

Sustainable Wastewater Infrastructure of the Future

Introduction

The **Sustainable Wastewater Infrastructure of the Future (SWIFt) Accelerator** began its Phase 1 as a three-year partnership (2016-2019) of 25 state, regional, and local agencies that engaged with more than 70 water resource recovery facilities in their jurisdictions to accelerate a pathway toward a sustainable infrastructure. DOE's work with SWIFt facility partners in Phase 1 has produced a number of tools and resources that support energy data management for wastewater operations, and planning, implementation, and financing for comprehensive energy efficiency and resource recovery projects to achieve 30 percent energy savings.

In SWIFt Phase 1, facility partners reduced their total energy consumption by more than 8 percent in three years, reduced the amount of energy needed to treat one million gallons of water by the same amount, and adopted innovative and best-practice energy management and planning approaches in their facilities. Phase 2 of SWIFt will continue this momentum by leveraging the tools, resources, and lessons of SWIFt beyond the time and space of the Accelerator to benefit the broader wastewater sector.

Why Reducing Energy in Water Resource Recovery Facilities Is Important

Municipal wastewater treatment systems in the U.S. consume a total of approximately 30 billion kWh annually,¹ and their operations are typically the largest energy users in a community. Individual wastewater facilities currently consume about five times more energy than is needed to treat their water flow,² with that energy use expected to increase by up to 20 percent in the coming decades due to more stringent water quality standards and growing water demand based on population growth.³ Reducing energy usage in these facilities can yield significant environmental, economic, and social benefits for local communities.

In recent years a growing number of utilities responsible for clean water have been moving from only wastewater treatment to water resource management, some formally renaming themselves water resource recovery facilities. Energy efficiency in equipment, processes, and operations is a fundamental part of this transition, and energy savings in facility retrofits can reach 50 percent. Facilities can expand this energy-efficient foundation with resource recovery measures to move closer to a sustainable wastewater infrastructure.

Introducing the Wastewater Energy Management Toolkit

The Wastewater Energy Management Toolkit is a collection of resources featured in the Better Buildings Solution Center that will enable water resource recovery facilities to learn and benefit from SWIFt's work. Toolkit resources support best practices and innovative approaches successfully used by wastewater facilities to establish and implement energy management and planning:

Energy Data Management

Energy data management is the foundation of strong energy management and planning in which facilities measure and track their energy performance to inform their decisions about infrastructure improvements. The resources below provide guidance on energy data management in the sector:

- **Energy Data Management Manual**

The *Energy Data Management Manual for the Wastewater Treatment Sector* describes the benefits of energy data management and provides step-by-step guidance for tracking and managing energy performance. The manual highlights the Data Tool Comparison Matrix, also included in the Toolkit, and produced during SWIFt to help facilities select a data management tool that is best suited to their needs.

- **Data Tool Comparison Matrix**

This comparison matrix evaluates the features and functions of three publicly available software tools (links provided below) that help water resource recovery facilities track and manage energy performance.

- **Data Management Tools**

Links to three publicly available data management tools for water resource recovery facilities:

- [DOE's Energy Performance Index \(EnPI\) Tool](#)
- [EPA's Energy Use Assessment Tool \(EAT\)](#) – Click on tab labeled “Determine Energy Usage”
- [EPA's Portfolio Manager \(PM\) – Water Module](#)

- **Data Tool Reference Sheets**

Reference sheets help users get started using three no-cost data tools available to water resource recovery facilities and include information on where to get additional tool training.

Measure Evaluation

SWIFt partners identified 23 energy conservation and resource recovery measures that address facility equipment, processes, and operations. The tools and resources below provide the information facilities can use to evaluate, plan for, and implement measures that meet their needs and goals:

- **Low- and No-Cost Measures Checklist**

This comprehensive checklist includes low- and no-cost energy conservation measures recommended by DOE's Industrial Assessment Centers at water resource recovery facilities across the country. When implemented as a package, the measures consistently demonstrate 5-7% facility-wide energy savings and average less than two-year payback periods.

- [DOE's Industrial Assessment Centers \(IACs\)](#)

Water resource recovery facilities may be eligible to receive a no-cost assessment provided by DOE's national network of Industrial Assessment Centers (IACs) to identify energy conservation opportunities.

- **Energy Conservation and Resource Recovery Measures List**

This reference list of the 23 energy conservation and resource recovery measures evaluated during SWIFt includes the median facility-wide energy savings associated with each measure.

- **Measure Planning Workbooks**

Developed with SWIFt partners and sector experts, each tool helps facilities decide whether and how to implement one of the 23 energy conservation and resource recovery measures evaluated during SWIFt.

Project Financing

Water resource recovery facilities typically rely on limited capital budget streams to pay for their infrastructure improvement projects, which often means upgrades must wait for funding to become available. The resources below provide information about common funding and financing options that offer alternatives to capital budgets and can mean more timely infrastructure improvement.

- **Project Financing Comparison Matrix**

The Project Financing Comparison Matrix is a quick, two-page reference document on nationally available funding and financing sources for the wastewater sector. The matrix enables facilities to compare financing options using a common set of evaluation criteria and select a method suited to their projects.

- [ESPC Guide for the Wastewater Sector](#)

Energy Savings Performance Contracting in Water Resource Recovery Facilities provides decision-makers at water resource recovery facilities with information, resources, and successful project profiles to consider energy savings performance contracting (ESPC) as a way to finance facility upgrades.

Improvement Planning

SWIFt partners developed infrastructure improvement plans outlining projects designed to achieve 30 percent total energy savings in their facilities from their chosen baseline year. The resources below include a template

with suggested best-practice structure and content for strategic improvement plans, guidance on how to design infrastructure improvement suited to individual facilities, and example plans from SWIFt partners.

- **Infrastructure Improvement Plan Template**

This template outlines the best-practice structure and content for an infrastructure improvement plan.

- **Guiding Principles & Frameworks**

High-level strategic goals serve as guiding principles and organizational frameworks for upgrade plans that help facilities select the actions needed to achieve their goals and meet their needs, prioritize the actions effectively, and organize them into a framework for implementation.

- **Overview of Guiding Principles & Frameworks**

This resource describes some of the most common principles used in water resource recovery facilities across the country and includes additional resources for those linked to each principle listed below:

- [50001 Ready Program](#)
- [Effective Utility Management](#)
- [Net Zero Energy](#)
- [Resilience](#)
- [Sustainability](#)
- [Utility of the Future](#)

- **Examples of SWIFt Partner Infrastructure Improvement Plans**

Several SWIFt facility partners agreed to share their infrastructure improvement plans as examples for other water resource recovery facilities. Partner plans represent a range of principles and frameworks:

- Metro Wastewater Reclamation District, Denver, CO
- Wastewater Treatment Facility, Warren, RI
- Water & Sewer Department, Miami-Dade County, FL
- Water Pollution Control Facility, Waterbury, CT

Recognizing Partner Success

SWIFt facility partners worked with DOE, technical experts, and other partners to develop individual Infrastructure Improvement Plans (IIP) in accordance with best practices in energy management and planning. The plans set forth one or more projects designed to achieve 30 percent facility-wide energy savings within 18 months of the conclusion of the Accelerator. Almost one-quarter of the 70 facility partners individually met or exceeded SWIFt's short-term 5 percent energy savings goal during the Accelerator's three-year period (listed by location):

- Carthage, TN
- Cleveland, TN
- Duluth, MN
- Grantsburg, WI
- Hampton, NH
- Keene, NH
- Kenosha, WI
- Lawrenceburg, TN
- Los Angeles County, CA
- Manchester, NH
- Miami-Dade County, FL
- Milford, CT
- Nashua, NH
- Northeast Ohio Regional Sewer District, OH
- Phoenix, AZ
- St. Cloud, MN
- Sullivan, WI

For more information on the SWIFt Accelerator, the Toolkit, and other SWIFt resources, contact Shannon Zaret, U.S. Department of Energy, at shannon.zaret@ee.doe.gov or e-mail stateandlocal@ee.doe.gov.

1. EPRI and Water Research Foundation. Electricity Use and Management in the Municipal Water Supply and Wastewater Industries. November 2013. Page ix.
2. NACWA, WEF, and WERF. Towards Energy Neutrality at WRRFs— Results and Findings of Recent Research. April 2, 2014. Page 5.
3. *Ibid.*