Process and Energy Audits at Water and Wastewater Facilities

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Presentation Outline

- Types of Audits
- Benchmarking
- Submetering
- Data Collection/Information Gathering
- Typical Energy Saving Measures
- Renewable Energy
- Measurement and Verification
- Funding

When should you conduct an energy audit?

Before a Major Upgrade

- Anytime
- Before a Major Upgrade
- If Funding becomes available
- After conducting a benchmarking analysis that results in a poor score

Types of Energy Audits

Walk Through Audits (Level I)

DURATION: Walk through of the facility (1-2 hours)

PRODUCT: Suggestions for low cost improvements to lights / HVAC – few if any calculations and/or quantified payback projections.

RESULTS: Quick payback projects that take advantage of utility rebates.

Identify potential energy saving items that would require additional analysis.

COSTS: Very low cost, sometimes free.

Energy Survey and Analysis (Level II)

DURATION: Several hours on site, plus time to review energy bills, etc.

PRODUCT: Suggestions for low cost improvements to lights / HVAC and equipment upgrades in existing processes (VFDs, Premium Efficient Motors). Calculations of energy savings and rough estimates of upgrade costs to determine simple payback period.

RESULTS: Quick payback projects that take advantage of utility rebates.

COSTS: $10K - $20k, depends on size of facility, scope to be analyzed.

Process Energy Audit (Level III)

DURATION: One or more days on site, time to analyze energy bills, develop pump curves, and possibly several weeks of data gathering and review

PRODUCT: Energy use of existing processes compared to alternative processes

- » Potential Design Modifications
- » Optimization of process controls

RESULTS: Detailed operational and process suggestions with both long and short term paybacks, some capital intensive projects that may require outside funding sources. Most likely to result in significant savings.

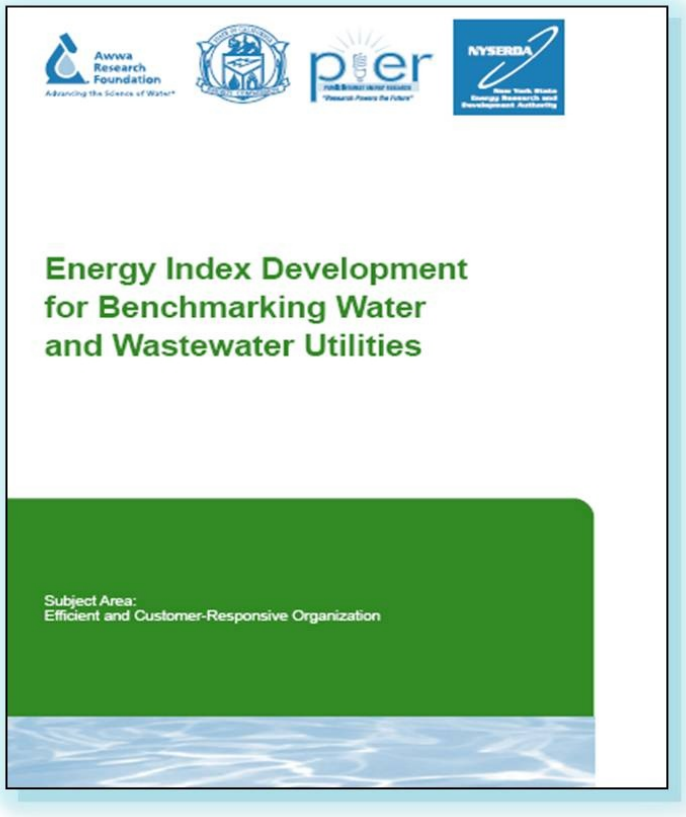
COSTS: $10K - $100K depending on size of facility and scope of work.

Benchmarking

Difference Between Benchmarking and Trending?

Energy Benchmarking

Benchmarking Tool



Energy Benchmarking

- Banks / Financial Institutions
- Courthouses
- Hospitals
- Hotels
- K-12 Schools
- Medical Offices
- Offices
- Dormitories
- Retail Stores
- Supermarkets
- Warehouses

Benchmarking Tool Inputs

- Electricity (kWhs)
- Natural Gas (therms)
- Fuel Oil #2 (gallons)
- Propane (gallons)

Benchmarking Tool Inputs

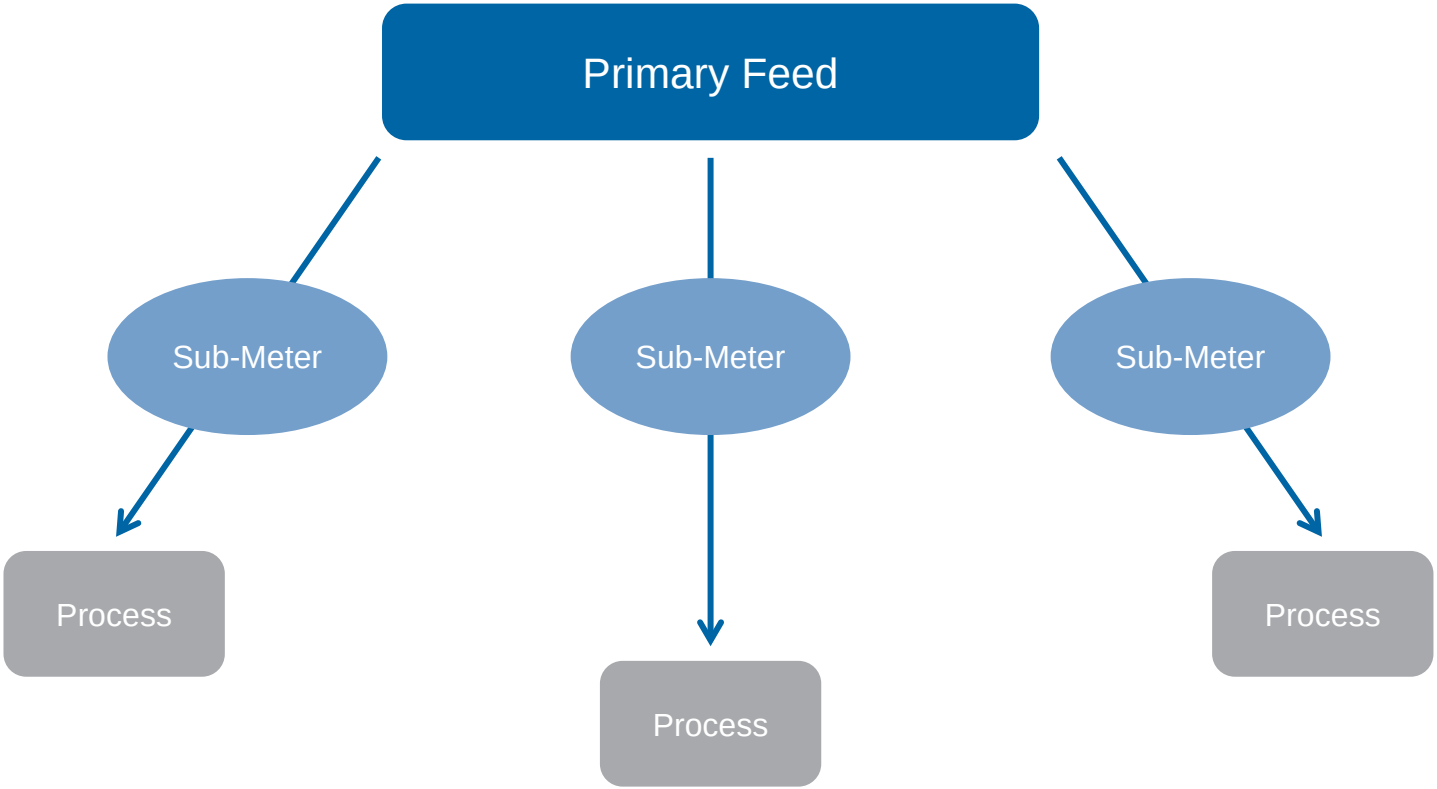
- Design Daily Influent Flow (mgd)
- Average Daily Influent Flow (mgd)
- Average Influent BOD (mg/L)
- Average Effluent BOD (mg/L)
- Does your plant have a fixed-film or trickling filtration process? (yes =1 or no = 0)
- Does your treatment include nutrient removal? (yes = 1 or no = 0)

Benchmarking Scores

- >75 Great job
- 65 -75 Energy Saving Opportunities exist, may require significant investment
- <65 Energy Savings Opportunities exist! Many at no or low costs with quick payback periods

Submetering

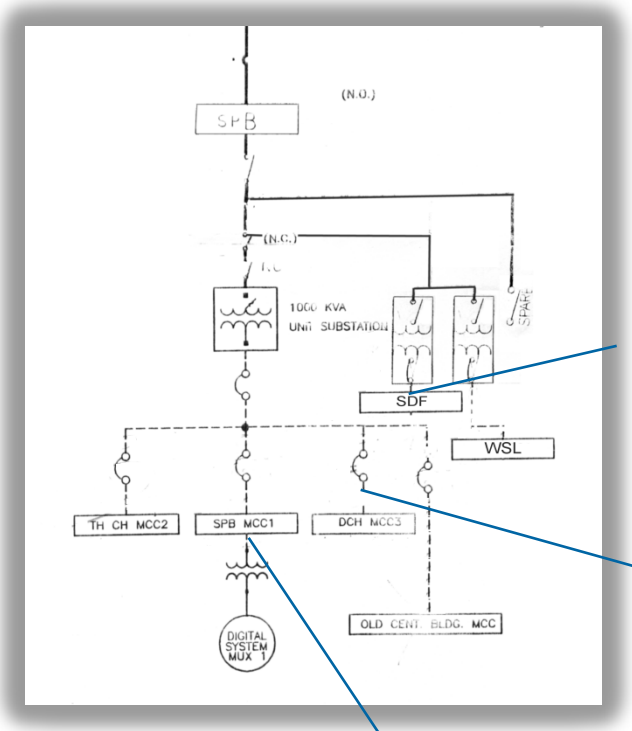
Submetering



Developing a submetering plan

- How many submeters are required?
- How can we electrically isolate equipment/ processes for metering?
- How long should the sampling interval be?
- How will data be collected? Data loggers vs. existing SCADA.
- How often should data be collected?
- Temporary or Permanent?

Submeter locations



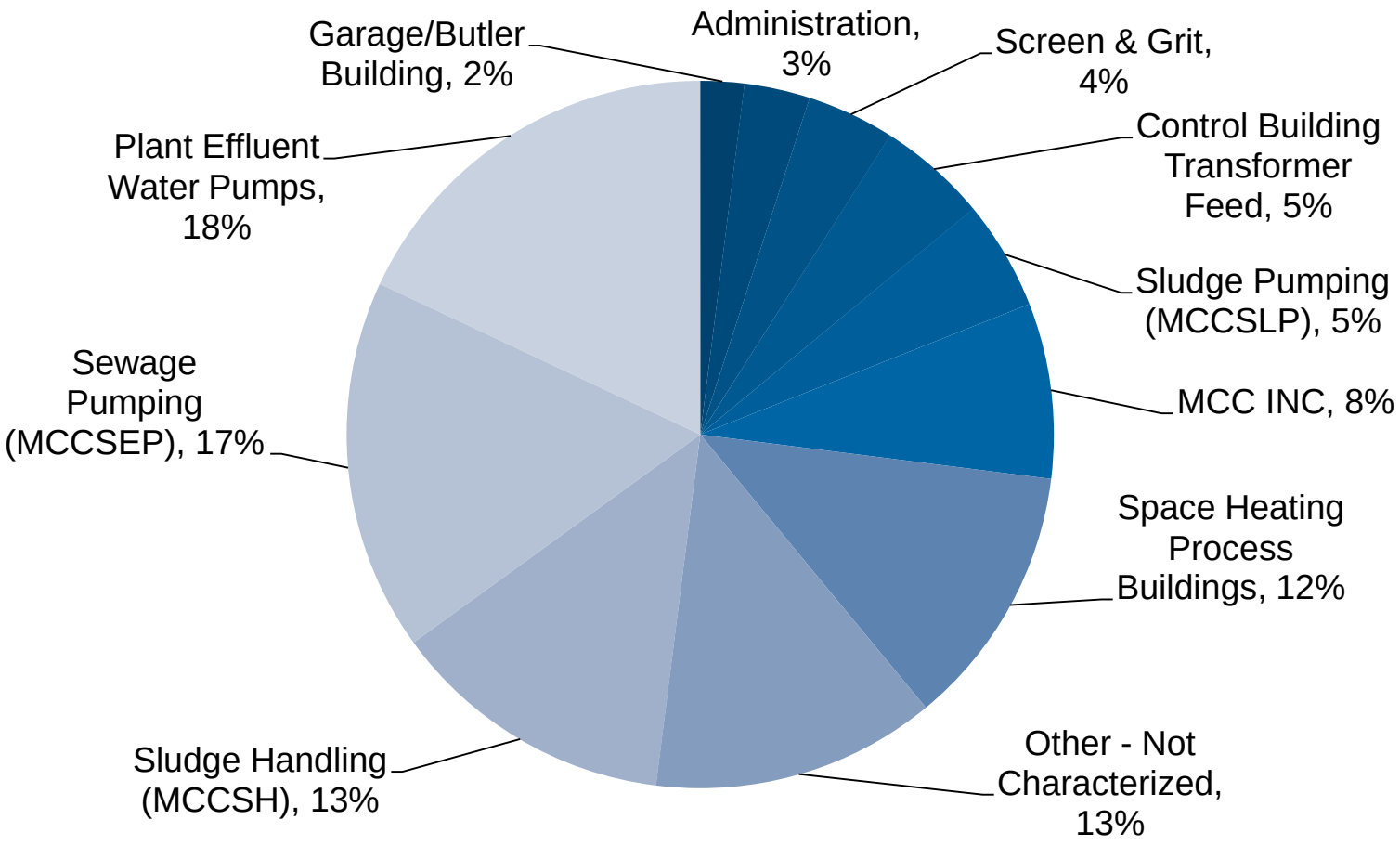
Location of power transducers on insulated conductors

Location of power transducers on insulated conductors

Location of power transducer on bus bars

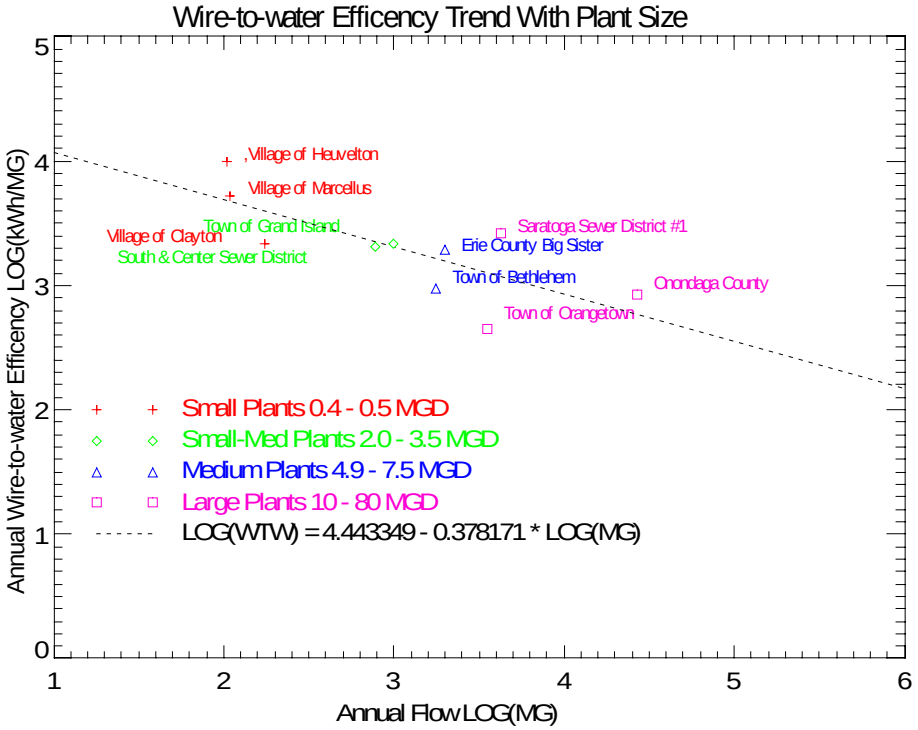
Submeter locations

Energy Breakdown Example



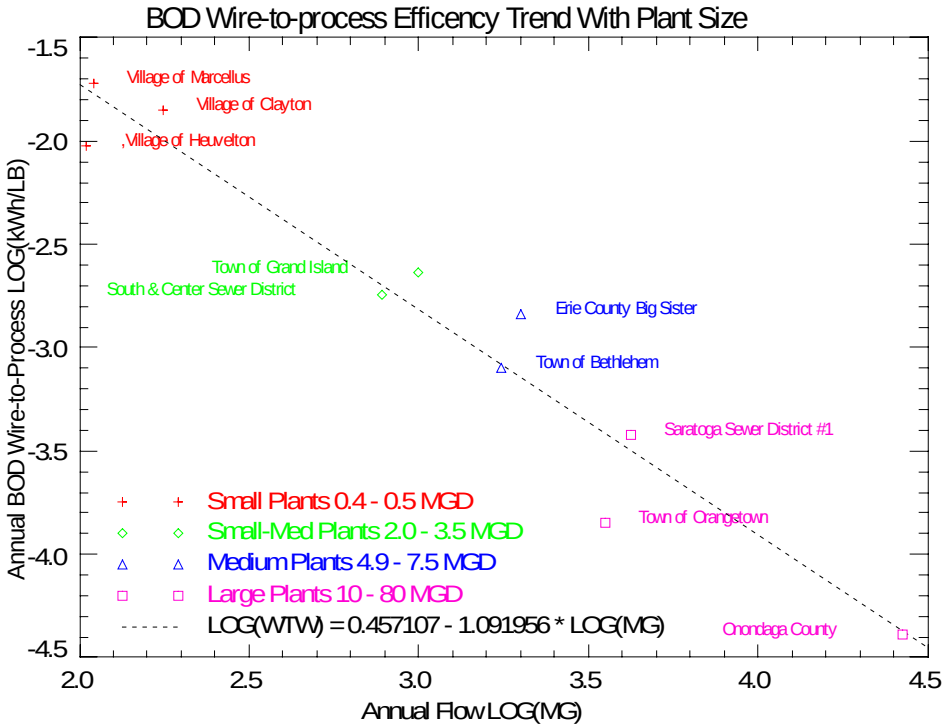
Wire to Water

Correlate energy use with flow



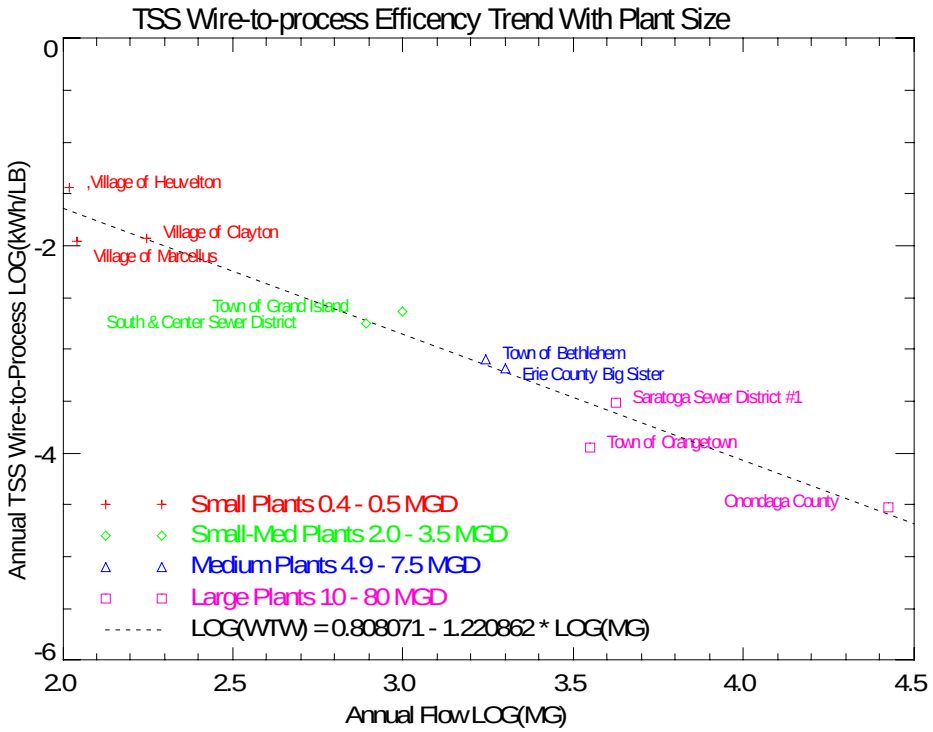
Wire to Process

Correlate energy use with BOD removal



Wire to Process

Correlate energy use with TSS



Data Collection and Information Gathering

Data Collection and Information Gathering

- As-Built/Record Drawings
- Original Basis of Design Reports
- Operation & Maintenance Manuals
- 2 Years of Energy Bills
- Equipment Maintenance History

Data Collection and Information Gathering

- Meetings/interviews with plant operators/staff.
- Establish acceptable payback period.
- Review of historical energy costs, usage, demand, and rate structure.
- “Walkthrough” the SCADA system or process flow diagram.
- Thorough site inspection and review of existing equipment, processes, and operation philosophy.
- Consider energy impacts of recent or planned upgrades.

Savings Calculations

- Develop Energy Saving Alternatives
- Evaluation Summary of Advantages and Disadvantages
- Installation Costs
- Operation and Maintenance Costs
- Energy Savings (kwh, kw, $)
- Simple Payback Period (also determine go/no-go payback period levels)

Typical Energy Saving Measures

Typical Energy Saving Measures

- Variable Frequency Drives \ Pumping System Optimization
- Energy Monitoring Systems
- Aeration System Optimization
- Anaerobic Digestion
- Solids Handling
- Opportunities for Recycling (i.e., waste heat recovery)
- Cogeneration
- Peak Load Reduction
- Conservation and Training

Typical Energy Saving Measures

- Lighting Systems
- Building Envelope and Insulation Systems
- Utility Rate Structures
- Heating Controls
- Alternative Fuels
- Operation and Maintenance Procedures
- Equipment Replacement
- Energy Efficient Motors

Renewable Energy

Renewable Energy

- Understand Utility Interconnection Requirements
- Understand Utility Rate Structures
- May Not Pass Payback Period Test Without Grant Incentives

Renewable Energy Options

Biogas

- From Anaerobic Digesters
- Combined Heat and Power Generation
- Use of Biogas for Heating

Hydropower

- Turbine on the Influent or Effluent
- Feasible for High Elevation Drops, On-Site Use of Electricity

Influent/Effluent Thermal Exchange

Renewable Energy Options

Solar or Photo Voltaic (PV)

- Need Large Space: Big Tank or Building Roof

Wind

- Need Large Space
- Esthetic/Community Concerns

Measurement and Verification

International Performance Measurement and Verification Protocol (IPMVP)

- A - Partially Measured Retrofit Isolation
- B - Retrofit Isolation
- C - Whole Facility
- D – Calibrated Simulation

Funding

Questions?