



Report to Board of Trustees

May 14, 2018

Subject: Energy Update

Recommendation

This report is for the information of the Board.

Status

2016/17 Energy Use Intensity and Consumption

Energy Use Intensity (EUI) measured in equivalent kilowatt hours per square metre (ekWh/m²) is the base unit for comparison purposes. This metric is developed by first using heating degree days to weather normalize the gas consumption, as its use is nearly exclusive for space heating. Cubic metres of gas or gigajoules, as reported by the utilities, are then converted to equivalent kilowatt hours (ekWh). Total energy consumption is calculated by adding ekWh of gas use to electrical consumption, already reported in kWh.

Determining intensity involves accounting for square footage of all facilities in our inventory including portables and port-a-packs as well as changes to school areas due to additions or school closures. This produces the EUI measured in ekWh/m².

Previous reports used a baseline of 2008 (January through December calendar year) as a benchmark. It is important to note that subsequent data is presented on a school calendar year basis.

EUI is presented in Figures 1a and 1b as follows:

Figure 1a – Energy Use Intensity by Panel (ekWh/m²) versus Year

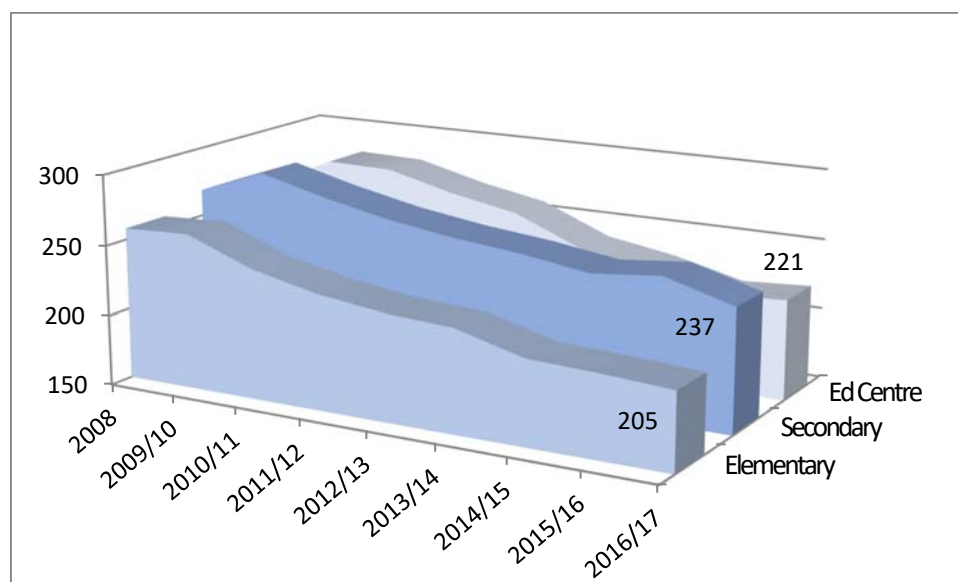
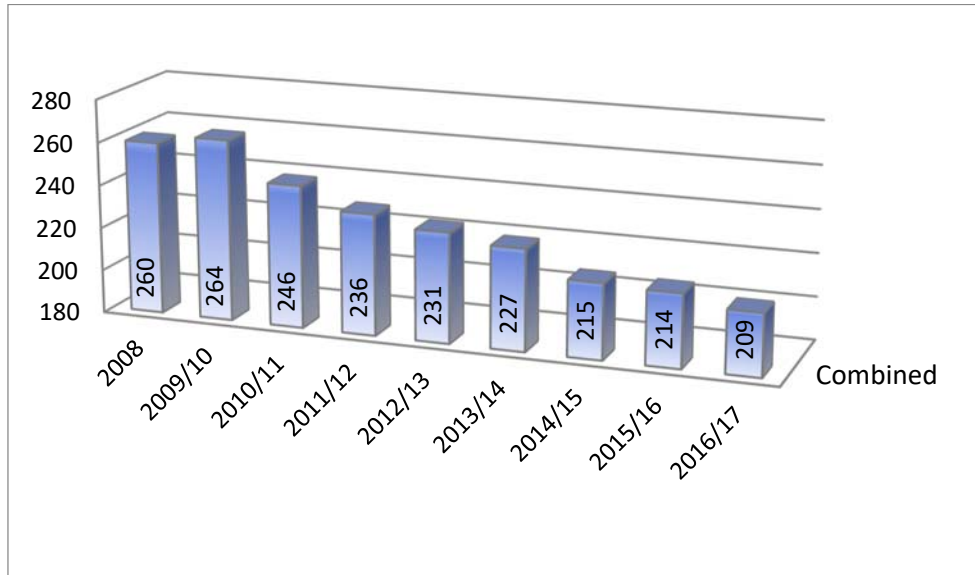


Figure 1b – Energy Use Intensity Combined (ekWh/m2) versus Year



The Board has experienced a 19.6% reduction in EUI when comparing 2016/17 to 2008 for the average energy intensity for both elementary and secondary schools as well as outdoor and education centres. Overall reduction in electricity was 13.58% and natural gas was 22.0% during this same period.

Detailed EUI for each school is presented in Appendix A for elementary and Appendix B for secondary schools and the Education Centre.

Consumption by commodity is an important factor that drives expenditures. Natural gas continues to be at a comparatively low cost to electricity. As such, a greater reliance on gas as a resource continues to be beneficial for our operational budget but generates greater greenhouse gas (GHG) emissions.

Energy consumption and expenditures for 2016/17 are presented in Figures 2 and 3 respectively;

Figure 2 – Energy Consumption by Commodity

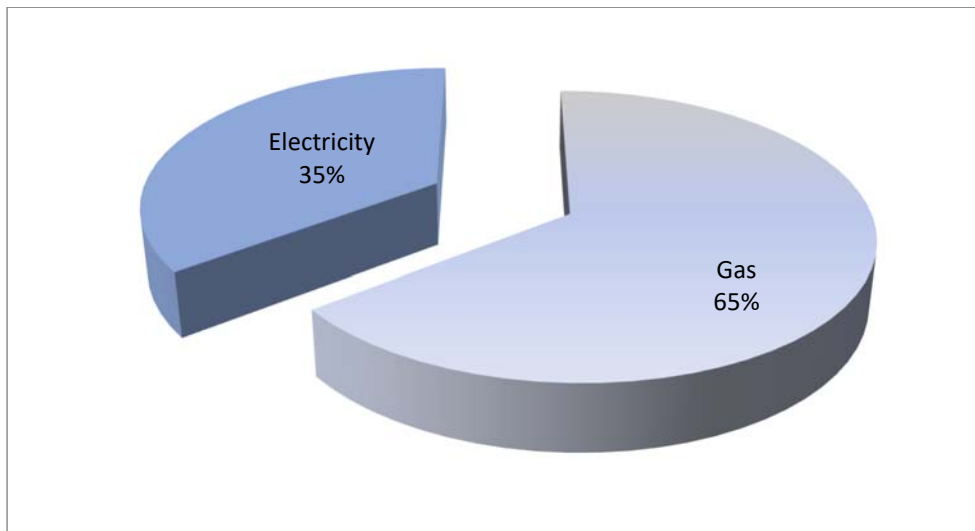
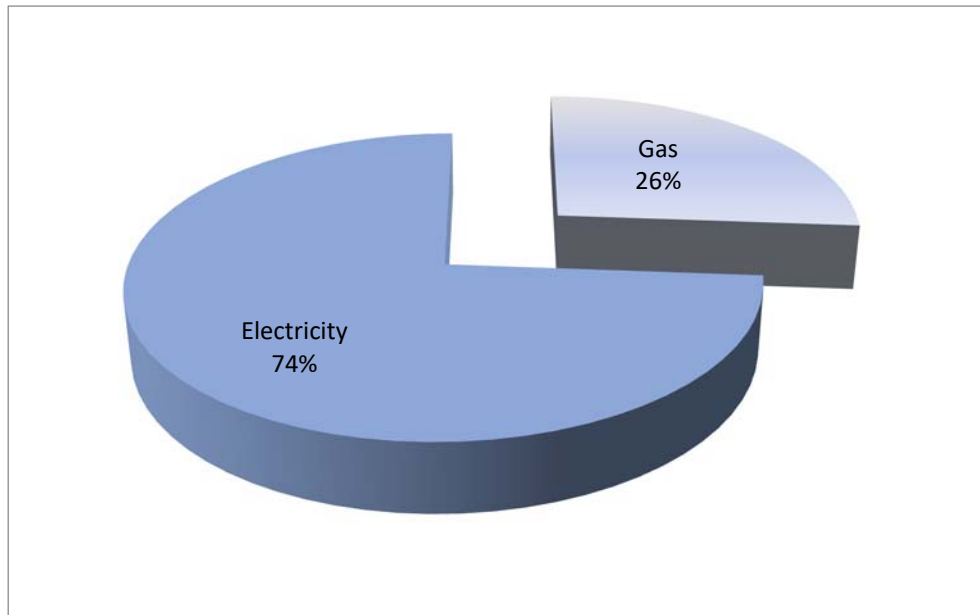


Figure 3 – Energy Expenditures by Commodity



On average for 2016/17, gas cost was approximately 2.8 cents per ekWh and electricity cost was approximately 17.4 cents per ekWh with a combined cost for both commodities at 7.8 cents. The combined utility cost appears to have stabilized and remains consistent from that of the previous year.

Energy intensity is driven by consumption. Consumption is an aspect over which the Waterloo Region District School Board (Board) and its stakeholders have partial control. Factors that are controllable may include:

- Student and staff behaviour
- Waste minimization
- Use of efficient technologies
- Automation and control (occupancy sensors or building automation systems)
- Building envelope improvements
- Reduction of equipment power use and heat gain (LED lighting, chromebooks / tables and similar).
- Designated periods of set-back and/or shut down

Consumption is also driven by factors beyond stakeholder control and can include factors such as:

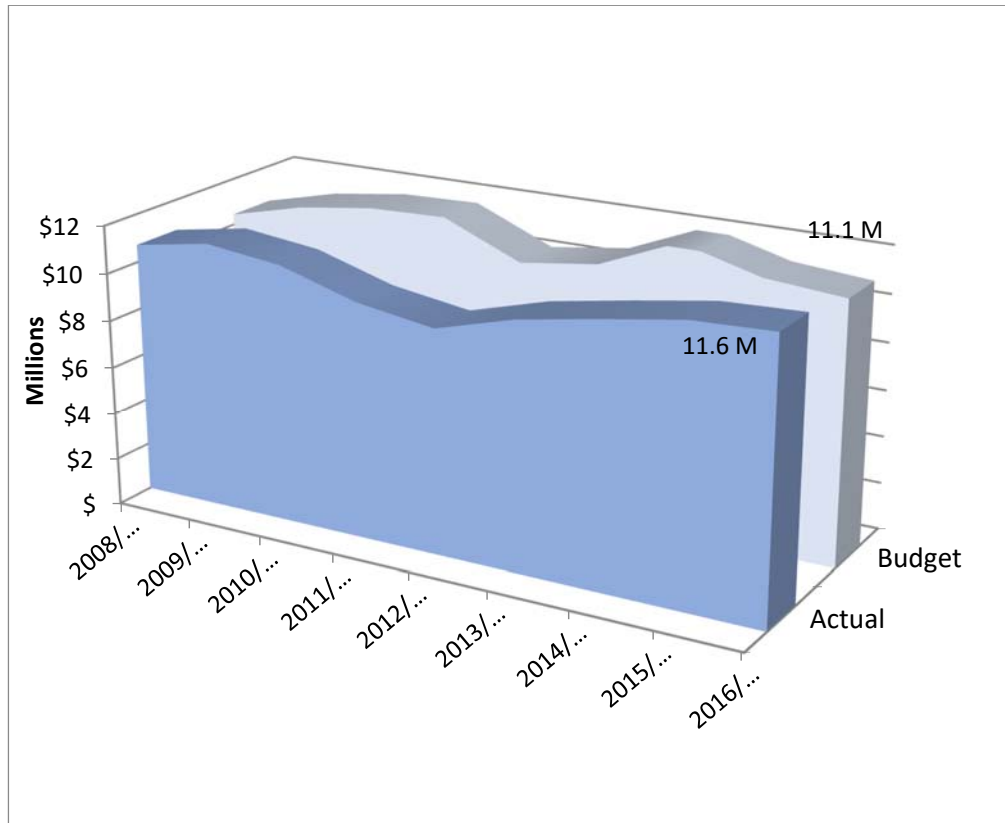
- Weather (warmer summer and shoulder season drives cooling demand)
- Hours of operation (extended use for Ministry initiatives such as Community Use)
- School closures (disposal of redundant school sites, port-a-packs or portables)
- Expansion of facilities and square footage (new schools or school additions)

Energy Budget and Expenditure

An nine year history of Board budgets and expenditures for electricity and gas are presented in Appendix C. The Board gas and electricity budget for 2016/17 was \$11.1M and expenditures were \$11.6M

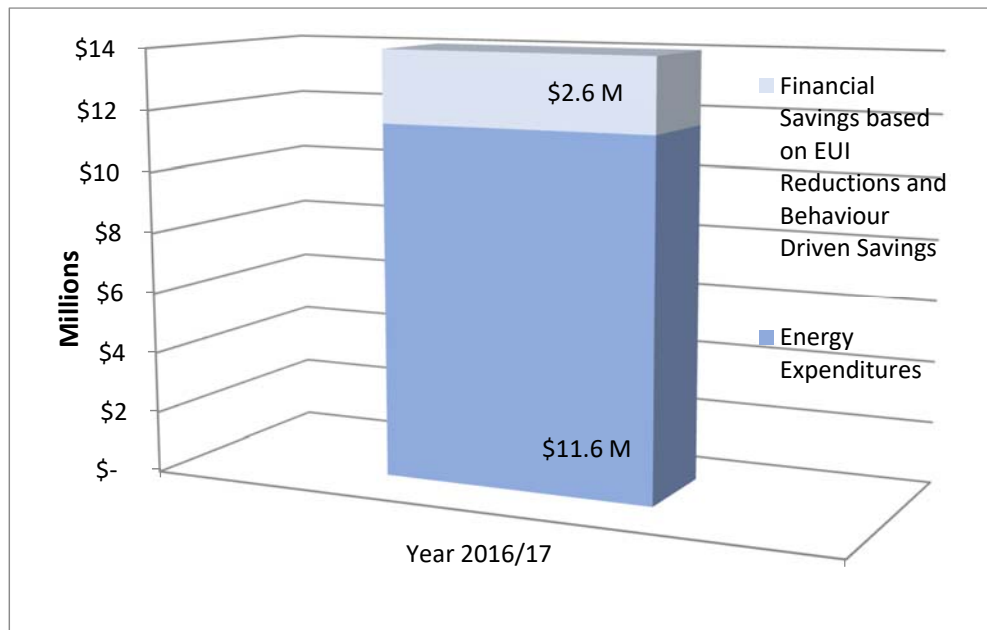
It is important to note when reviewing this information that budget and actual expenses cannot be compared directly year over year as a metric for operational efficiencies. Consumption is user and weather dependent and costs are market dependent. Market pricing and weather is something the Board has limited to no control over and both fluctuate year to year. Business Services staff continues to employ a 5 year cost averaging approach purchasing strategy working through a consortium. This minimizes the Board's exposure to spot market pricing and helped offset substantial increases in transmission, distribution and other service fees that the Board continues to experience. Figure 4 presents the board's budget versus expenditures since 2008.

Figure 4 – Budget and Expenditures (Dollars) versus Year



Costs offset by energy efficiency measures, not only from gains through building upgrades but also from changes in occupant practices, are estimated as noted below. This compares the base line EUI for 2008 at 260 ekWh/m² vs the EUI for 2016/17 at 209 ekWh/m² with both at the current cost of 7.8 cents. Figure 5 represents almost \$2.6M in offset costs for 2016/17 due to EUI reductions and behaviour driven savings.

Figure 5 – Reduction as compared to base line (Dollars) for 2016/17



Regardless of our best efforts to reduce consumption by driving down EUI, energy costs, in particular cost for electricity, are likely to continue to rise in the future. Natural gas costs, although currently stable, may be affected by carbon trade arrangements or other government initiatives. Offsetting these costs by reducing our EUI is critical to minimizing the anticipated increases in future budgets and expenditures.

Operations

Changing human behaviour is our most promising as well as our most challenging area in resource conservation. Presentations by Facility Services staff to schools as part of the elementary and secondary curriculums on energy efficiency and conservation provides a direct link with students and educators. Similar presentations and ongoing dialogue with custodial and maintenance personnel, school administrators and others, provides awareness and training. Feedback at last year’s presentation to Board of Trustees resulted in the realignment of resources in Facility Services, expanding the role of the Supervisor of Energy Conservation in this area.

The continuation of the Canada Summer Jobs program, assisting Facility Services with energy efficiency and resource conservation, was again funded in 2017 by the Government of Canada. It’s anticipated this program will continue in 2018 but feedback from the Ministry of Employment and Social Development has not yet flowed through.

Technologies

As we construct new facilities or renew older facilities, Facility Services continue to implement suitable energy efficiency technologies, including;

- Energy/heat recovery (ERV / HRV) for building fresh air
- Variable speed drives (VFD) for larger fans and pumps
- Electronically commutated motors (ECM) for smaller fans and pumps
- Occupancy sensors and daylight harvesting for interior lighting

- Astronomical clock control of exterior lighting
- T-8 / High Intensity Discharge (HID) to Light Emitting Diode (LED) lighting retrofits
- Carbon Dioxide (CO₂) demand control ventilation
- Humidity based free cooling in addition to temperature control
- Direct Digital Control (DDC) building automation systems
- Condensing gas air handling units for gyms and similar spaces
- Condensing space heating boilers and domestic hot water heaters
- Time-of-day control for electric heat at existing schools
- Occupancy control for cooling and ventilation in portables
- Regression analysis for boiler plant retrofits
- Energy modeling of new schools with targets for architects on exceeding building energy codes by 25% or more
- Commissioning of building controls for new builds and energy audits for older / poor performing schools

In addition a number of pilot programs continue to pursue energy and resource conservation, including;

- Cooling through high efficiency Gas Heat Pump (GHP) systems
- Load shedding cooling controls for summer schools
- Eyedro and AlbertLabs point of use remote power or water monitoring meters
- Retrofit of water meters at all cooling towers and play field irrigation systems
- Desiduous shade trees in strategic areas to minimize solar heat gain
- Envelope thermography to assist in determining breaches in the building
- Replacement of free flowing urinal tanks with low flow flush valves
- Media Induced Crystallization (MIC) in place of water softeners to reduce salt / water use and maintenance needs.
- Direct replacement LED lamps for non-renovated spaces as part of regular school maintenance

As implementations of these technologies help reduce consumption, Business Services staff intends to continue the expansion and use of such technologies in line with available funding, while targeting a reasonable, 3 year to 7.5 year, return on investment (ROI). It should be noted that while technology is a great resource to reduce consumption, our greatest opportunity to leverage reductions is to change behaviours and reduce waste.

Further to the use of technology, the continued implementation of Preventative Maintenance (PM) programs and reallocation of staff to further support building maintenance and controls in order to improve performance extends the working life of equipment and its efficient operation.

Recognition by the Region of Waterloo for the Board as a certified Water Efficient Organization for our ongoing efforts in convert high water use heating plants, utilizing low flow plumbing fixtures at our new schools and retrofits, sub metering and controlling water use in sports fields and cooling towers and polities and training of staff in water conservation. The WRDSB is one of five large scale organizations within the Region of Waterloo to receive this recognition during its first year of implementation.

Renewables

The Board received approximately \$1M for five renewable energy projects from the Ministry in 2010/2011. These projects were completed in late 2011 and have generated more than \$279,000 in revenue over 69 months of operation. Appendix D presents a summary of photovoltaic production and revenues.

It is important to recognize that despite generating significant revenue, the payback on the \$1M capital investment under the MicroFIT program at 80 cents per kWh provides a 20.6 year payback. This time frame would be significantly longer if not subsidized at 80 cents per kWh rate.

Incentives and Reinvestment

In addition to the projects implemented and the saving generated through reduced consumption, the Board has actively sought out incentive programs that generate savings that can be reinvested into schools and further help with resource conservation board wide.

Since 2009, the Board has received more than \$450,000 in incentives from partners that include:

- Cambridge and North Dumfries, Kitchener Wilmot and Waterloo North Hydro
- Reliance Commercial Solutions
- Region of Waterloo
- Union Gas

These incentives continue to be reinvested each year into upgrades directly related to energy conservation or to support schools for their use in promotion of their EcoSchool status. Appendix E presents the EcoSchools recognition awards and recent energy and sustainability enhancements funded from these incentives.

Background

The Green Energy Act (O.Reg. 397/11), came into effect in 2009 repealed the Energy Conservation Leadership Act and the Energy Efficiency Act. Under this Act the Ministry Education implemented the Utility Consumption Database (UCD). The UCD reports on annual utility consumption and greenhouse gas emissions for more than 5,000 schools and administrative buildings across 72 boards and require the implementation of a 5 year Conservation and Demand Management Plan initiated in 2013/14 and due for reporting to the Ministry of Education in June 2019 with a WRDSB targeted reduction in energy of 6.1%.

In school calendar years 2009/10, 2010/11, and 2011/12, Business Services provided energy updates to the Board through the Energy Efficient School Funding (EESF) annual capital report. EESF funding targeted capital investment into schools that were below the average in terms of energy performance and was discontinued by the Ministry at the end of 2011/12.

From 2012/13 to 2016/17 capital funding through School Renewal (SR), School Condition Improvement (SCI) or new capital investment supported energy efficiency measures as Business Services continued to deliver capital projects across the region.

As of April 2018, funding for energy efficiency and greenhouse gas reductions is again available through the Green House Reduction Fund (GGRF) with \$1.6M in projects scheduled for implementation.

Financial Implications

While the utility budget may represent less than two percent of the overall Board budget, the active management of the utility portfolio is required to mitigate risk exposure as cost over runs or savings can have a significant impact on the operating budget.

The utility budget will continue to be monitored regularly and developed on an annual basis within Business Services in consultation with external agencies as required (consortium, Ministry, OMC Energy Sub-Committee, School Energy Coalition), Coordinating Council, and brought forward through regular budget deliberations.

Communications

The Green Energy Act requires this Energy Update be presented to Board and available publicly on an annual basis. In addition, the Energy Conservation and Demand Management Plan and Energy Consumption and Greenhouse Gas Emission annual reports, as available through the UCD, are available in hard copy at the Education Centre or online for public access as required under the Green Energy Act:

- [Energy Conservation and Demand Management Plan](#)
- [Energy Conservation at the Waterloo Region District School Board](#)

It is intended that this report will be shared with the, Elementary Accommodation Committee (EAC), Secondary Accommodation Committee (SAC), and Accommodation Steering Committee (ASC) in an effort to enhance awareness and build a knowledge base and momentum for energy conservation in the schools.

Prepared by: Matthew Gerard, Coordinating Superintendent, Business Services
& Treasurer of the Board
Ian Gaudet, Controller, Facility Services
Ron Dallan, Manager of Capital Projects
Lou Lima, Manager of Mechanical, Electrical and Environmental Services
Steve Feeney, Supervisor of Energy Conservation
in consultation with Coordinating Council.