American Water: Energy Efficient Operations

AMERICAN WATER

American Water understands the importance of the nexus between water and energy. It takes a lot of energy to deliver reliable water service for our customers: together, water and wastewater systems account for about 2-4 percent of all energy use in the U.S.[1] That's why we have focused on enhancing energy efficiency by proactively managing our water, fuel and power use.

Decreasing our water and energy use makes good business sense, and it's good for the environment, too. It translates into reduced water treatment and delivery costs, lower electric bills, and a smaller carbon footprint. Here's how we do it.

PUMP EFFICIENCIES

American Water facilities consume about 1 million MWh per year of electricity, and over 95 percent of that is used to pump water. That's why we concentrate on improving pump efficiencies through refurbishment and/or replacement.

ENERGY USED FOR WATER TREATMENT AND DELIVERY	
Ground Water Utility	
Well Pumping	33%
Chlorination	1%
Booster Pumping	66%
Surface Water Utility	
Raw Water Pumping	9%
Treatment	5%
Finished Water Pumping	86%

As pumps age, they wear and become less hydraulically efficient. When this happens, more power is required to deliver the same volume of water. At American Water, we own and operate about 7,500 centrifugal pumping units nationwide. About 20 percent of these pumps consume 80 percent of the total power use, which is where we focus our efforts.

Energy Usage Index (EUI) metric: We manage our energy program using this metric derived by dividing total power usage in megawatt-hours (MWh) by the volume of water sold in million gallons (MG) during a discrete period of time. The current baseline for this metric is 2.89 based on 2011-2013 operating data. The EUI data that is collected and monitored serves as a barometer for the condition of the pump fleet, which helps us to better pinpoint pump improvement projects that will make the greatest impact.

Wire-to-Water Pumping Efficiency Tests: American Water conducts wire-to-water efficiency testing to monitor the efficiency of pumps and motors. Research has shown that the average "wire-to-water" efficiency of existing "in-field" water utility pumps is about 60 percent. New installations are designed to achieve efficiencies between 76-82 percent. Replacing or refurbishing older pumps to their original efficiencies can yield energy savings of 10-20 percent at that facility.

Pump Replacement/Refurbishment: A total of 52 pump refurbishments/replacements were completed from 2011-2013 at a cost of approximately $6 million, and provided an estimated energy reduction 8 million kwh/year.

Variable Frequency Drives (VFD): American Water has installed numerous variable frequency drives to vary pump speed/output. Variable speed pumping can reduce electrical consumption where a throttling valve would otherwise be used to control pumping rate.

Hydraulic Modeling: Distribution systems are modeled to analyze current and future hydraulic conditions to enable efficient pump selection.

[1] Environmental Protection Agency, *Strategies for Saving Energy at Public Water Systems*, July 2013; and Electrical Power Research Institute and the Water Research Foundation (WRF), *Electric Use and Management in the Municipal Water Supply and Wastewater Industries*, November 2013.

CASE STUDY

Five Pump Replacements Yield Great Results

Pennsylvania American Water's Aldrich Station Water Treatment Plant has three 10 million gallon per day (MGD) and two 20 MGD high service pumps. Combined, these pumps consume over 90 percent of the treatment plant's electrical usage.

Before Pump Improvements

- **Efficiency:** Low efficiencies; some as low as 53 percent (wire-to-water) due to age and wear-and-tear
- **Average age of pumps:** 50 years
- **Average annual energy consumption:** 28 Million kWh/year

After Pump Improvements

- **Actions:** All five pumps and motors were replaced at a cost of $1.8 million.
- **Average annual energy consumption:** 24 million kWh/year

RESULTS

Energy savings
4 million kWh/year

Energy cost savings
$320,000/year

Reduction in GHGe
6 million lbs. CO2 per year

FOCUSING ON CUSTOMER EFFICIENCY

When water is used efficiently, it helps protect our precious natural resources, and it reduces the capital and operating costs related to source, treat and pump water and wastewater. That's why we proactively promote wise water use to customers and have achieved reductions in customer demand as a result. Initiatives range from:

- Customer education (literature inserted into bills and presented at community events and conferences, as well as earned/paid media)
- Rebates on water-saving appliances
- Water efficiency audits
- In-home water conservation kits

WaterSense Partner: We also partner with other organizations that promote wise water use. American Water is a voluntary member of the EPA's WaterSense Program, which aims to raise awareness about the importance of conserving water and promotes the use of WaterSense products, which are at least 20 percent more efficient than standard toilets, faucets and irrigation fixtures. In fact, Since the inception of EPA's WaterSense program in 2006, U.S. consumers have saved 757 billion gallons of water and more than $14.2 billion in water and energy bills.

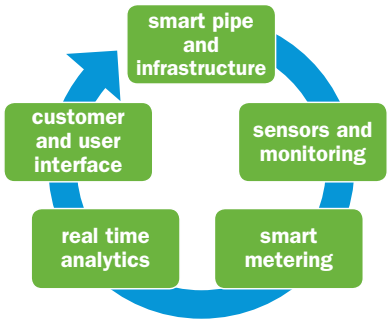
BENEFITS OF DECREASED CUSTOMER WATER DEMAND

There is a significant opportunity to increase water efficiency programs across the country given proper incentives from the regulatory community.

- **Good for our customers:** By reducing their water and energy use, customers save money through lower water and electric bills.
- **Good for the environment:** Reduces our carbon footprint and waste streams. Less energy is needed from power plants to support water delivery.
- **Good for the company:** Thanks to reduced customer demand, many American Water's subsidiaries have avoided the need to build increased supply, treatment and transmission capacity. And, as gains in water efficiency continue in the future, additional capital needs can be deferred or avoided (which is a cost savings to the customer as well).

DEMAND-SIDE ENERGY MANAGEMENT

American Water is the first U.S. water utility to use ENBALA Power Networks **Smart Grid technology**. This innovative technology manages the way our treatment plants and pumps use electrical power. Instead of adjusting electrical generation to match changes in electrical demand, the network adjusts demand, enabling electrical equipment to consume more energy when demand is low and less when it is high. This provides Grid Balance to electricity system operators. A successful pilot program at Pennsylvania American Water's Shire Oaks Pumping Station offset 2-3 percent of the site's total energy bill. As a result, we look to bring this technology to large treatment plants throughout American Water.



SMART WATER GRID

American Water is pioneering the use of the smart water grid to improve efficiency, and save water and energy. Through **enhanced infrastructure, sensors and metering systems**, we intensified our efforts to collect and integrate data and find leaks in our systems faster to reduce water loss (non-revenue water). Finding and stopping leaks quickly reduces repair costs, chemical use, energy consumption and associated greenhouse gas emissions.

RENEWABLE ENERGY

American Water maintains a portfolio of **alternative energy supplies** to reduce greenhouse gas emissions. This includes power from solar, wind and biomass facilities. It is estimated that this portfolio saves over 2,500 metric tons of CO2 annually.

PRESSURE MANAGEMENT

International efforts to reduce water leakage have confirmed that reducing excessive pressure reduces the volume of leaks through pipes and the frequency of pipe failures. American Water is a partner in a two-year award from the Israel-U.S. Binational Industrial Research and Development Foundation along with Stream Control Ltd. to develop an advanced pressure management system. **The Stream Control Research Project** will assess the feasibility of installing modifications on existing distribution system pressure controls that could reduce pressure in a system has experienced reduced customer demand.

BOTTOM LINE

Water and energy efficiency programs are a top priority at American Water. Over the years, we have introduced a number innovations that we hope will set the stage for operational efficiency across the company and throughout the industry. And, we continue to challenge ourselves to find innovative ways to operate more efficiently for the benefit of the company, customers and environment.