

The Role of Renewable Energy in Water and Wastewater Operations

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2 Rising Energy Demand in Water and Wastewater Operations

Key Factors

- Population growth and urban expansion
- Aging infrastructure
- Stricter regulatory standards
- Use of advanced technologies
- Climate change and drought resilience

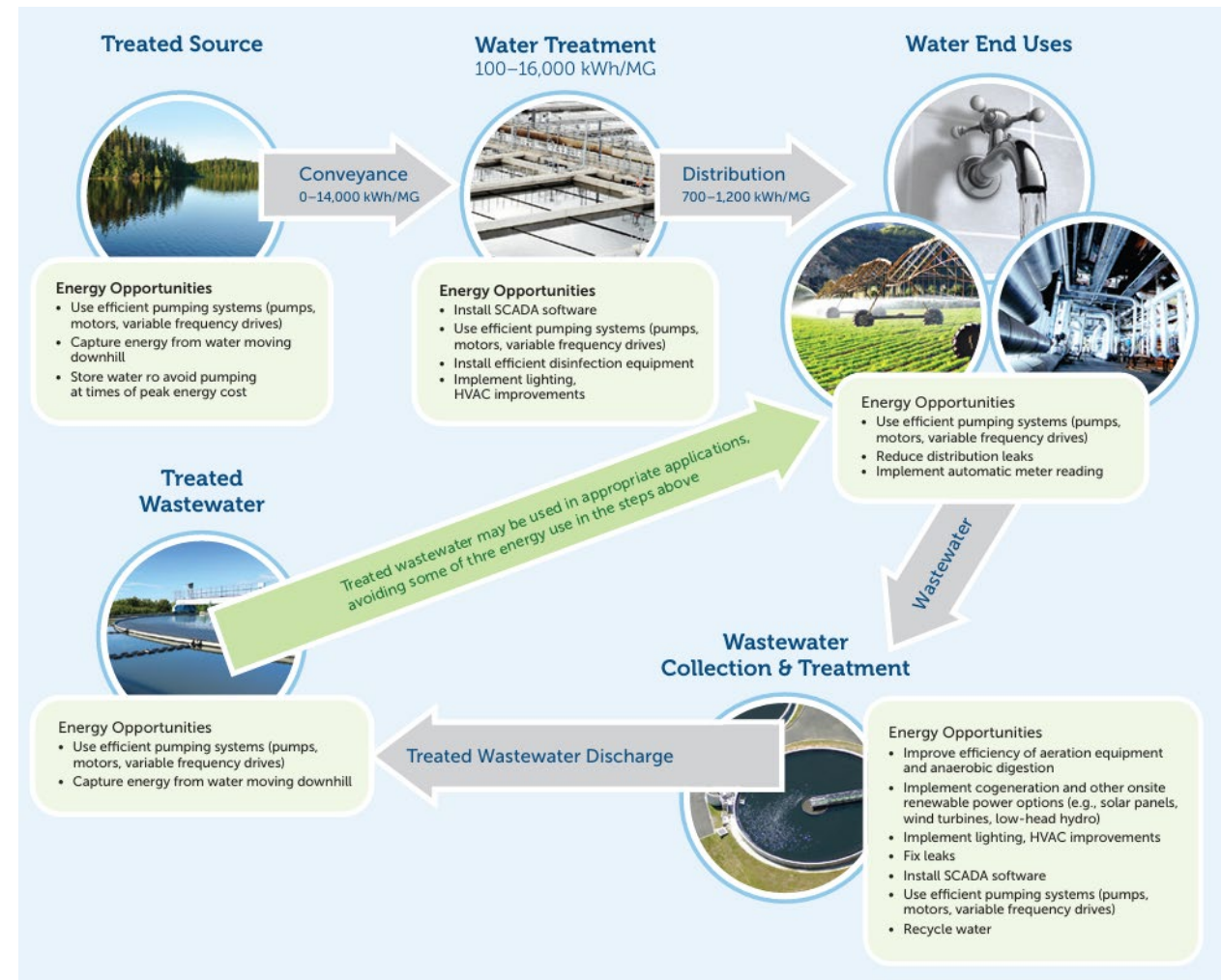
Consequences

- Higher operating costs
- Greater greenhouse gas emissions
- Grid dependence and vulnerability
- Reduced sustainability
- Delayed infrastructure investment

3 Strategies to Address Rising Energy Use



- Operational efficiency
- Energy recovery and reuse
- Renewable energy
- Demand management
- Planning and policy





4 Operational Efficiency

Lighting and Facility Energy

- Retrofit with LED lighting and motion sensors
- Implement building energy management systems (BEMS)
- Improve Heating, Ventilation, and Air Conditioning (HVAC) efficiency
- Use natural ventilation and daylighting where feasible

Pumping Systems, Motors and Drives

- Install variable frequency drives (VFDs)
- Conduct pump and motor load test
- Replace oversized or aging pumps with right-sized, high-efficiency models
- Upgrade to premium-efficiency motors
- Use smart controls and pressure sensors
- Implement proactive maintenance and lifecycle replacement

**the cheapest and
cleanest energy is the
energy you don't use**

U.S. Department of Energy (DOE), Better Buildings Initiative
National Renewable Energy Laboratory (NREL)

5 Operational Efficiency



Aeration Systems

- Upgrade to high-efficiency blowers
- Switch from coarse to fine bubble diffusers
- Implement dissolved oxygen (DO) feedback control systems
- Use intermittent aeration or step-feed processes
- Conduct aeration audits to assess system efficiency

Process Optimization

- Install or upgrade SCADA systems for real-time control and data tracking
- Perform energy benchmarking and KPIs (kWh/MG) by unit process
- Conduct process audits or modeling
- Modify process flow for gravity-driven or low-lift configurations
- Use advanced sensors and AI analytics

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6 Integrating Renewable Energy in Water & Wastewater Utilities

Common Renewable Energy Technologies

- Biogas/Combined heat and power (CHP)
- Solar photovoltaic (PV)
- Wind turbines
- Small-scale hydropower
- Energy storage

Opportunities

- Sustainable energy source
- Operational cost savings
- Carbon emission reduction
- Environmental credits revenue
- Grid resilience

Considerations:

- Upfront capital cost
- Interconnection agreements with the utility
- Regulatory requirements and construction permits
- Integration with existing systems

7 Biogas/Combined Heat and Power (CHP)



Opportunities

- Waste-to-energy solution
- Supports circular economy
- Heat recovery for process needs

Considerations:

- Operational complexity
- Gas quality and volume variability
- Odor and safety management
- Regulatory compliance



8 Solar Photovoltaic (PV)



Opportunities

- Scalability
- Minimal daily operations and oversight
- Low maintenance

Considerations:

- Intermittent supply
- Site requirements



9 Wind Turbines



Opportunities

- Space-efficient
- Strong performance in coastal or high-wind areas

Considerations:

- Site-specific feasibility
- Visual and noise impact
- Maintenance access
- Wildlife and zoning restrictions



10 Small-Scale Hydropower

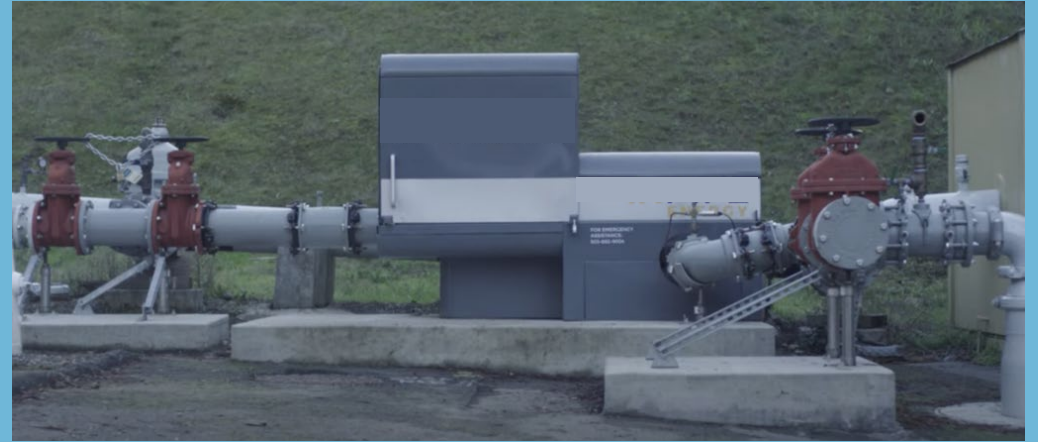


Opportunities

- Reliable, continuous energy
- Energy recovery from existing infrastructure
- Low operational costs
- Scalable and modular

Considerations:

- Site suitability requirements
- Maintenance and debris management
- Limited power output



11 Building a Renewable Energy Strategy: From Planning to Implementation

Assess

Conduct energy audits
Benchmark
performance against
similar utilities

Plan

Define clear energy
goals
Develop an energy plan
Leverage grants,
incentives, and public-
private partnerships

Implement

Pilot projects or hybrid
systems
Evaluate regulatory
requirements
Train staff and engage
stakeholders
Develop operation and
maintenance protocols

Monitor

Monitor and optimize
system performance
Conduct periodic
evaluations and adjust
the plan as needed
Communicate progress
with leadership,
regulators, and public



Questions?

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