



HAMILTON-WENTWORTH
DISTRICT SCHOOL BOARD



Conservation and Demand Management Plan 2014 - 2019

MAY 2017 UPDATE

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1) Introduction

Under the Green Energy Act 2009, (Ontario Regulation 397/11) public agencies as municipalities, municipal service boards, school boards, universities, colleges and hospitals are required to report on their energy consumption and greenhouse gas (GHG) emissions beginning in 2013 and to develop and implement energy Conservation and Demand (CDM) plans starting July 1, 2014.

The Hamilton-Wentworth District School Board is 100% funded by the Ministry of Education. In developing our Five Year Energy Conservation and Demand Plan it is assumed that the current level of funding will continue at the same or higher dollar values.

The Hamilton-Wentworth District School Board currently has 104 elementary and secondary schools, with a total enrolment of 49,551 students. The chart below reflects the age and square footage of buildings in the HWDSB portfolio. Currently there are 74 buildings constructed prior to 1970.

Construction Year	Total Number of Buildings	Total Building Area (Includes Portables) (m ²)
Constructed Prior to 1970	74	429,090
Constructed 1970-1979	4	17,063
Constructed 1980-1989	4	14,796
Constructed 1990-1999	6	64,077
Constructed 2000+	16	105,102

Fig.1- Number of Buildings versus age range

The Hamilton-Wentworth District School Board endeavours, as it has in the past, to continue our commitment of reducing both its energy consumption and resulting associated generated greenhouse gases. We have a responsibility to reduce or eliminate unnecessary consumption as part of the community and moral responsibility to our students whom will inherit the planet.

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The Hamilton-Wentworth District School Board currently uses and continually upgrades a large variety of energy efficient Heating and Ventilation & Air Conditioning (HVAC) equipment. These include items such as fully-condensing boilers; advanced technology air handling equipment such as Heat Recovery Units & Energy Recovery Units; Roof Top Air Handlers with Economizers; Heat Pumps, and High Tech Chillers; and Variable Frequency Drives on pump and fan motors.

The school board has 100+ sites with varying levels of computerized Building Automation Systems (BAS). The BAS controls and monitors operation of a variety of items including HVAC and lighting. While providing proper Indoor Air Quality (IAQ) for our occupants, the BAS allows more flexible operation and scheduling of equipment.

Both exterior and interior lighting have seen many upgrades to more efficient means while maintaining an excellent learning environment for our Staff and Students. In addition a wide variety of lighting controls are used to reduce unnecessary electrical consumption. Such controls are motion detectors, daylight harvesting and BAS.

The HWDSB ensures the selection of building products used for both new construction or renovations are of a high standard as they relate to “R” insulation value. Examples of these are window glazing, wall & roof insulation, pipe insulation, and insulated exterior doors.

The HWDSB also endeavours to promote environmental stewardship amongst our schools by participation in the Ministry of Education’s Eco-School Program. The program for grades 1-12 students is intended to develop ecological literacy while engaging them in practices to become environmentally responsible citizens.

The HWDSB currently has rooftop photovoltaic solar panels installed at the Education Centre, one secondary school and 7 elementary schools, generating power back to the local distribution company hydro grid.

Currently the HWDSB is trialing a program of displaying energy usage on a monitor in a school lobby. The monitor, referred to as a “Dashboard”, is set up to display real time energy consumption, historical use and school eco messages. Elsewhere, this has been proven to be very engaging for students as they can become interactive with building energy use. We currently have real time energy consumption meters installed at approximately 25 of our schools.

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2) Energy Consumption and Greenhouse Gas Emissions

The following is the energy consumption data for the HWDSB from September 1, 2012 to August 31, 2013.

Total Electricity (kWh)	49,839,540.00
Total Natural Gas (m ³)	8,783,727.91
Total Thermal Energy (Giga Joules)	8769.6
Energy Intensity for the board (ekWh/ft ²)	19.27
Greenhouse Gas Emissions (kgCO ₂)	24,988,294.00

Fig. -2 The above is the baseline year for which the HWDSB 5 year energy and consumption plan will be benchmarked.

3) Energy Conservation Goals, Objectives & Results

The Hamilton-Wentworth District School Board has set a quantitative conservation goal of a 12% reduction in equivalent kilowatt hours used per square foot or ekWh/ft² over the five year implementation period. Ongoing reductions for the 5 year energy and consumption plan will be calculated utilizing as baseline, the 2012/2013 fiscal year, of a 19.27 ekWh/ft². The 5 year energy intensity target would be 16.96 ekWh/ft². Please see Appendix-A.

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Year	2012/2013 (ekWh/ft ²) (Baseline Year)	2014/2015 (ekWh/ft ²)	2015/2016 (ekWh/ft ²)	2016/2017 (ekWh/ft ²)	2017/2018 (ekWh/ft ²)	2018/2019 (ekWh/ft ²)	Quantitative Goal
Conservation Target Reduction in (%)		3	3	2	2	2	12
Energy Intensity Target	19.27	18.69	18.12	17.73	17.34	16.96	2.31

Fig. 3 - Yearly ekWh targets versus baseline

Energy Conservation Results (End of FY2016 Update)

In July 2014, Facilities Management submitted the Energy Conservation & Demand Management Plan for the period of FY2014 through FY2019 (<http://www.hwdsb.on.ca/wp-content/uploads/2013/06/HWDSB-Conservation-Demand-and-Management-Plan-2014-2019.pdf>) to the Ministry. In that plan, HWDSB committed to the following reductions in our overall energy intensity (equivalent kilowatt-hours consumed per square foot of building area):

Year	2012/2013 (ekWh/ft ²) (Baseline Year)	2014/2015 (ekWh/ft ²)	2015/2016 (ekWh/ft ²)	2016/2017 (ekWh/ft ²)	2017/2018 (ekWh/ft ²)	2018/2019 (ekWh/ft ²)	Quantitative Goal
Conservation Target Reduction in (%)		3	3	2	2	2	12
Energy Intensity Target	19.27	18.69	18.12	17.73	17.34	16.96	2.31

Using a baseline year of fiscal year 2013, HWDSB committed to, beginning in fiscal year 2015, an overall energy intensity reduction of between 2-3% per year up to the end of fiscal year 2019. At the end of fiscal year 2019, that plan stated that HWDSB should have reduced our overall energy intensity by a cumulative total of 12%.

The table below indicates our progress in that regard using raw data. With raw data, all factors are taken into account, including the weather, which we obviously have no control over.

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Hamilton-Wentworth District School Board - Energy Profile (Raw data)	FY2012	FY2013 (Baseline Year)	FY2014	FY2015	FY2016
Electrical Consumption for the board (kWh)	52,145,012.00	50,643,136.00	48,626,156.00	47,444,816.00	45,049,832.00
Total Electricity Budget (\$)	\$5,640,854.00	\$5,845,854.00	\$6,442,854.00	\$5,597,435.00	\$5,886,700.00
Total Electricity Cost (\$)	\$6,034,699.15	\$5,927,346.90	\$6,386,486.08	\$6,633,019.97	\$7,473,663.14
Electricity Cost per Unit (\$/kWh)	\$0.1157	\$0.1170	\$0.1313	\$0.1398	\$0.1659
Year-To-Year Electricity Cost Increase		1.13%	12.22%	6.45%	18.66%
Natural Gas Consumption for the board (m ³)	8,227,119.38	8,783,734.88	10,343,644.96	9,163,822.48	7,303,063.57
Total Natural Gas Budget (\$)	\$2,521,493.00	\$2,213,718.00	\$2,423,293.00	\$2,950,000.00	\$2,532,500.00
Total Natural Gas Cost (\$)	\$2,013,413.39	\$1,993,511.03	\$2,929,438.49	\$2,186,518.00	\$1,648,347.86
Natural Gas Cost per Unit (\$/cubic metre)	\$0.2447	\$0.2270	\$0.2832	\$0.2386	\$0.2257
Natural Gas Cost per Unit (\$/ekWh)	\$0.0235	\$0.0218	\$0.0272	\$0.0230	\$0.0217
Year-To-Year Natural Gas Cost Increase		-7.26%	24.79%	-15.75%	-5.41%
District Heat Consumption for the board (GJ)	6,247.08	8,770.32	8,330.04	10,565.28	8,511.96
Total District Heat Budget (\$)	\$213,839.00	\$143,839.00	\$143,839.00	\$145,000.00	\$142,100.00
Total District Heat Cost (\$)	\$191,283.25	\$110,925.35	\$137,275.62	\$126,824.58	\$118,687.64
District Heat Cost per Unit (\$/GJ)	\$30.62	\$12.65	\$16.48	\$12.00	\$13.94
District Heat Cost per Unit (\$/ekWh)	\$0.1102	\$0.0455	\$0.0593	\$0.0432	\$0.0502
Year-To-Year District Heat Cost Increase		-58.69%	30.30%	-27.16%	16.16%
Total Energy Consumption for the board (ekWh)	138,784,192.00	143,727,488.00	157,686,480.00	144,950,272.00	122,781,880.00
Energy Intensity for the board (ekWh/ft ²)	17.97	19.17	21.07	19.40	16.50
Year-To-Year Energy Intensity Reduction - Target		Baseline Year		3.00%	3.00%
Year-To-Year Energy Intensity Reduction - Actual		Baseline Year		-1.16%	14.92%
Year-To-Year Energy Intensity Reduction - Target (Cumulative)		Baseline Year		3.00%	6.00%
Year-To-Year Energy Intensity Reduction - Actual (Cumulative)		Baseline Year		-1.16%	13.76%
Energy per Student for the Board (ekWh)	3,097.45	3,128.75	3,474.33	2,938.73	2,316.60
Greenhouse Gas Emissions (kgCO ₂)	20,428,184.00	20,493,154.00	21,888,458.00	19,395,376.00	15,759,302.00
Emissions Intensity (kgCO ₂ /m ²)	28.47	29.43	31.48	27.94	22.80

Based on the data above, HWDSB has achieved an overall energy intensity reduction of 13.76%. This reduction exceeds the 6% target expected at the end of fiscal year 2016 by 130%.

In the next table below, the same consumption data is displayed, however, in this table, the data has been weather normalized. Weather normalization is a statistical process designed to remove the impact of abnormal or extreme weather conditions from historical load data. This means that after historical consumption data has been weather normalized, any residual reduction or increase in overall energy intensity from year to year can be directly attributed to the efforts of Facilities Management staff (i.e. energy conservation measures, school consolidations/closures, etc.).

The table below indicates our progress using data which has been weather normalized to fiscal year 2013 weather data from the Burlington Piers weather station.

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Hamilton-Wentworth District School Board - Energy Profile (Weather normalized to the Burlington Piers Weather Station using FY2013 data)	FY2012	FY2013 (Baseline Year)	FY2014	FY2015	FY2016
Electrical Consumption for the board (kWh)	48,539,480.00	49,692,880.00	46,879,484.00	45,517,508.00	44,664,580.00
Natural Gas Consumption for the board (m ³)	9,103,182.95	8,258,512.40	8,169,420.16	7,647,817.83	7,443,744.19
District Heat Consumption for the board (GJ)	7,414.07	8,759.62	7,304.21	7,173.32	7,199.74
Total Energy Consumption for the board (ekWh)	144,543,792.00	137,353,952.00	133,216,848.00	126,435,576.00	123,483,952.00
Energy Intensity for the board (ekWh/ft ²)	18.71	18.32	17.80	16.92	16.60
Year-To-Year Energy Intensity Reduction - Target		Baseline Year		3.00%	3.00%
Year-To-Year Energy Intensity Reduction - Actual		Baseline Year		7.67%	1.90%
Year-To-Year Energy Intensity Reduction - Target (Cumulative)		Baseline Year		3.00%	6.00%
Year-To-Year Energy Intensity Reduction - Actual (Cumulative)		Baseline Year		7.67%	9.57%
Energy per Student for the Board (ekWh)	3,225.99	2,990.00	2,935.18	2,563.37	2,329.85
Greenhouse Gas Emissions (kgCO ₂)	21,763,202.00	18,960,760.00	17,353,224.00	16,332,024.00	15,923,968.00
Emissions Intensity (kgCO ₂ /m ²)	30.33	27.23	24.96	23.52	23.04

Based on the data above, HWDSB has achieved an overall energy intensity reduction of 9.57%. This reduction exceeds the 6% target expected at the end of fiscal year 2016 by 60%.

This reduction in overall energy intensity can be directly attributed to the work initiated by Facilities Management in the Operations and Capital divisions.

The HWDSB energy intensity reduction target of 12% by the end of fiscal year 2019 is an extremely ambitious target. For reference, listed below are the reduction targets that other school boards in our area have set for themselves:

- a. District School Board Of Niagara (DSBN) - 5% reduction in energy consumption by the end of fiscal year 2019 (fiscal year 2012 baseline year)
- b. Hamilton-Wentworth Catholic District School Board (HWCDSD) - 2% reduction in energy consumption by the end of fiscal year 2019 (fiscal year 2012 baseline year)
- c. York Catholic District School Board (YCDSB) - 5% reduction in energy intensity by the end of fiscal year 2019 (1% reduction per year)
- d. Halton Catholic District School Board (HCDSB) - no quantifiable reduction target stated on their plan

Staff believe that the overall energy reduction target of 12% by the end of fiscal year 2019 remains achievable.

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4) Conservation and Demand Management Measures

A combination of measures will assist the HWDSB in reaching the reduction target in energy use. As shown below in Fig. 4 these include such areas as construction, operations, and occupant behaviour.

Conservation Goal												
		FY2013										
Total Building Area (includes portables) (m ²)		713,939										
Total Building Area (includes portables) (ft ²)		7,684,839										
Energy Consumption for the board (ekWh)		140,487,616										
		2014-15		2015-16		2016-17		2017-18		2018-19		2014-19
		Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (ekWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (ekWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (ekWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (ekWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (ekWh)	Estimated Total Accumulated Energy Savings (ekWh)
Design, Construction and Retrofit Strategies	\$	1,797,000	1,794,532	\$ 576,000	732,985	\$ 185,000	167,901	\$ 470,000	751,852	\$ 745,000	1,204,989	15,116,607
Operations and Maintenance Strategies Total	\$	46,000	92,279	\$ 45,000	88,557	\$ 20,000	29,184	\$ 20,000	58,130	\$ 20,000	58,130	1,077,568
Occupant Behaviour Strategies Total	\$	8,000	20,209	\$ 22,500	32,690	\$ 22,000	27,332	\$ 23,000	37,988	\$ 24,000	48,585	438,541
TOTAL	\$	1,851,000	1,907,020	\$ 643,500	854,232	\$ 207,000	224,477	\$ 513,000	847,771	\$ 789,000	1,311,714	16,632,717
Percentage reduction			1		1		0		1		1	2.367855191
Conservation Goal (ekWh/m²)			2.67		1.20		0.31		1.19		1.84	23.30
Conservation Goal (ekWh/ft²)			0.248153546		0.1111581		0.029210362		0.1103173		0.17069	2.164354474

Fig. 4 Calculated Goal

In addition to the above planned work to lower levels of energy consumption, the HWDSB Facilities Management Team will be targeting the 15 schools with the highest energy intensity levels (ekWh). These will be identified based on our Utility Consumption Database (UCD) and Ministry of Energy annual reporting. Step one will be an ASHRAE Level One audit to determine a strategy for reducing consumption at each of the sites. Outcomes from these reports could provide a variety of recommendations, from equipment replacement, increased insulation levels, suggested changes to occupant behaviours, or perhaps a re-commissioning of the entire HVAC & BAS system within site.

Further reductions in HWDSB GHGs will come as result of a reduction in surplus space from currently approved and any future potential school consolidations or closures. As schools are closed, operation and energy funding for those sites will be reinvested in remaining sites.