NYSERDA New York State Energy Research and Development Authority

New York Energy $mart℠ Public Service Commission — NYSERDA

Energy Performance through Submetering Wastewater Treatment Plants

PROJECT BACKGROUND: Energy evaluations of 11 wastewater treatment plants located in NYS with plant flow rates ranging from 0.5 to 80 MGD were completed by Stearns & Wheler, LLC to identify and recommend specific process modifications and equipment replacements to save plant energy costs. These studies have been funded by the New York State Energy Research and Development Authority (NYSERDA) through the Submetering Wastewater Treatment Plant Program. The following municipalities participated:

- Village of Marcellus - 0.4 mgd
- Village of Clayton - 0.5 mgd
- Village of Heuvelton - 0.5 mgd
- South & Center Chautauqua Lake SD - 2.0 mgd
- Town of Grand Island - 2.1 mgd
- Village of Potsdam - 3.5 mgd
- Town of Bethlehem - 4.9 mgd
- Erie County SD No. 2 Big Sister Creek - 7.5 mgd
- Town of Orangetown - 10.0 mgd
- Saratoga Sewer District #1 - 21.0 mgd
- Metro Syracuse, Onondaga County - 80.0 mgd

SUBMETERING: Power metering was installed at each plant to accurately determine the energy consumption and savings of the evaluated processes. The energy and process data collected resulted in calculated energy use per unit and assist in making process efficiency comparison between the various monitored plants.

EVALUATION: Through the use of submetering data and a thorough understanding of wastewater treatment processes, many opportunities to reduce plant energy costs while maintaining or increasing treatment and/or capacity were identified.

Energy savings were found in the following evaluated treatment processes:

- pumping systems
- chemical systems
- aeration systems
- biological treatment systems
- filtration systems
- elimination of processes
- process conversions
- variable frequency drives (VFDs)
- lighting, heating and ventilation systems
- sludge handling systems (i.e., thickening, digestion, dewatering, disposal, etc.)

Energy saving measures were identified at each of the evaluated plants. Capital improvements were recommended with manageable calculated payback periods. Process performance was evaluated and compared to plant flow rate calculations. Energy saving trends within specific treatment processes was reported.

HIGHLIGHTS: BETHLEHEM, MARCELLUS AND CLAYTON PLANTS: Significant energy savings was found to be possible through the installation of positive displacement (PD) blowers. The proposed PD blower would be controlled by VFD and dissolved oxygen (DO) monitoring equipment. With the addition of DO monitoring equipment, DO levels can be recorded, logged and directly control the amount of air volume produced. This improvement would automate the aeration process to a predetermined DO target set point programmed into the DO transmitter/controller.

ONONDAGA PLANT: The secondary aeration system at the Onondaga Plant was operated as conventional plug flow activated sludge system with 8 aeration tanks, 21 blowers and 45,800 scfm. Existing operations included seasonal nitrification from June to December. New biological aerated filters (BAF) were installed as part of plant improvements prior to our evaluation. The BAF system provides year round nitrification. Nitrification could then be eliminated from the 8 aeration tanks by taking 4 tanks off line and reducing the solids retention time, resulting in a reduction in air requirements. Annual energy savings totaled 2.3 MWh or $166,000.

ERIE COUNTY, ANGOLA PLANT: Cost savings can be achieved with the use of a sludge-thickening polymer to optimize solids dewatering at the existing sludge drying beds during the summer months. Additional savings can be achieved with the use of the same sludge-thickening polymer, which would result in the elimination of dewatering chemicals presently used with the existing plate and frame filter press. Annual energy and operational cost savings totaled $20,700 and $113,750 respectively with a total payback of 0.2 years.

GRAND ISLAND PLANT: The existing liquid oxygen generation system was evaluated as the primary oxygen production source and the existing pressure swing adsorption system (PSA) as the back-up oxygen source. The annual cost to supply the liquid oxygen is 25% less than the annual cost to operate the PSA system. The high-energy costs of the 200 HP air compressor/blower will be eliminated. The liquid oxygen system includes an electric vaporizer system, a new concrete pad and upgrades to the safety system. The plant would save approximately $80,000 per year in energy costs with total payback of 1.4 years.

OVERALL PROJECT RESULTS: In implementing the recommended energy saving alternatives for participating plants, the total annual energy cost savings that can be achieved is $650,000 which represents 7,400 MWh. 3

Demand energy savings totaled 450 KW per month. Some recommended alternatives will provide operational costs savings totaling of $260,000.

Feasible opportunities to improve efficiency, reduce energy use, cost, and operational expenses were found at **every** participating plant having simple payback periods of less than 10 years. Average cost savings that can be realized if recommendations are implemented equal 17% of existing plant energy costs.

LESSONS LEARNED: Most plants were found to be over aerating. Significant energy savings can be saved when operations have the knowledge of DO concentration trending and requirements. DO instrumentation installation is recommended. Frequent DO monitoring is required to better define tank aeration requirements and blower adjustments to optimize energy.

FUTURE SUBMETERING PROJECTS: Future plant evaluations should consider sub-metering. Actual power consumption data can be utilized in energy saving calculations resulting in more accurate estimated energy savings and payback periods of recommended improvements. Circumstances for metering include:

- When a demand charge represent a significant portion of the utility bill, to identify which equipment, at which times, contribute to the facility's peak demand. This will focus on the most costly equipment and processes.
- When there is a reasonable degree of certainty that a facility is likely to implement recommended energy saving measures (ESM) and be utilized under the NYSERDA ECIPP Program.
- To verify that projected savings are actually achieved after an ESM has been implemented.

ADDED SAVINGS: Other plants not included in this study and through their review of program results can consider energy saving measures to implementation further energy savings across New York State.

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