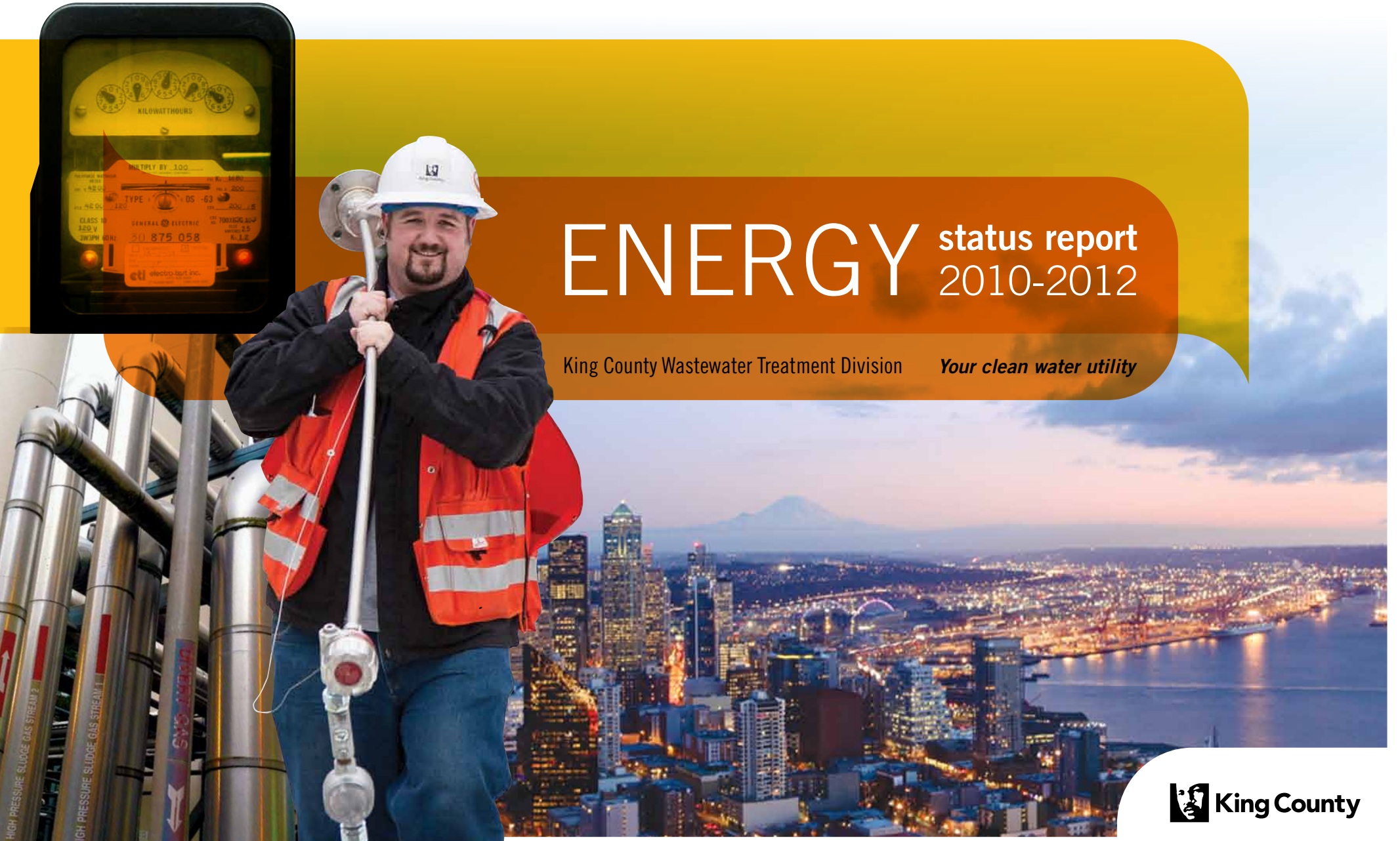


ENERGY status report 2010-2012

King County Wastewater Treatment Division

Your clean water utility

King County

Dear Community Members,

For nearly 50 years, King County's clean water utility has played a leading role in protecting the natural resources that support the region's quality of life. Our mission is to protect public health and enhance the environment by treating and reclaiming water, recycling solids and generating energy. Treating wastewater is required for clean water bodies and healthy communities.

The King County Wastewater Treatment Division (WTD) serves 1.5 million people in King, Snohomish, and Pierce counties. Every day, we convey 175 million gallons of wastewater from 420 square miles to one of our three large regional treatment plants and two community-based plants. The conveyance and treatment of wastewater requires a large amount of energy. The energy conservation efforts described in this report have proved critical to meeting our environmental mission and to reducing our agency's carbon footprint.

WTD has a long history of energy savings. We have been using biogas in the treatment process since 1966, began creating electricity from biogas in 1983, and started scrubbing and selling pipeline-quality biogas for use as natural gas in local homes and businesses since 1988. In this report, you will be introduced to WTD's history of energy conservation and learn about recent improvements that prioritize:

Independence and Reliability: By becoming more energy independent we can insulate the agency against gas and electricity rate volatility or the loss of power during storms.

Savings to Ratepayers: Investments in energy can support stable wastewater rates by protecting ratepayers from increases due to surges in energy costs.

Environmental Commitment: We are committed to continuing to integrate sustainability into an existing urban sanitation system.

I invite you to look through this report to learn more about our utility's energy goals and ongoing commitment to continual improvement.

Pam Elardo, P.E., Division Director
King County WTD – your clean water utility

Cover photo: Bryce VanWerven,
Instrument Technician

Energy vision & history

In 2010, County Executive Dow Constantine launched an initiative to reduce energy consumption, and where possible, increase the production of renewable energy.

Executive Constantine announcing a partnership with local dairies to build a renewable energy project in South King County.

Executive Energy Plan Goals 2010–2012

TARGET 1
Achieve a 10 percent normalized net reduction in energy use

TARGET 2
Produce, use or procure renewable energy equal to 50 percent of use

TARGET 3
Maximize the cost-effective conversion of waste to energy

"Our Energy Plan is a blueprint for continuous improvement in the sustainability and efficiency of County operations that will save money and protect the environment."

- King County Executive Dow Constantine

WTD Energy History

1958 King County voters create regional wastewater treatment utility.

1966 Two new regional treatment plants began operation.

Raw sewage pump engines that run on biogas (and capture waste heat) are installed at West Point Treatment Plant in Seattle.

1972 Congress passes the Clean Water Act which serves as catalyst for upgrades to the wastewater system.

1983 A 3.9 megawatt cogeneration system is installed at West Point to produce electricity and heat from biogas.

1988 WTD begins scrubbing and selling biogas at South Treatment Plant for use as natural gas by the region.

Effluent heat pumps and heat exchangers are installed at South Plant.

2004-06 A fuel cell demonstration project at South Plant generated 9.9 million kilowatts of electricity.

2006 West Point cogeneration reaches end of its useful life and is decommissioned.

2011 Brightwater Treatment Plant begins commissioning process.

2013 Construction of a West Point 4.6 megawatt cogeneration facility at West Point is completed.

1960 1970 1980 1990 2000 2010

Utility operations overview

Wastewater treatment plants must operate nonstop in order to meet environmental and regulatory obligations. Across the country, water and wastewater utilities are facing common challenges: aging infrastructure, rising operating costs, increasingly stringent regulatory requirements, population changes, impacts of climate change, and a rapidly changing workforce.

Because treating wastewater is energy intensive, we consider energy reliability and consumption with every capital investment decision and make efforts to increase energy efficiency in treatment processes.

Our approach:
1. Collect and analyze energy data
2. Use data to support operational decisions
3. Integrate energy efficiency into capital projects

WTD treats an average 175 million gallons of wastewater per day at three regional plants and two community-based plants. This puts King County's system in the **top 3 percent of U.S. systems**, ranked by the U.S. Environmental Protection Agency (EPA) according to volume of wastewater treated.
water.epa.gov/infrastructure/watersecurity/basicinformation.cfm

Energy efficiency means taking a holistic view of all our power-using assets. WTD owns and maintains about $6 billion in assets that include:

- 5 treatment plants
- 42 pump stations
- 350 miles of conveyance pipe
- Over 150 air handling units
- Over 6,000 pumps, motors, drives and blowers
- 4 combined sewer overflow treatment facilities
- Over 50 engines
- 8 boilers
- 3 turbines

Chad Vertz, Operator

Employee-driven efficiencies

John Komorita, Engineer

John Komorita was responsible for changes to Brightwater's design to install new aeration technology for the membrane bioreactor treatment. Komorita's idea resulted in $265,000 in energy rebates from SnoPUD. This project will save an estimated 4.5 million kWh per year, or roughly the annual electricity used in 450 Pacific Northwest homes.

James Alvarado, South Plant Lead Electrician

Butch Perry, Infrastructure Coordinator

Tim Tramble, West Section Operator

Bill Lockinger worked with Seattle City Light to upgrade West Point's lighting controls, resulting in energy savings estimated in excess of 350,000 kWh a year. A follow-up project replaced most of the lights with high efficiency light bulbs saving the county over $100,000. Lockinger made the case for the installation of a power monitoring system to examine power quality and quantity, so staff could successfully identify and pinpoint power abnormalities related to West Point.

Bill Lockinger, Maintenance Supervisor, looks down on West Point's Cogeneration machines.

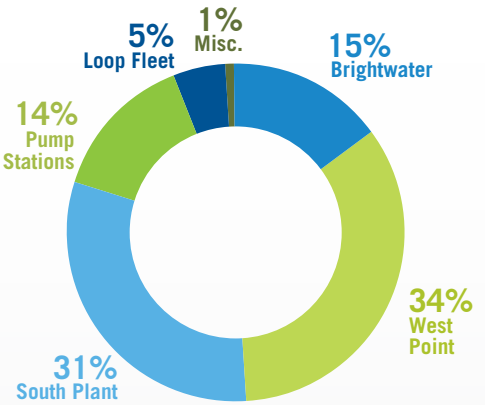
A network of 42 pump stations moves wastewater to treatment plants. Each pump station has its own heating, ventilation and air conditioning (HVAC) system, which are needed to maintain air quality and minimize corrosion within the pump station. **James Alvarado**, **Tim Tramble**, and **Butch Perry** took leadership roles by making the North Creek HVAC system more efficient – adding up to potential energy savings of up to $45,000 per year - and serving as a model for other pump stations across the system.

Energy snapshot

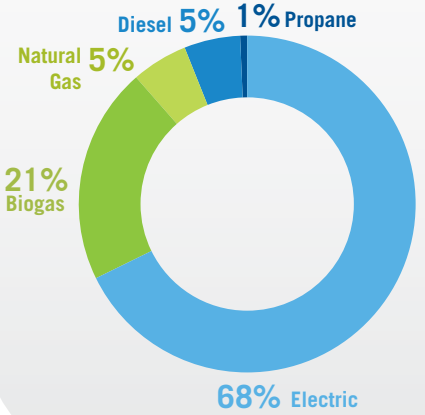
WTD's facilities account for about 58 percent on average of all King County government's facility energy usage.

Total Energy Use by Location
2012

Almost 80 percent of WTD energy is used at the three regional treatment plants. The majority of WTD's energy use is not discretionary or wasteful – it is required to fulfill service needs. Our goal is to capture ongoing efficiencies.



Kevin Moore, Instrument Technician

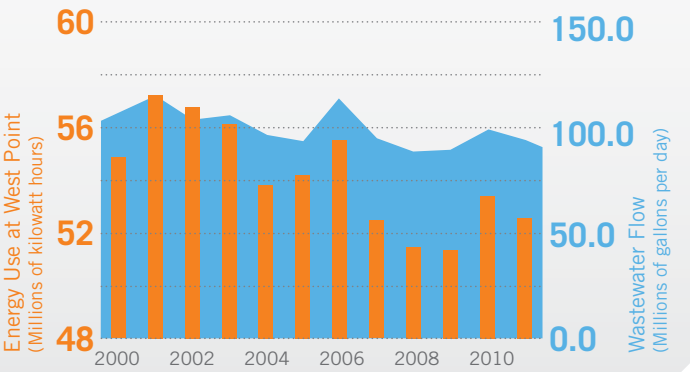


Energy Use by Fuel Type
2012

WTD's daily electricity needs are more than 17 megawatts (MW), nearly 70 percent of WTD's total energy use. Electricity is needed to power pumps, motors, and blowers whereas natural gas and biogas, propane, and diesel fuel boilers, engines, and turbines.

Jump Start on Energy Conservation

While flow volumes remain fairly steady at the West Point plant, energy usage has declined. This is largely due to the 2001 Productivity Initiative that served as a catalyst to initiate significant energy efficiency investments across WTD facilities.



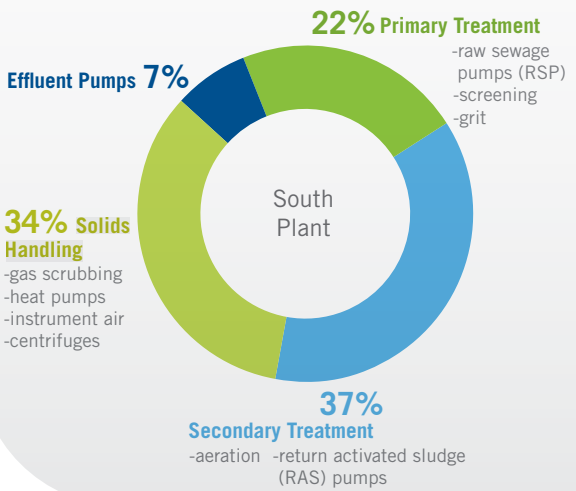
Treatment Plant Electricity Breakdown

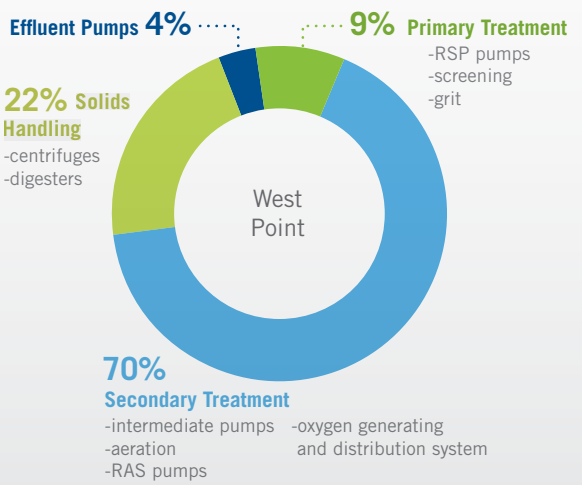
Each of King County's five treatment plants uses electricity differently based on the specific treatment technology and process needs. For example, South Plant is the only plant in our system to scrub biogas, which requires electricity. Due to space constraints, West Point's design includes high purity oxygen, which is generated on site and requires a significant amount of energy. And while all plants have odor control mechanisms, Brightwater odor control is especially energy-intensive.

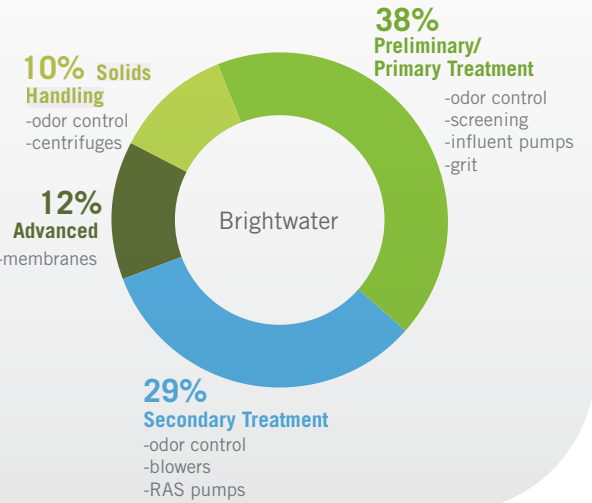
"Our plant operations and energy use present us with both opportunities and challenges. We are trying to be strategic and proactive in responding to current and future challenges. We are looking to the future so we can flatten costs for ratepayers, make the best use of renewable resources, and run a responsible, sustainable utility."

- Dan Grenet, West Section Manager

Electricity Use by Plant





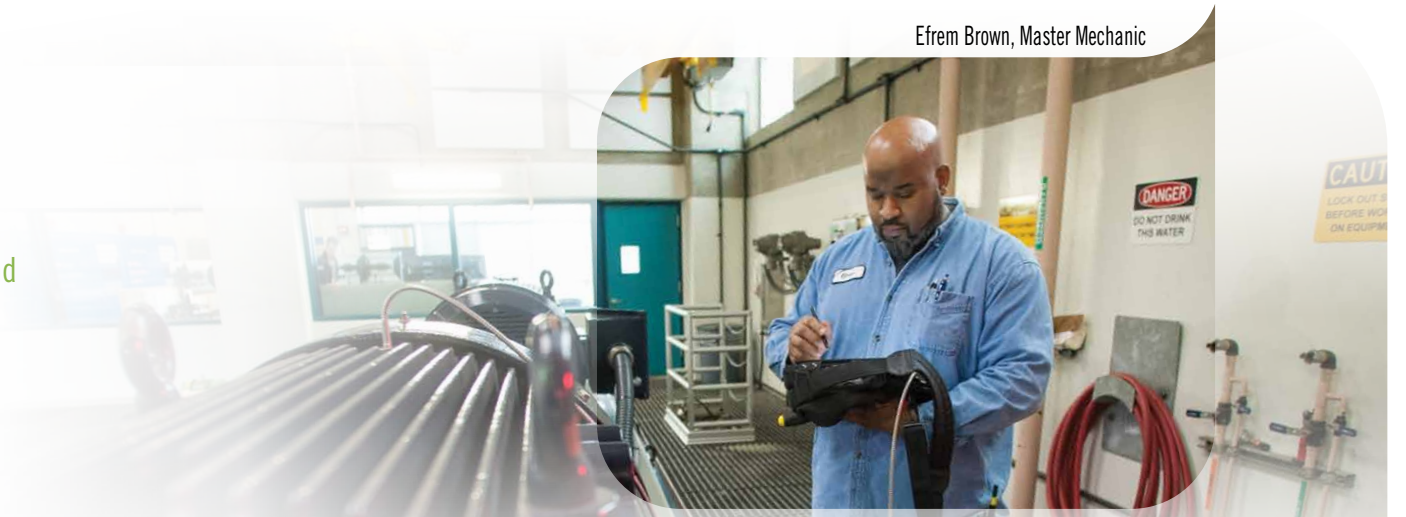


Normalized energy use by facility

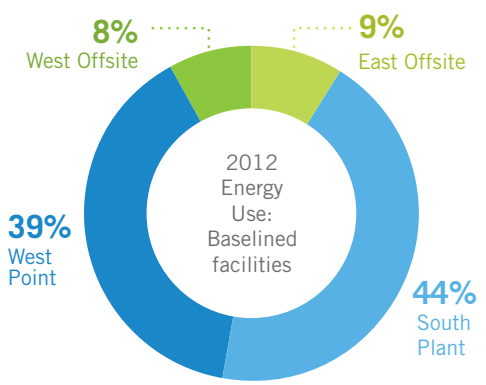
A facility's energy consumption depends on factors beyond the efficiency of equipment and process systems, and includes precipitation volumes, outside air temperature, and operating characteristics.

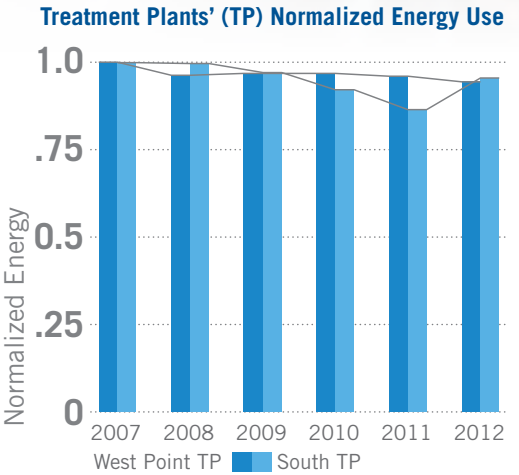
Normalizing data is the process of equalizing the impact of these factors on energy use to compare the energy performance of facilities and operations from year to year.

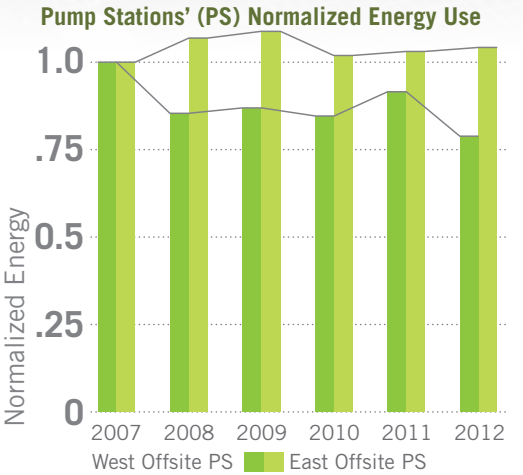
NOTE: *WTD's normalized energy use does not include facilities newer than 2007, such as the Brightwater Treatment Plant or the pump stations serving Brightwater. Normalized energy use does not credit energy created and used onsite.*



Efrem Brown, Master Mechanic







"Investment-grade energy audits can help provide a low-risk way for the County to bring in specialized help to develop energy conservation measures with guaranteed energy savings. This helps both our ratepayers and the environment."

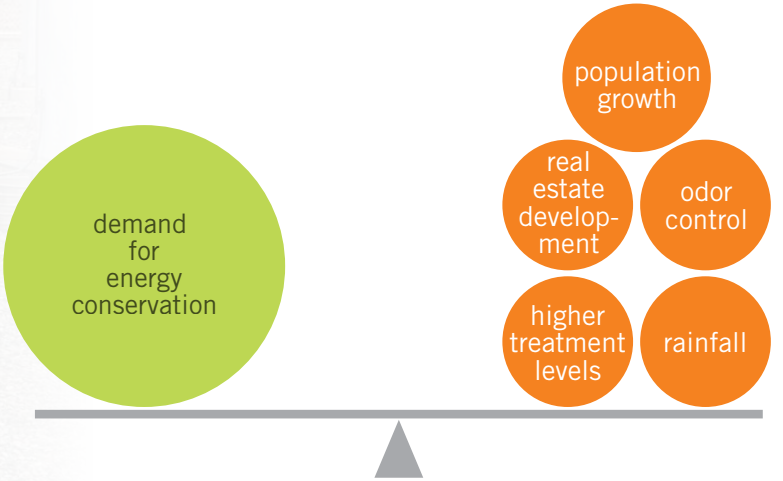
- Crystal Fleet,
  WTD Project Manager

Energy use and other variables: It's a balance

A 2010 EPA report estimates that 3 percent of national electricity consumption is related to the conveyance and treatment of water and wastewater – equivalent to approximately 100 billion kW or $7.5 billion per year.

WTD's energy needs are constant. Pumps operate nonstop to convey wastewater from homes and business to the treatment plants where energy-intensive processes operate 24 hours a day.

Conservation is challenging when wastewater plants are expected to provide increased protection of air and water quality for the growing populations they serve, especially as higher levels of treatment generally require more energy.



Energy use progress

WTD is in the business of protecting public health and enhancing the environment while being good stewards of public funds.

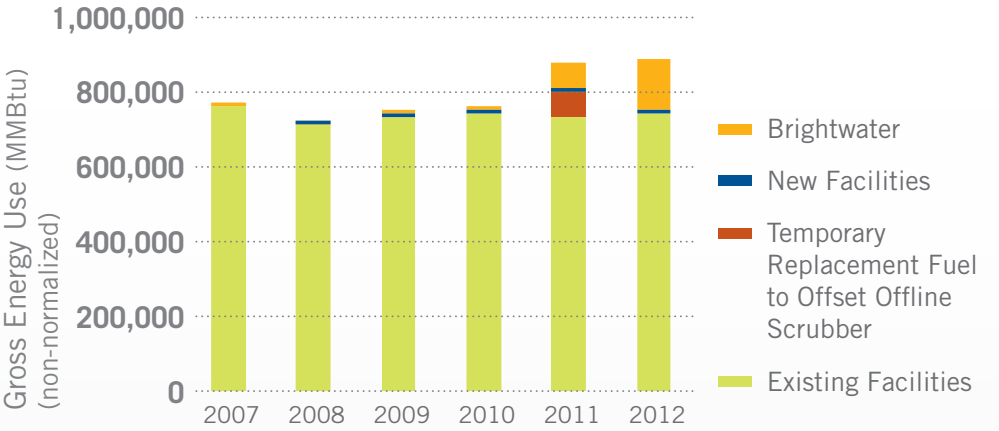
Because the majority of WTD's energy use occurs at our large treatment plants and pump stations that consume more than 5,000 MMBtu annually, these facilities have been targeted for many conservation measures.

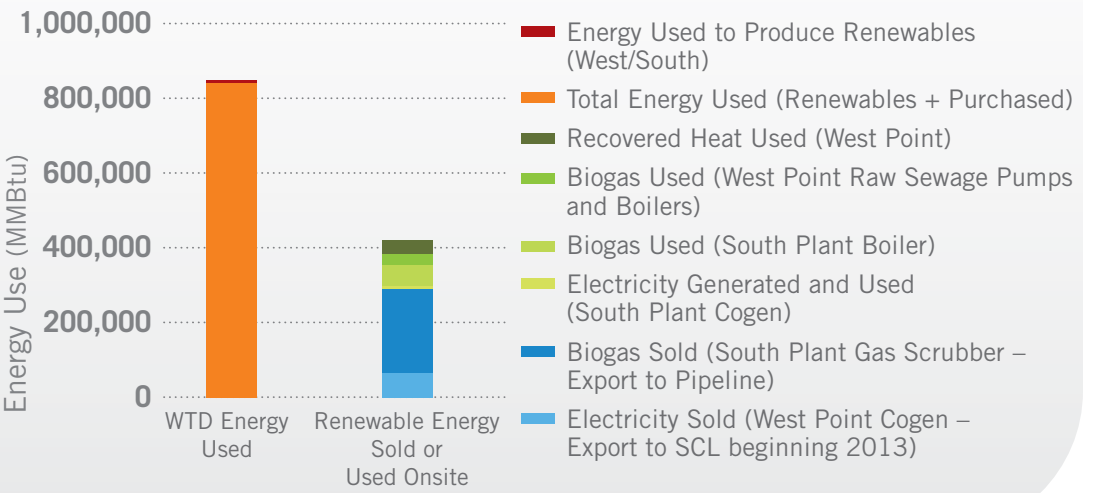
Since 1993, each treatment plant had a staff-driven Energy Committee empowered to optimize conservation efforts and business practices. With the adoption of the 2010 WTD Energy Plan, the Energy Committees have strengthened the integration of energy data within the capital program.

The addition of new facilities, including a third regional treatment plant, has impacted WTD's gross energy use. Investment in cogeneration at West Point Treatment Plant means that by 2014, WTD will be producing the equivalent of half of the energy it needs to power its facilities.

"King County's wastewater utility is an industry leader in effectively capturing and reporting plant process energy data. The next few years are going to be exciting to see how the program evolves and how WTD can set the pace for others across the nation."

- Layne McWilliams, Energy Smart Industrial, Wastewater Sector Specialist, energysmartindustrial.com



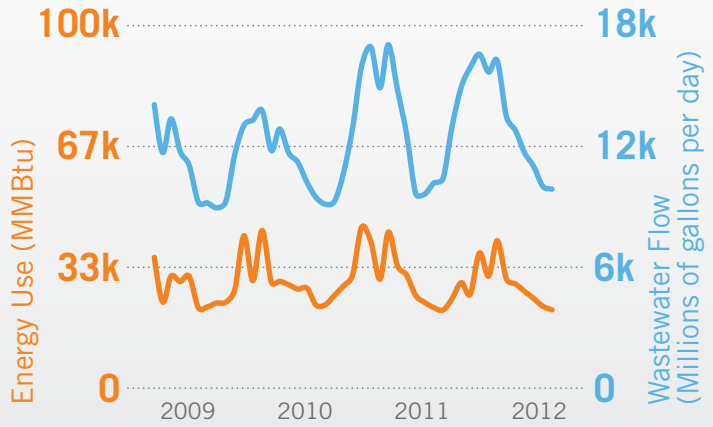


Factors driving energy use and costs

In the Pacific Northwest, our climate and geography pose unique challenges to reducing energy consumption in our operations.

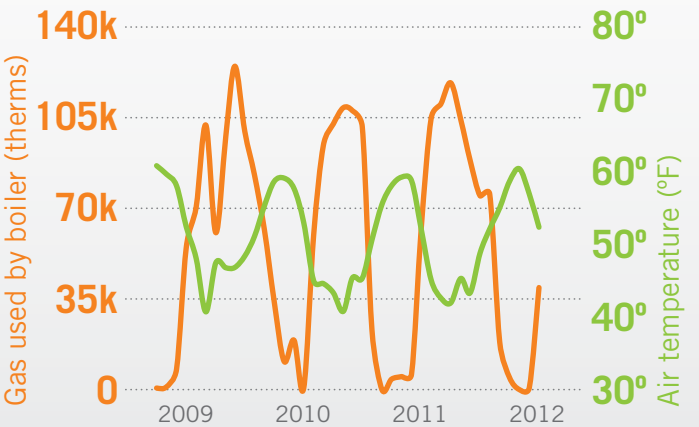
Rainfall and Flow

Seattle's annual average 38 inches of rainfall significantly influences the volume flowing into the West Point Treatment Plant's combined wastewater and stormwater system. Treating this rainwater, in addition to wastewater, increases energy consumption. Across our entire collection system, the infiltration and inflow (I/I) of stormwater and groundwater into sewer lines through cracks, holes, joint failures and direct connections can also account for upwards to 60 to 70 percent of the flow driving up our energy use for energy-intensive pumping and aeration. Some I/I is eliminated with repair and replacement of the aging infrastructure.



Outdoor Air Temperature

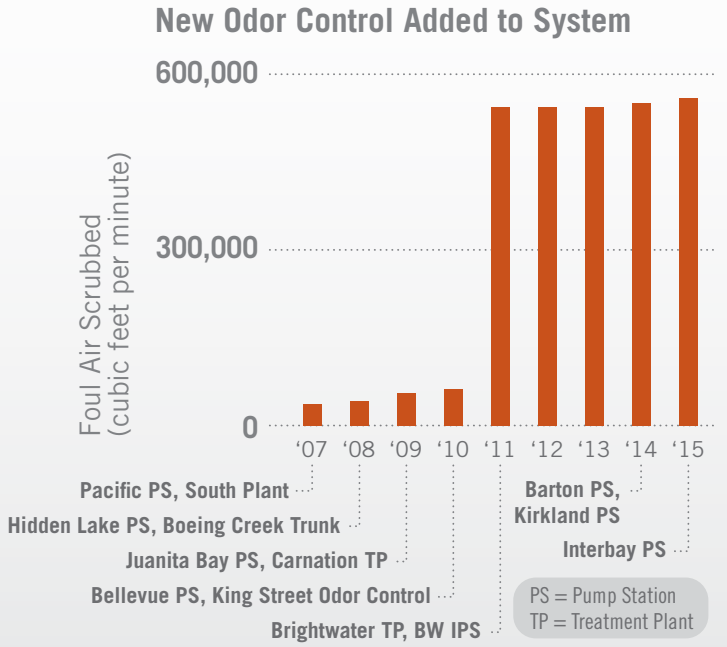
Annual average outdoor temperature ranges between 40 and 66 degrees and even colder temperatures off Elliott Bay can impact our shoreline facilities considerably. Anaerobic digester feed systems need to maintain a temperature of about 98 degrees to sustain microbial metabolic functioning.



Factors driving energy use and costs
continued

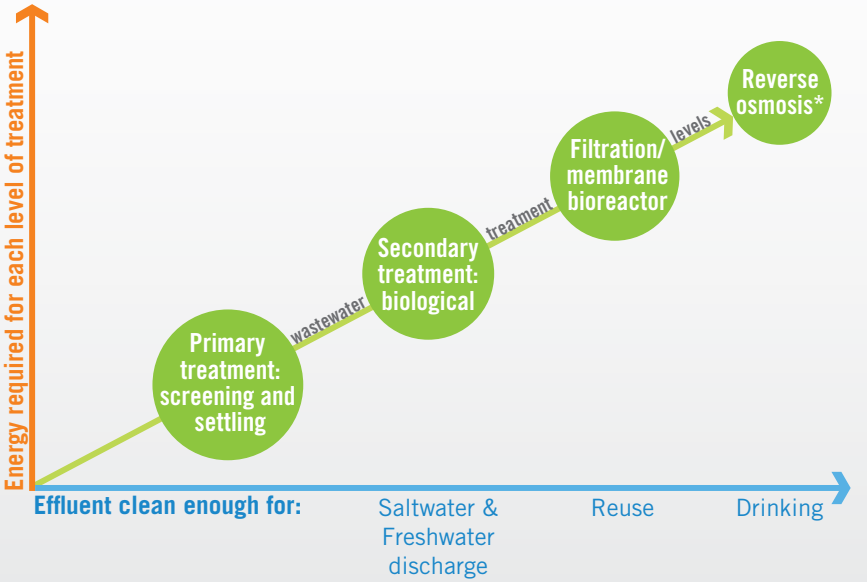
Odor Control

Control of odors has become a primary design consideration for most collection and treatment facilities. As development encroaches on WTD facilities and as new facilities are built, controlling nuisance odors is an important step toward mitigating WTD's presence in a community. Odor reduction involves forcing large volumes of fouled air through scrubbers such as carbon filters – an energy-intensive process that contributes to energy consumption regardless of the quality or quantity of water treated.



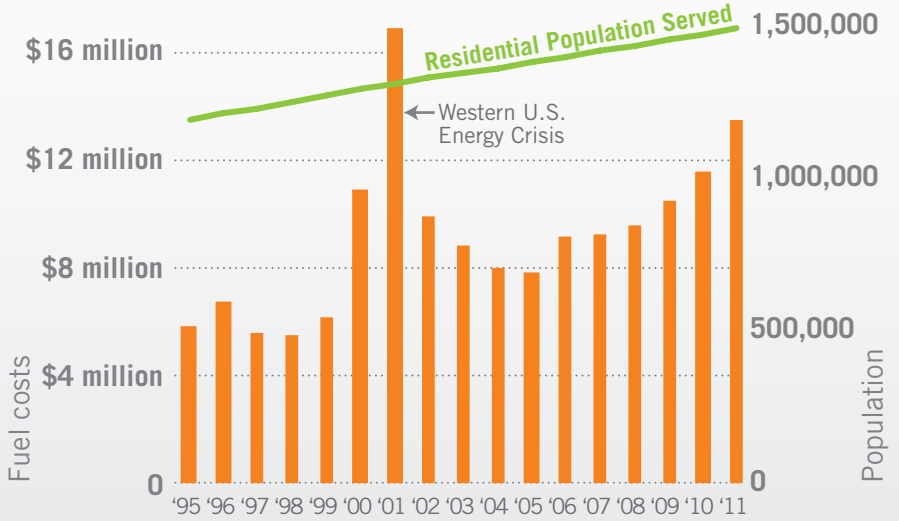
Wastewater Treatment Technologies

WTD's goal is to meet or exceed our permit standards in all facets of operation. While the environmental benefit of treatment is undeniable, each level of treatment requires incrementally more energy. Primary and secondary treatment technologies remove a majority of the suspended solids and dissolved contaminants found in wastewater. Advanced treatment technologies further improve the quality of effluent to meet regulatory limits for recycled water that can be used for non-drinking purposes.



*King County does not use reverse osmosis at any of our treatment plants.

Energy Independence
Biogas generated from WTD's anaerobic digesters remains our most cost-effective and reliable energy source. Reliance on on-site fuel sources also shields WTD's nonstop industrial operations from storm events when imported electricity may have reliability issues. Also, renewable energy projects insulate WTD's operations from fuel rate volatility. In this era of rising fuel prices and uncertainty over the availability of global oil supplies, investment in renewable energy systems is a sensible move toward energy independence.



"Wastewater is a reliable source for renewable energy that the public is using right now. Our scrubbed methane generates enough natural gas to heat 1,700 typical Seattle homes in a year. It's rewarding to be part of such an environmentally focused organization."

- Mike Wohlfert, Assistant Manager, South Treatment Plant

New Facilities to Serve New Neighbors
As more people move to our region, WTD must add capacity to the system. With careful planning, treatment plants are able to treat increased volumes of wastewater from residential and business sources. Accommodating increased capacity also means accommodating community expectations that wastewater treatment services are safe, reliable, thorough, and do not negatively impact property values.

Managing our carbon footprint

As a result of WTD's efforts toward energy efficiency, renewable energy production, and carbon and nutrient recycling, WTD is 70 percent of the way to being carbon-neutral in its operations.

Loop® biosolids is a natural soil amendment produced by safely extracting carbon and nutrients from wastewater at King County's treatment plants. Superior to conventional fertilizers, Loop replenishes soil by returning essential nutrients to the land and, with its proven ability to hold rainwater like a sponge, Loop reduces runoff and erosion.

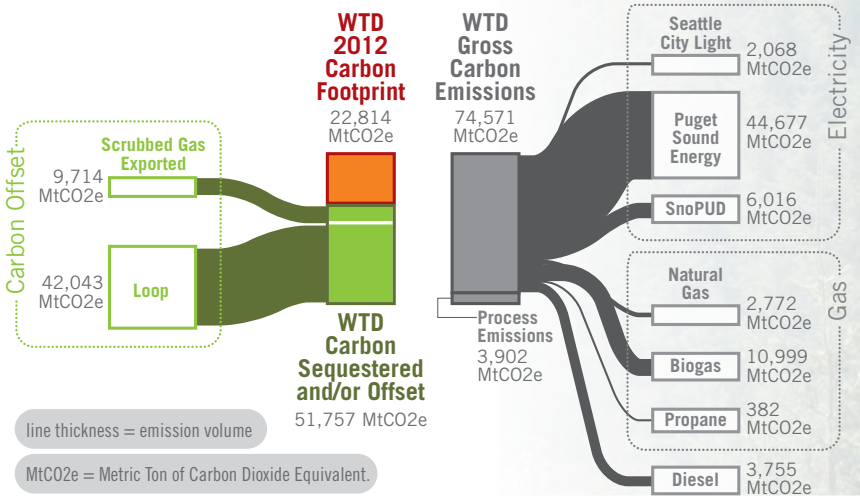
University scientists have found that in soils where Loop has been applied, it stores carbon and reduces greenhouse gas emissions into the atmosphere. These carbon offsets far outweigh the emissions associated with transportation of Loop and help offset the energy consumption associated with treating wastewater.

loop
Turn your dirt around

"Although vitally important, treating wastewater requires a lot of energy. Luckily, the carbon footprint can be reduced by tapping the wastewater for methane to produce clean energy, and by using biosolids to return carbon and nutrients to the land, boosting plant growth while replacing petroleum-based synthetic fertilizers."

– Dr. Sally Brown, UW School of Environmental and Forest Sciences

2012 Energy and Greenhouse Gas Emissions



Renewable energy progress: 2007-2015

Biogas put to use

WTD recovers methane biogas, also called digester gas, and uses it as a renewable energy source to power equipment at the treatment plants. Some biogas is converted into electricity via cogeneration engines, and some of it is scrubbed and sold to local utility companies. The availability, use, and sale of biogas not only reduce the amount of energy WTD needs to purchase but also reduce WTD's carbon footprint.

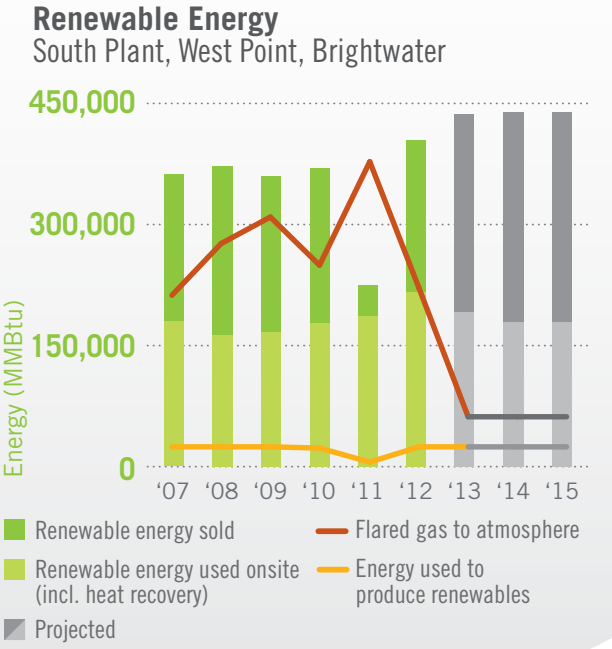
Sometimes excess biogas must be burned off, or flared. For the safety of its employees and nearby communities, treatment plants must have a way to manage biogas when energy recovery systems are offline for routine maintenance or repairs. For example, in 2011, South Plant's gas-scrubbing equipment was damaged, and all of its gas was flared while the problem was being fixed.

Cathy DeBlasio, Operator

Renewable Energy Produced

FUEL SOURCE	ENERGY PRODUCTION (MMBtu) 2007	projected 2015	PERCENT OF WTD NEED IN 2015	EQUIVALENT IN HOUSEHOLDS
Biogas Sold (SP Scrubber – primary system)	180,297	188,000	20%	1,741
Biogas Used (Pumping, Boilers, Cogen)	220,175	191,486	20%	1,773
Electricity Sold (WP Cogen – primary system)	15,093	67,558	7%	626
Electricity Used (SP Cogen - backup system)	10,856	911	0%	17
Solar (BW Education Center)	–	4,239	0%	39
Waste Heat Recovered (Pumping, Cogen)	11,593	32,973	3%	305

The Environmental Protection Agency estimates that an average Pacific Northwest single family home uses 108 MMBtu annually.



Energy project progress: 2007-2020

Equipped with power monitoring devices and energy auditing skills, WTD's Energy Program began making data-driven business cases to justify the value of incorporating energy efficiency measures into capital projects.

The Energy Program partners with local utility companies to invest in many of these efficiency measures with grant funding. This list of current capital projects demonstrates that conservation momentum has taken hold.

Energy Capital Projects Completed and Underway 2007 - 2020

LOCATION/PROJECT	TYPE	COMPLETION	EST. SAVINGS / PRODUCTION MMBtu / YEAR	GRANT/FUNDING
Hidden Lake Pump Station Replacement	Conservation	2008	160	n/a
South Plant Pre-Aeration Blower Replacement	Conservation	2009	1,508	$323,726 (PSE Grant)
South Plant System 1 Chiller Replacement	Conservation	2009	524	$151,505 (PSE Grant)
53rd Avenue Pump Station Upgrade	Conservation	2010	65	$10,609 (SCL Grant)
Bellevue Pump Station Upgrade	Conservation	2011	192	n/a
Brightwater Aeration Blowers	Conservation	2011	12,408	$281,323 (SnoPUD Grant)
West Point Pre-Aeration Blower Replacement	Conservation	2012	1,539	$119,164 (SCL Grant) $280,000 (Federal Grant – ARRA)
West Point Cogeneration	Renewable	2013*	68,000	$8,200,000 (Federal Grant - EPA)
South Plant Secondary Agitation Air Blower Replacement	Conservation	2013*	2,805	$331,785 (PSE Grant) $668,215 (WA State Loan)
North Creek Pump Station HVAC System Optimization – Controls Replacement	Conservation	2013*	1,500	~ $3,000 (PSE Grant) $19,500 (Federal Grant – ARRA)
South Plant Lighting Upgrade	Conservation	2013 or 2014*	1,500	$224,639 (PSE Grant)
Kirkland Pump Station Upgrade	Conservation	2014*	308	n/a
Environmental Lab HVAC System Upgrade	Conservation	2014*	1,082	PSE and SCL Grants TBD $331,785 (WA State Loan)
South Plant Aeration Diffuser Membrane Replacement	Conservation	2015*	8,530	PSE Grant TBD
Interbay Pump Station Upgrade	Conservation	2015*	2,509	$169,160 (SCL Grant)
West Point Influent Screening Improvements	Fleet Fuel Conservation	2015*	1,902	n/a
West Point Energy Savings Performance Contract – Replacement of Centrifuges, In-Line Mixers, and Biosolids Conveyors	Conservation	2016*	1,964	$172,655 (SCL Grant) $300,000 (WA State Loan)
South Plant Effluent Transfer Station VFD Replacement	Conservation	2016*	TBD	PSE Grant TBD
South Plant Raw Sewage Pump, Motor and Drive Replacement	Conservation	2017*	6,824	PSE Grant TBD $3,000,000 (Federal Bonds – QECB)
West Point OGADS and Aeration Mixers Replacement	Conservation	2018*	20,200	SCL Grant TBD
Sunset/Heathfield Pump Station Upgrade	Conservation	2020*	TBD	PSE Grant TBD

**Estimated*

Energy efficiencies from operational efforts: 2007-2013

Efforts toward energy efficiency, initiating new conservation and renewable energy projects continue to be a priority. Efforts initiated since 2007 have led to capital investments and operational efforts that will bring in $10.3 million in grants and $4.3 million in low-interest loans and bonds.

Once conservation projects currently underway are complete, they will save WTD ratepayers about $1.4 million each year in avoided energy costs. **

*** Based on an electricity rate of $0.07/kWh.*

Energy Efficiency Operational Efforts Completed and Underway 2007 - 2013

LOCATION/PROJECT	TYPE	COMPLETION	EST. SAVINGS / PRODUCTION MMBtu / YEAR	STATUS
WTD-Wide Maintenance – Panel Bulb Replacements with LEDs	Conservation	Ongoing	15	Completed / Ongoing
WTD-Wide Maintenance – Green Motor Initiative	Conservation	Ongoing	112	Completed / Ongoing
WTD-Wide Maintenance – Impeller Trimming	Conservation	Ongoing	TBD	Completed / Ongoing
WTD-Wide Maintenance – Pump Coating	Conservation	Ongoing	TBD	Completed / Ongoing
WTD-Wide Maintenance – Photocell and Occupancy Sensor Installation and Maintenance	Conservation	Ongoing	TBD	Completed / Ongoing
West Point and South Plant – Plug-In Hybrids	Emissions Reduction	2008	24	Completed
South Plant – Fuel Cell kW Draw Down	Conservation	2009	401	Completed
West Point – KTURBO Pre-Aeration Blower Test	Conservation	2009	741	Completed
Carkeek Pump Station – Shed Thermostat Repair	Conservation	2012	40	Completed
South Plant Agitation Air System – 4th Blower Shutdown	Conservation	2012	2,989	Completed
South Plant Agitation Air System – Blower PLCs Programmed to kW Control	Conservation	2013*	TBD	Completed
Black River Pump Station – Thermostat Upgrade*	Conservation	2013*	TBD	Completed
South Plant Aeration Tank 1 – Diffuser and Tank Cleaning	Conservation	2013*	546	Completed
South Plant Agitation Air System – Leak Repairs	Conservation	2013*	TBD	Underway
Matthews Park Pump Station – Energy Audit Recommendations	Conservation	2013*	TBD	Underway
South Plant – Wastewater Cohort OSU Industrial Energy Assessment Recommendations	Conservation	2013*	TBD	Underway
West Point – HPEM RAS Pumping Optimization	Conservation	2013*	TBD	Underway

**Estimated*

Potential annual energy savings from WTD Energy Program strategies

Behavior Change Initiatives

All of the WTD's Energy Program's conservation strategies benefit from an informed and empowered workforce. During winter 2012, an "Energy Challenge" encouraged employees to take specific energy-saving actions:

- Turn off lights and report broken lighting controls
- Suggest process changes to improve efficiency
- Note and report air leaks
- Close hatches and roll-up doors

Project considerations and complexity

WTD leadership and staff balance a variety of considerations when moving forward with energy conservation initiatives:

- Capital investment
- Geology of Project Area
- Planning and construction timelines
- Treatment process requirements
- Budget/cash flow
- Staffing
- Safety
- Regulatory requirements
- Neighborhood mitigation agreements
- Electricity and natural gas market prices

"By collecting the right data and putting it to work for us, we maximize value, limit risk, and drive down energy usage. We do this to ensure responsible stewardship and sustained service capacity of our assets."

– Sandy Kilroy,
WTD Assistant Division Director

ONGOING ENERGY SAVINGS EFFORTS savings indicate projected 2013 efficiency (MMBtu/year)

LOW ENERGY SAVINGS (less than 500 MMBtu/year)

- **Green Motor Initiative**
  Recent Motor Rewinds (~100)
- **Behavior Change Initiative**
  Annual "Energy Challenge"
- **Capital Improvement Project Involvement – Energy analysis on all projects with over $250,000 of powered equipment**
  Analyses result in energy conservation measures
- **Facility/System Energy Audits**
  Audit reports result in energy conservation projects
- **Tag and Fix Process Air Leaks**
  2012 Leak Fixes (~40)

MEDIUM ENERGY SAVINGS (500-8,000 MMBtu/year)

- **Equipment Shutoff**
  Current Initiatives (~3,000)
- **Plant Energy Teams**
  West Point High Performance Energy Management Industrial Cohort Program (~3,300)
  South Plant Water/Wastewater Sustainable Energy Cohort Program (~3,300)

Implementation Complexity

- Low
- Medium
- High

PROJECTS/EVALUATIONS CURRENTLY APPROVED IN CAPITAL IMPROVEMENT PROGRAM (CIP)

savings indicate projected annual project efficiency upon completion (MMBtu/year)

MEDIUM ENERGY SAVINGS (500-8,000 MMBtu/year)

- **Facility Lighting Upgrades**
  Projects under way in CIP (~1,500)
- **Pump Station HVAC – Control Optimization**
  Projects under way in CIP (~1,500)
- **Pump Station HVAC – Mechanical Optimization**
  Projects under way in CIP (~900)
- **Process Agitation Air Blower Replacements**
  Projects under way in CIP (~4,300)
- **West Point Energy Savings Performance Contract** (~2,000)

HIGH ENERGY SAVINGS (over 8,000 MMBtu/year)

- **Install or Replace Variable Frequency Drives**
  Projects Underway in CIP (~10,300)
- **South Plant Digester Gas Optimization**
  Feasibility Study Underway (~17,000)
- **West Point Oxygen Generation (OGADS) and Aeration Mixer Replacement** (~20,000)

Larry Woods, Master Mechanic

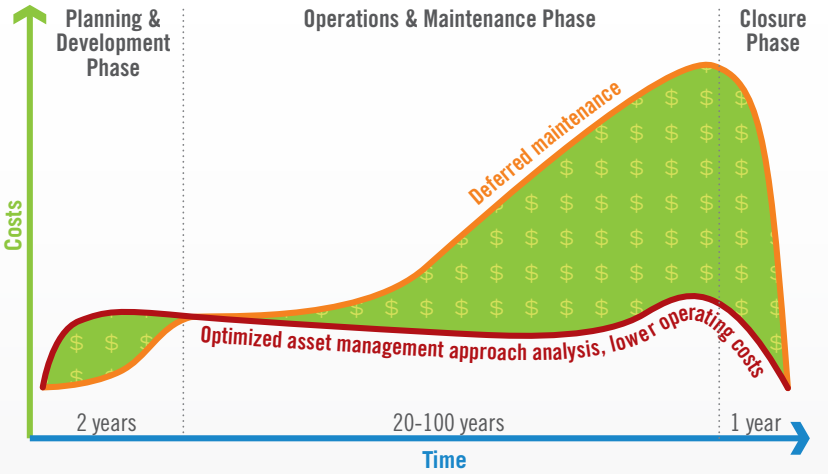
Efficiency as utility culture

A forward-thinking energy plan is fundamental to our environmental ethic and commitment to financial stewardship. Several tools have been developed to foster accountability and continual improvement as they relate to energy planning and use:

Data Systems and Quarterly Energy Reporting
Electricity, gas, and diesel use data are consolidated into a Utility Manager database and reported quarterly. WTD's Energy Program developed a wastewater-specific Sustainability Scorecard tool as a complement to the traditional LEED Green Building Scorecard. The Sustainability Scorecard ensures energy, green building, and climate information is documented, tracked, measured, and verified throughout the capital project delivery process for WTD facilities.

Staff Training on Energy Efficiency
In 2012, the Association of Energy Engineers (AEE) trained over 30 WTD employees on topics ranging from optimizing boiler efficiency to the pitfalls of performance contracting. This capacity-building opportunity was funded by the Federal Energy Efficiency and Conservation Block Grant (EECBG) program.

Energy Audits
WTD regularly audits facilities and systems to assess energy use. Depending on the complexity of the system, an audit can range from an American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Level One audit to a more detailed Investment Grade Audit. By the end of 2013, WTD will have completed audits on significant facilities that consume over 5,000 MMBtu of annual energy. When needed, portable devices log data on specific equipment or systems, helping WTD make informed decisions about the best way to improve energy use.



Asset Management and Life-cycle Cost Analysis
WTD integrates energy investments, analysis, and ongoing energy savings into our overall asset management strategy. This integration allows WTD to design and build facilities with the least amount of risk, the highest degree of reliability, and at a reasonable cost. Life-cycle cost analysis and Reliability Centered Maintenance principles also take into account life-cycle energy usage: operations and maintenance needs, capital investments, chemical costs, construction cost, disposal costs, and any other quantifiable variable.

"When it comes online next year, West Point's combined heat and power (CHP) facility will be the largest digester CHP system in the State of Washington (4.6 MW) to use biogas in creating green power. Kudos to King County's determination to move projects like this forward to completion."

- David Sjoding, Center Manager, U.S. Department of Energy, Northwest Clean Energy Application Center

West Point Cogen Engine

New power plant at West Point

The total energy recovered using a cogeneration system includes both the electricity generated and the energy recovered as heat. Starting in 2013, a new system will generate electricity and heat at West Point using a pair of 2.3-MW cogeneration engines (combined total of 4.6 MW of installed power). This system will produce about 20,000 MWh of electricity each year, the same amount of power used by 1,100 typical Pacific Northwest homes, and will reduce annual carbon emissions by 15,000 metric tons.*

Both of the engines will ensure we can generate enough heat to meet most of West Point's normal thermal needs – the vast majority going toward maintaining 98 degrees Fahrenheit in the digesters to ensure microbial functions. The plant's existing three biogas-fueled boilers will be kept as standby heat sources when the cogeneration system is out of service for maintenance or repair.

A strong partnership with Seattle City Light (SCL) and $8.2 million in grant funding from EPA allowed WTD to achieve this innovative energy solution for the benefit of our ratepayers and the region. This partnership will help SCL achieve its 15 percent renewable energy goal by 2020 in accordance with Washington Initiative 937. In addition, it will generate $1.4 million in annual revenue to WTD from the sale of "green" electricity.

*Calculated using 2009 data from the U.S Energy Information Administration.

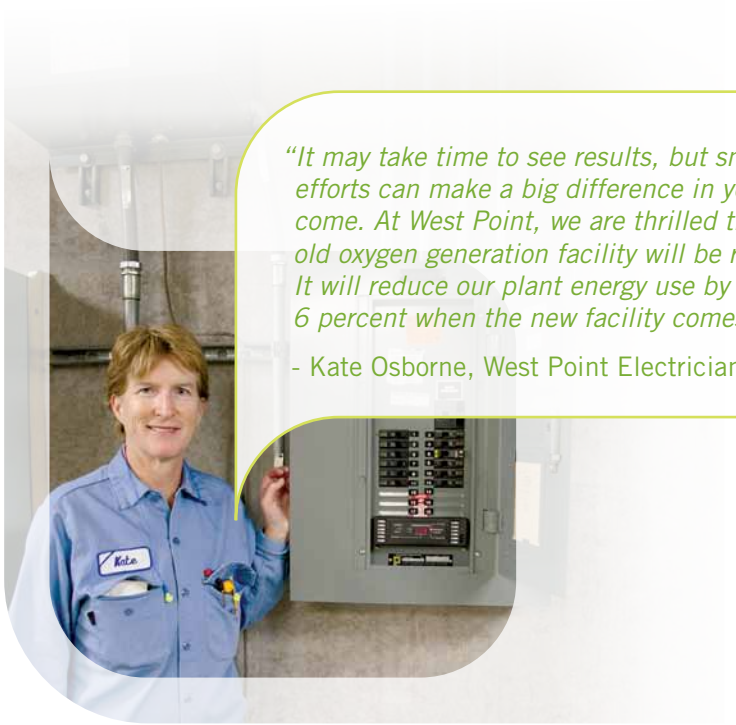
A HISTORY OF WASTE HEAT RECOVERY AT WEST POINT

West Point Treatment Plant treats about 100 million gallons of wastewater each day (MGD), with the capacity to treat additional stormwater for up to 440 MGD total. Since 1966, WTD has been using four digester-gas powered engines to pump incoming wastewater through the treatment system. Waste heat from these engines is used to heat other plant processes, eliminating the need to purchase this heat from elsewhere.

What's ahead?

WTD's mechanical and electrical equipment is strategically replaced or upgraded to meet performance, energy, budget, regulatory, safety, and other critical needs.

As part of its investment in capital improvements, WTD's Energy Team strives to ensure large-scale energy projects can be integrated into WTD's overall capital program and facility Energy Management Plans. Strong energy data management ensures projects are eligible for external financing and support.



"It may take time to see results, but small efforts can make a big difference in years to come. At West Point, we are thrilled that our old oxygen generation facility will be replaced. It will reduce our plant energy use by another 6 percent when the new facility comes online."

- Kate Osborne, West Point Electrician

Upcoming Energy Audits

FACILITY	SYSTEM	YEAR
Lake Ballinger Pump Station	HVAC	2013
Richmond Beach Pump Station	HVAC	2013
Juanita Bay Pump Station	Full Facility	2013
York Pump Station	HVAC	2013
North Beach Pump Station	Full Facility	2013
Matthews Park Pump Station	HVAC	2013

Planned Energy Efficiency Capital Projects*

PROJECT	TYPE	BUDGET YEARS	EST. SAVINGS / PRODUCTION MMBtu/year
North Creek Pump Station HVAC Optimization – Ductwork and Fan Removal	Conservation	TBD	900
South Plant Brown Grease Receiving Facility – Proposed Pilot Facility (feasibility study underway)	Renewable	TBD	12,000
South Plant Digester Gas Optimization (feasibility study underway)	Conservation	TBD	17,000
West Point Secondary Agitation Air Blower Replacement	Conservation	TBD	2,800
South Plant Chiller Replacement (Solids-Area)	Conservation	TBD	680

*Implementation subject to feasibility study results and funding approval.

Energy innovations: technology assessment

Since 1995, WTD has evaluated promising technologies with the potential to save money, improve treatment performance, or recover valuable resources. Now more than ever, there is an imperative to minimize energy usage, optimize production, and reduce WTD's energy footprint and costs.

In the past two years, nearly 40 technologies were evaluated and several have moved forward for further analysis, demonstration, or partnerships, including:

Co-digestion of Brown Grease Brown grease from restaurants can accumulate and clog sewer pipes. But if properly collected, grease can be a rich feedstock for biodiesel production or "food" for methane-producing bacteria in digesters. WTD will be working with partners to get brown grease out of wastewater pipes and make sure it can be beneficially used to create energy.

"Human waste is simply too valuable to throw away. With the right technology and innovation, we can safely transform it into clean water, energy, and other resources. At the Gates Foundation, we're working to bring these solutions to people in the developing world. But King County is already making it happen here in the Pacific Northwest."

- Carl Hensman, PhD,
Reinventing the Toilet Initiative,
Bill & Melinda Gates Foundation

South Plant Digester Gas Utilization
WTD has initiated a South Plant Gas Utilization Study to ensure WTD responds to the changing energy landscape while maintaining a reliable energy supply to support nonstop operations. The study will evaluate the current South Plant energy production approach against alternative approaches to make certain the digester gas produced at the plant is used to its best benefit.

Enumclaw Dairy Digester Dairy farms can use anaerobic digesters to generate energy. By digesting cow manure, a dairy can convert the manure into methane, nutrients, cow bedding, and soil amendment. Dairy digesters not only reduce farmers' operating costs by lowering manure management and sawdust bedding expenses, but also can create an additional source of revenue from the sale of gas or electricity to local utilities. Due to our specialized expertise in digester operation and biogas production, King County was asked to partner with Rainier Biogas, LLC, and farmers in South King County and obtained two federal grants to purchase a 1 MW-engine/generator set that will soon be converting dairy manure digester biogas into electricity.

Energy innovations: district energy

Heat Recovery from Raw Wastewater in Conveyance Lines

Wastewater traveling through underground pipes maintain an annual average temperature of about 65 degrees Fahrenheit, warm enough to provide an extractable source of thermal energy that can be piped to nearby buildings, and replace or supplement the need for water heaters, boilers, furnaces, or air conditioners. WTD is working with urban real estate developers to demonstrate how we can tap into this thermal energy asset.

NATIONAL GEOGRAPHIC

Waste Wattage: Cities Aim to Flush Heat Energy Out of Sewers, December 11, 2012

Shower drains and dirty dishwater and laundry water could be on the cutting edge of energy efficiency and recovery. Around the world, and more recently in the U.S., cities are realizing that the water leaving our homes and offices – specifically, warm and hot wastewater – is an astoundingly powerful source of energy. One estimate is that Americans flush 350 billion kilowatt-hours of energy into the sewers each year – roughly enough to power 30 million U.S. homes. Cities are taking notice, and taking steps to install sewage heat recovery systems to get a piece of that energy resource.

"I never thought I'd be saying the words 'Sewage heat recovery is the coolest thing,'" said **Jessie Israel**, Resource Recovery Section Manager at King County's Wastewater Treatment Division.

Acronyms/abbreviations

AEE	Association of Energy Engineers
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
Biogas	Methane produced in digester tanks
BW	Brightwater
CHP	Combined Heat & Power
CIP	Capital Improvement Project
Cogen	Cogeneration
EECBG	Federal Energy Efficiency & Conservation Block Grant
HPEM	High Performance Energy Management
HVAC	Heating & Ventilation Air Conditioning
I/I	Infiltration & Inflow
kW	Kilowatt
kWh	Kilowatt-hour
LED	Light-Emitting Diode
LEED	Leadership in Energy and Environmental Design
MGD	Million Gallons per Day
MMBtu	One million Btu
MtCO2e	Metric Tons of Carbon Dioxide Equivalents
MW	Megawatt
OGADS	Oxygen Generating and Distribution System
OSU	Oregon State University
PLC	Programmable Logic Controller
PS	Pump Station
PSE	Puget Sound Energy
RAS	Return Activated Sludge
RSP	Raw Sewage Pump
SCL	Seattle City Light
SnoPUD	Snohomish Public Utility District
SP	South Treatment Plant
TBD	To Be Determined
TP	Treatment Plant
W	Watt
WP	West Point Treatment Plant
WTD	Wastewater Treatment Division

About Resource Recovery

The WTD's Resource Recovery group works to recover and recycle beneficial resources from the wastewater treatment process. As an urban utility dedicated to protecting public health and the environment, WTD leads the country in the recovery of carbon, nutrients, methane, waste heat, and non-potable water resources from this renewable resource.

Resources from wastewater provide us with healthy crops, renewable energy, green sports fields, lush gardens, robust forests, and vibrant wetlands all nourished with King County's recycled resources.

For more information on King County waste-to-resources initiatives, visit: *www.kingcounty.gov/ResourceRecovery.*

King County
Department of
Natural Resources and Parks
Wastewater Treatment Division

Alternate formats available.
Call 206-477-5371 or TTY: 711.

file: 1403_2578wtdENERGYrevised.indd wgab

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