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Power Resilience: An Achievable Goal

Introduction

Grid power loss can have devastating impacts on drinking water and wastewater utilities and the communities they serve. Inoperable pumps at a drinking water utility can halt the production of finished water, make firefighting difficult, and cause local health care facilities and restaurants to close. Sewage overflows and bypasses can occur creating risks for public health and the environment. But having backup power to replace grid electricity is not required under the Safe Drinking Water or Clean Water Acts, and it is not always required under state laws either. So, how can planning for power loss at a water or wastewater utility be prioritized when there are so many other regulatory requirements demanding an operator's time and resources?

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Not sure where to start?

EPA can help. The updated Power Resilience Guide for Water and Wastewater Utilities on EPA's power resilience web page provides more information on increasing power resilience through several approaches, and it also includes new case studies and planning considerations for both short (e.g., 2-3 days) and long (e.g., several weeks) duration power outages.

First, reducing your utility's demand for grid energy through energy efficiency measures and on-site renewable energy sources lowers your operating costs and allows you to apply those funds elsewhere, such as in other infrastructure upgrades or backup power options. And, both energy efficiency and renewable energy can be viewed more broadly than in just economic terms since they can also provide resilience to grid outages. Furthermore, if you choose renewable energy resources, you can lower your utility's greenhouse gas (GHG) emissions and help support any climate action goals your utility, region, or state may have. These are all powerful reasons to move power resilience closer to the top of your utility's priority list.

Reducing Grid Energy Demand

According to the EPA, drinking water and wastewater treatment plants are typically the largest energy users in most communities, often accounting for 30 to 40 percent of total energy consumed. Together, drinking water and wastewater systems account for approximately two percent of energy use in the United States, adding over 45 million tons of greenhouse gases into the atmosphere annually. As much as 40 percent of operating costs for drinking water systems can be for energy. By incorporating energy efficiency practices into their water and wastewater plants, municipalities and utilities can reduce costs by 15 to 30 percent, saving thousands of dollars with payback periods of only a few months to a few years. And those dollars can now be used for other pressing needs at the utility.

The first step in increasing energy efficiency is to conduct an energy assessment. An energy assessment, or energy audit, can help you understand how much energy your utility uses, which processes consume the most energy, and your opportunities to increase energy efficiency. Some electric utilities provide energy assessments and there are professional energy assessment services. Additionally, water associations and the Department of Energy (DOE) offer a variety of technical assistance and tools.

LEARN MORE:
Want to know more about energy efficiency?

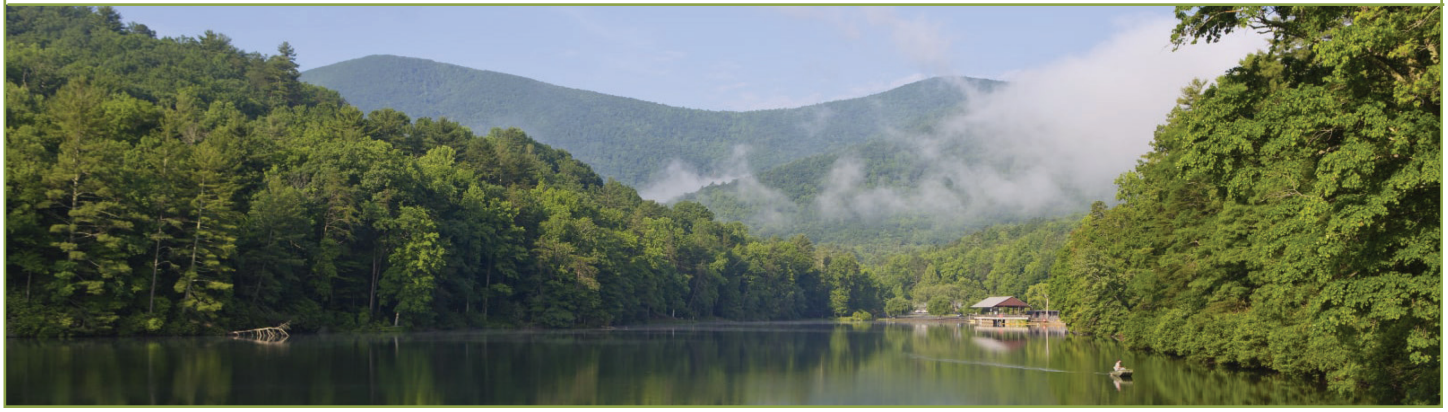
You can view presentations from EPA's Energy Efficiency at Water Utilities workshop at the Power Resilience Recorded Webinars web page.

Utility Case Study:
Wastewater Treatment Plant (WWTP), Blairsville, GA

Blairsville is a small city of about 724 people in Union County, Georgia. The Georgia Rural Water Association (GRWA) conducted an initial energy assessment for the WWTP and identified several conservation measures. The city implemented a variation of two of those recommendations. First, the city modified the target dissolved oxygen concentration in the aeration basin. Next, the city reduced aeration time. As a result of implementing these two strategies and experimenting with some additional strategies, the city realized a 16% reduction in energy consumption and a 15% reduction in energy cost amounting to an annual savings of $17,715.

GRWA conducted a follow-up assessment at the WWTP to identify even more ways to increase energy efficiency. The alternatives, outlined in the table below, show that the payback period can be very short for energy conservation measures with minimal capital costs.

Item #	Project Item	Energy Conservation Measure Discription	Annual Energy Savings (kWh)	Annual Cost Savings ($)	Estimated Cost of Improvement ($)	Payback (Years)
1	Influent Pump	Add a VFD to the Influent Pump Station and Set to Operate at a minimum 80% speed during normal operating conditions.	13,310	$2,296	$4,700	2.0
2	SBR Blower	Add a VFD to the Blower motor and Set to Operate at a minimum 85% speed during normal operating conditions.	107,862	$13,432	$8,300	0.6
3	Digesters	Reduce Aeration Run time from 12 hrs/day to 6 hrs/day.	87,008	$5,372	$0	0.0
		Total	**208,180**	**$21,101**	**$13,000**	**2.6**



There are also increasing opportunities for water and wastewater utilities to use on-site renewable energy sources, known as distributed energy resources (DERs). DERs can provide a variety of benefits for utilities. DERs can help utilities reduce their dependence on the electric grid and build resilience, meet goals and mandates, deliver cost and energy savings, potentially provide revenue through the sale of excess power produced back to the grid/electric utility, and provide environmental and public health benefits (e.g., less air pollutants).

LEARN MORE:
Want to know more about renewable energy?

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Utility Case Study:
Mountain Peak Special Utility District (SUD), Midlothian, TX

Mountain Peak SUD is a drinking water utility serving 16,000 customers in northeastern Texas. In 2010 the district installed a 100 KW wind turbine to power all buildings and equipment at Treatment Plant #1. This renewable energy resource enables the district to use less electricity from the grid. Since the wind turbine is not part of a microgrid, it cannot be used during power outages (this prevents any accidental back feed of power to the electrical grid), but it does help Mountain Peak SUD to reduce its carbon footprint and reduce its electrical bill. Since the wind turbine lowers the district's carbon output, EPA funded the project with a no interest loan. The district is expanding and based on its positive experience with its current wind turbine it is considering using both wind and solar energy for emergency power at two new treatment facilities.

Utility Case Study:
San Gabriel Valley Water Company (SGVWC), El Monte, CA

SGVWC provides drinking water to communities throughout the Los Angeles region. Sandhill is one of SGVWC's drinking water treatment plants (WTP). Its water supply is gravity-fed from higher elevations, creating 115 to 150 pounds per square inch (psi) of pressure upstream of the treatment plant. Rather than losing that energy at a pressure relief valve, SGVWC installed a dual-turbine array of pumps-as-turbine powerhouse, effectively turning the WTP into a 310-kW renewable energy generator. The turbines create sufficient energy such that the plant is net energy neutral. Since commissioning, the site has generated nearly two million kWhs of clean, renewable electricity, the equivalent of 1,300 tons of CO2 saved.

The project cost was $1,675,000 with a payback period of eight years. SGVWC received a Section 1603 U.S. Treasury Grant which covered 30 percent of the total project cost as well as incentives from the Self-Generation Incentive Program (SGIP) sponsored by the California Public Utilities Commission. Excess energy produced at Sandhill is sold to the electric utility.

An emerging application for DERs is resilience - providing power during the loss of grid electricity. To enable renewable energy sources to provide backup power, a method to store renewable energy for later use is needed, as well as the ability to operate these power sources independently of the grid. This is when a microgrid is helpful. A microgrid can connect and disconnect from the grid to operate in either grid-connected or "island" mode. In island mode, a water utility's microgrid can help provide backup power during a grid outage.

Utility Case Study:
McKinleyville Community Services District (MCSD), McKinleyville, CA

MCSD provides water and sewer service to 17,000 residents. One challenge faced by the district is that loss of power to the wastewater treatment plant (WWTP) for more than 30 minutes will upset the treatment process. To ensure maximum resilience to grid outages and to “backup” its backup generator, MCSD installed a microgrid at the plant. The microgrid includes a 500 kW AC Solar Array and a 712 KWh Battery Energy Storage System (BESS) which will help to keep the WWTP running during Public Safety Power Shutoff (PSPS) events throughout wildfire season. The $3.9 million project was funded half with grant funds and the other half with a loan.

In addition to the microgrid, MCSD also had batteries installed at both the main water pump station and the main wastewater lift station. These batteries, although charged by the grid during off peak hours, can provide one day of backup power for the stations and be used for peak shaving. If the batteries are being used for backup power and the outage extends beyond a day, backup power is then provided by traditional emergency generators. This strategy also lowers backup generator fuel needs during emergencies. Overall, MCSD expects that the microgrid will save approximately $10,000 in electrical costs every month and peak power shaving with the batteries should result in an additional savings of around $30,000 per year.

Reducing GHG Emissions

GHG reduction goals to help mitigate future climate change impacts have been set at the local, state, and federal levels. For example, the Biden administration announced a goal to achieve a 50-52 percent reduction from 2005 levels in economy-wide net GHG pollution by 2030. At least 16 states and Puerto Rico have enacted legislation establishing GHG emissions reduction requirements, with more requiring state agencies to report or inventory GHG emissions. Locally, the Austin, Texas Climate Equity Plan states a goal of equitably reaching net-zero community-wide GHG emissions by 2040 and Miami-Dade County, Florida's Climate Action Strategy aims to enact measures to reduce GHG emissions 50 percent by 2030 compared to 2019 levels and then progress forward to achieve net zero by 2050.

Since drinking water and wastewater plants typically are the largest energy users for most communities, it is appropriate for utilities to think of ways to reduce their own GHG emissions and support broader local and state efforts. Both energy efficiency measures and renewable energy sources can help a utility to achieve GHG emissions reductions.

Utility Case Study:
Traverse City Regional Wastewater Treatment Plant (WWTP), MI

The Traverse City Regional WWTP serves roughly 15,000 Traverse City residents, about 30,000 township residents, as well as local industries. In 2023, the city was awarded a $1.6 million Low Carbon Infrastructure Enhancement and Development grant from the Michigan Public Service Commission to install a solar and battery energy storage system at the WWTP. The plant uses approximately 5,048 MWh of electricity annually, and the solar PV plant would produce about 510 MWh per year of electricity, or about 10% of the WWTP's annual consumption needs. The solar project would also reduce the WWTP's electricity costs by approximately $41,000 each year and reduce annual CO_2 Emissions by 300 metric tons per year. With the battery storage system, the city intends to use stored solar energy at the WWTP for peak shaving.

Utility Case Study:
Columbus Utilities, Columbus, OH

In 2021, Columbus released its first-ever Climate Action Plan with goals to significantly reduce carbon emissions by 2030 and achieve carbon neutrality by 2050. To help do its part, the city's Department of Public Utilities (DPU) identified the Tussing Water Booster Station as a site that would benefit from having additional no-carbon, on-site generation and backup battery storage. With major funding help from AEP Ohio's Smart City Program, DPU installed a microgrid at the station consisting of onsite solar generation (100 kW) coupled with battery energy storage (440kWh). The system is designed to operate one of the four booster pumps and station accessories such as SCADA, lights, heating, and sump pumps. The batteries should be able to provide an estimated six hours of backup power during an overnight grid outage. During daylight hours the solar system will provide the backup power and recharge the batteries. In addition to reducing carbon production, the microgrid also allows DPU to manage fewer temporary backup generators.

Funding and Assistance

There are numerous funding mechanisms water utilities can use to increase energy efficiency, invest in renewable energy resources, and build power resilience. These range from government loans and grants to private sector financing. Some utilities can implement energy efficiency and power resilience projects with internal funding. Other efforts may require capital investment through the water or wastewater utility's capital improvement plan or government funding. Renewable Energy Certificates (RECs) may also help. RECs are issued when one megawatt-hour (MWh) of electricity is generated and delivered to the electricity grid from a renewable energy resource. These can be a useful element of a renewable energy investment strategy for water and wastewater utilities as a source of revenue to offset capital/operating costs, since RECs associated with your utility's renewable energy project's electricity output can be sold to another party.

And do not forget to reach out to your sector associations for help; organizations like the American Water Works Association (AWWA) and your state's rural water association have resources to assist with energy management and planning for backup power. For example, the National Rural Water Association has an Energy Efficiency Technical Assistance Program in 33 states to promote energy efficient practices in small water and wastewater systems. The program performs energy assessments, recommends energy efficient practices and technologies, and provides support in implementing recommendations.

Drinking water and wastewater utilities with annual energy bills between $100,000 to $3.5 million may be able to receive no-cost energy assessments from DOE Industrial Assessment Centers (IACs). Teams located at 37 universities around the country conduct energy assessments to identify opportunities to improve productivity and competitiveness, reduce waste, and save energy. Many states also offer programs and incentives to help utilities implement energy improvements – check with your regulatory agency for more details.

Conclusion

Some states require water utilities to identify alternate, backup power options as a part of their emergency plans. For example, in Texas, Senate Bill 3 requires that certain utilities must demonstrate the ability to provide emergency operations during extended power outages lasting more than 24 hours by identifying one or more allowable options as a part of their Emergency Preparedness Plan which is submitted for state approval. Even if a state has no legal requirements, reducing grid energy needs at a water or wastewater utility and planning for power resilience is a good idea for many of the reasons discussed above. As the AWWA Policy Statement on Electric Power Reliability for Public Water Supply and Wastewater Utilities states, "…every water and wastewater utility should set uninterrupted service as a high priority operating goal and include potential service interruptions in its risk assessment and resiliency plan. Avoiding extended interruptions in water service is essential for fire safety, sustaining local economies, maintaining public trust, and protecting public health and the environment."