CCLCC Energy Summary

An Analysis of the
Manitoba Hydro's Recreation Facility Survey
and
Manitoba Hydro's Power Quality Analysis

Prepared for:
Complex Communautaire de Lorette Community Complex

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Acknowledgments

Ted Viskup	- CCLCC Facility Manager
Manitoba Hydro	- Power Quality Report
Manitoba Hydro	- Benchmarking Survey
Manitoba Hydro	- Denton Vandersteen -Manitoba Hydro Power Smart Energy Evaluation
Mr. Robinson (retired)	- City of Winnipeg Facility Maintenance Supervisor

Background

The CCLCC submitted a detailed survey response to the Manitoba Hydro sponsored, Recreational Facility Survey on Ice Rinks and Curling Rinks. This report compares CCLCC with other like facilities. It provides both an energy consumption profile and an energy cost profile. The profiles are based on combined energy, electric energy and gas energy.

The CCLCC also requested a power audit to be performed on the facility at the point of delivery (metering point) by Manitoba Hydro. This audit provides an electrical power profile of the entire facility showing the quality of power being delivered, and the efficiency of the plant in terms of power factor.

The Facility Manager played a major role in providing information, identifying key areas for improvement and submitting the survey.

The energy data used for the survey was for the year 2002, which was an extraordinary year for the following reasons:

The summer of 2002, heaters and dehumidifiers where running constantly to dry out the change rooms in preparation for the renovation.

January – March, temporary trailers were still be used as change rooms adding to the overall consumption and demand.

The CCLCC was on a medium service type of service with Manitoba Hydro as a result of exceeding the demand threshold in the months of February, March 2001 and November 2001 through to April 2002.

Summary

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Summary

The CCLCC uses too much electrical demand energy, and pays more than the average in overall energy consumption (combined gas and electric). For the years 2001 and 2002, these demand charges were paid 12 months of the year. In July 2003, the Manitoba Hydro service type was returned to small service type resulting in lower demand charges.

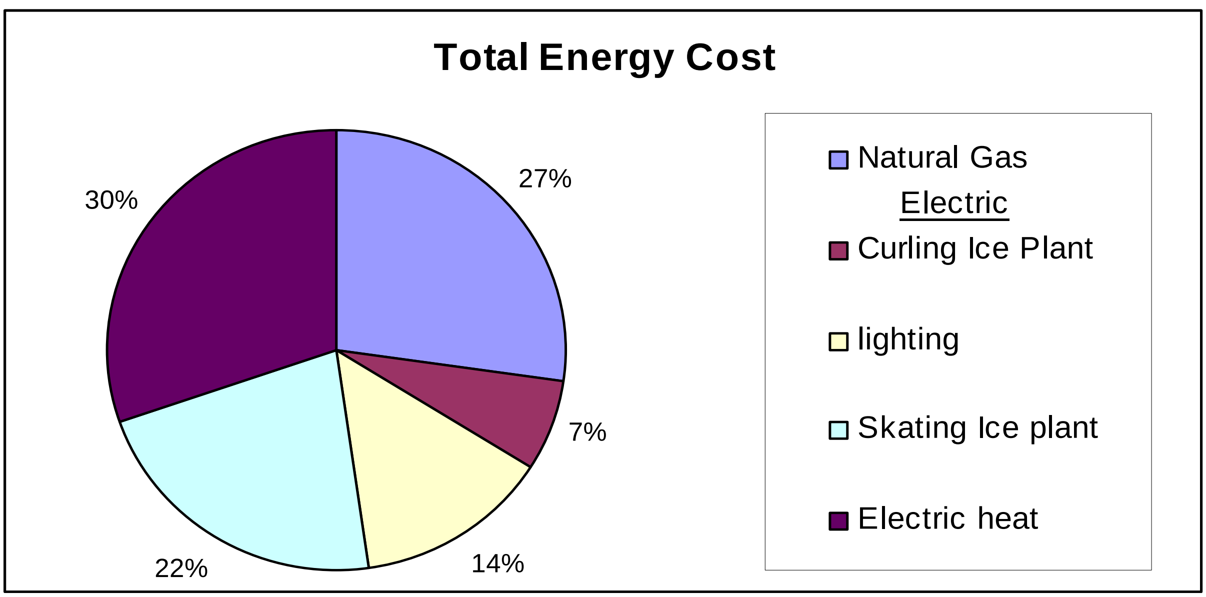
The 2003 energy data shows the demand just below the threshold where Manitoba Hydro changes the service type back to medium resulting in substantially higher demand charges.

The areas for savings can be broken down into two categories; Operational improvements and Investment improvements.

The three reports provide bases to make sound decisions on the future operation of the plant. The reports do not give exact recommendations, but rather areas to consider reviewing to help reduce the overall energy consumption and costs of the plant.

The following recommendations come in part from the Manitoba Hydro's Energy Efficiency manual, and also in consultation with the plant manager.

Some of the investment recommendations are eligible for Manitoba Hydro rebates.



Breakdown of energy costs in the CCLCC

CCLCC Energy Summary

Recommendations

Operational Improvements

1. Create a committee to work with the facility mangers to perform a cost analysis and action plan on each of the investment opportunities.

2. Create a supplier and specification list for critical components (pumps and motors) to ensure we can get the most cost efficient components during a critical breakdown with future operational costs and rebates being factored into the replacement costs.

3. Create an operation manual and train staff with the emphasis on reducing demand charges and incorporating operational improvements.

4. Provide a detail energy audit for each area of the facility; hockey, curling, canteen and social hall, indicating the electrical demand and energy costs to operate.

5. Reduce the number of fridges, freezers and coolers and coordinate when they are turned on or filled.

   Example put new stock in at end of night when the ice plant is idle.

6. Turn gas off during summer months.

7. Develop seasonal shutdown and startup procedures.

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Investment Improvements

Opportunity	Savings / year	Power Smart Rebate	Cost of Retrofit	Payback period (years)
1. Replace electric heat with gas	$3,000.00	$0.00	$11000	3.5
2. Install pony brine pump	$1,440.00	$0.00		
3. Auto shut off kitchen exhaust fans	$1,200.00	$0.00		
4. Hot water boiler system and super insulated holding tanks.	$1,000.00			
5. Circulate brine to outside condensers	$1,000.00			
6. Replace Therma-Stor tank	$600.00	$0.00		
7. Convert skating ice surface lights to pulse start	$320.00	$1,260.00		
	$460.00	$1,800.00		
8. Purchase a small electric deep fryer for canteen	$300-500			
9. Set back thermostats for curling rink	$383.00 / degree	$0.00		
10. Weather strip all doors and windows	$300.00	$0.00		
11. Auto shut of washroom exhaust fans	$240.00	$0.00		
12. Insulate brick wall in curling rink	$200			
13. Convert outside mercury vapor lights	$138.00	$310.00		
14. Combine gas supply for skating and curling (eliminate 1 meter)	$120 + price differential			
15. Insulate all hot water pipes & add a circulation pump	$100.00			
16. Install remote sensing thermostats to prevent unauthorized adjustments	$100.00			
17. Convert incandescent to compact florescent	$71.00	$250.00		
18. Timer control on skating ring circulating fans	$60.00	$0.00		
19. Replace exit signs with led version	$51.00	$900.00		
20. Convert curling rink surface lights to pulse start	$49.00	$840.00		
	$70.00	$1,200.00		
21. Convert to T-8 florescent lights	$43.00	1710		

(Items in blue are guestimate)

Recommendations are from Denton Vandersteen's Power Smart Energy Evaluation and Manitoba Hydro's Benchmarking Survey, consultation with the facility manager and Mr. Robertson. Table sorted by greatest savings per year. Cost estimates need to be performed and pay back periods determined

CCLCC Energy Summary

Manitoba Hydro Electrical Charges

<u>Energy charges</u>

Manitoba Hydro charges for actually watt-hours used (similar to residential customers) and for demand charges. Demand is the maximum amount of energy consumed in any 15 minute period. This is likened to how fast your meter turns when you turn on all the appliances and lights on in your house. The cost of demand can be equal to or greater than the actual watt-hour usage.
The demand charge is $8.32 for every kVA used in a given month. The consumption charge is approximately 5 cents per kilowatt hour.

<u>Service Type</u>

The type of service that Manitoba Hydro categorizes the facility is dependent upon the demand. Manitoba Hydro will automatically change the service type when any one month exceeds the threshold. General Service Small is the most cost effective service, and is the current service type. In June of 2003, the service was changed from General Service Medium to General Service Small to the benefit of CCLCC.

<u>Threshold</u>

The threshold to move up into General Service Medium is 200 kVA in any one month. (One kVA is essentially 1000 watts – see glossary of terms for exact definition)
The threshold for moving down to General Service Small is twelve consecutive months below 200 kVA

CCLCC Energy Summary

Demand Costs

For General Service Small, the first 50 kVA carries no charge; each additional kVA above 50 kVA costs $8.32 for the given month.
For General Service Medium, there is no grace charge. Each kVA used carries an additional $8.32 for the month. In addition, the minimum monthly demand charge is 80% of the highest month. That means that in July and August, your demand charges are 80% of the demand charges for December, January or February, which ever month was the highest.

Per Unit Demand Cost (10 kVA)

Demand Charge =10 kVA * $8.32 = $83.20 / month
Medium Service off season charge =10 kVA * 0.8 * $8.32 = $66.56 / month

TOTAL / 10 KW load / month *6 * ($83.20 + $ 66.56)/12 =$74.88*
(6 month operation - 12 month billing) or
Annually (6 month operation) Annually =$898.56

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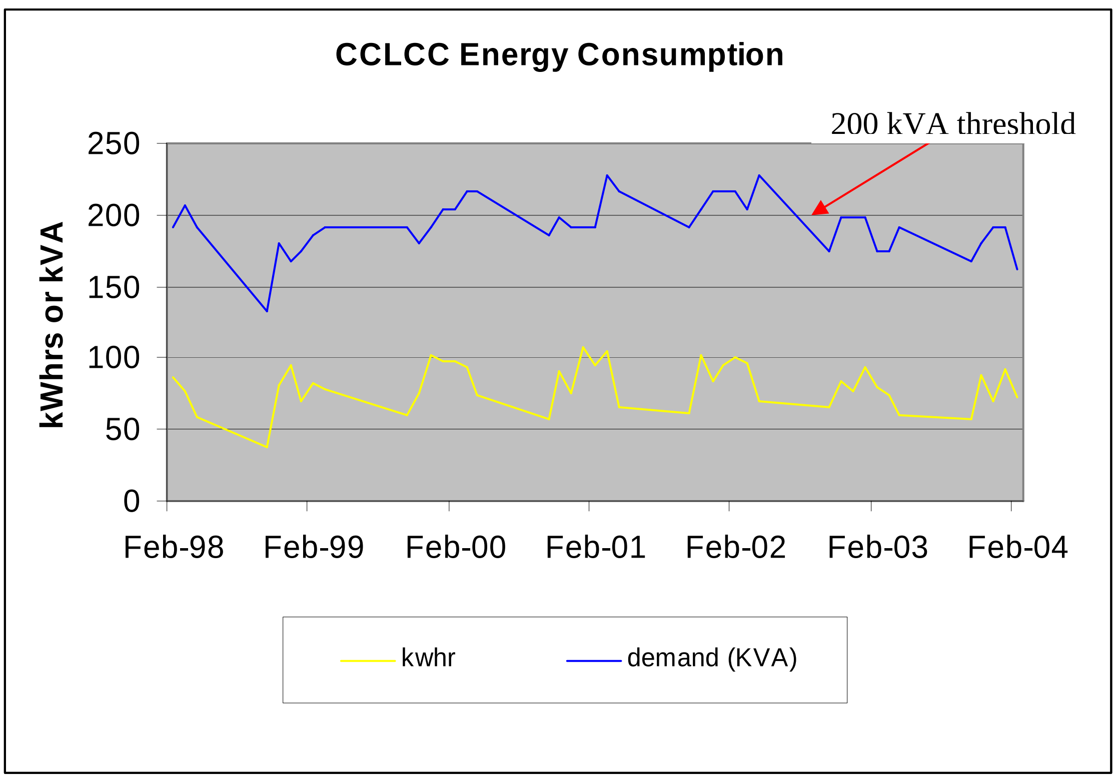
CCLCC Energy History

For the three years, 2000, 2001, and 2002, the CCLCC has been on a Medium Service type, paying high demand charges 12 months of the year. This coincides with the years that the trailers were in use. Since February 1998, CCLCC has exceeded 200 kVA 13 times.

In the summer of 2002, the CCLCC renovated the change rooms, converting the heating and hot water systems from electric to gas. This had a positive impact on demand; lowering the peak demand below the 200 kVA threshold for all 12 months. The 12 consecutives months below 200 kVA caused the service type to change from medium to small.

The demand charges for the year 2003-2004 peaked at 192 kVA, leaving little room before the threshold.



The graph shows the electrical energy consumption history (October – April) for each year from 1998 - 2004

CCLCC Energy Summary

Recreation Facility - Survey Report

The report benchmarked CCLCC against other facilities of similar usage (Arena & Curling), with electric and gas energy.

An energy index of 19.4 KW-hours / ft$^{\wedge 2}$ / year has been calculated. This is higher than the composite of 13.2.

<u>Energy Consumption Profiles – Section 2</u>

Comparisons on a purely electrical consumption bases show CCLCC considerably above the composite. This is partially due to a mix of electric vs. gas heating. The curling rink and the change rooms are primarily gas heated; the remainder of the facility is independent, non coordinated, electric heating.

Comparisons on a purely gas consumption bases shows CCLCC considerably below average. Again this is due to the mix of gas and electric heating, with too much reliance on electric heating. Although electric heating is 100% efficient, it is more costly per unit of heat energy because of the demand charges.

The overall energy comparison shows CCLCC above the average for the months of January, February, March, and November.

<u>Energy Cost Profiles – Section 3</u>

Comparisons on a purely electrical consumption bases show CCLCC's electrical cost are considerably higher than the average. The bulk of this cost is on the demand metering side. Essentially CCLCC is charged a premium of 80% of its highest demand for the off season. This translates into $1000.00 plus monthly hydro bills from May through September when there is almost no consumption.
The excessive demand charges were applied as the CCLCC was on a medium service type. It has currently been re-classed as a small service type, thus eliminating the summer demand charges.

Comparisons on a purely gas consumption bases shows CCLCC gas charges are minimal. CCLCC is not consuming large amounts of gas and is not paying a premium for large gas consumption.
The overall energy comparison shows CCLCC can gain some savings by identifying heating areas that are currently electric and converting

them to gas.

Demand Cost Profiles – Section 4

The demand profile shows CCLCC is paying large demand charges in the off season which is NOT typical with other similar facilities. This means that CCLCC should do a detailed electrical consumption survey and determine where savings can be gained.

To simplify, if the canteen's deep fryer is turned on for 5 hours it consumes approximately:

(*30 amps * 220volts * 5 hours * $0.05/kwh* 30%) = $4.95.*

However the additional demand would be:

*(30 amps * 220 volts / 1000 * $8.32) = $54.91 / month*

PLUS (if on medium service) an additional

*($54.91 * 0.8 * 6 months off season) = $263.57 per annum*.

[This is assuming that the plant is already running above 50 kVA. i.e. the ice plant is running]

Recreation Facility - Survey Report -Recommendations

The report identifies a number of possible areas to gain efficiencies. Most of them have some sort of rebate from Manitoba Hydro.

See pages 8, 46, 52,56,61,71 of the Manitoba Hydro's Energy Efficiency manual

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Manitoba Hydro's Power Smart Energy Evaluation
by Denton Vandersteen

This document was Manitoba Hydro's review of the Recreational Facility Survey. It was prepared to address the shortcomings of the original analysis. Manitoba Hydro presented this document to the facility manager and the CEO of the municipality – Dan Porshe.

The evaluation supports the conclusions of the original findings as well as providing a dollar value in savings for each recommendation. Between these reports, discussions with the facility manager, input from Mr. Robertson, the list of recommendations was developed.

Of the three reports, this one provided the best analysis. It recognizes that the current facility manager is operating with accepted industry practices.

This report determined that CCLCC had an energy index of 17.9 KW-hours / ft$^{\wedge 2}$ / year, higher than the composite of 16.5.

The report used the same time period as the previous report which was not the best representation of the CCLCC's practices. The temporary change rooms and dehumidifiers were still be used and renovations were taking place. These all increased our consumption and demand of electricity.

Manitoba Hydro reviewed the billing over the last three years and found we were over billed.

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CCLCC Power Quality Profile Report

The purpose of having the power profile was to ensure that CCLCC was receiving a quality of power within Manitoba Hydro's specifications. It also identifies the overall power consumption signature of the CCLCC plant.

The report concluded that the quality of power being delivered is within specifications and that the power factor correction equipment (caps) installed and owned by CCLCC are functioning correctly.

Power Quality Profile Report – Recommendations

The power factor correction caps should be checked annually to ensure they are operating correctly. This type of equipment fails silently, and would not generally be noticed on the operational side. Consequences for this type of failure would be a considerable increase in demand metering charges.

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Explanations of Recommendations

<u>Operational opportunities</u>

1. Reduce the number of fridges, freezers, coolers, and cold vending machines and coordinate when they are turned on or filled. Fridges and freezers run 24 hours a day 7 days a week. They are a large consumer of electricity and start randomly. This prevents coordination with other electrical devices thus increasing demand charges.
   By filling the fridges and freezers at the end of night, we can have the fridges and freezers working during the night when the ice plant is idle. This will help reduce the electrical demand.

2. Create a committee to work with the facility mangers to perform a cost analysis and action plan on each recommendation. This is required to determine which recommendation will provide the biggest pay off. Hydro rebates, scheduling, and available financial resources should be used to determine the implementation plan.

3. Create a supplier and specification list for critical components (pumps and motors) to ensure we can get the most cost efficient components during a critical breakdown with future operational costs and rebates being factored into the replacement costs. Moving to high efficient devices when original equipment fails will yield savings in operational costs and may be eligible for Hydro rebates.

4. Create an operation manual and train staff with the emphasis on reducing demand charges. In order to keep continuity between operations staff, reference and training manuals are required. The way the plant is operated provides the biggest savings. The hydro report identified a number of positive operational practices that are currently being performed by the CCLCC manager.

5. Provide a detailed energy audit for each area of the facility; hockey, curling, canteen and social hall, indicating the electrical demand and energy costs to operate. By identifying the energy costs for each area of the plant, we can analyze current practices to determine efficiencies. This information should be used in budgeting to help set the prices charged.

6. Turn gas off during summer months. The heaters in the curling rink and the hot water tank have pilot lights consuming gas.

7. Develop seasonal shutdown and startup procedures. The way the ice is put in and the ambient temperatures greatly affect the cost of running the plant. The hydro report recognized that the current practices at the CCLCC maximize these benefits. In order to continue with these practices documentation is required for future staff.

Investment opportunities

1. Convert electrical space heaters in observation, canteen, and upstairs meeting room into high efficiency gas with remote sensor thermostats.
   The electrical heaters make up to 30 KVA of the load or about 15%. Changing to gas will eliminate this load realizing the savings on the demand.
   The remote sensors have the temperature adjustment in secure place while they monitor the temperature in the required room. Set back controls can not be overridden by unauthorized personal.

2. Cycle and / or control the brine pumps (pony pump, variable pumps etc...).
   The brine pump circulates coolant under the ice to maintain a constant temperature. However, the brine pump also adds heat to the coolant, requiring the compressors to cycle and cool more often. A pony pump is a smaller pump that circulates the brine when the compressors are idle. The main pump would be cycled with the compressors. It is equivalent to a two speed pump. The compressors would not have to be cycled as much thus reducing energy consumption and wear.

3. (+ 11)
   Install timers to automatically shut off venting fans in the canteen, bathrooms, and meeting rooms. Fans that vent to the outside in areas that require heating increase heating costs. If the fans are not automatic they tend to be left on longer than required. The cost of this can be seen in the amount of make up air required to be heated. The colder it is outside the greater the cost it is to heat the new air. Bathroom fans can be connected to the same occupancy sensors as the lights. Major venting (Canteen can have timers and or heat / humidity controls)

4. Hot water boiler system and super insulated holding tanks. The current newly installed hot water system consists of large gas fired hot water tank. In general gas fired hot water tanks inefficiencies are due to there chimneys and the required heating of the make up air lost through the chimney. Because the hot water acts as a heat sink, it continually causes air to escape through the chimney. The ideal system would be a boiler and super insulated storage tanks. This is fairly expensive and should only be considered during the hot water system replacement

5. Circulate brine to outside condensers when outside temperature is < -10 degrees Celsius. This would use the outside temperature to cool the brine instead of the compressors. The less we use the compressors the bigger the savings.

6. Thermo-Storage tanks.
   Improve flood water holding tanks. Hot water is used for daily flooding of the ice. The water is kept in two large storage tanks in the Zamboni room. Heat from the compressor system is used to help heat the water, in addition to the main gas hot water system. These tanks should be highly insulated to keep the water hot. One of the current tanks is not working, and circulating pumps are required.

7. Change the existing metal halide lights above the skating rink to the new pulse start metal halide lights. A Manitoba Hydro rebate is available.

8. Purchase a small electric deep fryer for canteen. The deep fryer cost approx $1.00 per hour to run as opposed to 8 cents an hour for the small deep fryer. This combined with the warm up time makes the large deep fryer inefficient for small usage

9. Install set back thermostats to control the as heaters in the curling rink. This needs to be weighed against the effects on the ice surface, and the resulting additional maintenance to prep the ice.

10. Ensure all door ways into and out of the skating and curling rink, and any outside access door way have the proper weather stripping and that it is good working order.

11. Have auto shut off or occupancy sensor-ed controlled bathroom fans. Similar to the kitchen exhaust fans in item 3

12. Insulate brick wall (north) and overhead door in Curling Rink. The brick wall on the north side of the curling rink running the length of the ice is un – insulated. This acts a large heat sink and causes problems with the ice surface. The large overhead door at the south east corner creates the same problems. A sub wall complete with vapor barrier needs to be erected.

13. Change the existing mercury vapor lights used outside to metal halide.

14. Combine gas supply for hockey arena with that of curling (eliminate 1 meter). CCLCC is currently paying $10.00 a month for each of the two gas meters. The gas service in the curling club is at a commercial rate (lower rate). The CCLCC should eliminate the metering on the area side and run gas lines from the curling club. The savings will be $120.00 a year plus the difference in the reduced rate of gas consumption.

15. Insulate all the hot water pipes & add a circulation pump. Insulate the hot water pipes with foam insulation. All the hot water comes from the main hot water system. The distance between the tank and the Zamboni room is great. Un-insulated pipes waste energy. A circulation pump will provide hot water quickly to the taps despite the distance from the tanks. This will decrease the amount of water spilt before hot water appears at the tap. The spilt water is replaced by cold water in the tank and must be heated. Reducing the spilt water will reduce the amount of water required to be heated.

16. Install remote sensing set back thermostats in areas where the public has access to the thermostat. The current thermostats are accessible to the public and have been adjusted, reducing the savings that they were designed for.

17. Change the existing incandescent lights (regular light bulbs), to the new high efficient compact florescent lights. These lights only operate areas that at room temperature.

18. Have the skating rink circulating and exhaust fans on automatic timers so they can't be inadvertently left on.

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19. Change exit signs to LED low consumption style signs. The savings will be realized in the level of maintenance required (changing bulbs), the reduction of electricity, and the reduction of heat produced in the arena area.

20. Change the existing metal halide lights above the curling rink to the new pulse start metal halide lights. A Manitoba Hydro rebate is available.

21. Change florescent lights to high efficiency T-8 florescent lights. The energy used to produce light is converted directly into heat. A 100 watt light bulb produces 100 watts of heat. The efficiency of the light is measured by the amount of Luminas produced per watt of energy consumed. The newer style lights produce more light while consuming less energy. The current florescent light ballast will be obsolete in the next couple of years. Manitoba Hydro currently offers a rebate program for this replacement. The program will not be in effect when the product is obsolete.

Glossary of Terms

CCLCC	Complex Communautaire de Lorette Community Complex (Sports Center).
demand charges	The maximum use of power within a specified period, as measured in kVA for three phase services, and kW or kVA for single phase services.
demand scheduling	Scheduling the powering on and off of electrical devices to minimize the total amount of power required in any 15 minute period.
energy index	A number based on the annual total energy used divided by the total floor area of the facility. It is used to compare energy consumption from different facilities.
Kilowatt	1000 watts of electrical energy.
kVA	Kilo-Volt-Amp – A measure of total energy delivered, regardless of electrical efficiency.
point of delivery	The delineation point between Manitoba Hydro and its customer. Generally the meter.
PLC	Programmable Logic Controller – a dedicated computer that can turn on and off electrical, mechanical, and pneumatic devices, and provide annunciation, based on inputs to the computer.
power consumption signature	A graphical representation of the customer’s electrical habits over a stated period of time.
power factor	An energy efficiency indicator. Indicating the ratio between energy billed for and actual Kilowatts used.
watt-hours	A measure of electrical energy used over a 1 hour period.

CCLCC Monthly Electrical Charges

date	kwhr	Demand (kVA)	Demand billed	date	kwhr	Demand (kVA)	Demand billed
				Jan-02	**94.8**	**216**	**216**
Feb-98	86.4	192	192	Feb-02	100.2	216	216
Mar-98	76.8	207	207	Mar-02	96	204	204
Apr-98	58.2	192	192	Apr-02	70.2	228	228
May-98	7.8	192	192	May-02	21	78	173
Jun-98	7.2	60	60	Jun-02	16	72	173
Jul-98	7.2	60	60	Jul-02	10	66	173
Aug-98	5.4	48	48	Aug-02	9.6	60	173
Sep-98	7.8	60	60	Sep-02	6.6	66	173
Oct-98	37.8	132	132	Oct-02	65.4	174	174
Nov-98	81	180	180	Nov-02	84	198	198
Dec-98	95.4	168	168	Dec-02	76.8	198	198
Jan-99	**69.6**	**174**	**174**	**Jan-03**	**94.2**	**198**	**198**
Feb-99	82.8	186	186	Feb-03	79.2	174	174
Mar-99	78.6	192	192	Mar-03	73.8	174	174
Apr-99	61.2	192	192	Apr-03	60	192	192
May-99	12	72	72	May-03	19.2	72	158
Jun-99	8.4	66	66	Jun-03	9	60	158
Jul-99	10.2	72	72	Jul-03	10.2	48	48
Aug-99	7.2	60	60	Aug-03	72	48	48
Sep-99	10.8	60	60	Sep-03	24	117	117
Oct-99	60.6	192	192	Oct-03	57	168	168
Nov-99	75.6	180	180	Nov-03	87.6	180	180
Dec-99	102	192	192	Dec-03	70.2	192	192
Jan-00	**97.8**	**204**	**204**	**Jan-04**	**92.4**	**192**	**192**
Feb-00	97.8	204	204	Feb-04	72	162	162
Mar-00	93	216	216	Mar-04	71.4	180	180
Apr-00	73.8	216	216	Apr-04	63.6	168	168
May-00	12	72	72				
Jun-00	18.6	84	84				
Jul-00	10.8	60	60				
Aug-00	9	60	60				
Sep-00	9	60	60				
Oct-00	57	186	186				
Nov-00	90.6	198	198				
Dec-00	75.6	192	192				
Jan-01	**108**	**192**	**192**				
Feb-01	94.8	192	228				
Mar-01	104.4	228	216				
Apr-01	66	216	154				
May-01	19.2	72	154				
Jun-01	16.2	84	154				
Jul-01	12	60	154				
Aug-01	9.6	60	154				
Sep-01	10.8	66	154				
Oct-01	61.2	192	192				
Nov-01	101.4	204	204				
Dec-01	83.4	216	216				