Energy Efficiency for Water Utilities: A Key to Sustainability

The Path Forward

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Significance

- Electric use for moving and treating water and wastewater in the US
  - 25-30% of total plant O&M Cost
  - Consumption and costs expected to continue to rise
  - Usually the biggest consumers of energy in communities

- Current use of energy for wastewater treatment results in significant GHG emissions.
- Basic improvements in energy efficiency can show significant results (equipment, lighting, pumps)

- Several plants are becoming/approaching energy self sufficiency (net zero energy use)
  - Many plants in the US (Sheboygan, WI; East Bay MUD, CA, several others)
  - Internationally (Many plants - WERF Study: Strass WWTP, Austria)
Elements of Energy Self-Sufficiency

- Management motivation to implement energy efficiency initiatives—efficiency first!
- Integrated into utility’s overall vision and plan
- Empowerment of staff
- Buy in from local officials (Communicate!)
- Tolerance for risk
- Audit & energy management plan
- Process optimization & operator education
- Measurable goals (linked to vision and plan)
- High level of automation and process analysis tools
- Flexible and efficient designs
- ECMs

- Anaerobic digestion &:
  - Combined Heat & Power
  - pre-treatment
  - Co-digestion
- Enhanced primary sedimentation
- Nutrient recovery and side stream flow equalization or treatment
- Thermal biosolids processes
- Solar
- Wind
Where to Start

1. **Create energy team and assess energy consumption**
   - Examine and analyze bills
   - Plot energy consumption and demand for each process (recommend meters for each unit process)
   - Develop consumption baselines and compare to similar facilities, **where feasible**

2. **Assess energy savings opportunities (DO AN AUDIT!)**
   - Evaluate process energy consumption and operational procedures
   - Evaluate operation of each significant piece of equipment
     - Can it be turned off or run efficiently at lower capacity?
     - Are new pieces of equipment much more efficient?

3. **Develop and implement energy conservation plan** starting with “low hanging fruit” projects

4. **Contract specifications** for energy efficient equipment

5. **Measure progress, get some success under your belt, and keep moving!**
Managing to Maximize Energy Efficiency

Designed to help utilities:

- Systematically assess current energy costs and practices
- Set measurable performance improvement goals
- Monitor and measure progress over time

Uses a management system approach for energy conservation, based on the successful Plan-Do-Check-Act process [based on Environmental Management Systems (EMS)]
The Plan-Do-Check-Act Approach

- Allows utilities to systematically assess energy usage and opportunities for efficiency
- Doesn’t give you the answer—helps you get to the right answer!
- Used extensively by EPA Regions and others through workshops and training
Energy Use Assessment Tool

What is the Energy Use Assessment Tool?

- Free of charge, downloadable tool based in Excel that can be used by small and medium water and wastewater systems
- Allows a utility to conduct a utility bill and equipment analysis to assess baseline energy use and costs

What does the tool provide?

- Drills down to equipment level
- Printable summary report
  - Presentation of energy consumption & costs (broad to detail)
  - Graphs energy use over time
  - Highlights areas of energy efficiency

http://water.epa.gov/infrastructure/sustain/energy_use.cfm
Energy Conservation Measures at Wastewater Facilities

- Main audience: Utility managers and POTW owners and operators.

- Targeted performance, cost, and savings/benefits information.

- Focus on innovative energy efficient *equipment replacements* and *operational modification* projects that result in energy savings with reasonable payback periods.

- Nine detailed case studies.

- References info.
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<tr>
<th>ECM Category</th>
<th>ECM Description</th>
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<tbody>
<tr>
<td>Mechanical Aeration</td>
<td>Adjustable submergence impeller mechanical aerator</td>
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<td>Dual impeller mechanical aerator</td>
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<tr>
<td>Aeration Control Systems</td>
<td><strong>Integrated DO and air flow aeration control</strong></td>
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<td></td>
<td>Automated SRT/DO Control</td>
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<td>Blower and Diffuser Technology</td>
<td><strong>High speed turbo blowers</strong></td>
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<td>Single-stage centrifugal blowers with inlet guide vanes and variable diffuser vanes</td>
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<td></td>
<td>Ultra-fine bubble diffusers</td>
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<td>Solids Processing</td>
<td><strong>Vertical linear motion mixer</strong></td>
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<td>Multiple hearth furnace upgrade incorporating combustion air pre-heating and waste heat recovery</td>
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<td>Solar drying</td>
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<td>ECMs for Selected Treatment</td>
<td>Low-pressure, high intensity lamps for UV disinfection</td>
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<td>Processes</td>
<td>Automated channel routing for UV disinfection</td>
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<td>Membrane air scour for MBRs</td>
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<td>Hyperbolic mixers</td>
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<td><strong>Pulsed air mixing of anoxic and anaerobic zones</strong></td>
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<td>BNR process automation</td>
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Industry Leadership on Energy Efficiency

ENERGY ROADMAP
VERSION 1.0

Driving Water and Wastewater Utilities to More Sustainable Energy Management
Take Away Messages for Communities

- Energy efficient water utilities are critical to a community’s long-term sustainability
- Probably your biggest opportunity to save energy
- A great way for you to have a major impact on GHGs/Climate
- Lots of tools to help you take on this challenge
- Do it systematically—don’t jump on the next “neat project”
- DO AN AUDIT AND MOVE FORWARD FROM THERE!
THANKS!

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MATERIALS AVAILABLE AT:

http://water.epa.gov/infrastructure/sustain/energy
efficiency.cfm