Smart Management for Small Water Systems

Energy Management Planning: NYSERDA's Energy Management Program

EFCN environmental finance center network

American Water Works Association

UNC ENVIRONMENTAL FINANCE CENTER

This program is made possible under a cooperative agreement with EPA.

NYSERDA

- New York State Energy Research & Development Authority
- Public benefit corporation created in 1975
- Mission:
  - Use innovation and technology to solve some of New York's most difficult energy and environmental problems in ways that improve the state's economy
- Municipal water and wastewater sectors are a target to strategically reduce energy consumption in New York

Water System Goals

- Primary Goal – meet regulatory requirements to protect human health and environment
- Secondary Goal – provide services for reasonable and fair user fees or rates

Energy Use and Water Utilities

- Energy represents the largest controllable cost of providing water services to the public
  - Over 52,000 Community Water Systems
  - Over 18,000 Non-Transient Non-Community Water Systems
  - Over 86,000 Transient Non-Community Water Systems
  - The total inventory is about 157,000 Public Water Systems
- Small systems (3,300 or less) make up about 94% of all systems

Energy Use at Water Systems

- Pumping water is the largest consumer of energy
- Energy use is expected to increase
  - increases in demand
  - new energy intensive technologies (ozone, membranes, UV)
- Water-stressed states are shifting to more energy-intensive technologies to address current and future water-scarcity concerns
  - desalination plants
  - inter-basin water pipelines

Water Systems are Energy Users

- In 2010 water systems used 12.6% of the nation's total annual energy consumption.

= annual consumption of ~40 million Americans

Energy Management Goals

- Improve Energy Efficiency and Manage Total Energy Consumption
- Control Peak Demand for Energy
- Manage Energy Cost Volatility
- Improve Energy Reliability

Improve Efficiency and Manage Total Consumption

- Cost of electricity is based on two main components
  - Quantity of electricity used (kWh)
  - Demand for electricity (kW)
- On-peak vs. off-peak consumption affects rates
- Understanding the electric utility's pricing policies (rate structures) is critically important

Control Peak Demand for Energy

- Electric utilities typically include a “demand charge” in their rate structure
  - 30-60% of the overall cost of electricity
- Lower variability in electric demand over time (flattened demand curve)
  - Minimize changes in peak demand throughout the course of a billing period
  - Shifting loads from peak periods, typically during daylight hours, to off-peak periods
- Potential for significant cost savings by minimizing demand charges

Manage Energy Cost Volatility

- Energy costs fluctuate (more than water revenues)
- Dramatic changes stress budgets
- Protect against volatility as much as possible
  - Reducing need for energy
  - Long-term procurement of energy
  - Provisions for alternative energy sources
  - On-site generation of energy

Improve Energy Reliability

- Water utilities should be able to provide critical systems with adequate backup power
- Energy planning process should identify opportunities to improve energy reliability
  - Protection against complete loss
  - Identify changes in power quality that can damage equipment and/or
  - Institute operating procedures to address changes in overall power availability

Energy Management Program Development

Energy Management Program - Basic Steps

- Step 1. Establish Organizational Commitment
- Step 2. Develop a Baseline of Energy Use
- Step 3. Evaluate the System and Collect Data
- Step 4. Identify Energy Efficiency Opportunities
- Step 5. Prioritize Opportunities for Implementation
- Step 6. Develop an Implementation Plan
- Step 7. Provide for Progress Tracking and Reporting

Source: NYSERDA

Step 1 – Establish Organizational Commitment

- Is your team defined? Is your team diverse?
- Does it represent various interests and responsibilities within the utility? (i.e. elected official, manager, operator, member of finance team, etc.)
- Team responsibilities include: develop the plan, establish goals, define the resources needed, provide information to others (i.e. CIP team)

Why bother?

- Without the commitment of several individuals at varying levels within your utility, successful implementation of an energy management plan will be difficult
- Think of The Avengers – no one individual could have saved the city; it took all of them working towards a common goal to be successful!

Step 2 - Developing An Energy Baseline – What Should You Do?

- Gather basic information
  - One year of data minimum
  - Examples: utility billing records, SCADA system records, O&M records, equipment or motor lists (horsepower & load)
- Organize treatment processes by functional area
- Evaluate energy bills and understand the energy rate structure

Developing An Energy Baseline – What Else Should You Do?

- Review hydraulic data (flow) and compare it to energy use
  - Identify wet weather, seasonal patterns
- Build a basic ‘model’ to organize data, and capture energy use patterns
- Create basic graphics and reports to communicate initial findings

Why bother?

- Energy efficiency gains = $$$ saved
  - The process of investigating energy use, and improving awareness among staff, can provide measurable energy efficiency gains on the order of 3-5%.
- Value shown before resources committed
  - Successfully developing a basic understanding of energy use can be a good ‘early victory’, allowing the team to demonstrate some value even before any significant resources are committed to the program.

Step 3- Evaluate the System and Collect Data

- Use the spreadsheet provided or any other format that is easy and acceptable to your team
- This step goes beyond the baseline development (historical records). It involves data collection in the field
  - System walk-through (note operational information, motor sizes, etc.)
  - Staff interviews (operational practices, maintenance practices/history, take suggestions)
  - Energy performance data (field data from direct measurements, average equipment run time, sub-metering, etc.)

Possible Areas of Evaluation

- Raw and Finished Water Pumping
- Chemical Mixing
- Backwashing
- Well Systems
- Ozonation
- Load Shifting
- Distribution
- Supervisory Control and Data Acquisition (SCADA)
- Energy Efficient Motors

And… System Water Loss

Step 4: Identify Energy Efficiency Opportunities

- Energy efficiency opportunities can be defined as any system change that helps to reach a stated energy management goal.
- At this stage the energy management team should identify a broad array of energy efficiency opportunities.

Categories for Energy Efficiency Opportunities

- Capital program or equipment replacement
- Process change
- Operational change
- Automation or controls
- Maintenance improvements
- Business measures

Step 5: Prioritize Opportunities for Implementation

- The final product of this step is a short list of energy efficiency opportunities that have been selected and carefully evaluated out of the list of opportunities generated in the previous step
- Identify a consistent method to compare and rank opportunities (consider both the monetary and non-monetary)

Keys to Success

- Convert all energy efficiency opportunities characteristics to monetary terms whenever possible.
- Evaluate all energy management, including ancillary benefits when possible.
- Test the sensitivity of results to determine the impact of important assumptions (e.g. time horizons)
- Make sure that the final results make sense in terms of the utility's capabilities.

Step 6: Develop an Implementation Plan

- How to Do It – Business Plan
- Actions required in this step include the following:
  - List the projects chosen for implementation and describe the goals and objectives of the program
  - Explain the resources needed, including a budget and financing plan
  - Develop any specifications needed, including design criteria and procurement related documents

Step 6: Develop an Implementation Plan

- Actions required in this step (cont.):
  - Provide any changes in standard operating procedures, and/or process control strategies
  - Set the schedule for implementation, including milestones and gaining the necessary regulatory approvals (if applicable)
  - Set realistic expectations for the project in terms of resources required, schedule, procurement time frame, and expected results

Step 7: Provide for Progress Tracking and Reporting

- The success of a project should be measured as it is being implemented
- The specific actions required in this step include the following:
  - Assign the responsibility for tracking the progress of a project and reporting on that progress. Allocate the resources necessary to fulfill the responsibilities.
  - Set the performance metrics that will be used.
  - Create a communication plan. Identify who needs to be included in progress reports (examples: elected officials, public, etc.), when reports should be made, and any actions that need to occur in response to reports.

Constraints on Implementing an Energy Management Program

- Organizational constraints
- Capital costs
- Process reliability
- Regulatory requirements and limits
- O&M capabilities, and non-energy O&M costs
- Engineering constraints
- Space availability

Breaking Barriers

Lack of Awareness

Operators may not be used to thinking about energy. Utilities must understand benefit–cost arguments for doing so.

Risk

Deviating from the usual routine creates risk, whether perceived or real. Fears must be addressed and benefits must outweigh costs.

Change Implies a Problem

Utilities may resist new ideas if suggestions for improvements imply criticism or incompetence.

Cost

Identifying, understanding, and resolving inefficiencies require money that may be difficult to budget for, though this is becoming easier.

Questions?