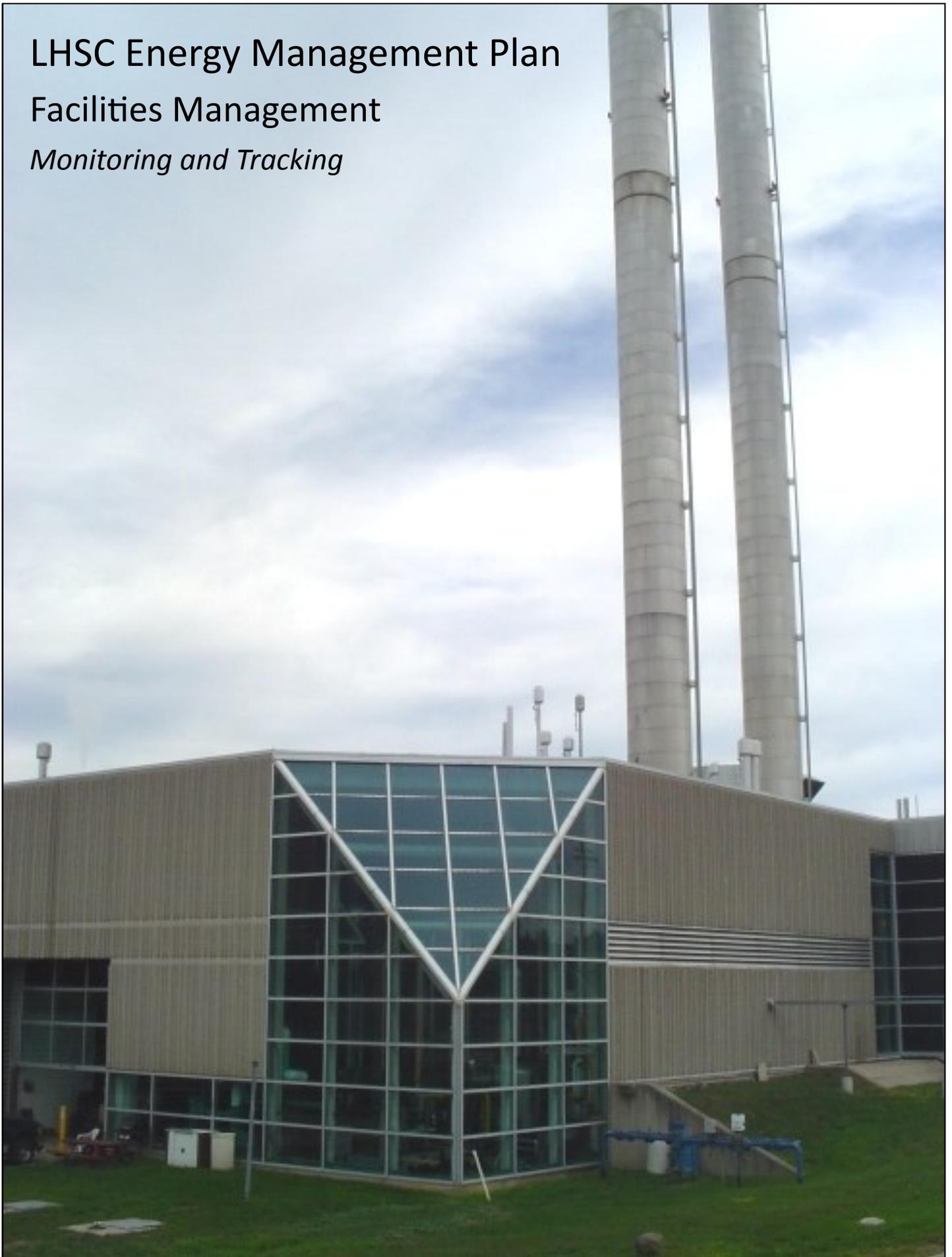
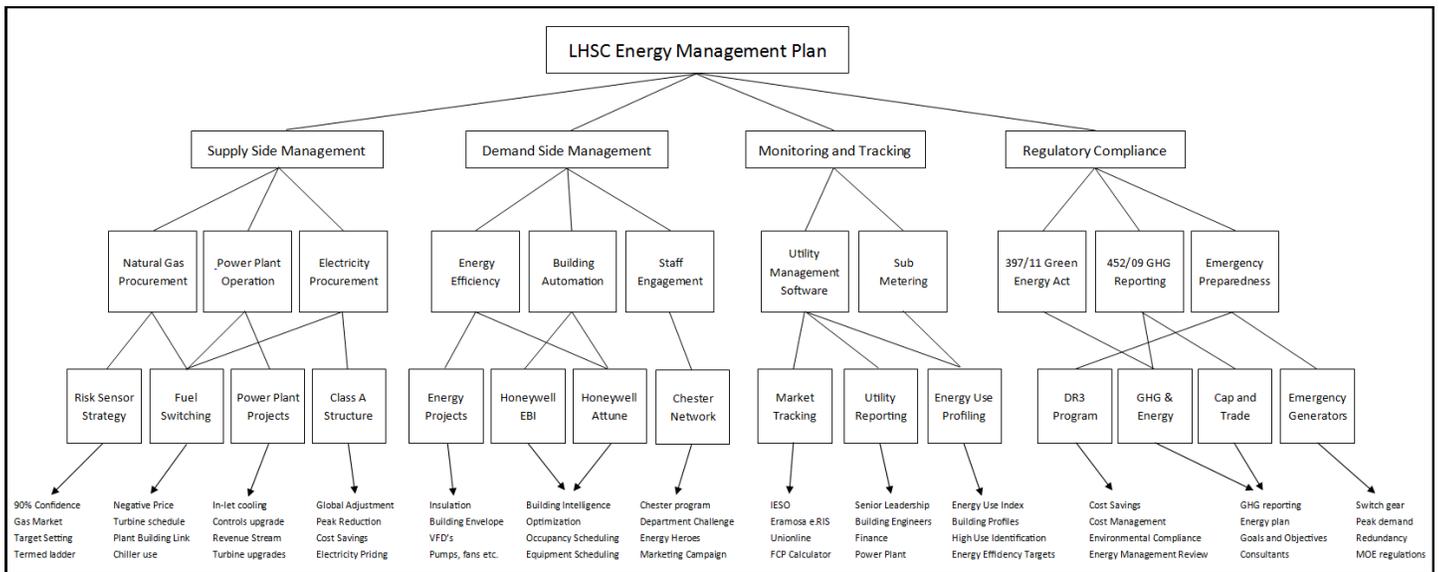


LHSC Energy Management Plan
Facilities Management
Monitoring and Tracking



Energy Management Plan

Monitoring and Tracking



London Health Sciences Centre has a long history of energy management, dating back to the 1970's. In that time, there have been many advancements made toward building intelligence and how it relates to energy management. Equipment and technology has advanced in such a way that buildings can be programmed to optimize their performance for heating, cooling, and lighting and automation has replaced manual tasks. Much has also changed within the energy markets and the prices of natural gas, steam, and electricity have risen and fallen over time. New regulations have been introduced with energy conservation and greenhouse gas emission reduction in mind and there is now more than ever a cost associated with a lack energy efficiency within an organization.

As a hospital there is a financial responsibility toward public tax dollars and an environmental responsibility to minimize our negative impact toward some of the very illnesses we treat. Proper energy management can save significant amounts of money while at the same time, help to reduce its contribution to air pollution, acid rain, carbon emissions etc. Being energy efficient falls under the "first do no harm" motto of the health care sector and LHSC has made great effort to do its part.

The energy management plan at LHSC has been broken down into four major categories; supply side management, demand side management, monitoring and tracking, and regulatory obligations. This forces the hospital to look at energy streams from the point of purchase to the point of exit and how its being used in between. LHSC has the ability to generate its own electricity at the Victoria Hospital power plant as well as supply steam and electricity to others, like Parkwood Institute.

Deciding how to invest in energy management is one the biggest and most important challenges one faces considering the many different possibilities and opinions that present themselves. Much of the easy work and short payback periods have already been exhausted at LHSC and so Facilities Management is always looking for the next opportunity and weighing the options carefully. Each project is considered for how it impacts the whole and fits together with existing strategies, equipment, and systems.

The following contains a more detailed review of the energy management plan by category until such time that the entire plan is constructed in web format on the Facilities Management website. In particular, this section focuses on monitoring and tracking.

Energy Management Plan

Monitoring and Tracking

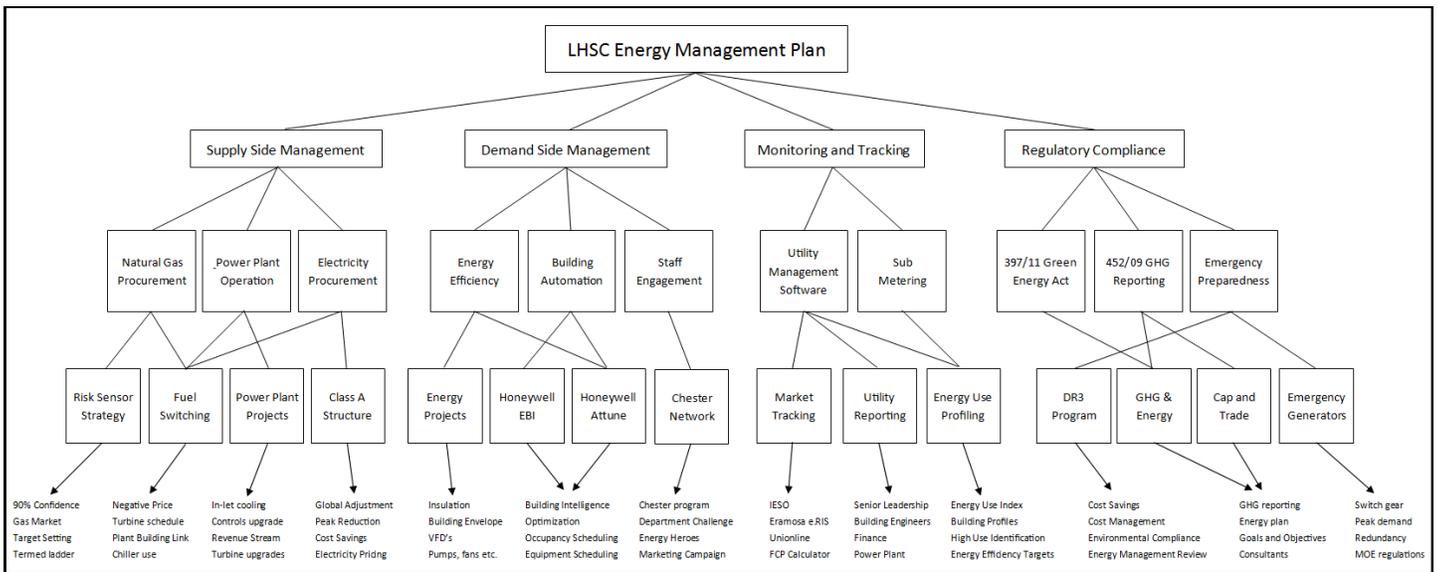


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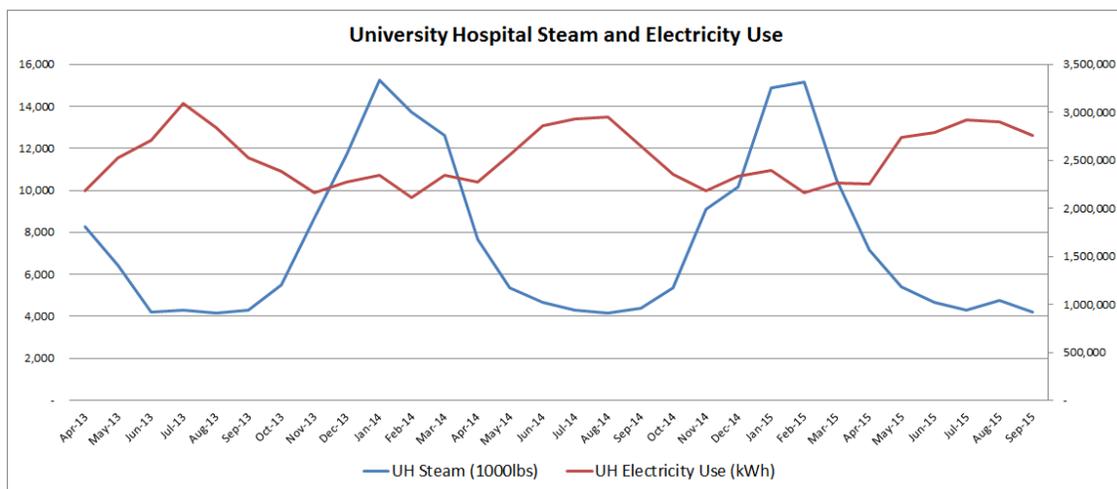
What is monitoring and tracking?

Understanding how energy is being used in the buildings and having the ability to measure this usage are crucial to being able to manage and reduce it. The old phrase, “you cannot manage what you cannot measure” certainly applies to energy consumption. An energy manager must be able to determine the relationship of energy consumption with the driving factors, such as weather, HVAC equipment, occupancy, service or production etc. Energy use that has been tracked must be explained in relation to these factors and instances when consumption is higher or lower than expected must have an answer. It is helpful to be able to visualize energy trends, determine future energy costs, diagnose specific areas of energy waste, and verify energy savings of any reduction initiatives taken. The ultimate goal is to reduce energy use through energy management and control and monitoring and tracking is essential to this process.



Energy use profiling

The first and most basic method of monitoring and tracking is to compile a few years of energy bills and begin to build an energy profile for the organization. LHSC has been doing this for the last fifteen years and produces annual reports that detail this information. LHSC tracks monthly data for approximately one hundred different outputs from natural gas, electricity, and steam usage, to energy rates and price trends, to energy production costs and greenhouse gas emissions. Looking back on this data, the hospital has been able to understand the major drivers in energy cost and consumption. A very simple example is shown below, where we see the seasonal fluctuations of steam and electricity usage. The steam consumption is higher in the winter when steam is being used to heat the building and electricity consumption is higher in the summer because electricity is used to cool the building.



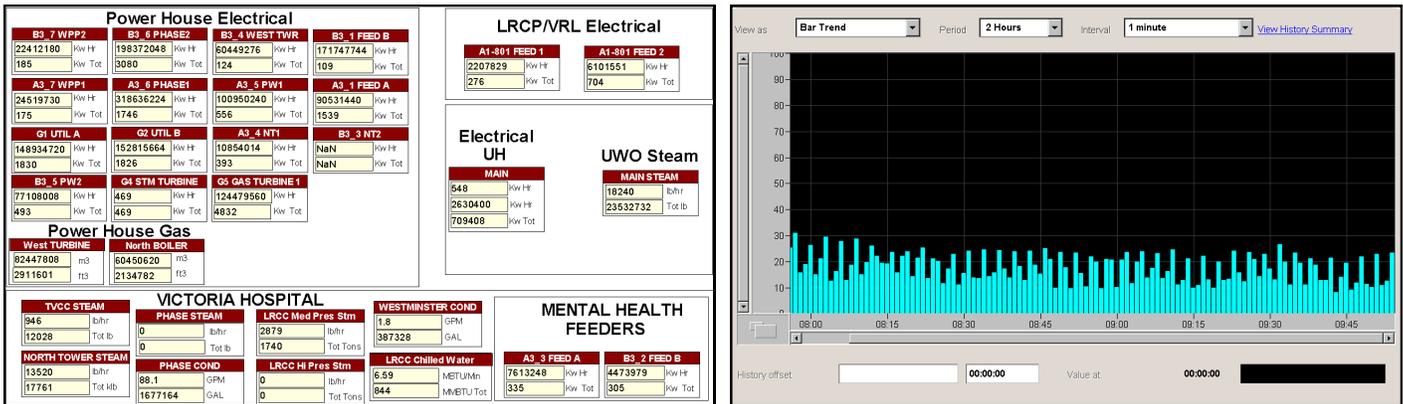
Moving to real-time monitoring and tracking

Of course, using historical data is very important to understanding how energy is used and what the driving factors are however it is not an effective way to catch energy waste issues at the time the problem has occurred. Real-time monitoring and tracking can alert the hospital to a problem related to energy consumption so that a solution can be implemented and save the cost of the particular issue running its course. For example, faulty steam traps can be a very expensive form of energy waste. Normally this is something that will only be discovered upon a steam trap inspection, which may not occur as often as desired. By tracking steam use and condensate return temperature in real time, a sudden spike could be an indicator that there is a steam trap issue and a maintenance staff can be dispatched to confirm and repair. It is LHSC's goal to move further in this direction with the use of sub-metering, a utility management software, and by making improvements to the building automation system.

[Energy Management Plan](#) > [Monitoring and Tracking](#) > [Sub Metering](#)

Sub-metering

Sub-meters are physical metering devices that monitor a buildings utilities. The meters will take a reading every few minutes or even seconds and relay that information back to a building automation system or utility management software where it will be stored. The data can be displayed in real-time and trends and history can be kept to refer back to at any time. Sub-metering provides a way for an energy manager to view energy consumption visually in present moment rather than compiling billing information and looking at the picture 30-45 days behind. Currently LHSC has a portfolio of about 30 sub-meters that measure steam and electricity and feed data to the Honeywell EBI as seen below. New chilled water and steam meters were also added to this list in 2015. An operator can see what a particular area of the building is using at any given time as well as pull up the history for a specified period of time. The more sub-metering that is added, the more detailed energy profile will be available and the more manageable the energy the hospital's energy consumption will become.



Meters also exist where natural gas, steam, and electricity services come into the hospital. For instance, there are two natural gas lines that enter at Victoria Hospital power plant from Union Gas, a high pressure line and a low pressure line. Each of these lines is measured both by Union Gas and by the power plant as data is pulled into the power plant control system. The same is so with London Hydro as they have two main feeds entering in at the power plant. Data for either of these accounts can be accessed via Union Gas, Unionline and London Hydro MV Web as seen below.

unionline

Contracts Measurements Reports Invoices Support

Measurement Results (Contract)

Contract ID SA9911 Measured Heat Value 38,8760 GJ/10⁶m³
Contract Name LHS T1

Gas Day	Volume (m ³)	Energy (GJ)	Total # Meters Read
Feb 01, 2016 (Mo)	57,446.8	2,233,3020	2 of 2
Feb 02, 2016 (Tu)	53,361.6	2,074,4860	2 of 2
Feb 03, 2016 (We)	53,727.8	2,088,7220	2 of 2
Feb 04, 2016 (Th)	61,841.9	2,404,1660	2 of 2
Feb 05, 2016 (Fr)	59,785.2	2,324,2090	2 of 2
Feb 06, 2016 (Sa)	58,038.4	2,256,3010	2 of 2
Feb 07, 2016 (Su)	52,798.0	2,052,5750	2 of 2
Feb 08, 2016 (Mo)	55,812.7	2,169,7740	2 of 2
Feb 09, 2016 (Tu)	63,222.4	2,457,8340	2 of 2
Feb 10, 2016 (We)	79,647.9	3,096,3920	2 of 2
Feb 11, 2016 (Th)	75,759.8	2,945,2380	2 of 2
Feb 12, 2016 (Fr)	74,492.0	2,895,9510	2 of 2
Feb 13, 2016 (Sa)	78,323.7	3,044,9130	2 of 2
Feb 14, 2016 (Su)	60,433.2	2,349,4010	2 of 2
Feb 15, 2016 (Mo)	63,532.4	2,469,8860	2 of 2
Total	948,223.8	36,863,1500	

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[Previous Month](#) | [Next Month](#)



Sub-metering becomes very important for maximizing the potential of other systems currently being reviewed by LHSC. The Honeywell Attune system and the Eramosa e.RIS utility management system will become more effective as the level of sub-metering is enhanced throughout the hospital. Sub-metering will allow profiles to be completed for each building or area of the hospital and these can then be ordered in terms of energy intensity. This profiling will help facilities management determine what areas of the hospital have the greatest potential for energy savings in the future.

LHSC Electricity Accounts

Date	Billing #	Meter#	\$	kWh	Location
Nov-15	1605255	428493	280.21	1691	VH ENTR Sign
Nov-15	1913252	310654	\$45.85	84	358 Hill St
Nov-15	4393641	700109	\$421	1,422	373 Hill St
Nov-15	4430659	378595	\$1,085	6,086	747 Baseline
Nov-15	4430675	603513	\$1,071	3,120	S.C. Dialysis
Nov-15	4632297	850250	\$1,757	9378	BMC
Nov-15	4635738	205526	\$2,534	16,800	385 Hill St
Nov-15	4645167	850675	\$1,270	7,231	60 Chesley
Nov-15	4661791	194963	\$293,746	2,218,380	UH
Nov-15	4669604	210372	\$10,993	82,218	SS
Nov-15	4669711	210485	\$331,803	2,279,972	VH
Nov-15	4684850	unmetered	\$999	5,276	VHP
Nov-15	4696326	unmetered	\$159	1,025	VH-HELI
Nov-15	6416756	416513	\$402	2,470	339 Wind Sign
Nov-15	7568902	218402	\$2,905	20,480	850 Com. CND BLD SRV
Nov-15	7466312	223954	\$7,879	57,634	SS
Nov-15	CA-065-00205-00	13185-2	\$4,934	40,863	Kidney Care
Nov-15	CA-085-00205P-00	13713-1	\$1,778	13,774	Kidney Care
Nov-15	50760612	195525	\$1,406	5,818	54 Riverview
Nov-15	1913252	310654	\$46	36	358 Hill St
Nov-15	4389187	305720	Done January 2014		Nelson St Park
Nov-15	4389541	305721	Done January 2015		346 South St Pkg
Nov-15	4391017	305663	Done May 2015		346 South St Pkg
Nov-15	4394219	305674	Done Nov2011		346 South St Pkg
Nov-15	4397429	305704	Done May 2015		120 Colborne
Nov-15	4669753	194626	Done April 2013		11 Maitland St
Nov-15	366971	428493	Done Dec 2014		800 Com ENTR

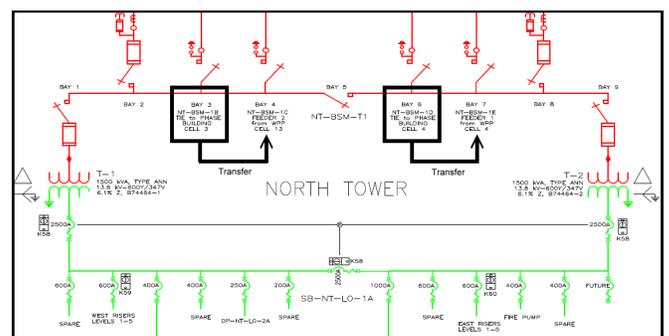
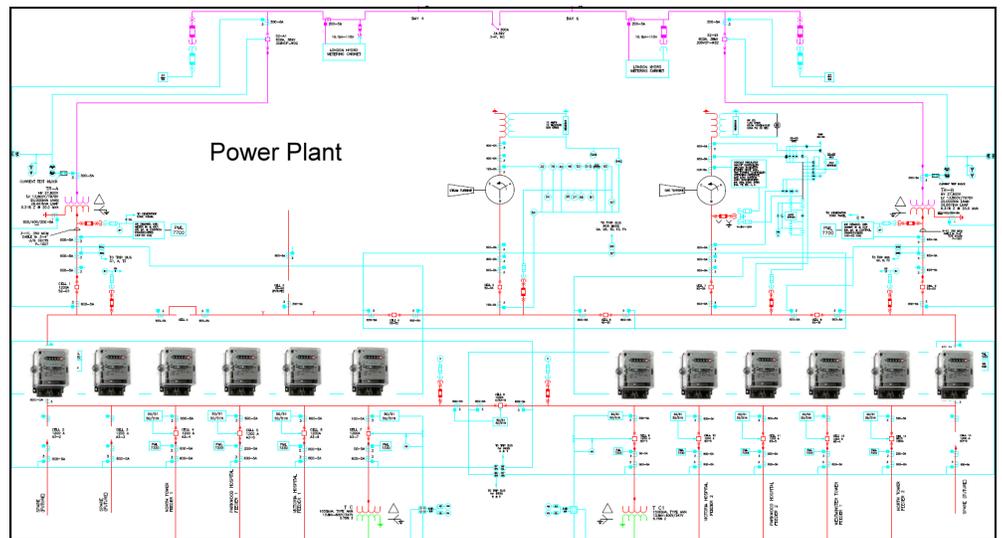
Victoria Hospital has eighteen active accounts being tracked through monthly billing and seven closed accounts, most associated with South Street Hospital closure. The smaller accounts consist of a single meter and adding sub-metering to them would not provide any additional value to the hospital and payback on sub-meter cost would likely be a minimum of several years. The bills are tracked and monitored and discrepancies are taken up with the local utility company, in this case, London Hydro. The larger accounts, Victoria Hospital and University Hospital, would benefit from sub-metering and a better understanding of how, where, and when electricity is being used in the building and to what degree. With monthly electricity bills over \$300,000, investing a few thousand dollars in sub-metering is likely to pay itself off very quickly. Additional sub-metering can then be connected to the building automation system and utility management software so that more detailed profiles of electricity use can be built.

Electrical sub-metering

The majority of electricity sub-metering exists at Victoria Hospital, more specifically at the power plant. Each of the 13kV lines coming from the power plant has a meter installed, as shown below. In cases where electricity is being billed to other partners, meters have also been installed. Victoria hospital electricity can currently be broken up into the following buildings/areas:

Victoria Hospital sub-meters

- Main Feeds 1 & 2
- Westminster Tower
- North Tower
- Phase—Zone ACD
- London Regional Cancer Centre
- Thames Valley Children’s Centre
- Parkwood Institute—Main
- Parkwood Institute—RMCH
- Impark Parking Garage
- Power Plant—Total
- Power Plant—Gas Turbine KB7
- Power Plant—Gas Turbine KB5
- Power Plant—Steam Turbine



Note: although two North Tower meters are available at the power plant, the North Tower is currently being fed from the Phase distribution and cannot currently be isolated for electricity consumption. Once the North Tower distribution is placed back on the 13kV lines from the power plant, the meters will take effect.

LHSC Steam Accounts

Date	Company	Acc #	\$ Before HST	Mlb's	\$/1000/lbs	Location	Date	Company	Acc #	\$ Before HST	Mlb's	\$/1000/lbs	Location
Jan-15	UWO	WES001452	\$210,298.50	14,879	\$ 14.13	UH	Jan-15	LDE	660	\$30,573.17	3,342	\$9.15	SS
Feb-15	UWO	WES001452	\$213,941.23	15,138	\$ 14.13	UH	Jan-15	LDE	670	\$20,101.98	2,103	\$9.56	SS
Mar-15	UWO	WES001452	\$148,667.77	10,551	\$ 14.09	UH	Feb-15	LDE	660	\$30,153.45	2,897	\$10.41	SS
Apr-15	UWO	WES001452	\$100,627.90	7,171	\$ 14.03	UH	Feb-15	LDE	670	\$18,818.48	1,717	\$10.96	SS
May-15	UWO	WES001452	\$75,371.90	5,398	\$ 13.96	UH	Mar-15	LDE	660	\$21,159.11	1,966	\$10.76	SS
Jun-15	UWO	WES001452	\$65,365.29	4,650	\$ 14.06	UH	Mar-15	LDE	670	\$18,135.19	1,650	\$10.99	SS
Jul-15	UWO	WES001452	\$60,592.81	4,306	\$ 14.07	UH	Apr-15	LDE	660	\$10,659.32	980	\$10.88	SS
Aug-15	UWO	WES001452	\$66,332.36	4,738	\$ 14.00	UH	Apr-15	LDE	670	\$11,158.82	1,039	\$10.74	SS
Sep-15	UWO	WES001452	\$58,336.39	4,200	\$ 13.89	UH	May-15	LDE	660	\$5,845.17	400	\$14.61	SS
Oct-15	UWO	WES001452	\$88,477.90	6,329	\$ 13.98	UH	May-15	LDE	670	\$7,770.35	621	\$12.51	SS
Nov-15	UWO	WES001452	\$101,477.43	7,497	\$ 13.54	UH	Jun-15	LDE	660	\$2,879.95	53	\$54.34	SS
Dec-15	UWO	WES001452	\$112,423.95	7,976	\$ 14.10	UH	Jun-15	LDE	670	\$6,003.06	380	\$15.80	SS
							Jul-15	LDE	660	\$3,013.16	70	\$43.05	SS
							Jul-15	LDE	670	\$6,209.23	423	\$14.68	SS
							Aug-15	LDE	660	\$3,002.40	67	\$44.81	SS
							Aug-15	LDE	670	\$4,439.41	222	\$20.00	SS
							Sep-15	LDE	660	\$3,207.92	85	\$37.74	SS
							Sep-15	LDE	670	\$4,812.66	250	\$19.25	SS
							Oct-15	LDE	660	\$6,642.83	468	\$14.19	SS
							Oct-15	LDE	670	\$8,137.53	632	\$12.88	SS
							Nov-15	LDE	660	\$8,922.66	804	\$11.10	SS
							Nov-15	LDE	670	\$10,856.86	1,043	\$10.41	SS
							Dec-15	LDE	660	\$8,366.60	831	\$10.07	SS
							Dec-15	LDE	670	\$9,890.37	1,042	\$9.49	SS

Steam is purchased at University Hospital from Western University and at South Street Hospital from London District Energy. Steam is produced at Victoria Hospital by the Power Plant from the purchase of natural gas. The steam at University Hospital come in from two lines charged at two different rates. One line is calculated from a condensate return meter and the other line is calculated from a steam flow meter. There are also two accounts for steam at South Street Hospital.

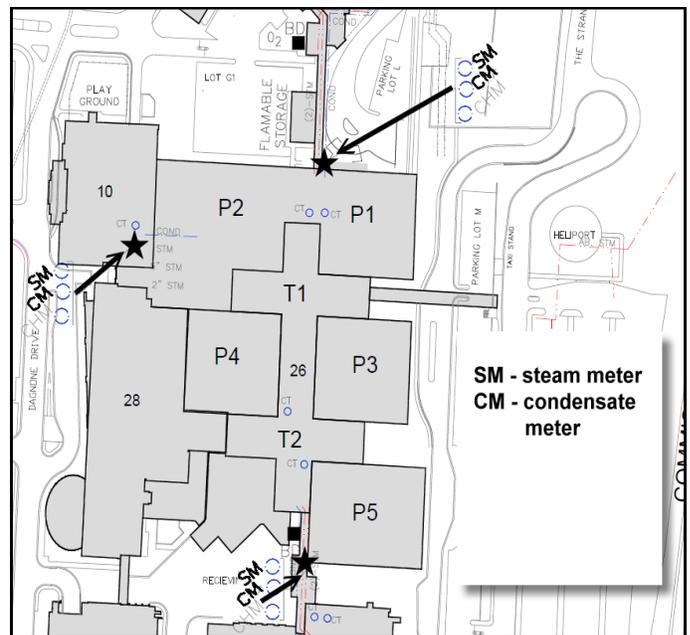
Steam sub-metering

Again, the majority of steam sub-metering exists at Victoria Hospital although it is less detailed than the electrical metering. Most of it has been installed for billing purposes. There is one major line for University Hospital steam coming from the University of Western Ontario and the rest of the metering exists at Victoria Hospital. Currently, steam usage can be broken up into the following buildings/areas:

Victoria Steam & Condensate Meters

- | | | |
|---------------------------------|-------------------------------|-------------------------|
| Phase | Parkwood Institute—RMHC | Parkwood Institute—Main |
| North Tower | Westminster Tower condensate | Western Counties Wing |
| Thames Valley Children’s Centre | London Regional Cancer Centre | |

Improvements to be made to the steam sub-metering system include a phase steam meter repair inside the steam tunnel by the Customer Support Centre. This is currently connected to the EBI however the meter is not reading. There is also a steam meter shown at the emergency entrance on the site drawings which does not show as being connected to the EBI. This meter must be located and connected. There are many condensate meters that exist at Victoria Hospital which measure the return condensate to the Power Plant. These meters are important for ensuring that the energy in the condensate is returned and not dumped or wasted. In some areas, like the TVCC, contracts exist to ensure that 80% of the condensate is returned to the hospital. The TVCC meter will soon be replaced with a new meter that can be remotely monitored by the EBI system. There have been leak issues with the current meter and manual readings are required to monitor the condensate. The difficulty with steam metering improvements is that in most cases a steam shutdown is required. These steam shutdowns are very sensitive to perform and affect patient care hot water for showers etc. They must be completed in the appropriate season in the off hours at the hospital. For this reason, they are not conducted very often and multiple jobs are scheduled for these times.



Energy Management Plan > Monitoring and Tracking > Sub Metering > Natural Gas

LHSC Natural Gas Accounts

Date	Acc #	Meter #	\$	m3	Location
Jan-16	193-5894178-1913	099-9148	\$439.21	2,240	60 CHESLEY
Jan-16	193-8609178-4083	233-3122	\$354.15	1,779	355 Hill str.
Jan-16	193-8781178-4219	223-1134	\$47.99	126	385 Hill str.
Jan-16	214-8964196-1027	213-525c	\$142.70	623	762 Comm.
Jan-16	204-6254-187-3968	104-5815	\$70.26	243	747 Base
Jan-16	214-8230-196-0541	233-3489	\$24.25	3	825 Comm.
Jan-16	215-1275196-3021	127-1579	\$243.62	1,165	800 Com
Jan-16	235-5417213-5374	130-5805	\$267.61	1,243	1228 Com.W
Jan-16	261-5415-235-6807	119-7657	\$323.18	1,558	UH
Jan-16	261-9767-236-0583	254-7023	\$4,515.06	23,147	UH
Jan-16	287-6856246-0899	269-3126	\$107.52	445	800 Com
Jan-16	287-6856272-5735	247-5564	\$105.54	434	LHSC-G
Jan-16	287-6856275-5855	247-5311	\$1,362.15	6,371	Wndland
Jan-16	287-6856275-3067	247-5189	\$28.70	22	Wndland
Jan-16	287-6856-196-1024	253-8509	\$1,670.53	8,102	840 Comm.
Jan-16	215-1275178-5129	215-3040	\$281.46	1,238	54 Riverview
Jan-16	287-6856276-7170	270-2063	\$23.74	0	785 Wndland

There are many small natural gas accounts at LHSC that are tracked via the monthly bills from Union Gas. Like the smaller electricity accounts, there would not be any value in putting in sub-metering. Victoria Hospital on the other hand consumes a large volume of natural gas due to the co-generation based power plant and has contracts in place with natural gas suppliers directly. The gas is then distributed to Victoria Hospital by Union Gas. The gas comes in through a high pressure line that feeds the gas turbines and one large boiler and through a low pressure line that feeds the other boilers. Gas sub-meters exist at the power plant so that we can determine how much gas each turbine is using and how much the boilers are using. This becomes important for creating the economics around how and when to run the equipment. It also helps to provide insight into the efficiency of the power plant.

Date	Company	Contract #	\$	m3	GJ	Location	Date	Company	Contract #	\$	m3	GJ	Location	Date	Company	Contract #	\$	m3	GJ	Location	Monthly Totals	Total Consumption	Total Cost
Jan-15	BP	5501561	\$376,074.03	1,812,506	67,873	LHSC	Jan-15	Union Gas	SA009911	\$48,840.98	2,960,946	110,885	LHSC	Jan-15	Direct	20116	\$117,842.29	695,340	26040	LHSC	\$ 542,757	2,960,946	\$542,757.30
Feb-15	BP	5501561	\$417,808.09	2,174,964	81,446	LHSC	Feb-15	Union Gas	SA009911	\$45,029.62	2,836,868	106,239	LHSC	Feb-15	Direct	20116	\$106,864.10	628,049	23520	LHSC	\$ 569,702	2,836,868	\$569,701.81
Mar-15	BP	5501561	\$369,524.82	1,812,506	67,873	LHSC	Mar-15	Union Gas	SA009911	\$43,998.64	2,608,292	97,679	LHSC	Mar-15	Direct	20116	\$117,210.00	695,340	26040	LHSC	\$ 530,333	2,608,292	\$530,333.46
Apr-15	BP	5501561	\$263,701.32	1,688,784	63,240	LHSC	Apr-15	Union Gas	SA009911	\$42,932.85	1,925,552	72,111	LHSC	Apr-15	Direct	20116	\$84,451.69	554,349	20760	LHSC	\$ 391,086	1,925,552	\$391,085.86
May-15	BP	5501561	\$51,468.68	277,165	10,379	LHSC	May-15	Union Gas	SA009911	\$43,127.52	1,807,813	67,701	LHSC	May-15	Direct	20116	\$168,775.37	1,197,618	44850	LHSC	\$ 263,372	1,807,813	\$263,371.57
Jun-15	BP	5501561	\$299,848.21	1,922,715	72,000	LHSC	Jun-15	Union Gas	SA009911	\$42,913.12	1,779,808	66,653	LHSC	Jun-15	Direct	20116	\$0.00	0	0	LHSC	\$ 342,761	1,779,808	\$342,761.33
Jul-15	BP	5501561	\$48,881.54	283,066	10,600	LHSC	Jul-15	Union Gas	SA009911	\$71,829.53	1,950,034	73,027	LHSC	Jul-15	Direct	20116	\$241,755.35	1,738,349	65100	LHSC	\$ 333,743	1,950,034	\$362,466.42
Aug-15	BP	5501561	\$119,386.44	738,429	27,652	LHSC	Aug-15	Union Gas	SA009911	\$43,106.36	1,919,466	71,883	LHSC	Aug-15	Direct	20116	\$240,614.07	1,579,414	59148	LHSC	\$ 402,741	1,919,466	\$403,106.87
Sep-15	BP	5501561	\$30,849.00	160,226	6,000	LHSC	Sep-15	Union Gas	SA009911	\$42,740.97	1,745,971	65,385	LHSC	Sep-15	Direct	20116	\$241,075.79	1,515,648	56760	LHSC	\$ 321,926	1,745,971	\$314,665.76
Oct-15	BP	5501561	\$31,877.00	165,567	6,200	LHSC	Oct-15	Union Gas	SA009911	\$50,001.00	1,664,267	62,326	LHSC	Oct-15	Direct	20116	\$336,942.71	2,152,242	80600	LHSC	\$ 418,484	1,664,267	\$418,820.71
Nov-15	BP	5501561	\$30,849.00	160,226	6,000	LHSC	Nov-15	Union Gas	SA009911	\$49,664.45	1,606,763	60,172	LHSC	Nov-15	Direct	20116	\$362,788.14	2,218,198	83070	LHSC	\$ 436,939	1,606,763	\$443,301.59
Dec-15	BP	5501561	\$10,122.31	(42,887)	(1,606)	LHSC	Dec-15	Union Gas	SA009911	\$43,302.02	1,820,998	68,195	LHSC	Dec-15	Direct	20116	\$374,205.60	2,320,469	86900	LHSC	\$ 429,562	1,820,998	\$427,629.93
Jan-16	BP	5501561	\$31,877.30	165,567	6,200	LHSC	Jan-16	Union Gas	SA009911	\$45,234.35	2,157,029	80,779	LHSC	Jan-16	Direct	20116	\$431,488.09	2,256,383	84500	LHSC	\$ 375,025	2,157,029	\$420,259.74

Natural Gas sub-metering

The hospital likely has the natural gas sub-metering it requires for the purposes mentioned above. The existing sub-metering provides the hospital with the information it needs to run the power plant cost effectively and manage the natural gas contract with Union Gas. Natural gas is track by daily usage for the turbines, duct burner and gas storage and by monthly usage for the high pressure and low pressure lines. These points will feed the utility management software so that real-time calculations can be made for outputs like the production cost of steam and electricity, fuel chargeable to power, and others.

Date	GT-G5 kscf Total	GT-G3 kscf Total	Duct kscf Total	HRSG-G5 Steam lbs/hr	HRSG-G3 Steam lbs/hr	Steam lbs/24 HR	Steam MJ / hr	GT's M3/24 hr	Duct M3/24 hr	MJ/m3	GT-G3 MJ/24 hr	ST-G4 MJ/24 hr	GT-G5 MJ/24 hr	MJ/24 HR	Inlet Temp	CDP	Inlet Temp	CDP	MJ/MW	Running Hours	Start Counter	Running Hours	Total Average Monthly Cycle Eff %
						Output	Input	Input	Input	Total Input				Total Output	KB5	KB5	KB7	KB7	Output	KB-7	KB-7	KB-5	%
6/3/15	786648	306078	416222	385,304,000	34,942,711	851,000	1,074,941	50,165	8,125	2,199,992	0	21	107	1,536,173	0	0	69	157	461,232	122,255	1,203	8,604	70%
6/4/15	788361	306078	416529	386,153,000	34,942,711	849,000	1,072,414	48,495	8,691	2,158,322	0	20	103	1,516,323	0	0	70	156	443,909	122,279	1,203	8,604	70%
6/5/15	790076	306078	416846	387,022,000	34,942,711	869,000	1,097,677	48,552	8,974	2,171,143	0	22	103	1,546,335	0	0	73	153	448,657	122,303	1,203	8,604	71%
6/6/15	791863	306078	417139	387,889,000	34,942,711	867,000	1,095,151	50,590	8,295	2,222,430	0	22	108	1,563,007	0	0	65	159	467,856	122,327	1,203	8,604	70%
6/7/15	793641	306078	417419	388,745,000	34,942,711	856,000	1,081,256	50,335	7,927	2,198,924	0	21	107	1,541,218	0	0	66	155	459,916	122,351	1,203	8,604	70%
6/8/15	795284	306078	417655	389,525,000	34,942,711	780,000	985,257	46,513	6,681	2,007,666	0	20	98	1,408,772	0	0	59	158	423,515	122,375	1,203	8,604	70%
6/9/15	797020	306078	417924	390,356,000	34,942,711	831,000	1,049,678	49,146	7,615	2,142,294	0	20	105	1,498,911	0	0	69	155	449,233	122,399	1,203	8,604	70%
6/10/15	798688	306078	418181	391,166,000	34,942,711	810,000	1,023,152	47,221	7,276	2,056,816	0	19	99	1,448,232	0	0	68	154	425,081	122,423	1,203	8,604	70%
6/11/15	800484	306078	418643	392,035,000	34,942,711	869,000	1,097,677	50,845	13,079	2,412,619	0	21	108	1,561,764	0	0	67	157	464,087	122,447	1,203	8,604	65%
6/12/15	802192	306078	418757	392,889,000	34,942,711	854,000	1,078,730	48,353	3,227	1,946,763	0	22	104	1,531,401	0	0	57	160	452,671	122,471	1,203	8,604	79%
6/13/15	803906	306078	418991	393,696,000	34,942,711	807,000	1,019,362	48,223	6,625	2,081,391	0	19	104	1,463,807	0	0	69	159	444,445	122,495	1,203	8,604	70%
6/14/15	805567	306078	419229	394,451,000	34,942,711	795,000	1,004,204	47,023	6,738	2,029,036	0	19	100	1,433,666	0	0	73	151	429,452	122,519	1,203	8,604	71%
6/15/15	807249	306078	419507	395,333,000	34,942,711	842,000	1,063,572	47,617	7,870	2,094,213	0	20	100	1,495,864	0	0	78	149	432,292	122,542	1,203	8,604	71%
6/16/15	808875	306078	419790	396,149,000	34,942,711	816,000	1,030,730	46,032	8,012	2,039,721	0	20	98	1,467,046	0	0	69	156	426,316	122,567	1,203	8,604	71%
6/17/15	810606	306078	420074	396,996,000	34,942,711	847,000	1,069,888	49,005	8,040	2,152,979	0	21	103	1,515,568	0	0	72	154	445,680	122,591	1,203	8,604	70%
6/18/15	812300	306078	420418	397,884,000	34,942,711	888,000	1,121,677	47,957	9,739	2,177,554	0	22	101	1,563,930	0	0	77	150	442,223	122,615	1,203	8,604	72%
6/19/15	814040	306078	420795	398,808,000	34,942,711	924,000	1,167,151	49,259	10,673	2,261,964	0	26	105	1,637,750	0	0	71	153	470,599	122,639	1,203	8,604	71%
6/20/15	815715	306078	421164	399,704,000	34,942,711	896,000	1,131,782	47,419	10,446	2,183,965	0	23	100	1,574,971	0	0	70	151	443,189	121,918	1,203	8,604	72%
6/21/15	817380	306078	421540	400,609,000	34,942,711	905,000	1,143,151	47,136	10,645	2,180,760	0	24	98	1,581,152	0	0	74	151	438,001	122,687	1,203	8,604	73%
6/22/15	819151	306078	421925	401,556,000	34,942,711	947,000	1,196,203	50,137	10,899	2,303,634	0	25	105	1,663,001	0	0	76	151	466,798	122,711	1,203	8,604	72%
6/23/15	820685	306078	422256	402,366,000	34,942,711	810,000	1,023,152	43,428	9,371	1,992,708	0	19	91	1,418,061	0	0	66	157	394,909	122,733	1,203	8,604	71%
6/24/15	822386	306078	422648	403,291,000	34,942,711	925,000	1,168,414	48,155	11,098	2,236,320	0	24	102	1,622,741	0	0	76	153	454,327	122,757	1,203	8,604	73%
6/25/15	824128	306078	423062	404,255,000	34,942,711	964,000	1,217,677	49,316	11,720	2,303,634	0	24	104	1,676,900	0	0	76	152	459,223	122,782	1,203	8,604	73%
6/26/15	825818	306078	423432	405,160,000	34,942,711	905,000	1,143,151	47,844	10,475	2,201,061	0	24	180	1,875,970	0	0	68	157	732,820	122,806	1,203	8,604	85%
6/27/15	827538	306078	423855	406,112,000	34,942,711	952,000	1,202,519	48,693	11,975	2,289,744	0	23	104	1,661,278	0	0	56	161	458,759	122,829	1,203	8,	

Utility Management Software

LHSC is now installing a utility management software called e.RIS from a company called Eramosa. The utility management software will track the hospital utilities, market prices of natural gas and electricity, sub-metering data from the hospital, weather data from Environment Canada, billing information from local utilities, and provincial electricity demand, all in real-time. This will assist the hospital in the following ways:

Desktop accessible knowledge and information

Currently, the knowledge and information related to hospital utilities resides primarily with a single individual at the hospital. The utility management software will be able to organize the information that is important to various leaders and executives, business managers, finance personnel, engineers etc. and provide simple dashboards that can be accessed at any time from an individual's desktop. The economics of energy management is important for many decisions within the hospital and the facilities management department, therefore the more readily accessible this information is, the more dollar savings will result. Some dashboards



may include budget information and track utility cost and revenue. Other dashboards may include real-time energy consumption and demand from sub-meters so that operational parameters can alert building staff to high energy usage. Other dashboards may show weather forecast and market pricing for natural gas and electricity. Each dashboard will be tailored to the individual so that information can be review quickly and frequently by those who will benefit from it.

Real-time monitoring and tracking for operational performance

LHSC must now participate in peak demand reduction exercises for electricity throughout the year in order to maximize the cost savings as a Class A customer with London Hydro. This requires real-time monitoring of IESO Ontario demand forecast as well as the electricity being generated by the power plant and imported from the grid. Weather data will also assist in the projection of when these peaks will occur. As a Class customer, LHSC can purchase electricity at the HOEP cost, which is often less than the cost to generate it at the power plant. For this reason, the power plant must follow the market price of electricity and adjust it's production accordingly. At the same time, the hospital building equipment must ramp up and down to correspond to the operational changes being made at the power plant in real time. The utility management software will allow the power plant to sync to the market and the building engineering to sync to the power plant. The synchronism of this information and operation is critical to the success of Class A status.



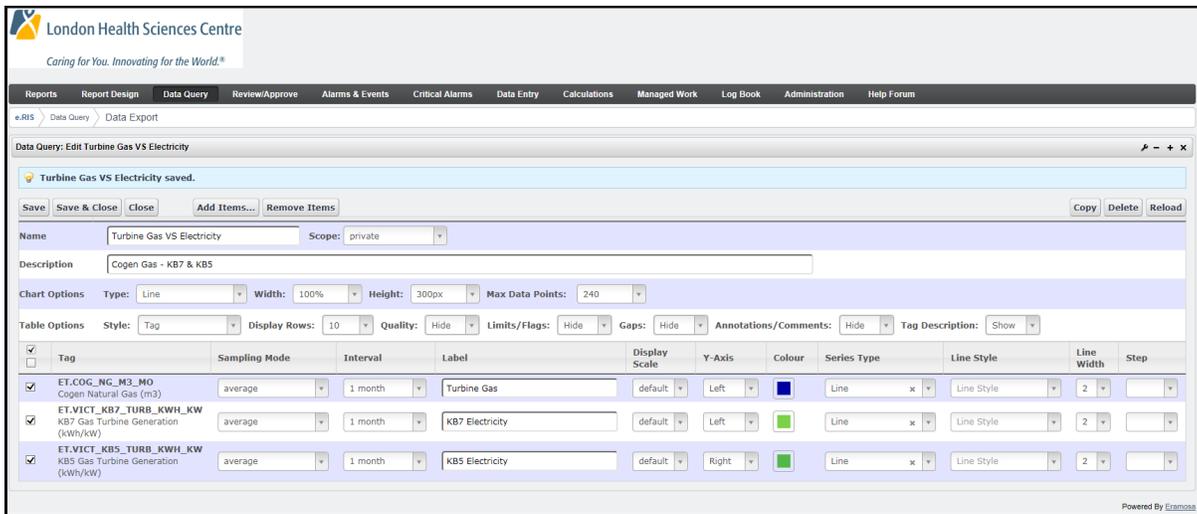
Energy Management

To improve the level of energy management at the hospital, a more detailed profile must be created. This is accomplished by way of sub-metering however sub-metering is a very expensive endeavor. Information must guide the decisions of where sub-metering must be located in order to provide the most value toward better managing energy use at the hospital. The utility management software can help to make these decisions and then build the energy profile of the buildings once the metering has been put in place. With more detailed energy profiles, buildings and areas of the buildings can be categorized by energy intensity and energy management projects can be directed toward the high use areas first. The impact of project work can then also be tracked to verify savings once the project is complete. This process helps to bring about an awareness of the energy use component of project work and energy use costs can then be considered more often during the project design and selection stage.

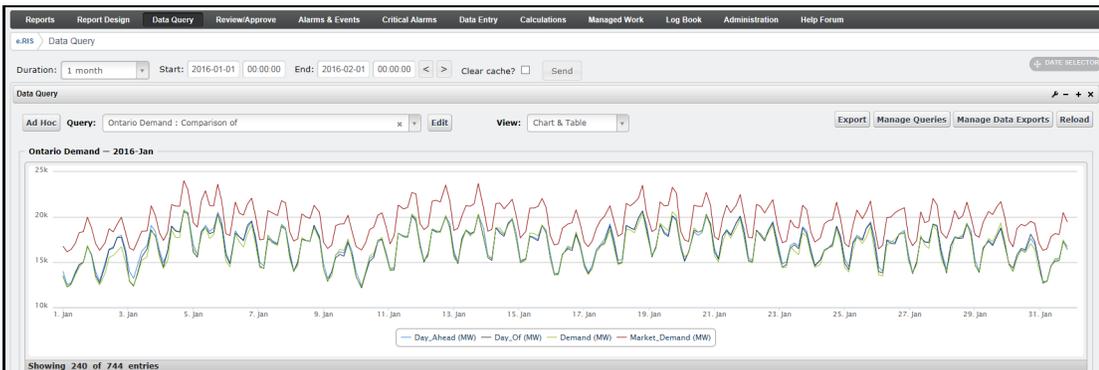
Eramosa and e.RIS

Eramosa and the e.RIS system was selected because it had real-time tracking capability and offered a great amount of control to the user. LHSC can select either live or manually inputted tags and then create the calculations and algorithms that it wishes the tags to perform. LHSC can create it's own report designs or choose from a prefabricated selection. Eramosa has frequent customer meetings where clients can make suggestions and ask for new features, which they will then work toward including for all customers. Eramosa is also a local company that is completing control upgrades to the power plant and has first hand experience and knowledge of the equipment and operations. Below is an example of the e.RIS process.

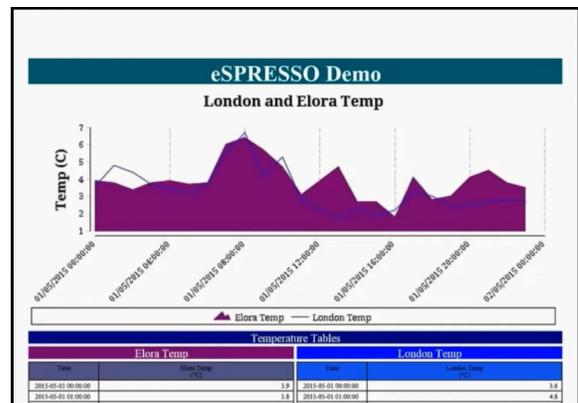
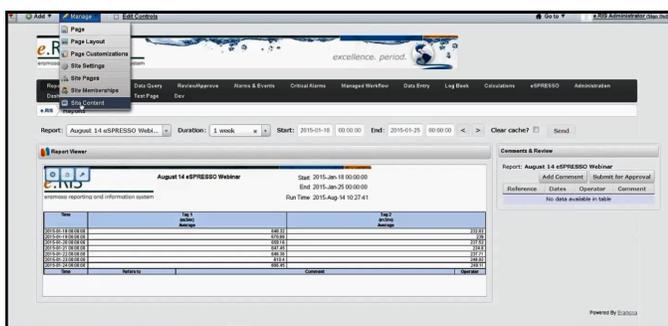
Tags are inputted into e.RIS and selected for comparison or review



Selected data queries are then displayed in the selected format

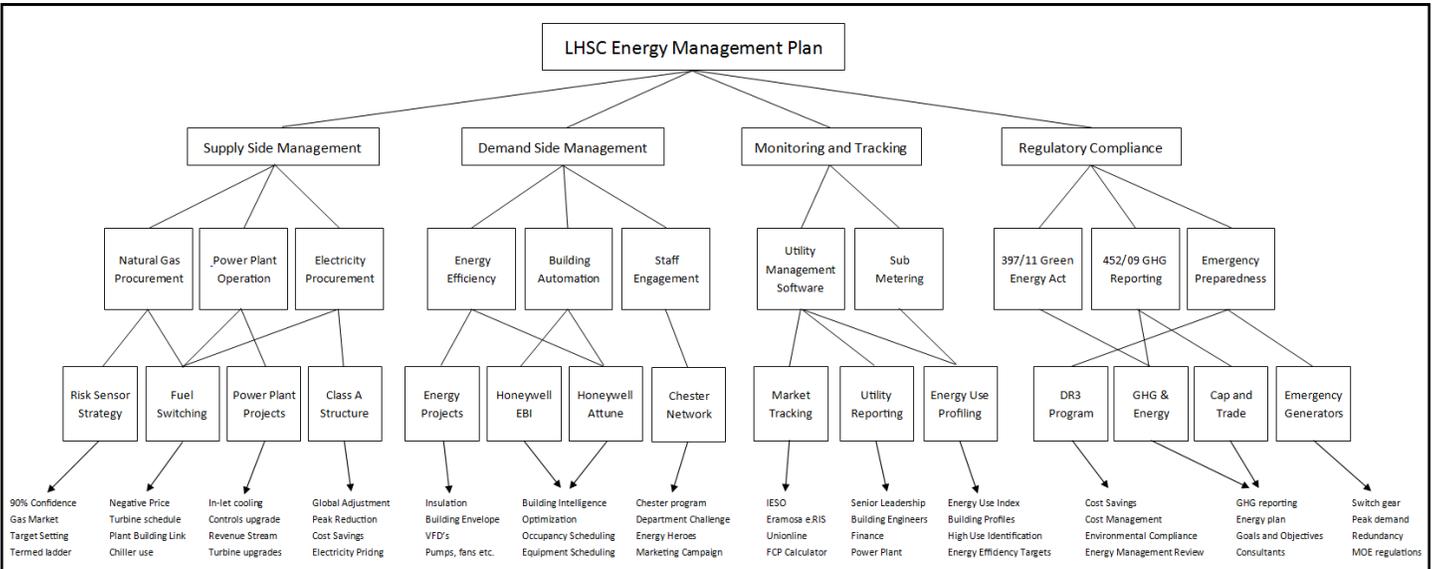


Reports are created based on the information you wish to see



Energy Management Plan > Monitoring and Tracking > Project Schedule

Now that the utility management software is being installed, the monitoring and tracking program will begin. Consultation will take place with each stakeholder to determine what type of reporting will be created for them. Much of the work over the next couple of years will be internal and making use of the utility software in the ways described above. Future investment in monitoring and tracking will be in the form of additional sub-metering and connecting this metering to the software. Where this sub-metering will go will be determined by the interests of the stakeholders and by the information being provided by e.RIS and tools like the Honeywell Attune system.



	Apr-15	Jul-15	Oct-15	Jan-16	Apr-16	Jul-16	Oct-16	Jan-17	Apr-17	Jul-17	Oct-17	Jan-18	Apr-18	Jul-18	Oct-18	Jan-19	Apr-19	Jul-19	Oct-19	Jan-20	Apr-20	Jul-20	Oct-20	Jan-21	Project Cost	
LRCF Chilled Water Meter Installation	█																								\$10,893	
LRCF Steam Meter Installation			█																							\$23,612
TVCC Condensate Meter Installation						█	█																			TBD
Power Plant Controls Upgrade				█	█	█																				\$100,000
Eramosa e.ris Development & Installation		█	█	█	█	█																				\$20,000
Utility Management Server Installation				█	█																					\$20,000
Additional Submetering							█	█	█	█						█	█									\$25,000/year
Connect remaining sub-meters to EBI							█	█	█	█																TBD