Wastewater Energy Savings & Operational Update

Summary:

Over the past year, Wastewater Treatment has significantly benefitted from the work of operations and maintenance staff to repair significant equipment failures, assist in critical preventative maintenance and participate in the Industrial Conservation Initiative (ICI). Since the last presentation to Operations Committee in March of 2019, this work has resulted in the following accomplishments:

- $421,000 in electricity cost avoidance at the Sudbury Wastewater Treatment Plant (WWTP) through participation in the ICI, an increase of $121,000 over 2018;
- $62,500 in anticipated annual electrical savings resulting from maintenance performed at the Sudbury Wastewater Treatment Plant in 2019;
- $16,000 in anticipated annual electrical savings resulting from maintenance performed at the Walden Wastewater Treatment Plant in 2019, and;
- Significant repairs completed on process equipment at the Sudbury, Azilda and Lively Wastewater Treatment Plants by CGS maintenance personnel.

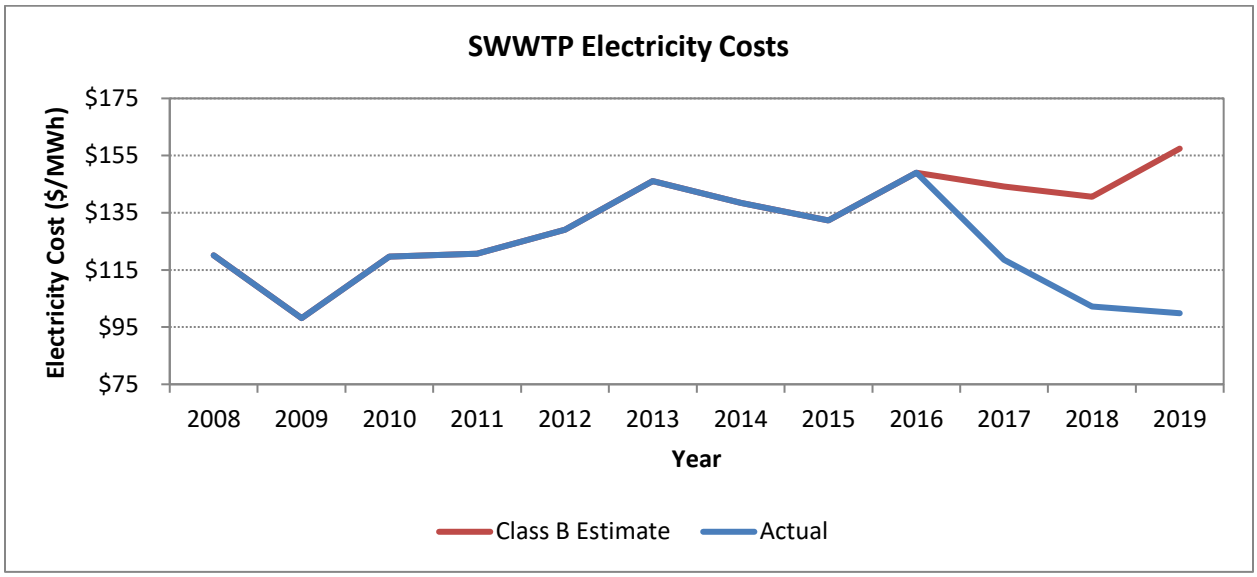
The work performed has had a significant impact on the cost of services delivered, and has been achieved while maintaining high quality treatment and effluent standards.

Cost Avoidance:

Global adjustment (GA) is the portion of total electricity costs that contributes to building new infrastructure, maintaining existing resources and funding conservation and management programs across Ontario. The GA charge for "Class A" industrial facilities, those with a peak demand of 1 Megawatt (MW) or greater, is determined by measuring the percentage contribution to the top five hours of peak electricity demand in Ontario from May 1st to April 30th each year. This value is then used to calculate a billing factor which determines the amount of total GA charges for the province (also known as the "Global Adjustment Pool") that are allocated to each customer for the following year.

Due to the size of the annual Global Adjustment Pool, these charges can represent a significant portion of total energy billing. Within Water & Wastewater operations only one facility classifies as a "Class A" customer, the Sudbury Wastewater Plant, where approximately 60% of total billing from 2015-2019 was due to GA. In an effort to mitigate these expenses, the facility participates in the Independent Electricity System Operator of Ontario (IESO) Industrial Conservation Initiative (ICI) Program (also known as "peak power response" or "high five response"). By reducing consumption during the 5 peak demand hours, staff can significantly reduce the GA billing factor for the facility.

The participation in the ICI has resulted in lower utility costs for the Sudbury WWTP, and the additional savings achieved each year is a direct result of increased operator engagement and improved prediction/notification systems.



As can be seen in the chart above, actions taken by operators resulted in the cost per Megawatt-hour (MWh) in 2019 being lowered to $100/MWh from the Class B rate of $157/MWh. This represented approximately $421,000 in cost avoidance, an increase of $121,000 over the savings achieved in 2018.

Additionally, operators were able to curtail electricity consumption for all 5 identified peaks during the summer of 2019, which should result in an additional savings of 26% (approximately $109,000) for the period from May 1st 2020 to April 30th 2021. Work continues on a project to install a new standby generator at the Sudbury WWTP, which will allow the facility to completely isolated from the power grid during peak periods to completely eliminate the GA charge.

Operational Savings:

In line with an initiative to make improvements through a preventative maintenance program, a tender was issued to clean critical process vessels at wastewater treatment facilities over a 3 year period. The justification for this contract was based on the success of work done in 2018, where savings of $180,000/year were achieved through cleaning three of the eight aeration tanks at the Sudbury WWTP.

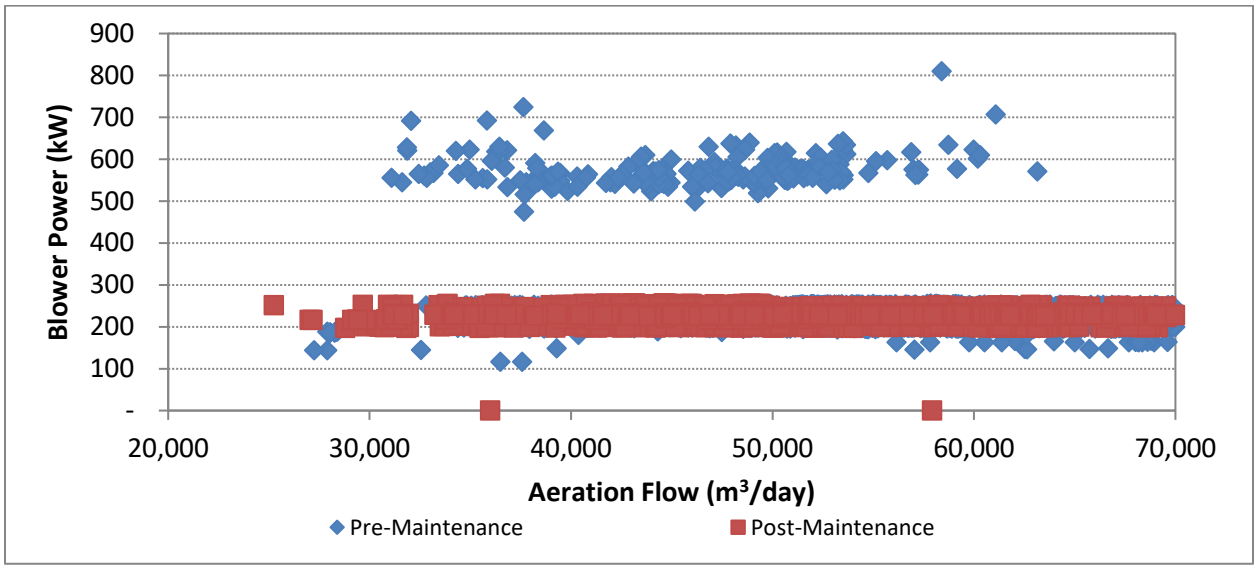
In 2019, the remaining two aeration tanks at the Sudbury WWTP (which had not been recently emptied) and both of the aeration tanks at the Walden WWTP were cleaned. Maintenance work completed included removing built up material, repairing broken or disconnected piping and replacing damaged aeration membranes and diffusers.

Sudbury WWTP Tank Cleaning:

To assess the savings achieved through tank cleaning at the Sudbury WWTP, process data was compared for periods before (15-May-2019 to 15-Jul-2019) and after (15-Sept-2019 to 15-Nov-2019) work was completed. These periods were chosen as they represented periods of similar influent flow rates and conditions:

Flow (m^3/Day)	Pre Maintenance	Post Maintenance
Average	63,641	61,011
Maximum	152,921	156,587
Minimum	27,250	25,243

Data for the power consumed by the aeration blowers at the plant is shown in the graph below:



Based on the step change observed in the operating data, an estimated savings of $62,500 per year will be achieved as a result of the work completed.

Walden WWTP Tank Cleaning:

Savings at the Walden WWTP were calculated using monthly electricity invoices as data from the Supervisory Control and Data Acquisition (SCADA) system is not available for the facility. In order to generate an estimate, invoices from October to January were compared for the past three years to ensure periods of similar influent flows and conditions were compared.

	Oct 2017 - Jan 2018	Oct 2018 - Jan 2019	Oct 2019 - Jan 2020
Average Flow (m^3/day)	2,468	2,325	2,853
Maximum Daily Flow (m^3/day)	5,383	6,331	5,552

Electricity Use (kWh/day)	529	477	501
Electricity Use (kWh/m^3)	0.88	0.85	0.72
% Savings:	18.5%	16.2%	

Average Savings:	17.3%
Calculation Factor:	0.75
Adjusted Savings:	13.0%

Although the savings are initially estimated at 17.3%, a more conservative value of 75% of the initial calculation was used for forecasting due to the limited data set available. Using a 3 year running average for total electrical consumption for the site, and the unit cost for the most recent year (2019), the following savings were then estimated:

	2017	2018	2019
Total Electricity Use:	694,976	702,999	677,788
Electricity Cost ($)	$122,211	$122,456	$120,457
Unit Cost ($/kWh)	$0.176	$0.174	$0.178

Estimated Annual Savings: 90,032 kWh/year
$16,000/year

Critical Equipment Repairs

A number of key equipment failures occurred in 2019 which affected treatment operations. Most notably, the following events occurred:

- Azilda WWTP Fire – March 2019

  A failure in a Motor Control Centre (MCC) resulted in a fire which damaged key electrical infrastructure at the facility. The root cause of the failure was identified as a starter motor for a blower that was approximately 40 years old.

  As a result of the quick actions taken, the damage was limited and the repairs were completed in approximately 1 day. The dedication shown by the operations and maintenance personnel was recognized with four staff receiving the CAO's Service Award for 2019.

- Azilda WWTP Clarifier Failure – September 2019

  In early fall, a part of the clarifier at the Azilda WWTP failed, resulting in a partial process shutdown. Prior to the capital upgrades completed at the facility in 2017 this would have resulted in a significant environmental impact, however, the

facility was able to continue operations in a limited fashion until repairs were completed as a result of additional equipment installed at the facility.

Wastewater employees were able to complete the repair, which required specialty parts and a crane to access the damaged equipment, and bring the facility fully back online within 5 days with no adverse environmental impacts.

- Sudbury WWTP Clarifier Failure – December 2019

  The gearbox on #2 clarifier at the Sudbury plant failed in early December, which resulted in reduced plant capacity while repairs were made. An additional risk was presented due to the cold weather, as the effluent and sludge in the tank can cause significant damage as a result of freezing.

  Operators were able to quickly empty the tank to mitigate the risk of damage, and repairs were made within one week to bring the unit back online.

- Lively WWTP – July & December 2019

  The Lively plant, scheduled to be decommissioned in the coming years, suffered a number of failures on the clarifier and vessel walls, including issues with the baffles used to separate treatment chambers in the plant and a clarifier failure in late 2019. These failures all occurred during low flow periods, which allowed the influent to be diverted to the Walden WWTP while repairs were made.

  Wastewater maintenance employees took these failures as an opportunity to address a number of deficiencies identified by operators. The repairs completed will allow this facility to operate effectively over the coming years until the planned shutdown of the plant.

It must be noted that in the past, equipment issues of this magnitude would often be dealt with through contract resources. Through resolving these issues with internal personnel, Wastewater treatment Operations was able to lower overall repair costs and reduce equipment downtime.