

Committee on Water



THE
Water
Research
FOUNDATION

Water Energy Nexus: Opportunities and Challenges for the Water Sector

NARUC Policy Summit 7/16/18 Scottsdale, AZ





THE
**Water
Research**
FOUNDATION

The integrated organization represents the evolution of water research issues, the overlap between water and wastewater, and efficiencies to be gained through a consolidated research program.

Learn more at www.waterrf.org and www.werf.org

**\$700 Million
in Research**

**2,300
Projects**

**1,200
Subscribers**

Energy and Water: The Issue

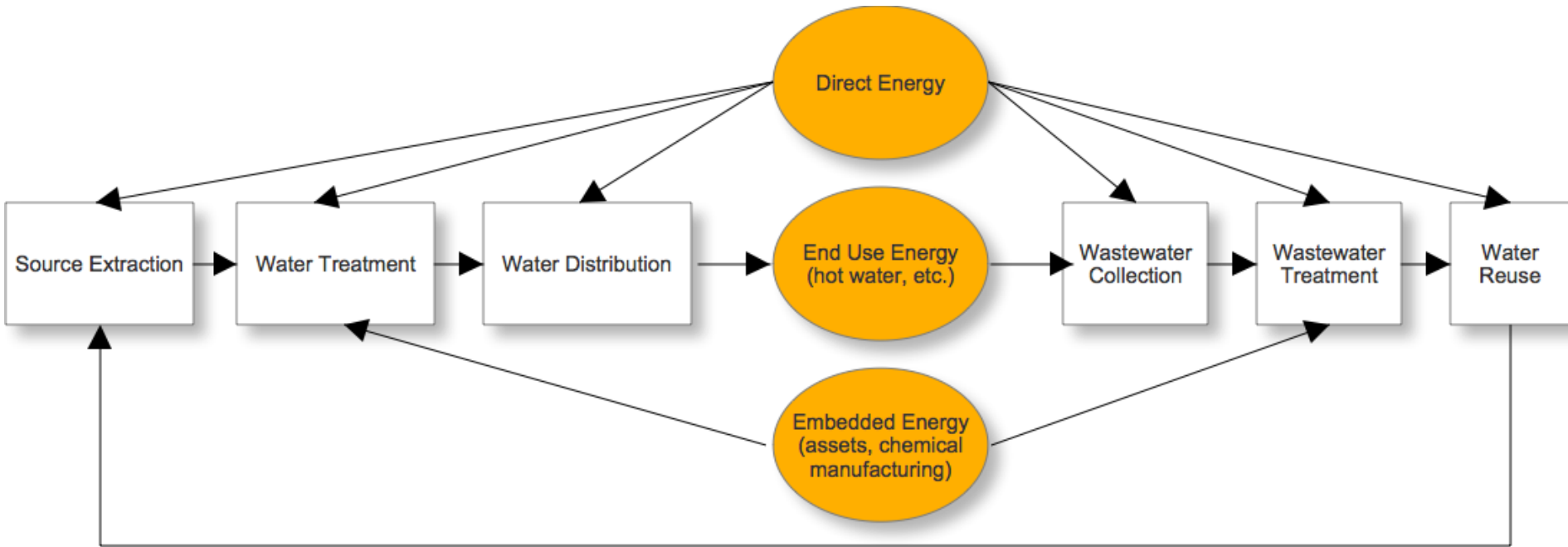
- \$4 Billion/year used on energy to provide drinking water and treat wastewater
- Majority of energy (80%) spent on conveyance of water (pumping)
- Water utilities represent 30-40% of total municipal energy consumption

Energy Demand is Increasing

- New technologies
- Drought and climate change
- Aging infrastructure
- Growth and system expansion
- Increased demand



Utility Energy Consumption



Source: Steve Conrad

Water Quality Goals

Energy Efficiency



Energy and Water: The Opportunities

- Energy savings of 15-30% are readily achievable through optimization and technology implementation
- Significant savings and reductions in GHG can be realized
- Ensure long-term sustainability

Energy Research at WRF

- Energy Efficiency – Pumping & Water Treatment
- Distributed Energy Recovery
- Waste to Energy
- Renewables
- GHG Emissions
- Best Management Practices
- Big Data and Intelligent Water Systems

Barriers to Energy Efficiency

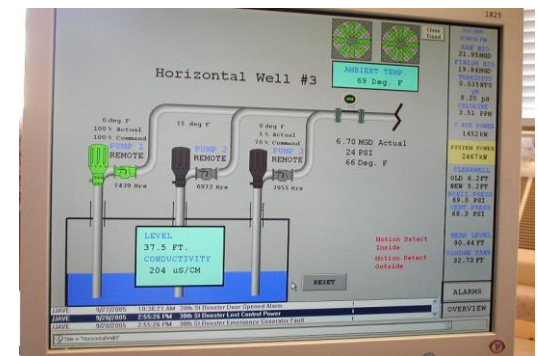
- Operational barriers
- Institutional barriers
- Political barriers
- Regulatory barriers
- Financial barriers

Energy Water Nexus - Challenges

- **Communication** is an extensive issue when it comes to utilities internally (between energy manager and operators) and externally (utilities – electric and water/wastewater).
- **Lack of data knowledge** - data is being collected in large quantities, but not exactly being utilized in the most appropriate method.
- **Technology utilization** - the technology available is not being accepted right away as they are sometimes seen as a competitor to human involvement, while they merely help make it better.
- **Regulatory Barriers** – regulations are a huge step in the wrong direction when it comes to reusing water for beneficial purposes.

Potential Energy Savings

- Potential savings of 10-30% are readily achievable
- Water facilities can save
 - 10-15% through load shifting
 - 5-15% through VFDs and premium efficiency motors
 - 10-20% through process optimization and SCADA
- Installing meters and monitoring systems can save 10%



Recent Key Projects

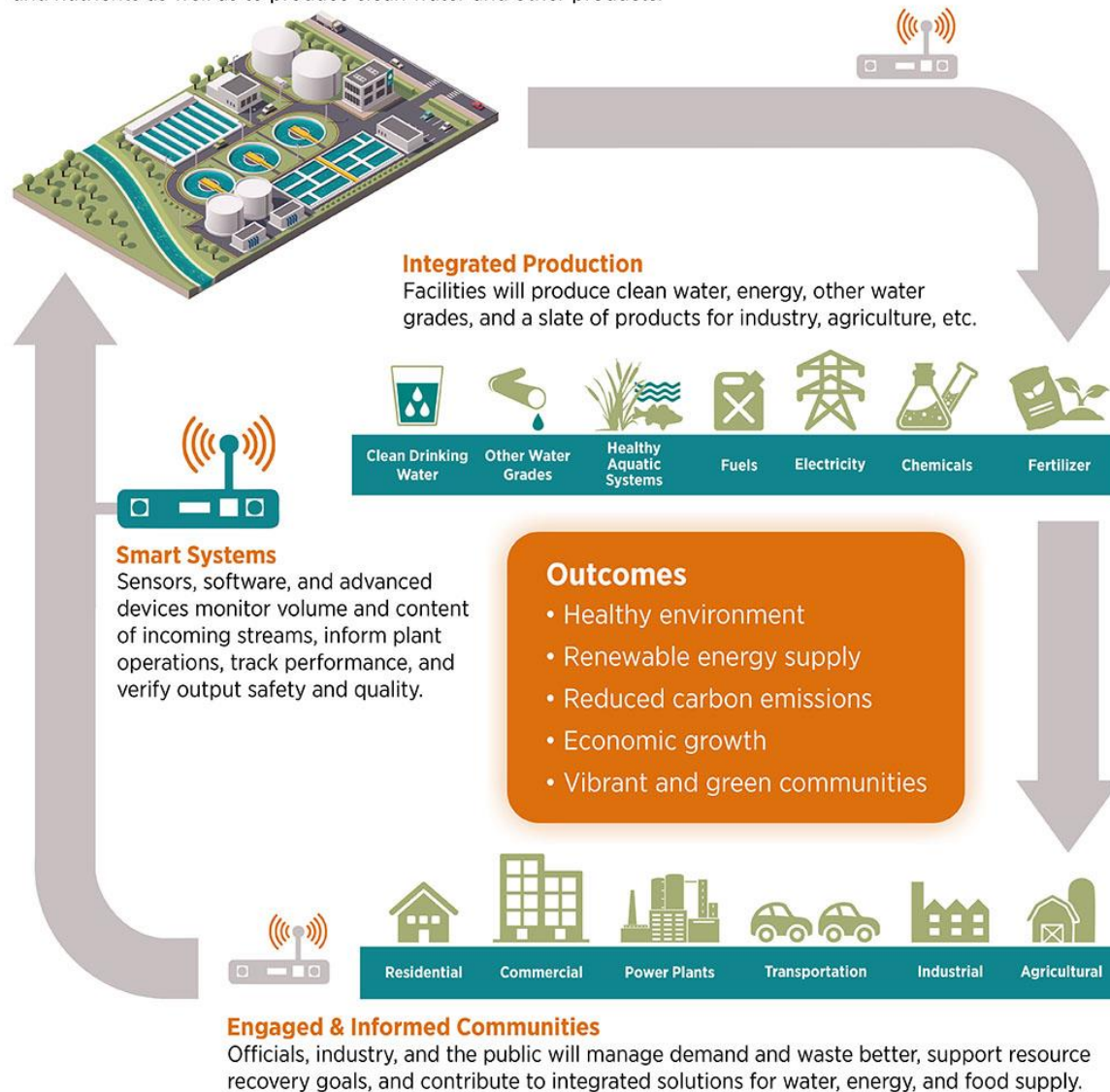
- *Managing Water and Wastewater Utility Data to Reduce Energy Consumption and Cost - **WRF 4668** (Ongoing)*
- *Opportunities and Barriers for Distributed Energy Resource Development at Water and Wastewater Utilities - **WRF 4625** (Ongoing)*
- *Battery Storage System Guidance for Water and Wastewater Utilities - **WRF 4718** (Ongoing)*
- *Assessing Public Private Partnership Opportunities for Water and Wastewater Energy Projects - **WRF 4634** (Ongoing)*
- *Water and Electric Utility Integrated Planning - **WRF 4469***

Water Resource Recovery Facility of the Future

Energy Positive and Beyond: The Vision for Transforming Wastewater Treatment

Energy Efficiency and Resource Recovery

Facilities will use energy-efficient operations to recover water, energy, and nutrients as well as to produce clean water and other products.



www.energy.gov

In Summary

- Drivers and Opportunities Are Real and Immediate
- Energy efficiency improvements can be made by utilities of all sizes
- Tools and resources are available
- Strategies and Actions Can Be Developed Now
- Partner with energy providers to identify energy cost savings and Conduct energy audit to understand current energy use

Thank you!

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The Policies and Politics of the Water-Energy Nexus

Peter J. Keenan, P.E.

Director of Engineering – Technical Services



AMERICAN WATER

thirsty energy

energy
and water's
interdependence

energy needs water

Energy production
processes require
water

- hydropower
- thermoelectric cooling
- power plant operations
- fuel extraction and refining
- fuel production

water needs energy

Water production, processing,
distribution, and end-use require
energy

- extraction
- treatment
- transportation

How Much Electricity Does the Water Industry Use?

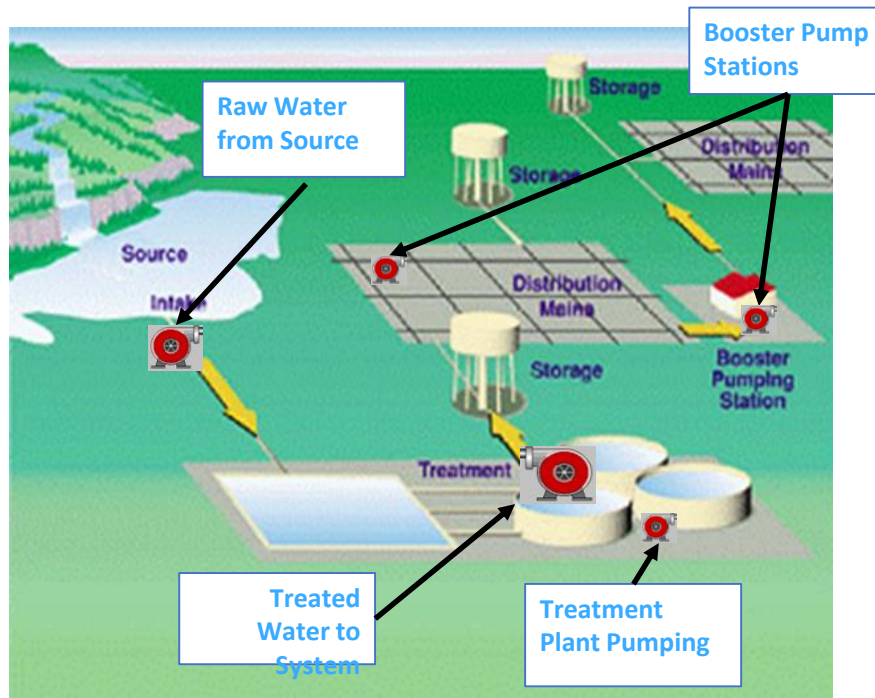
- Drinking water and wastewater consume:
 - 2% of domestic electricity¹
 - 7% of worldwide energy²
- Running the hot water faucet for 5 minutes uses about the same amount of energy as burning a 60-watt bulb for 14 hours.³

1. Electricity Usage and Management in the Municipal Water Supply and Wastewater Industries. (EPRI & WaterRF 2013)
2. The Connection: Water Supply and Energy Reserves (Dr. Allan R. Hoffman. USDOE)
3. USEPA



Pumping Accounts for the Biggest Energy Use in Potable Water Systems

- 80% – 90% of typical water utility's total energy consumption



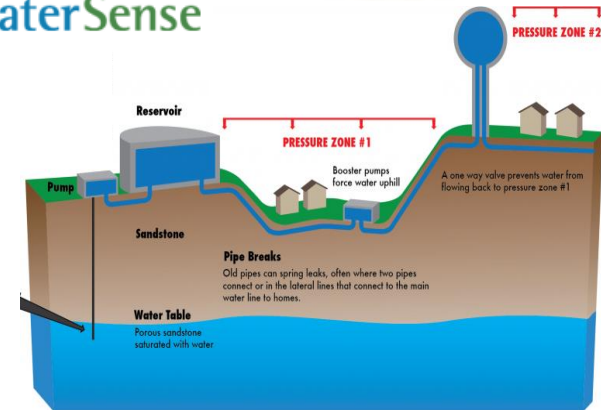
WATER IS HEAVY!

Water utilities deliver A TON of water to each residence every day

What Can Water Utilities Change to Lower Electricity Use?

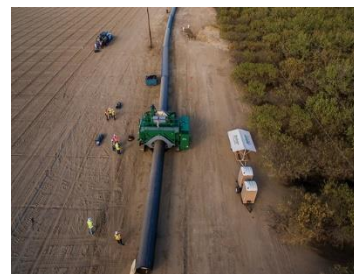
$$\text{Power} \approx (\text{Flow} \times \text{Pressure}) \div \text{Efficiency}$$

- **Flow Rate (Q) – Pump less water**
 - Decrease leakage
 - Decrease demand – help customers use water more efficiently
- **Pump Head (h) – Pressure Management**
 - Decrease pressure in localized areas where possible
- **Pump Efficiency (η) – Pump more efficiently**
 - Increase pump hydraulic efficiency
 - Increase motor and drive efficiency



Challenges to Reducing Water's Energy Needs

- Aging infrastructure
 - Drinking water leakage
 - Sewer system I&I
- Emerging contaminants of concern in drinking water
- Increasingly stringent discharge water quality standards
- Increasing demands and “competition” for sources of supply
 - Increases conveyance distances
 - Additional treatment required for lower quality supplies



Effective Regulatory Solutions

- Distribution System Replacement Surcharges
 - DSICs incentivize greater infrastructure investment that can reduce leakage and associated energy.
- Alternative Ratemaking Policies / Revenue Stabilization Mechanisms
 - Ratemaking policies that separate water volume sold from revenues encourage water (and therefore energy) efficiency efforts.
 - Demand-side management programs should be considered cost recoverable similar to capital for new water supplies.
- Encourage investments in data and technology
 - Real-time monitors
 - Artificial intelligence
 - Enhancing customer experience



Other Policy Opportunities



- Expand electric utility rebates to help fund efficiency improvements
- Financing (SRECs, credits etc.) needed to make projects cost effective in most cases (micro-turbines, solar, wind, bio-energy, energy-neutral WWTPs)
- Energy portfolio diversification provides efficiency and resiliency
- Optimize water storage use to aid in load shifting of pump energy demands
- Leverage new technologies such as “geothermal” and smart irrigation controllers





THANK YOU

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EPA in the Water-Energy Nexus

Raffael Stein, Director

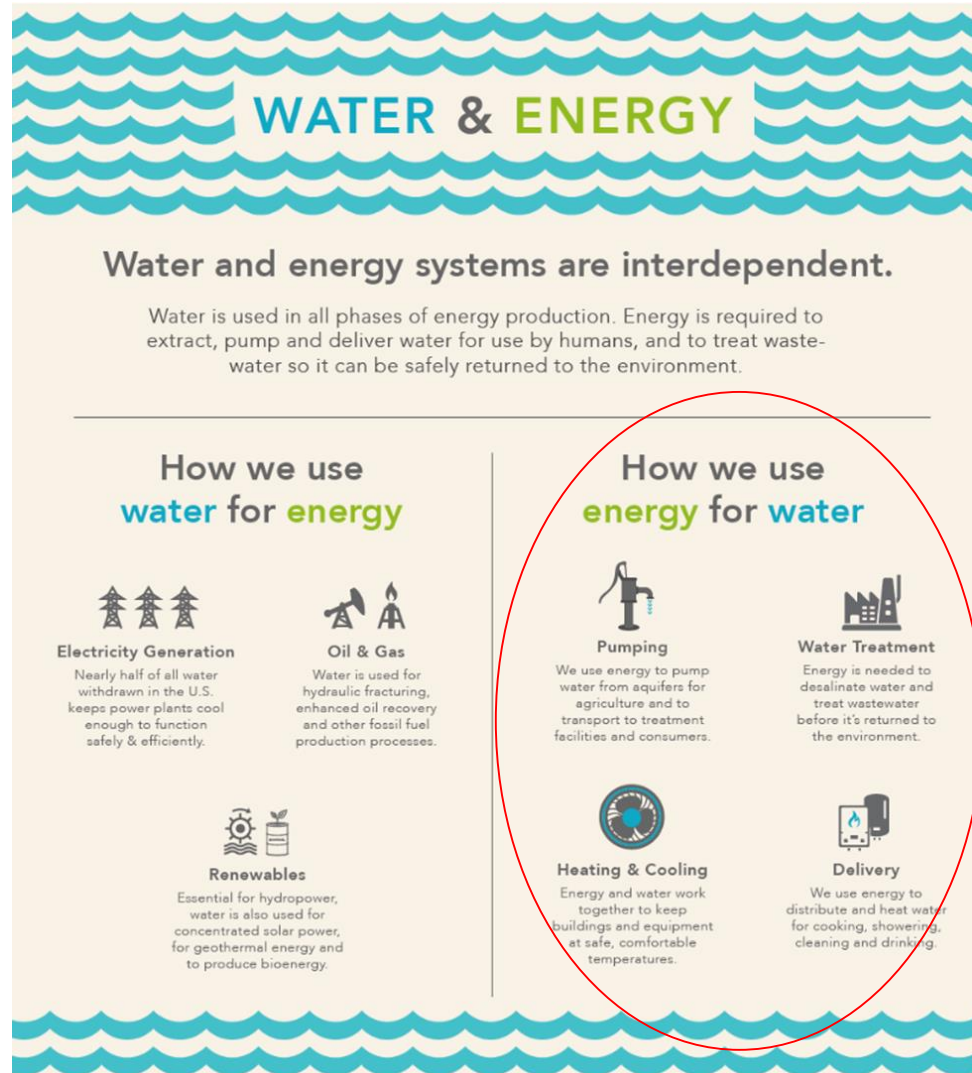
Water Infrastructure Division
U.S. EPA Office of Wastewater Management



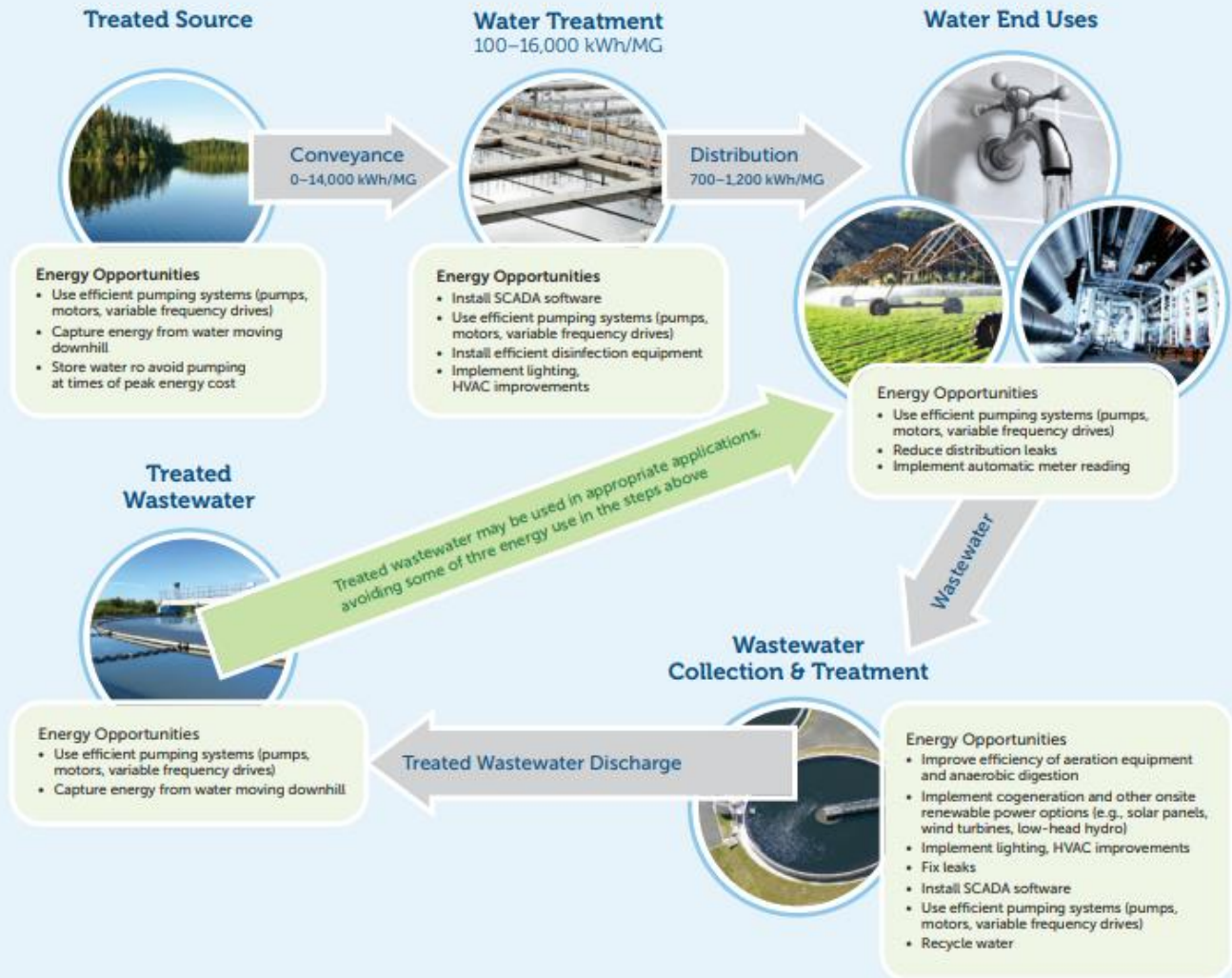
U.S. ENVIRONMENTAL PROTECTION AGENCY
1200 PENNSYLVANIA AVENUE, NW
WASHINGTON, DC 20460

Water-Energy Nexus

Source: US Department of Energy



What influence do energy costs have on the water sector?



Source: US Environmental Protection Agency

look for



2.7 trillion gallons of water saved since 2006!

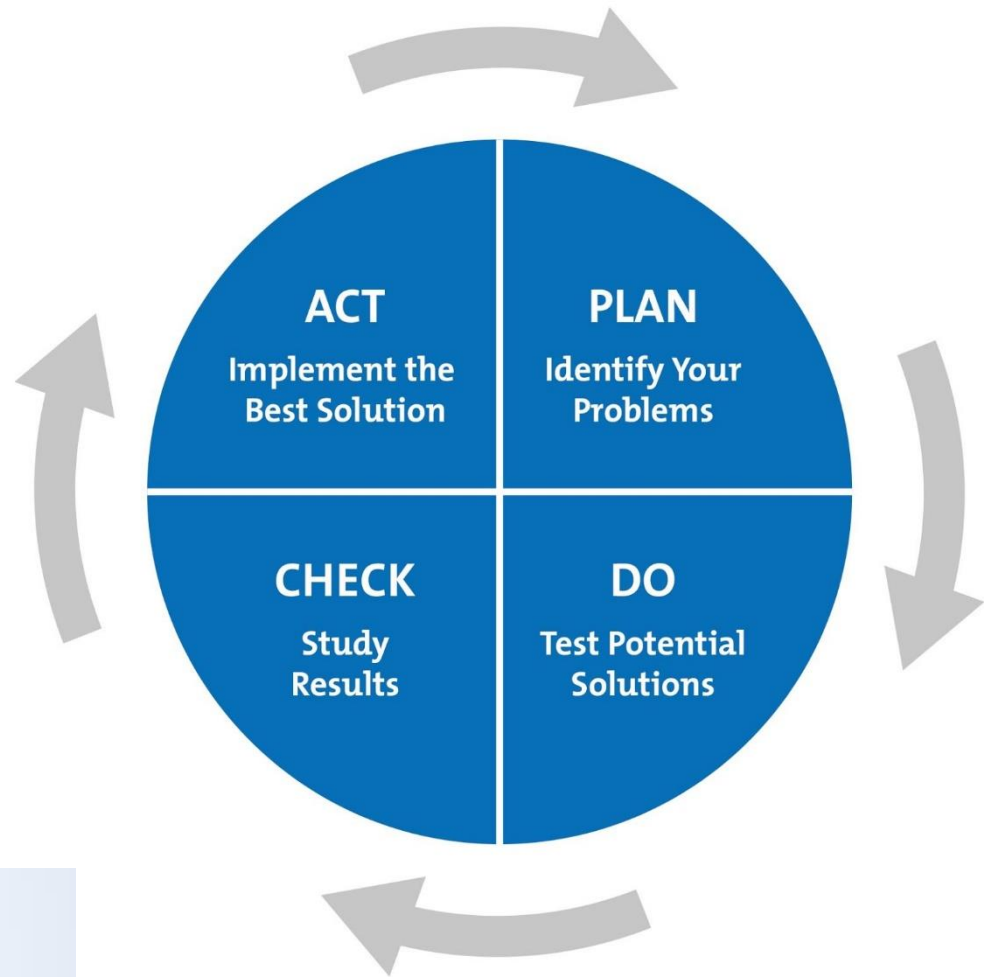
WaterSense has helped **reduce** the amount of **energy needed** to heat, pump, and treat water by

367 billion

kilowatt hours, enough to supply a year's worth of power to more than

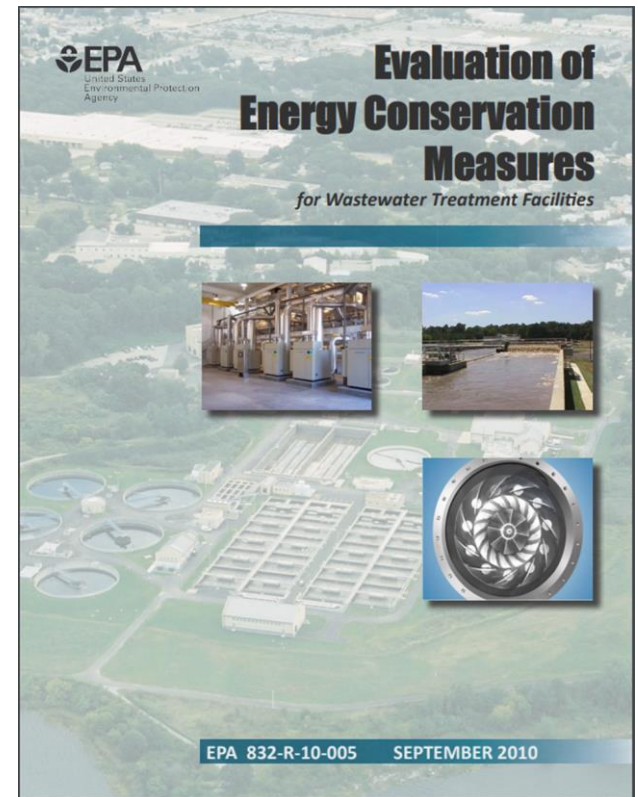
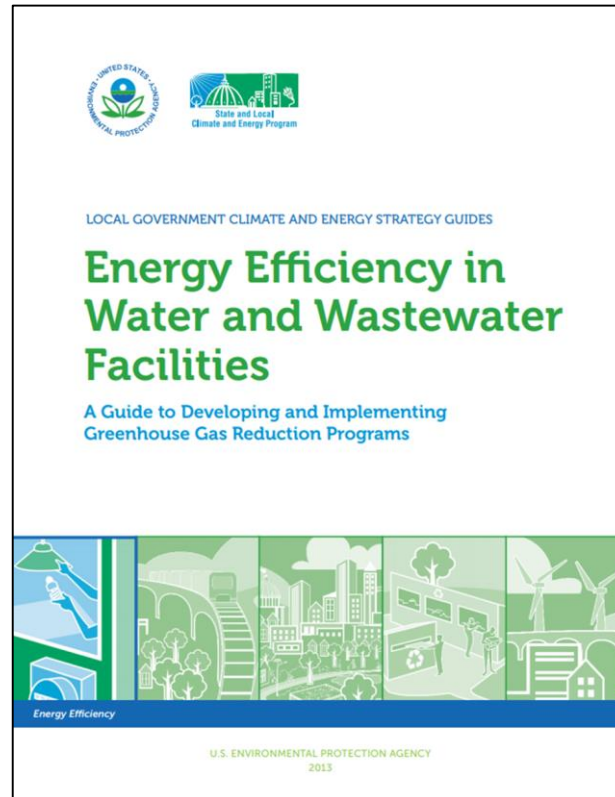


Sustainable Utilities Management Program



ENERGY STAR®
PortfolioManager®

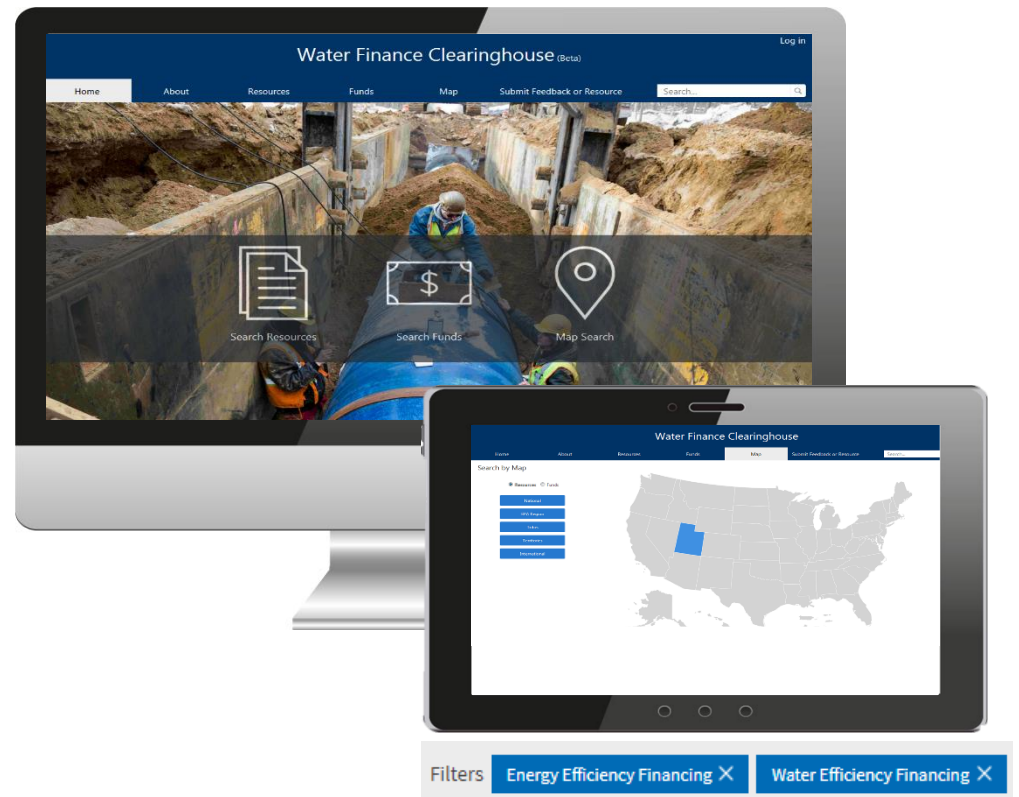
EPA Programs & Publications on Energy Efficiency



WIRFC & WIFIA



- WIRFC Clearinghouse of funding sources and finance information
- WIFIA funding to encourage new technologies and revenue streams



Clean Water State Revolving Funds

Water and Energy
Efficiency Projects



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