

Municipal Corporate Energy Efficiency Case Studies

City Of Brampton – Earnscliffe Recreation Centre

REALice Application

Corporate Energy Efficiency - Case Studies

About Earnscliffe Recreation Centre:

- 70,000 ft² - built in 1972, expanded in 2004
- \$415,000 - 2016 utility cost
- 41 kWh/ft² in 2016
- Two ice rinks (one year around)
- Swimming Pool
- Fitness Centre
- Community Rooms





REALice Vortex

- Removes micro-air bubbles in water through de-aeration making it possible to flood the ice without heated water
- Creates hard & resilient ice
- Lowers energy costs
- 10 year measure life
- ~\$30K installation cost

www.realice.ca

- **Traditional ice resurfacing uses hot water to remove air bubbles and impurities**
- **REALice allows facilities to resurface using cold water while still ensuring quality of ice**

From Business Case to PO in 20 days

- Pick the right site
- Start discussion with staff
- Get approval from recreation management
- Prepare the business case and talk to finance
- Work with purchasing – Single Source procurement

REALice Water Treatment Device at Earncliffe Recreation Centre

Date: Thursday, November 10, 2016

Project Description: Install REALice water treatment device at Earncliffe Recreation Centre

Project Location: Earncliffe Recreation Centre

Total Funding Requested: \$35,380 (HST not included)

Annual Energy Savings: \$30,802

Maintenance Savings: N/A

Estimated Incentive/Grants: \$26,535 (Enbridge Incentive i.e. 50% of the implementation cost ends December 7th 2016)

Annual GHG Reduction: N/A

Estimated Payback: 0.62 years (with incentive)

Prepared by: Junaid Iqbal, Certified Energy Auditor

Reviewed by: Saleh Daef, Certified Energy Auditor



Brampton
Grow Green

Account: 710031-001-0000-CB42m-141520-001-MATER-201
Req. 4405 61



Purchase Order

CITY OF BRAMPTON
INCULCATION STREET, WEST
BRAMPTON ON L6Y 4R5
Telephone: 905.874.2000 Fax: 905.874.2009

Vendor: EDCOENERGIE
5000 LES PARADES RD.
DAS - 520 1098 Ave
VANCOUVER BC V6V 1V9
Canada

Invoice: 886545-0162
File:
Email: Bids@brampton.ca

PO Number: 111012016
PO Date: 11/09/2016
PO Item: 001
Quantity: 1.00
Unit: LOT
PO Price: \$3,360.00
Extended Price: \$3,360.00
Est. Date: 11/10/2016

TO PROVIDE ALL LABOR, MATERIALS & EQUIPMENT NECESSARY FOR SUPPLY OF REALICE SYSTEM AT EARNSCLIFFE RECREATION CENTRE, 16 EARNSCLIFFE DRIVE, BRAMPTON, ONTARIO

ALL IN ACCORDANCE WITH INFORMAL QUOTATION DATED NOVEMBER 10, 2016.

THE ORDER SHALL BE DELIVERED BY NOVEMBER 10, 2016.

THE CONTRACT ADMINISTRATION IS RESPONSIBLE AT EDCOENERGIE'S RISK. IN HIS EVENTUALITY, THE CONTRACT ADMINISTRATION IS RESPONSIBLE FOR ALL ADMINISTRATIVE ISSUES CONCERNING THIS CONTRACT.

THE ACCEPTANCE OF THIS PURCHASE ORDER BY THE VENDOR/CONTRACTOR SHALL BE DEEMED TO HAVE OCCURRED UPON PERFORMANCE OF ANY SERVICES OR COMPLETION OF ANY WORK.

BY ACCEPTANCE OF THIS PURCHASE ORDER THE VENDOR/CONTRACTOR HEREBY AGREES TO COMPLY WITH THE FOLLOWING WITH RESPECT TO ALL WORK PERFORMED:

1) THE VENDOR/CONTRACTOR ACKNOWLEDGES AND ACCEPTS THE OBLIGATIONS AND OBLIGATIONS OF THE CONTRACTOR FOR THIS PROJECT AND AGREES TO COMPLY WITH ALL REQUIREMENTS REGARDING OCCUPATIONAL HEALTH AND SAFETY AND ENVIRONMENTAL AND THE CORPORATION OF THE CITY OF BRAMPTON HEALTH & SAFETY POLICIES AND ORDINANCES SPECIFIED IN THE CONTRACT.

2) WHERE THESE OR A REQUIREMENT IS NOT SPECIFIED BY THE CONTRACT ADMINISTRATION, THE ACCEPTOR AND SUBCONTRACTOR/CLAIM PROVIDERS MUST BE ACCOMPANIED BY A STATUTORY DECLARATION OF PRACTICES, LAWS & REGULATIONS.

3) THE VENDOR/CONTRACTOR SHALL AT ALL TIMES OBTAIN THE CONSENT OF THE TERMS OF THIS AGREEMENT AND ANY EXTENSION OR REVISED THEREOF BY THE CONTRACT ADMINISTRATION AND PROVIDE THE CONTRACTOR OF THE CITY OF BRAMPTON WITH EVIDENCE OF COMPLIANCE GENERAL LIABILITY INSURANCE, AGENT ALL CLAIMS FOR PERSONAL INJURY AND PROPERTY DAMAGE, AND THE CITY OF BRAMPTON RECEIVES THE RIGHT TO REQUIRE ALL SUCH INSURANCE POLICIES TO BE PROVIDED TO THE CITY OF BRAMPTON RECEIVES THE RIGHT TO REQUIRE ALL SUCH INSURANCE POLICIES TO BE PROVIDED TO THE CITY AND TO REQUIRE THE CITY MAY HEREBY REQUIRE FROM TIME TO TIME.

PO Balance: 31,020.00
HST: 4,360.00
Total PO Amount: 35,380.00

THE ABOVE NOTES PURCHASE ORDER NUMBER MUST BE SHOWN ON ALL INVOICES.

ACCEPTANCE
I hereby acknowledge and accept the terms and conditions of this purchase order.
Signature: _____
Date: 11/10/2016

NEW FAX RETURN EMAIL

From PO to Installation in 15

- Device was shipped from Europe and had to be cleared at customs
- A two inch mixing valve with desired temperature range was special ordered with two weeks delivery time
- Work done by local plumber in few hours



Using the device

- Training session for operation
- Took 2-3 days for full operation
- Ice was shaved and rebuilt
- Brine temperature was raised by 2 degrees in two steps

DATE	TIME	ETIME	STATUS	U1_AVE[V]	U2_AVE[V]	U3_AVE[V]	Uave_AVI	I1_AVE[A]	I2_AVE[A]	I3_AVE[A]	Iave_AVE	I4_AVE[A]	P_AVE[W]	Q_AVE[va]	S_AVE[VA]	PF_AVE_1	F_AVE[Hz]	P1_AVE[W]	P2_AVE[W]	P3_AVE[W]	Q1_AVE[vQ2]	Q2_AVE[vQ3]	Q3_AVE[vS1]	S2_AVE[V]	S3_AVE[V]
2016/12/05	11:14:38	00000:23	0	347.2	350.9	349.5	349.2	81.9	86.3	83.8	84.0	0.0	71780.0	50900.0	88000.0	0.8	60.0	23450.0	24940.0	23390.0	16080.0	17180.0	17620.0	28430.0	30280.0
2016/12/05	11:15:08	00000:23	0	347.3	350.8	349.7	349.3	82.1	86.5	83.9	84.2	0.0	71990.0	50970.0	88210.0	0.8	60.0	23530.0	24990.0	23470.0	16120.0	17200.0	17620.0	28530.0	30330.0
2016/12/05	11:15:38	00000:24	0	347.2	350.7	349.6	349.2	82.3	86.8	84.4	84.4	0.0	72100.0	51010.0	88300.0	0.8	60.0	23590.0	25080.0	23520.0	16100.0	17220.0	17650.0	28560.0	30420.0
2016/12/05	11:16:08	00000:24	10000000	347.3	350.9	349.7	349.3	82.9	87.4	84.8	85.0	0.0	72620.0	51560.0	89100.0	0.8	60.0	23730.0	25230.0	23660.0	16280.0	17410.0	17830.0	28800.0	30670.0
2016/12/05	11:16:38	00000:25	10101000	346.1	349.7	348.6	348.1	138.5	147.2	142.8	142.8	0.0	118030.0	89270.0	149000.0	0.8	60.0	38370.0	41310.0	38350.0	28040.0	30060.0	31090.0	47870.0	51420.0
2016/12/05	11:17:08	00000:25	0	346.1	349.7	348.6	348.1	140.9	149.5	144.9	145.1	0.0	126200.0	83880.0	151540.0	0.8	60.0	41040.0	44020.0	41140.0	26320.0	28180.0	29310.0	48750.0	52270.0
2016/12/05	11:18:08	00000:26	0	346.2	349.7	348.6	348.2	141.3	150.0	145.2	145.5	0.0	126620.0	84040.0	151970.0	0.8	60.0	41210.0	44170.0	41240.0	26350.0	28280.0	29340.0	48920.0	52450.0
2016/12/05	11:19:08	00000:27	0	345.9	349.4	348.2	347.9	146.0	155.1	150.2	150.4	0.0	129830.0	88010.0	156970.0	0.8	60.0	42250.0	45320.0	42260.0	27600.0	29620.0	30710.0	50510.0	54180.0
2016/12/05	11:19:38	00000:28	0	345.8	349.5	348.3	347.9	151.2	160.5	155.3	155.7	0.0	135650.0	89400.0	162460.0	0.8	60.0	44130.0	47350.0	44170.0	28000.0	30070.0	31250.0	52270.0	56090.0
2016/12/05	11:20:08	00000:28	0	345.8	349.4	348.3	347.8	151.0	160.3	155.2	155.5	0.0	135520.0	89240.0	162260.0	0.8	60.0	44100.0	47280.0	44140.0	27980.0	30010.0	31170.0	52230.0	56000.0
2016/12/05	11:21:08	00000:29	0	346.1	349.5	348.6	348.0	149.7	158.7	153.8	154.1	0.0	134090.0	88880.0	160870.0	0.8	60.0	43650.0	46730.0	43710.0	27930.0	29860.0	31020.0	51820.0	55460.0
2016/12/05	11:22:08	00000:30	0	346.0	349.4	348.5	348.0	148.2	157.1	152.2	152.5	0.0	132480.0	88330.0	159230.0	0.8	60.0	43130.0	46170.0	43180.0	27760.0	29690.0	30820.0	51290.0	54890.0
2016/12/05	11:22:38	00000:31	0	346.0	349.5	348.5	348.0	147.7	156.8	151.7	152.1	0.0	132050.0	88220.0	158810.0	0.8	60.0	42980.0	46070.0	42990.0	27670.0	29680.0	30800.0	51120.0	54810.0
2016/12/05	11:23:08	00000:31	0	346.1	349.5	348.6	348.1	147.0	156.2	151.2	151.5	0.0	131410.0	88060.0	158180.0	0.8	60.0	42740.0	45870.0	42800.0	27610.0	29600.0	30770.0	50880.0	54590.0
2016/12/05	11:24:08	00000:32	0	345.9	349.5	348.5	347.9	145.7	155.0	150.3	150.8	0.0	128400.0	87600.0	156910.0	0.8	60.0	42520.0	45710.0	42610.0	27500.0	29520.0	30740.0	50640.0	54420.0
2016/12/05	11:24:38	00000:32	0	345.9	349.5	348.5	347.9	145.7	155.0	150.3	150.8	0.0	128400.0	87600.0	156910.0	0.8	60.0	42520.0	45710.0	42610.0	27500.0	29520.0	30740.0	50640.0	54420.0
2016/12/05	11:25:08	00000:32	0	345.8	349.4	348.3	347.8	144.8	154.0	149.1	149.3	0.0	126530.0	87120.0	155370.0	0.8	60.0	41950.0	45080.0	42020.0	27340.0	29330.0	30520.0	50070.0	53780.0
2016/12/05	11:25:38	00000:33	0	345.7	349.3	348.3	347.9	144.3	153.5	148.6	148.8	0.0	125570.0	86710.0	155370.0	0.8	60.0	41880.0	44890.0	41880.0	27350.0	29310.0	30470.0	49960.0	53610.0
2016/12/05	11:26:08	00000:33	0	345.7	349.3	348.3	347.9	144.3	153.5	148.6	148.8	0.0	125570.0	86710.0	155370.0	0.8	60.0	41880.0	44890.0	41880.0	27350.0	29310.0	30470.0	49960.0	53610.0
2016/12/05	11:27:08	00000:35	0	345.7	349.0	348.2	347.6	143.8	152.2	147.5	147.8	0.0	127460.0	86710.0	154160.0	0.8	60.0	42740.0	45870.0	42800.0	27610.0	29600.0	30770.0	50880.0	54590.0
2016/12/05	11:27:38	00000:36	0	345.6	349.0	348.2	347.6	143.5	151.8	147.3	147.6	0.0	127180.0	86620.0	153880.0	0.8	60.0	42520.0	45710.0	42610.0	27500.0	29520.0	30740.0	50640.0	54420.0
2016/12/05	11:28:08	00000:37	0	345.6	349.0	348.2	347.6	143.1	151.4	146.8	147.1	0.0	126730.0	86430.0	153410.0	0.8	60.0	42300.0	45530.0	42400.0	27420.0	29420.0	30690.0	50380.0	54190.0
2016/12/05	11:28:38	00000:37	0	345.6	349.0	348.2	347.6	143.1	151.4	146.8	147.1	0.0	126730.0	86430.0	153410.0	0.8	60.0	42300.0	45530.0	42400.0	27420.0	29420.0	30690.0	50380.0	54190.0
2016/12/05	11:29:08	00000:37	0	345.8	349.2	348.4	347.8	142.9	151.1	146.5	146.8	0.0	126510.0	86430.0	153220.0	0.8	60.0	42200.0	45400.0	42300.0	27320.0	29390.0	30600.0	50200.0	54030.0
2016/12/05	11:29:38	00000:38	0	345.7	349.1	348.3	347.7	142.6	150.9	146.1	146.5	0.0	126180.0	86280.0	152860.0	0.8	60.0	42020.0	45200.0	42200.0	27340.0	29330.0	30520.0	50070.0	53780.0
2016/12/05	11:30:08	00000:39	0	346.0	349.2	348.3	347.8	142.1	150.5	145.5	146.0	0.0	125650.0	86200.0	152370.0	0.8	60.0	41880.0	44890.0	41880.0	27350.0	29310.0	30470.0	49960.0	53610.0
2016/12/05	11:31:38	00000:40	0	346.0	349.2	348.4	347.9	133.8	141.6	137.0	137.4	0.0	118140.0	81360.0	143440.0	0.8	60.0	41880.0	44890.0	41880.0	27350.0	29310.0	30470.0	49960.0	53610.0
2016/12/05	11:32:08	00000:40	0	346.0	349.3	348.4	347.9	134.0	141.8	137.1	137.6	0.0	118360.0	81440.0	143670.0	0.8	60.0	41880.0	44890.0	41880.0	27350.0	29310.0	30470.0	49960.0	53610.0
2016/12/05	11:32:38	00000:41	0	346.0	349.3	348.4	347.9	134.0	141.8	137.1	137.6	0.0	118360.0	81440.0	143670.0	0.8	60.0	41880.0	44890.0	41880.0	27350.0	29310.0	30470.0	49960.0	53610.0
2016/12/05	11:33:08	00000:41	0	346.0	349.3	348.4	347.9	134.0	141.8	137.1	137.6	0.0	118360.0	81440.0	143670.0	0.8	60.0	41880.0	44890.0	41880.0	27350.0	29310.0	30470.0	49960.0	53610.0

M&V - Natural Gas

Existing water meters on both cold and hot water supply lines (installed for sanitary water rebate program) measured a consumption of 260 m³ between Dec 21, 2016-Jan 21, 2017

Total energy : $Q = m C_p \Delta T$
 where $\Delta T = 60 - 27 = 33 \text{ }^\circ\text{C}$

Energy saved in January = 260,000 x 4186 x 33 = 36,000 M joules

Annual energy savings at boiler side = 36,000 / 0.8 = 45,000 M joules

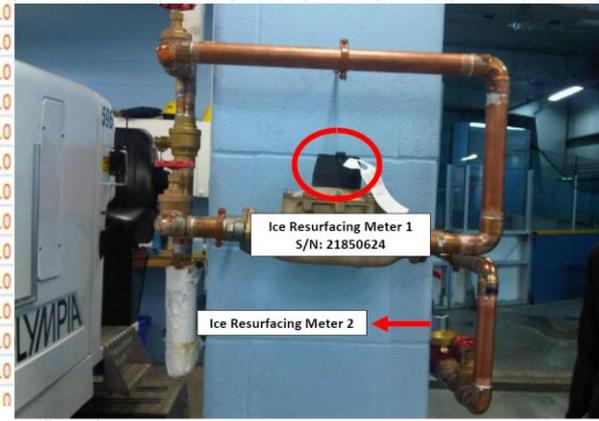
If natural gas is displaced, amount displaced = 45,000 / 37 = 1225 m³

Natural Gas Savings (@ \$0.30/m³) = \$3,670

Extended for one year: 367 x 4 = \$4,400 !! (Expected \$15,000)

The Rink schedule was underutilized due to new year holidays

A new set of M&V is being conducted now



Earncliffe Ice Resurfacing Meter 1 Overall View

DATE	TIME	ETIME	STATUS	U1_AVE[V]	U2_AVE[V]	U3_AVE[V]	Uave_AVI	I1_AVE[A]	I2_AVE[A]	I3_AVE[A]	Iave_AVE	I4_AVE[A]	P_AVE[W]	Q_AVE[va]	S_AVE[VA]	PF_AVE_1	F_AVE[Hz]	P1_AVE[W]	P2_AVE[W]	P3_AVE[W]	Q1_AVE[W]	Q2_AVE[W]	Q3_AVE[W]	S1_AVE[W]	S2_AVE[W]	S3_AVE[W]		
2016/12/05	11:14:38	00000:23	0	347.2	350.9	349.5	349.2	81.9	86.3	83.8	84.0	0.0	71780.0	50900.0	88000.0	0.8	60.0	23450.0	24940.0	23390.0	16080.0	17180.0	17620.0	28430.0	30280.0	0	0	0
2016/12/05	11:15:08	00000:23	0	347.3	350.8	349.7	349.3	82.1	86.5	83.9	84.2	0.0	71990.0	50970.0	88210.0	0.8	60.0	23530.0	24990.0	23470.0	16120.0	17200.0	17620.0	28530.0	30330.0	0	0	0
2016/12/05	11:15:38	00000:24	0	347.2	350.7	349.6	349.2	82.3	86.8	84.1	84.4	0.0	72100.0	51010.0	88390.0	0.8	60.0	23590.0	25080.0	23520.0	16100.0	17220.0	17650.0	28560.0	30420.0	0	0	0
2016/12/05	11:16:08	00000:24	10000000	347.3	350.9	349.7	349.3	82.9	87.4	84.8	85.0	0.0	72620.0	51360.0	89100.0	0.8	60.0	23730.0	25230.0	23660.0	16280.0	17410.0	17830.0	28800.0	30670.0	0	0	0
2016/12/05	11:16:38	00000:25	10101000	346.1	349.7	348.6	348.1	138.5	147.2	142.8	142.8	0.0	118030.0	89270.0	149000.0	0.8	60.0	38370.0	41310.0	38350.0	28040.0	30060.0	31090.0	47870.0	51420.0	0	0	0
2016/12/05	11:17:08	00000:25	0	346.1	349.7	348.6	348.1	140.9	149.5	144.9	145.1	0.0	126200.0	83880.0	151540.0	0.8	60.0	41040.0	44020.0	41140.0	26320.0	28180.0	29310.0	48750.0	52270.0	0	0	0
2016/12/05	11:17:38	00000:25	0	346.2	349.7	348.6	348.2	141.3	150.0	145.2	145.5	0.0	126620.0	84400.0	151970.0	0.8	60.0	41210.0	44170.0	41240.0	26350.0	28280.0	29340.0	48920.0	52450.0	0	0	0
2016/12/05	11:18:08	00000:25	0	349.7	348.6	348.2	348.2	141.8	150.4	145.7	146.0	0.0	127150.0	84170.0	152490.0	0.8	60.0	41380.0	44350.0	41430.0	26410.0	28300.0	29390.0	49090.0	52610.0	0	0	0
2016/12/05	11:19:08	00000:27	0	345.9	349.4	348.2	347.9	146.0	155.1	150.2	150.4	0.0	129830.0	88010.0	156970.0	0.8	60.0	42250.0	45320.0	42260.0	27600.0	29620.0	30710.0	50510.0	54180.0	0	0	0
2016/12/05	11:20:08	00000:28	0	345.8	349.4	348.3	347.8	151.0	160.3	155.2	155.5	0.0	135520.0	89240.0	162260.0	0.8	60.0	44100.0	47280.0	44140.0	27980.0	30010.0	31170.0	52230.0	56000.0	0	0	0
2016/12/05	11:21:08	00000:28	0	345.8	349.4	348.3	347.8	151.0	160.3	155.2	155.5	0.0	135520.0	89240.0	162260.0	0.8	60.0	44100.0	47280.0	44140.0	27980.0	30010.0	31170.0	52230.0	56000.0	0	0	0
2016/12/05	11:21:08	00000:29	0	346.1	349.5	348.6	348.0	154.6	164.7	159.7	160.1	0.0	134830.0	89060.0	161590.0	0.8	60.0	43860.0	47010.0	43960.0	27970.0	29900.0	31110.0	52020.0	55710.0	0	0	0
2016/12/05	11:21:38	00000:30	0	346.1	349.5	348.4	348.0	154.6	164.7	159.7	160.1	0.0	134830.0	89060.0	161590.0	0.8	60.0	43860.0	47010.0	43960.0	27970.0	29900.0	31110.0	52020.0	55710.0	0	0	0
2016/12/05	11:21:38	00000:30	0	346.0	349.4	348.5	348.0	154.6	164.7	159.7	160.1	0.0	134830.0	89060.0	161590.0	0.8	60.0	43860.0	47010.0	43960.0	27970.0	29900.0	31110.0	52020.0	55710.0	0	0	0
2016/12/05	11:21:38	00000:31	0	346.0	349.4	348.5	348.0	154.6	164.7	159.7	160.1	0.0	134830.0	89060.0	161590.0	0.8	60.0	43860.0	47010.0	43960.0	27970.0	29900.0	31110.0	52020.0	55710.0	0	0	0
2016/12/05	11:21:38	00000:31	0	346.1	349.5	348.6	348.1	154.6	164.7	159.7	160.1	0.0	134830.0	89060.0	161590.0	0.8	60.0	43860.0	47010.0	43960.0	27970.0	29900.0	31110.0	52020.0	55710.0	0	0	0
2016/12/05	11:21:38	00000:32	0	346.1	349.6	348.6	348.1	154.6	164.7	159.7	160.1	0.0	134830.0	89060.0	161590.0	0.8	60.0	43860.0	47010.0	43960.0	27970.0	29900.0	31110.0	52020.0	55710.0	0	0	0
2016/12/05	11:24:08	00000:32	0	345.9	349.5	348.5	347.9	154.6	164.7	159.7	160.1	0.0	134830.0	89060.0	161590.0	0.8	60.0	43860.0	47010.0	43960.0	27970.0	29900.0	31110.0	52020.0	55710.0	0	0	0
2016/12/05	11:24:38	00000:33	0	345.7	349.2	348.3	347.7	154.6	164.7	159.7	160.1	0.0	134830.0	89060.0	161590.0	0.8	60.0	43860.0	47010.0	43960.0	27970.0	29900.0	31110.0	52020.0	55710.0	0	0	0
2016/12/05	11:25:08	00000:33	0	345.8	349.2	348.3	347.8	154.6	164.7	159.7	160.1	0.0	134830.0	89060.0	161590.0	0.8	60.0	43860.0	47010.0	43960.0	27970.0	29900.0	31110.0	52020.0	55710.0	0	0	0
2016/12/05	11:25:38	00000:34	0	346.0	349.4	348.5	347.9	154.6	164.7	159.7	160.1	0.0	134830.0	89060.0	161590.0	0.8	60.0	43860.0	47010.0	43960.0	27970.0	29900.0	31110.0	52020.0	55710.0	0	0	0
2016/12/05	11:26:08	00000:34	0	345.7	349.1	348.2	347.7	154.6	164.7	159.7	160.1	0.0	134830.0	89060.0	161590.0	0.8	60.0	43860.0	47010.0	43960.0	27970.0	29900.0	31110.0	52020.0	55710.0	0	0	0
2016/12/05	11:26:38	00000:35	0	345.7	349.1	348.3	347.7	154.6	164.7	159.7	160.1	0.0	134830.0	89060.0	161590.0	0.8	60.0	43860.0	47010.0	43960.0	27970.0	29900.0	31110.0	52020.0	55710.0	0	0	0
2016/12/05	11:27:08	00000:35	0	345.7	349.0	348.2	347.6	143.8	152.2	147.5	147.8	0.0	127460.0	86710.0	154160.0	0.8	60.0	41540.0	44400.0	41520.0	27290.0	29170.0	30190.0	49700.0	53120.0	0	0	0
2016/12/05	11:27:38	00000:36	0	345.6	349.0	348.2	347.6	143.5	151.8	147.3	147.6	0.0	127180.0	86620.0	153880.0	0.8	60.0	41420.0	44290.0	41470.0	27290.0	29090.0	30170.0	49600.0	52990.0	0	0	0
2016/12/05	11:28:08	00000:36	0	345.3	348.9	348.1	347.5	143.5	151.7	147.3	147.6	0.0	127090.0	86610.0	153760.0	0.8	60.0	41360.0	44220.0	41400.0	27270.0	29080.0	30160.0	49550.0	52950.0	0	0	0
2016/12/05	11:28:38	00000:37	0	345.6	349.0	348.2	347.8	143.1	151.4	146.8	147.1	0.0	126750.0	86430.0	153410.0	0.8	60.0	41290.0	44140.0	41310.0	27220.0	29040.0	30100.0	49450.0	52840.0	0	0	0
2016/12/05	11:29:08	00000:37	0	345.5	348.9	348.4	347.8	142.9	151.1	146.5	146.8	0.0	126510.0	86430.0	153220.0	0.8	60.0	41240.0	44060.0	41210.0	27220.0	29070.0	30080.0	49410.0	52780.0	0	0	0
2016/12/05	11:29:38	00000:38	0	345.7	349.1	348.3	347.7	142.6	150.9	146.1	146.5	0.0	126180.0	86280.0	152860.0	0.8	60.0	41150.0	43940.0	41090.0	27170.0	29040.0	30010.0	49310.0	52670.0	0	0	0
2016/12/05	11:30:08	00000:38	0	345.7	349.1	348.3	347.7	142.6	150.9	146.1	146.5	0.0	126180.0	86280.0	152860.0	0.8	60.0	41150.0	43940.0	41090.0	27170.0	29040.0	30010.0	49310.0	52670.0	0	0	0
2016/12/05	11:30:38	00000:39	0	346.0	349.2	348.3	347.8	142.1	150.5	145.5	146.0	0.0	126550.0	86200.0	152370.0	0.8	60.0	41000.0	43780.0	40860.0	27100.0	29070.0	29960.0	49150.0	52560.0	0	0	0
2016/12/05	11:31:08	00000:39	0	346.0	349.2	348.3	347.8	142.1	150.5	145.5	146.0	0.0	126550.0	86200.0	152370.0	0.8	60.0	41000.0	43780.0	40860.0	27100.0	29070.0	29960.0	49150.0	52560.0	0	0	0
2016/12/05	11:31:38	00000:40	0	346.0	349.2	348.4	347.9	133.8	141.6	137.0	137.4	0.0	118140.0	81360.0	143440.0	0.8	60.0	38560.0	41140.0	38440.0	25610.0	27420.0	28260.0	46290.0	49440.0	0	0	0
2016/12/05	11:32:08	00000:40	0	346.0	349.3	348.4	347.9	134.0	141.8	137.1	137.6	0.0	118360.0	81440.0	143670.0	0.8	60.0	38630.0	41220.0	38510.0	25640.0	27450.0	28290.0	46370.0	49520.0	0	0	0
2016/12/05	11:32:38	00000:41	0	346.0	349.3	348.5	348.0	134.6	142.3	137.7	138.2	0.0	118950.0	81630.0	144270.0	0.8	60.0	38820.0	41420.0	38720.0	25710.0	27500.0	28360.0	46560.0	49720.0	0	0	0

M&V – Electricity

Using unheated water and increasing the br

Lesson Learned:

- Take advantage of short term incentive promotions
- Have everyone on board especially the facility operation team
- Secure the unit for any potential accident!!!



Thank You

Saleh Daei

Daleh.daei@brampton.ca