Energy Efficiency for Water Utilities

Resources and Opportunities for Energy Savings among Water and Wastewater Treatment Providers

Why does Energy Efficiency Matter for Water Utilities?

Energy consumption is essential to the water production and treatment process. In many communities, water and wastewater treatment facilities are among the largest municipal energy consumers. For example, Tarrant Regional Water District (TRWD), one of the largest raw water providers in North Texas, uses between **150-550 million kWh annually** across their operations. The water sector can account for up to **30-40%** of municipal energy consumption, and energy costs can be responsible for as much as **40%** of a facility's operating budget[1]. Nationally, an estimated **45 million tons** of greenhouse gas emissions per year come from energy use at drinking water and wastewater operations[1], making it an environmental as well as financial concern.

As the population of North Texas continues to rise, the water-energy nexus will become increasing important. The water sector will require more and more energy to meet demands, driving up energy costs and contributing higher emissions. To minimize this spike in energy usage and spending, as well as help communities meet various sustainability goals, water utilities can implement **energy efficiency measures** to reduce the energy consumed at all stages of the water treatment process.

How can Water Utilities be More Energy Efficient?

- **Identify and Fill Knowledge and Data Gaps.** In a 2021 survey of water and wastewater utilities conducted by the North Central Texas Council of Governments (NCTCOG), respondents listed **knowledge gaps** as the second biggest barrier to energy data management, behind lack of staff time.
    - Visit the *Resources on the Water-Energy Nexus* on the following page to learn more about how energy usage impacts the water sector and strategies for increasing energy efficiency.
    - Determine baseline annual energy consumption via a **self-assessed energy audit**. The EPA's Energy Use Assessment Tool can assist in measuring energy usage and costs based on a facility's monthly energy bills.
    - Draft an **Energy Management Plan** to identify energy goals, fill gaps in organizational knowledge, and assign staff to monitor progress. See *Case Study: Tarrant Regional Water District (TRWD) Energy Management Plan* for an example of this in practice.
- **Track Energy Usage Data via Energy Management Systems.** Tracking energy usage is essential to measuring the successes of energy efficiency measures and identifying opportunities for increased efficiency[2]. An **energy management system** is any process used to monitor energy performance over time.
    - Continue **tracking energy consumption** using the same metrics and methods as the baseline audit. This allows utilities to compare usage over time and monitor progress toward energy goals.
    - Implement a **demand response program** to reduce energy usage during peak hours. Communicate demand needs with your energy provider to assess demand response potential.

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How can Water Utilities be More Energy Efficient? (cont.)

- **Increase Equipment and Process Efficiency…**
  - **In facilities.** Upgrade facilities' lighting to LED bulbs, install motion sensors on lights in areas of low use, retrofit HVAC systems, and educate staff on energy-saving actions in the workplace.
  - **In pumping and aeration.** Up to 80% of the energy used in the water sector is related to pumping[3]. Energy efficiency decreases throughout a pump's use cycle, so older pumps and other equipment will be less efficient. Newer equipment, adjustable speed drives, and high-efficiency motors all improve energy efficiency. Energy-efficient blowers and diffusers are available for aeration systems. Supervisory control and data acquisition (SCADA) systems also improve process optimization on industrial equipment[3].
  - **In distribution.** Upgrade aging distribution infrastructure, and patch leaks along distribution networks. Leaky pipes and sewer systems require more energy to transport water, so decreasing water loss improves both water and energy efficiency.
- **Utilize Clean and/or Renewable Energy Sources.**
  - **Generate energy on-site** via anaerobic digestion, solar panels, or other methods. The City of Fort Worth's water utilities use **natural gas-fueled turbines** to generate electricity on-site, driving down costs. **Anaerobic digesters** can also transform biosolids from wastewater treatment into renewable natural gas, to be utilized in combined heat and power (CHP) systems[2,3]. On-site electricity may also be sold back to the grid.
  - Explore converting your energy system into a **microgrid**, where energy is generated onsite and operations can be powered independently from the main power grid[4]. Microgrids have the ability to operate with or without a utility grid connection, making them valuable in instances of grid failure.

Resources on the Water-Energy Nexus

- Conserve North Texas Energy and Water Resources.
- Environmental Protection Agency (EPA) Energy Efficiency for Water Utilities.
- Department of Energy (DOE) Sustainable Wastewater Infrastructure Accelerator.
- State Energy Conservation Office (SECO) Technical Assistance Opportunities.

Information Sources:
1. Energy Efficiency in Water and Wastewater Facilities. Environmental Protection Agency, 2013.
2. Energy Data Management Manual for the Wastewater Treatment Sector. Better Buildings Solution Center, 2017.
3. Energy-Water Nexus: The Water Sector's Energy Use. Congressional Research Service, 2017.
4. Energy-Water Microgrid Opportunity Analysis at the University of Arizona's Biosphere 2 Facility. National Renewable Energy Lab, 2018.

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Case Study: Tarrant Regional Water District (TRWD) Energy Management Plan

Background

Tarrant Regional Water District (TRWD) is one of the largest raw water suppliers in Texas, serving over 2 **million residents** across **eleven counties** in the North Central region. TRWD manages over one hundred facilities throughout its service area, from large office buildings and pumping stations to reservoir spillways. TRWD's annual energy consumption ranges from **150-550 million kWh**, depending on factors like varying demand and weather events. Energy management has been an essential part of TRWD's best practices for decades, and in 2019, these practices were formalized into an **Energy Management Plan**. Monitoring energy usage through an Energy Management Plan allows TRWD to identify areas of high energy demand, and to take action to optimize equipment and operations. This optimization reduces energy costs and limits the environmental impact of water infrastructure.

About the Plan

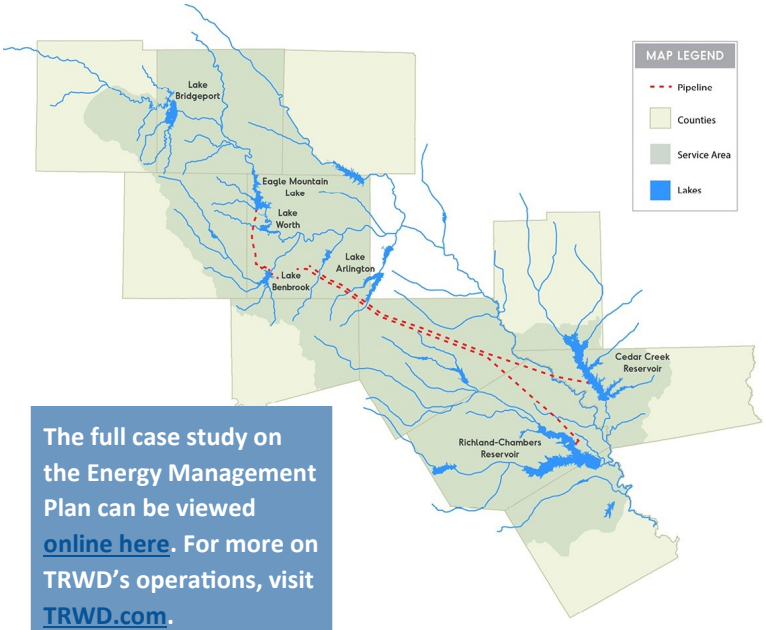
The Energy Management Plan details TRWD's strategic direction for its energy management program and implementation. Drafted in 2019, the Plan includes a review of operations across TRWD's profile that affect its energy performance, and outlines the energy management applications and software used to monitor usage. The Plan also incorporates individual Action Plans for pumping, facilities, and fleet, three areas of significant energy usage in TRWD's operations.

Before developing its Plan, TRWD created an Energy Management Team made up of Fleet, Engineering, and Facilities staff. This team is responsible for maintaining the Plan and outlining best practices and policies to support it.

Due to the fluctuating nature of TRWD's energy demands, the plan itself does not set specific goals for energy reduction. However, the practices outlined in the plan are designed to minimize energy usage per gallon of water processed.

In order to capture its energy data, TRWD developed custom applications utilizing SQL, Power BI, and Excel to monitor consumption, peak demand, costs, and unit data. TRWD also uses a SCADA system to collect vast stores of data both internally and from third-party electricity suppliers.

TRWD Service Area



The full case study on the Energy Management Plan can be viewed online here. For more on TRWD's operations, visit TRWD.com.