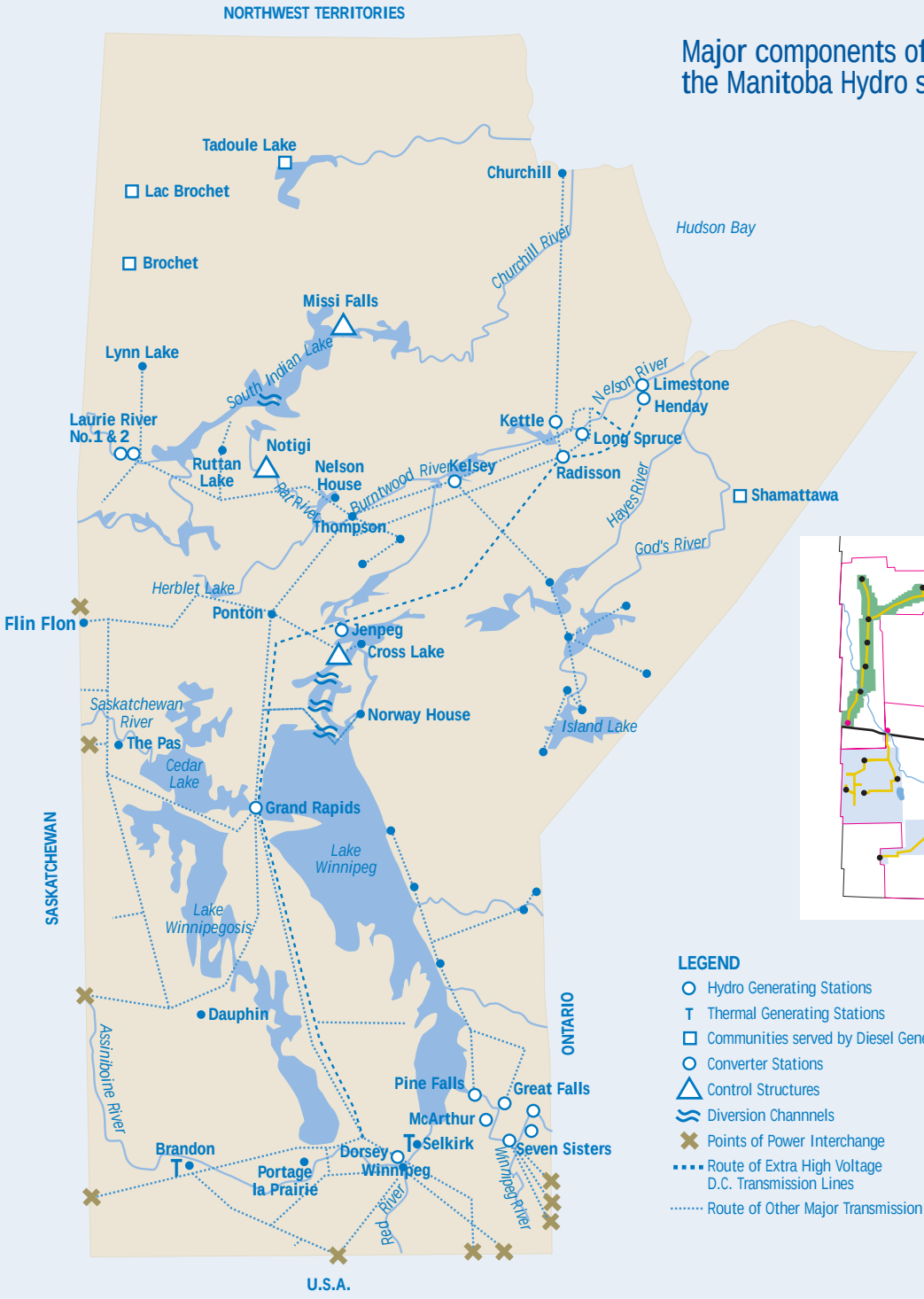
1999 Sustainable Development Report

it's about wiser use of your energy

Manitoba Hydro
POWER SMART

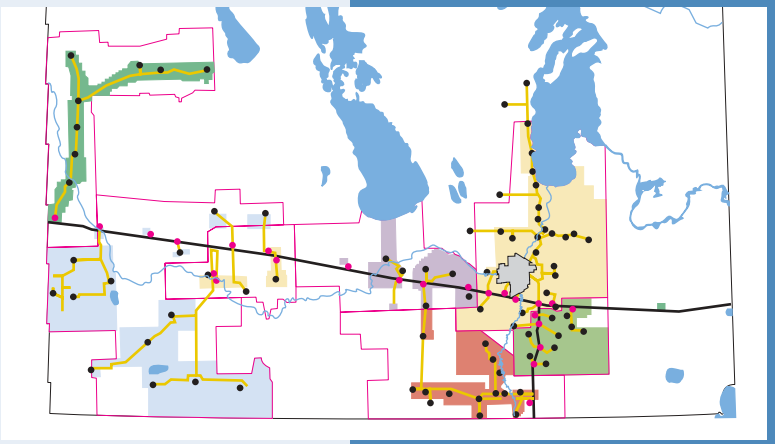
Major components of the Manitoba Hydro system



LEGEND

- Hydro Generating Stations
- T Thermal Generating Stations
- Communities served by Diesel Generation
- Converter Stations
- Control Structures
- Diversion Channnels
- Points of Power Interchange
- Route of Extra High Voltage D.C. Transmission Lines
- Route of Other Major Transmission Lines

Front cover photo: Manitoba Hydro launched a major media campaign in 1999 to encourage Manitobans to conserve energy. The campaign's theme was It's about the future of your energy.



Southern Manitoba; Areas served by Natural Gas

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Energy Savings: Manitoba Hydro's Power Smart programs saved 68 gigawatt hours of energy and 44 megawatts of capacity in 1999. Please see page 7.

Customer Services: A new integrated system-wide energy management service was offered to commercial and industrial clients, complimenting the industrial retrofit program previously offered when Power Smart programs were originally launched. Please see page 8.

Fish Solution: A team of engineers and scientists put together a solution to a problem that had caused fish to be caught in water intakes at the Selkirk thermal generating station. Please see page 17

Mercury Lowered: Mercury levels in fish along the Rat-Burntwood-Nelson river system have fallen considerably since hydro-electric projects were developed in the mid 1970s, to the point where some mercury concentrations are back to normal levels. Please see page 19.

Environmental Registration: Manitoba Hydro has decided to register its environmental management systems being developed at our generation stations under the ISO 14001 standard. Please see page 30.

Energy Instead Of Odours: A research project has demonstrated the effectiveness of microturbine technology for eliminating foul odours produced at wastewater treatment plants. Please see page 31.

Hydro Purchases Centra: Manitoba Hydro purchased Centra Gas in 1999, bringing together Manitoba's major electrical utility and major natural gas distributor. Significant synergies and savings are planned. Please see page 35.

North Central Project Completed: Local businesses and workers played a major role in completing the North Central Project connecting nearly ten thousand remote residents to the provincial transmission grid. Please see page 39.

Educational Collaboration: The Chemawawin First Nation and Manitoba Hydro have collaborated to produce educational materials to help young generations understand the history and ecology of Cedar Lake. Please see page 43.

Message from
The President and CEO

Manitoba Hydro was created 48 years ago to ensure a safe, efficient supply of electricity to the people and businesses of Manitoba. We have responded with one of the most reliable and the least expensive electrical services in North America. In 1999 Manitoba Hydro took a significant new initiative in the supply of energy to Manitobans, with the acquisition of the major natural gas distributor in the province. Now, as we head into a new millennium, we will be better able to provide our customers with the energy solutions that best achieve their financial and environmental objectives.

In this Sustainable Development Report, we provide you with information about noteworthy activities for the past year. The merger of Centra Gas with Manitoba Hydro is discussed, as are our commitments to environmental stewardship and community responsibility. This report also contains data by which you can gauge our progress in energy conservation, financial objectives, and environmental management. Many of these indicators include data from national surveys so that our performance can be compared to the performance of the Canadian electricity industry.

In recent years our sustainable development reports have become an important link with the public. I trust you will find this report continues the standard set by previous reports of providing information that is interesting and valuable to you.

R.B. Brennan, F.C.A.
President and Chief Executive Officer

1.

Energy Efficiency

Manitoba Hydro produced 27 700 gigawatt hours of electricity in 1999. That was enough to serve its Manitoba customers and still export 10 300 gigawatts hours of electricity to customers beyond our provincial borders.

In addition to generating energy, we also put a lot of effort into conserving it. In 1999, our Power Smart programs saved 68 gigawatt hours of energy and 44 megawatts of capacity, and at the same time, a major campaign was launched to increase customer awareness of our Power Smart programs.

Power Smart campaigns since 1991 have created an awareness of how customers can get more for their energy dollars. Manitoba Hydro helped transform the marketplace by encouraging manufacturers to produce energy-efficient products, retailers to carry them, and consumers to purchase them.

With these accomplishments in mind, in 1999 the Power Smart campaign sought to extend the meaning of the Power Smart brand. While maintaining awareness of Power Smart as an energy efficiency program, the campaign was designed to associate Power Smart with low rates and reliability. The campaign, aimed at residential customers, included TV commercials, a newspaper insert, and painted signs on Manitoba Hydro buildings across the province. According to follow-up surveys, the campaign has succeeded in its objectives.

Power Smart helps keep rates low by reducing the rate of growth in energy demand. Manitoba Hydro can then sell surplus power outside the province, earning major export revenues that help keep rates down.

Power Smart programs to date have taken advantage of the lowest cost energy-efficiency opportunities available. As the lowest cost opportunities are used up, the cost of Power Smart programs is expected to increase.

Photo Left: Motor Coach Industries where energy efficiency measures have improved compressed air system quality and pressure for substantial process improvements and yearly savings of more than $115,000.

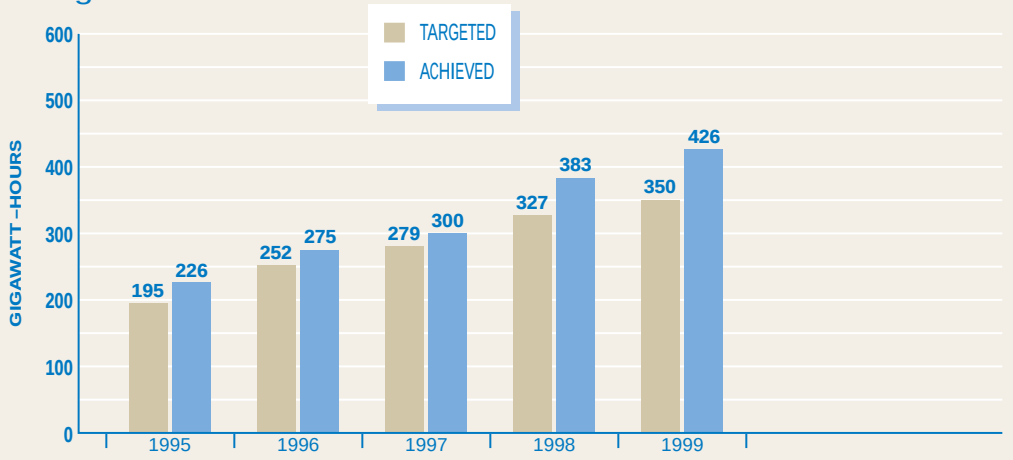
Manitoba Hydro believes that a combined approach including increased Power Smart activities and new generation will provide the lowest cost mix of resources, resulting in continued low rates and economic opportunities for Manitoba.

There is a flip side to the demand side management programs directed at our customers. Manitoba Hydro also looks within its system to find ways of getting more energy from its existing resources. In the past five years, these projects have added 26 megawatts of capacity to existing generating facilities. In many cases, supply side management projects involve improvements to runners (i.e. the blades) on generation turbines. In 1999, Manitoba Hydro added 3 megawatts of capacity with a re-runnering project at its Seven Sisters station.

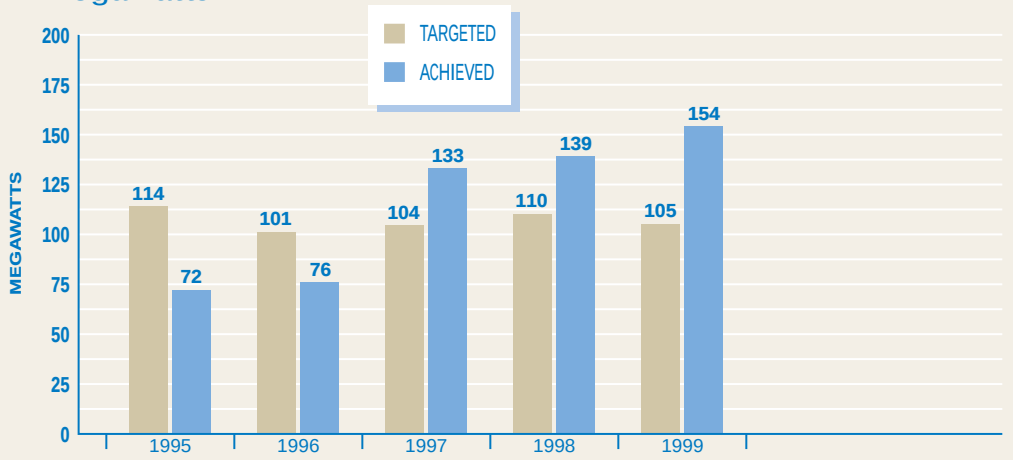
In 1999, Manitoba Hydro offered its commercial and industrial clients a major new Power Smart service. The new service, integrated system-wide energy management, complements the industrial retrofit program which Manitoba Hydro began offering when Power Smart programs were originally launched.

Industrial retrofits generally involve spot improvements, some as basic as the replacement of inefficient incandescent lighting with more efficient T-8 fluorescent, metal halide, or high-pressure sodium. In contrast, energy management uses whole-system monitoring, real-time communications, data processing, and centralised control to reduce overall energy costs and cut downtime. In a typical industrial installation, a series of power meters monitor consumption

Demand Side Cumulative Savings Targeted & Achieved
Gigawatt – Hours



Demand Side Cumulative Savings Targeted & Achieved
Megawatts

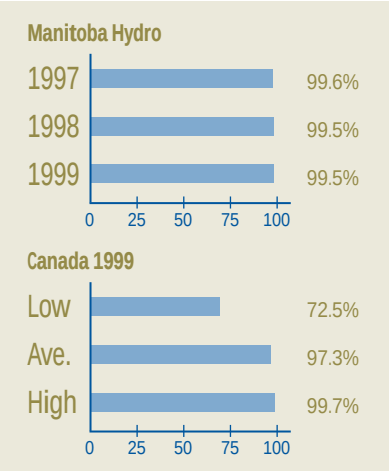


throughout the system. The meters serve as watchdogs that take the electrical pulse of the operation by sampling voltage and current at motors, heaters, and other key electrical equipment and distribution circuitry. Meters can also track fossil fuel consumption, for broad coverage of the energy spectrum. The power meters forward the information to specialized energy management software that stores it in an industrial strength database and manipulates it for presentation on-screen. The result is a series of virtually unlimited on-screen overviews and reports that give a real-time look at energy consumption throughout the operation.

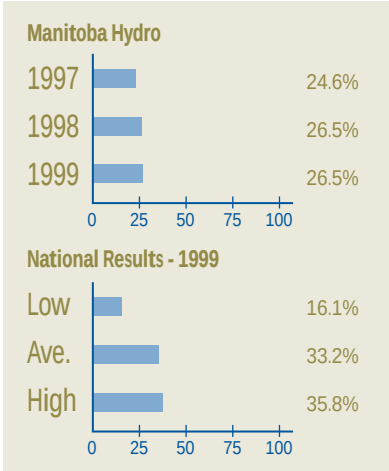
The second-by-second look at energy consumption presented by the system allows operators to make good decisions on the spot to save energy, maintain productivity, and avoid costly shutdowns. It also provides senior management with access to key information on system and plant performance. The entire operation relies on a range of communications systems, from copper wire and ethernet technology to fibre optics and leading edge radio links, to carry data to and from the power meters and give operators plant-wide control of equipment and processes.

One of the most valuable features of an energy management system is its ability to address deregulation issues, such as enabling operators to optimize plant loads to take advantage of real-time energy pricing. In a mining operation, for example, operators can schedule the timing of ore crushing and conveying operations to access the lowest rates. The system also predicts upcoming loads to warn operators of impending costly surcharges. Major savings from this aspect of energy management systems alone can often pay for the system in a matter of months.

Internal Energy Efficiency for Generation



Conversion Efficiency of Fossil Fuel Generation



Generation efficiency measures the percentage of electricity that leaves the generating station after their internal needs have been met. Energy conversion efficiency of fossil generation measures how much of the energy created by burning fossil fuels is converted into electricity. Efficiency is increased when stations are operated continuously for base load and is decreased when generating stations are used on a stand by basis. For example, Manitoba Hydro relies on water flowing through its hydroelectric stations for its base load and burns coal at its two thermal generating stations to support our hydroelectric operations. Although this reduces operating efficiencies at the thermal stations, it results in overall benefits by reducing operating costs and air emissions.

Current and Planned Power Smart Programs-1999

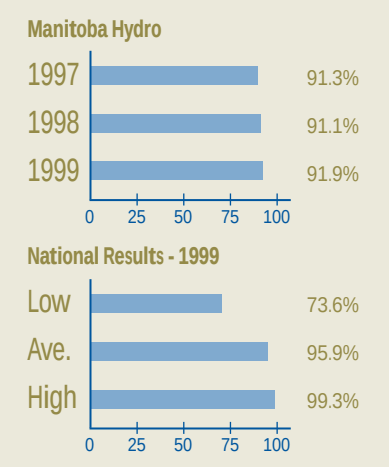
Program	Goal	MW Savings*		GW.h Savings*		Status
		Actual to end of 1999/00	Planned 2000/01-2011/12	Actual to end of 1999/00	Planned 2000/01-2011/12	
Residential						
Appliance Program	Through a national information dissemination program, encourage residential customers to buy energy efficient models when replacing their appliances.	—	—	—	—	consumer info
Power Saver Cord	Encourage the installation of temperature control relays to control block heaters on new vehicles.	—	—	—	—	consumer info
Commercial						
Commercial Lighting	Encourage customers to install cost-effective energy efficient lighting systems and involve lighting distributors,installers, contractors, and manufacturers in helping their customers save electricity.	17.56	38.42	97.92	153.56	launched April 1992
Commercial Custom	Encourage commercial customers who are renovating or building new facilities to incorporate custom energy efficient measures such as ground source heat pumps and direct digital controllers.	2.19	21.89	14.67	70.45	launched December 1995
Air Barrier Systems	Encourage customers who are renovating or building new facilities to incorporate effective air barrier systems that will reduce operating costs and alleviate potential moisture problems.	0.12	0.57	0.32	1.37	launched December 1995
Commercial Windows	Encourage customers who are renovating or building new facilities to incorporate energy efficient windows that are cost-effective and reduce operating costs.	0.35	1.14	0.76	4.56	launched December 1995
Air-conditioners	Where these types of systems are used, encourage commercial and industrial customers to select energy efficient equipment for new construction or when replacing existing equipment.	0.00	0.00	0.01	0.80	launched December 1995
Parking Lot Controllers	Encourage customers to install Parking Lot Control Systems in new and existing installations.	0.00	0.00	4.67	9.35	launched December 1995
Internal Retrofit	Achieve energy efficiency at Manitoba Hydro through such measures as: retrofitting buildings to energy efficient Power Smart levels, converting lighting in parking lots to high pressure sodium, and cycling of power in parking lots.	1.24	3.53	6.15	16.76	launched July 1995
Agricultural Heat Pads	Encourage swine farrowing operations to use energy efficient heat pads rather than heat lamps for creep heating to reduce demand and energy consumption.	0.46	1.14	2.77	11.97	launched April 1998
Industrial						
Performance Optimization of Motor Systems	Encourage commercial and industrial customers to achieve energy savings by optimizing fans, pumps, compressors, and other motor systems. Measures include speed controls, equipment improvements, and system modifications that reduce flow resistance. Energy savings of up to 50% can be achieved.	43.04	9.24	118.46	58.52	launched June 1993
High Efficiency Motors	Encourage vendors to promote and stock high-efficiency motors, and influence customers to install high-efficiency motors.	4.17	energy efficiency legislation	23.63	energy efficiency legislation	launched September 1991
Industrial Retrofit	Analyze customer electrical equipment and energy systems and provide solutions for energy savings, performance enhancements, and process and production improvements.	5.02	11.22	58.74	71.72	pilot program
Curtailable Rates (options A and AE)	Encourage large industrial customers to allow Manitoba Hydro to curtail electricity supplied to them for up to 4 hours on 5-minutes' notice (option A) or up to 10 days on 48-hours' notice (option AE) by offering credits on their monthly bills.	63.80	53.00	0.00	0.00	launched December 1998

** To facilitate comparison with other data in this section, the original data in this table, which represented "at meter" savings, was translated into "at generation" savings.*
The formula used for Performance Optimization, Industrial Retrofit, and Curtailable Rates Programs is: at generation savings = 1.10 x at meter savings.
The formula used for all other Programs is: at generation savings = 1.14 x at meter savings.

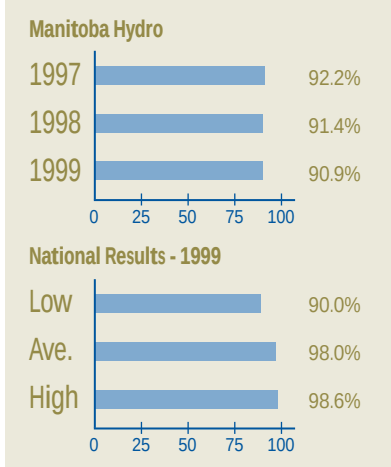
The system also gives operators the information they need to plan maintenance, streamline trouble-shooting, and develop strategies to avoid power quality events that could cause component stress or failure. Operators can quickly detect and correct energy waste through historical trending, compare the efficiencies of different shifts or lines, determine extra power system capacity, and avoid overbuilding by predicting future needs with greater precision.

Although integrated energy management systems have been available for many years, it was only recently that the technology caught up with the energy savings potential, making it feasible for Manitoba Hydro to offer the systems as a Power Smart service for managing electrical and fossil fuel use.

Internal Energy Efficiency for Transmission



Internal Energy Efficiency for Distribution



Transmission and distribution efficiency measures how much power gets to customers after it leaves the generating stations. Energy is lost in the form of heat as the electricity moves along transmission and distribution system. Losses are in direct proportion to the length of the lines and in reverse proportion to the voltage of the line. Manitoba Hydro significantly improves the efficiency of its system by operating on direct current to transmit energy from its northern generating stations to its southern customers.

Manitoba Hydro's Power Smart projects sometimes offer spin-off improvement opportunities that save more energy than the original project.

A compressed air audit at Friesens Corporation in Altona led to system improvements that now save the printing house more than $10 000 a year on its operating and maintenance costs. But the audit also revealed problems with the plant's steam-based humidification system. The system kept burning out electric heating elements and consuming excessive amounts of electricity. It also needed frequent maintenance to remove chronic scale build-ups.

On the recommendation of the audit, the steam-based system was converted to a high-pressure water system that cut the company's annual electricity bills by $18 500. The new water pressure humidification system forces cold water through nozzles so fine that the water turns to "fog" to keep relative humidity at the proper level in the plant. The cold water system will also help keep the plant cool because it doesn't use heat.

Before installing the new system, doors would be left open in the middle of winter to cool things off. That reduced the very levels of humidity that the system was trying to boost. It was a vicious circle that the new cold water pressure humidification system has eliminated.

Classroom lighting at Murdoch MacKay Collegiate using T8 fluorescents in place of T12s. The new fluorescents cast a softer light for classroom work and produce more accurate colour rendering of printed material.

Tyvek, an exterior vapour barrier that is wind-proof but vapour permeable, shown here being installed on the North Park Apartments. It protects the interior vapour barrier from tearing while allowing moisture to escape to the outside, keeping the well cavity virtually vapour-free.

Energy efficiency measures for the compressed air system at Motor Coach Industries have improved air system quality and pressure, for substantial process improvements and yearly savings.

A full compressed air audit showed that the company's compressed air system was annually costing $170 000 to operate and maintain. Improvement projects, estimated at $250 000, are expected to lower the company's operating and maintenance costs by $116 000 a year. Total annual electrical savings are an estimated 1 650 000 kW·h. Payback for the projects is 1.5 years, with the help of a Manitoba Hydro incentive under the Performance Optimization Program.

Motor Coach, which designs and manufactures buses for North American markets, operates four screw-type air compressors at its Clarence Avenue plant in Winnipeg. To maintain adequate system pressure, Motor Coach was forced to run all four compressors 24 hours a day, seven days a week. An audit showed that staff, faced with high operating costs, were trying to control the compressors with timers that often turned the compressors on and off at the wrong times, causing pressure drops during critical operations such as bus painting.

Another problem was heat build-ups that forced the compressors to shut down. Leak tests with an ultrasonic leak detector identified air leakage serious enough to keep a 125 hp compressor running continuously. Major

recommendations of the audit were to upgrade ventilation in the compressor rooms, install an 8200-gallon receiver tank and flow controller to cushion the compressors from large air events, and introduce a regular system of leak testing.

Improvement projects have reaped the following savings:

- $90 000 in lower operating costs;
- $16 000 in reduced maintenance; and
- $10 000 in lower gas heating costs through heat recovery.

Motor Coach is also saving an estimated $15 000 a year in increased productivity from improved air quality and system pressure.

North Park Apartments in Steinbach feature a range of Power Smart measures that have helped attract residents and lowered energy consumption by an estimated $4,457 a year, for annual savings of 76 676 kW·h. An improved air barrier system, energy efficient windows, and T8 lighting have proven both cost effective and appealing to residents.

The air barrier system proved to be one of the greatest sources of energy savings and comfort. On the inside face of exterior walls, a polyethylene vapour barrier was sandwiched between two layers of drywall to protect its integrity. On the outside walls, sheathing was covered with an air barrier material that also shields the interior polyethylene vapour barrier by keeping the wind out. In combination, both aspects of the air barrier system help control air leakage into and out of the buildings, improving occupant comfort and reducing heating and cooling energy consumption.

The block uses some of the most energy efficient windows on the market. They feature triple glazing with insulated spacer bars and argon fill between the panes. This cuts heat loss to roughly half that of conventional double-glazed windows with aluminum spacer bars. Because of energy savings associated with low heat loss, larger windows were installed for lots of natural light in the suites. Condensation problems in winter are minimal, and the windows feel warm when residents stand next to them, even in the coldest weather.

The North Park Apartments also take advantage of energy efficient lighting technologies, including T8 fluorescent fixtures. T8s, an energy efficient replacement for traditional T12s, generate more light per watt, and are 15 per cent more efficient. They cast a softer light, provide quieter operation, and reduce lamp flickering,

Architects for the block consider the Power Smart air barrier system so effective that they have made it a standard of their specifications for the commercial wood-frame projects they design.

A snow clearing system developed by Manitoba Hydro could save Canadian National Railway's Symington Yard close to $100 000 a year on its electricity bills. The new system automates control of blowers that keep snow from building up in track switches at the yard. Build-ups are serious because they can delay trains, costing thousands of dollars in late delivery penalties.

The old system consisted of 365 fans positioned to blow air on track switches throughout the yard. Because of the gravity of the problem, the fans were switched on after the first snowfall of the season and ran continuously until snowmelt in spring, whether on not they were needed to keep the switches from clogging with snow.

The new system, the result of a three-year study, uses a series of snow detectors, temperature probes, and anemometers to turn on the fans when temperature, windspeed, and rate of snowfall could combine to cause snow to collect in the switches. Installation of the new control system would cut current operating costs by 50%, for estimated yearly savings of $83 400. It could pay for itself in only 1.2 years.


NION DIVERS

2.

The Environment

Manitoba Hydro generates over 95% of its energy at 10 hydroelectric stations on the Nelson, Saskatchewan and Winnipeg rivers. It's little wonder, then, that a significant amount of Corporate energy is devoted to stewardship of the aquatic environment.

In 1999, one of the Corporation's most interesting aquatic projects occurred at the Selkirk Generating Station, a coal-burning thermal station along the Red River, where an elaborate fish screen was installed to keep fish out of the station.

One of the hazards of running a thermal generating station that uses river water for cooling its steam condensers is that fish can be drawn into the cooling water intake. These fish become trapped on the cooling water intake screen and eventually die under the stress. Although the Selkirk station began operating in the early 1960s, given the infrequent operation of the station and the generally low numbers of trapped fish, the problem was not considered a significant environmental impact.

Things changed in the summer of 1998. Low water flows resulted in reduced generation from the hydroelectric stations on the Winnipeg River and forced the typically quiet Selkirk plant to run almost continuously. During the summer, more than five times as many fish were caught in the intake. About a third of the fish were minnows, another third were small carp less than 5 centimetres long, and most of the remaining third were sauger between 20 and 28 centimetres long. Sauger were the biggest economic concern, because they are important to the Red River sport fishery. Although the exact percentage of the total River River sauger population being affected was unknown, it was clear something had to be done.

The first step was to cut down on suction at the intake by reducing the speed of the pump that draws cooling water from the river. The strategy paid off in fewer trapped fish, but it could not be applied all the time. During warm water periods the generating units' condenser systems cannot be operated on low speed without affecting generation output. A fixed intake screen, at a cost of $1.2 million, was the solution.

Photo Left: Towing new fish screen to the Selkirk Generating Station pumphouse. The screen was fabricated in the Town of Selkirk and floated down the Red River to the Selkirk Thermal Generating Station.

As the fixed intake screen was being constructed, monitoring found the number of trapped fish again increasing. Station staff decided to set up a temporary fish barrier to keep fish away from the intake until the new screen could be installed, but high flows in the Red River forced them to put their plans on hold. As an alternative, they launched a catch and release program. Fish were manually caught in a net as they entered the stations. Live fish were returned to the river beyond the suction of the intake.

When water levels dropped in the Red, station staff installed a temporary fish barrier consisting of a series of booms about 50 metres long forming an arc in front of the pumphouse. Wire mesh was suspended from the underside of the booms to the river bed, forming a curtain that kept larger fish from entering the intake area. The temporary fish barrier proved effective in preventing sauger greater than 22 centimetres long from reaching the intake.

Preparing to lower the new fish screen over the intake to the pumphouse where it will be attached by divers. It is equipped with an air backwash system to keep it clear of debris and prevent ice build-ups.

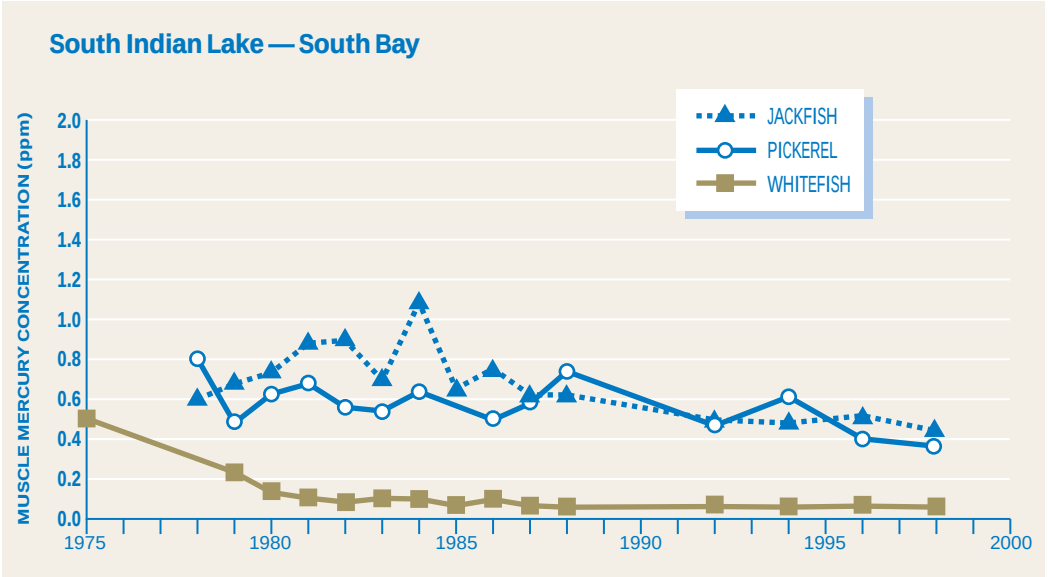
In November 1999, the new screen was installed. It consists of a wedge-shaped framework covered with mesh designed to prevent all fish longer than 25 mm (1 inch) from being drawn into the pumphouse. The open end of the structure, 3 metres high and 12 metres wide, fits over the intake on the face of the pumphouse. The front, covered by mesh, extends approximately 9 metres out into the water. The screen is equipped with a high pressure compressed air backwash system to clear debris that collects on the mesh. It also has a low pressure air system to prevent sediment from building up or ice from forming on the mesh.

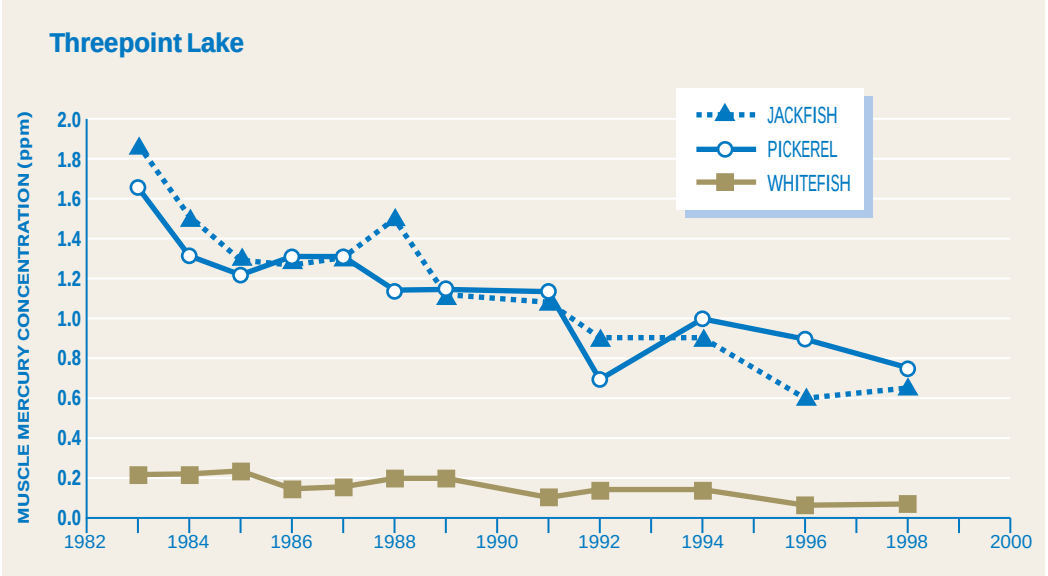
Station staff report that the screen works very well.

Major Projects such as the Selkirk fish screen are the exception. On a daily basis, our operators are devoted to maintaining a system producing energy for our customers while achieving our commitments to environmental stewardship.

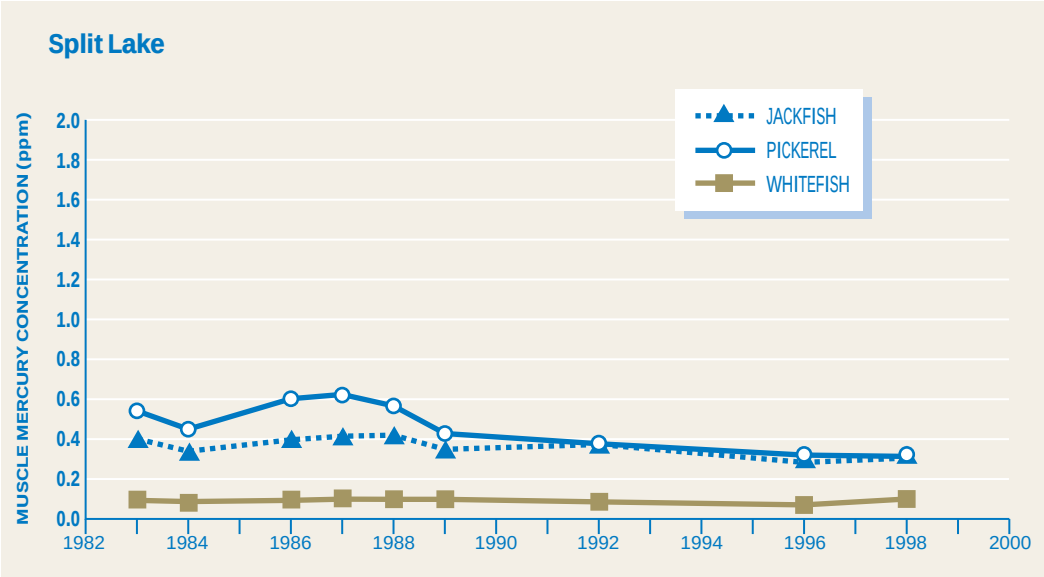
Manitoba Hydro regularly works with government agencies, independent scientists and local resource harvesters to monitor environmental conditions along river systems developed for hydroelectric power. One of the longest on-going scientific programs monitors mercury levels in fish along the Churchill River Diversion from Southern Indian Lake to the lower Nelson River.

Manitoba Hydro collaborates with Fisheries and Oceans Canada and Manitoba Conservation to collect and test fish on a three-year cycle. Flooding caused by





Above Graphs: Test results for mercury concentrations in fish go as far back as 1978 for Southern Indian Lake and 1983 in Threepoint Lake. Predatory fish such as jackfish and pickerel are more impacted than bottom feeders such as whitefish. The results show a steady decline since mercury levels peaked in the early 1980s.



Left Graph: Because mercury levels are related to the amount of organic material flooded in a lake, mercury levels in Split Lake fish are lower than levels in Southern Indian Lake and Threepoint Lake (see previous page).

the Churchill River Diversion accelerated the release of naturally occurring mercury into the water and ultimately increased mercury concentrations in fish. Both fish and people can eliminate mercury from their bodies, but this occurs slowly.

Therefore, consuming food with high mercury levels gradually increases the accumulation of mercury. Health Canada's guideline for total mercury content in commercial marine and freshwater fish is 0.5 parts per million (ppm). Predatory fish, such as walleye (pickerel) and northern pike (jackfish), will usually have higher mercury concentrations than bottom feeding, non-predatory species such as whitefish, tullibee and suckers. Mercury concentrations in non-predatory fish also return to normal levels more quickly after flooding has occurred.

While mercury levels in lake whitefish increased after development of the Churchill River Diversion in 1976, average mercury levels did not exceed 0.5 ppm. After peaking in the 1980s, the levels declined until stabilizing at or near pre-flood levels in Southern Indian, Isset, and Wuskwatim lakes (the lakes with pre-CRD data). Average mercury concentrations in whitefish from other lakes along the Churchill River Diversion are also at or near the pre-CRD levels.

Mercury concentrations in predatory fish dramatically increased following the flooding, generally peaking in the mid-1980s. At Southern Indian, Isset, Wuskwatim, Stephens, and Split lakes, concentrations declined over the

following decade and by 1996-1999 were similar to concentrations prior to flooding and to levels found in other local lakes not affected by development. Mercury concentrations in predatory fish from Rat, Notigi, Wapisu, Threepoint and Footprint lakes followed the same trends but have not yet reached natural levels. They require continued monitoring.

Aquatic monitoring at Limestone has been going on since 1985, five years before the first units went into service at the generating station.

In the decade since, the studies that began by describing the existing environment have gradually transformed into long-term studies on specific components of the aquatic environment. The following are highlights of the monitoring results:

- The fish population upstream of the generating station has changed since the project and is expected to continue to evolve in the coming years.
- The two most recent fish population surveys show a trend toward increasing numbers of walleye and decreasing numbers of longnose sucker in the forebay.
- Water chemistry in the forebay has changed little since the project was built.
- Invertebrate productivity in the forebay is increasing and becoming similar to other nearby forebays.
- While populations are down, brook trout continue to inhabit tributaries upstream of the generating station.

A sturgeon is released from monitoring nets as part of the Limestone Monitoring Project.

- Brook trout populations downstream of the station remain relatively stable, and some brook trout continue to migrate into the saltwater of Hudson Bay, travelling as far north as Churchill.
- Low numbers of sturgeon continue to inhabit the forebay. Catches of young sturgeon indicate that reproduction is occurring upstream of the generating station.
- Relatively healthy sturgeon population continues to inhabit the river downstream of the station.
- Studies on Nelson River tributaries found a correlation between water levels and flows and the number of fish using these streams. Fish continue to use streams similar to the way they did prior to the generating project, except for a lower number of lake cisco in the Limestone River in autumn.

While all generating stations have a forebay for storing water such as the one at Limestone, three lakes serve as the three largest reservoirs in the Manitoba Hydro system.

They are Lake Winnipeg, regulated by the Jenpeg Generating Station on the Nelson River; Cedar Lake, regulated by the Grand Rapids Generating Station on the Saskatchewan River; and Southern Indian Lake, regulated by the Notigi Control Structure on the Rat River and the Missi Control Structure on the Churchill River. Manitoba Hydro operates these reservoirs according to provincial licences.

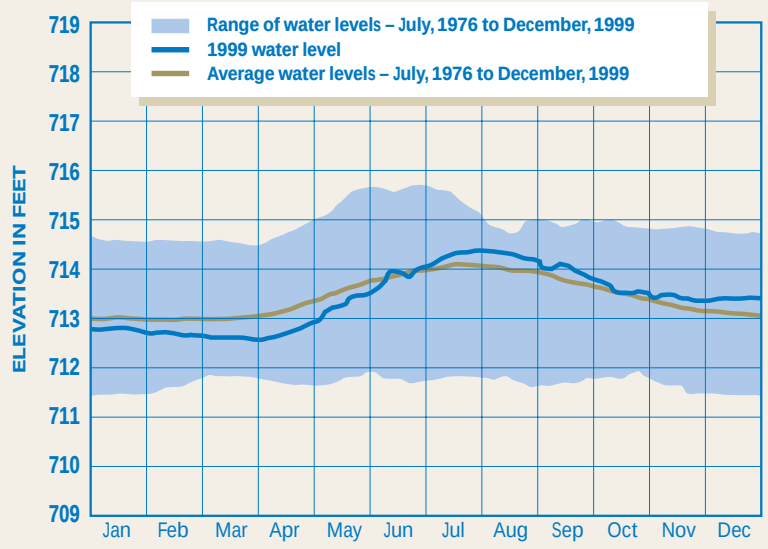
Although water supplies were variable throughout 1999, the reservoirs were operated within their normal ranges.

Above average summer and fall precipitation over the Lake Winnipeg drainage basin resulted in above average inflows. In spite of these higher inflows, near average lake levels were maintained by operating at higher-than-normal outflows. The higher outflows helped alleviate dry conditions in the North.

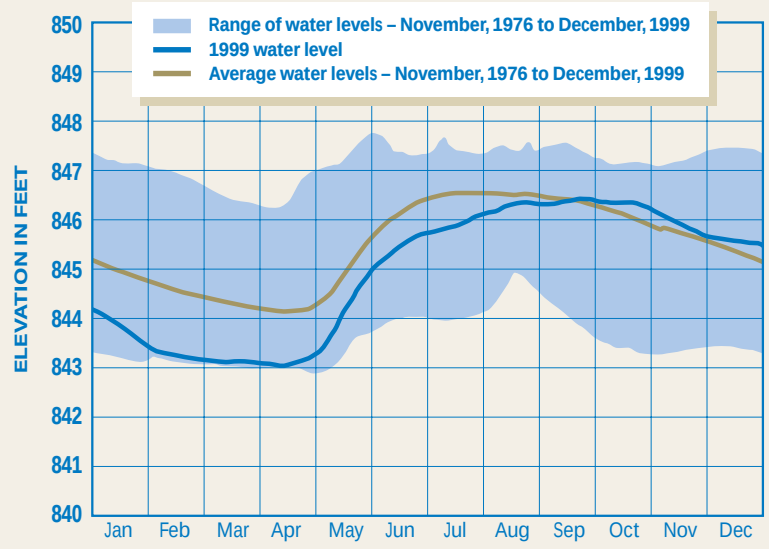
On Cedar Lake above average levels were experienced for the first few months of the year. These lake levels were maintained partly because a warm winter reduced customers' need for energy, resulting in less water being required to produce energy at downstream generating stations. This stored water protected against the possibility of low supplies should drought conditions have occurred later in the year. Near-average lake levels occurred from late spring to year's end.

From January to April, below average flows were experienced on the upper Churchill River flowing into Southern Indian Lake. As a result, Southern Indian Lake levels declined to the lower end of the power production range. Levels returned to near average by May due to reduced diversion outflows and increased inflows from spring runoff.

Lake Winnipeg Wind Eliminated Water Level



Southern Indian Lake Wind Eliminated Water Levels



Management of hazardous products

Manitoba Hydro handles thousands of different chemical products every year, including many designated under governmental hazardous material legislation. As a first step in its environmental practices, Manitoba Hydro prefers to avoid these types of products.

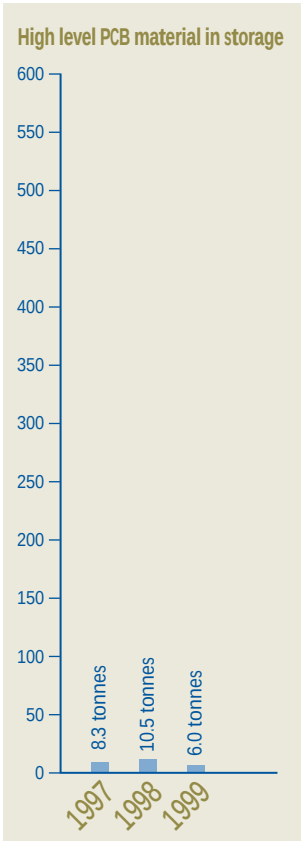
In 1999, 240 products were evaluated by the company. Of those, 50 were approved and another 155 had conditions and limitations attached to their use.

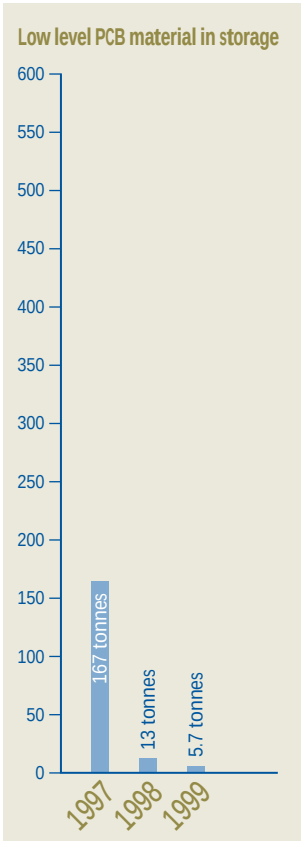
But not all hazardous materials can be avoided. Manitoba Hydro manages these in a safe and responsible manner and, should an accident occur, responds quickly with trained personnel.

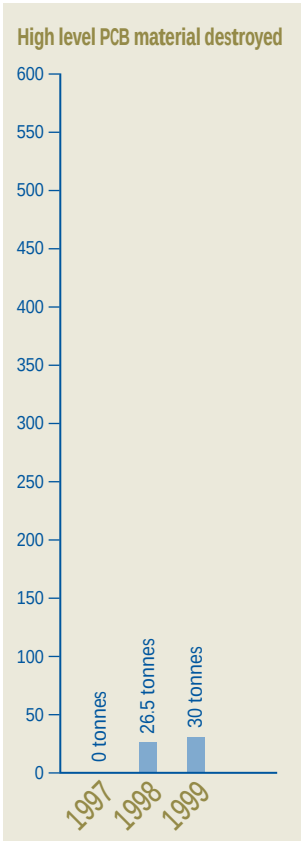
PCBs were once used in electrical equipment because of their cooling, insulation, and non-flammable properties. However, because of concerns with the effects of PCBs on health and the environment, the import, manufacture, and sale of PCBs in Canada was made illegal in 1977. The release of PCBs to the Canadian environment was made illegal in 1985.

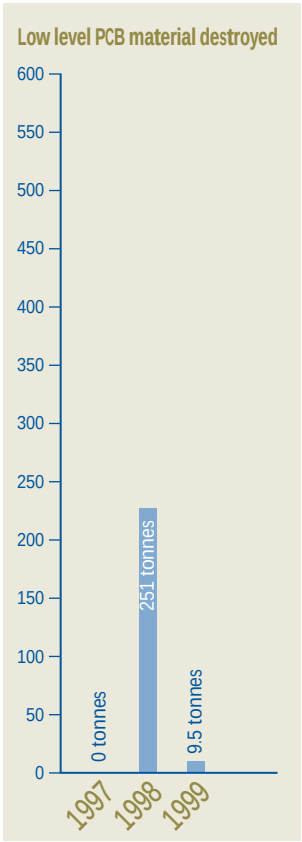
Consistent with regulatory and Canadian Electricity Association protocols, Manitoba Hydro tracks the amount of PCB material in use and in storage in its system. PCBs were once used in electrical equipment because of their cooling, insulating and non-flammable properties, but they have not been produced since 1985. Manitoba Hydro is systematically testing, decontaminating and phasing out equipment with PCBs. Material with PCBs is stored in licensed facilities and delivered to approved facilities for destruction.

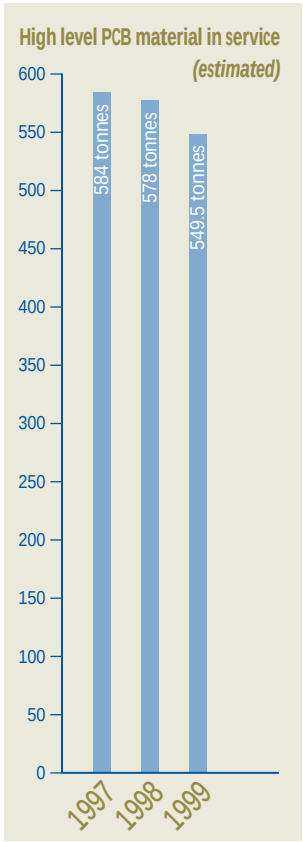
PCB Management











At Manitoba Hydro, electrical equipment in use is systematically tested to determine whether it contains insulating oils contaminated with PCBs. If it does, the equipment is scheduled for replacement or, where possible, decontamination. PCB-contaminated oil from the equipment is salvaged, decontaminated to less than 2 ppm, and reconditioned for use. Where salvage or decontamination is not feasible, PCB equipment is sent for destruction to a licensed and approved hazardous waste management facility.

PCBs generally cause no concern for people or the environment. But they can be released accidentally; and sometimes accidents happen at the worst times and places, such as at a university just hours before a convocation. When a busy intersection at the University of Manitoba was showered with PCB-contaminated oil from a failed pole-top transformer in 1999, campus officials turned to Manitoba Hydro to handle the cleanup.

Although the failed transformer released only 50 litres of oil with low levels of PCB, the spill demanded immediate attention. Winds of more than 80 kilometres an hour had dispersed the oil over the intersection of a main thoroughfare, a stretch of sod on a boulevard, a bus, a university security vehicle, street and traffic lights, traffic signs, and the walls of two buildings. Hydro's team secured the area with the help of the Winnipeg police and fire departments, then decontaminated the road, buildings, signs, street and traffic lights, and vehicles. Contaminated sod on the boulevard was cordoned off for excavation the following day.

The road was reopened at 10:30 that evening, less than 5 hours after the failure, without affecting the convocation ceremonies.

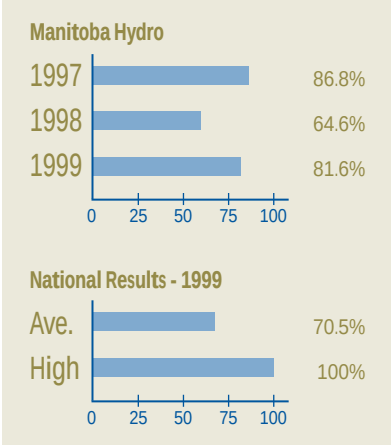
When a utility crew at Kelsey Generating Station discovered a diesel fuel like substance near the station's rail spur, a major soil remediation project was initiated in 1999.

When it was completed some 5000 cubic metres of soil had been excavated and replaced with clean material. The excavated soil was hauled to a "landfarm" where it was spread in layers and tilled, a practice that exposes the soil to air, encouraging the evaporation of light hydrocarbons and speeding bio-degradation by oil-consuming bacteria that occur naturally in the soil.

When the hydrocarbon content of the soil declines below 2000 ppm, a level accepted by regulators for low-risk sites, the soil can be used at landfills and as subgrade construction materials.

The project is typical of those coordinated under the Contaminated Lands Management Program which i) compiles and maintains Manitoba Hydro's and Centra Gas's inventories of contaminated and potentially contaminated lands, ii) coordinates site assessments (sampling investigations) to determine the presence and amounts of site contamination and iii) where necessary, initiates site remediation (cleanup) activities.

Reuse of Electrical Insulating Oil



Several kinds of electrical equipment use oil as an insulator and coolant. This oil tends to deteriorate over time and may need to be cleaned. Because of their age and level of degradation, some oils cannot be cleaned or reused, but can be recycled for other purposes or the energy can be recovered by burning the oils in industrial furnaces. These are not measured as part of the indicator, but if they were, the re-use rates would be close to 100%.

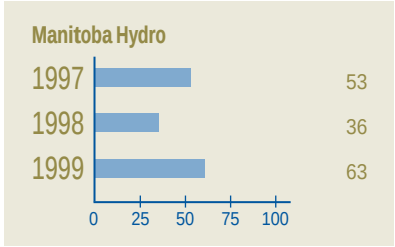
Most contaminated sites come to light as a result of a systematic inventory compiled to ensure that all of the Corporation's facilities are in compliance with current environmental legislation and the Corporation's environmental stewardship commitments.

The program, launched in 1996 with a total initial budget of $10 million, has documented more than 1300 sites where the utility and its predecessors have conducted operations over the past century. As more information and data are compiled the inventory files grow and site conditions are more accurately defined. A comprehensive computer data base has been developed specifically to manage the large volume and diverse nature of the site inventory records.

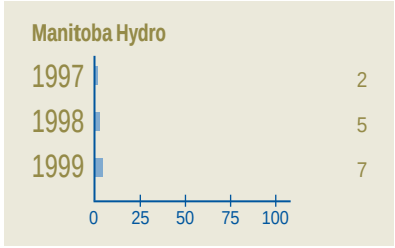
Although most sites require no action other than confirmation and documentation of site history, each year several comprehensive site assessments are undertaken to identify and assess reported site contamination. Where significant contamination is found remediation is carried out. A priority action list is maintained; approximately 15 sites are assessed and 10 remediated annually. These include diesel generating sites in about 30 remote communities. As the communities have been linked to the provincial transmission grid, the diesel generators have been decommissioned. The sites are being remediated, in some cases with federal and provincial collaboration, and returned to other uses in the communities. By the end of 1999, about half of the former diesel generating sites had been addressed.

Numerous departments and disciplines participate in the contaminated sites management program. These range from site owners/operators, to specialist technical services, and to construction managers. External contracted services such as laboratories, construction companies and waste management agencies also contribute to the program. All work is completed to the satisfaction of regulators, community authorities, and local interested parties.

Reportable Spills



Priority Spills



Reportable spills are those that must be reported to regulatory officials; that is, they exceed 68 litres of insulating oil or other petroleum materials, 45 parts per million of PCBs, or 10 or more kilograms of ozone depleting substances.

Priority spills are those that involve petroleum products or PCB contaminated substances in which the spill volume is greater than 500 litres, the spilled substances enters a waterbody, or media reported the event.

Until now, ash produced in the course of generating thermal electricity has sat unused in specially constructed storage lagoons. That changed in 1999 as Manitoba Hydro launched a campaign to market the ash left when coal is burned at the Brandon Generating Station.

The marketing campaign followed an environmental assessment by Manitoba Hydro and subsequent permission from Manitoba Environment to remove ash produced at the station for approved uses. The environmental regulator requires the ash to be covered when it is being transported, to be placed above the groundwater table, and not be subject to ongoing erosion by wind, water, or vehicle traffic.

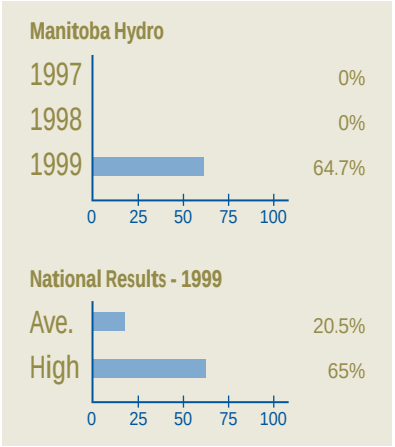
The ash can be used as a component of road bases, daily cover for local municipal sanitary landfills, and embankment material for roads, area fills, and dikes. It offers superior stabilizing properties compared with traditional alternatives, such as straw, saw dust, and peat moss. Ash can also be used as an additive for backfilling excavations in mines.

In 1999, roughly 7500 tonnes of the ash were used in road bases by paving companies in the Brandon area.

The Brandon and Selkirk generating stations are also the main sources of air emissions produced by Manitoba Hydro. But because over 95% of our electricity is produced at hydroelectric stations, Manitoba Hydro is one of the lowest contributors of these emissions among Canadian electricity utilities, most of which depend to a much greater extent on coal and natural gas as their main fuels.

Manitoba Hydro has also made the strongest commitment among Canadian utilities to reducing carbon dioxide and other greenhouse gases contributing to man-made influences on climate change. Between 1991 and 2012, we will reduce our net greenhouse gas emissions in excess of 6% below 1990 levels.

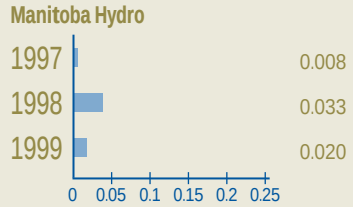
Utilization of Solid Combustion By-product (Ash)



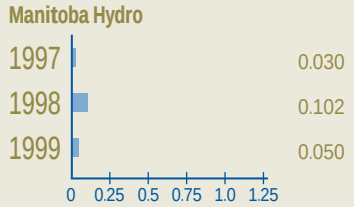
Burning any kind of fuel creates residues of various kinds. Some of these residues, such as fly ash from burning coal, can be captured in solid form and productively re-used.

While Manitoba Hydro's performance to date has exceeded our commitment, conditions could occur in the future making the long term commitment much more demanding. In the past two years, for example, the Brandon and Selkirk generating stations have been operated more often because of domestic requirements and increasing export opportunities. The stations are the major source of our greenhouse gas emissions.

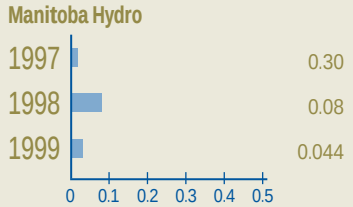
Carbon Dioxide Emissions
kg/kWh of System Generation



Sulfur Dioxide Emissions
g/kWh of System Generation

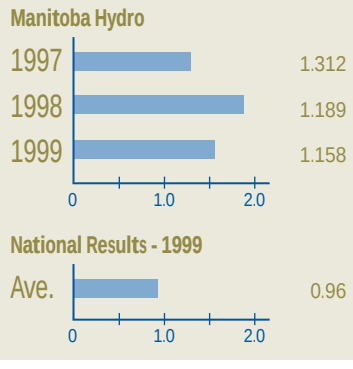


Nitrogen Oxides Emissions
g/kWh of System Generation

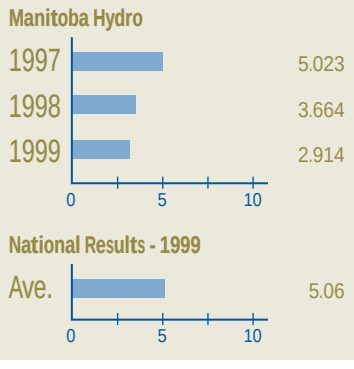


Thermal stations that operate continuously will generally produce fewer air emissions per unit of energy than will stations that are operated on a less frequent basis, but utilities that rely on thermal generation for their base system load will generally produce more total emissions than utilities such as Manitoba Hydro that rely on other forms of generation such as hydropower for their main source of energy. Air emissions will also fluctuate in relation to the characteristics of the fossil fuels, technologies used to capture certain emissions such as nitrogen oxide and particulates, and of course yearly fluctuations in electricity demand.

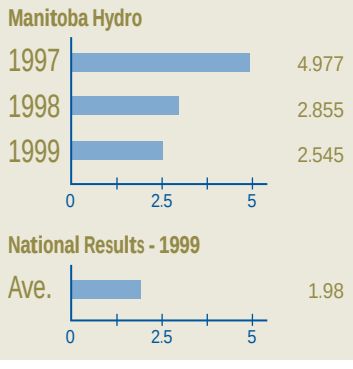
Kg/kWh of Fossil Fuel Generation



Grams/kWh of Fossil Fuel Generation



Grams/kWh of Fossil Fuel Generation



Obviously, living up to our environmental pledge to reduce greenhouse gases will be a challenge, especially as society continues to use more electricity. To satisfy the increasing demands to produce this additional electricity, Manitoba Hydro will consider all viable options, beginning with energy conservation. Additional hydroelectric and gas combustion turbines, which produce less greenhouse gas than coal-fired units, are also being planned. Manitoba Hydro is also working closely with local Cree Nations to study three potential hydroelectric sites at Wuskwatim and Notigi on the Rat-Burntwood river system and Gull on the Nelson River.

Two of the three hydroelectric options would not result in any significant additional amounts of greenhouse gases, produced in reservoirs when flooded organic material such as peat and trees decay, since no flooding would be associated with the Notigi project and the one-half square kilometer flooded at Wuskwatim will be cleared of trees. At the third site, Gull, approximately 42 square kilometres will be flooded. For every megawatt-hour of energy produced at the Gull site, less than 3 kilograms of carbon dioxide would be emitted.

This is small compared to the 1,100 kilograms of carbon dioxide released from a coal thermal station or 400 kilograms from the most efficient gas combustion station.

The other two major sources of greenhouse gases in Manitoba Hydro's system are its diesel generators in four remote communities, responsible for about 1% of our greenhouse gases, and our vehicle fleet, responsible for 2%. Attention is also being given to reducing these emissions.

In 1999 several of the latest models of engine coolant heaters for truck and highway tractor diesel engines were tested. Coolant heaters reduce emissions by eliminating idling customarily used to keep diesels warm overnight in cold weather. The latest coolant heaters burn only about 0.5 litres of diesel fuel an hour to keep the engine coolant sufficiently warm to ensure a trouble-free start in the morning, even after temperatures overnight have plunged to -40°C. In contrast, running an engine at fast idle to keep an engine warm consumes roughly 10 litres an hour.

Engine coolant heaters are sometimes cycled on and off, or kept on for progressively longer periods, depending on ambient temperature. Operating a coolant heater 50% of the time for eight hours overnight instead of idling the engine saves an estimated 78 litres of diesel fuel. At that rate, over a typical winter season, operating coolant heaters instead of idling Hydro's fleet of 250 trucks and highway tractors will spare the environment emissions from burning an estimated 3.5 million litres of diesel fuel.

Throughout the year, vehicle operators are instructed to avoid idling their engines where possible, since ten seconds of idling uses more fuel than restarting their engines.

Fuel storage tanks being transported out of Island Lake along the new Norway House winter road. Now that the community is connected to the provincial grid, the tanks are no longer needed at the old diesel generating station

***1999** marked the third year of operation of the Environmental Commitment and Responsibility (ECR) Program. An initiative of the Canadian Electricity Association, this program requires members to report annually on a set of environmental performance indicators and requires members to implement Environmental Management Systems (EMS) which are consistent with ISO 14001, the international standard for Environmental Management Systems.*

An EMS is a set of tools and processes a company uses to realize its environmental goals. Having a good EMS enables a company to identify its environmental impacts, set goals to manage them, implement plans to meet those goals, and then evaluate performance and make continual improvements to the system.

There were two targets associated with the implementation of Environmental Management Systems at member utilities: implementation of an EMS in the Corporate and Generation sectors by December 31, 1999 and implementation of an EMS in the Transmission and Distribution sectors by December 31, 2002.

Manitoba Hydro has been a participant and leading promoter of the ECR Program since its inception. The Corporation met the requirement for having its generation facilities covered by an EMS by December 31, 1999.

In 1999, a gap analysis was conducted at selected generation facilities. A gap analysis is used to determine if all parts of a management system as defined by ISO 14001 are present at the particular facility. The facilities then act upon the findings of the gap analysis to improve their management systems and prepare for the registration process.

Manitoba Hydro has now decided to seek registration of its environmental management systems under the ISO14001 standard. Most generation facilities are expected to receive registration over the next two years. Generation stations targeted for registration in 2000 are Long Spruce GS, Brandon GS, Selkirk GS, and Winnipeg River GSs. The steps involved in obtaining registration are: gap analysis, document review, internal audit, and implementation assessment.

Manitoba Hydro participates in many different research projects, often with external agencies such as universities, government agencies and first nations.

The following are a few examples with environmental components.

During the summer of 1999. Centra Gas Manitoba, Manitoba Hydro, and other participants successfully demonstrated the effectiveness of microturbine technology for eliminating foul odours produced by wastewater treatment plants. The test took place at the South End Water Pollution Control Centre operated by the City of Winnipeg. Sludge handling operations at the plant release hydrogen sulphide with its characteristic rotten egg smell. The odour is a common and growing problem for wastewater treatment plants and industries throughout North America.

A micro combustion turbine fueled by natural gas was set up at the plant. A microturbine is much the same as the engine used in a jet aircraft, with an electrical generator hooked up to the back end. In contrast to larger generators, such as the 260 MW version that Hydro proposes to install at Brandon Generating Station, the generator used in the test at the sewage treatment plant is capable of producing only 75 kW; hence the name "micro" combustion turbine.

Microturbine installation for demonstrating odour control at Winnipeg's South End Water Pollution Control Centre.

Normally a natural gas turbine runs on a mixture of natural gas and air. The mixture burns to produce rapidly expanding gases that rush through the turbine, pushing against the rotor blades on the turbine wheels, causing the wheels to spin and turn the axle. The turbine's axle drives the electric generator to produce electricity. In the demonstration, clean air was mixed with hydrogen sulphide laden air from the plant and the combination burned with natural gas to run the turbine and generate electricity. More than 99% of the hydrogen sulphide was destroyed, virtually eliminating foul odours from the process.

Electricity generated was used by the plant to offset some of its electrical load. The microturbine was also equipped with an exhaust heat recovery system that could be used to pre-heat the plant's domestic hot water. By generating electricity and usable waste heat, the microturbine offers advantages over the traditional approach of simply burning a mixture of natural gas and foul air in a furnace to destroy odours.

Odour control problems are not unique to wastewater treatment plants. The demonstration project will be used as a springboard to investigate the control of odours, methane, and other greenhouse gases from large hog barns and landfill sites. Centra Gas Manitoba spearheaded the project, in partnership with the City of Winnipeg, Natural Resources Canada, Manitoba Hydro, and the Manitoba Conservation/Sustainable Development Innovations Fund.

Woodpeckers sometimes bore holes in hydro poles to build their nests. The holes allow water to seep into the wood, creating conditions for the poles to rot from the inside out, causing millions of dollars of damage each year to utility poles across North America.

Epoxy resin and wire mesh can be applied to the cavities, but the birds simply peck holes in other parts of the same pole until it needs to be replaced. Depending on the type of power line, replacing a single pole varies from $4000 to $8000.

Several years ago, Manitoba Hydro staff tested a special foam designed to restore the structural rigidity of hydro poles by filling nests and holes bored by woodpeckers. The foam was to be poured into the nest hole, which can sometimes reach depths of 60 centimetres. It expands and hardens in minutes, creating a barrier to the birds. The foam was expected to save Manitoba Hydro millions of dollars in pole replacement costs. But it proved a health hazard for installers, and was never used.

In the latest search for a safe, effective solution, researchers are taking a different approach by trying audible and visible deterrents. They located pairs of poles favoured by woodpeckers along rights of way in the Ashern area. On each pole they mounted a model woodpecker and at the base of the pole positioned an audio system that could duplicate the distinctive sounds of a woodpecker. From pup tent "blinds" located midway between the poles, they watched for woodpeckers, triggered the audio system when they arrived, and noted which of the deterrents was effective at scaring the birds away.

Damage to poles at the beginning of the field season will be compared with damage at the end to determine the effectiveness of the deterrents.

A study to determine whether the construction of transmission line rights-of-way can damage overwintering bat habitat in the Grand Rapids uplands region will draw on traditional ecological knowledge as well as hard scientific data.

The region is famous for its labyrinth of sinkholes and caves that disappear underground, all developed by the action of water eroding soluble limestone. Several hundred bats have been counted in some of the caves, which reach depths of 11 metres and are known to be suitable for bat hibernation from September through April. In summer, the bats leave the caves at night to forage for insects, the mainstay of their diet.

Clear-cutting and bulldozing for line construction may have an impact on hibernating bats by altering water quality, air temperature, and relative humidity in the caves. If cave entrances are blocked by debris, carbon dioxide levels in the caves may also increase, disturbing the bats.

Researchers are monitoring temperature, relative humidity, and bat movements in four caves. Three of the caves are in locations where timber has been harvested, roads built, or the area swept by forest fires. The fourth or control cave has not been subjected to human disturbance. If researchers find a connection between disturbances and changes in the microclimates in the caves, they will determine whether treed buffer zones figure as a mitigative tool to maintain the natural internal regime of bat hibernacula.

Findings will be supplemented by traditional ecological knowledge collected from First Nations people living in and around the Grand Rapids uplands.

Woodpecker holes appeared in a pole at a river crossing of the North Central transmission lines — only two years after installation. The lower nest–hole could threaten the structural integrity of the pole because of its position so close to the attachment point of the guy wires.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3.

Economic Management

Two major sources of energy, electricity and natural gas, were brought under one management umbrella in 1999 when Manitoba Hydro purchased Centra Gas. The deal will enable the corporation to become a one-stop energy services provider, offering integrated energy solutions that meet the needs of its customers.

Synergies and saving are expected from amalgamating similar functions within the two utilities, such as customer service operations, customer accounting, information services, and finance and administration. Those savings will benefit Centra Gas' 240,000 customers and Manitoba Hydro's 390,000 customers. Rates paid by both gas and electricity customers fall under the purview of the Manitoba Public Utilities Board. Centra Gas has 1,430 kilometres of pipeline and 5,230 kilometres of distribution lines to deliver natural gas purchased from external suppliers, while Manitoba Hydro is a full service electricity utility with generation, transmission and distribution facilities.

Manitoba Hydro's management of those facilities has resulted in Manitobans paying the lowest electricity rates as a whole in Canada. A nation-wide survey by Statistics Canada determined that average residential and farm rates were lower in Manitoba, at 5.88 cents, than anywhere else in the country. Statistics Canada reported provincial results, rather than those from individual utilities, which for our province includes both Winnipeg Hydro (serving central areas of the city) and Manitoba Hydro. Manitoba Hydro's own survey also found our commercial and industrial rates on the whole to be the lowest in Canada.

Statistics Canada also reported that Manitoba utilities, with a return on revenue of 16%, were also the most profitable in Canada.

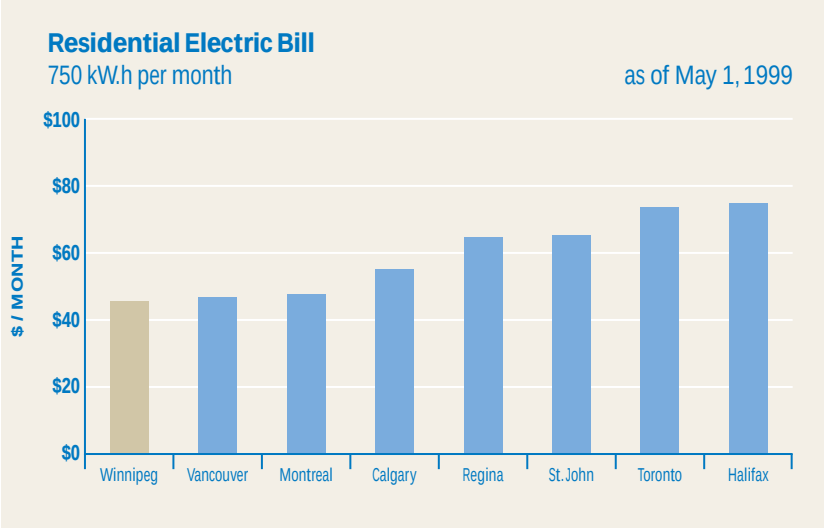
Photo Left: In 1999 two major Manitoba energy companies, Manitoba Hydro and Centra, became one.

Manitoba Hydro has been able to achieve these results by continuing to pay close attention to its operating costs while earning significant revenues from export sales.

In 1999, exports were worth $363 million, an increase of 13% from the previous year; this, despite the fact that the actual amount of energy shipped out of province was down almost 10% from the previous year. In 1997, the so-called "flood of the century" in southern Manitoba and another flood in northern Manitoba resulted in an all-time record production of energy in the water-powered hydroelectric generating stations, and this continued into 1998.

But the reduction in exports was more than off-set by increasing prices in the United States. Over half of all exports are sold under long-term contracts for "firm" power, which generally pay the best prices. In 1999, the price narrowed between firm power and short-term opportunity sales. The short-term opportunity prices increased by about 20%, reflecting a tightening of supply and rising prices for gas used at thermal generating stations. Coal and gas-fired thermal generating stations are the most prevalent generating sources in our American markets.

Manitoba Hydro is positioning itself to continue to provide power to its export customers for the benefit of its Manitoba ratepayers. Environmental and engineering studies are underway for three potential generating stations in northern Manitoba, at Notigi, Wuskwatim and Gull Rapids, and consideration is also being given to gas combustion turbines. One or more of these stations could be required to serve growing Manitoba demand for power in about 15 years. But these stations are being considered for development well in advance of provincial needs, in order to take advantage of profitable export opportunities.



Generation and Revenue Sales

The above figures represent only electrical values (not gas), and revenues have been restated based on annual report figures which include items previously excluded, i.e., accounting adjustments, loss repayment, spinning revenues. (Note that MAPP transmission credits which increase extraprovincial revenues on the financial statements are approx $3-4 million annually and previously not included).

The environmental, financial and engineering studies required for that decision will still take a few years. So, too, will discussions with the two local Cree Nations in whose resource management areas the generating stations would be located. The 100 MW Notigi and 200 MW Wuskwatim sites are within the Nelson House (Nisichawayasihk Cree Nation) resource management area, and the 600 MW Gull site is in the Split Lake (Tataskweyak) Cree Nation resource management area.

Should one or more of these projects proceed for export sales, Manitoba Hydro has already made two significant decisions:

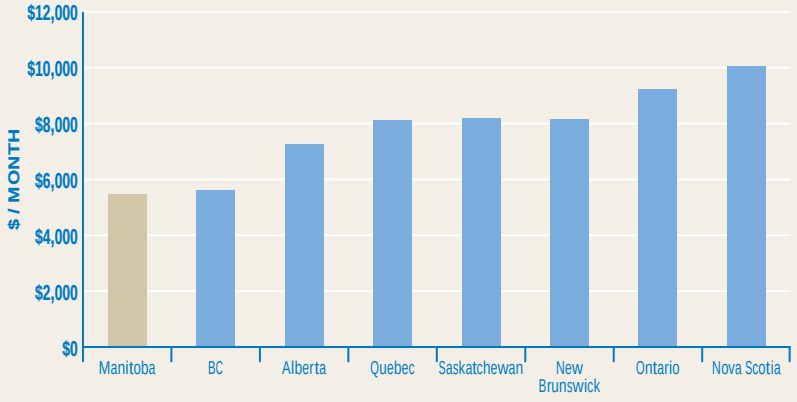
- All three projects will be designed to avoid or reduce the most significant environmental impact associated with hydroelectric development — flooding. No additional land will be flooded for the Notigi project, about one-half a kilometer for the Wuskwatim project, and 42 square kilometres for the Gull project. In arriving at this decision, alternatives that would have produced substantially more power at Wuskwatim and Gull were rejected because they would also have caused substantially more flooding.
- The two local Cree Nations will be offered an opportunity to invest in the projects in their respective resource management areas, becoming business partners with Manitoba Hydro in the projects.

Nisichawayasihk and Tataskweyak Cree Nations are each engaged in negotiations with Manitoba Hydro for agreements in principle for their respective projects. The parties hope to have these non-binding agreements completed in 2000. The agreements in principle will provide the framework for developing binding project development agreements covering business arrangements to construct, operate and own the projects.

Manitoba Hydro rates, on average are the lowest in Canada for residential customers (page 36), as well as commercial and industrial customers (below).

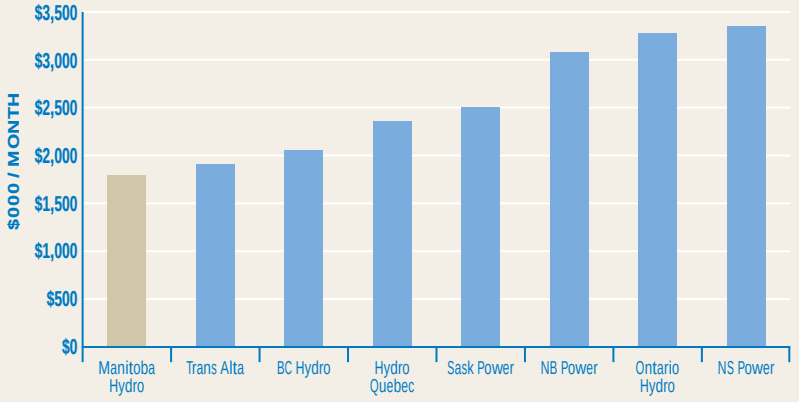
General Service Medium Bill

300 kW @ 90% Power Factor and 120,000 kW.h per month — as of May 1, 1999



Industrial Electric Bill

100 MW and 62 GW.h — as of May 1, 1999



4.

The Community

With completion of the North Central Project in the spring of 1999, nearly ten thousand residents in nine remote northern communities in Manitoba were hooked into "unrestricted" electricity service.

Local diesel generators once supplied homes with 15-amp service, enough power for a few lights and one or two appliances. The $146 million North Central Project now provides residents with 100- or 200-amp service, the same level most other Manitobans take for granted. And throughout the project attention was paid to ensuring local people and communities benefited from job and business opportunities.

Those efforts paid off. As the project was nearing completion, Chief James Mason of the Oxford House First Nation declared: "This project has taken a long time and many hard, tough, negotiations to complete. We fought to ensure we would fully benefit from the construction of this project in terms of jobs, training, and business opportunities. We accomplished this even though at times it was very frustrating. I am sure Manitoba Hydro feels the same way, and they should be proud as well of what has been accomplished here."

Five hundred twenty kilometres of transmission lines and distribution lines and four substations connect the provincial power grid at Kelsey with the seven First Nation communities: Oxford House, God's Lake Narrows, God's River, Red Sucker Lake, Garden Hill, Wasagamack, and St. Theresa Point, as well as communities at God's Lake and Island Lake falling under provincial jurisdiction. Manitoba Hydro managed the project and funded 10% of it, with the other 90% covered by the federal and provincial governments.

The communities were early advocates of the project. Through their local leadership and organizations such as the Community Support Agency, they were closely involved in its planning and construction. Of the 100 800 person-days of employment on the project, 55% were worked by Aboriginal people. Aboriginal people made up

Photo Left: Caribou in a cleared area next to the right-of-way between Oxford House and Kelsey.

34% of Manitoba Hydro's workforce, 39% of contractor's work forces, and 100% of First Nation businesses awarded contracts on the project.

Before construction, residents were consulted through open houses, awareness meetings and local media about preferred routes for the rights-of-way. The project was also the first in Manitoba to be subject to the full scrutiny of a federal-provincial environmental review panel. Two members of the panel, including the chairman, were of Aboriginal decent. Many local residents offered information and opinions to the Panel during hearings in the First Nation communities. Elders from the communities met to discuss the effects of clearing, construction, and maintenance on wildlife. Their efforts were guided by a review of Fur and Feathers, a non-technical publication prepared by Manitoba Hydro to encourage public consultation on projects by answering questions that people often ask about transmission lines and their impacts.

The Community Support Agency was organized to communicate information among all participants and facilitate local participation in project opportunities. Working under the authority of the region's Chiefs and Mayors, the agency gathered information from Manitoba Hydro and conveyed it in a series of two-language newsletters written for the communities. Contacts in the communities distributed the newsletters, fielded questions from residents, and relayed concerns to the Agency.

Throughout the project, community liaison committees, consisting of up to six residents, including representatives of women, elders, and youth, suggested improvements that were used to refine routes. Committee members were taken on fly-overs in their respective areas to see the progress of work on the

Top: Snow and Ice ramp under construction at a water crossing on Island Lake at St. Theresa Point. This is a standard construction practice to create a working surface that protects sensitive shoreline soils from the heavy equipment needed to install a river crossing.
Bottom: Clearing at a river crossing on the North Central Project. The narrow cleared section through the trees is only 8 feet wide — the bare minimum needed to pull the conductor through for stringing on poles. Such a narrow swath grows back within a season to maintain the tree buffer which anchors shoreline soils, protecting against erosion and minimizing visual impact. The standard width of the right-of-way here is 125 feet.

transmission lines and put to rest fears that the project would cause flooding. When people raised concerns about the effects of submarine cable crossings on water and fish, the committees were shown a representative crossing in the Whiteshell and toured a laboratory setup showing an energized submarine cable submerged in a tank filled with water. Residents directed the route away from important medicinal plants and culturally-significant sites. Rapids and scenic outlooks were avoided as much as possible, and in some cases valued hunting and fishing areas were bypassed. Manitoba Hydro took special measures to minimize the visual impact of the line, particularly in locations where tourism was important.

An example was the crossing of God's Lake Narrows which involved two separate lines, a 138 kV transmission line and a 25 kV distribution line. Towers to carry both sets of lines would normally deploy conductors vertically on a highly visible 200-foot-tall tower. Instead, a special 110-foot-tall tower was designed with long horizontal arms to carry lines out to the side rather than vertically. The low-profile towers were sited on the river side of a low hill, to screen them from the community of God's Lake, and they were painted to help them blend with their surroundings.

Photo Left: One of the transmission lines that serve communities on the North Central Project.

Construction crews followed environmental protection plans, in which sensitive sites were colour coded on aerial maps. The codes were attached to construction contracts, making them an integral part of the specifications to be followed. Environmental protection workers from each community were hired and assigned to the project in their resource area. Equipped with customized instruction manuals and checklists, they worked with foremen in sensitive situations or contacted Manitoba Hydro's senior construction supervisor if remedial work was required.

At river crossings with sensitive soils, crews cleared only 8-foot swaths through trees growing on river banks—just wide enough for stringing cable. Such a narrow swath grows back quickly, stabilizing riverbank soils to avoid erosion that could damage fish habitat. Crews also built snow and ice platforms on riverbanks as working surfaces to protect sensitive shorelines from cranes and diggers needed to install poles at crossings. Access routes were built diagonally to rights-of-way upstream or downstream from crossings to minimize visual impact.

Unacceptable impacts were few. However, in at least one case vegetation was mistakenly cleared to the edge of a stream crossing, rather than being left as a natural buffer. Because human intervention could cause further erosion, the site will be allowed to regenerate naturally.

When their work was finished, contractors were required to remove construction equipment and debris. Cleared topsoil and vegetation were pushed back at locations approved for excavating sand and gravel. After borrow pits had been worked out, their slopes were graded to prevent erosion, then the stripped soil and vegetation were replaced to restore habitat for wildlife. Similar practices were applied to rehabilitate power line rights-of-way, roads, and areas cleared for work sites and material storage.

With completion of the project, environmental effects will be monitored to the year 2000 through field measurements of vegetation cover and growth. Results will be used to determine areas requiring mitigation to halt erosion from wind and water, gather data on the natural reclamation of forested areas, gauge effects on trapping productivity, and provide other insights to guide right-of-way planning on future projects. Findings will be used to avoid unnecessary line maintenance work in sensitive locations.

Former diesel generating station sites in the communities will be remediated to clean up soils contaminated by diesel fuel and lubricating oils spilled inadvertently in the course of station operation, sometimes over several decades. Aboriginal involvement in these cleanup projects is roughly 95% because almost every community has the equipment and operators needed to perform the work. Local people also work with project inspectors and help with monitoring and testing.

The line has eliminated the need to transport and burn almost 8.5 million litres of fuel previously required by the diesel generators every year.

One of the legacies of the project is a winter road that runs from Norway House to Wasagamack. Built in January and February of 1999 by the Norway House Cree Nation for $500,000, it permitted Manitoba Hydro and its contractors to retrieve equipment from the communities when the traditional winter road system to the south melted early. But the road did more than avoid costly tie-ups of construction equipment. It provided substantial economic benefits to the Norway House Cree Nation by creating a new road for people in Island Lake communities to reach Norway House. The trip there and back takes only a day, in contrast to the trip to southern centres over traditional routes that takes twice as long. The new winter road also provided an alternate route for suppliers to the Island Lake region. The road was rebuilt in 2000, and it is expected that the communities will continue to rebuild it each winter season for ongoing economic benefits.

Local Aboriginal people are now educating consumers in North Central communities on how to save electricity, control their costs, read bills, and use electricity safely. They serve as Community Advisors for the Community-Based Energy Services Project, which was developed to educate community residents in reading meters, interpreting their bills, and applying Power Smart programs and other energy efficiency measures. Manitoba Hydro expects to support the Community-Based Energy Services Project with partial funding of up to $300 000 for the next three years.

If North Central homeowners use electricity efficiently, they may see a reduction in home heating costs because of the lower cost of electricity compared with other fuels. In 1999, average annual home heating costs at Norway House were estimated at $1268 for fuel oil, $1230 for wood, and $1058 for electricity.

The Chemawawin First Nation, in a joint venture with Manitoba Hydro, has produced teaching materials to help their younger generation understand the history and ecology of Cedar Lake.

The materials explain why the Grand Rapids Generating Station was built, why Cedar Lake was flooded, and why lake levels vary as it contributes energy for the Manitoba electricity system. Also discussed are the environmental and social issues of electrical energy development and use around the world.

Grand Rapids Generating Station, one of the first major northern generating station sites, was built in the 1960s, with the last of four generating units going into service in November 1968. The project flooded some 1200 square kilometres, about equal to all other hydroelectric projects in Manitoba combined. Chemawawin members became the only Manitoba community to be totally relocated because of a hydroelectric project as they moved to a new townsite at Easterville.

The teaching materials reflect the community's renewal. Scenes in a video accompanying the materials show local fishermen clearing a part of the lake to make a park, working to restore a cemetery at the Old Post site, and

building a fish hatchery to help in the revival of the fishery. People are collecting driftwood along the shores of the lake, for carving, garden ornaments, and pulpwood.

The Old Post site now serves as a meeting place for the community, a fishing spot, and a retreat for local people. The video conveys that the community is trying to make the most of the situation rather than dwell on the old way of life that it lost. As Chief Clarence Easter of the Chemawawin First Nation puts it: "We have set aside the sorrows of the past...We are now working with Manitoba Hydro."

More in the community

The following are other examples of Manitoba Hydro and Centra Gas activities in the community:

- The Volunteer Centre of Winnipeg selected Manitoba Hydro as the annual winner of its Volunteer Award for Manitoba Business (large business category).
- Canada's Climate Change Voluntary Registry awarded Manitoba Hydro with a gold champion award for its 1999 Climate Change Action Plan Update. The title recognizes the highest level in the national program to encourage businesses to voluntarily report their progress in limiting greenhouse gas production.
- Manitoba Hydro partnered with local communities, business and government in Operation Clean-up: Take Pride in the Red. The on-going project cleans up litter along the river in the Selkirk area so it can be enjoyed by people picnicking, fishing or just out for a day. Manitoba Hydro is among the property owners in this area.
- Fifty-six tree planting, forest education and innovative forest projects received funding from the Forest Enhancement Program. Over half of the funds went to non-profit organizations for their tree planting projects, with the remainder of the funds split between the education and innovative projects as well as program administration costs.

- Two bald eagles were nursed back to health and released into the wild by the Manitoba Wildlife Rehabilitation Organization with financial support from Centra Gas. The two birds had been under the organization's care for 10 months after being found hurt, one with a broken pelvis and the other with a severely cut wing. It was fitting that the thunderbirds, as they're known in Aboriginal culture, were released to the beat of Aboriginal drummers, pounding rain and roaring thunder.
- The work of more than 300 men, women and children collecting and recycling garbage during the 1999 Pan American Games was sponsored and organized by Manitoba Hydro. The volunteers from local groups and clubs kept more than 40 venues clean throughout the 16-day event. Their work ranged from picking up lead bullets at the shooting venues to recycling drink bottles after the opening and closing ceremonies, when they also got to march with the athletes. Manitoba Hydro provided honorariums to their organizations for their volunteer efforts.
- Manitoba Hydro introduces northern Aboriginal residents to career opportunities through our Aboriginal Preplacement Training Program. Participants spend time in each of the three generation trades during the 10 month program, and at the conclusion can select the trade in which they would like to apprentice. Eight of 10 who entered the program in 1998 graduated in 1999.

Facing Page: Members of the Manitoba Wildlife Rehabilitation Organization release bald eagles that were nursed back to health.
Left: Students plant trees as part of the Forest Enhancement Program.

Our Sustainable Development Principles

Sustainable Development Principles

1. Stewardship of the economy and the environment

Manitoba Hydro will recognize its responsibility as a caretaker of the economy and the environment for the benefit of present and future generations of Manitobans.
Meet the electricity needs of present and future Manitobans in a manner that ensures the long-term integrity and productivity of our economy, our environment, our natural resources and safeguards our human health.

2. Shared responsibility

Manitoba Hydro will ensure that Manitoba Hydro's employees, contractors, and agents are aware of our sustainable development policies and guiding principles and encourage them to act accordingly.
Encourage the Corporation's employees to share their knowledge of the concepts and practical application of sustainable development.

3. Integration of environmental and economic decisions

Manitoba Hydro will treat technical, economic and environmental factors on the same basis in all corporate decisions, from initial planning to construction to operations to decommissioning and disposal. To the extent practical, include environmental costs in economic and financial analysis.

4. Economic enhancement

Manitoba Hydro will enhance the productive capability and quality of Manitoba's economy and the well-being of Manitobans by providing reliable electrical services at competitive rates.

5. Efficient use of resources

Manitoba Hydro will encourage the development and application of programs and pricing mechanisms for efficient and economic use of electricity by our customers. As well, efficient and economic use of energy and materials will be encouraged throughout all our operations.

6. Prevention and Remedy

Manitoba Hydro will to the extent practical, anticipate and prevent adverse environmental and economic effects that may be caused by Corporate policies, programs, projects and decisions rather than reacting to and remedying such effects after they have occurred.
Purchase, where practical, environmentally sound products taking into account the lifecycle of the products.
Address adverse environmental effects of Corporate activities that cannot be prevented by:

- first, endeavouring, wherever feasible, to restore the environment to pre-development conditions or developing other beneficial uses through rehabilitation and reclamation
- second, striving to replace the loss with substitutes that would enhance the environment and/or associated resource uses while offsetting the type of damage experienced
- third, making monetary payments for compensable damages on a fair, equitable and timely basis.

7. Conservation

Manitoba Hydro will to the extent practical, plan, design, build, operate, maintain and decommission Corporate facilities in a manner that protects essential ecological processes and biological diversity.
Give preference, where practical, to projects and operating decisions that use renewable resources or that extend the life of supplies of nonrenewable resources.

8. Waste minimization

Manitoba Hydro will manage all wastes arising from Corporate activities by:

- first, endeavouring to eliminate or reduce the amount generated
- second, striving to fully utilise reuse and recycling opportunities
- third, disposing of remaining waste in an environmentally sound manner.

9. Access to adequate information

Manitoba Hydro will share relevant information on a timely basis with employees, interested people and governments to promote a greater understanding of Manitoba Hydro's current and planned business activities and to identify impacts associated with the Corporation's plans and operations.

10. Public participation

Manitoba Hydro will provide opportunities for input by potentially affected and interested parties when evaluating development and program alternatives and before deciding on a final course of action.

11. Understanding and respect

Manitoba Hydro will strive to understand and respect differing social and economic views, values, traditions and aspirations when deciding upon or taking action.
Give preference to those alternatives which best fulfill Corporate objectives while minimizing infringement on the ability, rights, and interests of others to pursue their aspirations

12. Scientific and technological innovation

Manitoba Hydro will research, develop, test and implement technologies, practices and institutions that will make electrical supply and services more efficient, economic and environmentally sound.

13. Global Responsibility

Manitoba Hydro will recognize there are no political and jurisdictional boundaries to our environment, and that there is ecological interdependence among provinces and nations.
Consider environmental effects that occur outside of Manitoba when planning and deciding on new developments and major modifications to facilities and to methods of operation.

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