



Utility Wide Strategic Energy Plan

Updated Winter 2017



PHILADELPHIA
WATER
— DEPARTMENT —

The Philadelphia Water Department strives to become a model energy efficient utility of the future by recovering its intrinsic resources, reducing greenhouse gas emissions, and pursuing resilient and economically beneficial energy operations.

City Of Philadelphia
**Philadelphia Water
Department**
Debra A. McCarty
Commissioner



Cover Photo: The solar panel array located at the Southeast Water Pollution Control Plant (Photo: PWD Staff).

Utility Wide Strategic Energy Plan

Executive Summary

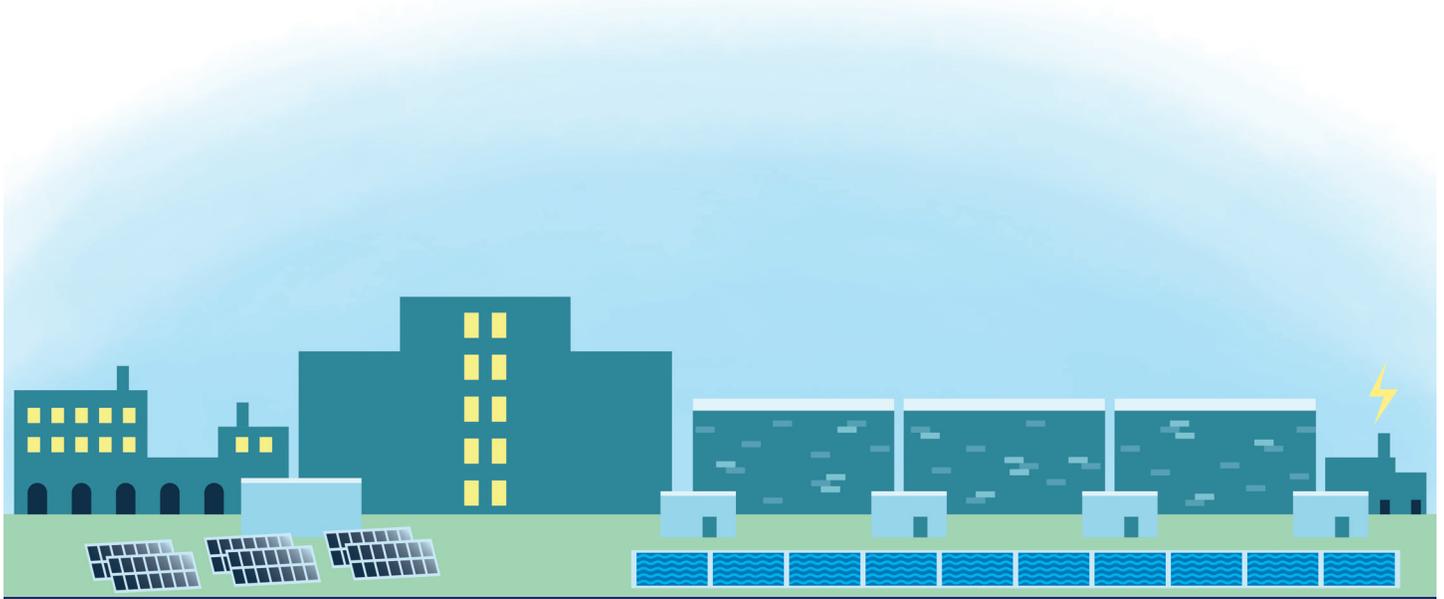
An innovative energy management approach is essential to PWD's commitment to sustainable utility operations. The scale of the Philadelphia Water Department's water and wastewater treatment, distribution, and collection services requires a large annual energy expenditure of approximately 1.7 trillion BTUs. Recognizing the interdependency of water and energy infrastructure, PWD manages the large-scale energy requirements for its operations by carefully monitoring and evaluating energy usage, and pursuing resource recovery projects that increase our energy independence.

PWD operational staff have demonstrated a long history of leadership in energy management via strategic load shifting, demand management, the installation of energy efficient equipment, and, more recently, power generation. Further, our wastewater treatment plants present substantial opportunities to reduce our carbon footprint, via the recovery and use of fuel generated onsite from the anaerobic digestion process. PWD's Utility Wide Strategic Energy Plan responds to the urgency of climate change proactively, by mitigating our contribution to climate change, in tandem with the department's climate change adaptation efforts.

Implementing the objectives outlined in this plan will increase operational flexibility and resiliency. Pursuing financially sound energy efficiency and resource recovery projects can provide budget certainty by protecting PWD operations from energy rate volatility. In turn, ratepayers can benefit from PWD's diverse energy portfolio while receiving the highest quality, dependable, affordable water and wastewater services.

PWD's Utility Wide Strategic Energy Plan is supported by four core goals:

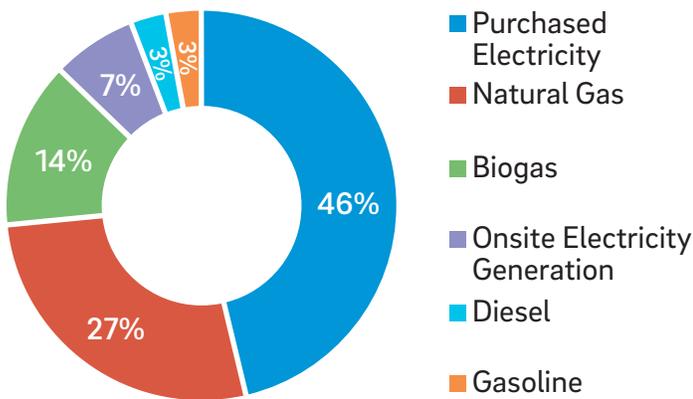
- I. Strive to maintain a stable energy footprint by increasing energy efficiency at our facilities.
- II. Reduce greenhouse gas emissions 50% by 2030.
- III. Continue to pursue renewable energy generation and resource recovery at our facilities.
- IV. Maintain or reduce energy costs and provide budget certainty to the ratepayer.



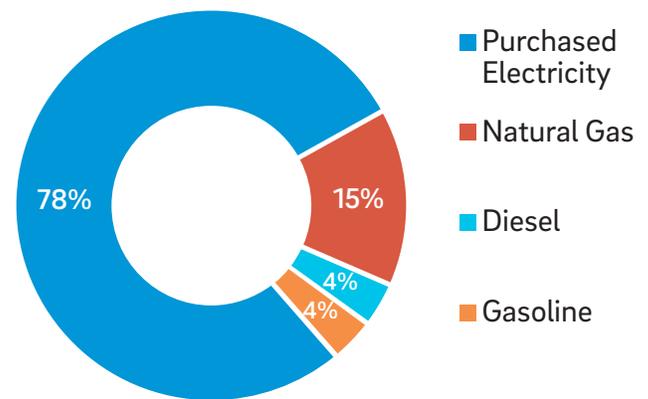
Energy Management at the Philadelphia Water Department

The Philadelphia Water Department takes advantage of a diverse energy source portfolio by employing the use of grid-supplied electricity, natural gas, vehicle fuels, biogas, and onsite electricity generation (derived from both biogas and natural gas). Annually, PWD spends approximately \$20 million on energy for drinking water and wastewater pumping stations, wastewater treatment plants, water treatment plants, fleet vehicles, and dozens of other smaller facilities. This energy use results in approximately 150,000 metric tons of carbon dioxide-equivalent (CO₂e), which accounts for about one-third of the City of Philadelphia Municipal Operations' carbon footprint.

Energy Footprint by Fuel Type (MMBTU)



Purchased Energy Costs by Fuel Type (Fiscal Year 2017)



PWD's Energy Program supports the department's commitment to sustainable energy management practices in the operations and maintenance of utility infrastructure. The Energy Program's key roles include:

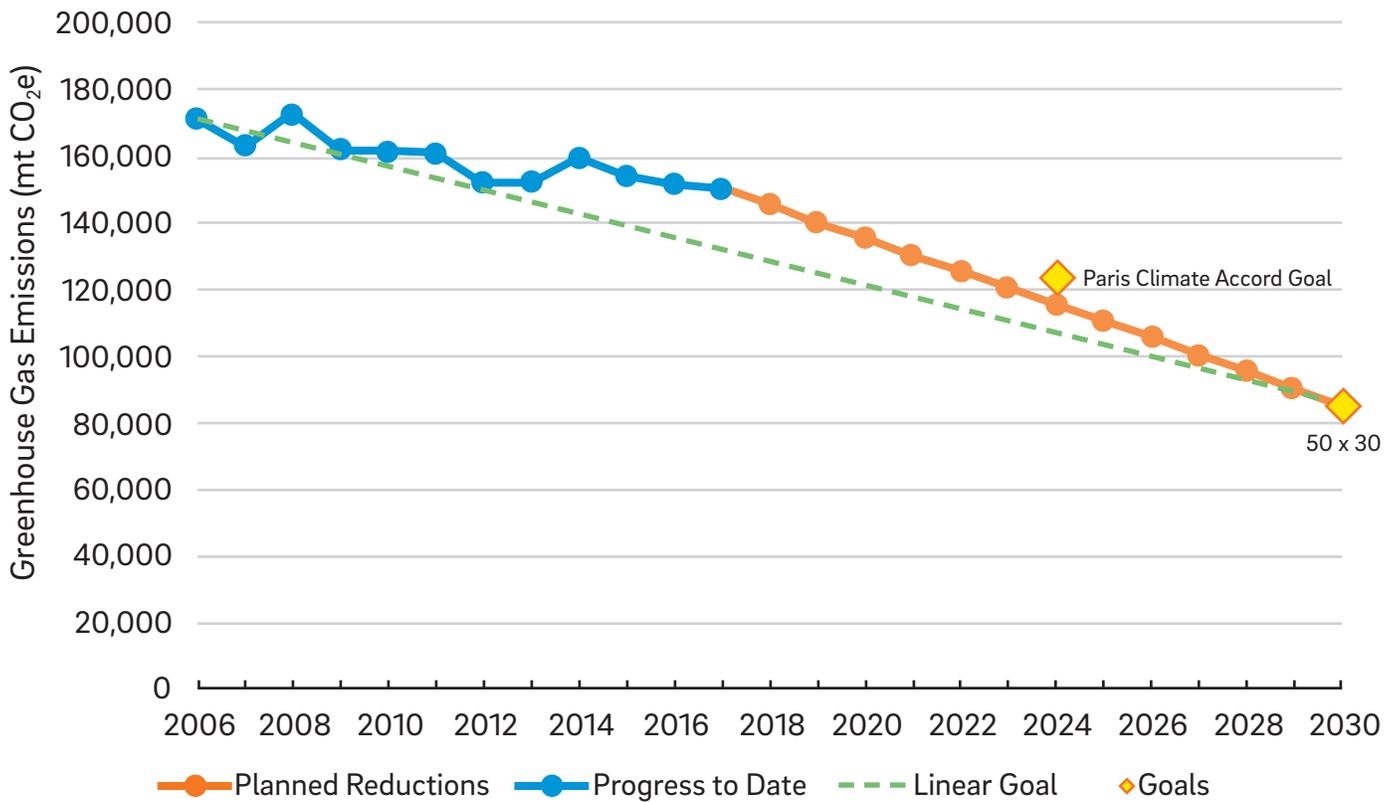
- Monitoring energy use and costs at PWD facilities to ensure reliable and accurate billing;
- Promoting energy efficiency and operational flexibility at PWD facilities by analyzing energy saving opportunities and emerging energy management technologies;
- Monitoring the performance of PWD's current renewable energy projects and identifying new opportunities to reduce PWD's energy footprint.

Water and wastewater treatment and pumping facilities' energy use fluctuates with environmental conditions including varying weather and precipitation flow patterns. Furthermore, regulatory impacts that require changes to treatment processes, or other necessary adjustments in facility operations can cause energy needs to change. Fortunately, the Philadelphia Water Department has already taken many steps toward energy independence, including peak shaving, demand management, and the development of a biogas cogeneration facility at the Northeast Water Pollution Control Plant. In addition, PWD also plans to purchase some electric vehicles in the near future. These actions help us achieve both resilient operations, and energy cost certainty.

Greenhouse Gas Emissions at the Philadelphia Water Department

PWD is a large user of energy and has a correspondingly large carbon footprint. As the City of Philadelphia pursues aggressive greenhouse gas reductions goals – 80% reductions by 2050-- PWD will adopt a parallel approach. While maintaining and enhancing our core business, PWD will focus on energy reduction and the development of alternative energy generation, thereby lowering our carbon impact.

Historical and Projected PWD Greenhouse Gas Emissions at PWD



Since 2006, PWD has reduced GHG emissions by 12%. The use of renewable fuels and onsite electricity generation at our wastewater treatment plants has a positive impact on our greenhouse gas footprint. By taking advantage of more opportunities for energy reduction and alternative energy production, we can continue to reduce our carbon footprint. Furthermore, the City of Philadelphia is committed to cleaning the City’s energy supply and moving away from fossil fuel sources of electricity, thereby changing the regional electricity grid. In conjunction with regional and national efforts to clean the regional grid mix, the City assumes that the carbon intensity of the grid will be lowered by at least 33% by 2030 compared to the most current electricity grid emissions factors. Therefore, emissions from the electricity that we purchase for our facilities is expected to trend downward.

Strategic Energy Planning at PWD

Strategy: Increase energy efficiency

Focusing on energy efficiency in our facilities can result in less energy consumption, less waste, and cost savings.

The department's suite of water and wastewater treatment assets present many opportunities for saving energy and costs. Through the capital planning process, facility assets are replaced and upgraded with high-efficiency equipment. Additional energy efficiency upgrades that can improve existing infrastructure and decrease energy consumption will be critical to reaching our greenhouse gas reduction goal. Partnerships with the City's Energy Office and the Department of Energy's Better Plants program will be critical to developing targeted energy investments that will both decrease energy intensity at our facilities, and increase resiliency.

Action	Timeline	Stakeholders
Perform facility energy audits and identify energy conservation measures for implementation	Ongoing	PWD Operations
Maintain electric load profile through off-peak pumping and demand management	Ongoing	PWD Operations
Investigate enhanced performance management tools	Ongoing	PWD Operations Planning & Research
Incorporate energy and greenhouse gas impacts of projects into the capital planning alternatives evaluation process	Ongoing	PWD Operations Planning & Research
Participate in the U.S. Department of Energy's Better Plants program to identify energy and cost saving opportunities	Ongoing	PWD Operations Planning & Research

Strategic Energy Planning at PWD

Strategy: Pursue energy and resource recovery

PWD recognizes that the inherent resources present in wastewater offer opportunities for resource recovery and renewable onsite energy generation. Resource recovery efforts help to reduce costs from purchased fuel and electricity, diversify our energy portfolio, and mitigate our carbon footprint.

PWD's water pollution control plants (WPCPs) not only deliver high quality wastewater treatment services, but they are also resource recovery hubs that can provide a reliable source of onsite energy. A WPCP's anaerobic digesters can safely process high strength wastes that might otherwise become pollutants; the biogas created by digesters can fuel onsite generation systems and displace fossil fuels; and nutrient-rich biosolids are converted to fuel and fertilizer.

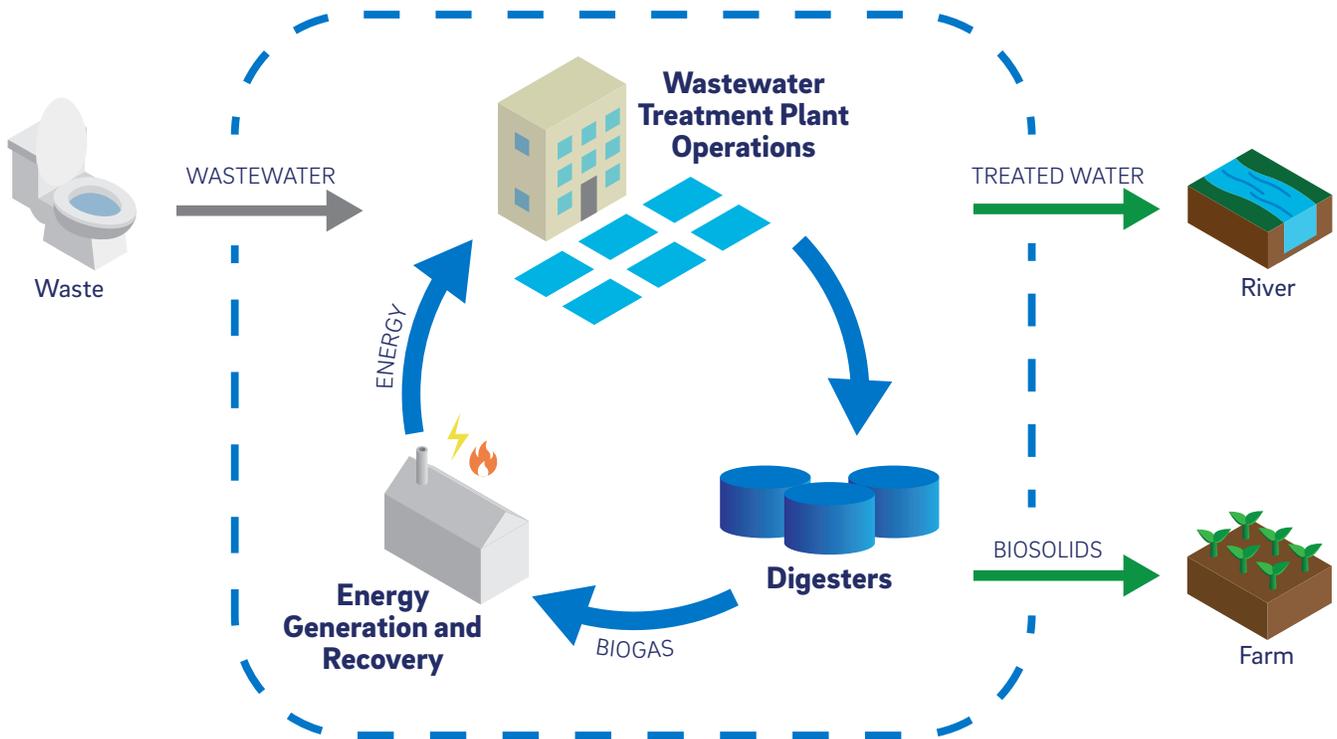
Pursuing financially sound renewable energy and resource recovery projects can provide budget certainty, thus protecting PWD operations from energy rate volatility. In turn, ratepayers can benefit from PWD's diverse energy portfolio while receiving the highest quality, dependable, affordable water and wastewater services.

Action	Timeline	Stakeholders
Optimize biogas production and use	Ongoing	Southwest and Northeast WPCP Operations
Generate increasing amounts of electricity from alternative energy	Ongoing	City Energy Office
Investigate the potential for food waste co-digestion at a wastewater treatment plant	Ongoing	Southwest and Northeast WPCP Operations Planning & Research Philadelphia Zero Waste and Litter Cabinet Streets Department
Collect aircraft deicing fluid through partnership with PHL airport to increase biogas production	Ongoing	Southwest WPCP Operations PHL Airport
Continue to operate solar panel array at Southeast WPCP	Ongoing	Southeast WPCP Operations
Evaluate opportunities for additional renewable energy projects including solar and hydropower	Ongoing	PWD Operations Planning & Research

Resource Recovery Facilities

Water pollution control plants do more than just wastewater treatment. In fact, our WPCPs contain many opportunities to increase self-sustaining operations at our plants. For instance, biogas generated from treated wastewater can be used as energy. This free onsite fuel is created in the anaerobic digesters at the SW and NE WPCPs. This fuel can be used to offset natural gas, fuel oil, and electricity purchases and it is nearly free of greenhouse gas emissions. At SW WPCP, biogas is recovered and used in the boilers, and is also conveyed to the biosolids recycling center (BRC) for use in the thermal biosolids drying facility. At NE WPCP, biogas is recovered and sent to the cogeneration system to generate onsite power and heat for plant operations. Opportunities still exist to further optimize the production and use of the inherent resources at our WPCPs.

Resource Recovery Facility: Conceptual Diagram



Resource Recovery Projects: Turning Waste into Energy

Biogas Cogeneration

In December 2013, the biogas cogeneration facility came online at the Northeast Water Pollution Control Plant. The biogas cogeneration system can generate up to 85% of NE WPCP's electricity needs. On average, the captured biogas from this facility produces 35 million kilowatt hours of energy, enough to power 3,365 homes in Pennsylvania for one year. The PWD Energy Program works with the City's Energy Office who facilitates the sale of renewable energy credits (RECs) created by this project, adding to its value.



The Northeast WPCP biogas cogeneration facility (Photo: PWD staff).



Typical commercial aircraft being deiced prior to takeoff (Photo: Rick Mullin).

Aircraft Deicing Fluid Co-Digestion

In the winter of 2008, PWD began accepting aircraft deicer fluid (ADF) from the Philadelphia International Airport to feed the digesters at its SW WPCP. The addition of ADF increases the production of energy rich methane gas that PWD can use to decrease fossil fuel consumption, thereby reducing the Department's dependence on non-renewable energy sources.

Biosolids Recycling Center

For decades PWD has been safely treating and processing biosolids, the residuals resulting from the wastewater treatment process, from our three WPCPs. Since 2012, biosolids have been thermally dried into environmentally beneficial, pathogen-free pellets used as organic fertilizer and renewable fuel. Prior to the thermal drying process, biosolids were composted, applied to farmland as fertilizer, or landfilled. Many trucks were required for the transport of this material. Currently operations are contained at the thermal drying facility, resulting in far less greenhouse gas emissions from truck traffic.



A handful of Class A biosolid pellets (Photo: Synagro).



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