



Figure 1. Series of aeration basins at a wastewater treatment plant (courtesy of MnTAP).

Driving Wastewater Treatment Energy Efficiency – A Cohort Training and Implementation Plan

Wastewater treatment operations tend to be comprised of well-established technology implemented in a customized manner to deliver treated wastewater effluent water discharge at a quality needed by each community served. Energy use is generally one of the highest costs for wastewater operations. Significant energy efficiency opportunity has been identified in previous work with Minnesota wastewater treatment plants (WWTPs) along with several barriers to considering energy efficiency in these facilities.

- Site energy use and relative energy performance are generally unknown to operations staff.
- There is a perception that energy efficiency measures require large capital investment.
- Customized plants may require tailored energy efficiency solutions beyond staff capability.
- Plant staff are concerned about not meeting discharge permit requirements if operations are changed.

Strategies for overcoming these barriers and motivating facilities to engage in energy efficiency activities have been developed over successful projects across Minnesota. These strategies emphasize

benchmarking to identify relative plant energy performance, increasing awareness of plant design to optimize operations for existing load and supporting facility staff in identifying and planning operational changes that maintain plant discharge performance and decrease energy use.

As one approach to applying these strategies effectively, the [Minnesota Technical Assistance Program \(MnTAP\)](#) received a CARD grant to develop an instructor led, cohort based energy efficiency training program at a scale and level appropriate for small to mid-size mechanical WWTPs (wastewater flow between 300,000 and 10,000,000 gallons per day). This size range is large enough to have a potential energy efficiency opportunity to justify the investment in training and small enough that these sites are unlikely to have engineering resources to conduct the analysis without assistance. There are 107 facilities in this category or 53% of Minnesota mechanical WWTPs accounting for 33% of the estimated energy use in the sector or 127,000,000 kWh/yr.

Training Content

The cohort training approach provides key foundational information and concepts on energy use and conservation in the wastewater sector. Participants use data from their own facilities in active learning and collaborative exercises related to benchmarking, creating a site energy footprint, evaluating energy use in aeration operations, developing improvement strategies and testing these strategies to identify and implement energy efficiency targets for their facility. The outline of the program is shown in Figure 2.

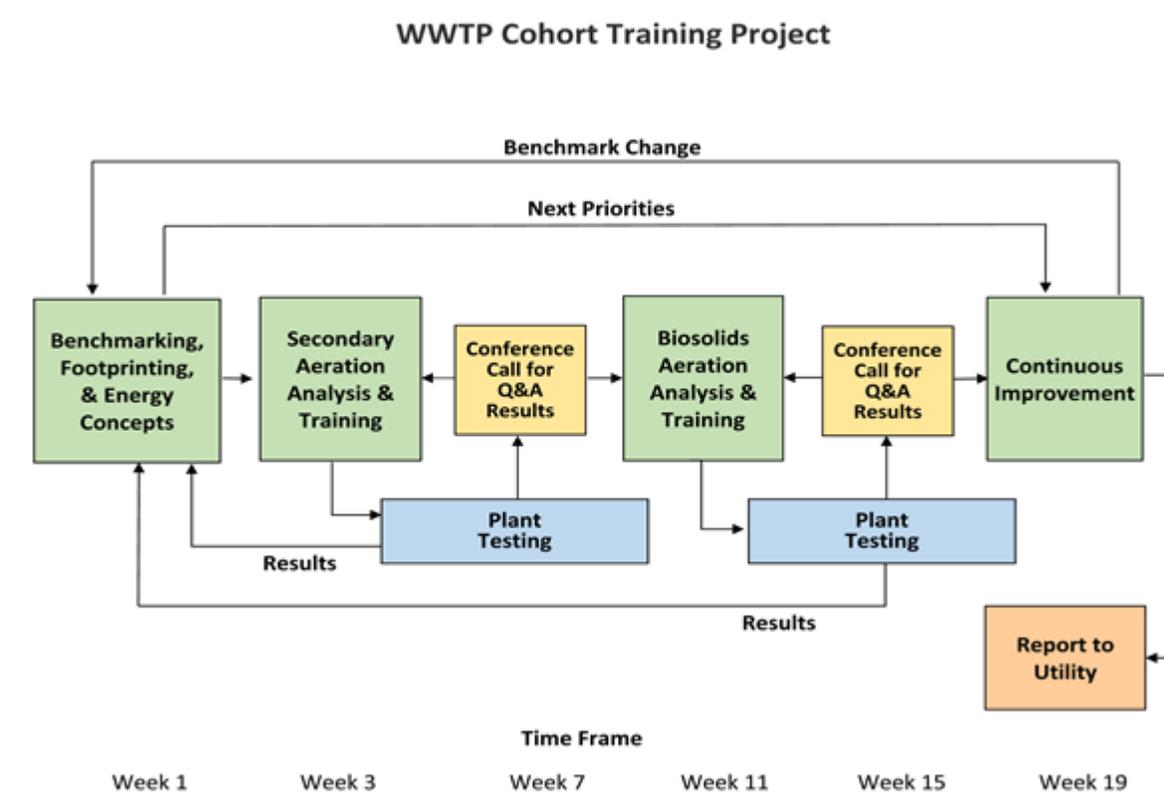


Figure 2. Cohort Training Model

Past experience combined with industry stakeholder feedback guided the creation of the training modules. Specific activities within each module and conference calls in between ensure that participants have a clear path to testing and implementing changes prior to the next modules.

Training Guide

Curriculum resources were created to support training wastewater operations staff in energy efficiency through the four modules. Each module contains a power point presentation and accompanying documents and spreadsheets such as “Materials to Bring,” “Calculators,” “Worksheets” and “Implementation Plan.” The goal is for operators to complete benchmarking, estimate new set points and develop implementation plans during the training sessions. Each training module was developed to include active learning components where participants apply energy concepts to their specific plant conditions.

Utility Model

The Minnesota CIP program model works well for many customer segments. It allows utilities to develop offerings tailored to their unique customer profile and customer needs. For a cohort training model, such as the WWTP Cohort Energy Efficiency Program, with few and geographically spread-out customers, a statewide administrative structure may help utilities reach a high-energy-using customer segment that may otherwise remain unaddressed. A statewide offering would maximize the number of eligible WWTPs along with the energy savings potential and could be a model for other sector-focused programs. A statewide approach to implementing the WWTP Cohort Efficiency Program would potentially entail a third-party implementer that would manage the program and meet CIP compliance requirements.

It is estimated that cohort training cash cost would be between \$4,150 per participant, for the training instruction only, and \$5,750 if the trainer is recruiting the sites. This includes up to \$750 in charges per participant for expenses that are dependent on location. For each five member cohort a total program cost would be \$20,750 to \$28,750 per cohort. Cost effectiveness was estimated based on utility stakeholder input using a high training cost per facility of \$6,000 divided by \$0.02/kWh results in a total required energy savings of 300,000 kWh over the four year project lifetime or 75,000 kWh/yr. With a 25% energy savings opportunity estimated from previous work, a plant should use at least 300,000 kWh/yr. for the program to be cost effective.

Possible funding mechanisms include:

- program participants pay the program implementer to participate,
- program costs are paid up front by the utilities and
- program implementer charges a high registration fee to the participating WWTP that is partially or fully refundable by the utility if criteria energy savings are achieved.

In addition to upfront training costs, WWTP operators will invest approximately 100 hours of staff time, worth an estimated \$5,000. As a result, WWTPs will need to see significant energy cost savings in order to justify such a high investment cost.

Conclusions and Recommendations

The robust 16 hour curriculum and comprehensive set of training resources that were developed through this work will be useful for training and development of wastewater operations staff in energy efficiency. These resources introduce energy efficiency concepts and tools at a level suitable for operations staff with the intent to motivate identification and implementation of energy efficiency opportunities within their facilities.

The cohort approach chosen for this energy efficiency training model is well suited for WWTP staff at small to medium sized plants with variable, but generally limited, formal energy training and knowledge. It provides key foundational information and concepts on energy use and conservation for overall operations workforce development. Training participants will bring plant knowledge and data, applying it in active learning and collaborative exercises. The cohort model will optimize use of training resources and peer learning opportunities to minimize program costs and maximize the number of facilities that can realize benefits from energy efficiency actions at their facilities.

Establishing funding opportunities for this training through Minnesota electric utility CIP programs may require additional administration considerations. The wastewater treatment customer segment poses a challenge to the typical CIP program model in that most electric utilities in Minnesota will not have many wastewater facilities located within their territory. Therefore, most utilities would likely not be able to justify the expense of a full program offering for this customer segment. However, a statewide administrative structure could provide an effective alternative. While there may be a few utilities with enough WWTP customers to justify designing and filing a CIP offering specifically for small to mid-sized WWTPs, there is significant statewide energy savings potential among this customer group. Therefore, further exploration of whether and how this program could be offered across multiple utility territories is warranted.

For complete details on the WWTP cohort training developed in this project, download the final report, "[Driving Wastewater Treatment Energy Efficiency: A Cohort Training and Implementation Plan.](#)" In addition, a recorded [webinar](#), which describes the cohort approach is available for on-demand viewing, along with the [slide deck](#) from the webinar. For more information, contact project manager [Lindsay Anderson](#), or CARD program administrator [Mary Sue Lobenstein](#).