Energy Efficiency in the Wastewater Sector

Energy Efficiency in Value Engineering: Barriers and Pathways – OWSO6R07a

Overview of State Energy Reduction Programs and Guidelines for the Wastewater Sector – OWSO6R07b

The primary goal of the WERF research program referred to as the *Optimization Challenge* is to promote and support wastewater operations that achieve treatment objectives while reducing the resources expended. Two new research reports in this Challenge help utilities incorporate energy efficiency practices into new wastewater treatment plants and help existing plants reduce energy demand.

This research will assist wastewater engineers, designers, operators, and state agencies achieve economically and environmentally responsible energy improvements.

The first study, *Energy Efficiency in Value Engineering: Barriers and Pathways* (OWSO6R07a), examined implementing value engineering (VE) at wastewater utilities to encourage more energy efficient designs and upgrades. The second report, *Overview of State Energy Reduction Programs and Guidelines for the Wastewater Sector* (OWSO6R07b), looked at state energy efficiency programs that target the wastewater treatment sector and examined how these programs are successful at reducing energy demand through their program design. Taken together, the reports will assist wastewater engineers, designers, operators, and state agencies to achieve economically and environmentally responsible energy improvements.

The value engineering practice report (OWSO6R07a) explores a technique that wastewater treatment plants (WWTPs) can use to analyze cost reduction and performance optimization opportunities, as a way to include energy efficiency in wastewater system design. This report outlines the six-step process developed by the Society of American Value Engineers (SAVE) International as the standard for value engineering analyses and provides examples of the current use of value engineering in WWTP projects that resulted in more energy efficient projects.

The research team identified municipalities that have performed value engineering analyses as part of WWTP construction planning. They found that municipalities tend to perform informal value engineering analyses that do not involve a SAVE Certified Value Specialist (CVS) to reduce the time and cost of the SAVE value engineering process. While seven municipalities contacted had performed value engineering analyses on past wastewater projects, only three followed the SAVE value engineering process. Projects that have a formal SAVE value engineering effort are generally larger (i.e., $10 million or more) or are subject to a funding agency value engineering analysis requirement. The U.S. Environmental Protection Agency (EPA) requires value engineering analysis for WWTP projects greater than or equal to $10 million estimated construction cost (excluding sewers) receiving financial support in the form of EPA direct grants. However, EPA does not require that such analyses address energy efficiency.

Value engineering studies are effective in defining potential cost savings by implementing technology alternatives that increase treatment process energy efficiency. While none of the municipalities indicated a focus on energy aspects, the value engineering analyses conducted by the three municipalities that followed the SAVE value engineering process did

BENEFITS

- Provides draft energy efficiency language as a starting point for revising state design guidelines.
- Supplies a program management framework for a model wastewater sector energy efficiency program based on the best practices of existing programs.
- Demonstrates commonality in best practices for program management among existing wastewater treatment sector energy efficiency programs.
- Presents a pathway through collaboration with Society of American Value Engineers (SAVE) to add WWTP-oriented energy efficiency training materials to its value engineer certification training.

RELATED PRODUCTS

Integrated Methods for Wastewater Treatment Plant Upgrading and Optimization (04CTS5)

State of the Science Report: Energy and Resource Recovery from Sludge (OWSO3R07)

Best Practices for Sustainable Wastewater Treatment: Initial Case Study Incorporating European Experience and Evaluation Tool Concept (OWSO4R07a)

Energy Efficiency in Wastewater Treatment in North America: A Compendium of Best Practices and Case Studies of Novel Approaches (OWSO4R07e)

AVAILABLE FORMAT

Soft cover and online PDF.

TO ORDER

Contact WERF at 571-384-2100 or visit www.werf.org and click on Search Research Publications & Tools.

WERF Subscribers: Your first hardcopy of this report is free. Additional copies are $10 each or download unlimited free PDFs at www.werf.org.

Non-Subscribers: Charges apply to some products. Visit www.werf.org for more information.

Refer to:

STOCK NO. OWSO6R07a/OWSO6R07b

For more information, log on to **www.werf.org**.

identify energy-efficient alternatives (i.e., monitoring power, using premium efficiency motors, designing to use gravity feed versus pumping, implementing a biogas-fired boiler to reduce fuel costs, and designing two digester gas-fired engine-driven generators to match current loads rather than 20-year peak loads).

Secondarily, the study shows that value engineering analyses also identified cost savings opportunities for energy recovery (e.g., combined heat and power [CHP] and biogas production). Additionally, the study presents a concept for incorporating value engineering into a national standard related to WWTP construction.

In the second report, *Overview of State Energy Reduction Programs and Guidelines for the Wastewater Sector* (OWSO6R07b), the research team evaluated the feasibility of establishing a national design standard for WWTPs that incorporates energy efficiency-related concepts and provides suggested model language. Key recommendations in the model language include requirements for:

- Scalable system design which can be operated incrementally at flows below maximum design; and
- life-cycle cost analysis (LCCA) for each alternative and to present the net present value of any energy savings.

This report also identifies state energy efficiency program best practices that are most effective in assisting wastewater facilities. This study highlights three states (California, New York, and Wisconsin) that have effective energy reduction programs for the wastewater sector with a long-term history of performance. These exemplary programs showed substantial commonality in best practices, including:

- Implementation of energy efficiency measures using a performance-based contract with the program implementation contractor.
- Maintenance of lists of qualified engineering consultants and project implementation contractors.
- Support of a variety of marketing and outreach activities.
- Personalized project facilitation services throughout the project to ensure that it moved to completion.
- Program assistance to smaller wastewater systems which have fewer financial and staff resources.
- Provided access to independent funding sources and financial incentives such as cost-share grants to develop energy efficiency projects.
- Presentation of non-energy benefits of energy efficiency projects (e.g., reduced green house gas emissions and improved sustainability) to municipal decision makers.
- Responded to participants' needs as the program grew by refining program services.

COLLABORATOR

New York State Energy Research and Development Authority (NYSERDA)

CONTRACTOR

Joseph C. Cantwell, P.E.
Science Applications International Corporation

RESEARCH TEAM

William R. King
Robert T. Lorand, P.E.
Science Applications International Corporation

Robert C. Ganley, P.E.
Nathyn M. Knipe, P.E.
David I. Page
O'Brien & Gere

TECHNICAL REVIEW COMMITTEE

Robert K. Bastian
James Wheeler, P.E.
U.S. Environmental Protection Agency

George V. Crawford
CH2M HILL

Kathleen O'Connor
New York State Energy Research and Development Authority

Shahid Chaudhry
California Energy Commission

Stephen Constable, P.E.
DuPont Engineering Technology

Ted Jones
Consortium for Energy Efficiency

Matt Reis
Water Environment Federation

ISSUE AREA TEAM

John Barber, Ph.D.
Eastman Chemical

Shahid Chaudhry
California Energy Commission

Stephen Constable, P.E.
DuPont Engineering Technology

David Cooley
Hampton Roads Sanitation District (HRSD)

Glen Daigger, Ph.D., P.E.
CH2M HILL

Robert F. Kelly
Infilco Degremont, Inc.

Melanie S. Masek, P.E.
DuPont Engineering Research & Technology

Arthur J. Meyers, Jr., Ph.D., Retired
Hsiao-Ting Ong, P.E.
City of San Jose

Ali Oskouie, Ph.D.
Metropolitan Water Reclamation District of Greater Chicago

Steven M. Rogowski, P.E.
Metro Wastewater Reclamation District of Denver

Gary Shimp
Black and Veatch

Rob Simm
Stantec Consulting, Inc.

David W. Tucker
City of San Jose

Dariush Vosooghi, Ph.D., P.E.
City of Los Angeles

Milind Wable, Ph.D., P.E.
CDM

James Wheeler, P.E.
U.S. Environmental Protection Agency

John Willis, P.E.
Brown and Caldwell

The research on which this report is based was funded in part by the U.S. Environmental Protection Agency (U.S. EPA) through Cooperative Agreement No. CR-83155901-2 with the Water Environment Research Foundation (WERF). Unless an U.S. EPA logo appears on the cover, this report is a publication of WERF, not U.S. EPA. Funds awarded under the agreement cited above were not used for editorial services, reproduction, printing, or distribution.

9/10