Minnesota Action Plan/Implementation Model

Energy Efficiency and Renewable Energy Generation at Minnesota Wastewater Treatment Facilities

Benchmarking, Assessments and Training

Recommendations Prepared for:
Office of Energy Efficiency and Renewable Energy, U.S. Department of Energy

Submitted by:

Minnesota Technical Assistance Program
University of Minnesota

Commerce Department
Division of Energy Resources

Minnesota Pollution Control Agency

Goal

To provide comprehensive technical assistance program for energy efficiency at wastewater treatment facilities

Barriers

Awareness of energy efficiency opportunity within wastewater sector is uneven across facilities and resources for assessments and support are not coordinated

Solution

Increase sector awareness of energy efficiency through coordinated outreach and assistance incorporating facility benchmarking, site assessments, technical and financial support to encourage identification and implementation of efficiency opportunities and continuous improvement planning

Outcomes

- Incorporate facility benchmarking as a starting point for site based energy assessments focused on operational efficiency measures for site engagement
- Develop and launch an energy benchmarking module for wastewater treatment facilities within the Minnesota Buildings Benchmarking and Beyond (B3) program based on ENERGY STAR Portfolio Manager®
- Capture synergies with benchmarking, technical assistance and state financing opportunities to motivate implementation

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Special Thanks: The Department of Energy, Office of Energy Efficiency and Renewable Energy for awarding our project team this State Energy Program grant, and to the many wastewater treatment plant staff and affiliated organizations who contributed to this project and helped us develop a program to scope, identify, and implement energy efficiency improvements at plants throughout Minnesota.

Background

Cities are under constant pressure to deliver improved services and manage operating costs. Wastewater treatment service can be a high cost effort due to the high capital and maintenance costs, the energy intensity of operating equipment and the need to meet increasing effluent quality requirements for positive public health and environmental outcomes. Nationally, the U.S. Environmental Protection Agency (EPA) estimates that wastewater treatment plants (WWTPs) account for 1.5-2% of all U. S. energy use.[1] Energy is a large component of facility operating costs, accounting for 25-40% of most wastewater utility operating budgets.[2,3] WWTPs reduce environmental impacts in receiving water, but create other life cycle impacts mainly through energy consumption.

Given the critical nature of WWTPs to community health and economic development, the sector's large energy consumption and the widespread distribution of facilities within Minnesota, highly effective programs to improve operation and energy use may serve as a cornerstone for communities seeking continued growth and improved community resilience. A variety of strategies will be needed to identify improvement opportunities across the spectrum of plant sizes and designs to optimize performance and operating cost.

This action plan/implementation model meets the objectives of the project to present a detailed that other wastewater treatment facilities can utilize to identify and implement onsite energy efficiency and renewable energy opportunities. By summarizing the resources and best practices gathered over the course of the project tasks, this Action Plan will present explicit strategies and tactics that can be employed by wastewater treatment facilities across Minnesota and in other states.

Wastewater Treatment in Minnesota

With wastewater treatment facilities operating in over 600 communities throughout Minnesota it is critical for state and local economies to improve the efficiency of operations to extend the useful life of this public infrastructure, meet permitted effluent quality and reduce the cost burden for residents and businesses. According to the Minnesota State Auditor's Office the age of wastewater facilities across the state ranges from less than 10 years to greater than 40 years[4] in communities ranging in size from some of the largest to cities and towns with 2,000 people or less. The cost to operate and maintain these systems can be high, which may limit the ability of some communities to reinvest in their systems to upgrade performance. Optimizing the operations and energy use of wastewater facilities can increase the working lifetime of equipment as well as help communities save money to put toward future infrastructure investment and other critical community needs.

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[1] U.S. EPA – *State and Local Climate and Energy Program: Water/Wastewater*, 2012
[2] Municipal Wastewater Treatment Plant Energy Baseline Study, Pacific Gas & Electric, 2003 https://www.scribd.com/document/62799540/Waste-Water-Treatment-Plant-Energy-Baseline-Study
[3] NYSERDA – Statewide Assessment of Energy Use by the Municipal Water and Wastewater Sector, 2008
[4] Minnesota Office of the State Auditor, Civil Infrastructure Project https://www.auditor.state.mn.us/maps/

While technology for WWTP operations is well established, facilities are highly customized to meet individual community needs and deliver effluent water discharge meeting regional permit requirements. Site specific technical assistance has been successful in identifying WWTP energy efficiency in facilities across Minnesota. In 2013, the Minnesota Technical Assistance Program (MnTAP) completed a project to assess energy use and operational benchmarks for ten WWTPs under an EPA Region 5 Water Quality Cooperative Agreement.[5] A collaborative effort between the Minnesota Department of Commerce Division of Energy Resources (DER), the Minnesota Pollution Control Agency (MPCA) and MnTAP was supported with a State Energy Program grant from U. S. Department of Energy (DOE) and provided energy assessments at eleven small to mid-sized facilities across the state.[6]

Barriers to Energy Efficiency in Wastewater Treatment

Over the course of these projects, several key barriers to energy efficiency at WWTPs have been identified:

- *Engagement* - Local knowledge of facility energy use and comparative energy performance with peer facilities is often unknown and limits justification to look for energy savings.
- *Finance* - Perception that energy efficiency efforts require large capital investments that are typically not available to facilities limits interest in identifying savings.
- *Assistance* - Highly customized plant designs require more tailored energy efficiency solutions to equip site operations staff to implement large energy conservation projects.
- *Support* - Uncertainty with risk if facilities are operated outside historically prescribed set points results in maintaining high energy use operating strategies and limits continuous improvement.

This Minnesota based DOE funded project sought to capture the significant energy efficiency opportunity at wastewater treatment facilities by addressing the root causes behind these barriers and providing tools and assistance to overcoming them. Minnesota was well positioned to execute this project based on strong State energy policies and tools that promote energy efficiency.

Minnesota Energy Policies and Tools

Next Generation Energy Act

Minnesota has a history of energy policy-making through collaboration among stakeholders, resulting in consistent achievement of aggressive carbon emission reduction and energy savings goals supported by programmatic offerings in technical assistance, education and outreach. The State has implemented policies that support energy efficiency at all levels from households and municipalities to large and small business enterprises. One of the cornerstones of State policy supporting energy efficiency is the 2007 Next Generation Energy Act (NGEA) which set a 1.5% Energy Efficiency Resource Standards (EERS) beginning in 2010 for electric and natural gas utilities. Each utility is required to develop a Conservation

[5] EPA-R5-WQCA-2010, CP-00E00758-0, Energy Efficiency Demonstration Projects and Audits for Minnesota's Wastewater Treatment Plants, final report, 2013

[6] Grant project MN Department of Commerce – 90103 – UofM (MNTAP Sub DE6888)-G, http://www.mntap.umn.edu/POTW/wwtp.html

Improvement Program (CIP) plan to achieve energy savings of 1.5% of gross annual retail sales,[7] unless adjusted by the Commissioner of Commerce.

Conservation Improvement Program

The Conservation Improvement Program (CIP) is a statewide program funded by ratepayers and administered by electric and natural gas utilities to help Minnesota households and businesses lower their energy costs by using electricity and natural gas more efficiently. CIP helps to conserve these important resources while reducing harmful emissions and the need to build new utility infrastructure. Utility CIPs are a significant source of energy efficiency activity in Minnesota and a key part of achieving the statewide EERS. Electric and natural gas CIP savings have grown significantly since the advent of NGEA, however, development of new and innovative CIP programs are needed to help utilities continue meeting their energy savings goals going forward. The *Energy Efficiency and Renewable Energy Generation at Minnesota Wastewater Treatment Facilities* program, which is focused on collaborating with Minnesota utilities to target and implement cost-effective energy efficiency measures at WWTPs, represents a CIP program concept that would help Minnesota continue to be recognized as a national leader in energy efficiency.

Buildings, Benchmarks and Beyond

Buildings, Benchmarks and Beyond[8] (B3) is a public building energy benchmarking system that provides data to support energy use planning by owners of public buildings. The Minnesota B3 was developed to meet legislative requirements[9] that energy use be benchmarked in Minnesota public buildings for the purpose of meeting State energy conservation goals. The Minnesota B3 platform has been developed under contract with The Weidt Group® (TWG) and is managed by the Department of Commerce.

Implementation and Financing Tools

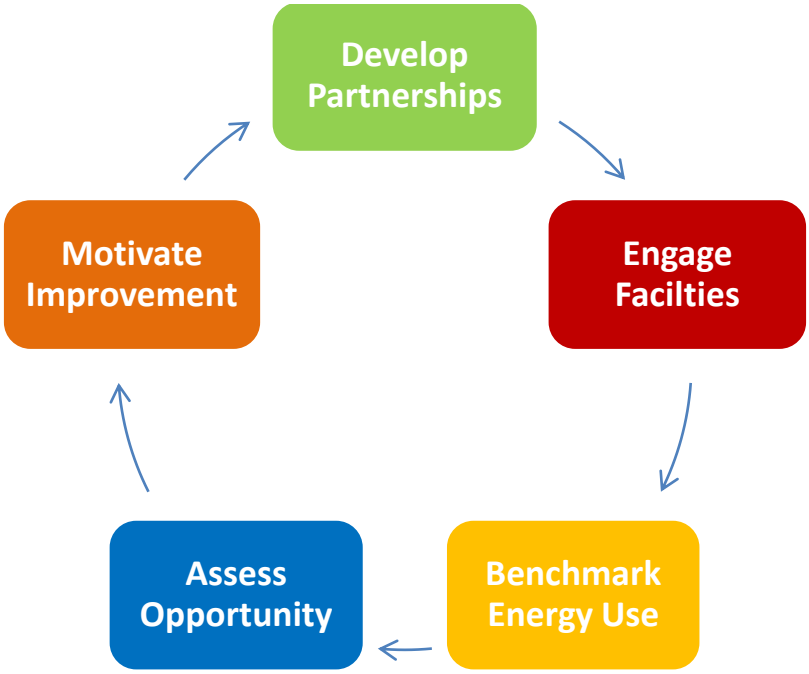
Minnesota has developed a suite of financing tools to help motivate identification and implementation of energy efficiency projects at facilities throughout the state. These tools are available to wastewater facilities to minimize barriers of capital funding for improvement projects. A brief description of these programs is outlined in the Appendix.

Process

A summary of the key process activities required to develop and execute energy efficiency and renewable energy generation activities for Minnesota WWTPs is outlined in Figure 1. Details of the major components of the process are discussed in sections below.

[7] As defined in Minn. Stat. §216B.241 subd. 1 (g), “gross annual retail sales” excludes sales to CIP-exempt customers.
[8] https://mn.b3benchmarking.com/
[9] https://mn.b3benchmarking.com/MN-session-law

Figure 1 – Key Process Activities



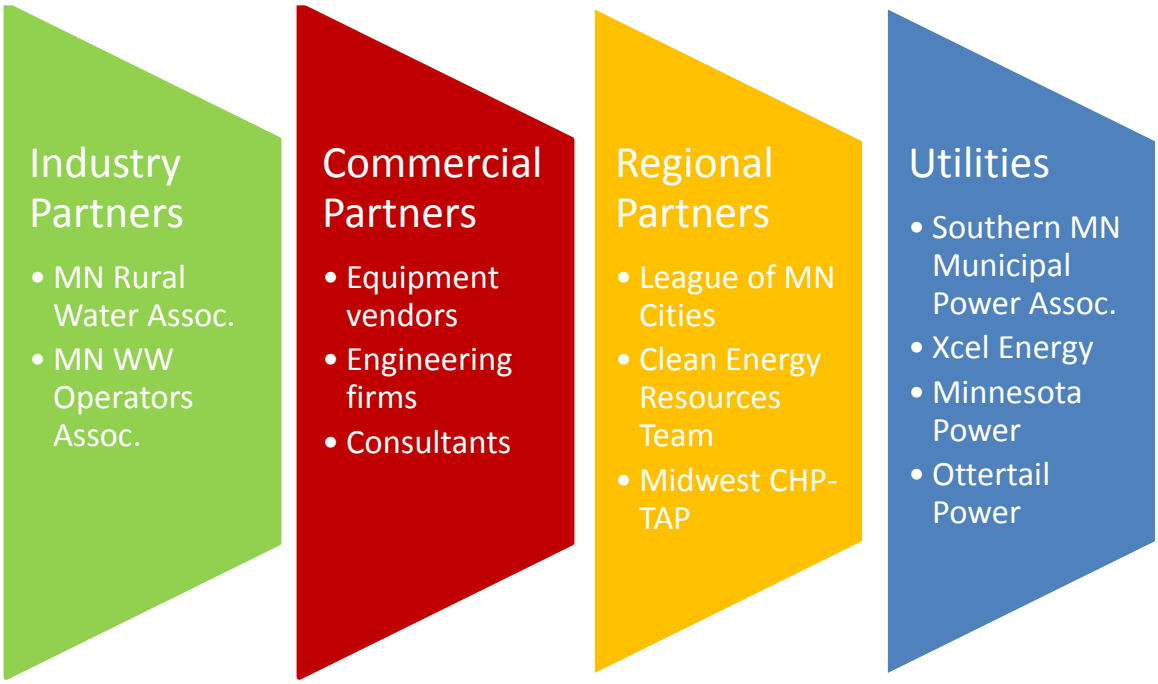
Step 1 - Develop Partnerships

There are multiple stakeholders associated with WWTPs, Figure 2 lists many of those identified in Minnesota with responsibility for engineering design, management, operation, regulation, support services, technical assistance, training and project financing. Each stakeholder can provide a unique input to the process from technical and financial support to site specific program introduction and engagement. It is necessary to identify these key stakeholders and invite them into the process to contribute to the overall success of the program.

Partnership activities focused on aligning with existing assistance providers and industry networks across the state with the primary mission to serve the WWTP community. The initial purpose of these partnership activities is to share information about the program opportunities and solicit input on approaches and strategies to get these resources to the facility level. Ultimately these relationships were critical to reporting results from the project activities back to the wastewater operations community. Commercial partners were also engaged in this process. Specifically vendors, consultants and engineering firms were engaged to provide tools, training and review of technical recommendations. Other state/regional resources were engaged as available and needed to provide specific services for outreach and engagement, efficiency assessments, tool development and training. Additional partnership activities target energy utility providers who, along with individual site operations staff, are the primary source for facility energy data. As indicated in the Policy section, utility partners are responsible for managing CIP which can be an important source of financing for site assessment and

efficiency implementation activities. The Tools and Resources section provides an overview of many additional resources available to facilities in Minnesota.

Figure 2 – Key Project Partners



Step 2 - Engage Facilities

Development and promotion of case study examples created from early grant funded technical assistance efforts with WWTPs was necessary to illustrate the program approach and the energy efficiency opportunity potential that could be achieved.[5] Newsletter articles, website content and promotional presentations crafted for the WWTP community were continuously developed and revised throughout the program to reflect the breadth of facility operations across the state and engage additional facilities with the program.

One highly effective engagement strategy was to present program results at state and regional meeting focused on wastewater topics. Minnesota has a very strong network of training and technical assistance for wastewater treatment personnel through MPCA, Minnesota Rural Water Association (MRWA) and the Minnesota Wastewater Operators Association (MWOA). Presenting energy efficiency training, benchmarking discussion and case study examples to operations staff attending these meetings proved to be a highly effective way to engage facilities. Benefits of this approach include:

- Alliances with industry affiliated partner organizations
- Access to staff from many wastewater facilities at one time, in one location
- Opportunities to visit sites and demonstrate best practices through regional meeting activities
- Repeated exposure to operations staff through recurring meeting activities

Energy efficiency training and informational presentations were well received by operations staff at these meetings. Early stage engagement of facility staff and stakeholders often occurred at these events.

Step 3 - Benchmark Energy Use

The most significant engagement tool and launch point for site energy assessments identified over the course of this project was the introduction of facility benchmarking within the wastewater sector. As outlined in the Background section, a key barrier to facility engagement with energy efficiency assessments and implementation is that local knowledge of site energy use and energy performance relative to other facilities is limited. Benchmarking allows the energy use and the potential for improvement to become clearer to site staff, city managers and energy utility representatives and serves as a focus for conversations around identification and implementation of basic energy efficiency measures through opportunity scoping and evaluation of advanced energy technologies.

A variety of benchmarking strategies were employed over the course of this work depending on the type of facility and the amount of data available. Simple benchmark strategies such as energy use per million gallons processed or per unit biolochemical oxygen demand (BOD) processed were effective to convey the concepts of benchmarking to operations staff but often lack sufficient detail to allow site staff to evaluate their energy performance relative to peer facilities. To provide the comparative capacity the project team looked to improve the B3 Benchmarking tool already used by public facilities to track energy performance and utility cost based on building envelope criteria.

Over the course of the Minnesota DOE project, new functionality was added to B3 so the platform can now provide a wastewater benchmark score based on operational factors not just building size. For facilities treating >0.6 million gallons per day flow, the Minnesota B3 system provides data to EPA to generate ENERGY STAR® Portfolio Manager scores.[10,11] For smaller facilities a similar score is calculated within B3 to generate an equivalent benchmark value. The ENERGY STAR® Portfolio Manager score is the percentile ranking of plant energy performance against a national sampling of facilities, with a higher value being more efficient. With the newly added WWTP benchmarking functionality, cities can compare their plant's energy performance to other WWTPs throughout Minnesota, and the nation, to determine how efficiently their plant is operating.[12]

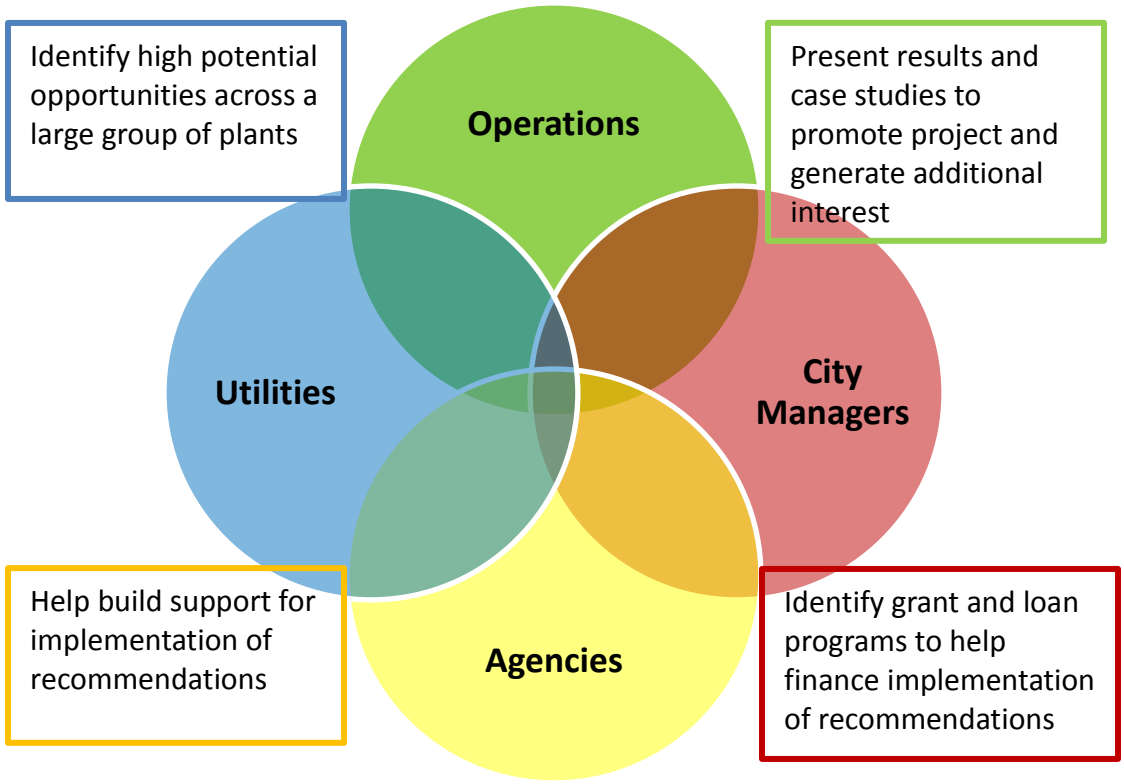
Key features of this tool include:

- B3 branding to for recognition and alignment with the State program
- Discharge Monitoring Report (DMR) data uploaded from the State quarterly
- Energy data can be added manually or uploaded automatically from some utility providers
- Scores for facilities >0.6 MGD are provided from Portfolio Manager
- Performance indicators for facilities <0.6 MGD are calculated from Portfolio Manager standards

[10] https://www.energystar.gov/buildings/tools-and-resources/energy-star-score-wastewater-treatment-plants
[11] https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/use-portfolio-manager/understand-metrics/eligibility
[12] http://mn.b3benchmarking.com/WastewaterTreatmentPlants

Benchmarking was key to efficiently identify and communicate energy efficiency opportunities to a variety of sector stakeholders. The benchmark scores were an important part of the overall process to identify sites with energy savings opportunity, engage the facilities in assessment activities and aggregate support resources to encourage and enable implementation. Figure 3 illustrates how stakeholders and facilitating relationships between stakeholders can help support assessment activities, identify financing resources and motivate implementation of energy efficiency recommendations.

Figure 3 – Benchmarking as a Program Engagement Tool



It was found that receiving the energy performance as a ranking relative to other facilities resulted in a high level of site engagement with the assessment process. This was the case for facilities with both high and low benchmark indicators, with low scoring sites actively seeking technical assistance to identify opportunities to improve. Once the benchmarking analysis was completed, site based energy performance based on the energy benchmark indicator value was discussed with site personnel to assist with interpretation of the analysis. Facility energy use was classified as shown in Table 2.

Table 2 - Energy Benchmark Indicator Recommendation Plan

Relative Performance	Project Action
Lowest quartile	Energy assessment whole facility recommended Implementation plan developed Operational changes for high energy uses Outlined list of next steps available Follow up for technical support
Third quartile	Energy assessment whole facility often recommended Implementation plan developed Operational changes for high energy uses Capital change opportunities discussed Follow up for technical support
Second quartile	Energy assessment targeted operations on request Implementation plan for continuous improvement Discussion about advanced technology screening Possible request for best practices case study
Top quartile	Possible site visit for unique operations Review of continuous improvement plan Discussion about advanced technology screening Request for best practices case study

The success in engaging WWTPs in energy efficiency activities based on process benchmarking results and the lack of an available tool to generate these results for all the mechanical facilities in the state encouraged the DER to revise the wastewater treatment module in the current state B3 system. While the existing B3 system included WWTPs, the facilities were benchmarked like other public buildings based on square foot area and utilization of the building. Revisions to include process energy use provide more useful measures of energy use in these facilities.

As additional incentive for communities to participate in B3 for wastewater treatment, entering facility data into B3 will be required for all applications for State Revolving Fund capital funding projects.

Step 4 - Assess Opportunity

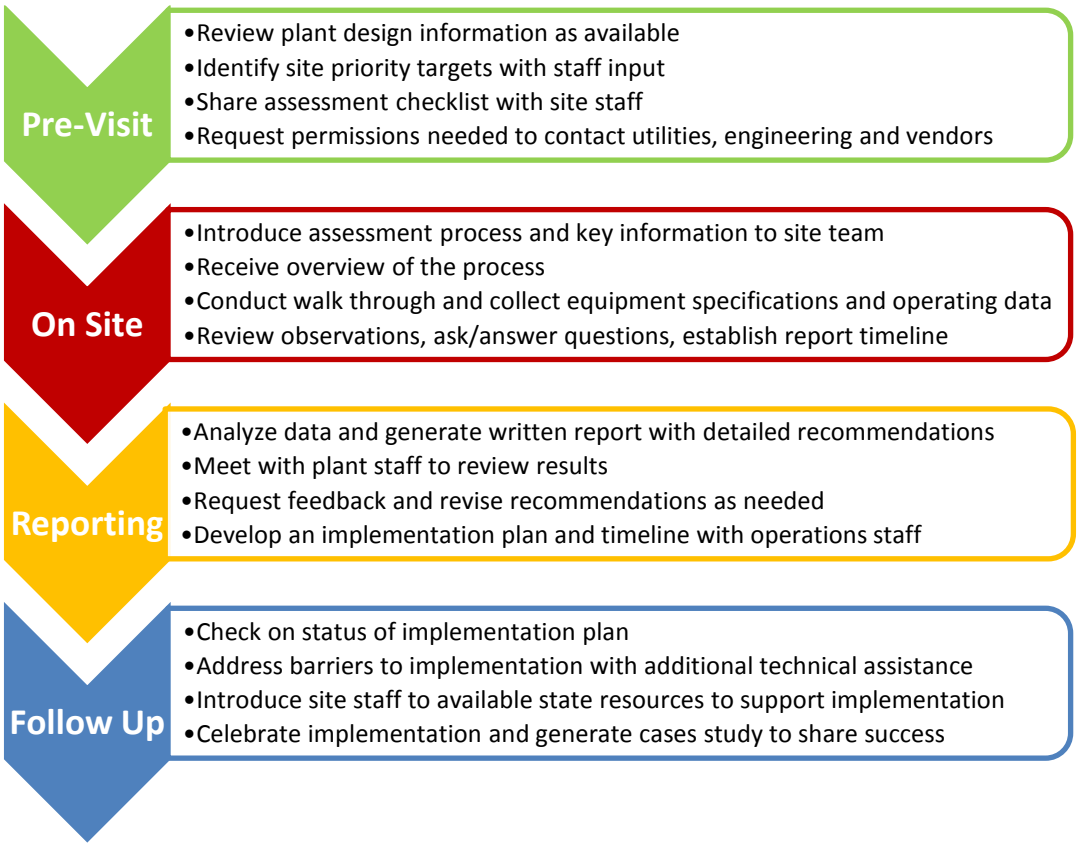
Energy use in WWTPs depends on plant design choices. Facilities have been designed to run most efficiently at full capacity and generally have limited ability to tune operations for energy efficiency at intermediate flow, which is where most plants operate. There were three themes addressed in the energy efficiency assessments conducted in this work.

- Optimize operation of existing equipment for plant loading
- Manage dissolved oxygen (DO) in aerated systems
- Emphasize life cycle cost advantages of energy efficiency equipment choices

Facilities that had low benchmark indicators were generally interested in technical assistance to identify options to improve performance. The assessment visits were scheduled as soon after the benchmarking review as possible to maintain interest and site momentum. A detailed site assessment procedure has

been developed which includes data sheets and checklists. Figure 4 provides a brief overview of the site visit process steps.

Figure 4 - Site Assessment Process Overview



Step 5 - Motivate Improvement

The true measure of an energy efficiency program is how effectively it motivates implementation of recommended energy conservation measures and encourages continuous improvement. Follow up with facilities has been a key to measuring success over the course of this work. Connecting with facility managers after the initial assessment activities have been completed and the report and recommendations delivered is a critical piece to ensuring the site staff understand the opportunities presented and are engaged in testing operational strategies to support implementation. These conversations offer the opportunity to support and encourage site efforts toward implementation, revisit concerns site staff may have over suggested activities and provide additional information or resources that may help facilitate implementation or identify additional opportunity. Supplying additional resource support was used as a tool to maintain progress on opportunity identification, testing and implementation for facilities with complex operational changes or unclear implementation pathways as identified during initial assessment activities. In these cases, student intern projects, supported in part through grant funds and facility utility providers as part of the MN CIP program,

supplied the manpower needed to refine the process improvement suggestions and launch implementation. Follow up activities offer an important opportunity to test recommendations, measure the impact of implemented recommendations and verify the electric energy conserved and cost savings achieved.

On occasion, facilities may become stalled during the implementation phase due to lack of knowledge on how to best proceed or out of concern for what might happen to facility performance. Reconnecting with the project sites allows for added input to the implementation process, discussion on additional opportunities or limits identified and awareness of unintended outcomes that may have been observed. An additional opportunity that often comes from building these relationships with facilities is the ability to share the site energy story through case study development. As facilities pursue implementation of the recommended energy measures, there is an increasing investment in the process and awareness of energy use opportunity. Celebrating the site by promoting their participation in the program and the efficiency activities that were identified and implemented is a good opportunity to positively reinforce their work and encourage continued improvement. Additionally, creating case studies can serves to generate teaching materials used to engage other facilities, government leaders and utilities as they seek to improve energy performance and operating costs.

Upon full implementation and site utilization, the State B3 benchmarking for wastewater treatment will allow facilities to track implementation and resulting energy use impact. Site energy performance will be recorded and visualized in the software reporting package for easy retrieval and comparison with site goals. B3 data tracking offers sites a way to track energy use performance over time and provide feedback to sites engaged in continuous improvement programs. Data tracking will also allow stakeholders, such as energy utilities, funding partners and technical assistance providers, to tailor program outreach activities for facilities that need the most assistance.

Outcomes

On-site technical energy efficiency assessments identified a total of 5.5 million kWh annual energy savings opportunity with an estimated value of $423,000. This is an average energy savings of 500,000 kWh per year per facility with an actual range from 69,000 to 1.2 million kWh/year across the eleven assessed sites. Approximately 70% of the recommended energy efficiency opportunities identified in this work could be achieved through operational changes requiring no or low capital investment. Approximately 40% of the 5.5 million kWh of recommended energy savings has been implemented to date with an additional 39% planned. A summary of project objectives and outcomes has been outlined in Table 3 below. A summary of the status of recommendations is shown in Figure 5. A summary of facility level recommendation status is shown in Figure 6.

Table 3 – Project Objectives and Outcomes

Project Objective	Project Target	Project Outcome
Engage MN WWTP in E2 and DG	-	26 presentations/events
Attendees at events	-	1139 attendees
Operators Trained in E2	50	108
E2 Assessments	10	11
Identified energy efficiency	2-5 million kWh	5.5 million kWh/year
Implemented energy efficiency	-	2.2 million kWh/year
Planned Implementation	-	2.1 million kWh/year
Case studies generated	-	6
Discussions on E2 planning	10	11
MnTAP Intern Projects	2-3	2
CHP Screening Analysis	5	5 launched, 4 completed
CHP Assessment	1-2	1 under consideration

In addition to direct energy savings, 6 case studies were produced providing public facing summaries of energy efficiency measures recommended to various facilities and best practices from high performing facilities. These case studies can be used as tools for outreach and education to additional facilities that would like to capture energy efficiency beyond the grant period.

Figure 5 – Program Energy Recommendation Status

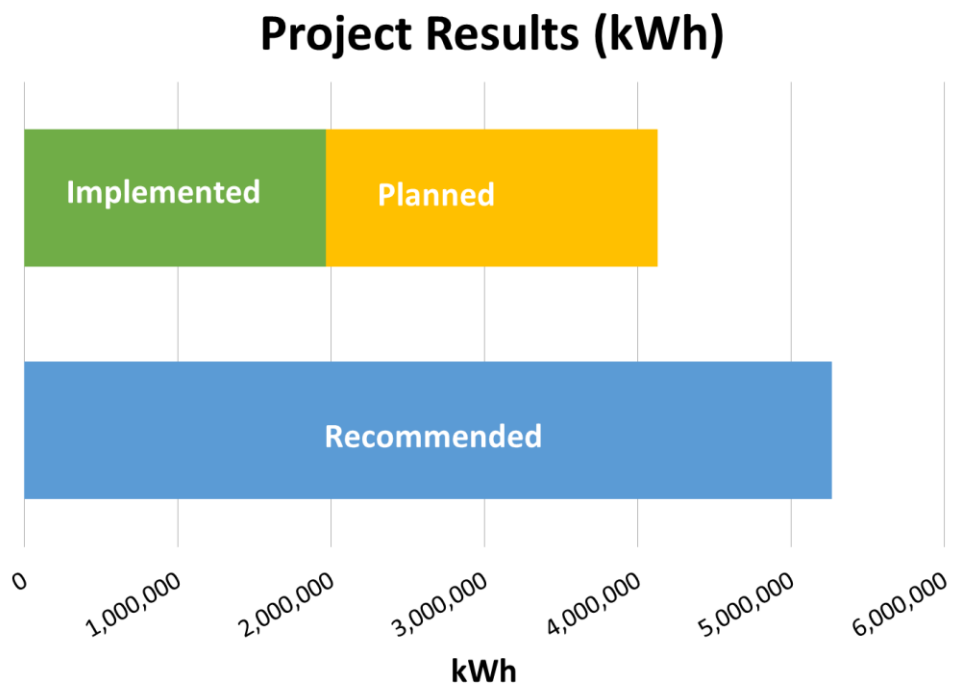
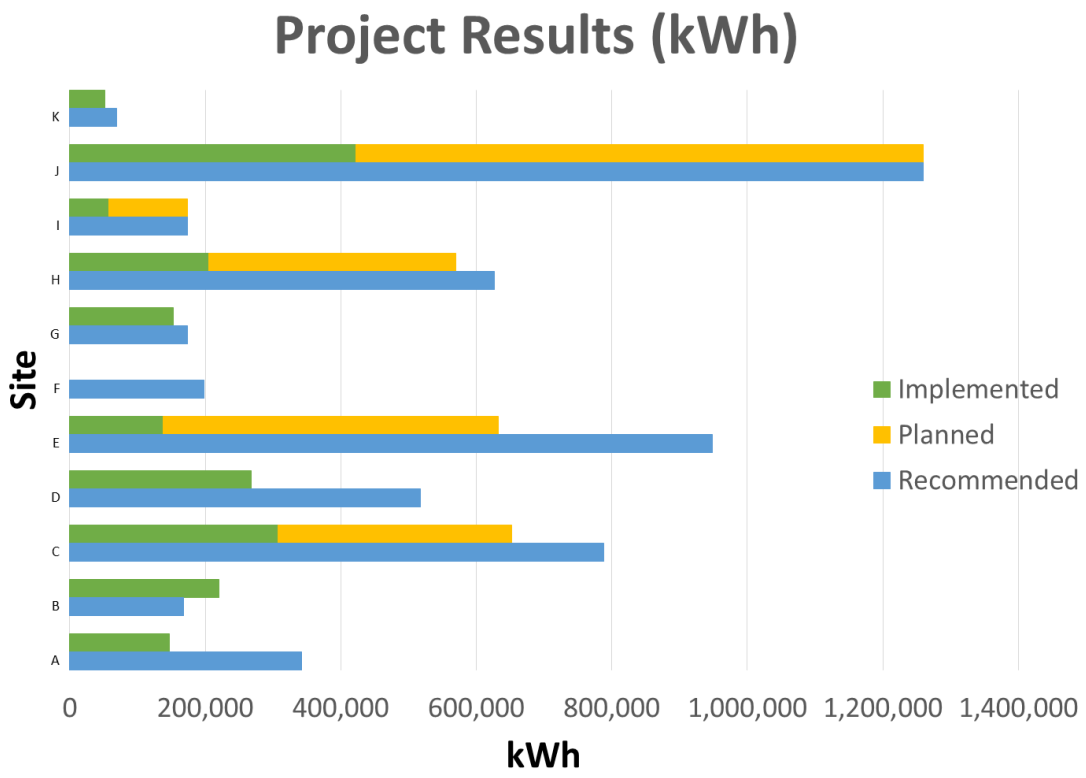


Figure 6 – Facility Level Energy Efficiency Recommendations and Implementation



Additional Opportunities

Distributed Energy Generation

This project also served to connect wastewater treatment plants with information and site scoping for combined heat and power (CHP) opportunity. Wastewater plants that practice anaerobic digestion may be good candidates, as the process is in place to break these wastes down into methane that can be used as fuel. An additional attribute of strong candidates for CHP are those wastewater facilities with moderate to high BOD loading or with access to compatible high-load industrial waste.

This part of the project was conducted in collaboration with the Combined Heat and Power Technical Assistance Partnership (CHP TAP) based out of the University of Illinois, Chicago. This organization provides no-cost first level combined heat and power (CHP) screening assessments throughout the Midwest. The assessments serve to give sites a first-look at the cost-benefit analysis associated with using the gases generated in anaerobic digestion processes for electric energy generation and heat for their plants, reducing their need for externally generated electricity and natural gas from the grid.

MnTAP conducted site screening evaluations based on suggestions provided by CHP TAP[13] including facility attributes such as having anaerobic digestion operations and a flow of >5 MGD. There were few facilities in Minnesota that met those criteria. To increase the number of facilities for consideration, MnTAP staff chose to look at potential sites with lower flow but with high organic load. State discharge monitoring report (DMR) data were analyzed and MN sites practicing anaerobic digestion with >1 MGD flow and high BOD load were identified. Twenty-five facilities were approached for CHP screening, having BOD loadings between 2500 and 25,000 lb/day. Of these, five facilities were engaged in the screening assessments.

Of the five sites engaged in the screening evaluation, four completed the feasibility assessment by providing operations data that were analyzed by the Chicago CHP TAP. The feasibility assessments showed investment payback periods for site CHP investments ranged from four years to ten years. This return on investment period, while likely too long for most private investment, is within the range of many wastewater facility investment projects. It was good to see that a reasonable investment opportunity appears to be available even to smaller facilities, which comprise most of the Minnesota wastewater infrastructure. Of the four facilities completing the feasibility assessment, one site is interested in proceeding to an investment grade analysis to further refine the site CHP opportunity.

While renewable energy generation at wastewater facilities has been practiced at a few sites throughout the state for many years, it is still relatively rare. Most wastewater operations managers and staff as well as support services such as engineering firms and utility providers do not have extensive knowledge about the opportunity appropriately applied implementation of renewable energy generation technologies can bring to a site or region. This general lack of familiarity can present barriers to consideration of technologies such as CHP that may manifest as inability to invest time to explore the opportunity potential, lack of support from service providers and lack of willingness to explore the technology and cost implications. This project provided an important introduction to CHP to Minnesota wastewater facilities and provided data that can be utilized to educate industry stakeholders and promote the potential for renewable energy generation in this sector.

Continued Impact - Cohort Energy Efficiency Model

While technology for WWTP operations is well established, facilities are highly customized to meet individual community needs and deliver effluent water discharge meeting permit requirements. Due to this customization, general solutions for energy efficiency are limited in equipping site operations staff to implement significant energy conservation projects. Site specific technical assistance model described in this document has been effective in identifying significant WWTP energy efficiency opportunity and motivating implementation in facilities across Minnesota. However, given the large number of facilities across the state and country, site based technical assistance will require significant resource investment to capture the full energy potential within this sector and may not equip site operations staff with the tools needed for continuous improvement.

[13] http://www.midwestchptap.org/support/documents/CHP_TAP_Technical_Assistance_Offerings.pdf

Future efforts seek to deliver a cohort based energy efficiency program at a scale and level appropriate for small to medium sized WWTPs within Minnesota. A regional energy efficiency cohort model can make use of the strong culture of education and knowledge sharing within the operations community to magnify the impact of site based technical assistance resources. A cohort energy efficiency model is expected to increase peer learning, motivate group participation for the identification and implementation of energy efficiency measures and reduce program transaction costs over individual site assistance efforts. MnTAP has won a Conservation Applied Research and Development (CARD) grant from DER to develop curriculum and delivery models for a small to mid-size wastewater treatment facility cohort training program. This program, scheduled to start in January 2018 and run for 18 months, will seek to apply the information gained from site based technical assistance at small to mid-size wastewater facilities and transform it into a cohort energy efficiency training model that would help overcome many of the remaining engagement, assistance, and support barriers to energy efficiency outlined in the Background Section.

Municipal wastewater treatment is an ideal sector to demonstrate the value of a cohort model for energy efficiency. There are few issues with proprietary operations. Workforce licensing in this sector fosters a culture of continuing education. There are strong regional and state networks that enable and encourage peer interactions, technical training and collaboration. Similar approaches have been used on a national level by DOE focused on very large facilities to improve energy performance of critical infrastructure across the United States through programs such as, Superior Energy Performance Water and Wastewater Pilot Project and Sustainable Wastewater Infrastructure of the Future Accelerator. This program would seek to understand best practices identified in this effort and use similar methods at smaller treatment facilities where appropriate.

Once the curriculum is developed a second phase will be to utilize the developed training tools in a technical demonstration of a regional WWTP cohort assessment model to achieve energy efficiency. When a pilot cohort training is conducted, the process will be documented to facilitate replication as a utility program. Recommended and implemented energy efficiency measures will be assessed in order to estimate opportunity potential upon program replication. Benefits of the program will result from the site based energy efficiency opportunities identified by cohort participants. A cost/benefit analysis of this cohort model is critical to justify the approach as a cost effective energy efficiency program. In addition the time, operational and capital commitments from the cohort members will be documented to better assess the site investment required to achieve outcomes within a cohort framework. An additional outcome of this effort will be the implemented energy reduction achieved by the cohort member facilities.

Appendix - Tools and Resources

Minnesota Implementation and Financing Programs

	Implementation & Financing Programs			Financing Programs	
Method	Clean Water Project Priority List (PPL)**	Guaranteed Energy Savings Program	Local Energy Efficiency Program	Energy Saving Partnership	Rev It Up Program
Eligibility (recipient)	Cities, Counties, Sanitary Districts and other Municipals Entities Borrowers Must have authority to issue General Obligation debt	State Agencies, Higher Ed, Local Governmental Units, K-12	Local Governmental Units, K-12 buildings	Local Governmental Units, K-12	Local Governmental Units, Commercial and industrial Businesses, Small Businesses (<50 employees), Health Care Facility's, MHFA
Type	Build, repair and improves wastewater and stormwater collection and treatment systems Low interest loans and either affordability or pollutant based grants	State Assisted Energy Savings Performance Contracting (ESPC) Program with Guaranteed Savings	State Assisted Energy Study using Design-Bid-Build for implementation	Municipal Leasing program-tax-exempt	Revenue Bonds - tax-exempt or taxable (project dependent)
Project Size*	Min. Historical of under $100k (additional requirements may not off set interest saved under $300k) Max. none	Min. $300k Max. none	Typically between $50k and $350k	Min. $50k Max. none	Min. $1M Max. $20M
Term (years)	20 years, up to 30 years for some projects if demonstrated financial hardship. Loan term cannot exceed useful life of project	Up to 25	Up to 15	Up to 15	Up to 25
Interest Rate*	Below market rate, less annual discount approved by the PFA Board. Cities under 2,500 may quality for additional discounts. Rates cannot go below 1%	Dependent upon financing instrument – eligible for lease purchase financing	Dependent upon financing instrument – eligible for lease purchase financing	Dependent upon issuance	Dependent upon Project Security
Administrator	MN Pollution Control Agency, Bill Dunn (MPCA) 651-757-2324Public Facilities Authority, Becky Sable (PFA) 651-259-747	MN Department of Commerce Peter Berger 651-539-1850	MN Department of Commerce Peter Berger 651-539-1850	St. Paul Port Authority Peter Klein 651-204-6211	MN Department of Commerce Peter Berger 651-539-1850