

US EPA ARCHIVE DOCUMENT

# 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!**

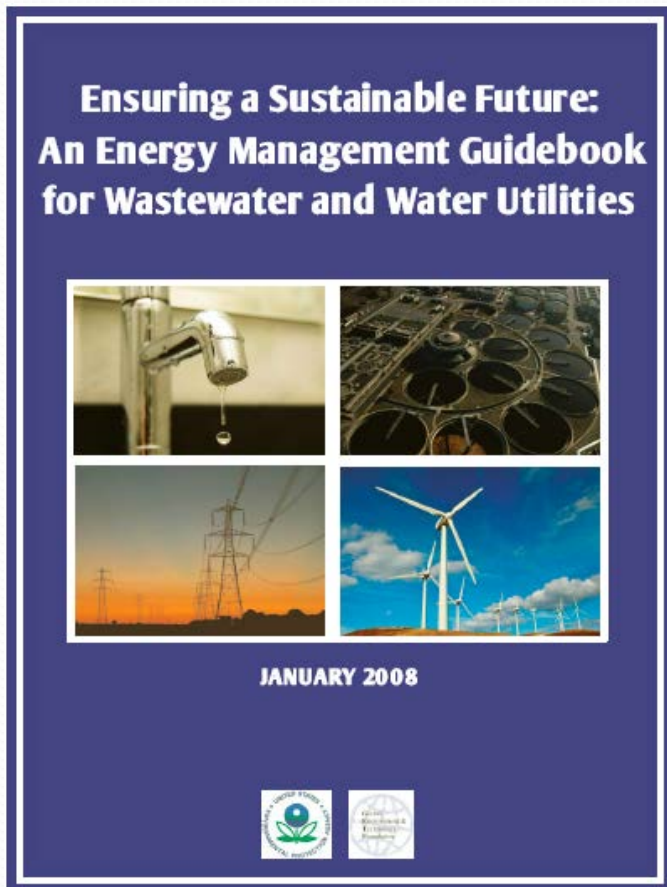


# Managing to Maximize Energy Efficiency

## Designed to help utilities:

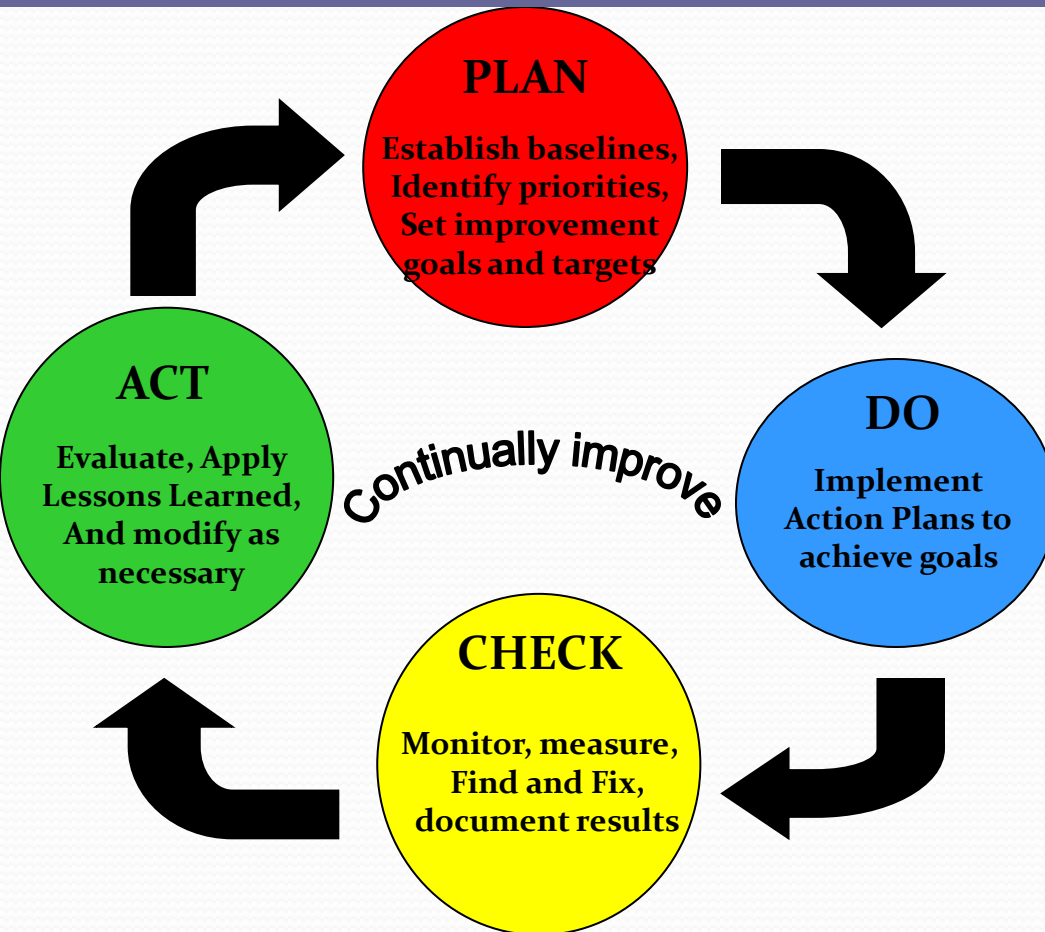
- Systematically assess current energy costs and practices
- Set measurable performance improvement goals
- Monitor and measure progress over time

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



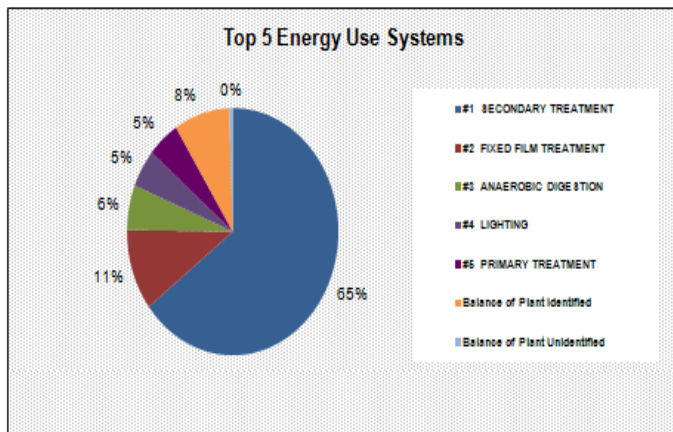
# Energy Use Assessment Tool

## 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

The screenshot displays the 'EPA Energy Use Assessment Tool for Wastewater Systems' Excel spreadsheet. The interface includes a 'General Information' section at the top with fields for 'Building Info', 'Plant Energy Usage', 'Reset Data', and 'Save'. Below this, there's a section for 'Specify Other Utility Type (if any)' and 'Specify Units for Other Energy Consumption (if any)'. The main data area is a large table with columns for months (January to December) and rows for different energy utilities: Electric (\$/kWh), Natural Gas (\$/CCF), No 2 Fuel Oil (\$/CCF), Water/Sewer (\$/GAL), and Alternative Energy (\$/CCF). Each utility row has sub-rows for 'Consumption' and 'Cost' for the years 2010 and 2011. The bottom of the spreadsheet shows a summary of 'Total Utility Costs' and 'Total Energy Costs' for both years.

DISTRIBUTION OF ELECTRICAL ENERGY USE & COST BY MAJOR PROCESS FOR 7/2010 - 6/2011



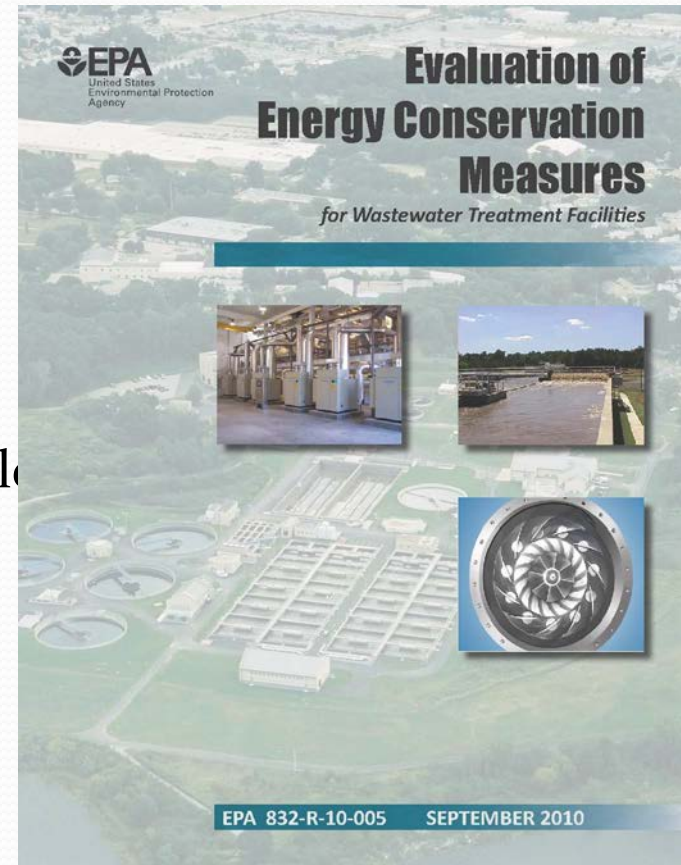
## What does the tool provide?

- 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



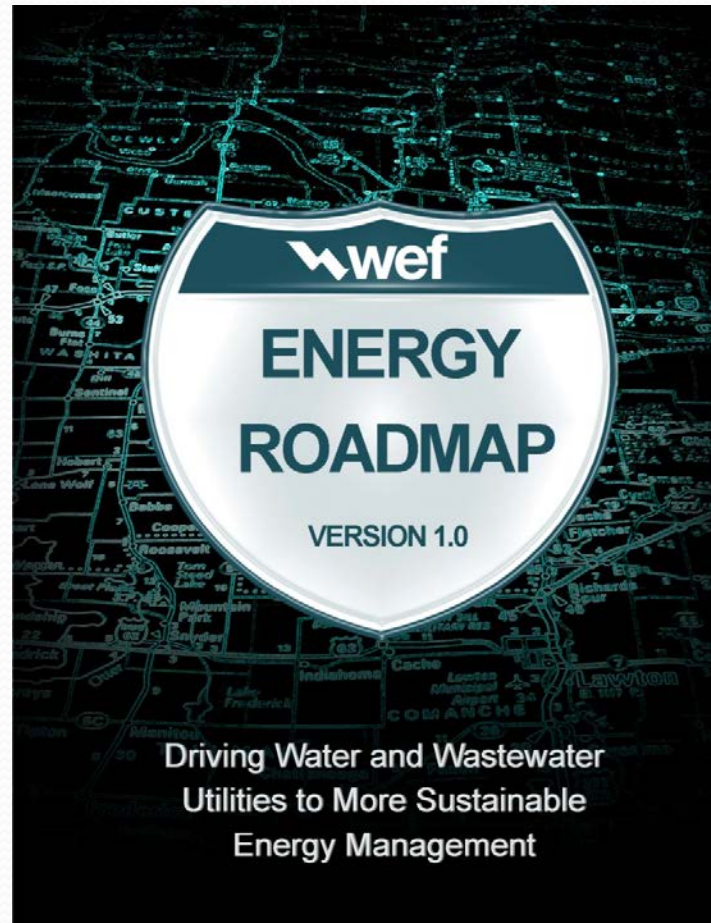
# Energy Conservation Measures at Wastewater Facilities

- 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 pay back periods.
- Nine detailed case studies.
- References info.



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

# Industry Leadership on Energy Efficiency



# 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](http://water.epa.gov/infrastructure/sustain/energy_efficiency.cfm)**