A Survey of Energy Use in Water Companies

Rachel Young

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529 14th Street NW, Suite 600, Washington, DC 20045
Phone: (202) 507-4000 • Twitter: @ACEEEDC
Facebook.com/myACEEE • aceee.org

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About the Author

Rachel Young conducts research on the impacts of federal and national energy efficiency policies. She works in the ACEEE Policy Program where she focuses on energy efficiency as a way to reduce air pollution, the water–energy nexus, and natural gas efficiency policies and programs. She has authored and coauthored several publications, including ACEEE's *International Energy Efficiency Scorecard*, and she conducts quantitative and qualitative research in a number of ACEEE priority areas. Prior to joining ACEEE, Rachel held a Climate and Energy research fellowship position at the Breakthrough Institute and an activist fellowship position with Avaaz.org. She has a BA in environmental studies with a concentration in chemistry from Lewis & Clark College.

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Abstract

The relationship between water and energy is a close one. Water requires a tremendous amount of energy to move from a reservoir or well, through the treatment process, and out into a distribution system. In addition, energy is required to process wastewater and recycle or discharge it. The energy required to operate the water and wastewater system is often called embedded energy.

Despite this strong connection, the energy intensity of water and wastewater systems is relatively undocumented. There are few data sources and reports analyzing the energy required to move and treat water, and the data generally are not publicly available. ACEEE has been working to gain a better understanding of the energy embedded in water in order to help water utilities reduce costs, improve energy efficiency, and quantify the avoided energy and pollution savings that accrue as a result of water conservation programs.

As part of an ongoing effort to advance the understanding of the water–energy nexus and bring attention to possible opportunities, the National Association of Water Companies (NAWC) and the American Council for an Energy-Efficient Economy (ACEEE) collaborated on a new research project to gather primary information on the amount of energy required to treat and distribute water. ACEEE and NAWC jointly produced a survey for NAWC's member companies related to their energy use and water processing. NAWC has over 100 member water and wastewater companies of varying sizes throughout the United States.

Unsurprisingly, the water companies surveyed have energy intensity similar to those seen in previous ACEEE research (Young 2014). In our previous study we found that energy intensity of the water system is between 200 kWh/million gallons and 16,000 kWh/million gallons. Table ES1 shows the result of the NAWC survey, a range of 0–2,800 kWh/million gallons, with an average of about 2,300 kWh/million gallons.

Table ES1. Energy intensity of water processes (kWh/million gallons)

Water service	Mean	Minimum	Maximum
Water source and conveyance	1,100	200	1,800
Treatment	1,100	300	2,700
Distribution	700	–	1,500
Total	2,300	1,500	3,500

The survey also confirmed previous studies showing that the distance water travels in the system, the water source, and the size of the water utility all impact the energy intensity of the water system.

In addition to the energy and water data collected, ACEEE found that some water and wastewater companies are making substantial progress in improving their energy and water efficiency. Overall we found that 9 out of 11 participating utilities have instituted leak-detection efforts in the past three years and 5 out of 11 offer water conservation

programs of some sort to their customers. Of the 11 participating utilities, 3 partner with an energy utility, including 1 water utility with a joint program for end-use customers.

Introduction

The relationship between water and energy is a close one. Water requires a tremendous amount of energy to move from a reservoir or well, through the treatment process, and out into a distribution system. A gallon of water weighs approximately eight pounds, and water systems may stretch for hundreds of miles. In addition, energy is required to process wastewater and to recycle or discharge it. The energy required to operate the water and wastewater system is often called embedded energy.

Despite this strong connection, the energy intensity of water and wastewater systems is relatively undocumented. There are few data sources and reports analyzing the energy required to move and treat water, and the data are generally not publicly available. ACEEE has been working to gain a better understanding of the energy embedded in water in order to help water utilities reduce costs, improve energy efficiency, and quantify the avoided energy and pollution savings that accrue as a result of water conservation programs.

As part of an ongoing effort to advance the understanding of the water-energy nexus and bring attention to possible opportunities, the National Association of Water Companies (NAWC) and the American Council for an Energy-Efficient Economy (ACEEE) collaborated on a new research project to gather primary information on the amount of energy required to treat and distribute water.[1] This effort has three goals:

1. Expand our understanding of the energy embedded in water source and conveyance, treatment, and distribution as well as wastewater treatment and discharge.
2. Provide data on energy use per gallon of water processed.
3. Help NAWC members better understand their energy use to help them identify opportunities for reducing energy use.

To achieve these objectives, ACEEE and NAWC jointly produced a survey for NAWC's member companies related to their energy use and water processing. NAWC has over 100 member companies of varying sizes throughout the United States. The intersection between water and energy provides many opportunities for water companies to save energy by becoming more energy efficient, reducing water waste at their facilities, and persuading their customers to waste less water. We wanted to get a better understanding of how NAWC's members are improving their energy efficiency. In our survey we asked companies to provide their energy consumption and water processing data so we could understand their energy intensities. Several questions in the survey focused on energy efficiency at water processing plants, conservation programs provided, and any efforts undertaken in partnership with energy utilities.

[1] NAWC is the voice of the private water industry—the organization exclusively representing this group of quality service providers, innovation drivers, and responsible partners. For more information about the organization and its members see http://www.nawc.org/about-NAWC/.

WATER AND WASTEWATER FACILITIES

In this paper when we refer to water companies we mean companies that process and supply potable water to customers. Water supply has a multitude of systems that use energy during operations, including the actual processing and pumping of water. The majority of energy use in potable water processes is in pumping water from the source through to distribution channels. Pumping of treated water is particularly electric-intensive and accounts for the majority of total electricity use in public water-supply systems.

We also discuss wastewater companies that are responsible for the collection, treatment, and discharge of water after it has been used by people in homes, businesses, or industry. We include any treatment of water that is then recycled back to the end-use customer or is supplied back to the water companies. The energy associated with recycling water is included in the wastewater section of this paper.

Though wastewater treatment facilities use some natural gas for space heating and heating of anaerobic digesters, they rely primarily on electricity for a wide range of processes, including pumping, filtration, aeration, air compression, and sludge dewatering and thickening (Hamilton et al. 2009). Electricity accounts for almost all energy use in public water supply systems, where it is used for pumping, flocculation, filtration, and feeding of coagulant and chlorine (Carns 2005). For this paper we report electricity use from survey respondents.

Last, there are companies who serve both water and wastewater needs. We report findings for water process and wastewater process separately, but it is important to note that some companies have both services.

PRIVATE VERSUS PUBLIC WATER COMPANIES

The majority of water in the United States is supplied by municipal or public water and wastewater utilities, while approximately 16% of water companies are private. There are approximately 4,200 privately owned wastewater companies in the United States, which equates to about 20% of wastewater utilities (NAWC 2009). For the purpose of this survey, we partnered with NAWC, whose members are all private water and wastewater companies.

NAWC's members include privately owned and publicly traded drinking water utilities and wastewater services companies. They also serve professional water contracting companies. Their members are within the United States and include over 120 companies that range from very small businesses to companies with service territories covering multiple states. Their members serve over 90% of all private water customers.

Often private water companies work in partnership with public entities. Public-private partnerships (PPPs) are contractual arrangements that enable municipalities to outsource the management and operation of their water and wastewater systems. Several of NAWC's member companies are working in partnership with municipalities.

Methodology

We started by assembling survey questions for data we wanted to collect. We considered data from the Alliance for Water Efficiency (AWE) Water Conservation Tracking Tool, results from previous ACEEE papers, and survey work done by the Illinois Section of the American Water Works Association (AWE 2014; Young 2014; ISAWWA 2012). ACEEE and NAWC staff and several experts in the water and energy sectors developed the survey questions and the online submission format. We asked NAWC member companies for their feedback on the feasibility of collecting and submitting the data asked for in the survey.

The survey included questions on the total energy used by water or wastewater companies and the amount of water processed by those companies. We tried to gather information about the companies that would help contextualize the energy and water use, including the location water is drawn from, the number of connections and population served by each company, and the distance water is distributed. We also wanted to understand energy efficiency improvements that companies were undertaking, so we included questions on existing efficiency efforts and ongoing partnerships with power producers. The full survey can be seen in Appendix A.

We emailed a call for survey responses to NAWC water company members and followed up with phone interviews and further emails. We supplied an Excel-based submission format in addition to the online form to ease the submission process. To incentivize member organizations to submit their data, NAWC provided a $100 donation in the name of each participating company to Water for People.[2] Once submissions were collected, all data were anonymized and kept confidential between NAWC, ACEEE, and the submitting company.

Results

SURVEY RESPONDENTS

After the survey submissions concluded, ACEEE staff assembled and analyzed the data. The response rate was lower than we had hoped. ISAWWA's survey, which we based our survey on, collected data from 44 water utilities (ISAWWA 2012). Our goal was to collect 20 submissions. In the end we received 12 completed surveys, of which 9 had usable data. Eight of the respondents were from water companies, two were from companies that are both water and wastewater, one was from a wastewater company, and one was a duplicate. The 11 respondents cover over 20 million customers in every region of the country. The respondents represent 64% of customers served by NAWC members. Because few wastewater companies responded to the survey, we were unable to do a full analysis of the energy intensity of wastewater companies. The results are not representative of overall wastewater use.

WATER SYSTEMS

Water system energy use consists largely of pumping water from the source to the customer. In the survey we asked respondents to break out their energy use by activity,

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[2] Water for People's website can be found here: http://www.waterforpeople.org/.

source or conveyance, treatment, and distribution. This break out allows us to identify where in the water process the most energy is being consumed. Tables 1 and 2 show the reported results for electricity use and water processing from the nine water companies. Because only one company reported energy use from other fuels, we do not show this use separately.

Table 1. Total electricity consumed in the water processes (kWh)

Water service	Mean	Minimum	Maximum	Total
Water source and conveyance	6,582,000	600,000	34,255,000	39,492,00
Treatment	2,609,000	100,000	9,584,000	13,043,000
Distribution	46,821,000	517,000	977,704,000	993,495,000
Total	217,272,000	700,000	977,704,000	1,263,301,813

Table 2. Water processed by potable water systems (million gallons)

	Mean	Minimum	Maximum
Water source or conveyance, treatment, and distribution	53,367,000	100	373,553,167

Energy Intensity of Water Systems

To understand how much energy the NAWC water company members are using, it is better to examine how intensive their processes are. One way to do this is to examine the amount of energy required to process a million gallons of water. Table 3 shows the overall energy intensity of the potable water system by service. These results are based on the data reported in our survey collection.

Table 3. Energy intensity of water processes (kWh/million gallons)

Water service	Mean	Minimum	Maximum
Water source or conveyance	1,100	200	1,800
Treatment	1,100	300	2,700
Distribution	700	—	1,500
Total	2,300	1,500	3,500

Unsurprisingly, these energy intensity ranges are similar to those seen in previous ACEEE research (Young 2014). In our previous study we found that the energy intensity of the water system is between 200 kWh/million gallons and 16,000 kWh/million gallons.

IAWWA's survey reported that for the whole water system, energy intensity ranges from 218 to 12,830 kWh/million gallons for all utility sizes (ISAWWA 2012). Within this range ISAWWA reported mean intensities of 2,844 kWh/million gallons for groundwater, 866 kWh/million gallons for water from Lake Michigan, and 2,019 kWh/million gallons for surface water.

Factors Impacting Energy Intensity

Energy consumption of water can vary dramatically in the water service sector (source, conveyance, and treatment) because of differences in the size of the water systems, pumping requirements between geographic locations, and raw water characteristics. Water availability differs between states. The treatment of water can be a very energy-intensive process depending on the water source. For example, brackish groundwater or seawater desalination require much more treatment, so their energy intensity is significantly higher.

In the survey we also asked respondents to provide information on the sources of water and the distance water is pumped and distributed. Table 4 shows the average, minimum, and maximum percentages of water from each source.

Table 4. Water sources

Water source	Mean (all respondents)	Mean (only respondents who receive water from that source)	Minimum	Maximum
Local surface water	51%	72%	50%*	100%*
Groundwater	48%	53%	20%*	100%*
Brackish desalination	0%	—	0%	0%
Recycled water	2%	10%	0%	10%*
Seawater desalination	0%	—	0%	0%

* Results show only respondents that receive water from that source and exclude those who do not.

The majority of water comes from local surface water or groundwater. Three respondents reported that they get 100% of their water from groundwater sources. Respondents that get a mix of their water from groundwater, local surface water, or recycled water all reported that they receive 50% or more of their water from local surface water. One respondent reported they receive all of their water from local surface water. Only two companies reported they get water from recycled sources, and both said it was only 10% of their total water supply. No companies are getting water from brackish desalination or seawater desalination.

Table 5 provides information on the relative energy use for systems utilizing different water sources. We report energy intensity for the conveyance portion of the process, since this is where the difference in water source could make a significant difference. The majority of the reporting was on either groundwater or surface water. No respondents use brackish desalination or seawater desalination. Two companies were getting water from recycled water sources, but the amount was less than 10% of the water source. Therefore, we omitted recycled water from table 5.

Table 5. Energy intensity for water conveyance by water source (kWh/million gallons)

Utility water source	Mean	Minimum	Maximum
Local surface water (equal to or greater than 50%)	1,800	0	4,700
Groundwater (equal to or greater than 50%)	2,400	1,800	3,800

Table 5 shows that the average energy intensity of water conveyance for companies where half or more of their water is from local surface sources is lower than for the companies where half or more of their water is from ground water sources. The average energy intensity for local surface water is lower than groundwater, which is what we expect to find. Local surface water is less energy intensive than groundwater because it requires less pumping.

However the maximum energy intensity for local surface water sources is higher than groundwater. The company whose energy intensity is the maximum for surface water gets 30% of its water from a groundwater source and has to transport both its local and groundwater farther than any other responding company. In addition, the company with the second highest energy intensity in local surface water gets 30% of its water from groundwater sources, and that company has the highest elevations to transport groundwater over. These energy-intensive processes likely skewed the results. More sources would likely show greater range and more accurate results.

The two companies that reported that 100% of their water is from groundwater sources also have among the highest total energy intensity. Another company with a higher overall energy intensity gets its water from many different sources, including recycled water. In addition, that company has a high elevation, which requires it to pump its groundwater. Therefore, although its water source is mostly from surface water, the groundwater it uses has to be pumped a greater distance than that of the other two companies.

Energy use by source depends on the distance water has to travel to reach the facility and the elevation it has to be pumped from. Generally groundwater sources require the most change in elevation; however, water that has to be moved a great distance can require a large change in elevation. Yet change in elevation to move surface water is only energy intensive if the water has to be moved up hill. Often gravity can work to move water, which significantly reduces the amount of energy needed. Table 6 shows the distances and the elevation that survey respondents move their water.

Table 6. Distance and elevation

Water source		Mean	Minimum*	Maximum
Local surface water	Distance (miles)	2	0.25	5
	Elevation (feet)	553	15	2,680
Groundwater	Distance (miles)	6	0.02	<50
	Elevation (feet)	380	10	1,790
Recycled water	Distance (miles)	0.06	0.02	0.1
	Elevation (feet)	0	0	0

* Results show only respondents who receive water from that source and exclude those who do not.

The distance and elevation water must be moved changes the energy intensity of the system. In the small sample of respondents, we were not able to draw significant conclusions about the impact of distances, elevation or water source on the range of energy intensity. However anecdotally we see that the company with one of the highest energy intensities gets 35% of its water from groundwater that it has to pump an elevation of 200 feet.

We see that size of the utility matters. Table 8 shows the range of energy use based on the size of the utility.

Table 8. Mean energy intensity by company size (kWh/million gallons)

Water company size	Energy intensity
Large (>100,000 service connections)	1,700
Medium (25,000–100,000 service connections)	1,900
Small (<25,000 service connections)	2,600

In previous studies we have seen that smaller utilities use more electricity per unit of water (ISAWWA 2012). As seen from our survey, smaller utilities or utilities with fewer service connections have a higher energy intensity.

WASTEWATER SYSTEMS

According to EPA, wastewater aeration systems such as blowers and diffuser technology typically account for about half of a wastewater treatment plant's energy use (EPA 2013b). In addition, there is energy use associated with moving water with pumps, similar to potable water facilities.

Because only three companies that process wastewater responded to the survey, and two had complete data, we were unable to do a full analysis of the energy intensity of wastewater companies. Therefore the results are not representative of overall wastewater use.

Tables 9 and 10 show the energy used and wastewater processed by respondents to the survey.

Table 9. Total electricity consumed in water processes (kWh)

Wastewater service	Mean	Minimum	Maximum
Wastewater collection	NA	963,000	5,263,000
Wastewater treatment	NA	5,316,000	120,016,000
Wastewater distribution	NA	109,000	109,000
Recycling	NA	27,000	27,000
Total	NA	6,415,000	125,279,000

Table 10. Wastewater processed by potable water systems (million gallons)

Wastewater processed by facilities	Mean	Minimum	Maximum
Annual wastewater collected	NA	1,600	19,500
Annual wastewater treated	NA	1,600	19,500
Annual wastewater discharged	NA	1,600	17,500
Total	NA	1,600	19,500

DISCUSSION OF RESULTS

Though our data sample was limited, we found that the data range was largely consistent with previous work by ACEEE and others. The range was smaller than findings in California and Illinois. However this smaller range is consistent and similar to findings from a study of the whole United States done by the Electric Power Research Institute (EPRI) (Goldstein and Smith 2002). Table 11 shows a summary of the findings from these studies.

Table 11. Energy intensity in water services

<table>
<tr><th rowspan="2">Source</th><th rowspan="2">State</th><th rowspan="2">Year</th><th colspan="3">Water services (kWh/million gallons per year)</th></tr>
<tr><th>Source and conveyance</th><th>Treatment</th><th>Distribution</th></tr>
<tr><td>CEC</td><td>CA</td><td>2005</td><td>0–14,000</td><td>100–16,000</td><td>100–1,200</td></tr>
<tr><td>EPRI</td><td>USA</td><td>2002</td><td colspan="2">300–1,824</td><td>NA</td></tr>
<tr><td rowspan="2">ISAWWA</td><td>IL</td><td>2012</td><td colspan="3">218–12,890 (range for all utility sizes)
1,560–2,912 (range of group means)</td></tr>
<tr><td>IN</td><td>2012</td><td colspan="3">1,981–2,198 (range for three utilities)</td></tr>
</table>

Sources: Klein et al. 2005 (CEC); Goldstein and Smith 2002 (EPRI); ISAWWA 2012 (ISAWWA).

This range also suggests large variations across companies. These variations are due to a variety of factors such as distance, elevation, water source, and company size. Variations in energy intensity also suggest that these systems and companies can process, treat, pump, and distribute water more efficiently. The next section discusses opportunities for water and wastewater companies to improve their energy efficiency, implement water conservation programs, and partner with energy companies.

Energy Efficiency Opportunities

Most water and wastewater facilities were designed and built with large pumps, drives, motors, and other equipment operating 24 hours a day. Energy costs can represent 25–30% of total operation costs for water and wastewater utilities (EPA 2013a). Energy efficiency can help lower these costs for water and wastewater utilities while improving the performance of their services.

Overall spending on efficiency improvements depends on the improvements a company makes. Capital improvements pertaining to source water protection and collection, treatment, storage, and distribution are positively related to water demand, average and peak demand, and time of demand.

Below we describe some of the opportunities that survey respondents have taken advantage of to improve the energy efficiency of their facilities.

ENERGY AUDITS

An energy audit is the first step in identifying the energy efficiency opportunities for any efficiency improvements. Audits range from benchmarking the energy performance of the facility to more detailed analysis of possible improvements. Of the water companies that have been engaging in energy efficiency improvements, two have undergone an energy audit, but neither made additional improvements spurred by audits.

CAPITAL INVESTMENTS

Capital investment improvements in energy efficiency typically include purchasing and replacing inefficient equipment with newer, more efficient models. For water utilities, this typically means more energy-efficient pumps and motors. For example, pumping water typically makes up greater than 80% of potable water utility energy use (Copeland 2014). Installing new, more efficient pumps can help move water from source to user with less energy.

A much smaller percentage of the energy used in water and wastewater utilities powers office buildings and other non-water-processing-related activities. These activities provide another opportunity to reduce energy waste in water companies. For example, companies can undertake lighting improvements or lighting optimization to improve their energy efficiency and reduce their energy costs.

Of the nine respondents who stated they had done energy efficiency upgrades, eight of them had implemented capital investment improvements.

OPERATIONAL IMPROVEMENTS

Operational improvements allow for some of the greatest opportunities to improve energy efficiency at water and wastewater facilities. Operational improvements require devising a strategy to regularly monitor energy usage in the water and wastewater infrastructure to allow for continuous improvement. Monitoring energy use helps identify where the most energy-intensive processes are in the water system. For example, there may be certain times of day when water consumption in a service territory is lower and motors can ramp down at those times.

Of the nine respondents who stated they had done energy efficiency upgrades, seven had undergone operational improvements.

ENERGY UTILITY INCENTIVES

Many energy utilities offer incentives for industrial efficiency improvements that water and wastewater facilities can take advantage of. These financial incentives assist water utilities in overcoming the upfront investment barrier to energy efficiency. Many utilities offer incentives for efficient motors and adjustable speed drives. Many offer custom incentives per unit of energy saved, and a few, such as the Connecticut Energy Efficiency Fund, offer specific programs and services targeting the water and wastewater sector.

Of the nine respondents who stated they had upgraded their energy efficiency, three had used energy utility incentive programs.

SUMMARY OF EFFICIENCY IMPROVEMENTS

Overall, most companies that participated in the survey have made some efforts to improve their energy efficiency. Table 11 summarizes the energy efficiency efforts participants reported.

Table 11. Summary of energy efficiency efforts

Energy efficiency effort	Number of companies
Underwent energy efficiency audits or upgrades in the last three years	9
Made operational improvements	7
Made capital investments in energy efficiency measures	8
Participated in energy utility incentive programs	3
Conducted energy audits	2
Made capital investments in power generation at wastewater facilities	1
Other	2

Water Conservation Efforts

Water conservation encompasses the policies, strategies, and activities to manage fresh water and to meet current and future human demand. Water efficiency programs save energy because energy is embedded in water through the water system. Most residences and commercial buildings use treated, potable water for all activities, even activities that do not require potable water use, such as landscaping. This means that every gallon of water used in homes and offices is treated and includes all the energy to process that water. In addition, there is a huge amount of energy embedded in hot water. Water conservation programs aimed at reducing hot-water use can save billions of kilowatt-hours of electricity (Young 2014).

Water utilities are the common providers of water conservation programs and the techniques to reduce water waste. Programs can include improving water delivery to the customer or reducing customer water consumption. As part of our survey, we wanted to see if NAWC members are currently engaging in water conservation efforts. Below we describe the programs that were included in the survey and the results.

LEAK DETECTION

Energy is embedded not only in water facilities, but also throughout pipe systems; leaking pipes for drinking water require the use of more energy to deliver water to the end user. The average water loss in the water system is 16% (EPA 2013c). Energy is required to pump that water, and lost water means lost energy. The total amount of energy lost through leaks is largely unknown. Projects to fix leaky pipes and improve end-use efficiency can be promoted as both water- and energy-saving investments.

Of the 11 respondents to the survey, 9 have undertaken a leak-detection program on their distribution system in the last 3 years.

CONSERVATION PROGRAMS

The conservation programs we surveyed are focused on offerings from the water utilities to their customers that would reduce water waste in homes and businesses. These efforts not only save water, but because of the energy embedded in that water system, they also save energy. Of the 11 respondents who participated in our survey, 5 are currently offering water conservation programs for their customers.

Cooling Tower Management

Cooling towers regulate temperature by dissipating heat from recirculating water used to cool chillers, air-conditioning equipment, or other process equipment. Heat is rejected from the tower primarily through evaporation. Therefore, by design, cooling towers consume significant amounts of water.

Of the five respondents who stated they offer water conservation programs, one includes a cooling water management program.

Water Conservation Incentives

Higher upfront costs can be a barrier to new equipment. Equipment and new technology programs can help customers overcome this barrier by providing financial incentives. Many water utilities offer incentives such as rebates or vouchers for water efficiency improvements that water consumers and utility customers can take advantage of. These vouchers are meant to help customers purchase and install water-efficient appliances and fixtures.

Of the five respondents who stated they offer water conservation programs, one offers incentives or rebates for water conservation measures.

Installation of Water Saving Technology

Under these programs, qualifying customers can receive assistance installing high-performance technology and water-efficient appliances, fixtures, water systems, and accessories that reduce water use in the home and help preserve the nation's water resources.

Of the five respondents who stated they offer water conservation programs, three have programs that provide installation of water-saving technology.

Irrigation Management

Approximately 38% of fresh water withdrawals are used for irrigation (DOI 2014). In common watering practices, a large portion of the water applied to lawns and gardens is not absorbed by the plants; it is lost through evaporation, runoff, or by watering too quickly or in excess of the plants' needs. Efficient irrigation systems and practices reduce these losses by applying only as much water as is needed to keep plants and lawns healthy.

Of the five respondents who stated they offer water conservation programs, two have implemented irrigation management programs for their customers.

SUMMARY OF WATER CONSERVATION EFFORTS

Overall, fewer companies are offering water conservation programs to customers than are participating in energy efficiency programs. Table 12 summarizes the programs that survey respondents offer.

Table 12. Summary of water conservation efforts

Water conservation effort	Number of companies
Programs offered in the past three years	5
Water audits for customers	4
Water conservation incentives such as rebates or vouchers	1
Direct installation of water-saving technology (including plumbing fixtures and appliances)	3
Cooling tower management	1
Irrigation management	2
Other	2

In addition to the programs outlined above, two companies reported other efforts to improve energy efficiency. Both were focused on education and outreach.

Opportunities for Water Companies and Energy Utilities to Work Together

REBATE AND INCENTIVE PROGRAMS FOR WATER UTILITIES

More survey respondents are participating in an energy utility's energy efficiency program than are offering their own conservation programs. Two water companies are currently receiving rebates from one or multiple energy utilities.

One example of such a program is the Large Energy User Program through New Jersey's Clean Energy Program and Industrial and Process Efficiency program. New Jersey's Clean Energy Program offers financial incentives, programs, and services for New Jersey residents, business owners, and local governments to help them save energy and money and help the environment. The Large Energy Users Program is within the Clean Energy Program umbrella. The Large Energy Users Program is designed to promote self-investment in energy efficiency and combined heat and power projects, with incentives of up to $4 million for eligible projects in the state's largest commercial and industrial facilities.

For more information on these opportunities see http://www.njcleanenergy.com/.

JOINT EFFICIENCY PROGRAMS

Energy and water are interconnected. For example, both energy and water are used to wash clothes and dishes and for bathing, and energy is required to heat water in homes and commercial and industrial facilities. These supply-side and end-use relationships mean that energy (electric and gas) and water (water and wastewater) utilities often implement efficiency programs that have savings benefits for the other utility. For example, natural gas utilities will offer incentives for appliances that use less hot water in order to reduce energy requirements to heat water. If utilities recognize this intersection and work together on joint programs, they could learn from one another, share costs, and potentially achieve greater savings.

Unfortunately, experience between joint water and electric utility programs is limited. Our research on exemplary efficiency programs that save both water and energy (Young and Mackres 2013) showed that there is only a scattering of programs that coordinate to save both energy and water, and there are even fewer programs that are jointly run by electric and water utilities.

ACEEE has previously written about the benefits of joint programs (Young 2013), and as part of our survey we sought to learn more about what some of NAWC's member water companies may be doing to coordinate better with energy utilities. Unsurprisingly, the majority of members were not currently engaging with energy utilities on joint projects. However three of the companies that responded to the survey said they are working in partnership with an energy utility.

In this survey only one company, California American Water, stated that it is currently working with an energy company to implement a joint program. It partners with multiple energy utilities to implement hot-water efficiency programs.

Conclusions

The results of the survey show a similar range of energy intensity for potable water services, as we have seen in the past. Though our data sample was limited, we found that the data results were impacted by factors such as distance, elevation, water source, and company size.

Last, there are additional opportunities for greater energy efficiency, water conservation, and joint program partnership. A few respondents have already taken advantage of these opportunities, charting the course for other companies to follow.

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Appendix A. Survey Instrument

These questions will be presented to the users in an online submission through JotForm

General Information

Company name:

Date of submission:

State(s) in which the company operates:

Localities in which the company operates:

Type of water company (water versus wastewater or both):

Manager or contact person:

Name:

Email:

Phone:

Useful web links, such as company website and annual reports (please give exact URLs):

System Data

Please report company-wide data. If it is easier for you to report individual facility data, please use the available spreadsheet and specify the facilities reported. If your company works in multiple regions, if possible, please fill out a separate questionnaire for each region.

Year of data. Please indicate whether the data are in a calendar year or fiscal year. (Please note that water and energy data should be the same year): _____ CY or FY? _____

Annual energy use by the system for water-related processes (e.g., exclude office energy use). Please provide responses in kWh for electricity and btu for other fuels as applicable: ___________kWh and ______________ btu

Water source(s):

Please specify the different sources of water (groundwater, surface water ,etc.), the percentage of the total supply from that source, the distance from the source to the treatment facility, and the elevation:

	Percentage of local supply	Approximate average distance (miles) from central distribution point	Approximate average elevation (feet) from central distribution point
Local surface water	________________	________________	________________
Groundwater	________________	________________	________________

Brackish desalination	________________	________________	________________
Recycled water	________________	________________	________________
Seawater desalination	________________	________________	________________

Potable water systems only

Annual energy used for conveyance. Please provide responses in kWh for electricity and btu for other fuels as applicable: ___________kWh and ______________ btu

Annual energy used for pumping. Please provide responses in kWh for electricity and btu for other fuels as applicable: ___________kWh and ______________ btu

Annual energy used for treatment. Please provide responses in kWh for electricity and btu for other fuels as applicable: ___________kWh and ______________ btu

Annual energy used for distribution. Please provide responses in kWh for electricity and btu for other fuels as applicable: ___________kWh and ______________ btu

Annual water processed or sold by the system. Please provide responses in million gallons.

Total annual water production. Please provide responses in million gallons. ____________

Annual water conveyed. Please provide response in million gallons. ___________

Annual water treated. Please provide response in million gallons. _____________

Annual water sold. Please provide response in million gallons. ___________

Wastewater systems only

Annual energy used for collection. Please provide responses in kWh for electricity and btu for other fuels as applicable: ___________kWh and ______________ btu

Annual energy used for treatment. Please provide responses in kWh for electricity and btu for other fuels as applicable: ___________kWh and ______________ btu

Annual energy used for discharge. Please provide responses in kWh for electricity and btu for other fuels as applicable: ___________kWh and ______________ btu

Annual energy used for recycling or reuse (as applicable). Please provide responses in kWh for electricity and btu for other fuels as applicable: ___________kWh and ______________ btu

Annual wastewater processed by the system. Please provide response in million gallons.

Annual wastewater collected. Please provide response in million gallons. __________

Annual wastewater treated. Please provide response in million gallons. __________

Annual wastewater discharged. Please provide response in million gallons. __________

Other relevant information:

Attach relevant documents and additional information as needed to explain your answers.

Energy Efficiency

Has your facility undergone energy efficiency audits or upgrades in the last three years? YES/NO

If so…

Which of the following improvements have you undergone:

_____ Conducted energy audits

_____ Made operational improvements

_____ Participated in energy utility incentive programs

_____ Made capital investments in power generation at wastewater facilities

_____ Made capital investments in energy efficiency measures

_____ Other (specify _______________)

Please briefly describe your efforts (a few sentences):

Approximate annual energy efficiency budget (for most recent year available)—please give year:

_________ (dollars) _________ (year)

Are evaluation data on program impacts available?

If yes, please attach evaluation or let us know where it can be accessed. Or, briefly describe the methodology and results.

If not, is there is an evaluation underway? (If so, when are results expected)?

Attach relevant documents and additional information as available.

Water Conservation Programs

Have you undertaken a leak detection effort for your water distribution system in the last three years? YES/NO

Has your company offered water conservation programs to customers in the last three years? YES/NO

If so…

Which of the following conservation programs have you offered your customers:

_____ Water audits

_____ Water conservation incentives, such as rebates or vouchers

_____ Water-saving technology installation (including plumbing fixtures and appliances)

_____ Cooling tower management

_____ Irrigation management

_____ Other (specify _______________)

Please briefly describe your efforts (a few sentences):

Approximate annual water conservation program budget (for most recent year available)—please give year:

_________ (dollars) _________ (year)

Are evaluation data on program impacts available?

If yes, please attach evaluation or let us know where it can be accessed. Or, briefly describe the methodology and results.

If not, is there is an evaluation underway? (If so, when are results expected)?

Attach relevant documents and additional information as available.

Joint Programs with Electric or Gas Utilities

Is your company working in partnership with an energy utility to implement conservation and/or efficiency programs? YES/NO

If so, specify the applicable utilities:

Program type	Electric utility partners	Gas utility partners
Joint demand and supply planning	____________________	____________________
Joint consumer education	____________________	____________________
Joint programs for end users	____________________	____________________
Our facility participates in their energy efficiency programs	____________________	____________________

Attach relevant documents and additional information as available.

Person submitting information:

Position:

Organization:

Phone: Email:

Note: Your contact information is for purposes of facilitating any follow-up inquiries. Information about persons and organizations submitting survey results will be kept confidential.