EFFICIENCY MANITOBA

Rink Presentation
January 7, 2026

AGENDA

I. Electrical Billing
II. Natural Gas Billing
III. Monitoring & Tracking
IV. Energy Efficiency Programs

System Operators & Efficiency

- System operators often dictate energy use for majority of the facility.
  - Determine pressures, temperatures, operating strategies, equipment selection.
- There is often a disconnect between utility bills and operators.
  - Efficiency efforts by operators aren't recognized or acknowledged.
  - Energy bills are almost never shared with operators.

Designers & Contractors

- Pressure to provide lowest first-cost design.
  - Efficiency usually adds cost.
  - Competitors are usually judged on price.
- Rarely time enough to do life-cycle costing of efficiency options.
- Efficient design sometimes goes unnoticed by end-user.
- Efficiency is often systematic, not just a simple equipment upgrade.

ELECTRICAL BILLING

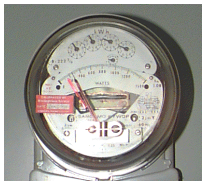
Electrical Billing Components

- Basic Charge
  - This includes the direct costs of metering, portions of the distribution system, as well as billing and customer service administration.
- Energy Charge
  - That portion of the charge for electric service based upon the electric energy (kWh) consumed.
- Demand Charge
  - That portion of the charge for electric service based upon the peak electric capacity (kVA) required each month.
- Taxes (GST, PUT, City of Winnipeg Tax)

Demand & Energy Metering

- Demand / energy meters are like a vehicle's speedometer / odometer.

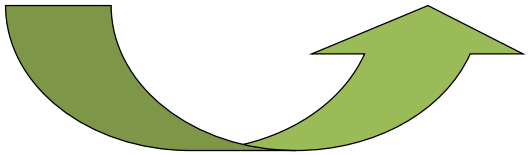
Energy / Demand Meter	Vehicle's Odometer / Speedometer
Amount of energy in kWh's consumed	Distance traveled in km's
Rate of demand for power in kVA	Speed you are traveling in km/h



Electrical Terminology

Power (Demand)
Horsepower (hp)
Watt (W)
Kilowatt (kW) (1,000 W)
Kilovolt Ampere (kVA)
Measure of how **fast**

Energy (Consumption)
Kilowatt Hour (kWh)
Joule (J)
Giga Joule (GJ)
Measure of how **much**



Have to multiply POWER by TIME to get ENERGY

Demand Details

- Peak demand is the peak rate of demand for power in kilovolt-amps (kVA) recorded since the last meter reading.
- The billed demand is the highest actual demand recorded in a 15 minute floating time frame. Therefore, a motor has to operate for only 15 minutes to set the demand for the entire month.

General Service Electric Rates

- Residential
- G.S. Small (Non-Demand) (<= 50 kVA peak)
- G.S. Small (Demand) (51 to 200 kVA peak)
- G.S. Medium (Demand over 200 kVA)
- G.S. Large (Customer owned transformation)
  - 750 V to 30 kV
  - 30 kV to 100 kV
  - Greater than 100 kV

- (G.S. = General Service)

G.S. Small (Non-Demand) (<= 50 kVA peak)(Apr.1/24)

- Basic Charge:
  - $20.74/month plus $12.95 for three phase service
- Energy Charge:
  - 9.485¢/kWh for the first 11,000 kWh per month
  - 7.277¢/kWh for the balance
- Demand Charge:
  - None

G.S. Small (Demand) (51 to 200 kVA peak)(Apr. 1/24)

- Basic Charge:
  - $20.74/month plus $12.95 for three phase service
- Energy Charge:
  - 9.485¢/kWh for the first 11,000 kWh per month
  - 7.277¢/kWh for the next 8,500 kWh per month
  - 4.671¢/kWh for the balance
- Demand Charge:
  - No charge for the first 50 kVA
  - $12.33/kVA for demand over 50 kVA

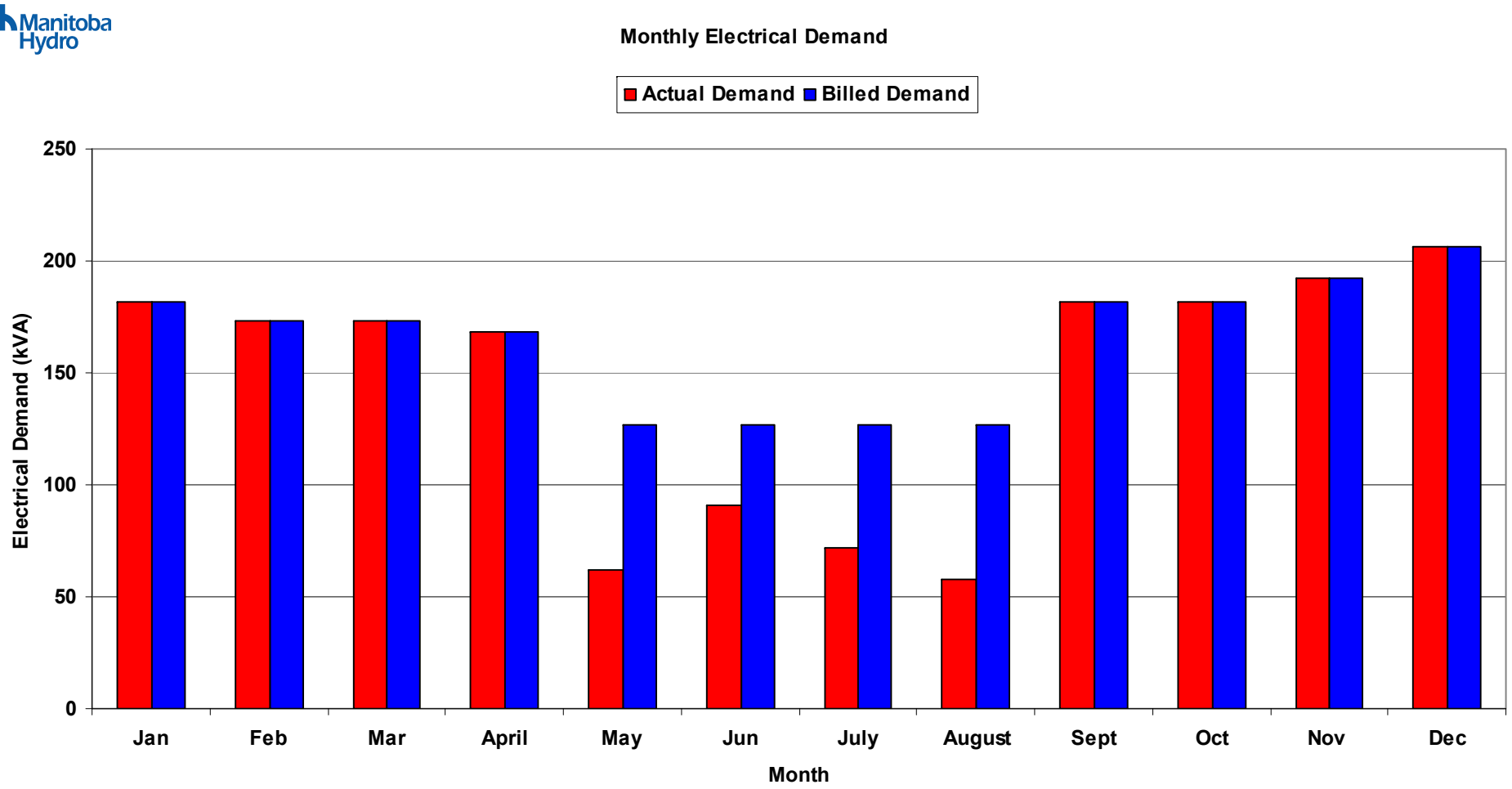
G.S. Medium (Demand over 200 kVA)(Apr.1/24)

- Basic Charge:
  - $34.43/month
- Energy Charge:
  - 8.769¢/kWh for the first 19,500 kWh per month
  - 4.546¢/kWh for the balance
- Demand Charge:
  - No charge for the first 50 kVA
  - $11.91/kVA for demand over 50 kVA
  - Billed demand greater of: (1) measured demand, (2) 25% of contract demand, (3) 25% of highest demand in past 12 months

Billing Ratchet

- Eliminated on April 1, 2010
- Previously applied to GS Medium and Large only
- Billed demand was the greatest of the measured demand or 70% of highest demand in the Billing Year for the months of December, January and February.
- Do have the following minimum demand charges for GS Medium and GS Large accounts:
  - 25% of contract demand
  - 25% of the highest measured demand in the previous 12 months

Ratchet Example – Hockey Rink

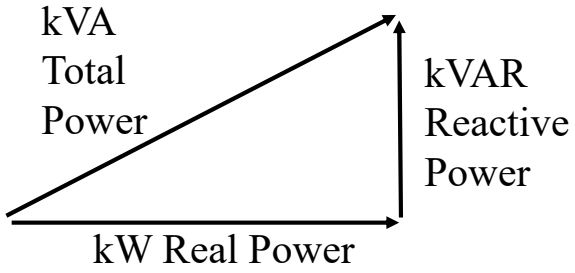


Reducing Demand Charges

- Manually schedule equipment operation to ensure that major equipment is not all on at the same time (unforgiving of mistakes).
- Electrical interlocks to prevent 2 pieces of equipment from operating at the same time.
- Automatic systems which monitor building demand & turn off selected (non-essential) loads on an assigned priority basis.

Power Factor (PF) Correction

- Power Triangle
  - PF = kW / kVA
  - kVA is reduced as PF approaches 1.0
  - Unity power factor (PF=1) at time of peak minimizes demand charges so kW=kVA



- Install capacitors to store & recycle (cancel) reactive power (kVARs).
- Electrical engineers typically are required to design power factor correction systems.

Reducing Demand Charges

- Coordinate the startup and shutdown of the ice plant with the electric meter reading
  - Read the meter before startup in the fall
  - Read the meter after shutdown in the spring

What Does 50 hp Cost to Run?

- Assume 93% motor efficiency, 100% load, 0.9 PF, GSM Rate
- 50 hp ≈ 40.1 kW ≈ 44.6 kVA
- Energy
  - Rate = 4.546 ¢/kWh (use run-off rate)
  - Charge = $1,331/month (based on operating 24/7)
- Demand (assume total demand > 50 kVA)
  - Rate = $11.91/kVA (assume more than 50 kVA)
  - Charge = $531/month
  - It only takes 15 minutes every month to see this charge
- Total Charges = $1,862/month (before taxes)

Lighting Cost – Question #1

- Calculate the cost to operate the following light bulb for 10 hours:
  - 100 watt incandescent light bulb
  - General Service Small (Non-Demand) Rate Class
    - First 11,000 kWh/month at 9.485 cents/kWh
    - Balance at 7.277 cents/kWh
    - No Demand Charges
  - Assume total monthly consumption of more than 11,000 kWh/month

Lighting Cost - Answer

- Power = 100 watts = 0.1 kW
- Duration = 10 hrs
- Rate = $0.07277/kWh

- Energy = 0.1 kW * 10 hrs = 1 kWh
- Cost = 1 kWh * $0.07277/kWh = $0.07 (before taxes)

Lighting Cost – Question #2

- Calculate the cost to operate the following light bulbs for 1 hour:
  - Forty 400 watt metal halide (470 watt inc. ballast)
  - General Service Medium Rate Class
    - First 19,500 kWh/month at 8.769 cents/kWh
    - Balance at 4.546 cents/kWh
    - Demand: $11.91/kVA for demand over 50 kVA
  - Assume total monthly consumption of more than 19,500 kWh/month and demand greater than 50 kVA

Lighting Cost - Answer

- Power = 40 fixtures * 0.470 kW = 18.8 kW
- Energy = 18.8 kW * 1 hr = 18.8 kWh
- Demand = 18.8 kW / 0.9 P.F. = 20.9 kVA

- Energy Cost = 18.8 kWh * $0.04546/kWh = $0.85
- Demand Cost = 20.9 kVA * $11.91/kVA = $248.79
- Before taxes

NATURAL GAS BILLING

Natural Gas Billing Components

- Basic Monthly Charge
- Gas Commodity
- Delivery
- Demand
- Taxes (GST, PUT, City of Winnipeg)
- Federal Carbon Charge (eliminated April 1, 2025)

Natural Gas Rate Classes

- Small General Service - Residential
- Small General Service - Commercial
- Large General Service
- High Volume Firm Service
- Mainline Firm Service
- Interruptible Service

Small General Service – Commercial – Effective Nov. 1/25

- **$14.75/month** basic monthly charge
- $0.0805/m3 gas commodity
- $0.1537/m3 delivery
- For a blended rate of **$0.2342/m3**

Large General Service – Effective Nov. 1/25

- **$85.00/month** basic monthly charge
- $0.0805/m3 gas commodity
- $0.1086/m3 delivery
- For a blended rate of **$0.1891/m3**

Natural Gas Rates

- Rates are subject to change every three months (February, May, August, November)
- Potential savings by switching rate classes.
- Potential savings by combining gas meters.
- Gas can be purchased from either Manitoba Hydro or a broker.

MONITORING & TRACKING

Energy Monitoring and Tracking

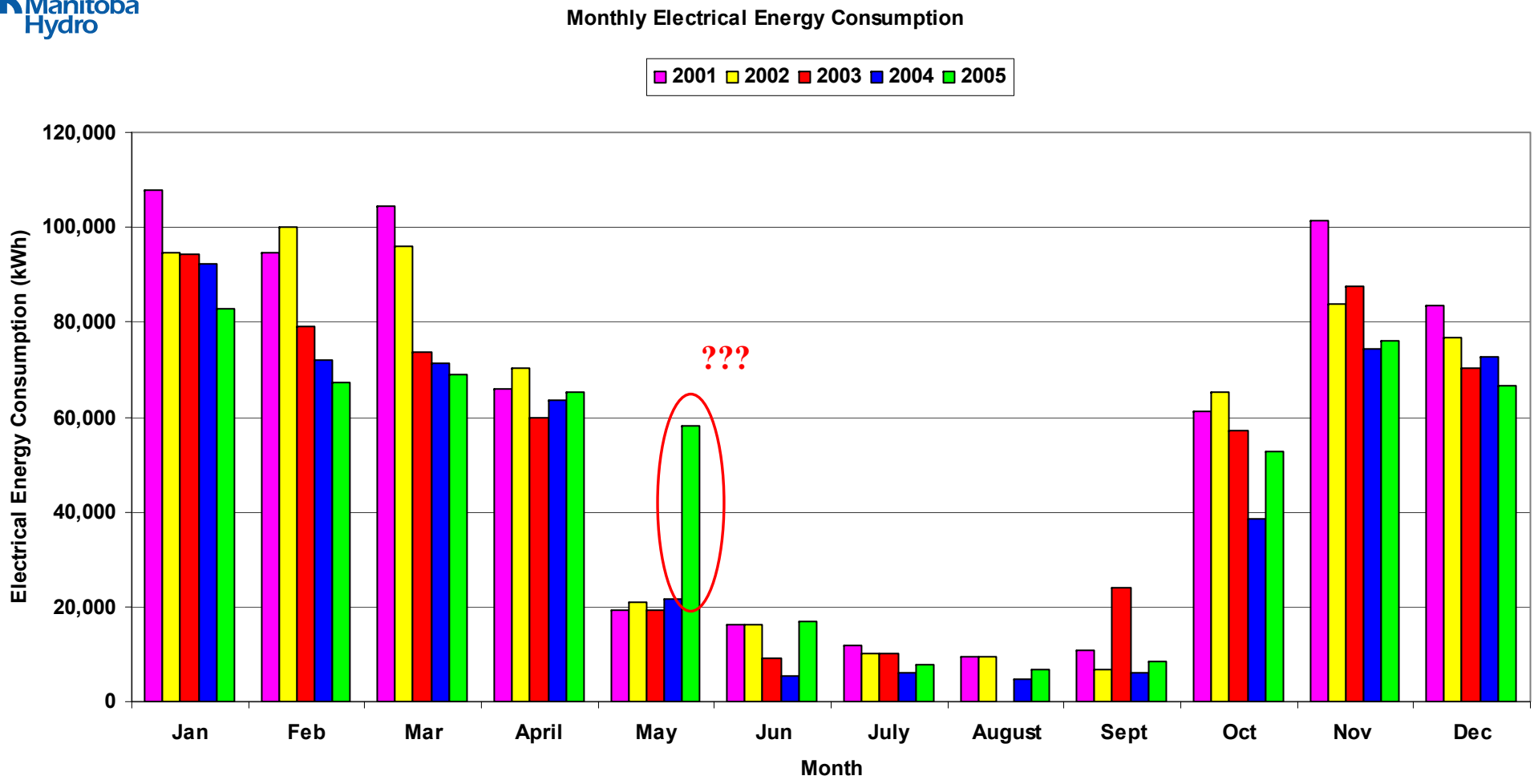
- Important to track energy and demand
- Compare to previous months
- May want to normalize data to:
  - Heating Degree Days
  - Cooling Degree Days
  - Number of events (create energy intensity number eg. kWh/event)

Benchmark Your Facility to Similar Facilities

- Items to consider:
  - Should compare facilities with similar uses
  - Weather differences
  - Building size
  - Hours of operation
  - Etc.

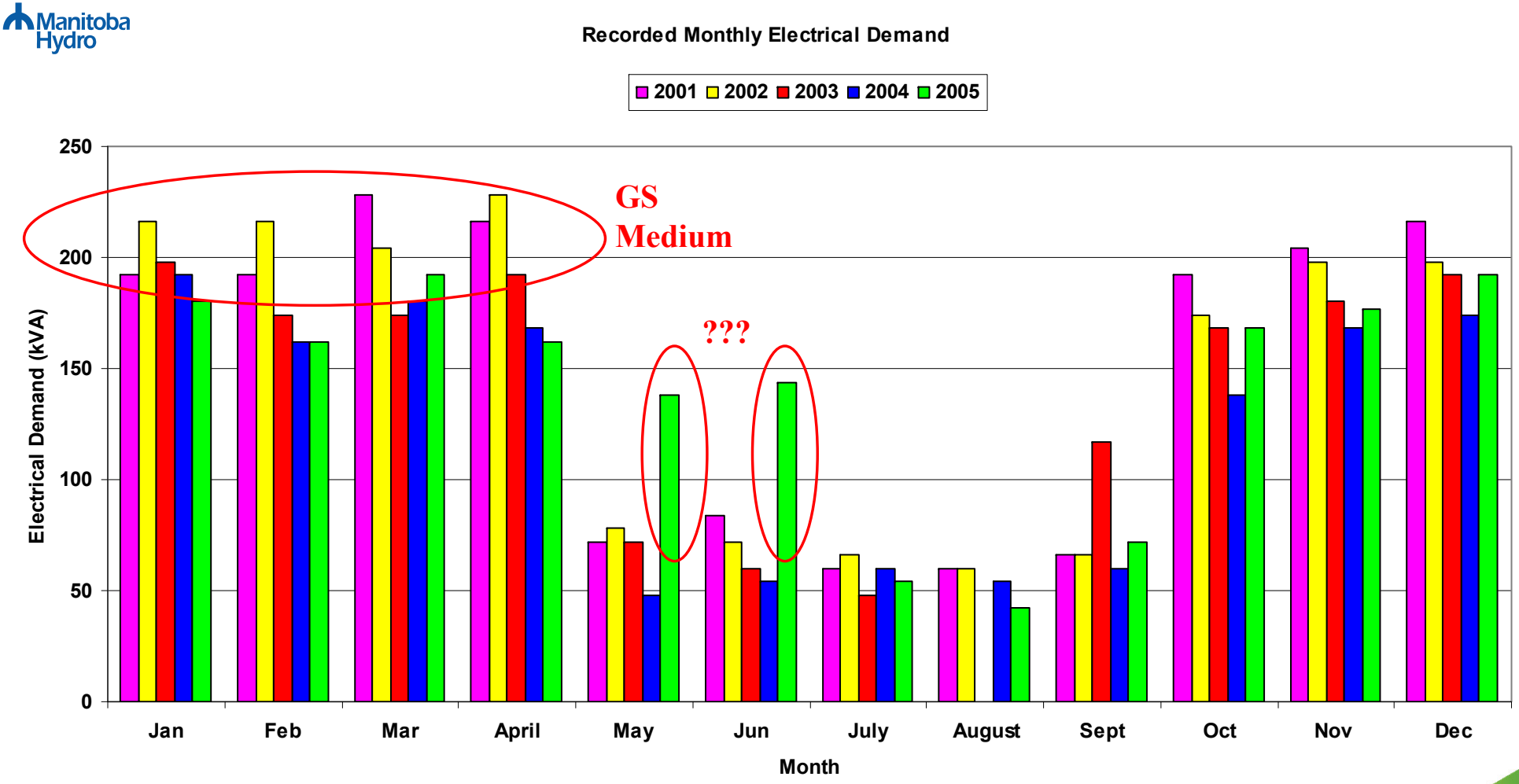
Energy Monitoring and Tracking

Manitoba Hydro

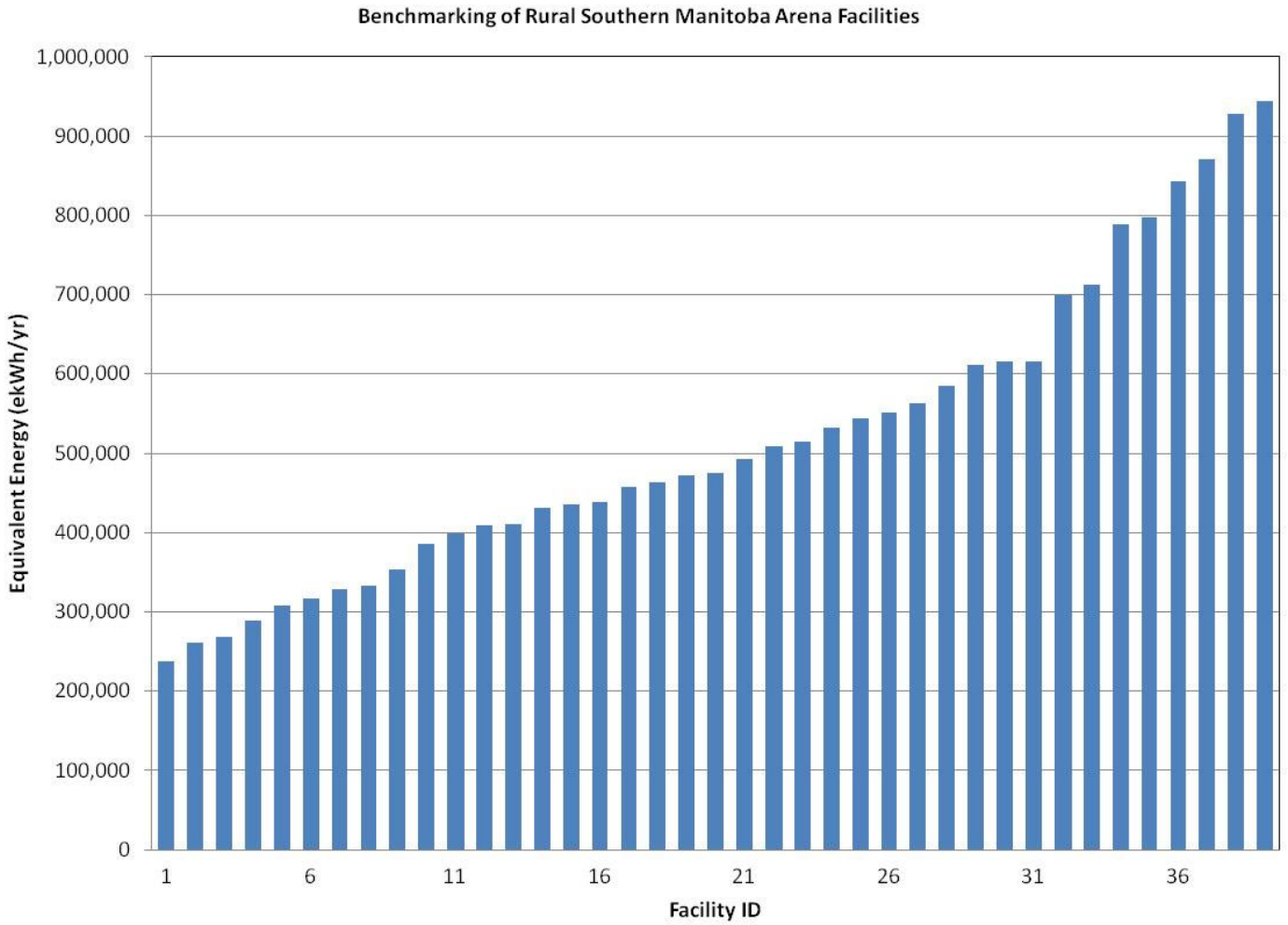


Energy Monitoring and Tracking

Manitoba Hydro



Benchmarking



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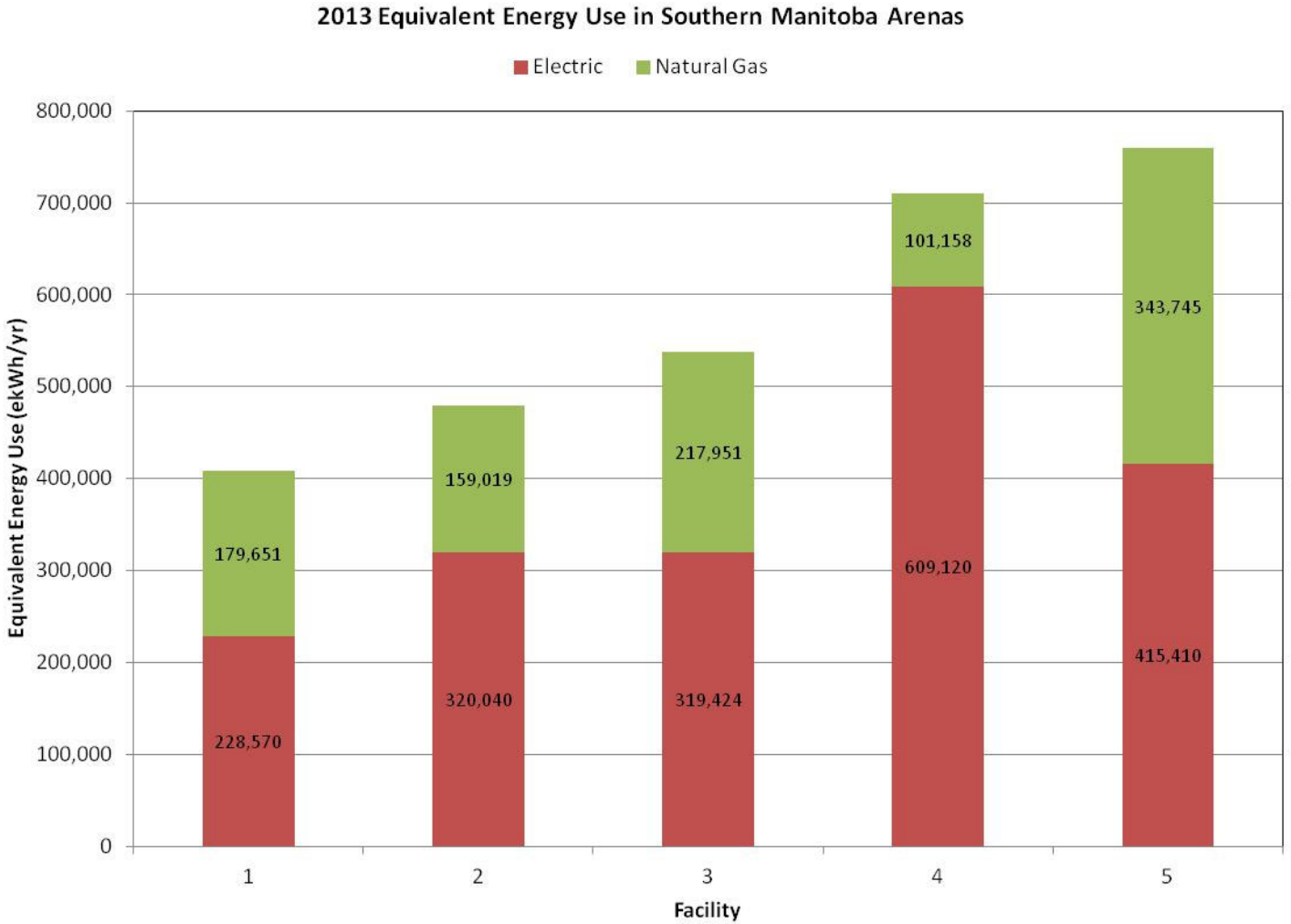
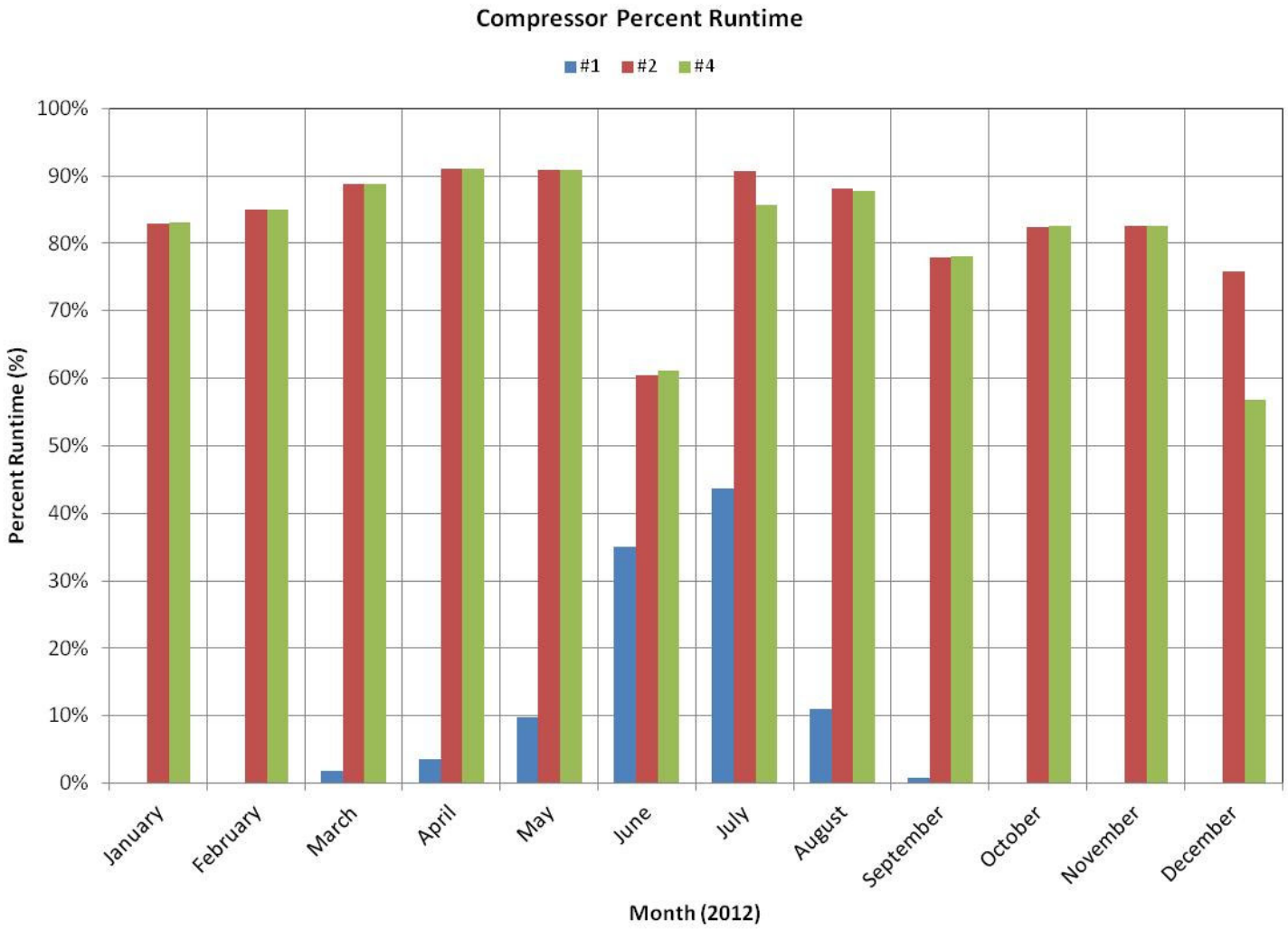


Engine Room Logs



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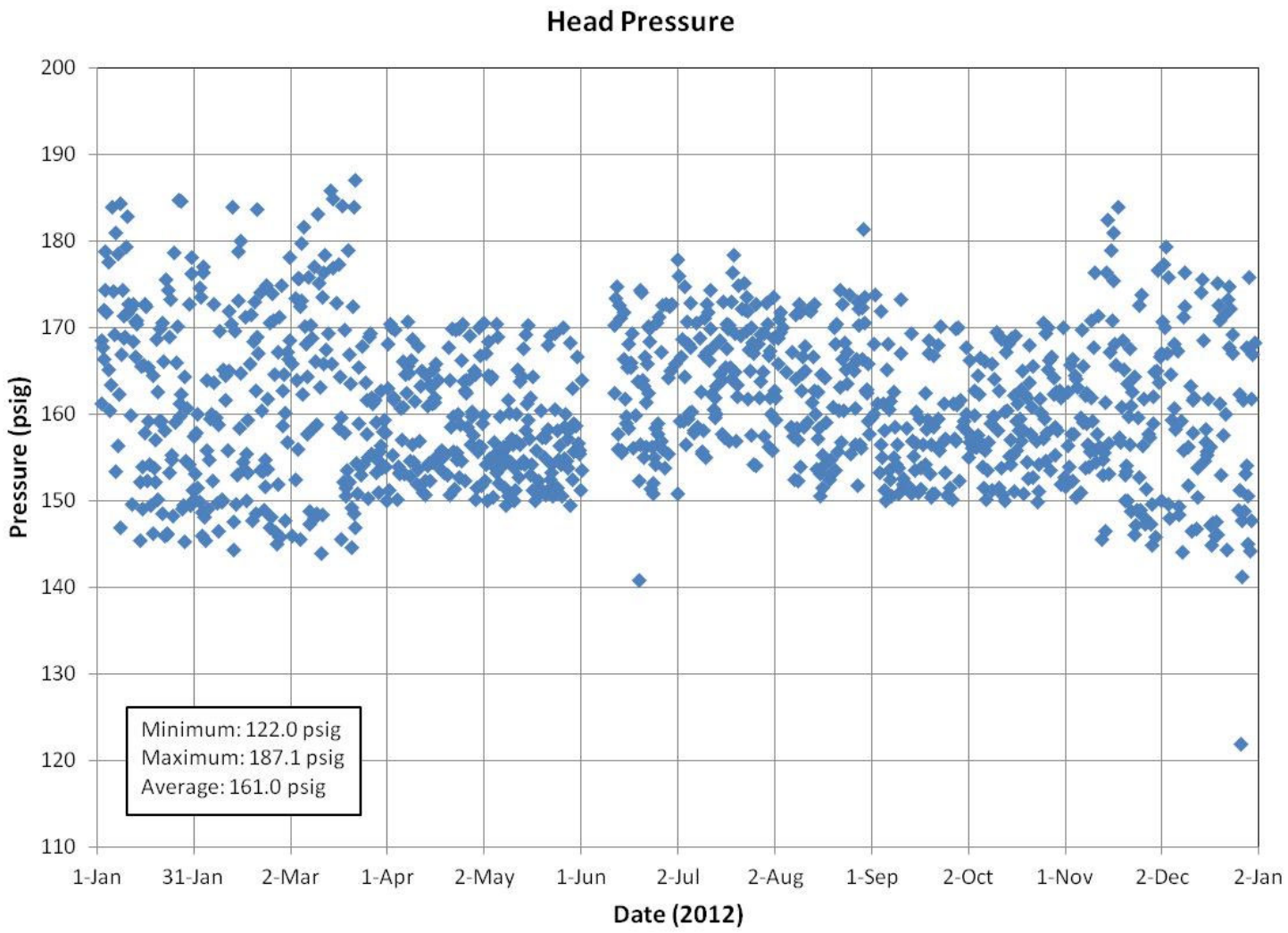
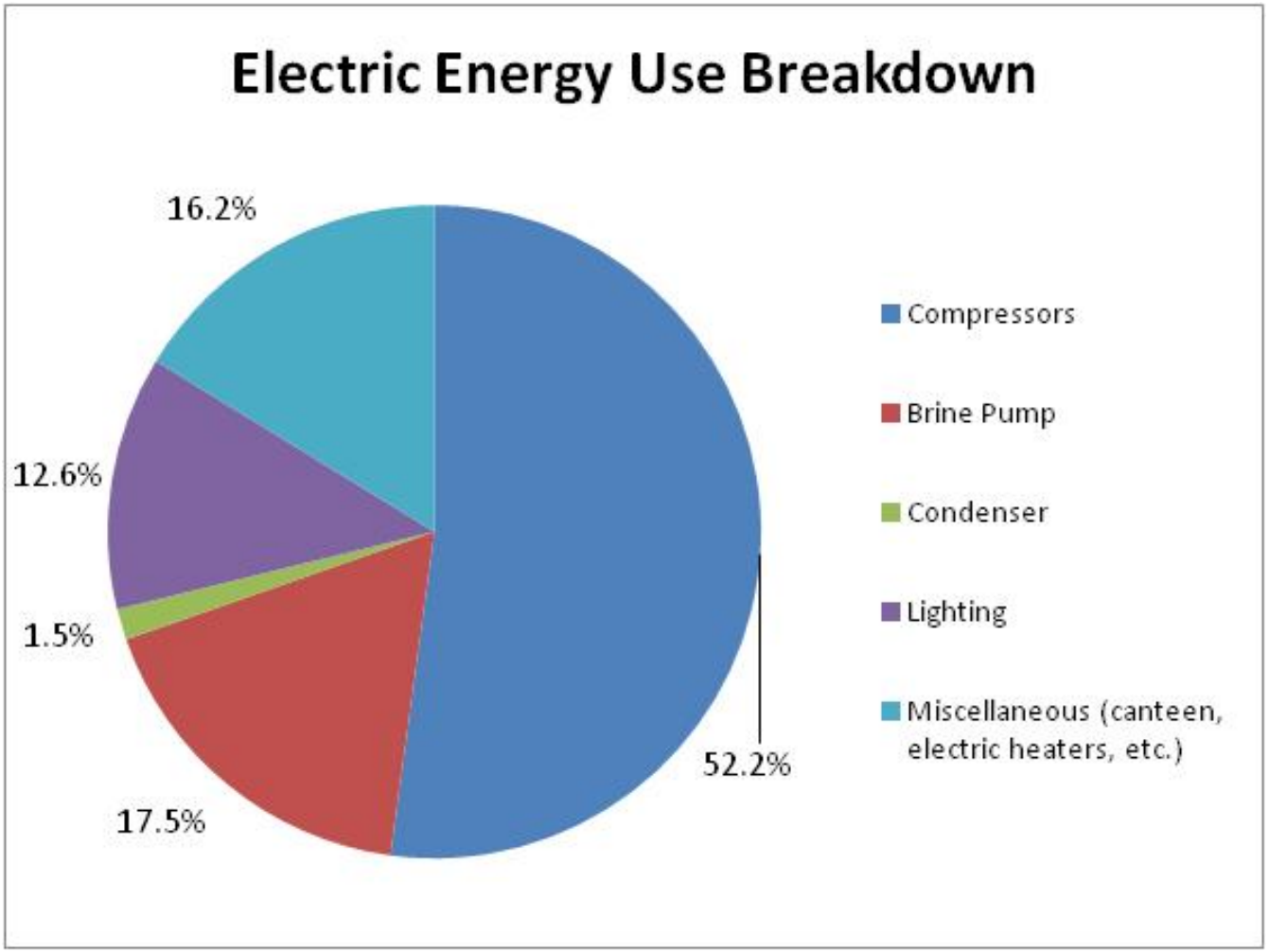
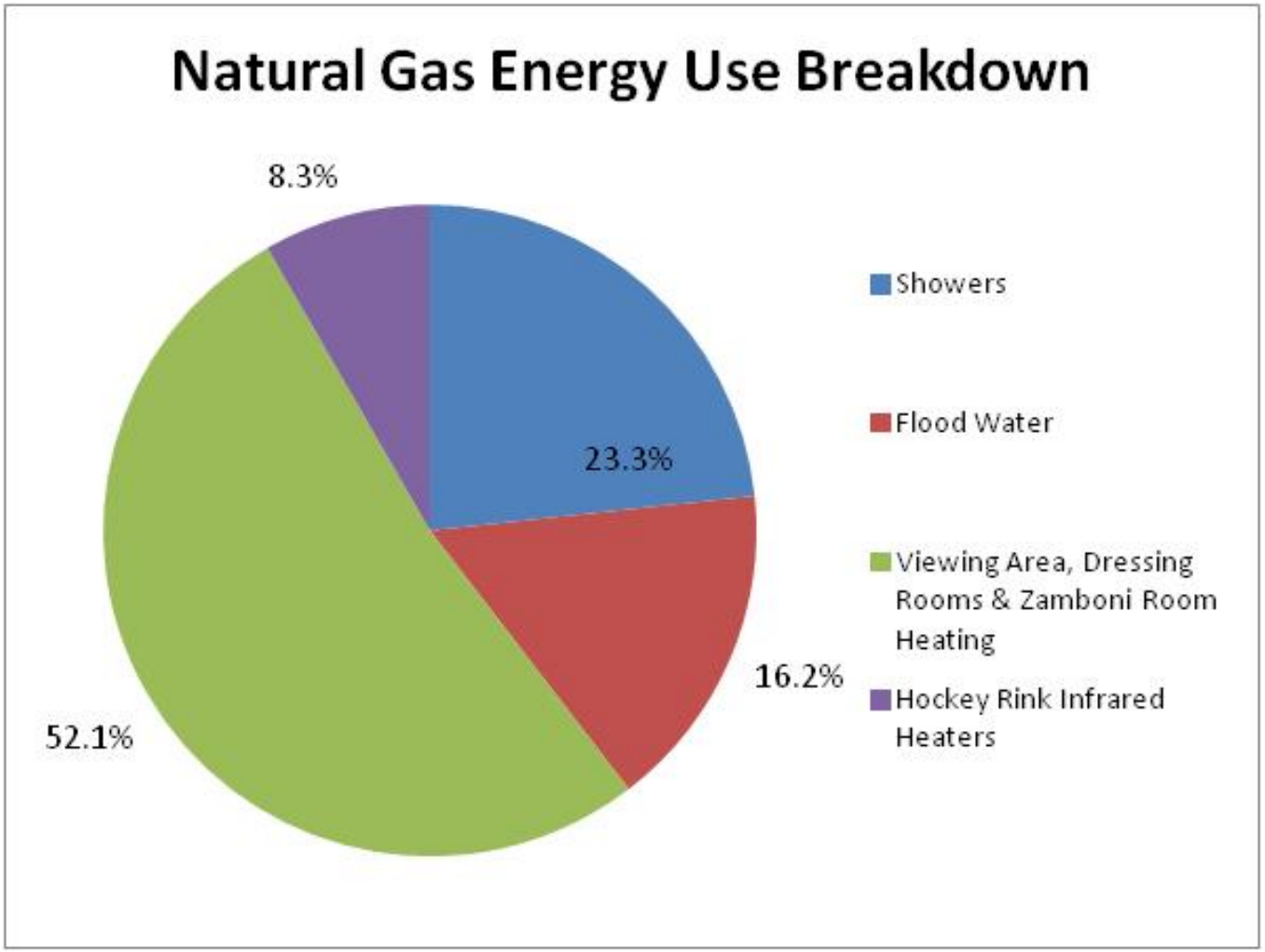


Electric Energy Use Breakdown



Natural Gas Energy Use Breakdown



ENERGY EFFICIENCY PROGRAMS

Sectors

- Residential
- Commercial
- Industrial
- Agricultural

Commercial Energy Efficiency Programs

- Building Envelope (insulation, windows, air barriers)
- Custom Measures (feasibility studies and projects)
- Geothermal
- Commercial HVAC (boilers, water heaters, CO2 sensors, ERVs, HRVs)
- Kitchen Appliances
- Lighting
- New Buildings Program
- Refrigeration (grocery stores & restaurants)
- Water & Energy Saver Program
- Etc.

Lighting

- New fixtures
- Bulb replacements
- Occupancy sensors

Lighting Energy - Interactive Effects

- First law of thermodynamics:
  - Energy is neither created or destroyed, it only changes form.
- Electrical energy is transformed by a light fixture into light and heat.
- The light and infrared are ultimately absorbed by objects in the space and become heat.
- Therefore, 100% of the electrical energy consumed by a light fixture ultimately appears as heat within a building.

Lighting Energy - Interactive Effects

- Reducing lighting system energy consumption in areas where the heat is useful may result in an increase in heating system operation.
- When considering the overall savings of potential lighting system retrofits it is very important to consider the additional costs of heating the building.
- Lighting in unheated interior areas or outdoor areas is not affected.

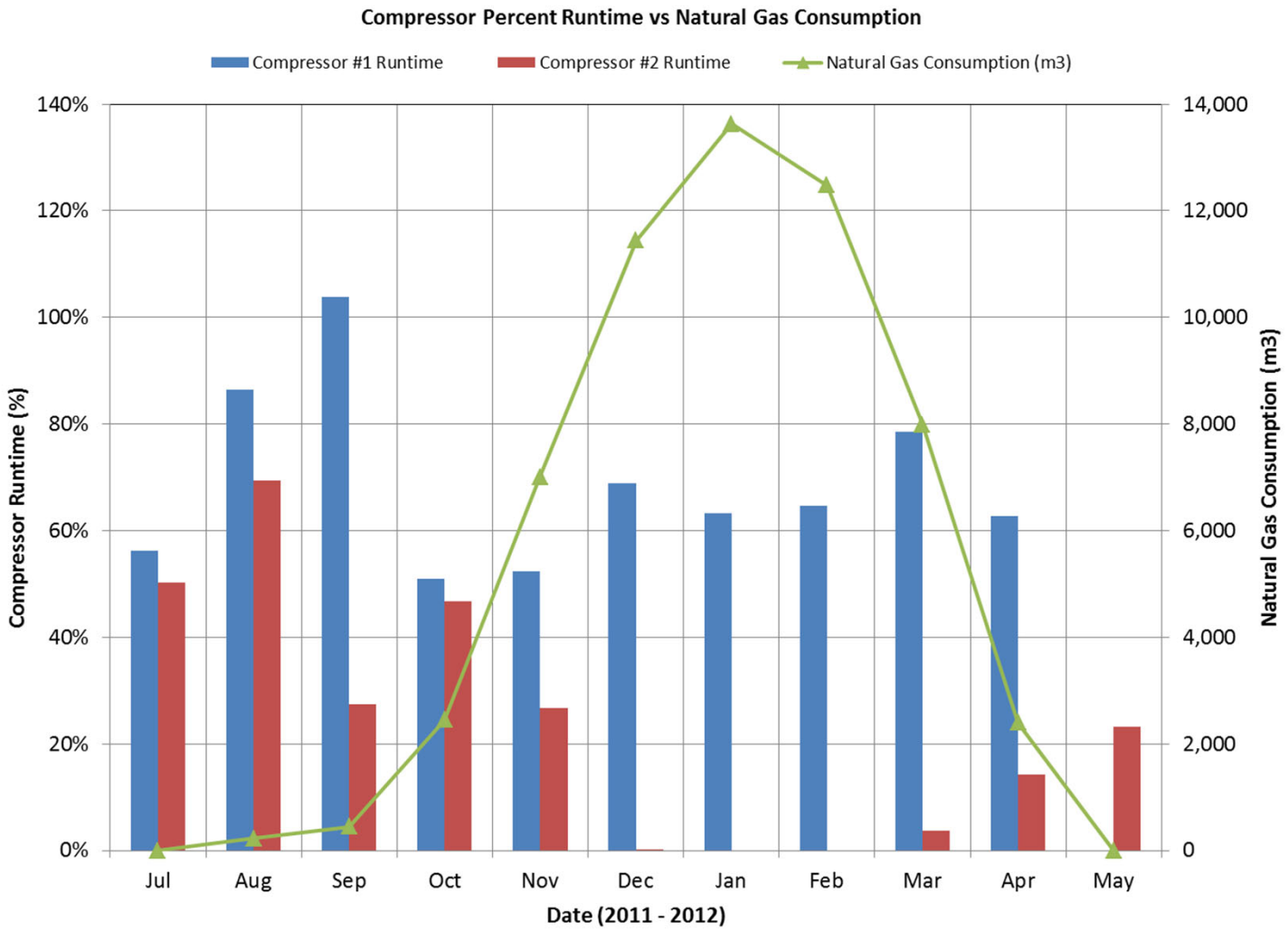
Potential Utility Cost Saving Projects

- Heat recovery
  - Flood water
  - Showers
  - Space heating
  - Snow melt pit

Refrigeration System Heat Recovery

- Items to consider:
  - Project cost
  - Potential savings
  - Potential payback – calculate best case scenario by utilizing entire heating bill
  - Load match
    - Flood water – compressors operate when flooding
    - Building heat – compressors run less when its cold outside and heat is required
  - Increased electrical energy use and demand if compressor head pressure is raised to provide more heat.

Refrigeration System Heat Recovery



Potential Utility Cost Saving Projects

- Condenser fan VFD (save energy, maintain more stable head pressure, quieter on start-up)
- Oversized condenser

Low-E Ceiling

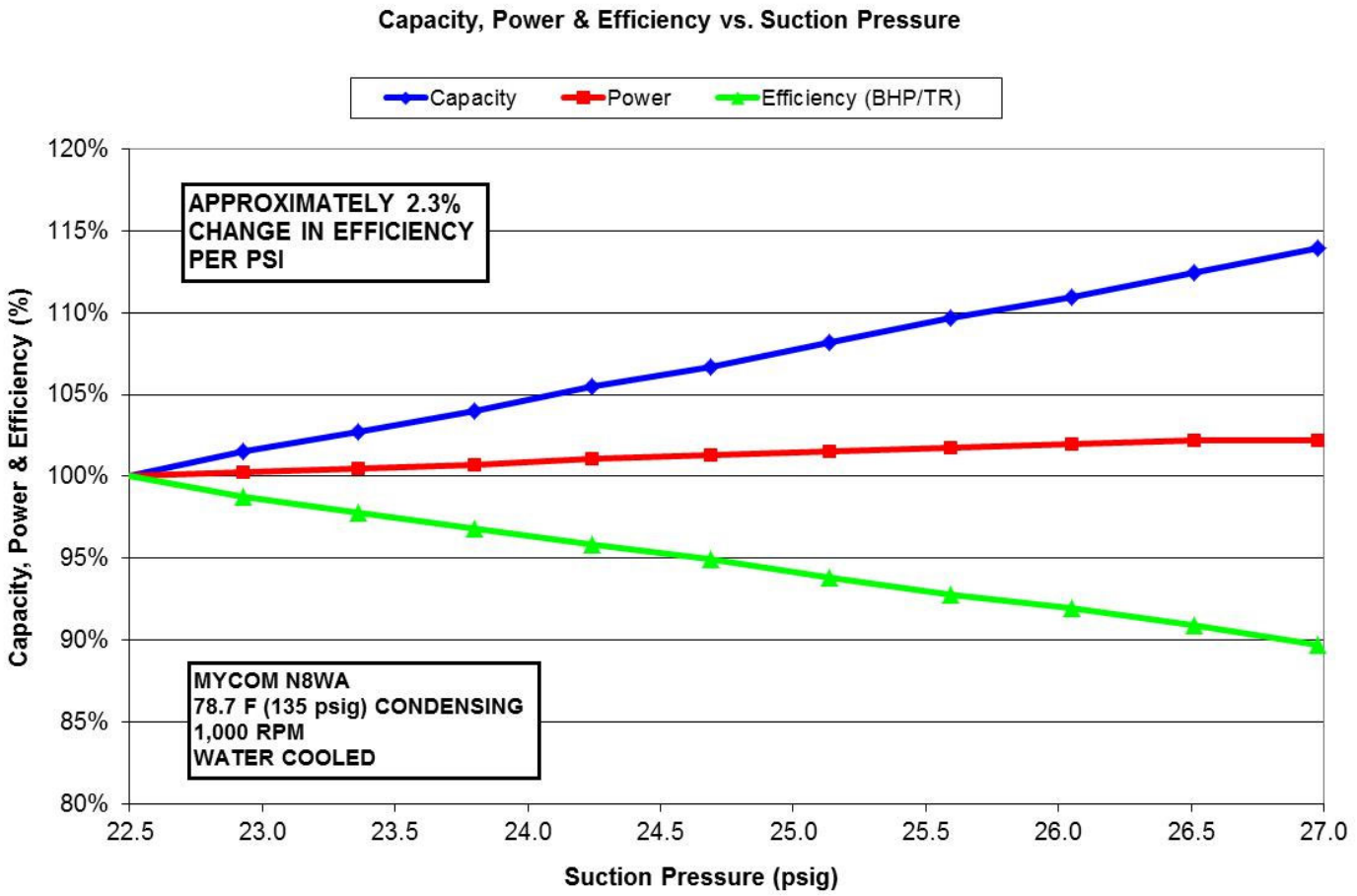
- Reduce the radiant heat load from the ceiling
- Improve light levels

Optimize Ice and Brine Temperatures

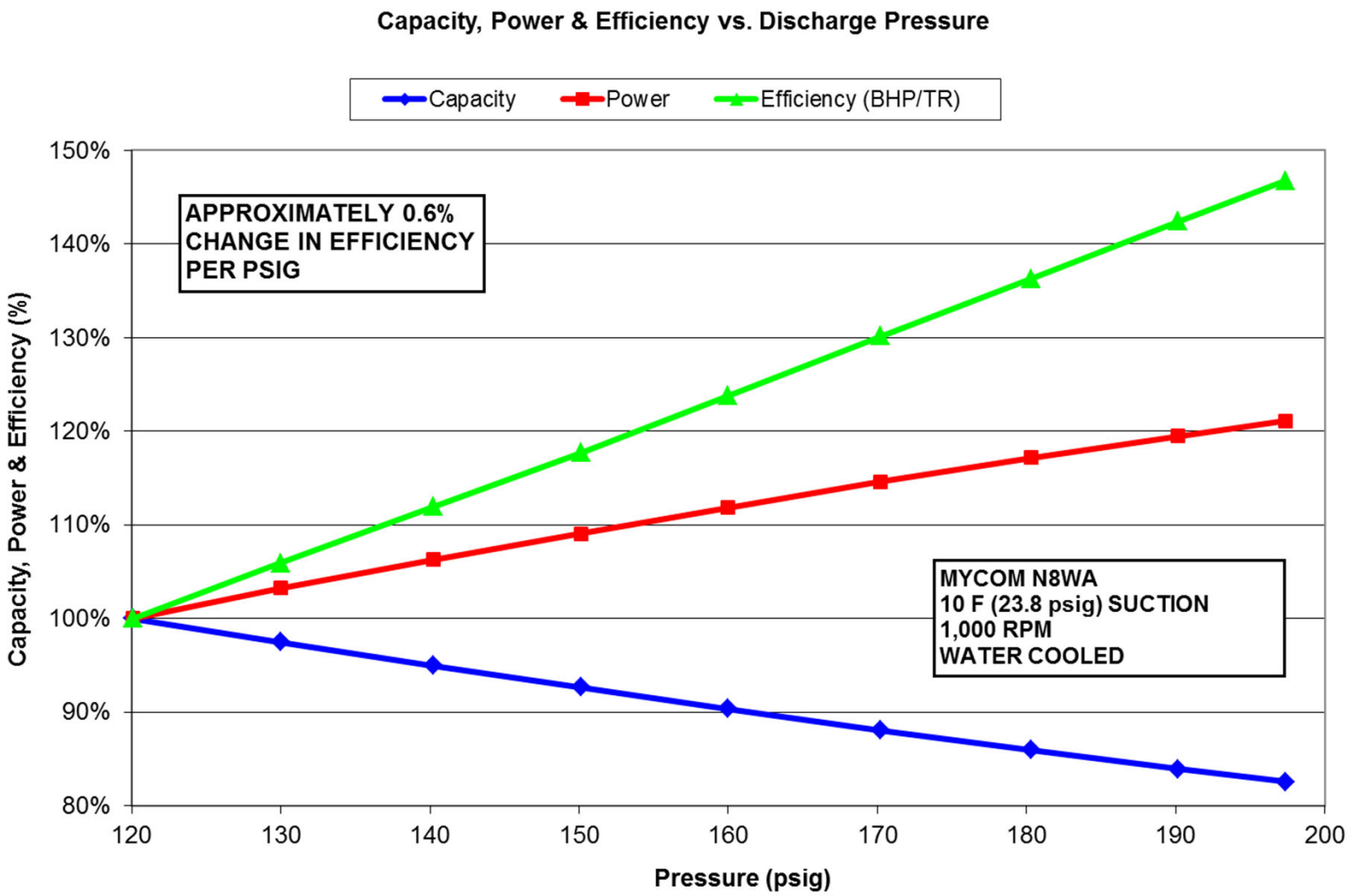
- ASHRAE ice temperature recommendations:
  - 20 F to 22 F for hockey
  - 24 F to 26 F for figure skating
  - 26 F to 28 F for recreational skating
- Efficiency Manitoba's best practices guide for brine temperatures:
  - Hockey: 16 F supply and 18 F return
  - Curling: 22 F supply and 24 F return

Raise Compressor Suction Pressure

- Achievable by increasing ice temperature



Lower Compressor Head Pressure



Potential Utility Cost Saving Projects

- Temperature setback during unoccupied periods (caution if using electric heat – may increase demand charge)
- Ice thickness of 1 inch
- Switch fuel source (natural gas usually cheaper than electricity)
- Parking lot controllers
- Building envelope upgrades

Energy Efficient Shower Heads

Free from Efficiency Manitoba

STANDARD SHOWER HEADS (EXISTING)

Total # of Showers:	6	showers
Shower Duration:	10	hrs/week/shower
Shower Flowrate:	2.5	US gal/min
Shower Season:	8	months/yr
Shower Water Temp. In:	42	F
Shower Water Temp. Out:	100	F
Water Specific Heat:	1.000	BTU / lb F
Density of Water:	62.32	lb/cu.ft.
Volume Conversion:	7.48	US gal/cu.ft.
Annual Water Volume:	312,000	US gal/yr
Heating Efficiency:	80.0%	
Annual Energy Use:	5,337	m3/yr
Gas Blended Rate:	$0.2287	/m3
Total Taxes:	13.0%	
Operating Cost:	$1,379	/year

LOW FLOW SHOWER HEADS (PROPOSED)

Total # of Showers:	6	showers
Shower Duration:	10	hrs/week/shower
Shower Flowrate:	1.5	US gal/min
Shower Season:	8	months/yr
Shower Water Temp. In:	42	F
Shower Water Temp. Out:	100	F
Water Specific Heat:	1.000	BTU / lb F
Density of Water:	62.32	lb/cu.ft.
Volume Conversion:	7.48	US gal/cu.ft.
Annual Water Volume:	187,200	US gal/yr
Heating Efficiency:	80.0%	
Annual Energy Use:	3,202	m3/yr
Gas Blended Rate:	$0.2287	/m3
Total Taxes:	13.0%	
Operating Cost:	$828	/year
Annual Gas Savings:	2,135	m3/yr
Annual Cost Savings:	**$552**	/year

Reduce Flood Water Temperature

- Reduces refrigeration load as well

EXISTING		
FLOOD WATER:		
Flood Rate:	2,000	floods/year
Gallons per Flood:	100	US gal/flood
Flood Water Temp. In:	42	F
Flood Water Temp. Out:	170	F
Water Specific Heat:	1.000	BTU / lb F
Density of Water:	62.32	lb/cu.ft.
Volume Conversion:	7.48	gal/cu.ft.
Annual Water Volume:	200,000	gal/yr
Heating Efficiency:	80.0%	
Annual Energy Use:	7,551	m3/yr
Gas Blended Rate:	$0.2287	/m3
Total Tax:	13.0%	
Annual Operating Cost:	$1,951.29	/year

PROPOSED (LOWER TEMPERATURE)		
FLOOD WATER:		
Flood Rate:	2,000	floods/year
Gallons per Flood:	100	US gal/flood
Flood Water Temp. In:	42	F
Flood Water Temp. Out:	130	F
Water Specific Heat:	1.000	BTU / lb F
Density of Water:	62.32	lb/cu.ft.
Volume Conversion:	7.48	gal/cu.ft.
Annual Water Volume:	200,000	gal/yr
Heating Efficiency:	80.0%	
Annual Energy Use:	5,191	m3/yr
Gas Blended Rate:	$0.2287	/m3
Total Tax:	13.0%	
Annual Operating Cost:	$1,341.51	/year
Annual Cost Savings:	**$609.78**	

Potential Utility Cost Saving Projects

- Dump ice shavings outside
- Only heat shed when spectators are in attendance
- More efficient compressors

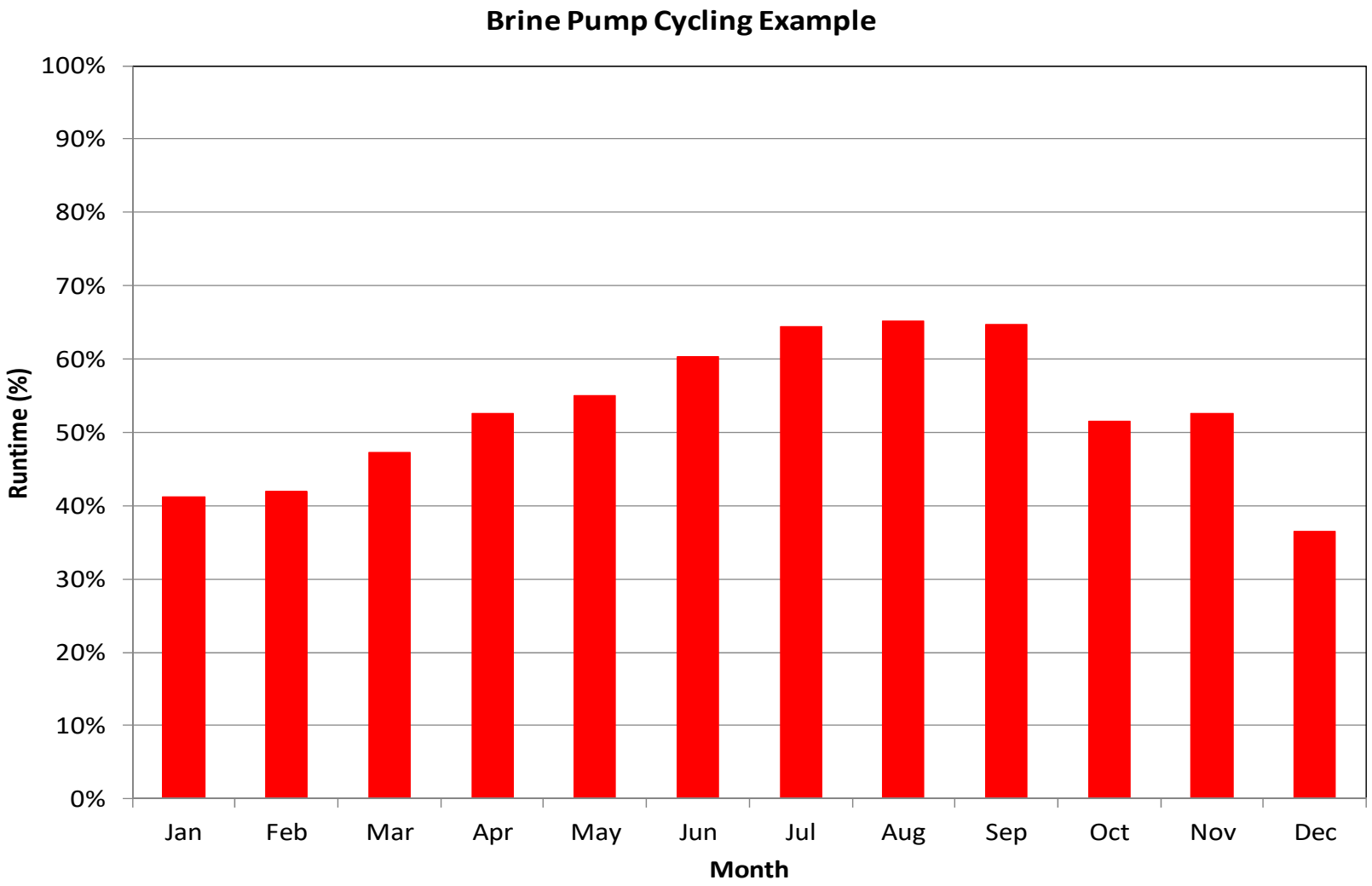
Brine Pump Cycling & Speed Control

- Saves pumping power as well as compressor runtime
- Options:
  - Continuous
  - Cycle ON/OFF
  - Two speed
  - VFD

Brine Pump Cycling

- Lots of facilities have the controls in place already but force the pump to operate continuously

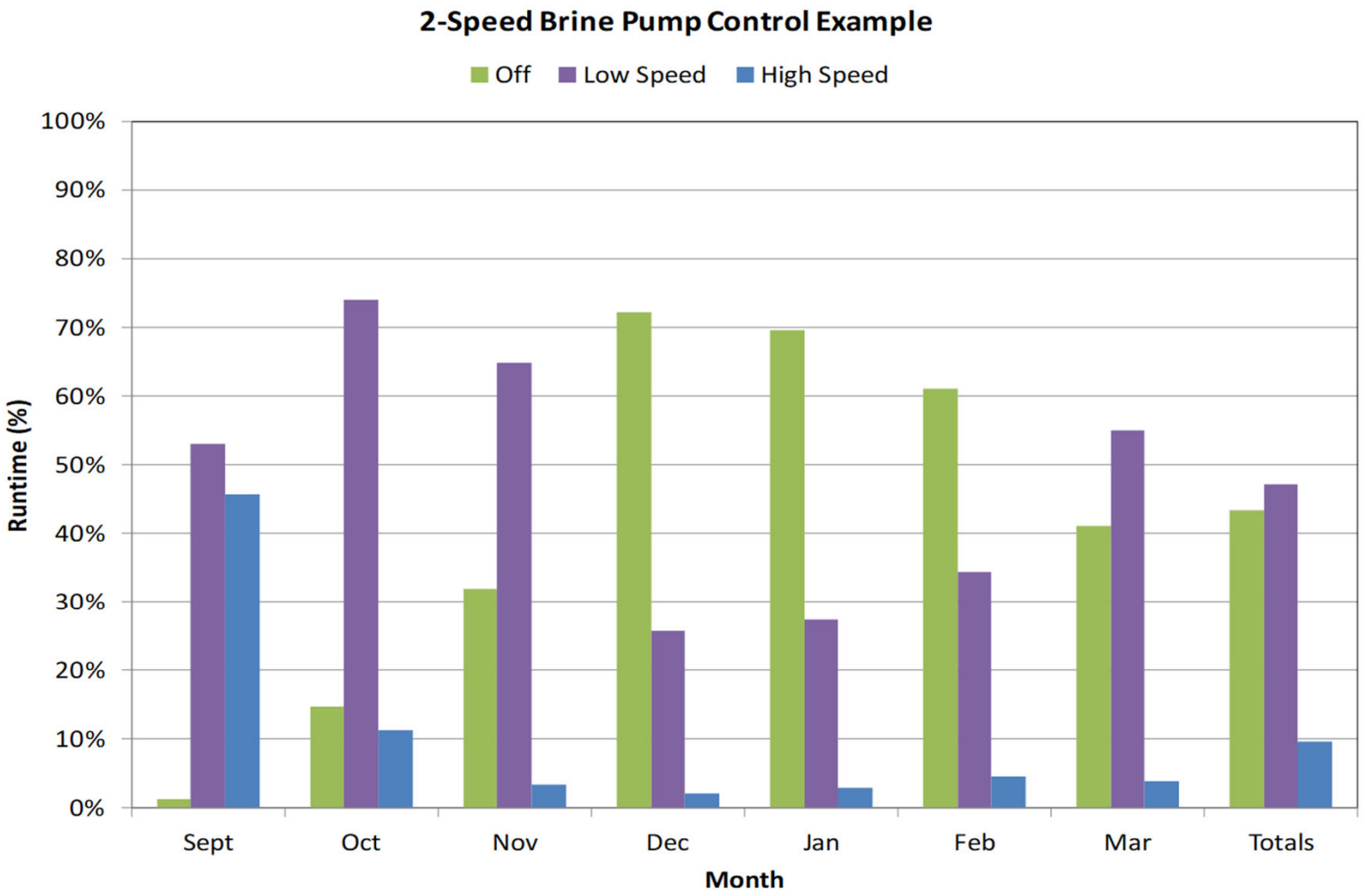
Brine Pump Cycling



Brine Pump Cycling

Brine Pump HP:	20	HP
Months of Operation:	12	months/year
Potential Brine Pump Percent Runtime:	50%	
Annual Runtime Savings:	4,380	hrs/year
Pump Motor Efficiency:	90.0%	
Compressor Motor Efficiency:	94.5%	
Pump Loading:	100.0%	
Compresssor Efficiency:	1.26	BHP/TR
Annual Pump kWh Savings:	72,611	kWh/year
Annual Compressor kWh Savings:	18,479	kWh/year
Total Annual kWh Savings:	91,090	kWh/year
Energy Charge:	$0.04108	/kWh
Total Taxes:	13.0%	
Total Annual Cost Savings:	$4,228.44	/year

Two Speed Brine Pump

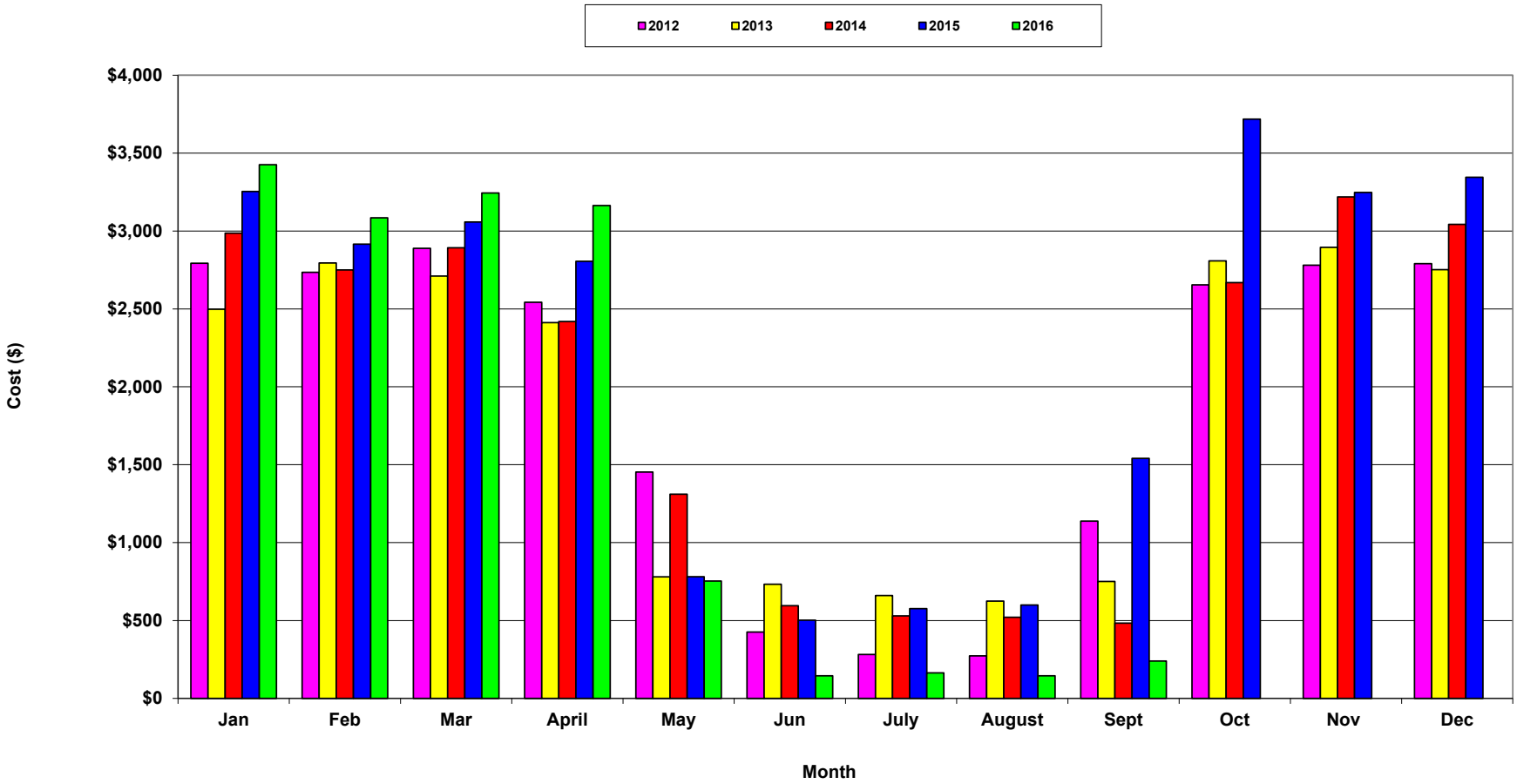


Potential Utility Cost Saving Projects

- Unplug and turnoff equipment during summer shutdown
  - Fridges, freezers & beverage coolers
  - Heaters
  - Lights
- Example #1 shown on next slides (curling rink)
  - Fridges, freezers & beverage coolers operated yet nothing in them
  - Found heaters in basement forced to operate non-stop
  - Outdoor advertising sign lit when not required
  - Electric heating element in dishwasher stuck on
  - Will save over $3,000 per summer by turning things off and scheduling startup and shutdown with meter reading

Summer Shutdown – Example #1

Manitoba Hydro



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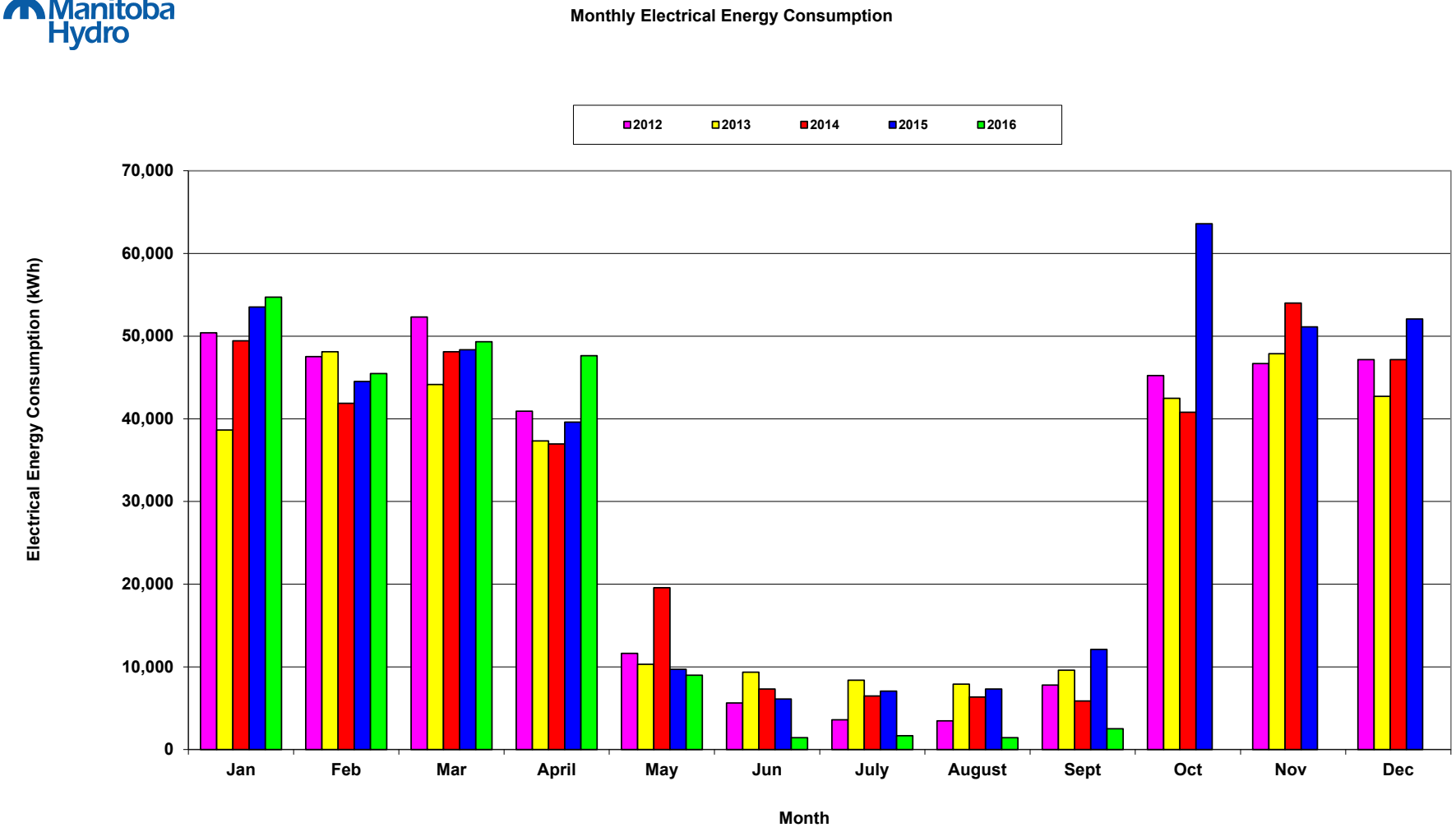

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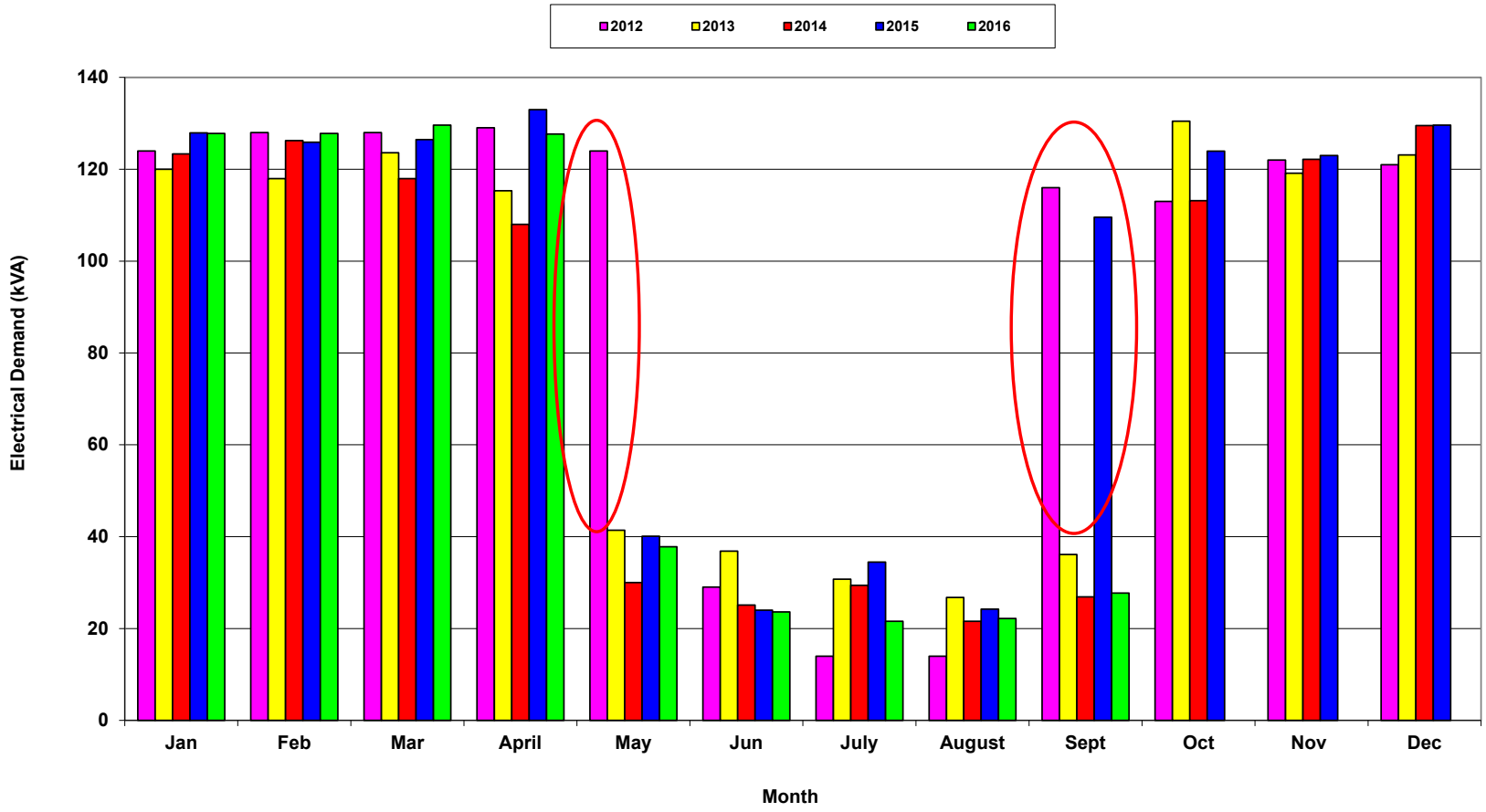

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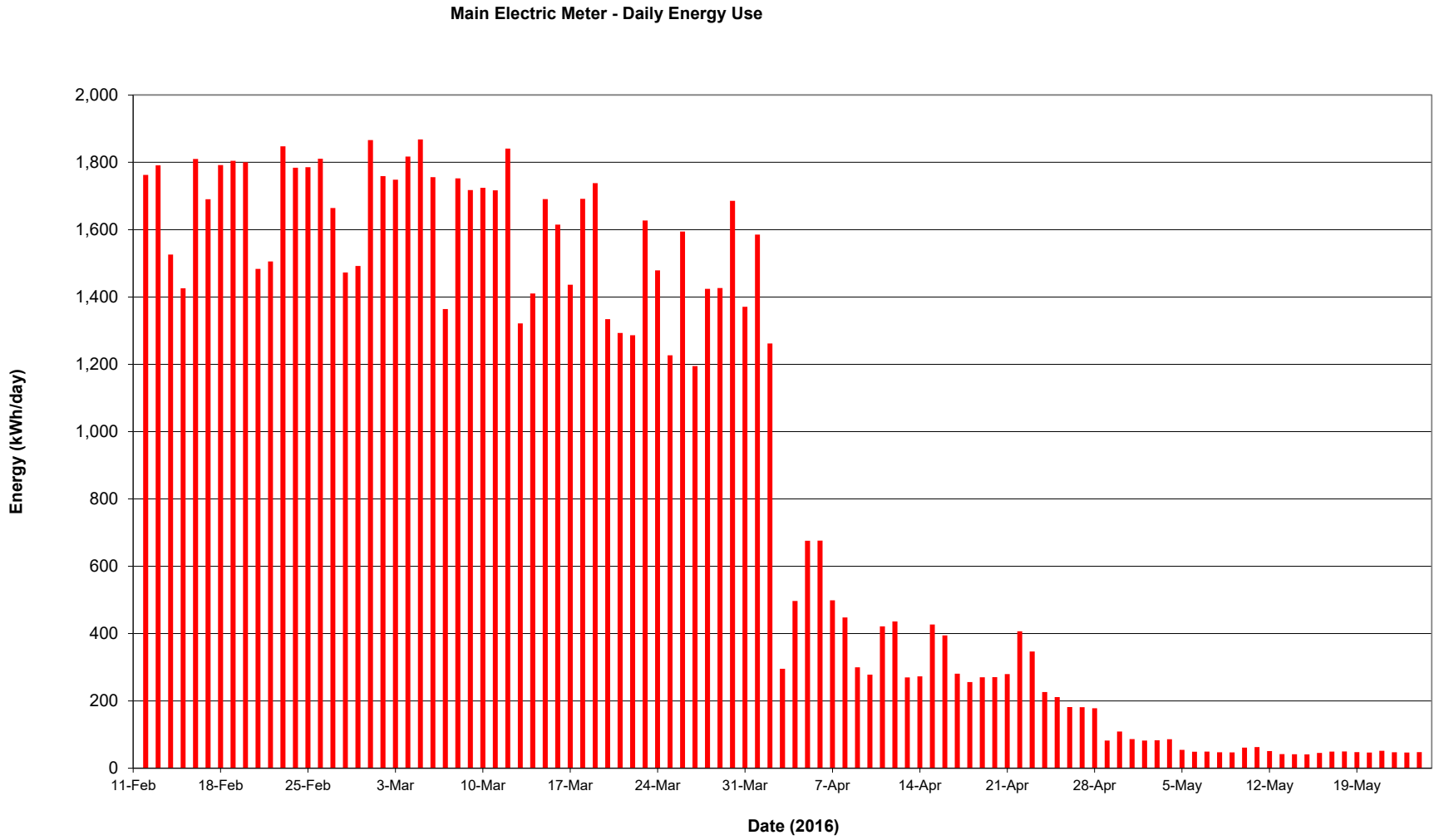
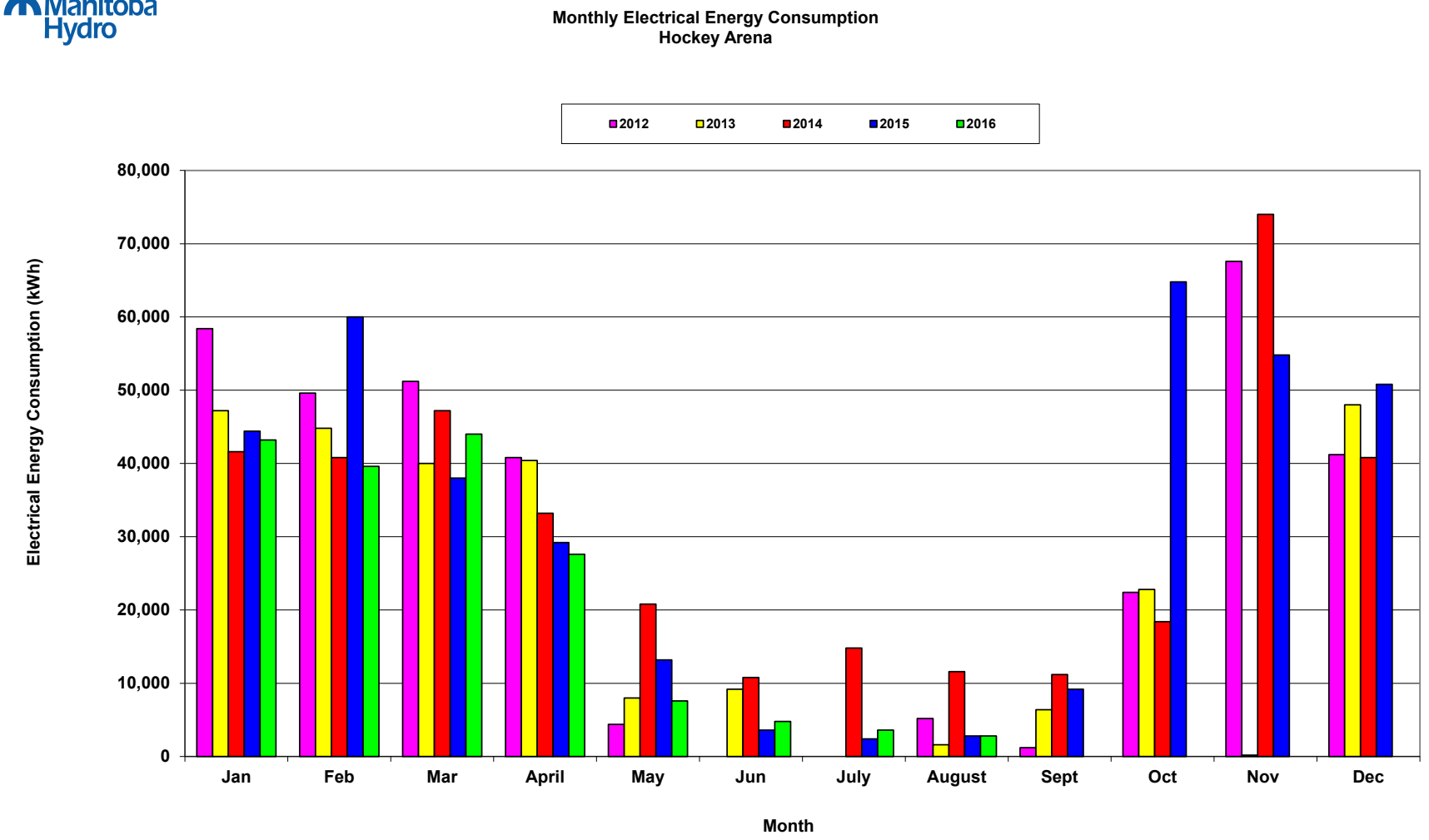


Potential Utility Cost Saving Projects

- Example #2 shown on next slides
  - Arena hosts grad for adjacent high school and turns on refrigeration system for a day to provide cooling

Summer Shutdown – Example #2

Manitoba Hydro



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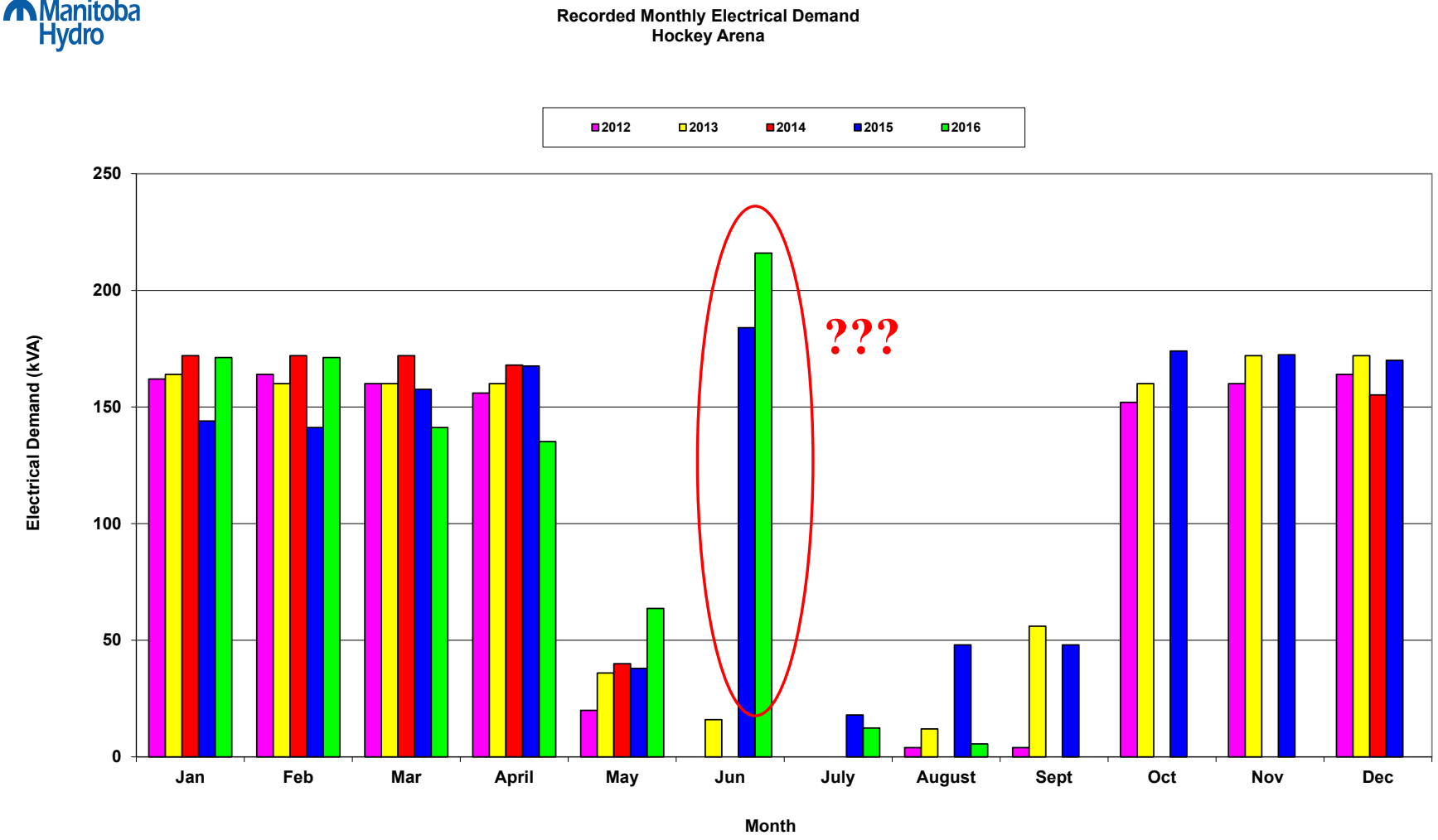

Summer Shutdown – Example #2

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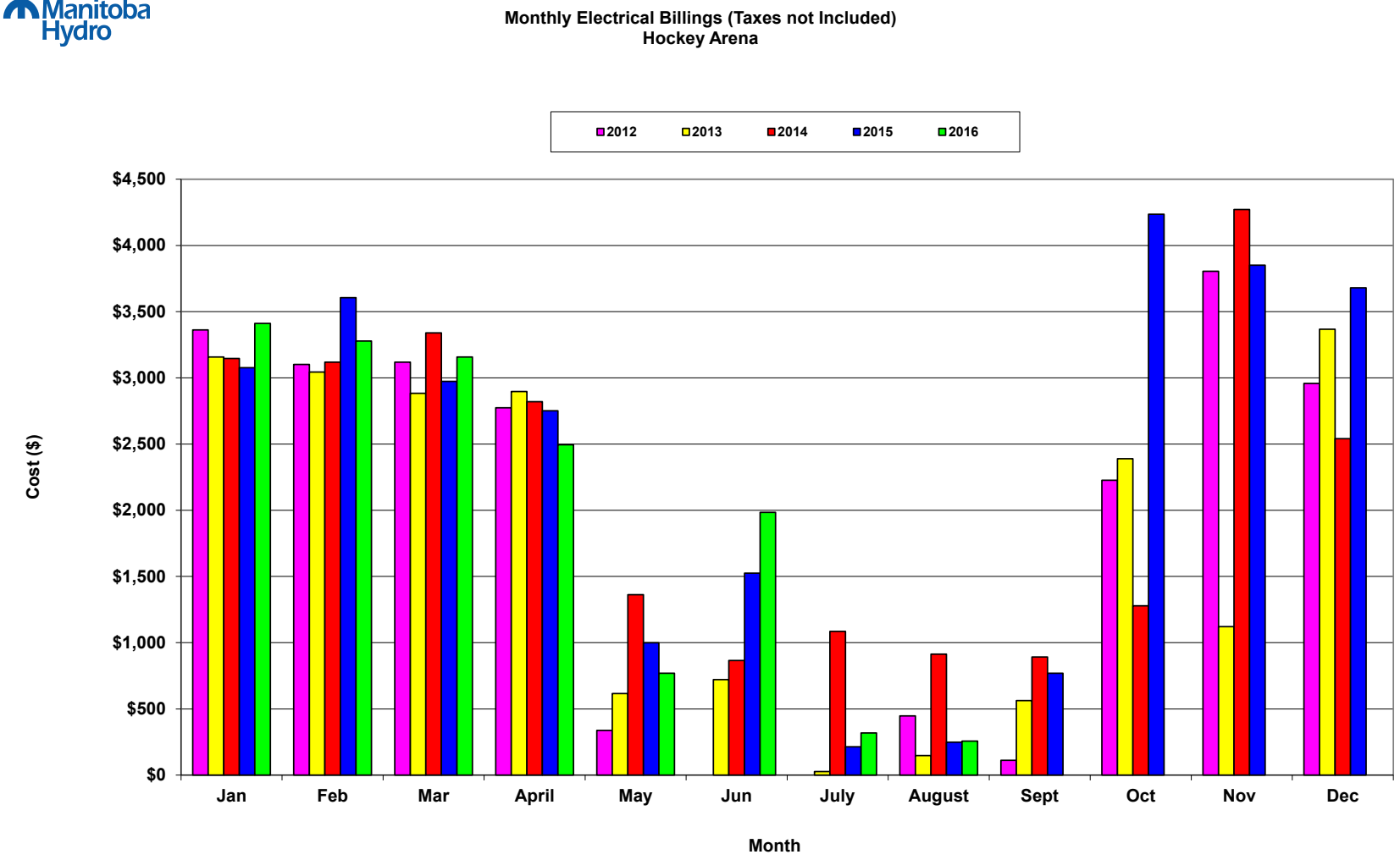
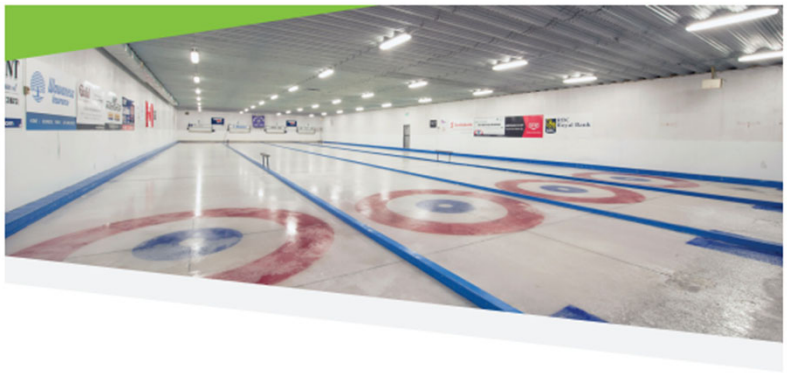


Energy Efficiency Guide



ENERGY EFFICIENCY GUIDE

FOR MUNICIPAL
RECREATION FACILITIES

DESIGN WITH ENERGY EFFICIENCY IN MIND.

EFFICIENCY MANITOBA

ASSOCIATION OF MANITOBA MUNICIPALITIES

THANK YOU!

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