ethanol and biodiesel, bioplastics, biomaterials and carbon sequestration; while urbanites focus on hybrid vehicles, smart metres, advanced appliances and the immediate savings available to them through “energy efficiency.”

Two years ago, the Government of Manitoba decided to strengthen its national position on climate change. Eighteen months ago, it backed up this approach with a new Department of Energy, Science and Technology – including a new unit, the Energy Development Initiative with a mandate to focus on these opportunities. It has become clear that Manitoba's approach is to ensure minimal downside risk to existing major industries, position itself to lever in new resources, and benefit from the very specific advantages it possesses.

Perhaps the most noteworthy development of the past two and one-half years (since the Axworthy Report on climate change), is that Manitoba has become a Canadian leader in developing a number of these proposals and projects – in new hydro, hydrogen, new buildings, ethanol, transmission, heat pumps and wind. These projects will help to boost Manitoba's energy self-sufficiency, speed its move away from fossil fuels, and enable the creation of a renewable energy hub – where generation, transmission, efficiency and expertise will meet. With development in these fields being extremely rapid, it is worth surveying those sectors which are most important to Manitobans.

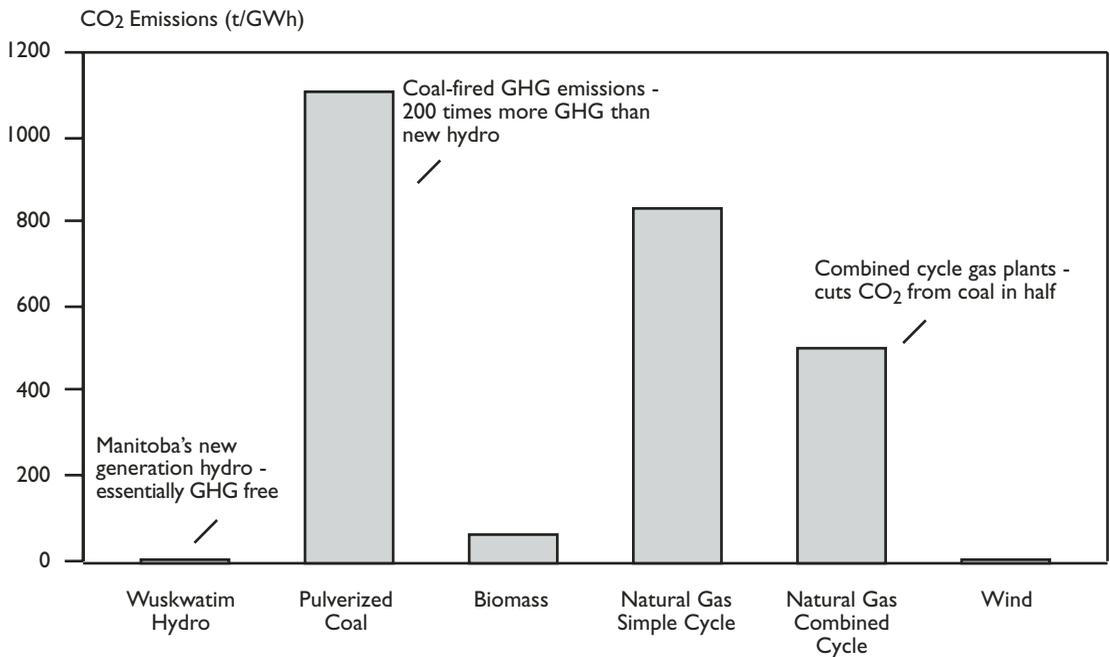
## ■ New Generation Hydro

Manitoba Hydro provides among the lowest-cost electricity on the continent, largely as a result of its hydro-electric generating base. The fact that 95% of our power is generated through renewable hydro-electricity also means that it generates less CO<sub>2</sub> per kilowatt hour than any other utility in North America. As neighbouring coal-based jurisdictions (such as the U.S. Midwest, Ontario, Saskatchewan and Alberta) come under increasing pressure to reduce their CO<sub>2</sub> emissions and clean up smog and acid rain, Manitoba's potential to export clean energy rises correspondingly.

While Manitoba has 5,000 megawatts (MW) of potential new hydro-electric capacity available, it has decided to proceed prudently with the development of these resources, and to minimize and even eliminate certain problems associated with hydro development in the past.

- All new Manitoba Hydro projects will be designed so that flooding is substantially reduced or virtually eliminated. For example, the Wuskwatim project was originally designed to generate 350 MW of power, a design which would have resulted in the flooding of 140 square kilometres (km<sup>2</sup>) of land. In consultation with local Aboriginal communities, a new-generation, “run-of-river” design was chosen, which reduced capacity to 200 MW, but which also virtually eliminated flooding. By comparison, previous projects, such as James Bay in Quebec, flooded more than 10,000 km<sup>2</sup>, whereas Wuskwatim will reduce land-take to an area less than 0.4 km<sup>2</sup> (less than a single quarter section of farmland.)
- Manitoba has ensured that Aboriginal communities – which historically have borne a significant share of the hardship associated with past projects – are not only consulted, but enabled to become active, direct financial partners in these new projects. This means employment opportunities during the construction and operation, as well as active pre-project training to ensure maximum skill development – skills which can be used to generate income long after construction is complete. First Nations will also benefit from a direct share in the project’s lifetime revenue streams through an equity partnership at Wuskwatim.
- Manitoba is working with potential buyers to ensure that, wherever possible, the new export sales are used to reduce coal-fired generation, and thus, CO<sub>2</sub>, acid rain, mercury and other emissions. Since Ontario and Saskatchewan have a significant number of aging coal-fired plants, tightening

### Manitoba’s New Generation Hydro - Reduces Air Pollutants by 99.9%



Source: Pembina Institute

environmental and climate-change regulations will result in significant emissions reductions. For example, the estimated 20-year value of the 7-9 million tonnes of CO<sub>2</sub> to be reduced through a major coal-displacing power transfer to Ontario ranges from \$1.0 - \$4.8 billion.

These changes represent a great opportunity for “new generation hydro,” and encompass both larger-scale projects like Wuskwatim (200 MW), Conawapa (1,250 MW) and Keeyask (620 MW), as well as hydro micro-projects in off-grid, diesel-dependent communities such as Brochet and Lac Brochet.

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## Manitoba’s New Generation Hydro Design Floods Less Than One Average Canadian Farm

	<u>Old Design</u>	<u>New Generation</u>
Power.....	350 MW	200 MW
Flooding.....	140 km <sup>2</sup>	< 0.5 km <sup>2</sup>

Economically, the three larger projects could trigger 80,000 person-years of employment. Further, they could generate substantial new tax revenues (including \$700 million for the federal government.) Environmentally, they would displace enough coal-fired CO<sub>2</sub> to make this clean energy project the single largest CO<sub>2</sub>-reducing measure in Canada.

Clean energy, such as would come from the Conawapa Project, would need a buyer. Manitoba finds itself in an enviable position, with Ontario requiring up to 25,000 MW of additional clean power to meet its supply/demand “gap” over the next two decades. In addition, there are considerable export opportunities in other neighbouring jurisdictions. To support the power transfer from our province, Manitoba has developed and promoted the concept of a “National Clean Energy Grid.” Nationally, existing east-west interconnections between Manitoba and Ontario are able to carry only 300 MW (compared to 2,250 MW North-South to the U.S.) which leaves in question Canada’s ability to secure a reliable and sufficient energy supply. In addition, Canada needs increased investment in east-west transmission capacity to carry clean energy to Canadian markets. Strategically, such a development would offer Manitoba the critical marketing advantage of being able to sell both east-west and north-south, while Ontario could assure itself of substantial supplies of clean power at a stable price. A Clean Energy Grid could also be designed to accommodate wind power in Northern Ontario which, due to lack of transmission, is currently “stranded”.

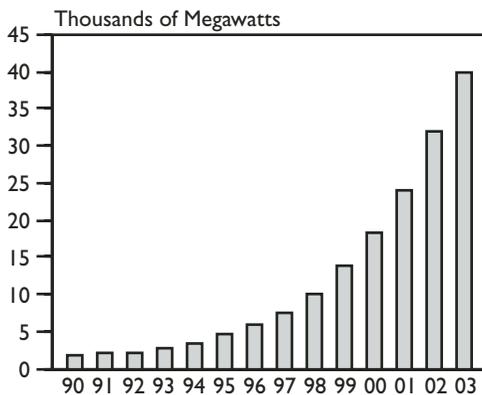
These clean energy opportunities are at the forefront of national policy discourse as a result of leadership shown by the Government of Manitoba and by Manitoba Hydro. Hydro has the lowest electricity rates, the best reliability record, and the highest customer satisfaction ratings in Canada. With more than 500 Aboriginal employees, it also has become Canada’s leading industrial employer of Aboriginal people. Meanwhile, our province has reduced its overall CO<sub>2</sub> emissions and led the national climate change effort, while designing and leading the national campaign to develop the National Clean Energy Grid – projects with Canada’s interests, as well as Manitoba’s, front and centre.

The federal government could play a constructive role in this development by investing in the National Clean Energy Grid, and by ensuring that the emission-reduction benefits of clean energy are recognized financially. Past nation-building projects such as the Trans-Canada Highway, the National Railway and the St. Lawrence Seaway were led nationally – while other energy sources, such as nuclear power, offshore oil and gas, and the oilsands, benefited from substantial federal investment support. The national interest in our National Grid is clear - it will ensure our national energy security and reliability, capture enormous CO<sub>2</sub> and clean-air improvements, trigger billions of dollars of new investment, and bring major employment gains to communities across Canada.

## ■ Wind Power

During the 1990s, wind power was the world's fastest-growing source of electricity. It grew at 30% annually, and with more than 40,000 MW of wind turbines installed worldwide. Throughout that decade, manufacturers of wind-turbines made remarkable progress in increasing generating capacity, hub-height, and reliability. Whereas just 10 years ago, turbine capacity averaged 0.3 MW, today's turbines generate 1.5 MW – five times the power. New 4.5-MW models are already undergoing field tests. Hub-heights have now reached 80 metres (the height of a 20-storey building) to harness the stronger winds that blow at greater heights. Turbine blades are larger than the wings of a Boeing 747. Leadership in these manufacturing improvements has come from European innovators such as Vestas and NEG-Micon, now joined by global giants such as GE and Mitsubishi, who sell the turbines for wind projects worth \$12 billion annually. The merged Vestas/NEG-Micon firm sold \$3.5 billion worth of turbines last year alone.

### Growth in Global Wind Capacity



Sources: BTM Consult and EWEA

Some of the world's largest private investors, global oil and gas firms, and electrical utilities have led in making inroads for wind power, based on its greater competitiveness. U.S. investor Warren Buffett is building the world's largest wind farm in Iowa, worth \$500 million. Shell recently announced a \$2.5 billion investment in offshore wind-power development in the United Kingdom, capable of supplying one-quarter of the power needed by London. Texas installed 1,000 MW in the year 2000 alone. Sir Mark Moody-Stuart (former Chair of Shell and now Chair of Anglo-American) predicts that wind power will be a \$90 billion industry within ten years.

While Canada has lagged behind other jurisdictions in developing wind power, there is now a rapid, nationwide movement of capital into the sector. Quebec already has more than 100 MW installed, and is tendering 1,000 MW more – an investment worth \$1.8 billion. Private energy firms such as Suncor, Enbridge, TransAlta, Irving, and Brascan have already built, or are proposing to build, more than 1,500 MW of additional wind-power capacity across Canada.

On the part of the private sector, communities, investors and individuals, there is a great deal of interest in developing wind power in Manitoba. This interest stems in large part from our particular advantages.

- Manitoba's wind resource is strong. North Dakota's excellent wind resource has made it known as "the Saudi Arabia of wind," which led developers to take a closer look north of the border, at Manitoba.
- Manitoba's sites are easily accessible, especially when compared to windy sites in mountainous or offshore regions. Major transmission lines already run through several Manitoba regions, making it more economical to connect wind farms there to the grid.
- Many rural Manitobans remember when windmills were part of our working landscape. The St. Leon project has shown that they are enthusiastically willing to support the return of wind power to Manitoba. This could speed the development of wind farms here by making them less risky and less costly.
- Wind power is an excellent complement to hydro-electric power. Wind power's major weakness is its "intermittency." Failing winds mean power is unavailable to be "dispatched". The best generating technology for storing wind power and "firming" it for release on demand is a hydro reservoir system like Manitoba's. And for hydro-based systems, wind power offers additional diversity and protection against droughts, generates more power in winter to meet our peak loads, and can be constructed within one year, whereas new hydro projects have long lead times. While other prairie and plains jurisdictions, including Saskatchewan and the Dakotas, also have strong winds, Manitoba is the only such jurisdiction which holds this critical and complementary advantage – hydro power to address the intermittent nature of wind power.

This combination of advantages has led to the erection across Southwest Manitoba of wind-monitoring towers. These include seven sites owned by Manitoba Hydro and the Province, along with numerous installations owned by private energy firms and wind developers. The St. Leon project is furthest along in development: sufficient wind data has been gathered; local access and wind rights have been secured; environmental approvals have been completed; final terms for a power purchase agreement with Manitoba Hydro are being negotiated; and financing is being arranged. Should this 99.5-MW project go ahead, it would trigger investment of \$190 million; create 280 jobs in construction and 25 to 30 ongoing operational and management positions; and provide hundreds of thousands of dollars in annual payments to local landowners and the community. If its power replaced coal-fired power, it would eliminate more than six million tonnes of CO<sub>2</sub> over its working life.

Wind power offers substantial benefits to Manitoba Hydro. It also offers significant economic benefits to rural communities. Landowners will obtain revenues from the sale of wind power and access rights. Local communities will gain a new source of property taxation. Young people seeking employment will have access to a growing, innovative and sustainable industry. In the longer term, Manitoba can look forward to jobs in spinoff industries.

## ■ Biofuels and Bioproducts

When Henry Ford created the Model T and Rudolph Diesel invented the diesel engine, they were not originally designed to run on conventional, petroleum-based gasoline and diesel. Rather, they were designed to run on ethanol and biodiesel, both biofuels. But when the mid-20th Century petroleum-based revolution began to produce enormous quantities of low-cost fuels from fossil-fuel stocks, bio-based products were largely left aside.

Recently, the U.S. Government announced a 10-year partnership to triple the use of bioproducts, aiming to “cut the costs of these technologies two- to ten-fold.” This commitment of major public funding to bioproduct development has combined with significant new R&D commitment and direct investment by major corporations such as DuPont, Procter & Gamble and Dow. Minneapolis-based Cargill Dow Polymers recently invested \$1.2 billion to develop a new plant-based bioplastic called NatureWorks, made at the world’s first large-scale plant of its kind, near Omaha, Nebraska. This plant can produce 140,000 tonnes of bioplastic annually, using as raw material 40,000 bushels of corn every day – 14 million bushels a year. This new bioplastic resin (called polylactide or “PLA”) is competitive with petroleum-based plastics and is already being purchased by Coca Cola, Dunlop and Sony for food packaging, mattresses, comforters, pillows, rugs and clothing. In CO<sub>2</sub> terms, its life-cycle greenhouse gas (GHG) reductions are 15% to 60%, and future developments are likely to raise this to 80% to 100%.

The bioproducts field includes hundreds of new products, moving agriculture well beyond its traditional role of supplying “food, feed and fibre”. Subsectors include:

- biofuels (e.g. ethanol and biodiesel);
- bioenergy (energy and electricity from biomass/biogas – e.g. livestock manure);
- biomaterials and biofibers (e.g. composites, polymers, insulation, panels, etc.);
- biochemicals (e.g. enzymes, adhesives, solvents, coatings, inks);
- bioplastics (such as Cargill Dow’s “NatureWorks” line); and
- bio-based pharmaceuticals and nutraceuticals.

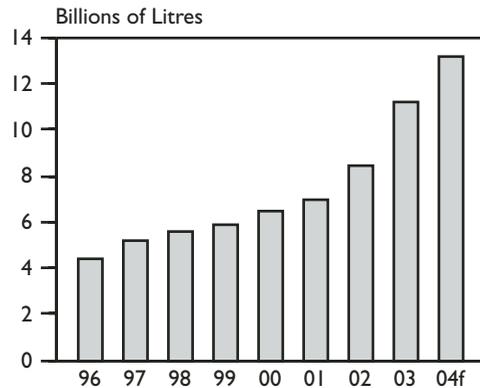
In Manitoba, the wider bioproducts sector is already beginning to bloom.

- Manitoba is already home to the Dow BioProducts “Woodstalk” product – a building material made from straw – with plant production rising rapidly in recent years.
- Manitoba’s first major anaerobic digester (AD) for hog manure was recently constructed by DGH Engineering, at a 6,000-head hog feeder farm owned by Cook Feedlot in Teulon. The “Bio-Terre” system is a commercial prototype of a widely heralded Canadian design intended to capture the usual benefits of such systems (generating methane to heat farm buildings with reduction in odours, air emissions and GHGs, and soluble COD in the slurry) while overcoming the difficulties traditionally facing such technology in cold climates.
- Engineering studies are under way at Winnipeg’s Brady landfill, with preliminary work highlighting the possibility of capturing enough methane from the decaying organic material to produce 7 MW of electricity, while reducing GHG emissions by 500,000 tonnes annually.

Manitoba's most obvious opportunity, however, is in ethanol and biodiesel. Biodiesel opportunities are being explored as the Manitoba Biodiesel Advisory Council looks into key issues surrounding this new industry. Ethanol has a much longer history in Manitoba; it has been produced, sold and consumed here for over 20 years. It is supplied by the 10-million-litre-per-year Minnedosa ethanol plant owned by Husky Mohawk. Worldwide, the ethanol industry is booming.

- Minnesota has 17 ethanol plants, most of them farmer-owned, which triggered \$1.4 billion in new investment, and which are now supplying 1.3 billion litres of fuel.
- U.S. ethanol sales have quadrupled in eight years, and are now over \$8 billion annually, enabling motorists in virtually every state to purchase and use ethanol.
- Within Canada, the federal government recently announced additional support for ethanol, intended to engage Sunoco, Commercial, Husky and others in quadrupling national production to 1 billion litres annually, with fuel and co-product sales worth \$600 million annually.
- Even the European Union has adopted ethanol, with biofuel targets rising to 15 billion litres by 2020.

### U.S. Ethanol Production



f - Forecast

Source: U.S. Renewable Fuels Association

Ethanol has long been known as a “high performance” fuel, but its recent production surge has been driven by additional forces.

- Ethanol burns more cleanly than gasoline and thus reduces air pollution in major cities.
- Ethanol's life-cycle GHG emissions are substantially lower than for gasoline, with federal studies showing Manitoba-produced ethanol reduces GHG the most, i.e. by 50%.
- Ethanol production reduces reliance on fossil fuels, an especially pressing issue as oil and gas prices rise. The U.S. now produces enough ethanol to replace the equivalent of 75 million barrels of oil annually.
- Ethanol production boosts agricultural diversification, creating not just fuel, but also a protein-rich animal feed co-product.
- The production cost of ethanol has steadily fallen over the past 20 years.

The Manitoba Legislature recently passed *The Biofuels Act*, which will see gasoline blended with Manitoba-produced ethanol receive a tax reduction at the pump, as well as blending becoming mandatory (as in Minnesota.) The mandate and tax preferences will help provide ethanol a level playing field with long-subsidized gasoline, and help ensure that pump prices remain competitive.

The potential economic gains for Manitoba are substantial. Last year, Manitobans paid more than \$700 million to producers of fossil-fuel gasoline, money which left our economy and thus triggered little or no multiplier effect. On the other hand, production of 130 million litres of ethanol (10% of the Manitoba market) would result in \$1 billion remaining in Manitoba's economy over the 20-year lifetime of the plants. Most of the spending to produce ethanol will go to Manitoba's wheat producers, diversifying their markets and also capturing protein value in the form of Distillers Dried Grains (DDG), which can replace imported animal feed. Should farmers and investors take a direct equity share in their ethanol plants (as in Minnesota), returns to the local economy would further increase. And environmentally, this initial stage of ethanol expansion will reduce CO<sub>2</sub> by 135,000 tonnes – the equivalent of removing over 10,000 vehicles from the road.

Manitoba is also accelerating its R&D efforts in biofuels. It is exploring the use of wheat varieties, such as winter wheat, which can yield 50% more while reducing inputs. This, in turn, can enhance returns to growers, and raise the 50% GHG reduction from ethanol. A second area of research concerns the potential to supply DDG to the hog industry, offering additional local markets for this co-product, plus benefits to Manitoba's hog producers. And third, Manitoba is exploring the potential of R&D to improve production efficiency which could enable ethanol producers to replace expensive natural gas for drying purposes.

Increased ethanol production will also be needed to meet the demand coming from the rising sales of flexi-fuel vehicles (FFVs) – vehicles designed to take up to 85% ethanol. There are already four million FFVs on North American roads, with the Ford Taurus and Explorer about to be joined by the Suburban, Yukon, Sierra and other GM models. Since more FFV models are on the road every year, the option for drivers to obtain 85% of their fuel from a renewable, low-CO<sub>2</sub>, locally made fuel is expanding.

## ■ Geothermal Heat Pumps and Energy Efficiency

More than 500,000 geothermal ground-source heat pumps (or “earth energy” systems) have already been installed in Canadian and U.S. homes to provide heating and cooling. Another 400,000 are operating in Europe.

Geothermal systems draw their energy from the earth, utilizing the difference between air temperatures and more stable temperatures (around 10°C) in the earth (or water), 5 to 10 metres down. In winter, these systems bring the earth's warmth up into a building, concentrate it, and distribute it using heat pumps and ventilation systems. In summer, they work in reverse, extracting heat from inside to be discharged into the cooler earth. The earth itself supplies the renewable thermal energy, and the systems run with almost no pollution or GHG emissions.

However, partially because geothermal units do not visibly “produce” energy, they are often overlooked when discussion turns to “renewable” energy. This invisibility makes it perhaps even more surprising that geothermal heat pumps – one of the so-called “emerging” renewable energy sources – already turn out to be the lowest-cost method of heating and cooling most buildings today. For instance, the U.S. Environmental Protection Agency (EPA) states that geothermal is “the most energy-efficient, environmentally friendly, and cost-effective heating and

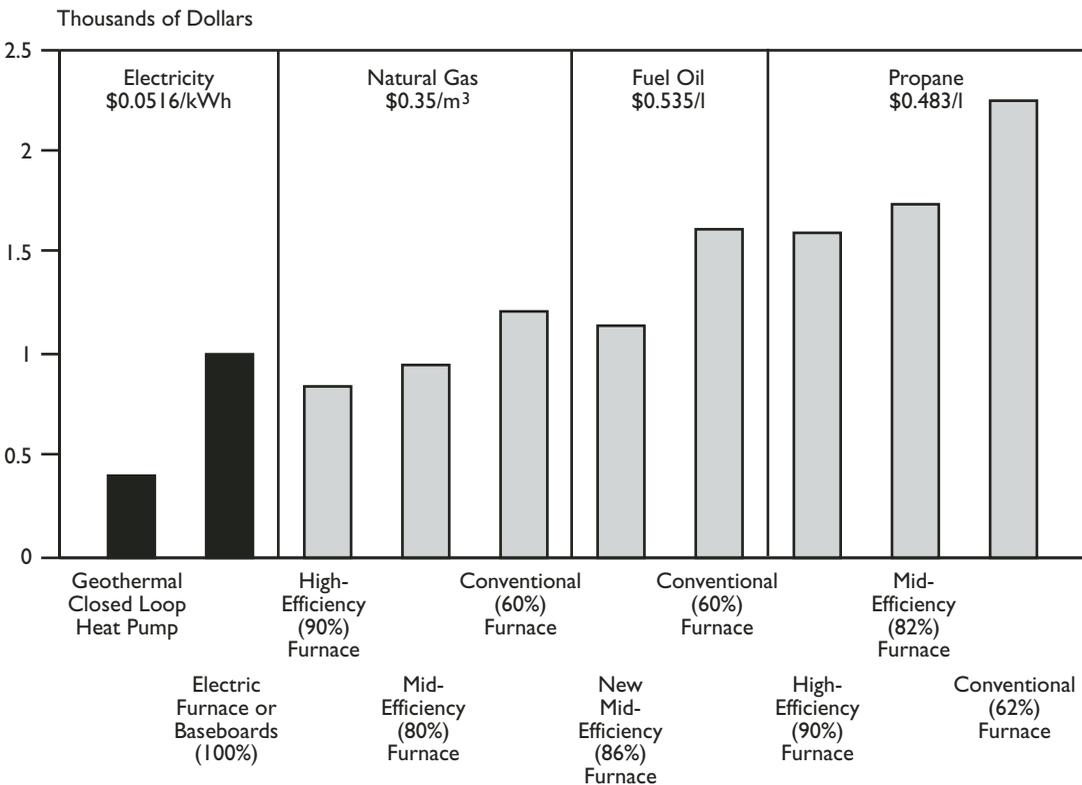
cooling technology available today...” Even compared to the best gas technology, the EPA found geothermal performed 36% to 43% better.

In Manitoba, with its low electricity costs, Manitoba Hydro found that geothermal heat pumps can still reduce annual heating bills by \$400 to \$800 compared with natural gas; by \$600 compared with all-electric heating; and by \$700 to \$1,800 compared with heating oil and propane. The financial benefits to homeowners concerned about high or volatile heating bills are especially pronounced, as geothermal provides much greater predictability and stability of energy bills.

For Manitoba Hydro, there are additional benefits from expanding geothermal installations.

- Electrical energy “freed up” by geothermal can be resold at higher prices for export.
- Geothermal usage can reduce Manitoba Hydro’s winter and summer peak loads.
- Additional diversity is added to a 95% hydro-based system.
- Geothermal can be added incrementally, and rapidly.
- On the gas side, ratepayers may be able to avoid the costly extension of gas infrastructure into less populated areas.

### Home Heating - Total Annual Costs



Source: Manitoba Hydro

As a result, Manitoba Hydro has increased its marketing and communications support for geothermal, added incentives and on-bill financing for residential purchasers, and increased the training and certification of new installers. The Province has negotiated federal incentives for homes converting to geothermal.

The Manitoba geothermal industry last year achieved a 40% growth rate. Manitoba is now first in Canada in total installations of geothermal, representing 30% of total new Canadian installations last year.

Geothermal units are also being installed widely in commercial buildings, arenas, schools and other public buildings. The award-winning Manitoba company, Ice Kube Heating and Cooling, has installed its customized geothermal designs in arenas across North America.

The most cost-effective stage at which to install geothermal units is when the buildings are first being constructed. For instance, 95% of all new homes built in Sweden have geothermal systems installed at that stage. In Manitoba, a Wawanesa development has prepared 11 lots with geothermal loops, at an up-front cost of \$4,000 per loop, so that geothermal can be installed from the start. In Winnipeg, the Waverley West development is intended to have geothermal installed for every home – not the first, but the largest such 100% geothermal housing development in Canada – with the intention of eliminating natural gas-fired CO<sub>2</sub> emissions (and price volatility) from the start.

Beyond lower bills and systems benefits to Manitoba Hydro, geothermal expansion offers three additional gains. First, according to Manitoba Hydro's calculations, each geothermal home reduces CO<sub>2</sub> by approximately 10 tonnes and each commercial unit by 50 tonnes. Second, each 1,000 units installed will produce \$15 million in construction-related activity and approximately 150 jobs. Third, every 1,000 units will reduce imported natural gas purchases by \$1 million each year, to be respent in the Manitoba economy.

Improving energy efficiency and energy intensity has been a priority in Manitoba for decades. It is estimated that the 25% improvement over the past 25 years saves Manitobans \$700 million annually. However, Manitobans still spend \$1.4 billion on electricity and natural gas, of which \$400 million flows directly out of the province for natural gas alone. The market for natural gas is volatile, and costs have risen by \$200 million in recent years; so Manitoba has dramatically stepped up its efficiency efforts.

Most visibly, efficiency standards for Manitoba's new commercial and public buildings have been raised. Leading examples of this trend include the new Red River College campus, the Mountain Equipment Co-op site, and the 20-storey solar wall installed at the Smith Street seniors' residence. And the new Manitoba Hydro head office building will become a signature building for Manitoba and a national leader in energy efficiency.

Manitoba homeowners have accelerated their energy-efficient renovations following a series of incentives put in place since 2001. The federal government responded to provincial urging by creating a Home EnerGuide incentive worth up to \$600 to \$1,000 per household, and thousands of Manitobans have already taken the first step by obtaining a home assessment. Manitoba Hydro's enhanced Power Smart residential program has generated \$40 million in loans for home

renovations to date, triggering 700 person-years of employment in a labour-intensive sector with strong linkages across the Manitoba economy (e.g. to suppliers of high-efficiency windows, etc.).

In order to accelerate efficiency efforts across Manitoba, and to ensure that savings are captured across all resources – electricity, gas, oil and propane, water, waste and transport – “Efficiency Manitoba” was announced last December. This independent agency, building on the success of Manitoba Hydro’s Power Smart program, is designed to cut bills for electricity and all other fuels and resources; to expand activity to rectify increasingly costly efficiency “gaps” in such areas as natural gas, and water and sewer; to use a customized, community-based approach rather than a one-size-fits-all approach; to lever in additional federal funding; and to defer or eliminate the need for expensive new infrastructure expansion (such as sewer and water).

Efficiency Manitoba will allow a faster, one-stop response to the rising number and range of opportunities being identified by Manitobans to reach greater efficiency.

- Manitoba teachers, parents and students want to reduce electricity and gas use at their schools, reduce water use, increase walk-to-school projects, boost recycling, and green their schoolyards.
- Owners of gas-heated homes facing high and volatile gas prices want to access efficiency measures, furnace conversion and geothermal options – and the ability to obtain the kind of incentives and supports already available to electrically heated homes.
- Manitobans building new homes, offices and public buildings want to build in long-term, sustainable savings in all their resources and all their utility and input bills, a task which requires specialized assistance and support, as well as improved codes and standards.
- Manitoba’s diverse communities want to implement their own ideas on how best to boost efficiency and keep dollars circulating locally, working at one table with all partners to design and rollout a customized, community-based efficiency effort.

For the economy, a 10% to 20% increase in the efficiency with which we use electricity and natural gas could translate into savings of \$140-\$280 million every year – another major economic opportunity for Manitoba.

## ■ Hydrogen, Fuel Cells and Hybrids

Hydrogen and fuel cells have become a major focus of global R&D, with Canada, the U.S., the EU, and Japan all racing to develop these opportunities. That companies such as Ford and GM, Shell and BP, Toyota and Honda are joining in new ventures with fuel-cell innovators (including Canadian firms such as Ballard, Stuart and Hydrogenics) is less a recognition of the existing \$1 billion in fuel-cell activity, than a reflection of future market projections of \$15-\$150 billion.

Manitoba’s April 2003 “Preliminary Hydrogen Opportunities Report,” outlined specific areas in which Manitoba had a competitive advantage. Since then, Manitoba has:

- partnered in an \$8 million project that will develop and demonstrate the world’s most efficient fuel-cell bus, using New Flyer’s most advanced “Glider” chassis, drawing on fuel cells made by Hydrogenics, and combining the fuel-cell engine with a hybrid electric motor;

- worked with Manitoba Hydro to install a commercial electrolysis unit at its Dorsey Converter Station, a project which is already cost-effective, since it replaces external purchases of fossil-fuel derived hydrogen, and generates hydrogen on site;
- signed a memorandum of understanding on hydrogen with Iceland in September 2003, knitting together Manitoba's unique ties to a nation widely identified as a world leader in hydrogen development; and
- completed studies into a proposed Hydrogen Research Centre of Expertise, capable of drawing together Manitoba expertise in the private sector, university research, and the specialist knowledge and equipment of AECL at Pinawa.

While most public attention has been drawn to fuel cells, they remain just part of a much larger movement toward hydrogen-based systems. And although hydrogen itself must be recognized as a longer-term energy solution, it is here that Manitoba has significant advantages.

- If hydrogen is to be derived from clean, low-CO<sub>2</sub> sources, then electrolysis from clean, low-cost electricity will be viable in Manitoba before almost anywhere else on earth. For example, it is estimated that in coming decades, a complete conversion to fuel-cell vehicles in Manitoba would theoretically only require the electricity equivalent of a hydro project the size of Conawapa (1,200 MW) to offer Manitoba complete energy self-sufficiency for vehicle fuels.
- Manitoba has enormous biomass and bioenergy sources (such as ethanol) which themselves can be used to generate hydrogen for fuel cells.
- Manitoba is already the bus manufacturing centre of North America. Transit buses, in particular, have been identified as one of the likely key early adoption niches for hydrogen-fuelled vehicles, using fuel cells or hydrogen-capable internal combustion engines. Over the next decade, hydrogen power could well penetrate 10% of the North American transit bus market, and our bus manufacturers would be well-positioned to lead such a transition.

Another vehicle-related opportunity for our economy is the rapid growth in hybrid electric vehicles. The first Toyota Prius hybrid appeared in North America only in 2001; by 2004, it had been named "Car of the Year" by Motor Trends. Automakers now plan at least 17 hybrid models within three years – including a hybrid Civic, Accord, Prius and Camry, as well as a hybrid Lexus, Ford and Saturn SUV. Annual sales are projected by J.D. Power and Associates at 500,000 within four years, and 900,000 within six years. Toyota aims to sell two million hybrids annually within a decade.

The great advantage of hybrids is that they can reduce fuel usage (and CO<sub>2</sub> emissions) by 30% to 60% (and other air pollutants by 75% to 95%) without sacrificing the performance of the vehicle or the convenience of the user. As the cost of hybrids declines and their performance continues to improve, it is entirely possible that vehicle fuel usage can be cut in half. In Manitoba's case, this would mean a potential reduction worth \$300 million each year, and a reduction of CO<sub>2</sub> emissions totalling 1.5 million tonnes.

An intriguing possible future step for hybrid electric vehicles (HEVs) has been outlined by the Electric Power Research Institute (EPRI): expanding the capability of the hybrid electric motor

side by adding a “plug-in” capability. This would produce a vehicle which could cut gasoline usage by as much as 60% to 85%. As EPRI notes, the plug-in hybrid (PHEV) is “the logical next member of the family of hybrid vehicles” and that “with the possible exception of the batteries, PHEVs will require only evolutionary engineering advances” to meet technical requirements.

Assuming remaining battery-related issues are overcome (and this is a major challenge), Manitoba would have some real advantages in advancing the testing and rollout of PHEVs on a large scale.

- Consumers in many other regions physically cannot “plug in” their cars and are not accustomed to do so. Most Manitobans, on the other hand, have easy access to an electrical outlet for their cars, and are used to plugging them in during winter.
- Manitobans can access electrical power at very low rates – power which also emits almost no CO<sub>2</sub> during generation.
- Manitoba can offer car makers a test climate which presents extreme winter cold, high summer temperatures, city driving, and rural travel.

While PHEVs are still in the future, they offer another avenue for replacing imported, fossil-fuel-based energy resources with domestic renewable energy forms. While numerous combinations of these energy sources, carriers and technologies are possible – standard hybrids with E-85 FFV chips, plug-in hybrids with electricity from renewable sources, fuel cells using ethanol coupled with a hybrid – Manitoba is now well-positioned to take advantage of any such opportunities.

## ■ Summary – Running a Clean Energy Economy... and a Carbon Surplus

This survey of Manitoba’s clean energy opportunities has outlined some of the breadth and scale of activity and potential in these fields. The most obvious opportunities for Manitoba include the potential to trigger \$10 to \$15 billion in new investment, and more than 100,000 person-years of work. But there are additional features of these projects which can also be identified.

- Provincewide geographic coverage: These projects offer employment and equity opportunities to Aboriginal and Northern Manitobans; to rural families and communities involved in wind farms and in production of ethanol, biogas and geothermal; and to residents of Winnipeg involved in supplying research, engineering and other services to these new projects, as well as in developing and renovating more efficient buildings and housing.
- Greater self-reliance and stability: For those concerned with volatile monthly bills, these projects offer an array of tools to bring more stability and control to their finances. Commuters can cut their gasoline bills in half. Farmers can add a new income stream from “harvesting the wind,” can diversify their markets for grain, and reduce the risks associated with manure management, while creating their own on-farm biogas energy. Businesses and schools can reduce their monthly energy, water, waste and transport bills. Those looking to invest for their retirement can take advantage of new local growth opportunities – in ethanol, wind power, geothermal and others. And overall, Manitoba can significantly reduce its imports of volatile-priced products, while increasing its exports of premium-priced products.

- Diverse and exciting opportunities for youth: Manitoba communities and their young people have long had to fight against the pull of bigger cities outside the province. Now clean energy offers young Manitobans a remarkable range of opportunities in these new industries.
- If you like working 300 feet up, are technically adept, don't mind cold weather, and if you would enjoy a chance to maintain a dozen turbines worth \$3 million each – then becoming a wind technician, or “wind walker” is a great choice.
- If you like working downtown, are interested in design, engineering or architecture, and want to push the envelope developing world-class, energy-efficient, environmentally friendly buildings, then Winnipeg's new commercial and public buildings are for you.
- If you like working in labs or crunching data, you can choose between developing new high-starch wheat varieties or new enzymes for ethanol production, mapping wind data or calculating the advantages of dispersing wind farms across the province, and designing systems to support the rollout of PHEVs or E-85 FFV vehicles.
- If you want to work in construction, you can choose to build the new commercial projects in Winnipeg, renovate the homes and schools of your local neighbourhood, bring new wind farms to rural Manitoba, or lend a hand on the new generation hydro projects in the North.
- Partnerships: New clean energy projects worldwide offer a much wider range of partnerships than earlier energy-related industrial developments. For instance, Manitoba's new generation hydro projects will draw on private sector suppliers and services, while offering strong equity, employment and business partnership opportunities for Aboriginals. Modern ethanol plants can be owned by farmer co-ops, sell shares to venture capital or RRSP funds, be privately owned, or be community owned. Wind farms can be owned publicly, privately, by communities, farmers, pension or venture capital funds.

Finally, the potential impact of these projects fits well with the objective of reducing CO<sub>2</sub>. From 1990 to 2002, Manitoba's emissions of CO<sub>2</sub> and other greenhouse gases were kept stable at 20 million tonnes (MT). However, during that time, our electricity exports soared – largely from Limestone – allowing an ongoing 10 MT of CO<sub>2</sub> reduction by our coal-burning trade partners. In addition, the federal government credits Manitoba with expanding its agricultural and forestry “carbon sinks” by 5.5 MT during that time. This all adds up to a “net” Manitoba emission level of around 5 MT of CO<sub>2</sub> today.

The projects discussed above (plus some not discussed in this Appendix, such as carbon sequestration, improvements in gas pipelines, etc.) offer the potential for 20-25 MTs of new CO<sub>2</sub> reductions by Manitoba (for instance, Conawapa alone could offer 7 MTs).

This mathematical result is unusual, and quite spectacular in global terms. The Kyoto Protocol requires 6% cuts from most nations, while the world's leading nations (the U.K. and Germany) are aiming for CO<sub>2</sub> reductions of 15% to 20% by 2012. Beyond that, the world's leading think-tanks and scientific groups have put forward plans to reduce CO<sub>2</sub> emissions by 50%, but the earliest this can be achieved is 2050. Leading corporations, such as TransAlta, are proposing to become “net zero CO<sub>2</sub>” firms, not solely by reducing their own emissions, but also by planting trees, and particularly by purchasing CO<sub>2</sub> credits or offsets from others.

Manitoba, however, has it entirely within its grasp, not just to become the first jurisdiction to reach such a “net zero CO<sub>2</sub>” position (e.g. by building Conawapa) – but to become the world’s first “net carbon-positive” region. With a net carbon deficit today of only around 5 MTs, the development of even a subset of the projects above – e.g. the Ontario power sale, three new wind farms, 140 million litres of ethanol, methane capture at Brady landfill, and limited market sales of hybrids and geothermal systems – could well see Manitoba reach a +5 MT or even a +10 MT carbon budget. This is an outcome with which many innovative industries and companies (such as those discussed above) would wish to be associated.

This would mean Manitoba had achieved the world’s first “carbon surplus,” rather than adding yet more megatonnes to the world’s “carbon deficit.” This would be an extraordinary environmental gift for our children, and perhaps a suitable one as they enter what could be Manitoba’s booming clean energy economy.

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