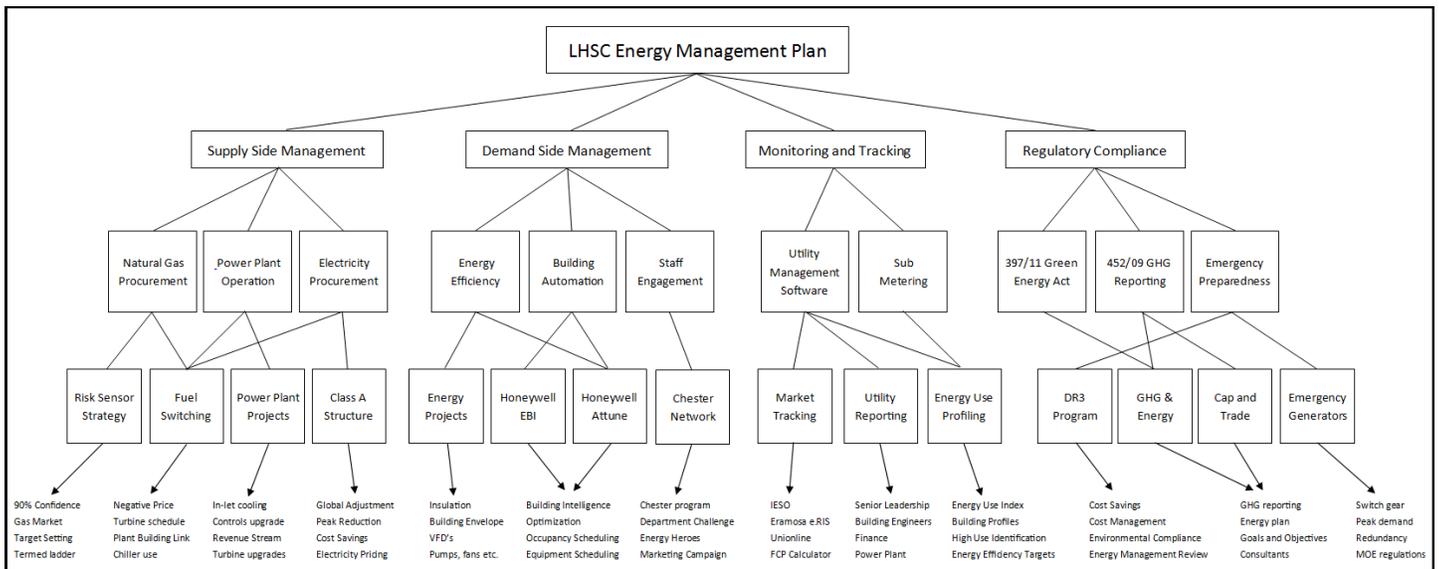


LHSC Energy Management Plan
Facilities Management
Regulatory Compliance



Energy Management Plan

Regulatory Compliance



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 regulatory compliance.

Energy Management Plan

Regulatory Compliance

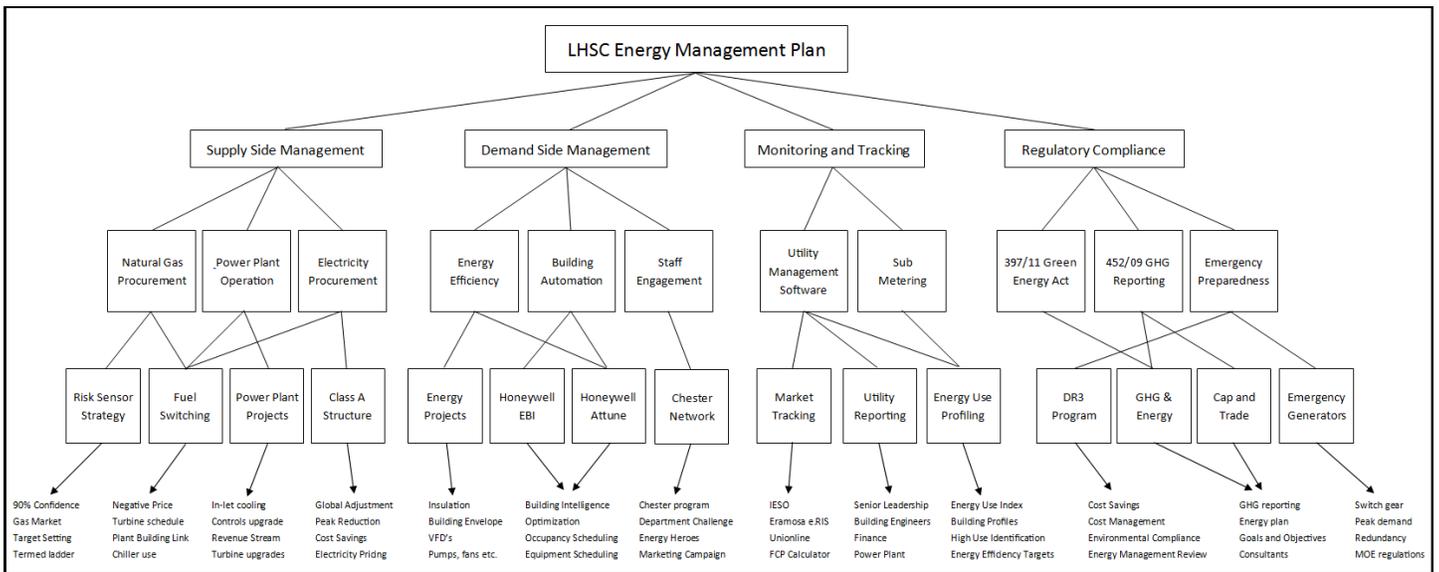


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Regulatory Compliance at LHSC

Energy consumption and greenhouse gas emissions are items of importance to both the provincial and federal government. Particular legislation and regulations have been developed to address these items and LHSC ensures that it meets any requirements outlined in them . Below is a summary of each of the regulations that LHSC is currently in compliance with.

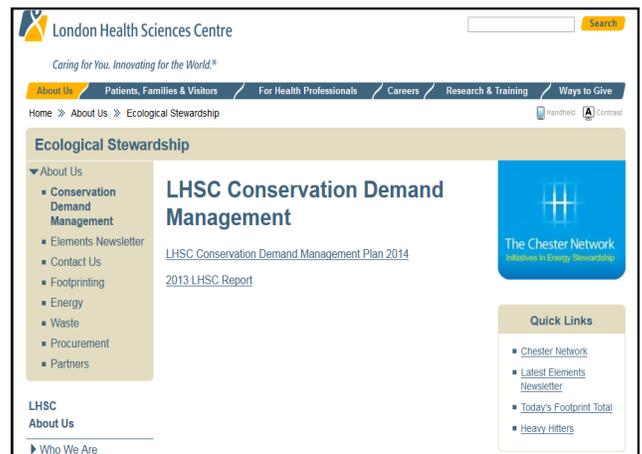
The Green Energy Act—regulation 397/11

The Green Energy Act was created to expand renewable energy generation, encourage energy conservation, and promote the creation of clean energy jobs. Regulation 397/11 pertains to the Energy Conservation and Demand Management Plan portion of this act. This regulation requires LHSC to:

1. Prepare, publish, make available to the public and implement an energy conservation and demand management plan or joint plans that detail information about its energy consumption, outlines goals and objectives for reducing energy consumption, lists cost and savings estimates for proposed measures, and confirms that the plan has been approved by senior management. This plan must be made available before July 1st 2014 and posted to the LHSC intranet/internet website. LHSC shall publish a revised plan on or before July 1, 2019 and every subsequent 5 years following.
2. Provide a summary of its annual energy use and greenhouse gas emissions for the year relative to the buildings or facilities as they are defined by the regulation. This summary must be submitted by July 1st each year to the Ministry of Energy and made available to the public on the intranet/internet website.

LHSC is currently in the process of updating the energy conservation and demand management plan voluntarily prior to the July 1, 2019 deadline so that the plan better reflects the projects and direction currently being pursued. The outline of the plan can be reviewed in the opening page of this document. The new energy management plan will replace the old one that is currently posted on the LHSC internet as required, in the Ecological Stewardship section.

The energy use and greenhouse gas emission template submitted each year is shown below. The data is two years behind the year of submission, therefore the latest data pertains to 2013. LHSC’s facilities are recorded as Victoria Hospital, University Hospital, Victoria Family Medical Centre, Byron Family Medical Centre, and Kidney Care Centre.



Energy Consumption and Greenhouse Gas Emissions Reporting - for 2013													
2013													
Sector													
Agency Sub-sector													
AcuteChronic													
Organization Name													
London Health Sciences Centre													
Operation Name	Operation Type	Address	Total Floor Area	Unit	Avg hrs/wk	Energy Type and Amount Purchased and Consumed in Natural Units						Total (calculated in webform)	
						Electricity		Natural Gas		District Heating		GHG Emissions (Kg)	Energy Intensity (ekWh/sqft)
						Quantity	Unit	Quantity	Unit	Quantity	Unit		
Byron Family Medical Centre	Facilities used for hospital purposes	1228 Commissioners Rd.	12,147	Square feet	168	151,859	kWh	5,219	Cubic Meter			21,410	17
Kidney Care Centre	Facilities used for hospital purposes	785 Wonderland Rd. S.	29,202	Square feet	168	849,424	kWh	72,780	Cubic Meter			202,166	56
University Hospital	Facilities used for hospital purposes	339 Windermere Rd.	1,041,593	Square feet	168	29,320,090	kWh			39,633	Metric Tonne	7,704,572	53
Victoria Family Medical Centre	Facilities used for hospital purposes	60 Chesley Ave.	12,100	Square feet	168	139,250	kWh	15,929	Cubic Meter			40,700	25
Victoria Hospital	Facilities used for hospital purposes	800 Commissioners Rd. E.	2,175,298	Square feet	168	19,628,332	kWh	20,234,576	Cubic Meter			39,748,024	108

Note that because Victoria Hospital uses natural gas to generate its own electricity the greenhouse gas emissions are higher than normal. Victoria hospital’s greenhouse gas emissions exceed a 25,000 tonne threshold that places LHSC into another compliance obligation with respect to regulation 452/09 under the Environmental Protection Act described on the next page.

Energy Management Plan > Regulatory Compliance > Regulation 452/09

The Environmental Protection Act—regulation 452/09

Regulation 452/09 pertains to greenhouse gas emission reporting. It was brought into place largely because of the expectation that Canada would eventually become part of a carbon tax or cap and trade system. Anyone in Ontario emitting over 25,000 tonnes of greenhouse gas is required to report their greenhouse gas emissions to the Ministry of Environment and anyone over the 50,000 tonnes threshold must also report at the federal level to Environment Canada. So far, LHSC has emitted around 45,000 tonnes per year and has been reporting to the Ministry of Environment for the last several years now.

Greenhouse gases must be reported according to the reporting guidelines provided from the Ministry. Victoria Hospital must separate their emissions into “Electricity Generation” and “Stationary Combustion” categories and complete calculations for greenhouse gas emissions (below). Once the calculations have been made and submitted, LHSC must have the reporting reviewed by a qualified third party. This entails a desktop review of the calculations and natural gas bills along with a site visit every three years. LHSC has used Stantec for this purpose for last few years however it is mandatory that the company cannot provide the service to the same organization past seven years so LHSC will be required to find a new third party verifier in the near future. The cost of this process is about \$8,000/year. Years that include site visits may cost more.

Split for Reporting							2015 - Total Gas Consumption Volumes from Union Gas Invoices (m ³)						
Victoria Hospital Natural Gas - 2015							Account #						
	Co Gen (m ³)	Boilers (m ³)	Small Acc (m ³)	Total Stationary (m ³)	Total (m ³)	HHV (MJ/m ³)	HHV (GJ/m ³)	SA009911	287-6856 272-5735	215-1275 196-3021	214-6964 196-1027	204-6254 187-3968	All Accounts
January	2,247,834	713,112	6,845	721,157	2,968,791	38,7820	0.038762	Location	825 Main Meter	Victoria Garage Unit	Self Care Dialysis	NT Loading Dock	LHS Foundation
February	2,165,337	671,471	6,845	678,315	2,843,712	38,9370	0.038937	January	2,961,946	1,060	3,636	3,538	471
March	2,119,558	488,734	6,587	495,321	2,614,879	38,6650	0.038665	February	2,836,868	1,245	1,635	1,635	570
April	1,472,514	453,098	1,603	454,641	1,927,155	38,6910	0.038891	March	2,608,322	539	4,568	853	276
May	1,352,605	455,208	442	455,649	1,808,255	38,8660	0.038860	April	1,525,552	0	522	1,008	73
June	1,158,365	622,843	672	623,515	1,780,480	38,6820	0.038862	May	1,807,813	0	3	334	27
July	1,263,161	686,654	630	687,483	1,950,634	38,2020	0.038202	June	1,778,608	0	1	668	1
August	1,216,605	702,857	588	703,444	1,920,054	38,2420	0.038242	July	1,950,034	0	6	623	1
September	1,174,433	571,538	731	572,269	1,746,702	38,6730	0.038673	August	1,919,466	0	6	581	1
October	1,180,313	476,253	1,179	477,433	1,656,446	38,5580	0.038558	September	1,745,371	0	9	632	1
November	1,171,554	434,603	1,363	435,966	1,606,128	38,9360	0.038936	October	1,654,287	0	508	609	53
December	1,313,528	507,470	2,121	509,591	1,823,119	38,3410	0.038341	November	1,606,783	82	673	538	32
Total	17,842,590	6,784,186	31,605	6,815,791	24,658,381	Average	0.038801417	Total	24,626,776	3,411	14,663	11,743	1,782

Electricity Generation				Thermal Output			
Date	kWh	HRSGs (lbs)	btu	MJ			
January	6,731,408	40,096,000	58,487,186,800	33,576,049			
February	6,564,782	42,022,304	59,180,855,703	62,433,111			
March	6,302,305	37,736,000	53,143,608,800	58,069,478			
April	3,671,615	25,375,000	35,735,612,500	37,703,063			
May	3,632,065	24,225,000	34,117,475,800	35,395,844			
June	3,731,637	26,394,000	37,110,810,200	39,271,135			
July	4,093,403	30,898,223	43,513,867,451	45,909,668			
August	3,391,127	32,403,000	45,641,534,700	48,154,434			
September	3,816,264	27,753,000	39,084,543,900	41,236,395			
October	3,725,558	21,955,000	30,322,451,400	32,625,370			
November	3,396,428	37,367,763	39,246,170,083	41,406,313			
December	3,536,332	37,923,275	53,415,737,983	56,356,653			
Total	53,725,924	374,665,171	527,640,960,319	556,690,708			

Carbon Dioxide (tonne)		Methane (tonne)		Nitrous Oxide (tonne)		
Co-gen	Stationary	Co-gen	Stationary	Co-gen	Stationary	
January	4,272,010	1,372,080	1.114	0.027	0.111	0.024
February	4,133,918	1,294,953	1.078	0.026	0.108	0.023
March	4,018,141	939,002	1.048	0.019	0.105	0.016
April	2,361,627	696,321	0.732	0.017	0.073	0.015
May	2,577,524	865,285	0.672	0.017	0.067	0.015
June	2,205,620	1,188,658	0.575	0.023	0.058	0.021
July	2,365,994	1,287,687	0.617	0.025	0.062	0.023
August	2,291,143	1,318,362	0.535	0.026	0.060	0.023
September	2,226,886	1,065,101	0.591	0.021	0.058	0.019
October	2,245,337	302,586	0.588	0.018	0.053	0.016
November	2,240,860	833,933	0.585	0.016	0.058	0.015
December	2,572,231	397,336	0.671	0.020	0.067	0.018
Total	33,948,157	12,956,170	8.856	0.255	0.886	0.228

Equation 20-2	Equation 20-12	Equation 20-12
$CO_2 = \sum_{i=1}^n Fuel_i \times HHV_i \times EF \times 0.0001$	$CH_4 = \sum_{i=1}^n Fuel_i \times HHV_i \times EF \times 0.0000001$	$N_2O = \sum_{i=1}^n Fuel_i \times HHV_i \times EF \times 0.0000001$
Total CO₂ (tonn)	Total CH₄ (tonne)	Total N₂O (tonne)
46,304,327	9.111	1.113

Once the review is complete, the third party verifier provides a signed report to the organization outlining any discrepancies in the methodology, calculations, or reporting and includes a statement as to whether the reported volumes fall within a 5% error allowance of their findings. Anything under 5% is considered immaterial and the Ministry will accept the reporting as complete. The signed verification statement is uploaded to the Ministry website with the original report. The deadline for the original report is June 1st each year. This is the same reporting mechanism that will be used to comply with the upcoming Cap and Trade program in Ontario, starting January 2017.

Part 3 - Lead Verifier Declaration

I, the undersigned, do hereby declare that

- At the time of verification, the Accredited Verification Body held a valid accreditation to ISO 14065 by a member of the International Accreditation Forum;
- To the best of my knowledge, the information provided in this Statement is true and complete;
- The verification was conducted in accordance with the requirements set out in O. Reg. 452/09, which includes specified clauses of ISO 14064-3 and ISO 14065 and;
- I am aware of the penalties of providing false information as per subsection 184(2) of the Environmental Protection Act.

Printed Name: **Nicole Flanagan**
 Signature of Lead Verifier: *Nicole Flanagan*
 Title: **Regional Technical Leader, GHG & Climate Services**
 Date (yyyy/mm/dd): **2015/07/20**

Part 4 - Peer Reviewer Declaration and Confirmation

I, the undersigned, do hereby declare that

- I was not involved in the verification documented in this Statement, other than to provide a peer review in accordance with clause 8.5 of ISO 14065, as it relates to verification activities; and
- I am aware of the penalties of providing false information as per subsection 184(2) of the Environmental Protection Act.

I, the undersigned, do further confirm, based on my evaluation of the verification and its outcome, that

- All verification activities required under the requirements set out in O. Reg. 452/09, which includes specified clauses of ISO 14064-3 and 14065, have been completed;
- The verification determinations and opinion presented above (Section B, Part II) are appropriate based on the activities conducted; and
- The verification activities conducted are sufficient to provide a reasonable level of assurance as defined under O. Reg. 452/09.

Printed Name: **Mike Murphy**
 Signature of Peer Reviewer: *Mike Murphy*
 Title: **National Technical Leader, Atmospheric Environments**
 Date (yyyy/mm/dd): **2015/07/21**

Low-carbon Economy Act, 2016—Bill 172, Climate Change Mitigation

On November 16, 2015 the Ministry of Environment and Climate Change posted a policy paper to the Environmental Registry for a 30 day comment period for the design options of Ontario’s cap and trade program. LHSC submitted a letter to the MOECC after careful review of the proposed design and included its concerns and recommendations. On February 25, 2016 the MOECC submitted a draft cap and trade regulation with revised guidelines for greenhouse gas reporting and opened a 45 day comment period. Under the proposed regulation the following impact to LHSC is derived as of March 2016:

1. Victoria Hospital, under the Ontario regulation 452/09, has emissions over the 25,000 threshold and therefore a direct compliance obligation to acquire the appropriate carbon allowances in the cap and trade market. These allowances can be purchased and sold by bidding in an auction based market four times per year. One allowance equals one tonne of carbon emissions. The final true-up of carbon allowances is completed by November 1st following the end of each compliance period. The first compliance period is 2017-2020. There are penalties for shortfalls.

2. Victoria Hospital qualifies for free allowances under the reasoning that it is providing a public service and therefore would have difficulty complying with the regulation and reducing greenhouse gas emissions. The hospital falls under the Direct Allocation method for free allowances, shown in Table 4 of the Appendix in the regulation. Therefore, the free allowances awarded to LHSC for the first compliance period are calculated with the following formula:

$$B(2017) = AF(2017) \times Bh_c(2017) \times Cc(2017)$$

↑ ↑ ↑ ↑
Free 1 Year – t-2 1
Allowances

The baseline being used for LHSC is a historical baseline for the year t-2, meaning that the 2015 emissions for Victoria Hospital will be used as a baseline to calculate the free allowances. Because the assistance factor and cap adjustment factor will remain at 1 for the duration of the compliance period, LHSC will receive the full 2015 year of emission allowances for free. Any additional emissions must be accounted for via purchasing allowances in the auctions and any extra allowances can be held for future years or sold back to the market. This assistance greatly reduces the expected cost to LHSC prior to the February release.

3. It is expected that because LHSC has a direct compliance obligation for its emissions that these emissions will be subtracted from the distributor’s obligation (in this case Union Gas). Therefore, there should be no pass-through charges applied to Victoria Hospital’s gas consumption. With the free allowances considered, LHSC has a cost avoidance that will not be available to hospitals that are not capped (do not have a direct compliance obligation) and will received this cost increase on their gas bills.

4. Since the hospital falls under the direct allocation method for free allowances, any consideration toward the thermal portion of cogeneration emissions will be moved. The thermal portion of cogeneration is considered for Energy Intensive Trade Exposed (EITE) organizations for gas used behind the meter. This may come into play during the second compliance period depending on if and how free allowances are issued.

5. LHSC will need to acquire some administrative assistance or an account agent to manage the holding and compliance accounts, participate in the auctions, and act on behalf of LHSC’s interests in performing any actions required under the Act. LHSC can have a primary account representative and up to four alternate account representatives. The representatives must be recognized by the Ministry director according to the specifications outlined in the regulation.

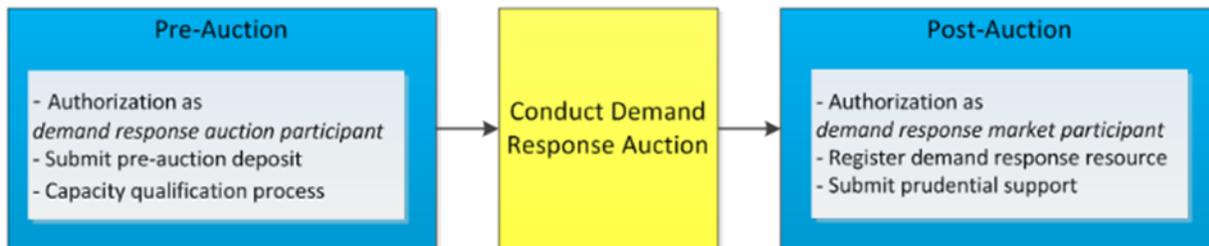
6. Financial assurance must be given by LHSC under the regulation for the purpose of bidding in the auctions. Bids must be provided in the form of a transfer, irrevocable letter of credit or letter of guarantee by a bank with the meaning of the Canadian Bank Act or financial cooperative authorized by a statute of Ontario or Canada to conduct business in Ontario or Canada. All accepted bids must be paid within seven days after receiving notice.

What is the demand response program?

The IESO created a program to reduce the overall amount of power generation that needs to be operated on the power system during peak times in Ontario. The program asks committed participants to be on call to curtail their electricity demand when called upon during peak hours. 2016 is the pilot year for the demand response auction program. LHSC has been considering participating in the demand response program if assured that there is little risk to the organization. Having recently become a Class A global adjustment customer, the strategies at Victoria Hospital have changed in a manner that may serve the new Demand Response Auction well. Currently Victoria Hospital could participate during the winter term with extra generation capacity now available. As winter electricity prices drop, generation is backed off, making it available for a program like the demand response. As for the summer months, the current peak reduction exercises have afforded experience with curtailing the electricity demand and reductions of around 2 MW have been obtained by the temporary shutdown process. With more absorption chilling for the future, the curtailment may be possible with less impact to the building temperature and risk to patient care.

Demand response auction

The graphic below shows requirements for participation before and after the demand response auction as well as the auction timeline, which occurs yearly. The auction is held in December and sets the price for the summer and winter commitment periods. The market participants can choose to participate in either one or both commitment periods.

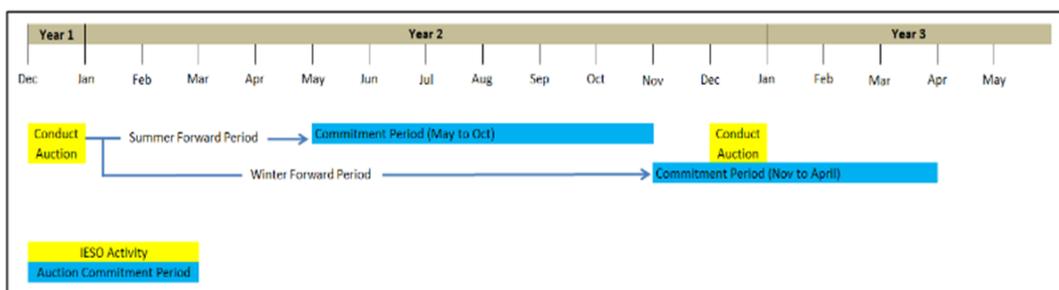


Participation directly VS through an aggregator

Demand response participants with the capacity to reduce demand by 1 MW or greater have the option to be a direct participant in demand response with the IESO, as opposed to operating through an aggregator. Direct participants to the IESO receive access to a private reporting site in order to manage and monitor their demand response operation. The benefit to being a direct market participant is that a third party is not taking a cut however the risk involved is that LHSC is required to keep track of all the rules and regulations, as well as monitoring the variables which inform the decision around when it is beneficial to participate. The aggregator on average would take 15-20% of LHSC's revenue.

Commitment periods

The commitment period is the length of time for which a successful demand response auction participant is required to make their demand response capacity obligation available for dispatch through the energy market during the availability window. Some types of demand response resources will have different performance profiles over different seasons – This applies considering LHSC's new operating strategy as a Class A global adjustment customer. Utilizing seasonal commitment periods fosters increased participation and provides greater flexibility for demand response resources to offer into the auction in a manner most consistent with the capability. There are two season commitment periods for the demand response auction, defined as:



[Energy Management Plan](#) > Regulatory Compliance > Demand Response Program

Penalties

In order to ensure that organizations live up to their curtailing commitment, the IESO has put in place penalties based on when there is a high chance for the demand response to be called upon. If the commitment is not upheld in a particular day then the organization is charged a penalty day times the factor presented for a given month. For example, missing a day in August will cost the organization two days worth of payment.

Month	Factor
January – February	2.0
March	1.5
April – May	1.0
June	1.5
July - August	2.0
September	1.5
October – November	1.0
December	1.5

Cost reimbursement for load reduction

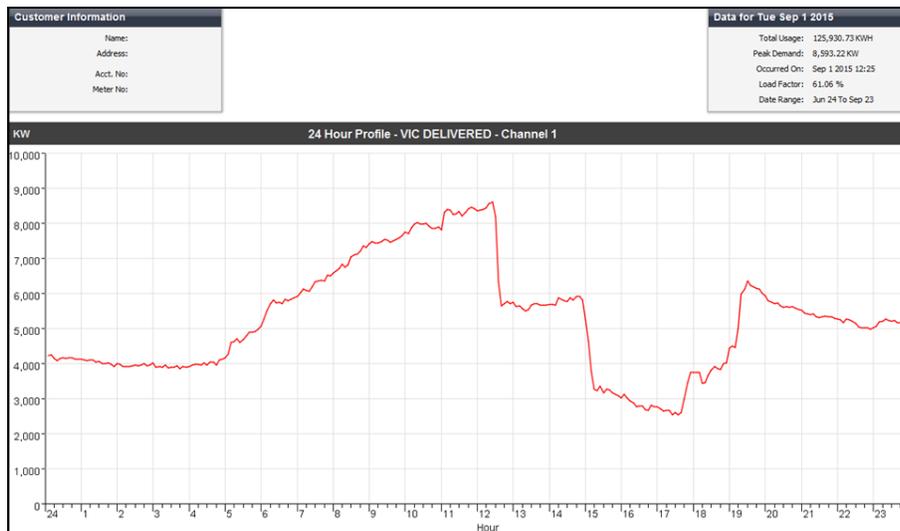
Fuel costs and other curtailing costs are not covered and must be incurred by the participants. The most recent auction set the following clearing prices:

Summer commitment period is \$378.21/MW-day
Winter commitment period is \$359.87/MW-day

A MW-day is essentially any day where a demand response event may occur; typically business days. Therefore each commitment period has approximately 125 days. If LHSC were to sign up 1 MW towards the demand response program, making the commitment to curtail its load by 1 MW should it be required, would have the following value:

Summer commitment period = \$378.21 x 125 days = \$47,276.25
Winter commitment period = \$359.87 x 125 days = \$44,983.75
Total (If signed up for both periods) = \$92,260 /yr

This value would be multiplied by every megawatt of demand response that LHSC can offer. The option remains to bid into the auction for either the summer or winter period or both. LHSC would need to carefully weigh the expected ability to meet these calls, especially in the summer when LHSC must commit their demand reduction to the Class A program. Demand reduction cannot count toward both programs. More information is currently being sources for the penalties of non-compliance and criteria around disqualification however if the information comes back favourable, LHSC can consider bidding into the auction for December 2016. Below is a graphical representation of the demand response capability at Victoria hospital as determined by the peak reduction exercises in the summer of 2015.



Energy Management Plan > Regulatory Compliance > Emergency Power

Emergency generation

LHSC must ensure that it has adequate emergency power so that critical services at the hospital can be maintained in the event of a blackout period. Money will be allocated as it becomes available to this end and the emergency power structure is being prioritized to receive this money over the next several years. Recently, automatic transfer switches were upgraded in the high voltage room to allow for smooth switching to emergency power at Victoria Hospital. The Caterpillar emergency generators in the P6 parking lot at Victoria Hospital are slated to receive PLC upgrades, bringing them back up to code.

Making use of emergency generation

Normally emergency power represents a cost to the hospital that is only capitalized on in the event of an emergency. However, with the proper planning, there may be opportunities to make use of this emergency power to the hospital’s economic advantage. It would be beneficial to have depreciating, standby equipment produce a payback over its life cycle instead of sitting there idle.

Class A peak reduction

With the proper switching for instance, generators could be brought online during peak days in the summer to contribute to the Class A reduction strategy. Every megawatt of electricity brought off the grid successfully for all five peak days is worth over four hundred thousand dollars per year.

Demand response program

In relation to the demand response program, should LHSC acquire the proper CofA with the ministry, the generators could become part of LHSC’s commitment to curtailing demand throughout the year. Each megawatt of electricity curtailment in this case is worth over ninety thousand dollars per year. The University Hospital generators with an approval for 4.5 megawatts of peak reduction could potentially generate over four hundred thousand dollars per year of revenue. The requirements for these generators to be approved have ben laid out by RWDI consulting firm and simply needs to be signed and sent to the MOECC.

Victoria Hospital emergency generators

Three Cat Generators		
Servicing North Tower & Phase		
#1 - 563 kW, #2 - 681 kW, #3 - 692kW		
Switch	Power (kW)	Servicing
ATS 1	717	
ATS 5	290	Phase Ventilation
ATS 8	212	Critical Care
L3P2-13	131	New Ors
NTL3-DE10	54	Elevators N. Tower
NTL3-DE9	118	N.T. Delayed Emerg
NTL3-VE12	193	N.T. Vital
NTL3-VE11	85	

Detroit Diesel
Servicing LRCP, VRL, CT, MRI
800 kW

It would have to be decided how much investment toward this end would be made at Victoria Hospital and with what level of confidence in the demand response program. Left is a short list of available power from emergency generators and the areas they service. A cost of running the generators for four hour periods multiplied by the number of response call days must be estimated and weighed in as well.

One last consideration for emergency generators is that currently, any emergency generator over 10 megawatts must be included in the regulation 452/09 greenhouse gas emission reporting and the fuel emissions would contribute to the allowances required to be purchased in auction by the hospital. Although it is unlikely that LHSC would have generators this large, if the regulation changes to include smaller generators then the additional cost of fuel emission must be included in the business case.

