Reducing Purchased Energy Greenhouse Gas Emissions

KEY TAKEAWAYS

- **Implement Structured Energy Management:** Establish energy policies, set baselines, and integrate continuous improvement.
- **Enhance Energy Efficiency and Recovery:** Upgrade equipment, optimize performance, and use advanced control systems.
- **Invest in Renewable Energy:** Deploy on-site renewables and secure long-term power purchase agreements.
- **Foster a Culture of Energy Awareness:** Ensure staff engagement and leadership commitment to energy efficiency.

INTRODUCTION

Scope 2 emissions encompass indirect greenhouse gas (GHG) emissions from purchased electricity, heat, and steam. For water and wastewater utilities, these emissions are significant due to the high energy demands of pumping, treatment, distribution, and operating on-site buildings. Addressing scope 2 emissions provides opportunities to reduce energy costs, enhance operational efficiency, and align with community sustainability priorities.

ACTIVITIES AND ACTIONS

Reducing scope 2 emissions involves three core strategies: energy management, energy efficiency and recovery, and renewable energy integration.

Energy Management

Effective energy management is fundamental to reducing scope 2 emissions. Frameworks such as International Organization of Standardization (ISO) 50001 offer structured methodologies to integrate energy efficiency into daily operations, ensuring accountability and continuous improvement.

Setting the Foundation: Energy Policy

A well-defined energy policy is a formal statement from leadership demonstrating a strong commitment to improving energy efficiency. When top management prioritizes energy use, it signals the importance of energy efficiency, ensuring alignment from senior leadership to staff. This alignment integrates energy goals into the organization's overall direction, fostering a culture of openness, accountability, and continuous improvement.

Tip: *Formalize energy policies and ensure leadership communicates the commitment to all stakeholders.*

Utilize Publicly Available Energy Management Programs

The first step of any long journey can seem daunting, but utilities do not have to start from scratch. A range of publicly available programs, resources, and proven frameworks exist to support the launch or strengthening of energy management efforts. These systems draw on real-world experience and help avoid the need to reinvent the wheel. Connecting with peer utilities that have implemented similar programs can also provide valuable insights and lessons learned.

Tip: *Water and wastewater utilities can leverage the US Environmental Protection Agency's (EPA) Energy Efficiency for Water Utilities program and the Department of Energy's Better Plants initiative for tools and peer support. State energy offices and local electric utilities may also offer region-specific incentives and technical assistance.*

Planning and Implementation: Key Steps to Success

Developing an energy baseline is essential for tracking progress and identifying savings opportunities. Utilities should establish energy objectives and targets to guide efficiency efforts and create action plans outlining specific measures, responsibilities, and resource allocations. These steps ensure structured and measurable improvements, enabling utilities to identify inefficiencies and enhance overall performance.

Tip: *Regularly review and adjust energy targets based on performance data to ensure continuous improvement.*

Tracking Progress and Improving Over Time

Monitoring energy performance and conducting periodic reviews ensures energy management systems remain effective. Leadership should actively participate in reviewing performance data and implementing refinements where necessary. Long-term success requires integrating data-driven insights and making continuous adjustments to align with evolving operational goals.

Tip: *Utilize automated monitoring tools to track real-time energy consumption and promptly identify inefficiencies.*

Making Energy Efficiency Everyone's Job

For an energy management system to succeed, stakeholder engagement is essential. When all employees understand the importance of energy efficiency and actively participate, the organization achieves better results. Sharing energy performance data fosters trust and demonstrates a commitment to ongoing improvement. Promoting transparency and accountability encourages participation while listening to feedback helps refine strategies over time.

Tip: *Encourage open communication and continuous feedback to integrate energy efficiency into everyday operations.*

Energy Efficiency and Recovery

Reducing energy consumption through efficiency improvements is a key approach to mitigating scope 2 emissions.

Building Systems and Controls

Energy efficiency in utility buildings can be achieved through lighting and heating, ventilation, and air-conditioning (HVAC) systems upgrades and integrations of building controls to automatically adjust temperature, lighting, and ventilation based on occupancy while still maintaining comfort and safety.

Tip: *Implement occupancy-based lighting and temperature controls to reduce unnecessary energy use.*

Aeration Systems and Blowers

The proper selection and maintenance of valves, header distribution piping, and diffusers, combined with advanced process controls, are essential for optimizing energy performance in aeration systems. Process controls allow for real-time adjustments, ensuring that the precise amount of air is delivered based on current process needs. Well-maintained systems with integrated process controls ensure even air distribution, reduce pressure losses, and deliver air efficiently when and to where it's needed.

Tip: *Conduct periodic leak detection and maintenance to prevent energy losses from inefficient aeration systems.*

Pumps, Fans, Motors, and Drives

Installing high-efficiency motors and variable frequency drives (VFDs) enables energy use to match real demand, reducing excess consumption. Routine maintenance and system optimization further enhance efficiency, extending the lifespan of equipment. Integrating smart monitoring technology allows utilities to adjust performance dynamically, minimizing energy waste while meeting operational needs.

Tip: *Regular performance assessments ensure that motors and pumps operate at peak efficiency.*

Heat and Energy Recovery

Heat recovery systems enable utilities to capture and repurpose waste heat from processes like combustion systems, significantly reducing the need for additional energy inputs. Waste heat from boilers or engines can be reused for heating or other processes, lowering overall energy consumption. Additionally, utilities can tap into plant flows like wastewater streams as potential heat sources or sinks for heat pump systems. By using heat pumps, utilities can extract low-grade heat from these flows and upgrade it for use in other areas of the facility. Implementing technologies such as boiler economizers, heat exchangers, and combined heat and power (CHP) systems can further enhance energy efficiency and reduce reliance on external energy sources.

Water System Leak Detection and Repair

Leaks in water distribution systems contribute to non-revenue water and increase energy consumption due to excessive treatment and pumping. Utilities can use advanced metering infrastructure (AMI) and leak detection technologies to enable real-time monitoring and early leak identification. A proactive maintenance approach that incorporates data analytics to predict and prioritize repairs minimizes water loss and prevents leaks from escalating. Effective pressure management further reduces the risk of new leaks, optimizing both water conservation and energy efficiency.

Tip: *Use predictive analytics and real-time monitoring tools to detect and repair leaks before they become major system inefficiencies.*

Implementing Green Building Frameworks for New and Existing Assets

The built environment that supports treatment operations is often a major energy consumer and can contribute significantly to scope 2 emissions. Applying green building frameworks such as the US Green Building Council's Leadership in Energy and Environmental Design (LEED) and the Institute for Sustainable Infrastructure's Envision Program can help ensure that new or renovated facilities are energy-efficient and high-performing. Integrating energy performance measures during design and construction requires a relatively small upfront investment and can yield substantial long-term savings over the asset's operational life.

Tip: *Train planning and design staff in green building frameworks to embed energy performance and lifecycle savings into future capital projects.*

Renewable Energy

Transitioning to renewable sources, such as solar and wind power, can significantly lower the emissions associated with purchased electricity.

Integrating On-Site Renewable Energy

Water utility facilities are well-suited for on-site renewable energy, utilizing solar power and in-line hydroelectric systems. Their access to grid infrastructure and ample space—such as buffer lands, parking lots, and reservoir covers—facilitates solar installations. Meanwhile, the continuous water flow through pipelines and treatment processes supports hydroelectric generation, allowing utilities to produce electricity efficiently with minimal additional infrastructure.

Tip: *Conduct a site assessment to identify unused space for solar panels (e.g., reservoir covers and parking lots) and evaluate pipeline flow rates to determine the feasibility of in-line hydroelectric generation.*

Power Purchase Agreements and Long-Term Contracts

For utilities looking to supplement on-site renewable energy, securing renewable electricity through long-term contracts like power purchase agreements (PPAs) and green tariffs can offer a stable supply of low-carbon energy. These agreements also provide financial predictability by locking in energy prices over an extended period, helping utilities manage costs while transitioning to renewables.

Tip: *Connect with your electric utility to review available PPAs and green tariff options, then collaborate with your budget and finance departments to evaluate costs, savings, and long-term financial impacts.*

Community Solar Gardens

Water utility facilities can also play a key role in supporting community solar gardens, which allow multiple participants—such as residents, businesses, or municipalities—to share the benefits of a single solar installation. By hosting solar gardens on unused land or rooftops, utilities can help provide clean, renewable energy to the surrounding community. This not only contributes to local sustainability goals but also enhances community engagement and support for renewable energy initiatives.

Tip: *Identify potential partners—such as local governments, businesses, or community organizations—to co-develop a community solar garden, then assess site feasibility and establish agreements for shared participation and benefits.*

Energy Recovery Opportunities

Water and wastewater utilities have multiple pathways to recover energy from process streams. For wastewater utilities, opportunities include enhanced biogas production through co-digestion of high-strength organics, improvements to anaerobic digestion systems to boost biogas yields, and the beneficial use of biogas in CHP systems or as renewable natural gas. Thermal energy can also be recovered from wastewater effluent or sewer systems for on-site heating or to supply district energy networks.

The most promising opportunities for drinking water utilities involve thermal energy recovery from distribution systems, particularly where large volumes and temperature gradients exist. Recovered energy can be used for on-site building or process cooling or to support district energy networks.

Tip: *Start with a system-wide assessment that evaluates energy recovery potential and feasibility, taking into account available energy resources, proximity to viable end uses, and technical and financial constraints.*

KEY CHALLENGES AND SOLUTIONS

High Upfront Costs and Competing Priorities

Many renewable energy and energy efficiency projects require significant initial investments, which can be a barrier for utilities managing competing financial priorities. Infrastructure upgrades, compliance costs, and other essential expenditures often take precedence, making it difficult to allocate funds for energy projects.

Solutions:

- Use energy performance contracts to fund energy efficiency projects with cost savings covering repayment.
- Utilize PPAs to procure renewable energy with minimal financial risk, as third-party providers finance and maintain the installations.
- Conduct a lifecycle cost analysis with finance teams to compare long-term savings against initial investments.
- Establish internal budget policies that prioritize projects with a strong return on investment and measurable cost reductions.

Regulatory and Contractual Barriers

Deploying renewable energy can be complicated by policy uncertainty, lengthy approvals, and unfamiliarity with solar project development. Aligning commercial and operational priorities along with navigating complex contracts can also pose challenges. Solar projects involve multiple entities—including developers, financiers, utilities, and third-party owners—which complicates coordination and decision-making, slowing deployment.

Solutions:

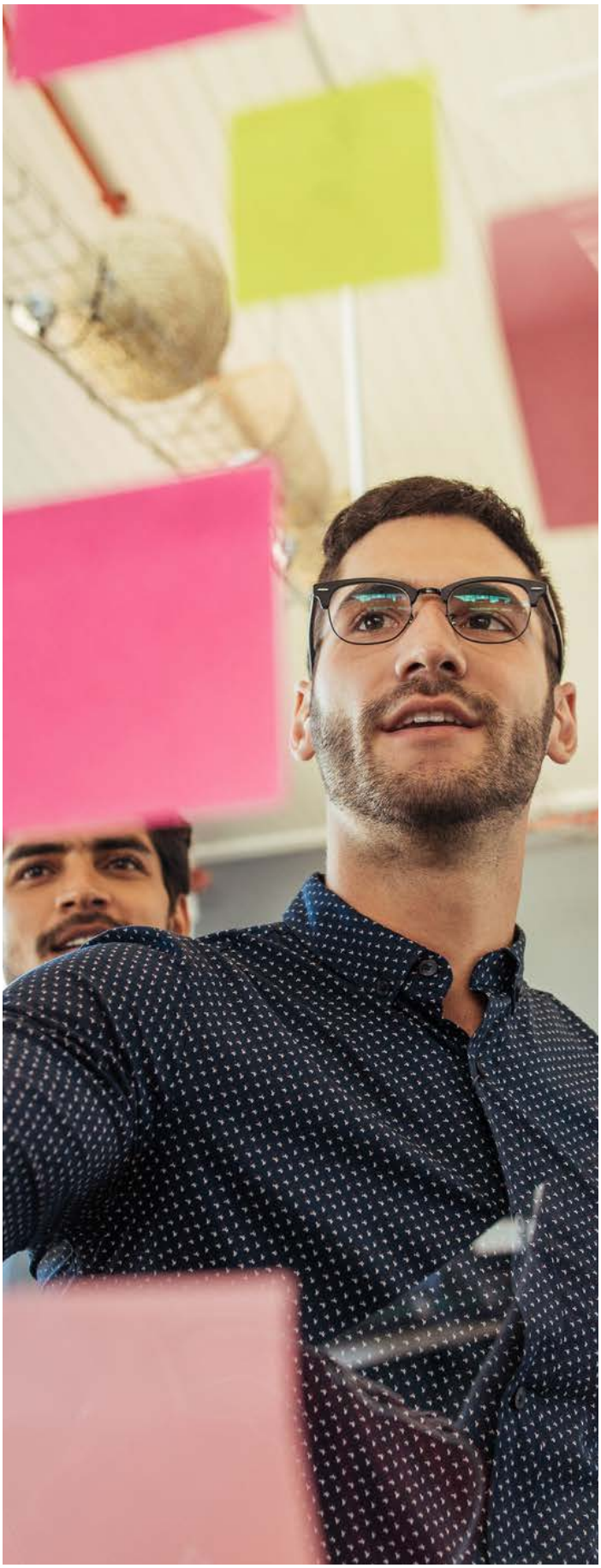
- Standardize contract evaluation, streamline approvals, and ensure cross-functional teams (e.g., sustainability, finance, and operations) are aligned and well-versed in solar project structures to facilitate more efficient decision-making.
- Initiate early collaboration with energy providers and potential project developers to ensure procurement strategies and RFPs align with private sector standards.
- Aggregate demand across departments or locations to improve pricing and increase contract flexibility while ensuring alignment between operational needs and commercial terms.
- Collaborate with legal and policy teams to understand and address any policy barriers that could hinder the deployment process and work toward any changes that might help simplify solar project approval and execution.
- Identify legacy requirements to preserve and maintain renewable energy systems. This includes funding for operation and maintenance, labor requirements, and insurance/protection.

Staffing Levels and Organizational Culture

Implementing effective energy management systems in utilities can be hindered by insufficient staffing and challenges in embedding energy management into organizational culture. Many utilities may lack dedicated personnel to manage and optimize energy use, with existing staff often stretched thin by daily responsibilities. Additionally, integrating energy efficiency into the utility's culture can be a significant hurdle, requiring strong leadership, ongoing training, and clear communication to prioritize energy efficiency across all levels.

Solutions:

- Secure executive sponsorship to elevate energy management as a strategic priority and signal its importance throughout the organization.
- Assign dedicated staff or formally embed energy responsibilities into existing roles, supported by adequate time, funding, and cross-functional coordination.
- Embed energy performance targets into strategic plans, budgets, and performance evaluations to institutionalize accountability.
- Provide ongoing, role-specific training to equip staff with the skills needed to manage energy effectively and confidently.
- Foster a culture of efficiency by engaging staff across departments, collaborating with unions when applicable, and participating in peer networks to share lessons and sustain momentum.



UTILITY SPOTLIGHT

Miami-Dade County Water and Sewer Department—Advancing Energy Management to Cut Scope 2 Emissions

Despite the unexpected and ever-changing needs of managing a water utility, Miami-Dade County Water and Sewer Department's (WASD) structured energy management approach has enabled effective management of scope 2 emissions. This has allowed them to track and optimize energy use, explore on-site generation innovations, and build operational resilience. At the core is a culture deeply focused on energy awareness and performance.

Energy as a Strategic Priority

Embedding energy goals and strategies in utility-wide strategic planning helps address challenges, including competing priorities and upfront costs. In 2023, WASD launched its first comprehensive five-year strategic plan, Water: A Vision for Excellence (WAVE), which defines key priorities and investments to propel and transform the way WASD conducts business. Built by the collective WASD workforce, the WAVE is a living document designed to navigate the ever-changing regulatory, political, cultural, environmental, and economic pressures of operating a complex water utility in Florida. WASD's energy goals and initiatives, with defined teams, timelines, and outcomes, are seen as a key mechanism to help drive these strategic priorities forward.

> *"The work of our diverse teams is now connected and guided by the WAVE's compass, which has four distinct cardinal directions: vibrant organizational culture, exceptional customer service, an efficient organization, and a future-ready utility," said Amanda Kinnick, WASD's Interim Director.*

Leveraging Frameworks for Continuity

Meeting county goals for reuse and GHG emissions has greatly benefited from WASD's commitment to ISO 50001 Energy Management and its partnership with the US Department of Energy's Better Plants program. WASD joined an ISO 500001 cohort to identify gaps in its energy management approach and learn best practices. The structured continuous improvement approach gained through the program helps maintain consistency despite changes or challenges that might arise.

Building upon Miami-Dade County Mayor Daniella Levine Cava's commitment to building a future-ready and resilient community, WASD—for the first time—integrated energy management into the department's five-year strategic plan, no longer treating it as an afterthought.

> *"Utilities are subject to different drivers at different times. We're subject to a lot of change and have to pivot frequently. That's why we moved to the ISO standard," said Debbie Griner, WASD's Chief Resilience and Sustainability Officer. "Those policies get ingrained in your utility and your staff, so it's less vulnerable to big shifts."*

Key Insight: Embedding a culture of energy performance can be challenging, but frameworks like ISO 50001 and the regular reporting of energy use help make it possible. Implementing energy efficiency measures can also provide co-benefits and relieve pressure on operations staff, reinforcing that culture over time.

Progressing Energy Use Tracking

WASD has made energy tracking a key part of its work to cut electricity-related (Scope 2) emissions and implement the ISO 50001 energy management standard. What started as a way to gather data and measure progress has grown into a sophisticated tool for spotting unusual patterns in energy use and finding ways to improve efficiency. WASD now has more than five years of energy data to help manage both energy use and demand.

Using Dashboards to Spot Trends

A key part of WASD's energy monitoring system is a business intelligence dashboard that tracks overall energy performance and costs. The dashboard uses several analytical tools to help staff and decision-makers understand how different parts of the system are performing. One method it relies on is Pareto analysis, which highlights the areas using the most energy and helps focus attention where improvements can have the greatest impact.

Catching and Fixing Problems Early

To detect problems early, WASD sets thresholds that flag equipment performing outside its expected 12-month rolling average. The system accounts for expected variation in operations and is designed to distinguish between normal fluctuations and actual issues. Staff review energy data daily and weekly. When an anomaly is found, the operations team is alerted to investigate and address the root cause. This proactive approach helps WASD monitor hundreds of assets and maintain strong energy performance.

> *"As part of a continuous improvement culture, our standard work involves the daily and weekly supervision of all our assets to identify energy anomalies. For example, we've been able to identify when water infiltration takes place, which helps to both reduce energy use and operate more efficiently," said Kenneth Rosario-Gonzalez, an Energy Management Analyst at WASD.*

Key Insight: Regularly reporting energy use has not only led toward the tracking of long-term goals but also the identification of trends that can be corrected in the near term.

Innovating Energy Recovery

In addition to seeking reductions in energy use, WASD actively seeks ways to generate their own energy and meet state water reuse requirements. One standout project is an advanced heat recovery initiative at WASD's Central District Plant, which aims to capture the steady temperature of wastewater effluent to provide cooling to buildings and energy-intensive processes at the treatment plants.

Key Insight: Onsite energy recovery can reduce the need for additional energy inputs.

Developing a Culture of Innovation

The ability to continually innovate and implement emerging technologies has helped WASD pivot toward solutions that reduce scope 2 emissions. This begins with a business-friendly pilot ordinance that enables departments to test new products and technology through a structured agreement that is outside the traditional procurement process. Additionally, WASD has collaborated with outside organizations to develop innovation frameworks to tackle issues related to renewable fuels, waste reduction, and energy management.

Energy Management is Asset Management

Energy management at WASD is not just about efficiency; it's about resilience and seamless operations. This understanding has created a strong relationship between the energy management and operations teams, which can use the information to operate pumps more efficiently and effectively. Their focus on on-site generation has also paid dividends to resilience. The implementation of momentary power agreements has significantly improved electrical resiliency by allowing for seamless transitions between the power provider grid and backup generators during storms. This capability ensures that operations continue uninterrupted, providing a robust foundation for the utility's resilience efforts and representing one solution to establishing contractual agreements that work for both utilities and power providers.

ADDITIONAL RESOURCES AND REFERENCES

1. Review best-practice guides for managing energy and using it more efficiently:

- Energy Efficiency for Water Utilities resource collection from the US EPA Office of Water
- Water & Wastewater Industry Energy Best Practices Guidebook from Wisconsin Focus on Energy
- Wastewater Energy Management Best Practices Handbook from New Your State Energy Research and Development Authority from New Your State Energy Research and Development Authority (NYSERDA)

2. Consider if on-site energy production (including solar) can help offset your energy needs. The EPA's guidance on self-generation and solar power purchase agreements offer strong foundations.

3. Identify opportunities for green power purchasing, starting with EPA's Guide to Green Power Purchasing.

This paper is part of Net Zero Fundamentals, a collection of action-oriented briefs designed to help water and wastewater utilities cut climate pollution and chart a clear path to net zero. Each brief delivers practical insights, real-world utility examples, and implementation guidance for immediate impact. Access the collection of briefing papers on the US Water Alliance website.

US Water Alliance

One Water, One Future.

uswateralliance.org
@USWaterAlliance