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2016

CITY OF NORTH TONAWANDA BENCHMARKING ENERGY ANALYSIS

February 4, 2016

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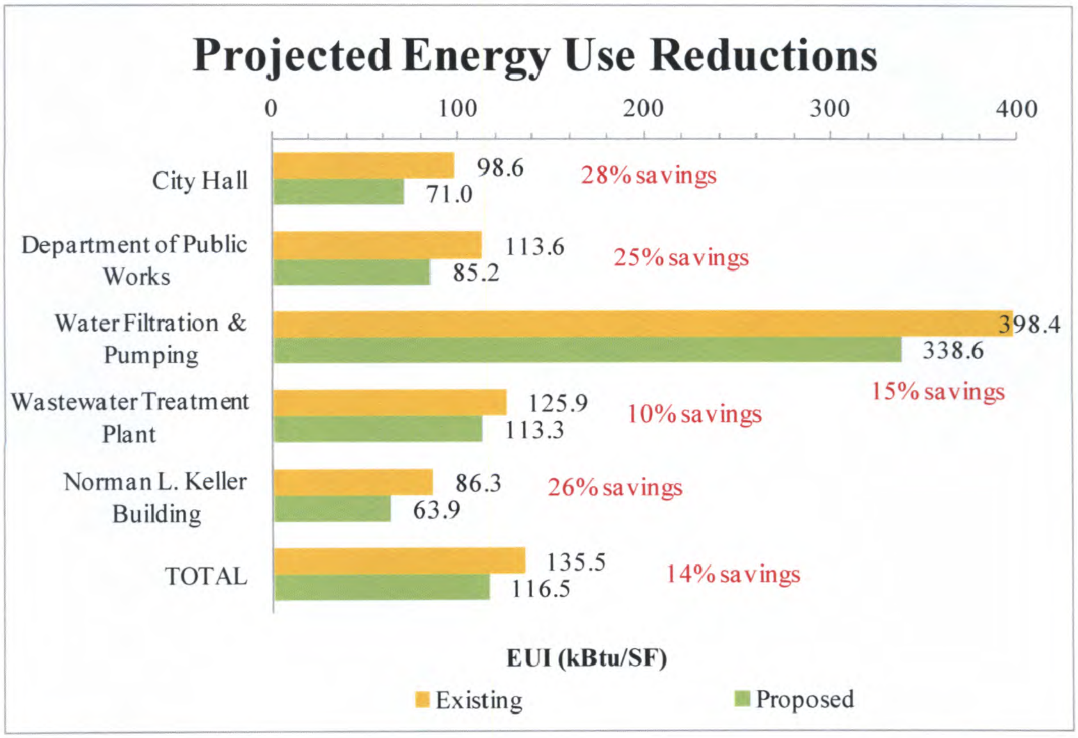
EXECUTIVE SUMMARY

Danforth is pleased to present this preliminary Benchmarking Analysis to the City of North Tonawanda. We take a strategic and consultative approach to developing solutions with our clients. This allows us to work with each individual customer to create a strategy that will maximize the outcomes of the project while incorporating unique customer needs.

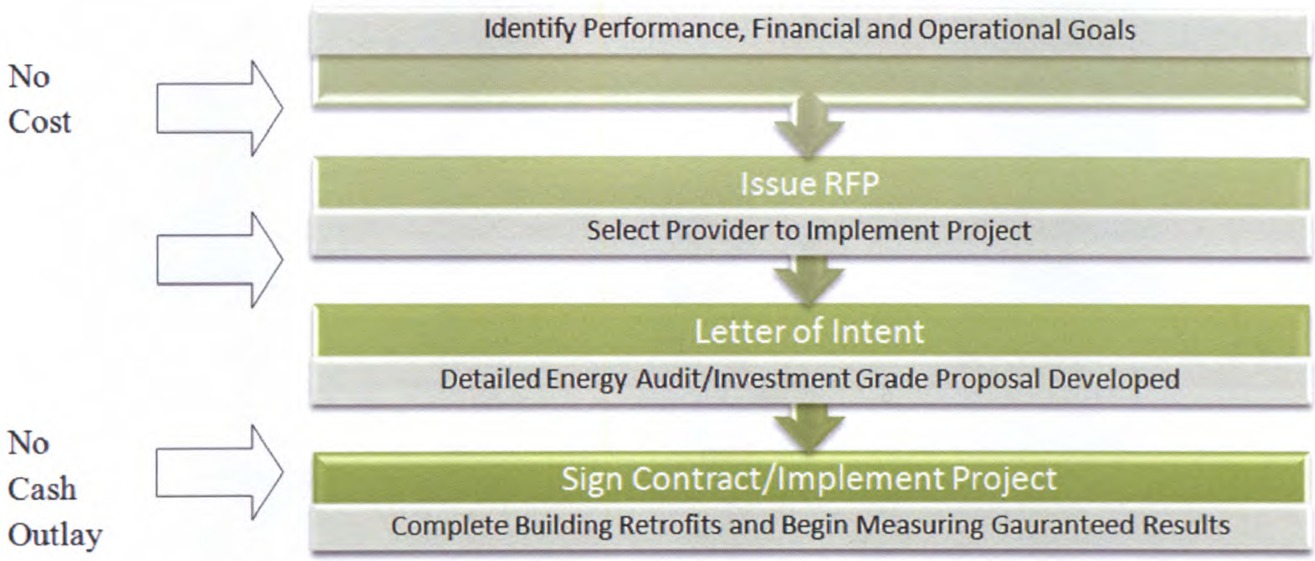
The graph below shows the Energy Use Intensity (EUI) for the each of the City buildings based on an analysis of historical annual energy usage (orange bars), and a projection of what the City may be able to achieve by implementing a comprehensive energy performance project (green bars).



Danforth estimates that a city-wide energy project which reduces the energy usage of North Tonawanda's facilities as shown above could yield an annual estimated energy savings of **$125,000 - $145,000**. Assuming a 15 year simple payback period, this savings could finance a project valued at approximately **$2,100,000**. Recommended facility improvement measures which can be implemented to achieve this savings include Interior and Exterior Lighting Improvements, Building Envelope Improvements, HVAC Controls Upgrades, Heating System Upgrades, Energy Efficiency Motor Replacements and Variable Frequency Drives.

Based on Danforth's experience in similar municipalities, expanding the scope of this project to include converting the City's streetlights to LEDs could provide an additional **$200,000** in energy and maintenance savings, which could potentially increase the value of the project by **$2,400,000.** However, Danforth will need to review the City's street lighting accounts in greater detail to properly quantify this opportunity.

The program we have developed is intended to deliver a performance-based, turnkey, self-funding facility improvement project. The project is structured to be implemented as an energy performance contract as outlined in the New York State Energy Law, Article 9. The ultimate goal of the program is to provide needed facilities upgrades that are paid for through a guaranteed savings program. All costs of the program are offset by savings and potentially generate additional cash flow beyond the cost of the program. These additional funds can be used at the discretion of the City of North Tonawanda to fund other initiatives or programs that have yet to be implemented.



An energy performance contract is a financial vehicle that allows the City of North Tonawanda to use future utility, operations and maintenance savings to pay for the cost of energy efficiency retrofits and upgrades today. Our suggested methodology for implementation of these improvements is beneficial to the City in a number of ways:

- Eliminates the financial risk of the cost exceeding the original quoted price since the contract will be a "guaranteed maximum price" format.

- Reduces the engineering and procurement cost of the project due to the design/build nature which reduces costly overlaps and non-productive efforts.

- Access to capital via third party resources to fund the project. This allows the City of North Tonawanda to use its existing in-house capital resources for other desired improvements or projects.

Danforth will guarantee the results of the savings projections as well as the technical implementation, eliminating the risk to City.

HISTORICAL ENERGY USAGE

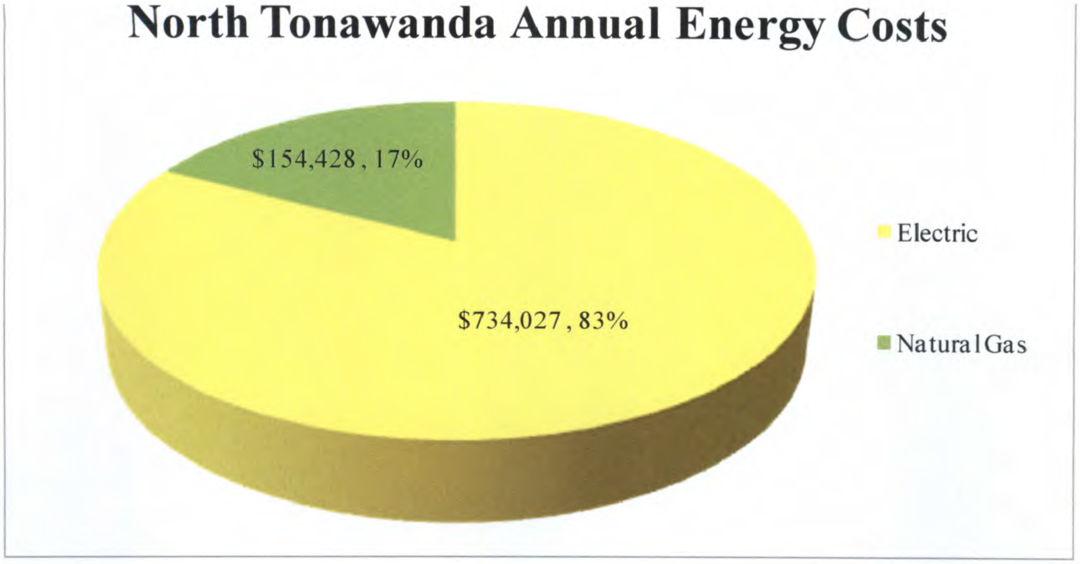
Establishing the baseline annual energy usage for each building in the scope of the project is a fundamental step in identifying the level of energy savings opportunities which exist in each facility.

The City of North Tonawanda authorized Danforth to gather historical energy data from the City's utility providers and suppliers. Some of this information was incomplete as the individual account numbers for each facility were unavailable, but Danforth was able to gather historical electric and gas consumption data for the majority of the buildings. The table below summarizes the energy usage and costs for each building from November 2014 – October 2015. The values shown in red have been estimated at this time.

Building	Building Area (SF)	Electric			Natural Gas			Total Costs
		Annual Usage (kWh)	Annual Costs	Blended Rate ($/kWh)	Annual Usage (therm)	Annual Costs	Average Rate ($/therm)	
City Hall	42,000	371,520	$ 41,918	$ 0.113	28,724	$ 26,189	$ 0.91	$ 68,107
Department of Public Works	38,000	501,025	$ 55,113	$ 0.110	26,082	$ 23,781	$ 0.91	$ 78,893
Water Filtration & Pumping	22,000	1,706,627	$ 165,444	$ 0.097	29,390	$ 26,797	$ 0.91	$ 192,241
Wastewater Treatment Plant	264,682	5,319,640	$ 459,506	$ 0.086	151,770	$ 66,417	$ 0.44	$ 525,922
Norman L. Keller Building	18,000	93,760	$ 12,046	$ 0.128	12,332	$ 11,244	$ 0.91	$ 23,290
TOTAL	**384,682**	**7,992,572**	**$ 734,027**	**$ 0.092**	**248,298**	**$ 154,428**	**$ 0.62**	**$ 888,454**

Electric usage and transportation costs for the above buildings were provided by National Grid, however no data was available for the Department of Public Works (see Energy Use Intensity section of the report for estimation methodology). The City is billed by a separate utility provider for their electric supply costs but unfortunately this data was unavailable to Danforth. Danforth has estimated an electric supply rate of $0.07 per kWh for each account in addition to the known transportation costs based on our experience in similar facilities. The table above can be revised if historical electric supply bills are made available.

Similarly, Danforth was able to obtain historical natural gas consumption data from National Fuels for most of the above buildings, however no data was available for the Norman L. Keller Building (see Energy Use Intensity section of the report for estimation methodology). Gas transportation and supply costs were available for the Water Filtration and Water Treatment Plants, but unfortunately were not available for the remaining buildings. At this time, Danforth has estimated that the average gas rate for the Water Filtration & Pumping Plant ($0.91 per therm) applies to City Hall, DPW and Norman L. Keller buildings based on similar volumes of consumption.



The graph above compares the portions of the City's annual utility budget that are related to natural gas and electricity. Electricity accounts for over 80% of the North Tonawanda's utility costs, mainly due to the fact that electricity is over four times more expensive than natural gas on a per unit basis. Natural gas actually makes up almost 50% of the City's annual energy usage (in Btus) compared to electricity.

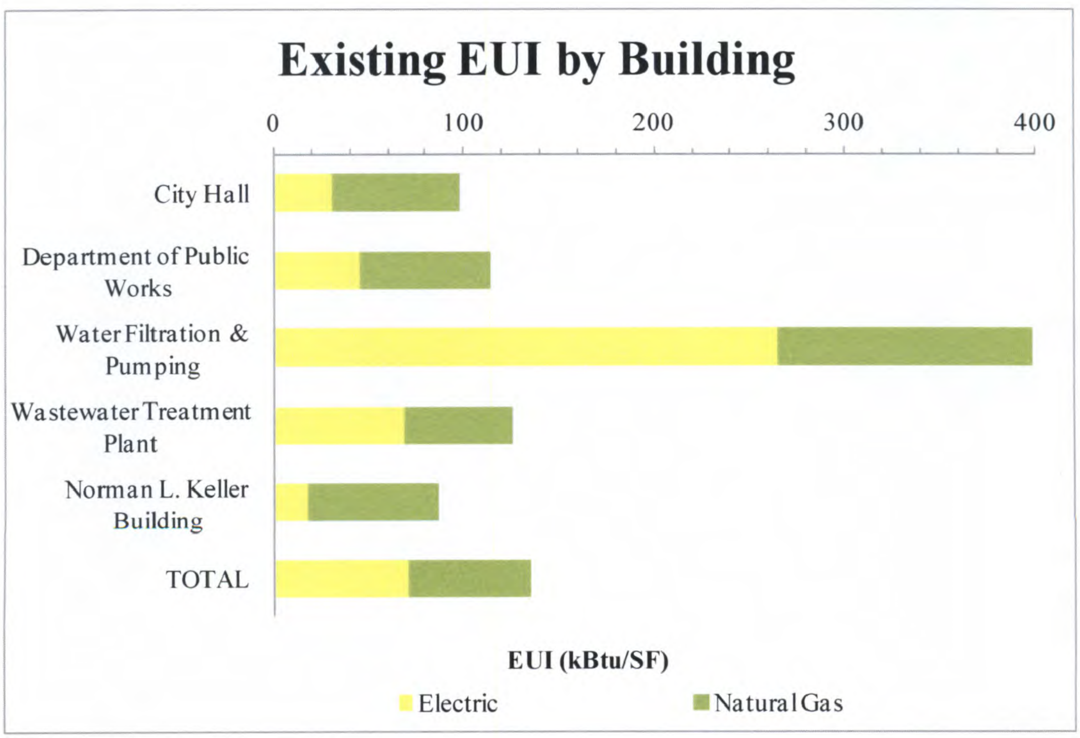
ENERGY USE INTENSITY (EUI)

Calculating building Energy Use Intensity (EUI) is a useful method for comparing buildings of different types and sizes. A building's EUI is a ratio of its total energy usage (electricity and fuel) and its overall area (square footage). Similarly, Energy Cost Intensity (ECI) is ratio of a building's total energy costs and its area.

The table below shows the EUI and ECI for each building in the City of North Tonawanda.

Building	Building Area (SF)	Energy Use Intensity (kBtu / SF)			Energy Cost Intensity ($ / SF)		
		Electric	Natural Gas	Total	Electric	Natural Gas	Total
City Hall	42,000	30.2	68.4	98.6	$ 1.00	$ 0.62	$ 1.62
Department of Public Works	38,000	45.0	68.6	113.6	$ 1.45	$ 0.63	$ 2.08
Water Filtration & Pumping	22,000	264.8	133.6	398.4	$ 7.52	$ 1.22	$ 8.74
Wastewater Treatment Plant	264,682	68.6	57.3	125.9	$ 1.74	$ 0.25	$ 1.99
Norman L. Keller Building	18,000	17.8	68.5	86.3	$ 0.67	$ 0.62	$ 1.29
TOTAL	**384,682**	**70.9**	**64.5**	**135.5**	**$ 1.91**	**$ 0.40**	**$ 2.31**

The chart below illustrates the electric and natural gas EUIs for each facility.



Electrical consumption data for the Department of Public Works was unavailable, therefore Danforth estimated the electric EUI for this facility based on the other buildings in the City and our experience in similar facilities, and then extrapolated what the consumption in kWh would be using the SF for the DPW.

Similarly, natural gas consumption data for the Norman L. Keller building was unavailable, therefore Danforth estimated the gas EUI for this facility based on the other buildings in the City and our experience in similar facilities, and then extrapolated what the consumption in therms would be using the SF for the Keller Building.

The City Hall's total EUI of 98.6 kBtu/SF/year would fall in the 71^{st} percentile when benchmarked against similar facilities across the United States (2011 ASHRAE Handbook). Likewise, the Norman L. Keller building's EUI of 86.3 kBtu/SF/year would fall in the 59^{th} percentile. A comprehensive Energy Performance Project should be able to reduce the overall EUI for the City Hall to the 65 – 75 kBtu/SF range and the EUI for the Keller Building to the 60 – 70 kBtu/SF range, which would put the City Hall in the 41^{st} percentile and the Keller Building in the 37^{th} percentile compared to similar government office buildings.

The Water Filtration and Wastewater Treatment Plants are difficult to benchmark due to the fact that the majority of their energy usage is related building-specific processes and equipment, but Interior and Exterior Lighting Improvements, Energy Efficient Motor Replacements, Variable Frequency Drives, Building Envelope Improvements and HVAC Controls Upgrades are some of the opportunities for energy savings which are likely applicable to these facilities.

MEASURES TO BE INVESTIGATED DURING THE DETAILED AUDIT

Below is a list of concepts and measures which Danforth recommends analyzing more closely during the Detailed Energy Audit (DEA) phase of the project. These concepts have been shown to be effective in similar municipal buildings and can allow The City of North Tonawanda to achieve significant energy savings and improve conditions for building occupants while upgrading the City's infrastructure.

Interior Lighting Upgrades

Lighting represents a major portion of a facility's electricity use, and given the continuous hours of use, normally contributes to the peak electric demand each month. Taking steps to improve the efficiency of lighting will reduce both the total electric energy used and reduce the peak electric demand. Lighting retrofit projects often improve the facility aesthetically by providing brighter, whiter light and operating more quietly than the old lighting systems.

Most municipal buildings utilize a mixture of fluorescent (T12 or T8) and compact fluorescent (CFLs) fixtures to provide lighting in their buildings. Upgrading these lighting system to LED can reduce power consumption by 40-50% while improving space lighting levels and building aesthetics.

Exterior Lighting/Street Lighting Upgrades

Municipalities often illuminate the exteriors of their buildings and parking lots using High Intensity Discharge (HID) lighting, which typically consists of a mixture of High Pressure Sodium (HPS) and Metal Halide (MH) fixtures. These systems are often scheduled using time clocks or photocells and operate nearly half of the time over the course of the year, which means that lighting replacements that yield significant reductions in power consumption can have attractive simple payback periods. Upgrading these exterior fixtures to LEDs can reduce power consumption by 60% or more, and the quality of light produced by these LEDs can provide improved light levels and visibility.

Street lights are similar in terms of power consumption and reduction potential to building exterior lights, but upgrading them to LEDs may also be able to provide operational savings due to the fact that the local utility company owns these fixtures and typically charges municipalities additional monthly fees to maintain them. These maintenance fees can often be as much or more than the actual electricity costs. In order to convert these fixtures to LEDs, the City of Tonawanda would likely need to purchase their street lights and poles from the local utility company and maintain them going forward, but the savings in utility company maintenance fees would be substantial and would likely be even greater than the energy savings the LEDs would provide. During the DEA, Danforth will need to review the City's street lighting accounts in greater detail to properly quantify the size of this opportunity.

Lighting Control Upgrades

Lighting controls, such as occupancy sensors and daylight sensors, can improve the functionality of the lighting system and provide energy savings by dimming or shutting off light fixtures under the appropriate conditions. Occupancy sensors continuously scan the space for motion and heat and shut off light fixtures when the space is determined to be unoccupied for a certain period of time (i.e. 15 minutes). Daylight sensors are generally used in perimeter spaces which receive significant amounts of daylight, and dim or even shut off light fixtures when it's determined that there are sufficient levels of natural light in the space.

Building Envelope Improvements

Air leakage is defined as the uncontrolled migration of conditioned air through the building envelope caused by pressure differences due to wind, chimney (or stack) effect, and mechanical systems. It has been shown to represent the single largest source of heat loss or gain through the building envelopes of nearly all types of buildings.

Beyond the potential for energy savings, uncontrolled air leakage can affect thermal comfort of occupants, air quality through ingress of contaminants from outside and the imbalance of mechanical systems, and the structural integrity of the building envelope through moisture migration. Control of air leakage involves the sealing of gaps, cracks and holes, using appropriate materials and systems, to create, if possible, a continuous plane of air-tightness to completely encompass the building envelope. Part of this process also incorporates the need to "decouple" floor - to - floor, and to "compartmentalize" components of the building in order to equalize pressure differences.

Energy Efficient Motor Replacements

Energy Savings can be achieved by replacing standard efficiency motors with new premium efficiency motors. High efficiency motors will reduce added heat load, electrical demand charges and electrical consumption charges. The new motors improve system reliability and allow for Variable Frequency Drive (VFD) technology to further system efficiency. This measure can be especially applicable to large pumps in process-intensive buildings such as the Water Filtration and Wastewater Treatment Plants.

Install VFDs on Pump and Fan Motors

Adding Variable Frequency Drives (VFDs) to existing fan and pumping systems can save energy and improve control. Fan and pump motors that are not fitted with Variable Frequency Drives (VFDs) run at a constant speed whenever they are operational. When applied properly, VFDs are the most effective motor control in the industry. VFDs are affordable and reliable, allow building operators to control fan and pump speeds based building conditions and offer significant electrical energy savings when operating motors at reduced speeds. VFDs offer the greatest opportunity for energy savings when driving variable loads because horsepower varies as the cube of speed (fan affinity laws) and torque varies as the square of speed for these loads.

HVAC Controls Upgrades

Direct Digital Controls (DDC) systems have become the standard for controlling and maintaining building systems and equipment. They are more accurate at temperature measurements and control than pneumatic systems with mechanical time clocks. By using a DDC system, it is possible to develop historical records on the operating characteristics of a building to identify trends which can lead to better performance. The DDC system also allows for alarm management in the event of a mechanical system malfunction. These systems save time by eliminating the need to change various time clocks for holidays and schedule changes.

Space heating and cooling can account for over 50% of the energy use in a building. One of the most cost effective means of reducing energy consumption is by setting the temperature back when the building is unoccupied. Typical thermostats are set between 65°F to 70°F for heating and 72°F to 78°F for cooling. DOE projects an energy cost reduction of 5% - 12% with a 3°F to 10°F setback and a 9% - 18% energy cost reduction with a 10°F to 20°F setback.

Another potential strategy for enhancing the HVAC controls in each building is Demand Control Ventilation (DCV). For this measure, CO_2 sensors are linked to the HVAC system through the existing DDC system. This allows the amount of outside air to be controlled to the occupant density of a space in real time, thus saving heating, cooling and fan power energy. This technology works best in spaces where there is variable occupancy such open office areas and conference rooms. This reduction of ventilation air can be accomplished through a combination of fan speed control using a variable frequency drive (VFD), and control of the outdoor air and return air dampers on the air handling unit (AHU). Spaces with regularly timed occupancy can be handled by DDC programming. This technology is approved by ASHRAE and most building codes.

Transformers

Conventional transformers are not designed to handle the harmonic loads of today's modern facilities and suffer significant losses as a result. Typically transformer losses, which are non-linear, increase by 2.7 times when feeding computer loads. The nonlinear load loss multiplier reflects this increase in heat loss, which decreases the net transformer efficiency. Also, unlike most substation transformers that are vented to the exterior, building transformers are ventilated within the building, and heat losses therefore add to the building's cooling load.

Distribution transformers are installed in the mechanical rooms and in various electrical closets to step down the primary voltage supplied to the building by the utility. A considerable portion of the losses that are typically associated with an electrical distribution system are related to distribution transformers.

Install Vending Misers

VendingMiser is a power control technology for cold beverage vending machines. VendingMiser can save a large percentage of the annual electricity costs that the machine consumes. It is a simple plug-and-play device used by government offices, school districts, colleges and universities, retail stores, and hospitality properties to reduce energy usage by vending type machines. These systems include a Passive Infrared (PIR) Sensor which is used to power down the machine when the surrounding area is vacant, monitor the room's temperature, and automatically repower the cooling system every 1 to 3 hours (independent of sales), ensuring the product stays cold. Both Coca-Cola and Pepsi have tested the VendingMiser and more than 300,000 EnergyMisers have been installed on refrigerated beverage machines. Snack Misers are similar except they do not control a compressor.

Pipe & Valve Insulation Upgrades

Adequately insulated water heating and domestic water pipes and valves reduce heat loss, allowing for a lower temperature setting. This reduces the energy input to the heating systems. Additionally, insulation controls pipe surface temperatures for personnel protection and comfort.

Boiler Controllers

For buildings that are not connected to the central heating plant, installing boiler controllers may be a cost-effective method of reducing energy usage. Energy is saved by adjusting the burner run pattern to match the system's "heat load" which reduces cycling. These controls reduce fuel consumption, wear on parts, flue emissions and electrical usage when installed.