2015 Corporate Energy Consumption Report

City of London

August 2016

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CANADA

Contents

1. Background

London's Corporate Energy Conservation and Demand Management (CDM) Plan was approved by Council in July 2014. The scope of the CDM Plan covers all forms of energy used in activities undertaken by the Corporation of the City of London. The CDM Plan established a goal to reduce total corporate energy use by ten percent from 2014 levels by 2020.

In August 2011, the provincial government introduced Ontario Regulation 397/11 under the *Green Energy Act*, which requires municipalities, municipal service boards, schools boards, universities, colleges and hospitals to report on facility energy consumption and associated greenhouse gas (GHG) emissions annually beginning in 2013. The scope of this mandatory report was limited to those facilities that:

- are heated or cooled and in respect of which the public agency is issued the invoices and is responsible for making the payments for the energy consumptions; or

- are related to the treatment or pumping of water or sewage and in respect of which the public agency is issued the invoices and is responsible for making the payments for the energy consumptions.

The Ontario Regulation 397/11 reporting requirement does not include significant corporate energy users such as streetlighting and corporate fleet fuel use, nor other needs such as sports field lighting. These energy needs and impacts are included within the scope of the *2015 Corporate Energy Consumption Report* as it is imperative that all energy uses and impacts within the City's control are continuously examined for reduction opportunities.

The total energy consumption in 2015 is compared with two reporting periods, 2007 and 2014. The tracking and monitoring of utility data for City was made possible in 2007 through EnergyCap software and is hence used here for comparison. 2014 is the baseline year for CDM Plan, as identified by the Province, and is being tracked.

Energy management activities and reporting of City of London's agencies, boards and commissions is handled by the individual organizations. City staff provides assistance when requested.

2. Corporate Energy Consumption Overview

The 2015 Corporate Energy Consumption Report provides a summary of the City of London's 2015 annual energy consumption and GHG emissions for all operations. The document provides a total of all significant energy costs associated with City of London operations. In addition to the report requirements mandated by the *Green Energy Act and Ontario Regulation 397/11,* information on all energy consuming infrastructure (e.g., street lighting, sports fields) as well as fleet fuel has been included to provide a complete picture of energy needs for our municipal operations.

- **The Corporation consumed approximately 182 million "equivalent" kilowatt-hours (ekWh) of energy, a decrease of five percent from 2014.** This is nearly half-way towards the CDM Plan goal for a 10 percent reduction from 2014 levels by 2020. Over the longer term, total energy use is now eight percent lower than it was in 2007.

- **In terms of service delivery to Londoners, corporate energy use per person dropped by 14 percent from 2007 levels**. This reduction can be attributed to recent energy conservation measures and facility upgrades:

  - Wastewater treatment energy use per person has decreased by 27 percent
  - Water pumping energy use per person has decreased by 20 percent
  - Building energy use per person has decreased by 12 percent
  - No change for streetlighting nor fleet fuel use

- **Total energy cost in 2015 increased to over $19 million** with the increase primarily due to rising electricity prices. Total electricity costs have risen by 63 percent since 2007 (unadjusted for inflation) even though total electricity use actually dropped by two percent over that period.

  - Energy costs would have been $1.6 million higher in 2015 if the energy efficiencies noted above were not in place.
  - Between 2013 and 2015, the City spent $11.7 million in capital investments related to energy–efficiency projects. These investments create energy savings every year over the life of the investment.

- **Energy cost per person was $50 in 2015**. Dividing the Corporation's total energy cost by London's population provides an indication of the relative contribution of energy costs associated with service delivery. Energy cost for each commodity increases each year. Therefore, sustained energy reductions become more important each year as each unit of energy consumed becomes more expensive with rising energy prices.

- **Energy related greenhouse gas emissions in 2015 were 51 percent lower than 2007.** The City of London's improvement in energy efficiency accounts for about 25 percent of this reduction. In particular, the new centrifugal sludge dewatering system at the Greenway Pollution Control Centre's sludge incinerator resulted in a significant reduction in natural gas at that facility. The remaining 75 percent of the reduction comes from Ontario's actions to replace coal-fired power plants with cleaner forms of power generation. About 90 percent of Ontario's electricity is now generated from emissions-free sources, such as nuclear, hydro-electric generating stations, wind and solar. In 2015, every 1,000 kilowatt-hours of electricity generated in Ontario produced less than 60 kilograms of carbon dioxide emissions. This is significantly better than it was in 2007, when 1,000 kilowatt-hours of electricity produced around 240 kilograms of carbon dioxide emissions.

2.1 Methods of Measurement

The City of London procured software in 2007 to log monthly utility bills for our municipally-owned and administered buildings and facilities. The EnergyCap software has the capability to track, monitor and capture data to assist the City of London with reporting consumption and providing

historical data. EnergyCap tracks data in the following Municipal Service Categories: Buildings; Traffic Signals & Streetlights; Wastewater & Treatment and Water Pumping.

Fleet data is provided from its software system Petrovend which is used for tracking vehicle fuelling at City of London Operation Centers.

2.2 Limitations of Measurement

The annual energy consumption and greenhouse gas emissions for the City of London do not include our Agencies, Boards & Commissions, nor does it include energy consumed in leased office space where the utility costs are incorporated in the leasing agreements.

Annual transportation fuel consumption and GHG emissions for the City of London do not include fuel consumption and emissions produced from the use of personal vehicles, railway or air travel for work related tasks by staff or by contracted services by the City of London.

3. Conservation and Demand Management (CDM) Goal Update

The introduction of CDM Plan provided City of London with an opportunity to review its energy management program initiatives and proposed energy targets. The Plan was developed according to Ministry of Energy's direction to provide the City's annual energy consumption information to the public and set goals and actions for conserving energy and reducing GHG emissions from 2014 to 2020.

A series of past energy activities, programs, utility consumption and documents were analyzed to understand the City's standing in energy management and to set a CDM target. The approach was to set a target achievable by continuing to implement short term initiatives, adopt energy conservation resources into existing capital investments already assigned, explore incentive opportunities towards energy project initiatives, review long term initiatives that have significant impacts on energy consumption and GHG emissions, and deepen the culture of conservation within the City's operations.

The City of London's proposed CDM goal is to achieve a 10 percent reduction in overall annual energy use over the duration of the CDM Plan to the end of calendar year in 2020. The baseline year is 2014. Tied to this goal are:

- A projected total energy use reduction of 30 million ekWh by 2020.
- A projected 15 percent improvement (76 ekWh/person) in energy efficiency annually based on the projected population in 2020.
- A projected total GHG emission reduction of 3,900 tonnes annually by 2020.
- A projected energy cost avoidance of about $4 million by 2020.

In order to achieve this goal of a 10 percent reduction by 2020, 35 technical and non-technical actions were prioritized to contribute to overall reductions. All actions were identified under four prescribed categories as follows:

- Tracking and Monitoring Measures

- Technical Measures
- Organizational Measures
- Behavioral Measures

Identified on Table 1 is the City's progress towards the CDM goals.

Table 1 - CDM Plan Target Tracking

	2014 (Baseline)	2015	2020 (CDM Target)	Percentage Change from 2014 to 2015	Notes
Total Energy use (ekWh)	191,514,000	182,368,000	170,074,000	-5%	• Halfway to the CDM 2020 target of 10%.
Energy Performance (ekWh/person)	511	482	432	-6%	• Improved energy efficiency. • Achieved more than half to CDM target.
GHG emissions (tonnes)	26,000	21,900	24,500	-16%	• Exceeded CDM target
Total Energy Costs	$18,754,000	$19,051,000	$22,700,000	1.6%	• Increase in electricity costs year over year makes it challenging for City of London to reduce its overall commodity costs. • The increase in energy cost would be significantly higher without the implementation of efficiency measures. • There was a total of 10% increase in electricity cost from 2014 to 2015, but the overall commodity cost increase for the City of London was just over 1 percent. • A total of $4.7 million in avoided energy costs were accumulated since 2007.

Overall, City of London's performance in 2015 is on track with the CDM goal. A complete update of all actions (complete or in progress) will be provided as part of a comprehensive 2017 CDM Update report.

4. Corporate Energy Annual Summary

In 2015, the City of London's corporate energy summary is categorized by consumption and the total cost of annual energy procured by commodity. Currently the City of London is capable of tracking annual electricity, natural gas, steam, chilled water, diesel and gasoline consumptions and costs. This allows the City of London to show the variances in costs associated to consumption.

The City of London has averaged the 2015 energy consumptions and cost data in comparison to London's population. This allows the City to demonstrate and relay to Londoners the energy consumed in relationship to service delivery provided by the Corporation.

As noted in section 1, total energy consumption in 2015 is compared with two reporting periods, 2007 and 2014. The tracking and monitoring of utility data for City was made possible in 2007 through EnergyCap software and is hence used here for comparison. 2014 is the baseline year for CDM Plan, as identified by the Province, and is being tracked.

4.1 Total Corporate Energy Consumption

With the use of the EnergyCap software, the City of London has ability to breakdown and report annual energy consumption by the commodity and by municipal service category.

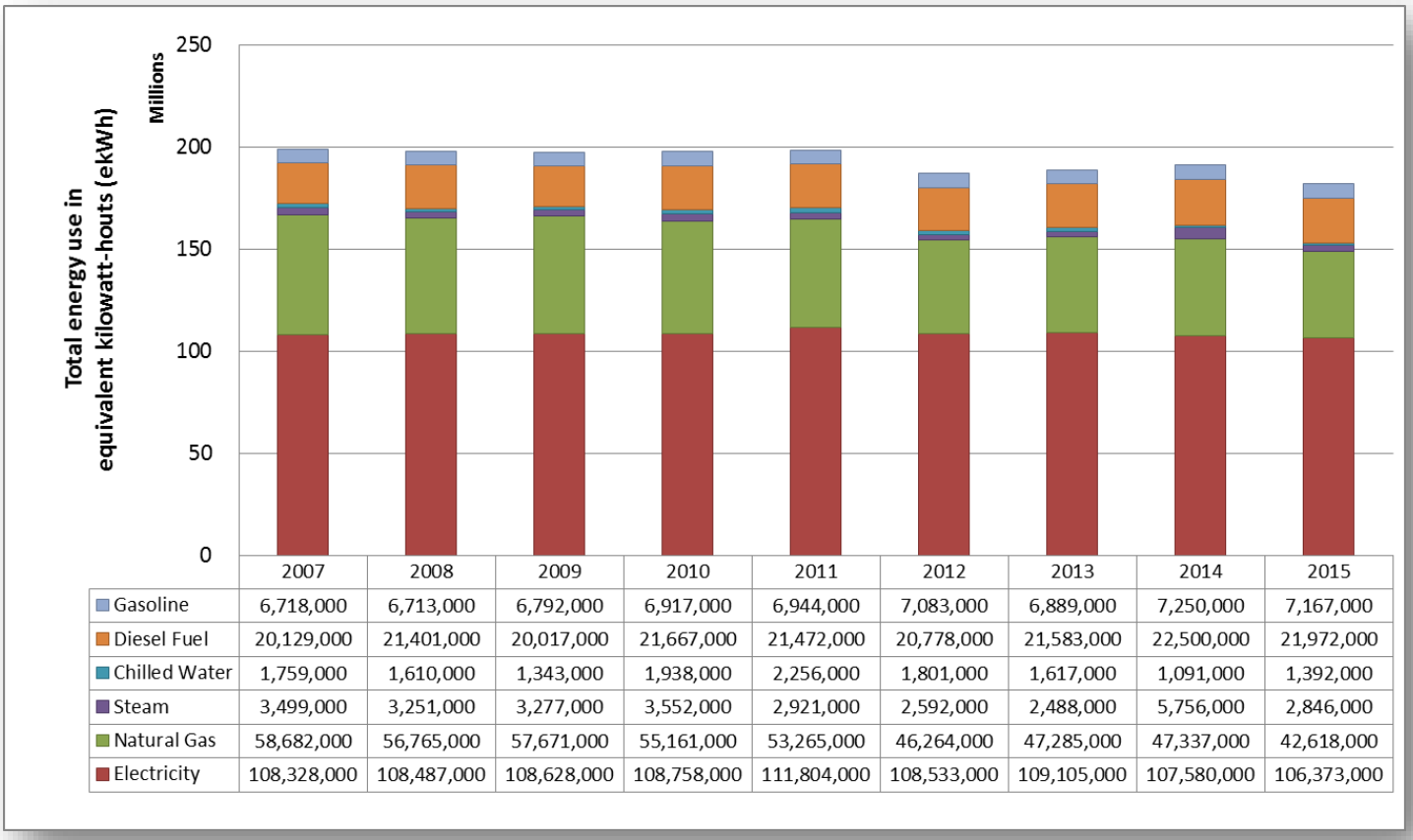
4.1.1 Energy Consumption by Commodity

Table 2 – Consumption by Commodity Comparison 2014 – 2015 (CDM baseline tracking)

Energy Consumption (ekWh)	2014	2015	Variance	% Change
Electricity	107,580,000	106,373,000	(1,207,000)	-1%
Natural Gas	47,337,000	42,618,000	(4,719,000)	-10%
Steam	5,756,000	2,846,000	(2,910,000)	-51%
Chilled Water	1,091,000	1,392,000	301,000	28%
Diesel Fuel	22,500,000	21,972,000	(528,000)	-2%
Gasoline	7,250,000	7,167,000	(83,000)	-1%
Total City of London	**191,514,000**	**182,368,000**	**(9,146,000)**	**-5%**

In comparison to 2014, the City of London's total energy consumption and percentage of usage by commodity has shown a five percent reduction in 2015 as shown in Table 2.

Figure 1 – Total Energy Consumption by Commodity



	2007	2008	2009	2010	2011	2012	2013	2014	2015
Gasoline	6,718,000	6,713,000	6,792,000	6,917,000	6,944,000	7,083,000	6,889,000	7,250,000	7,167,000
Diesel Fuel	20,129,000	21,401,000	20,017,000	21,667,000	21,472,000	20,778,000	21,583,000	22,500,000	21,972,000
Chilled Water	1,759,000	1,610,000	1,343,000	1,938,000	2,256,000	1,801,000	1,617,000	1,091,000	1,392,000
Steam	3,499,000	3,251,000	3,277,000	3,552,000	2,921,000	2,592,000	2,488,000	5,756,000	2,846,000
Natural Gas	58,682,000	56,765,000	57,671,000	55,161,000	53,265,000	46,264,000	47,285,000	47,337,000	42,618,000
Electricity	108,328,000	108,487,000	108,628,000	108,758,000	111,804,000	108,533,000	109,105,000	107,580,000	106,373,000

Figure 1 is a representation of energy consumption (ekWh) for the overall commodity usage every year since 2007.

The commodity consumption trend indicate that consumption has remained relatively unchanged for the City of London until 2012. In 2012, the City of London reduced consumptions across all commodities. Further from 2012 to 2015, there is a three percent decrease in total consumption. Since 2007, London's population has increased by about 6.5 percent, which means that corporate energy efficiency (in terms of energy used per person in London) improved by 14 percent over the extent of the nine year period. Compared to CDM baseline year 2014, the results conclude an overall 5.5 percent improvement in energy efficiency.

It is also important to note that differences in annual weather conditions will impact energy needs, as this will impact building air conditioning and space heating needs as well as pumping and treatment requirements for water supply and wastewater. In 2014, the natural gas and steam consumption were high due to extreme cold winter that year (i.e., the "Polar Vortex").

In Table 3, energy consumptions by commodity are compared to 2007 values, along with the percentage of changes.

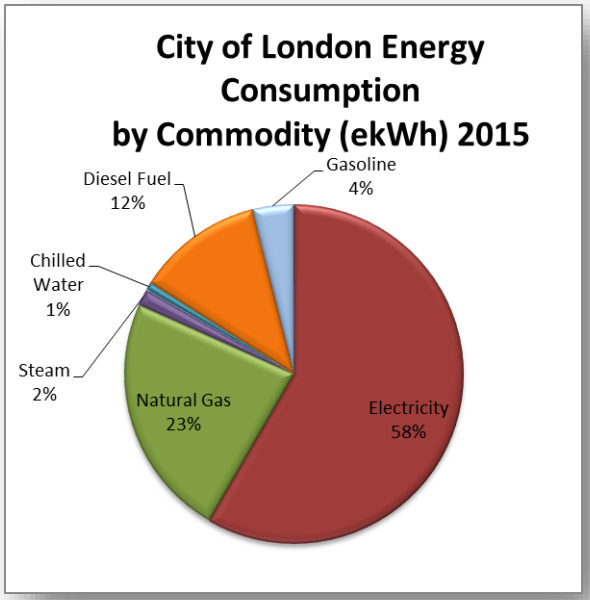
Table 3 – Energy Consumption by Commodity 2007-2015

Energy Consumption (ekWh)	2007	2015	Variance	% Change
Electricity	108,328,000	106,373,000	(1,955,000)	-2%
Natural Gas	58,682,000	42,618,000	(16,064,000)	-27%
Steam	3,499,000	2,846,000	(653,000)	-19%
Chilled Water	1,759,000	1,392,000	(367,000)	-21%
Diesel Fuel	20,129,000	21,972,000	1,843,000	9%
Gasoline	6,718,000	7,167,000	449,000	7%
Total City of London	**199,115,000**	**182,368,000**	**(16,747,000)**	**-8%**

Table 3 illustrates that building and facility energy consumption has been decreasing, whereas transportation fuel consumption has been growing at a pace consistent with London's growth.

In summary:

- Electricity represents the majority of the corporation's energy consumption, accounting for 58% of overall needs. This decreased by 2% compared to 2014.
- Natural gas consumption accounts for 23% overall energy needs. This decreased by 2% compared to 2014.
- Diesel remains the most prominent fuel used within the City's vehicle fleet, given the large number of heavy-duty vehicles in operation. The total fleet units also tend to increase year over year with the City's expansion.



4.1.2 Energy Consumption by Municipal Service Categories

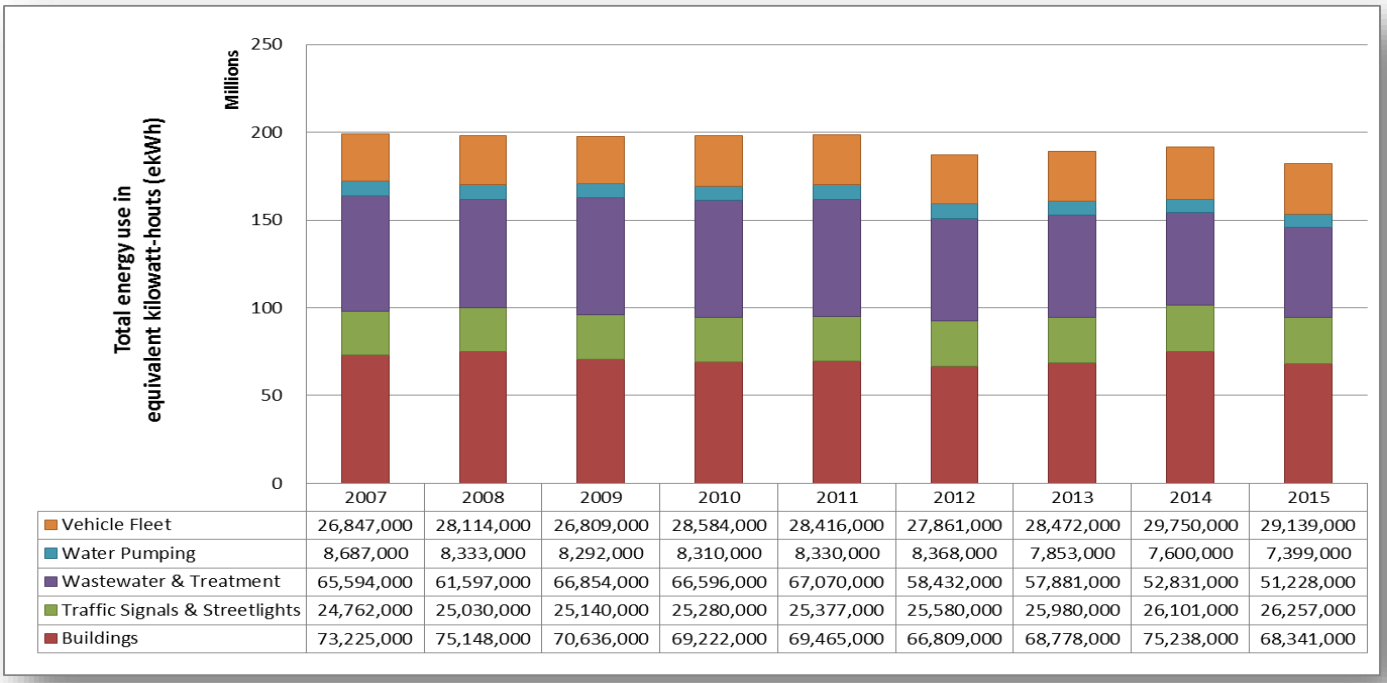
Table 4 – Consumption by Municipal Service Categories Comparison 2014 – 2015 (CDM baseline tracking)

Energy Consumption (ekWh)	2014	2015	Variance	% Change
Buildings	75,238,000	68,341,000	(6,897,000)	-9%
Traffic Signals & Streetlights	26,101,000	26,257,000	156,000	1%
Wastewater & Treatment	52,831,000	51,228,000	(1,603,000)	-3%
Water Pumping	7,600,000	7,399,000	(201,000)	-3%
Vehicle Fleet	29,750,000	29,139,000	(611,000)	-2%
Total City of London	**191,520,000**	**182,364,000**	**(9,156,000)**	**-5%**

Table 4 shows the City of London's total energy consumption by municipal service categories in 2015 compared to the CDM Plan's baseline year of 2014. By separating the municipal service

categories, this gives the City of London the ability to see areas where progress is being made and the opportunity to target areas for future improvements.

Figure 2 – Total Energy Consumption by Municipal Service Categories



	2007	2008	2009	2010	2011	2012	2013	2014	2015
Vehicle Fleet	26,847,000	28,114,000	26,809,000	28,584,000	28,416,000	27,861,000	28,472,000	29,750,000	29,139,000
Water Pumping	8,687,000	8,333,000	8,292,000	8,310,000	8,330,000	8,368,000	7,853,000	7,600,000	7,399,000
Wastewater & Treatment	65,594,000	61,597,000	66,854,000	66,596,000	67,070,000	58,432,000	57,881,000	52,831,000	51,228,000
Traffic Signals & Streetlights	24,762,000	25,030,000	25,140,000	25,280,000	25,377,000	25,580,000	25,980,000	26,101,000	26,257,000
Buildings	73,225,000	75,148,000	70,636,000	69,222,000	69,465,000	66,809,000	68,778,000	75,238,000	68,341,000

The total energy consumption by commodity illustrated in Figure 2 represents the overall energy consumption (ekWh) by the Municipal Service Categories since 2007.

In Table 5 below, further detailed energy consumption by municipal service categories in comparison to 2007 values is shown, along with the percentage of changes.

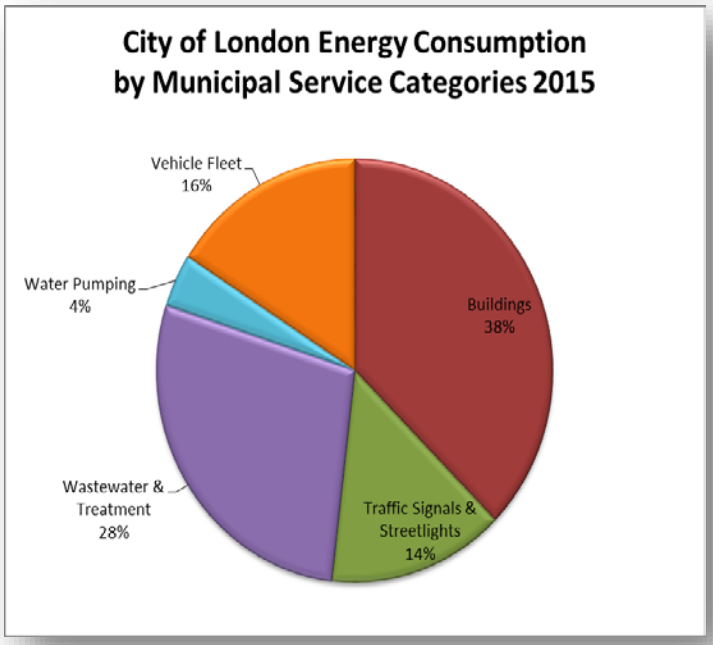
Table 5 – Energy Consumption by Municipal Service Categories 2007 – 2015

Energy Consumption (ekWh)	2007	2015	Variance	% Change
Buildings	73,225,000	68,341,000	(4,884,000)	-7%
Traffic Signals & Streetlights	24,762,000	26,257,000	1,495,000	6%
Wastewater & Treatment	65,594,000	51,228,000	(14,366,000)	-22%
Water Pumping	8,687,000	7,399,000	(1,288,000)	-15%
Vehicle Fleet	26,847,000	29,139,000	2,292,000	9%
Total City of London	**199,115,000**	**182,364,000**	**(16,751,000)**	**-8%**

In terms of municipal service categories, there has been significant reduction in energy use within wastewater and treatment. Process retrofit actions undertaken by Wastewater Treatment Operations include the sludge dewaterer at the Greenway Wastewater Treatment Plant sludge incinerator, as well as the replacement of aeration blowers at a number of wastewater treatment plants. Water Supply has also made improvements to water pumping infrastructure. The impact of building retrofits undertaken by Facilities can also be seen.

Vehicle fleet fuel use and streetlighting electricity tend to grow as London has grown. In summary:

- Buildings (38%) and Wastewater & Treatment (28%) hold the highest percentage of demand for energy consumption for the City of London.
- Vehicle Fleet (16%) and traffic Signals & Streetlights (14%) contribute to significant demand for energy consumptions.
- Water Pumping (4%) remains the lowest end user contributor in energy consumption demands for the City of London.



4.1.3 Total Corporate Energy Consumption Per Capita by Municipal Service Categories

The City of London's corporate energy consumption is a direct function of serving the public, businesses and visitors to London. The trends in consumption reported is significant to the services provided to the community. London continues to grow in population and increased services are generally required to support that growth. It is important to capture energy usage per capita to demonstrate the City of London's achievements in energy reductions while continued growth occurs in London.

Table 6 – Energy Consumption Per Capita 2014 – 2015 (CDM baseline tracking)

Energy Consumption (ekWh) by Municipal Service Categories	2014	2015	Change from Past Year Variance	% Change
Buildings	75,238,000	68,341,000	(6,897,000)	-9.2%
Traffic Signals & Streetlights	26,101,000	26,257,000	156,000	0.6%
Wastewater & Treatment	52,831,000	51,228,000	(1,603,000)	-3.0%
Water Pumping	7,600,000	7,399,000	(201,000)	-2.6%
Vehicle Fleet	29,750,000	29,139,000	(611,000)	-2.1%
Total City of London	**191,520,000**	**182,364,000**	**(9,156,000)**	**-4.8%**
London's Population	**375,000**	**378,000**	**3,000**	**0.8%**
Energy Use (ekWh) per person	**511**	**482**	**(28)**	**-5.5%**

In 2015, the City of London improved corporate energy efficiency by over 5 percent illustrated in Table 6 above. Decreases in commodity use suggests that corporate initiatives and programs currently in place to reduce consumption act as a counterbalance to the additional increases of demand for energy due to London's growth. The City of London's population increased by almost one percent in 2015, while corporate energy use decreased by over 5 percent from 2014.

Table 7 – Energy Consumption Per Capita 2007 – 2015

Energy Consumption (ekWh) by Municipal Service Categories	2007	2015	Change since 2007 Variance	% Change
Buildings	73,225,000	68,341,000	(4,884,000)	-6.7%
Traffic Signals & Streetlights	24,762,000	26,257,000	1,495,000	6.0%
Wastewater & Treatment	65,594,000	51,228,000	(14,366,000)	-21.9%
Water Pumping	8,687,000	7,399,000	(1,288,000)	-14.8%
Vehicle Fleet	26,847,000	29,139,000	2,292,000	8.5%
Total City of London	**199,115,000**	**182,364,000**	**(16,751,000)**	**-8.4%**
London's Population	**355,000**	**378,000**	**23,000**	**6.5%**
Energy Use (ekWh) per person	**561**	**482**	**(78)**	**-14.0%**

Table 7 above indicates the corporate energy consumption per capita by municipal service categories in comparison to 2007. The City of London's population has grown by 6.5 percent (23,000 people) since 2007. Nine years of data shows continued improvement of corporate energy use per capita with an overall reduction of 14 percent in 2015 compared to 2007.

4.1.4 Total Corporate Energy Consumption Summary

Overall, City of London reduced its energy consumption by eight percent to 2007 levels. This reduction suggests that corporate initiatives currently in place to decrease consumption on existing and new infrastructure act as a counterbalance to the additional increases of demand for energy due to London's growth.

4.2 Total Corporate Energy Costs

With the use of the EnergyCap software, the City of London has the ability to breakdown and report annual energy costs by the commodity and by municipal service category.

In 2015 the City of London (not including Agencies, Boards & Commissions) spent approximately $19,052,000 on energy. This represents about two percent of the City of London's operating budget for 2015.

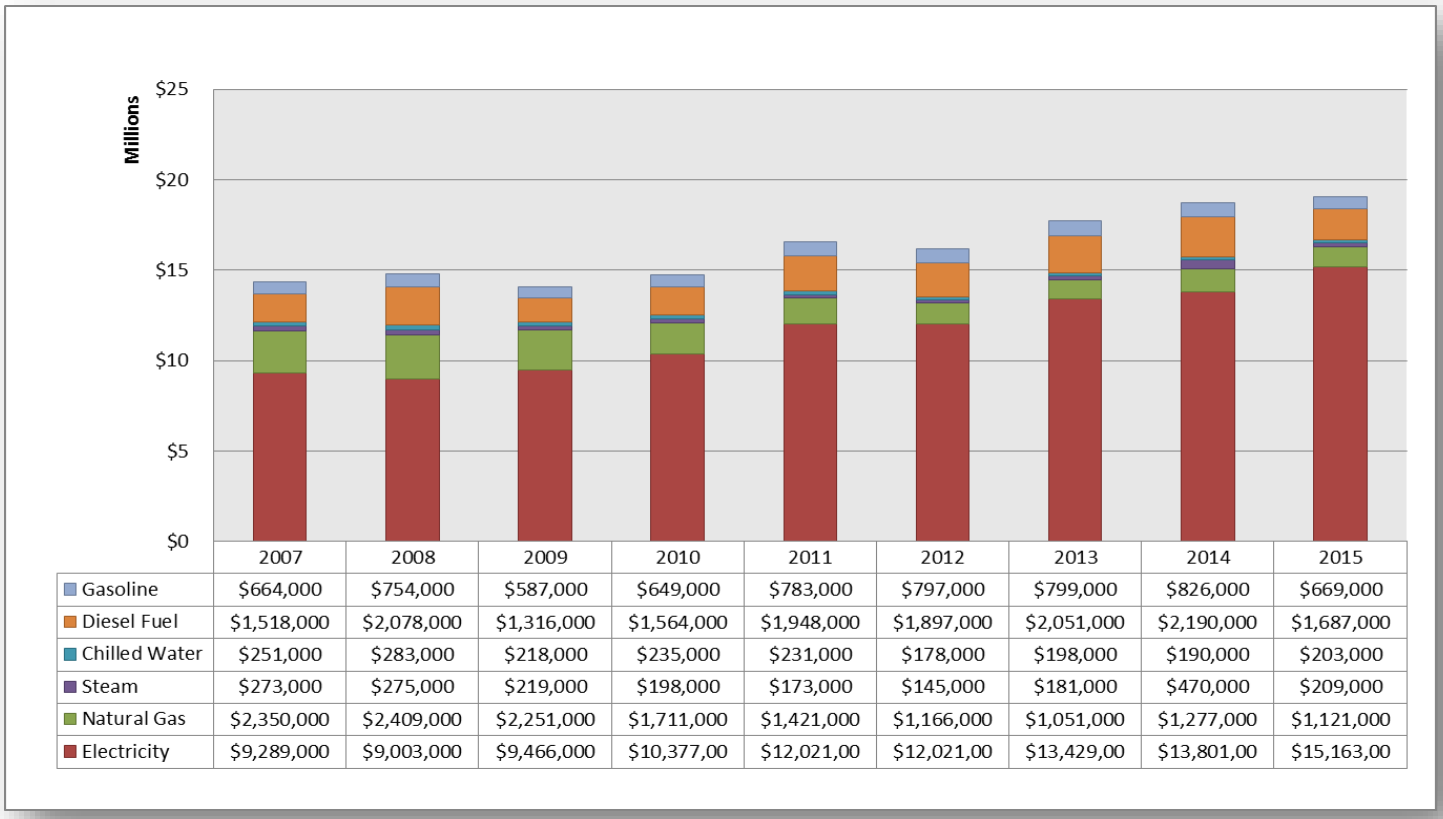
4.2.1 Energy Costs by Commodity

Table 8 – Energy Costs by Commodity Comparison 2014 – 2015

Energy Cost by Commodity	2014	2015	Change Since 2014 Variance	% Change
Electricity	$ 13,801,000	$ 15,163,000	$ 1,362,000	10%
Natural Gas	$ 1,277,000	$ 1,121,000	$ (156,000)	-12%
Steam	$ 470,000	$ 209,000	$ (261,000)	-56%
Chilled Water	$ 190,000	$ 203,000	$ 13,000	7%
Diesel Fuel	$ 2,190,000	$ 1,687,000	$ (503,000)	-23%
Gasoline	$ 826,000	$ 669,000	$ (157,000)	-19%
Total City of London	**$ 18,754,000**	**$ 19,052,000**	**$ 298,000**	**2%**

In 2015, the City of London's total energy costs by commodity results indicate an approximate increase by 2 percent from 2014 as illustrated in Table 8. Electricity prices have been rising year over year. Total electricity cost have risen by 10 percent even though total electrical consumption dropped by 1 percent.

Figure 3 – Total Energy Costs by Commodity



	2007	2008	2009	2010	2011	2012	2013	2014	2015
Gasoline	$664,000	$754,000	$587,000	$649,000	$783,000	$797,000	$799,000	$826,000	$669,000
Diesel Fuel	$1,518,000	$2,078,000	$1,316,000	$1,564,000	$1,948,000	$1,897,000	$2,051,000	$2,190,000	$1,687,000
Chilled Water	$251,000	$283,000	$218,000	$235,000	$231,000	$178,000	$198,000	$190,000	$203,000
Steam	$273,000	$275,000	$219,000	$198,000	$173,000	$145,000	$181,000	$470,000	$209,000
Natural Gas	$2,350,000	$2,409,000	$2,251,000	$1,711,000	$1,421,000	$1,166,000	$1,051,000	$1,277,000	$1,121,000
Electricity	$9,289,000	$9,003,000	$9,466,000	$10,377,00	$12,021,00	$12,021,00	$13,429,00	$13,801,00	$15,163,00

The total energy cost by commodity illustrated in Figure 3 is a representation of the energy overall cost by commodity per year since 2007.

The cost by commodity trend indicates the costs for energy continue to rise for the City of London. In 2015, the City of London total commodity costs remained relatively unchanged from 2014. However, there was significant price volatility in energy commodities in 2015, with a 10 percent increase in electricity costs, this was offset by a 23 percent and 19 percent decrease in diesel fuel and gasoline costs due to the global decline in oil prices. This resulted in an overall two percent increase in utility costs for the City.

In Table 9, further detailed energy consumption by commodity to 2007 values are shown, along with the percentage of changes.

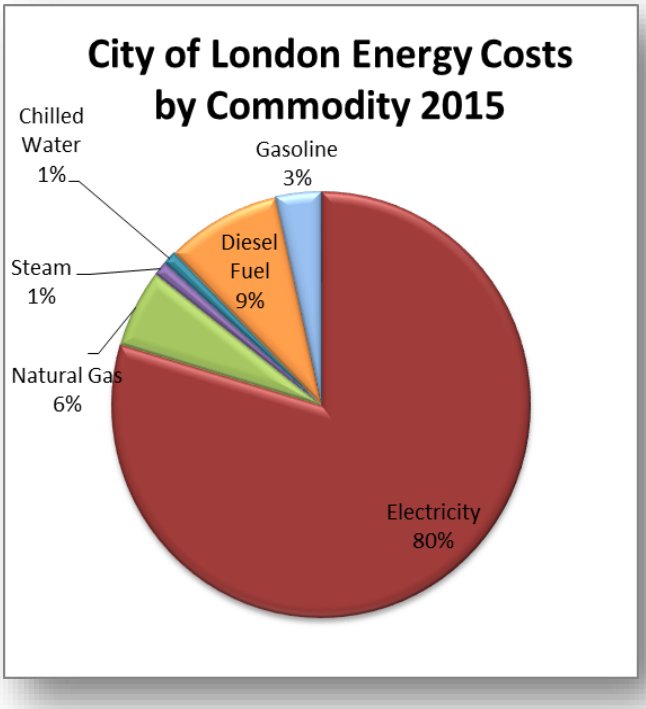
Table 9 – Energy Costs by Commodity 2007 – 2015

Energy Cost by Commodity	2007	2015	Change Since 2007 Variance	% Change
Electricity	$ 9,289,000	$ 15,163,000	$ 5,874,000	63%
Natural Gas	$ 2,350,000	$ 1,121,000	$ (1,229,000)	-52%
Steam	$ 273,000	$ 209,000	$ (64,000)	-23%
Chilled Water	$ 251,000	$ 203,000	$ (48,000)	-19%
Diesel Fuel	$ 1,518,000	$ 1,687,000	$ 169,000	11%
Gasoline	$ 664,000	$ 669,000	$ 5,000	1%
Total City of London	**$ 14,345,000**	**$ 19,052,000**	**$ 4,707,000**	**33%**

Over this longer period (Table 9), the dramatic changes in corporate energy costs are evident:

- Reduced natural gas costs due to the combination of lower use and lower natural gas prices
- Increased electricity costs driven solely by electricity prices since corporate electricity use has actually dropped by two percent

Given that electricity is the biggest source of energy the Corporation uses, the total combined costs are noticeably higher today (by 33%) compared to 2007.



In summary:

- Electricity represents the majority of the Corporation's energy costs, accounting for 80% in 2015. This is an increase of 6% compared to 2014.
- Natural gas consumption accounts for 6% of overall energy costs in 2015. This is 1% decrease compared to 2014.
- Diesel is the largest fuel type used within the City's vehicle fleet, given the large number of heavy-duty vehicles the City of London operates.

Even though there is an increase across all the municipal service categories in 2015 due to rising electricity prices, the decrease of 22 percent in vehicle fleet fuel costs resulted in an overall commodity cost increase of only two percent in 2015 (Table 10). This would be even higher if there was no change in fleet costs. Diesel and gasoline market prices have dropped to the lowest level in 2015 compared to last nine years.

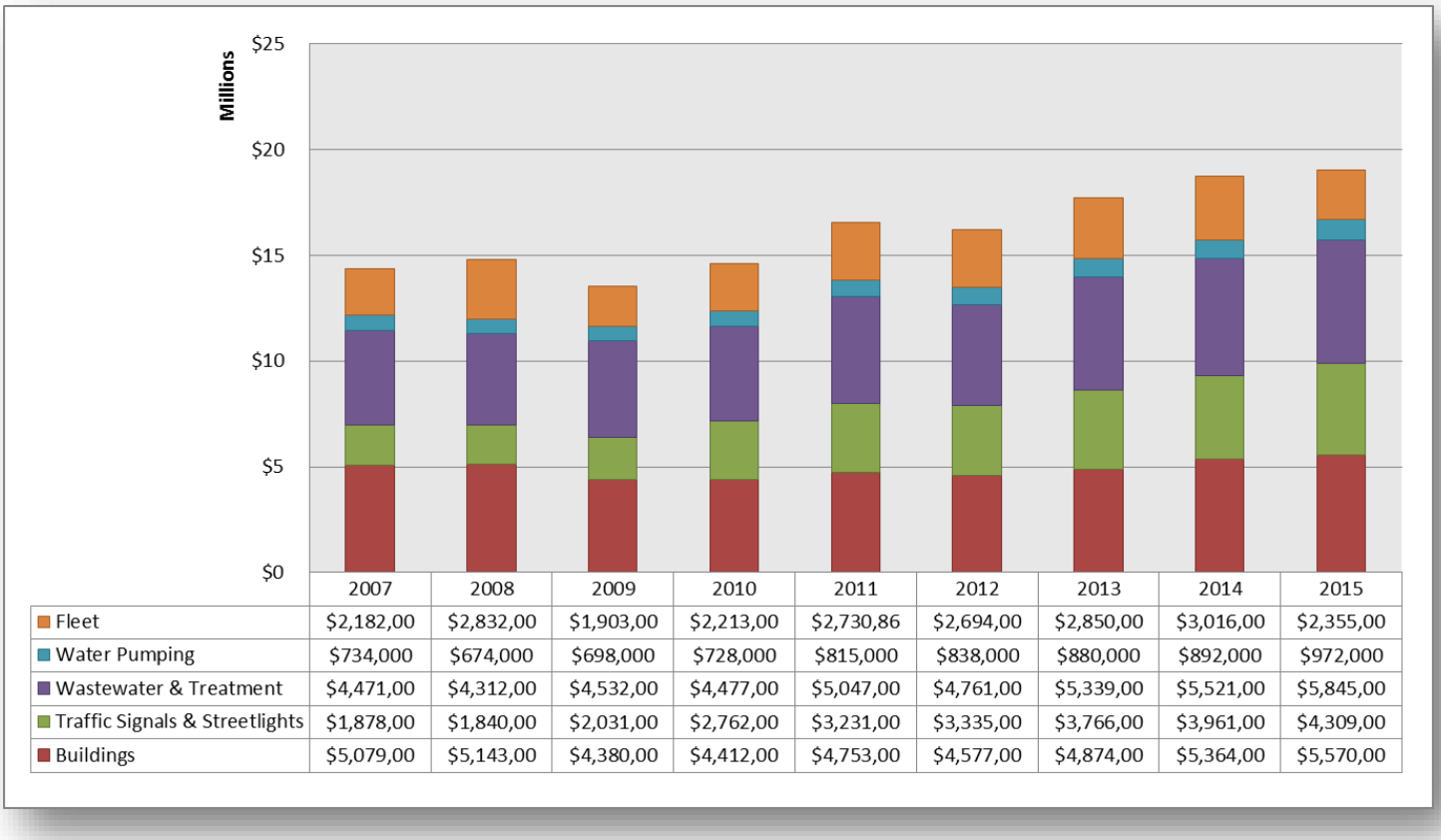
4.2.2 Energy Costs by Municipal Service Categories

Table 10 – Energy Costs by Municipal Service Categories Comparison 2014 – 2015

Energy Cost by Municipal Service Categories	2014	2015	Change since 2014 Variance	% Change
Buildings	$ 5,364,000	$ 5,570,000	$ 206,000	4%
Traffic Signals & Streetlights	$ 3,961,000	$ 4,309,000	$ 348,000	9%
Wastewater & Treatment	$ 5,521,000	$ 5,845,000	$ 324,000	6%
Water Pumping	$ 892,000	$ 972,000	$ 80,000	9%
Vehicle Fleet	$ 3,016,000	$ 2,355,000	$ (661,000)	-22%
Total City of London	**$ 18,754,000**	**$ 19,052,000**	**$ 297,000**	**2%**

Figure 4 is a representation of the energy overall cost by Municipal Service Categories per year since 2007.

Figure 4 – Total Energy Cost by Municipal Service Categories



	2007	2008	2009	2010	2011	2012	2013	2014	2015
Fleet	$2,182,00	$2,832,00	$1,903,00	$2,213,00	$2,730,86	$2,694,00	$2,850,00	$3,016,00	$2,355,00
Water Pumping	$734,000	$674,000	$698,000	$728,000	$815,000	$838,000	$880,000	$892,000	$972,000
Wastewater & Treatment	$4,471,00	$4,312,00	$4,532,00	$4,477,00	$5,047,00	$4,761,00	$5,339,00	$5,521,00	$5,845,00
Traffic Signals & Streetlights	$1,878,00	$1,840,00	$2,031,00	$2,762,00	$3,231,00	$3,335,00	$3,766,00	$3,961,00	$4,309,00
Buildings	$5,079,00	$5,143,00	$4,380,00	$4,412,00	$4,753,00	$4,577,00	$4,874,00	$5,364,00	$5,570,00

The trend in cost by municipal service categories indicate that there is a steady increase in energy costs since 2010. Fleet fuel costs are largely a factor of global prices for transportation fuels, which has seen significant price volatility since 2007.

The new Organic Rankine Cycle (ORC) project proposed at the Greenway Wastewater Treatment Plant (WWTP) to generate electricity using waste heat and the LED lighting project for

street lights which are planned to be completed in next two years should contribute towards avoided costs in the coming years.

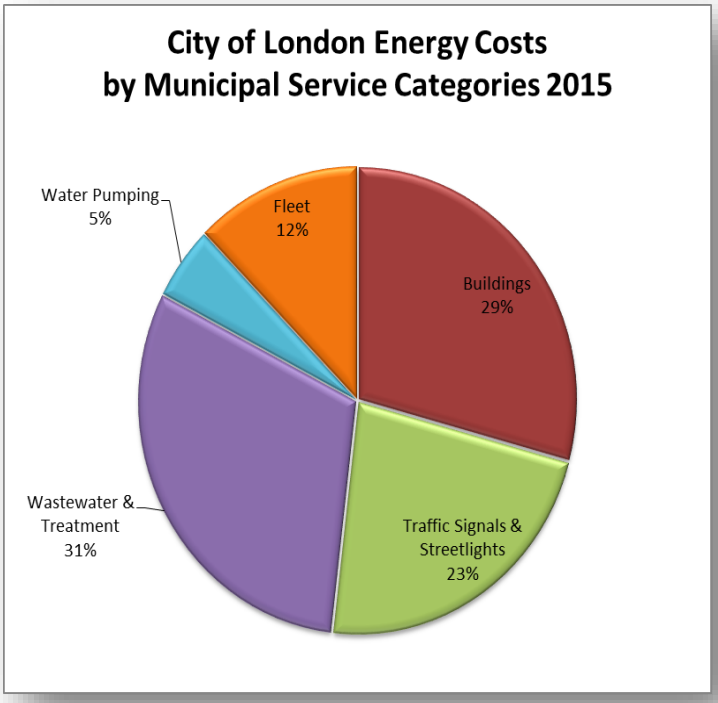
In Table 11, further detailed energy costs by municipal service categories in comparison to 2007 values is shown, along with the percentage of changes.

Table 11 – Energy Costs by Municipal Service Categories 2007 – 2015

Energy Cost by Municipal Service Categories	2007	2015	Change since 2007 Variance	% Change
Buildings	$ 5,079,000	$ 5,570,000	$ 491,000	10%
Traffic Signals & Streetlights	$ 1,878,000	$ 4,309,000	$ 2,431,000	129%
Wastewater & Treatment	$ 4,471,000	$ 5,845,000	$ 1,374,000	31%
Water Pumping	$ 734,000	$ 972,000	$ 238,000	32%
Vehicle Fleet	$ 2,182,000	$ 2,355,000	$ 173,000	8%
Total City of London	**$ 14,344,000**	**$ 19,052,000**	**$ 4,707,000**	**33%**

Those municipal service categories that rely on electricity have seen the highest increases in costs:

- Increased Water Pumping and Wastewater Treatment energy costs by 31% and 32% compared to 2007.
- Increased traffic signals & streetlight costs by 129% compared to 2007.



In summary:

- Wastewater & Treatment represents majority of the Corporation's energy cost by service area, accounting to 31% in 2015.
- Buildings continue to account for 29% of overall end user energy costs.
- Street lighting & traffic signals are the third highest contributor in energy consumed by end user at 23%.

4.2.3 Energy Costs Per Capita

The operation, maintenance and services provided by the City of London contribute to the overall corporate energy costs associated with serving the public, businesses and visitors of London.

Table 12 – Energy Costs Per Capita 2014 – 2015

Energy Costs by Municipal Service Categories	2014	2015	Change from Past Year Variance	% Change
Buildings	$ 5,364,000	$ 5,570,000	$ 206,000	3.8%
Traffic Signals & Streetlights	$ 3,961,000	$ 4,309,000	$ 348,000	8.8%
Wastewater & Treatment	$ 5,521,000	$ 5,845,000	$ 324,000	5.9%
Water Pumping	$ 892,000	$ 972,000	$ 80,000	9.0%
Fleet	$ 3,016,000	$ 2,355,000	$ (661,000)	-21.9%
Total City of London	**$ 18,754,000**	**$ 19,052,000**	**$ 297,000**	**1.6%**
London's Population	**375,000**	**378,000**	**3,000**	**0.8%**
Energy costs per person	**$ 50**	**$ 50**	**$ 0.39**	**0.8%**

Table 12 above reflects the corporate energy costs per capita by municipal Service Categories for the City of London.

The total energy costs for the City has increased by two percent but energy costs per capita remained stable with population growth at approximately one percent. This shows that the Corporate energy initiatives undertaken by the City are helping in achieving efficient performance.

Table 13 – Energy Costs per Capita by Municipal Service Categories 2007 – 2015

Energy Costs by End User	2007	2015	Change since 2007 Variance	% Change
Buildings	$ 5,079,000	$ 5,570,000	$ 491,000	9.7%
Traffic Signals & Streetlights	$ 1,878,000	$ 4,309,000	$ 2,431,000	129.4%
Wastewater & Treatment	$ 4,471,000	$ 5,845,000	$ 1,374,000	30.7%
Water Pumping	$ 734,000	$ 972,000	$ 238,000	32.4%
Fleet	$ 2,182,000	$ 2,355,000	$ 173,000	7.9%
Total City of London	**$ 14,344,000**	**$ 19,052,000**	**$ 4,707,000**	**32.8%**
London's Population	**355,000**	**378,000**	**23,000**	**6.5%**
Energy costs per person	**$ 40**	**$ 50**	**$ 9.99**	**24.7%**

The City of London's population has grown by 6.5 percent (23,000 people) since 2007. Table 13 above indicates the corporate energy costs per capita by municipal service categories in comparison to 2007. Nine years of commodity data shows continued energy cost increases for corporate energy with an overall increase of 25 percent in corporate energy cost per capita from 2007.

4.2.4 Total Corporate Energy Costs Summary

Total corporate energy costs continue to increase with the price of electricity in Ontario being the major contributor. However, corporate energy management practices by the City of London including cost avoidance measures through procurement, building retrofits, and other conservation measures assist in continued efforts to reduce amounts of energy used to help reduce the market cost increase.

The City of London requires a number of different initiatives to sustain and/or reduce energy costs. The cost per capita remained the same in 2015 versus 2014. The energy improvements and cost avoidance measures being implemented today are trying to avoid and sustain the market

changes and inflation costs the City of London is faced with in the associated costs to procure energy.

5. Corporate Energy Cost Avoidance

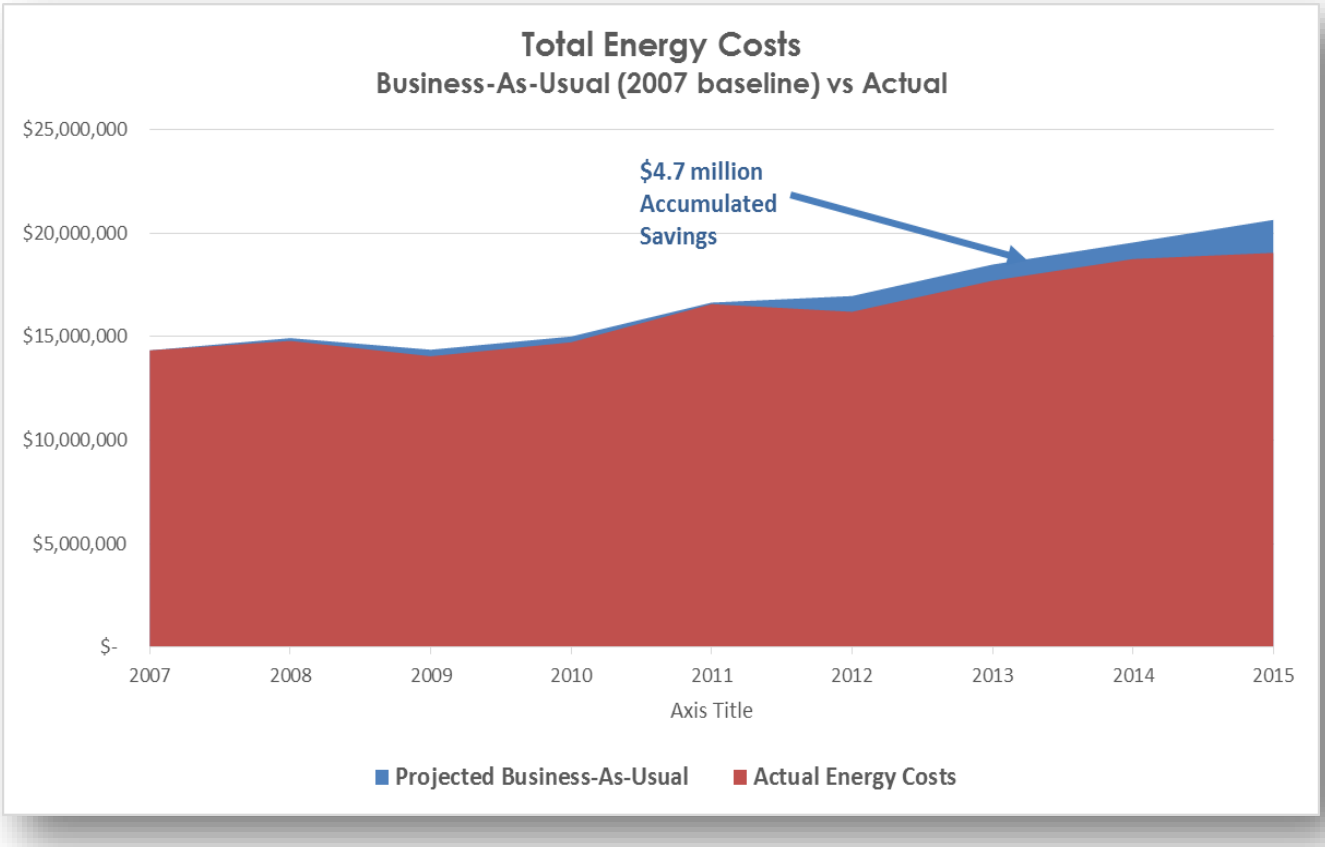
In terms of service delivery to Londoners, energy use per person has dropped by 14 percent since 2007 levels. This energy reduction can be attributed to recent energy conservation measures at Water, Wastewater & Treatment and facility upgrades.

Table 14 – Energy Costs Per Capita by Commodity 2007 – 2015

Energy Consumption (ekWh) by Commodity per person	2007	2015	Change since 2007 Variance	% Change	2007 compared to 2015 Avoided Costs
Electricity	305	281	(24)	-7.8%	$ (1,180,000)
Natural Gas	165	113	(53)	-31.8%	$ (356,000)
Steam	10	8	(2)	-23.6%	$ (49,000)
Chilled Water	5	4	(1)	-25.7%	$ (52,000)
Diesel Fuel	57	58	1	2.5%	$ 42,000
Gasoline	19	19	0	0.2%	$ 1,000
Total City of London	**561**	**482**	**(79)**	**-14.1%**	**$ 1,594,000**

Approximately $1.6 million in energy costs were avoided in 2015 compared to 2007 levels and more than $4.7 million in avoided energy costs have been accumulated since 2007 (Figure 5).

Figure 5 – Avoided Energy Costs (Accumulated)



6. Corporate Greenhouse Gas Emissions

In 2015, the City of London's corporate GHG emissions can be summarized by commodity and by municipal service categories. Based on the City of London's current use of electricity, natural gas, steam, chilled water, diesel and gasoline consumptions and costs, GHG emissions can be calculated.

The total GHG reflects the municipal operations and can be measured annually back to 2007. This allows the City of London to show trends in GHG emissions over the last nine years.

6.1 Total Corporate Greenhouse Gas Emissions

Overall, since 2007 the City of London has reduced its annual energy related carbon footprint by over 51 percent.

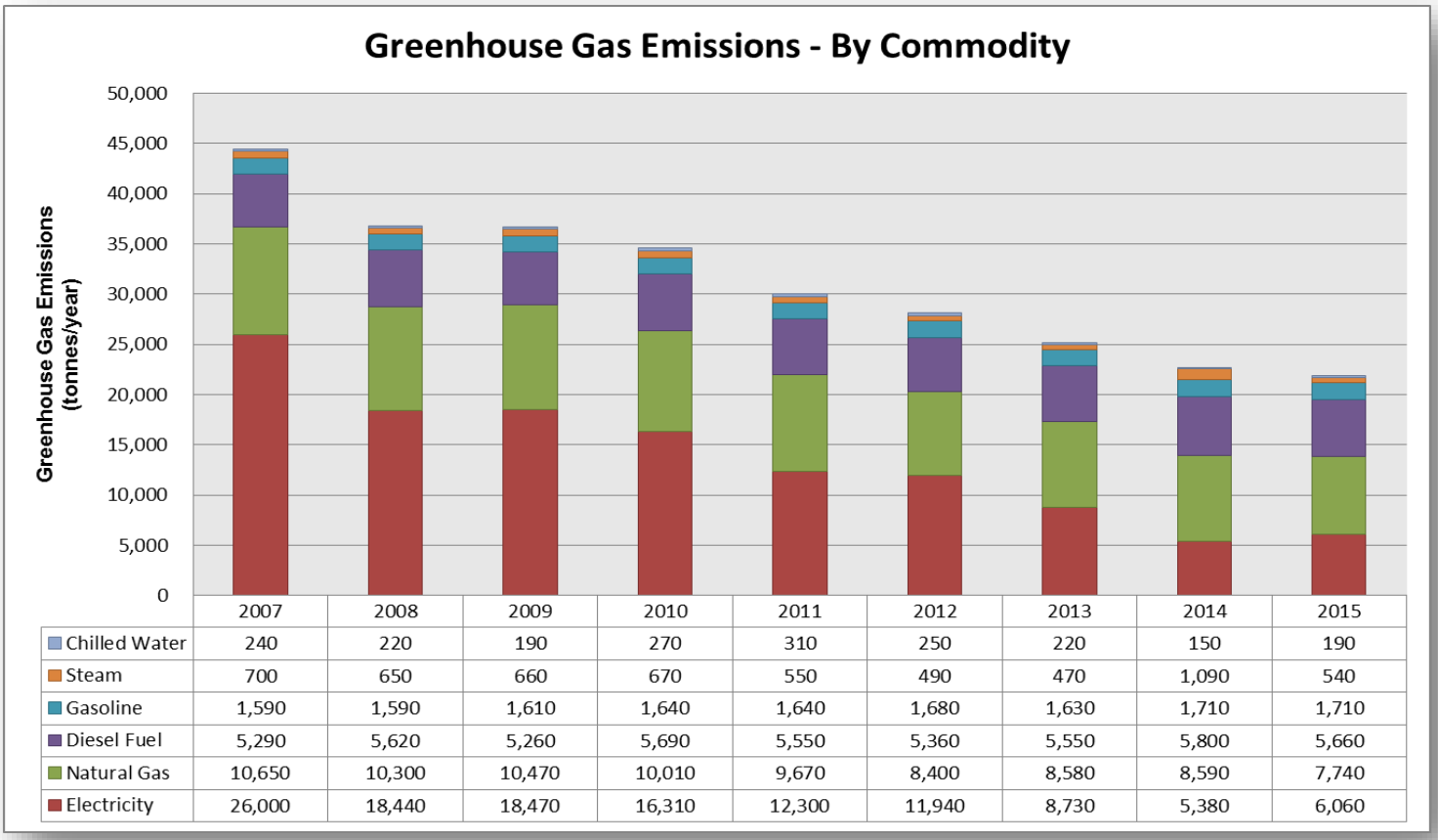
Table 15 – Greenhouse Gas Emissions by Commodity 2007 – 2015

GHG Emissions – By Commodity (tonnes/year)	2007	2015	Change since 2007 Variance (tonnes)	% Change
Electricity	26,000	6,060	(19,940)	-77%
Natural Gas	10,650	7,740	(2,910)	-27%
Diesel Fuel	5,290	5,660	370	7%
Gasoline	1,590	1,710	120	8%
Steam	700	540	(160)	-23%
Chilled Water	240	190	(50)	-21%
Total City of London	**44,500**	**21,900**	**(22,600)**	**-51%**

Most of the recent progress in reducing energy-related corporate greenhouse gas emissions is due to provincial action to replace coal-power plants with cleaner electricity generation.

The total GHG emissions by commodity, illustrated in Figure 6, is a representation of the GHG emission reductions since 2007.

Figure 6 – Greenhouse Gas Emissions – By Commodity



	2007	2008	2009	2010	2011	2012	2013	2014	2015
Chilled Water	240	220	190	270	310	250	220	150	190
Steam	700	650	660	670	550	490	470	1,090	540
Gasoline	1,590	1,590	1,610	1,640	1,640	1,680	1,630	1,710	1,710
Diesel Fuel	5,290	5,620	5,260	5,690	5,550	5,360	5,550	5,800	5,660
Natural Gas	10,650	10,300	10,470	10,010	9,670	8,400	8,580	8,590	7,740
Electricity	26,000	18,440	18,470	16,310	12,300	11,940	8,730	5,380	6,060

6.2 Total Corporate Greenhouse Gas Emissions by Municipal Service Categories

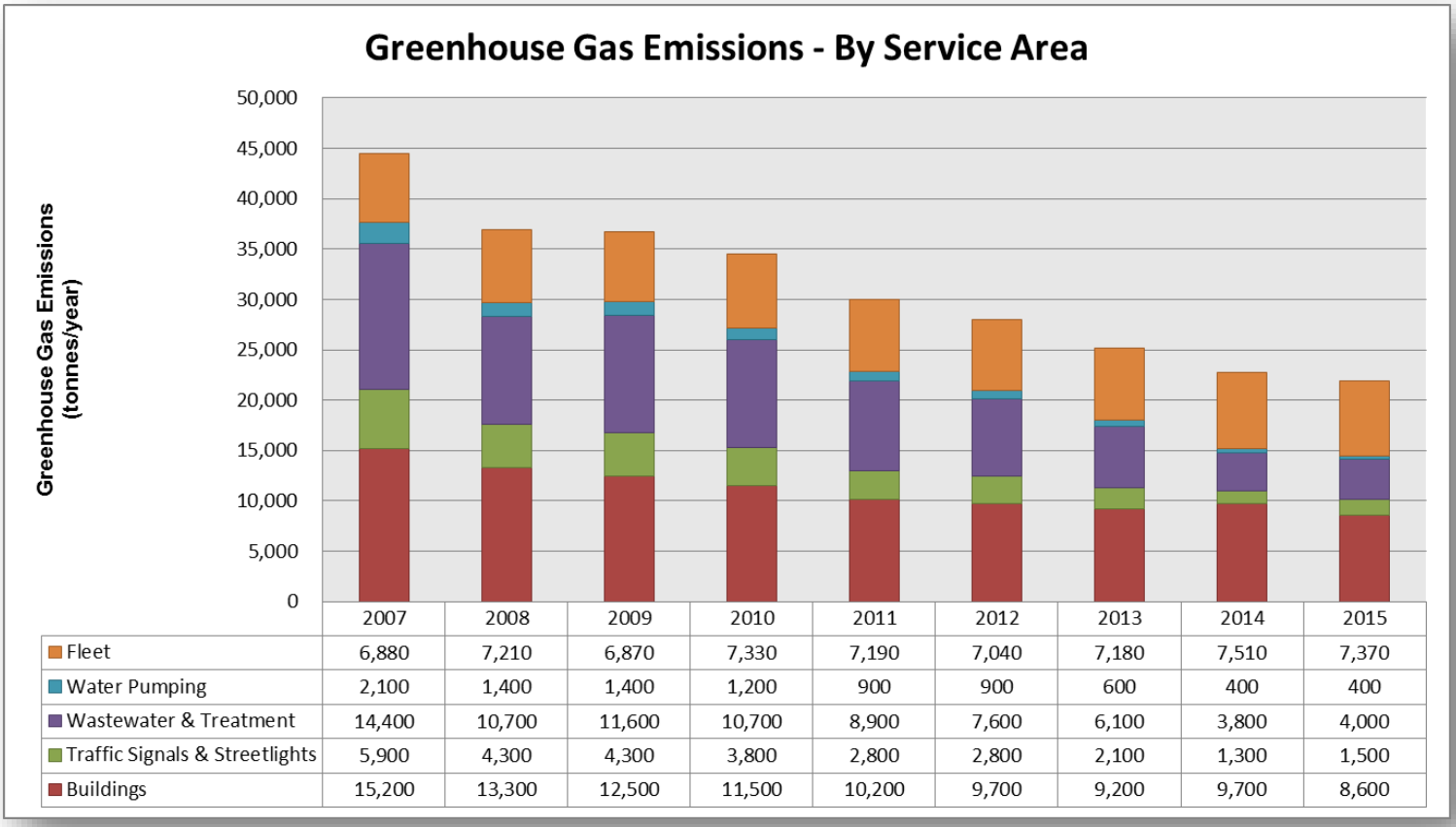
Table 16 represents trends for all municipal service categories for the City of London since the baseline year of 2007. (It should be noted that the total does not include landfill gas emissions. These are identified as part of community greenhouse gas generation estimates.)

Table 16 – Greenhouse Gas Emissions by Municipal Service Categories 2007-2015

GHG Emissions – By Municipal Service Categories (tonnes/year)	2007	2015	Change since 2007 Variance (tonnes)	% Change
Buildings	15,200	8,600	(6,600)	-43%
Traffic Signals & Streetlights	5,900	1,500	(4,400)	-75%
Wastewater & Treatment	14,400	4,000	(10,400)	-72%
Water Pumping	2,100	400	(1,700)	-81%
Fleet	6,880	7,370	490	7%
Total City of London	**44,500**	**21,900**	**(22,600)**	**-51%**

The total GHG emissions by municipal service categories illustrated in Figure 7 below is a representation of the GHG emission reductions by commodity since 2007.

Figure 7 – Energy Related Greenhouse Gas Emissions by Municipal Service Categories



	2007	2008	2009	2010	2011	2012	2013	2014	2015
Fleet	6,880	7,210	6,870	7,330	7,190	7,040	7,180	7,510	7,370
Water Pumping	2,100	1,400	1,400	1,200	900	900	600	400	400
Wastewater & Treatment	14,400	10,700	11,600	10,700	8,900	7,600	6,100	3,800	4,000
Traffic Signals & Streetlights	5,900	4,300	4,300	3,800	2,800	2,800	2,100	1,300	1,500
Buildings	15,200	13,300	12,500	11,500	10,200	9,700	9,200	9,700	8,600

Overall, since 2007 the City of London has reduced its annual energy related carbon footprint by over 51 percent (not including landfills). Compared to 2014 CDM baseline year, this has been reduced by four percent.

Those municipal service categories powered by electricity have seen the benefits associated with the phase-out of coal-fired power generation. The sludge dewaterer at Greenway WWTP has also contributed significantly to GHG emissions reductions through the reduced use of natural gas. In fact, had this action had not taken place, it is likely that the Greenway WWTP would have been considered a Large Emitter (i.e., a facility emitting more than 25,000 tonnes of GHGs per year) under Ontario's new Cap & Trade program.

The only municipal service category that has seen increased emissions has been fleet fuel use. Fleet greening efforts are in place, but the increasing size of London's population and urban land area places demands on City vehicles providing services to Londoners. This will the subject of the upcoming Green Fleet Strategy to be completed in Fall 2016.

The Corporation continues to search for innovative and collective ways to reduce GHG emissions from energy use.