

Renewable Energy Technologies and Energy Efficiency Strategies (Guidebook for Desalination and Water Reuse)

Is guidance available for water utilities and others to strategize for energy minimization and renewable energy utilization?

The purpose of this guidebook is to provide utilities and water treatment practitioners with energy minimization strategies and renewable energy utilization guidelines. This free guidebook is primarily focused on desalination using reverse osmosis (RO) and advanced water treatment (AWT) technologies for water reuse.

BACKGROUND

To cope with the nation's increasing water demand, many municipalities and other water suppliers are turning toward more energy-intensive desalination and water reclamation to supplement dwindling freshwater sources. Energy consumption on desalination and water reuse processes is a particular concern due to the rising cost of electricity. Improving energy efficiency requires a comprehensive understanding of energy consumption by the equipment used. Until recently, conventional fossil-fuel-based power plants have been utilized as the primary source of supplying energy to desalination and water reuse plants, and the use of fossil fuels has spurred environmental concerns, specifically with greenhouse gas (GHG) emissions. In response, a large number of energy minimization approaches and renewable energy alternatives are being developed and implemented for desalination and water reuse applications.

KEY PROJECT FINDINGS

- A combination of several strategies needs to be considered to reduce energy consumption. Strategies include improved system design, utilization of high-efficiency pumping,

Questions Answered in the Guidebook

- What are the steps and methods to reduce energy consumption for various membrane-based desalination and AWT processes?
- What are the resources and tools available in pursuing energy at a treatment facility and in renewable energy resource implementation?
- What are the steps required for utilizing renewable energy resources?
- What are the challenges faced during implementation of renewable energy technologies?

implementation of energy recovery devices, and non-process-related conservation.

- Pumping consumes the largest energy for desalination using RO.
- Many energy minimization strategies and technologies are well-developed and proven. Energy-efficient strategies can result in significant energy savings at desalination and water reuse treatment facilities.
- Technologies such as solar voltaic, concentrating solar power, wind turbine, geothermal energy, and biogas cogeneration are well developed but expensive to implement without the availability of funding, grants, and incentives. Return on investment is an important criterion and decision-maker for implementation of renewable energy technologies at the utility scale.
- Developing an energy core team that understands a utility's energy usage is key to implementing energy-efficient strategies.

KEY PROJECT FINDINGS (cont'd)

- Utilization of renewable energy technologies depends on geography, technology, means for handling variability, and solving economic scale-up and permitting issues.
- Implementation of energy efficient programs should be performed with an energy audit to assess baseline energy consumption.
- Energy minimization approaches need to be considered during the initial design phase of a project, plan operation, retrofits and process modification, plan expansion, and treatment scheme upgrades.

RELEVANCE TO INDUSTRY

- The guidebook provides utilities and water practitioners with energy minimization strategies and renewable energy utilization guidelines. It provides a comprehensive knowledge base for utilities in the United States and includes the most updated developments in

energy minimization and renewable energy techniques.

- The guidebook delineates analytical and quantitative guidelines for technologies to reduce energy use, overall facility costs, and GHG emissions from AWT processes used in water reuse and desalination.
- Additional resources for many of the topics discussed in the guidebook can be accessed by readers via a plethora of websites provided in the document.

Benefits of Implementing Energy Efficiency and Renewable Energy Utilization

- *Financial savings:* Reducing energy consumption will result in significant cost savings for the utility in term of its energy bill.
- *Reduced GHG emissions:* Implementation of renewable energy resources will result in lower GHG emissions by reducing he consumption of fossil-fuel-based electricity.
- *Meeting state and federal energy-reduction targets:* Reduction of energy consumption will result in meeting targets set by local and federal authorities for energy utilization.
- *Environmental stewardship:* Utilization of renewable energy resource will result in a clean and sustainable environment for the public.
- *Improved customer relations:* By implementing green initiatives and carbon-neutral treatment, facilities will improve utility-customer relationships.

PROJECT SUMMARY

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RELATED RESEARCH

WRRF-08-14 Evaluation and Optimization of Existing Emerging Devices

WRRF-10-06 Lower Energy Treatment Schemes for Water Reuse

WRRF-10-12 Feasibility Study on Model Development to Estimate and Minimize GHG Concentrations in Carbon Footprint of Water Reuse and Desalination Facilities

WRRF-11-04 Emerging Desalination Technologies for Energy Reduction