ORANGE WATER AND SEWER AUTHORITY

A public, non-profit agency providing water, sewer and reclaimed water services to the Carrboro-Chapel Hill community.

MEMORANDUM

TO: **Natural Resources and Technical Systems Committee**
Terri Buckner (Chair) Ruchir Vora
Dave Moreau John Young (*ex officio*)
Heather Payne

THROUGH: Ed Kerwin

FROM: Ruth Rouse

DATE: April 24, 2015

SUBJECT: April 28, 2015 NRTS Committee Meeting: Energy Management Planning

The NRTS Committee will meet on Tuesday, April 28, 2015 from 5:30 to 7:00 PM in the OWASA Boardroom. Pat Davis, Sustainability Manager, will present information regarding the development of the Energy Management Plan, including:

- Revisions to the draft Technical Memorandum (TM) titled *Baseline Assessment of Energy Use; Overview of Energy Management Strategies to Date; and Potential Goals and Objectives for Energy Management* (Attachment #1). The draft TM has been revised to address the Committee's comments at the March 17th meeting;
- Potential goals and objectives for the Energy Management Plan; and
- Estimates of the range of energy savings if OWASA implements the proposed projects in the draft Capital Improvements Program (CIP) for fiscal years 2016-2020 (Attachment #2).

Staff seeks the Committee's feedback regarding the revisions to the TM, and potential goals and objectives for the Plan. Once the Committee concludes its review and discussion of this information, and reaches agreement on draft goals and objectives, we will schedule an update on the energy management planning project for the Board of Directors at a future televised meeting.

We look forward to seeing you on April 28th.

Ruth C. Rouse

Ruth Rouse, AICP
Planning and Development Manager

c: OWASA Board of Directors
Robert Epting, OWASA General Counsel

Attachments
Attachment 1: Revised Draft TM: *Baseline Assessment of Energy Use; Overview of Energy Management Strategies to Date; and Potential Goals and Objectives for Energy Management*
Attachment 2: Summary of Estimated Energy Savings from CIP Projects for FY 2016-2020

ATTACHMENT #1

Energy Management Plan Technical Memorandum #1 (DRAFT)

Baseline Assessment of Energy Use; Overview of Energy Management Strategies to Date; and Potential Goals and Objectives for Energy Management

(Revised Draft: April 28, 2015)

1.0 Purpose

To obtain the Natural Resources and Technical Systems (NRTS) Committee's feedback and guidance concerning this **revised** draft baseline assessment of energy use at OWASA; overview of energy management strategies to date; and background information regarding potential goals and objectives for OWASA's Energy Management Plan project.

Revisions have been made to address the NRTS Committee's March 17, 2015 request for additional information. The major additions are highlighted in yellow.

We seek the Committee's feedback as to:

(a) the usefulness, format, and content of the information in this revised Technical Memorandum (TM);
(b) potential goals and objectives for our energy management efforts, including guidance regarding specific, measurable targets and timetables for energy use reductions, possible use of renewable energy, and associated reductions in greenhouse gas emissions (GHGs); and
(c) additional information that the Committee needs in support of this effort. (In revising this draft, we have given priority to energy use data.)

2.0 Background

Development of an Energy Management Plan is Strategic Initiative #5 of OWASA's *Strategic Plan for Fiscal Years 2014 – 2017*. On January 22, 2015 the Board of Directors approved a Project Charter to help guide our efforts, and directed that staff receive input and guidance from the NRTS Committee prior to presenting information, analyses, and recommendations to the Board.

The first phase of the project is completion of a baseline assessment of energy use; documentation of energy management strategies to date; and background information regarding potential goals and objectives for the Plan. This TM addresses these three topics.

3.0 Baseline Assessment of Energy Use

This section summarizes historical energy use information for Calendar Years (CY) 2005 through 2014 for three primary areas: (a) use of purchased electrical energy; (b) use of natural gas; and (c) use of fuel for vehicles, work equipment, and standby power generators. This baseline analysis will help inform decisions regarding program goals and objectives, as well as support our efforts to track, analyze, and report on the progress of our energy management efforts.

In this section, electricity use is reported in kilowatt-hours (kWh) and natural gas use is reported in therms. One therm has the energy equivalency of about 29.31 kWh. Total energy use for all facilities and for fuel use in our vehicles, standby generators, etc. is also provided, and is reported in Million British Thermal

Units (MMBTUs), thereby enabling a comparison of the relative use of our different energy sources. A BTU measures the heating value, or energy content, of fuel. One BTU is the amount of energy needed to heat one pound of water by one degree Fahrenheit. One kWh has the energy equivalency of about 3,412 BTUs.

3.1. Use of Purchased Electricity

Figure 1 shows historical electrical energy use across all OWASA facilities, by major functional area. This graph incorporates monthly billing data for OWASA's more than 50 different electrical service accounts. Energy use for the reclaimed water system was not separately metered until last year; therefore, that use is included in the energy use totals shown for the Wastewater Treatment and Recycling function. The reclaimed water system was placed in service in April 2009.

Figure 1. Electrical Energy Purchases, By Calendar Year (CY), By Major Functional Area

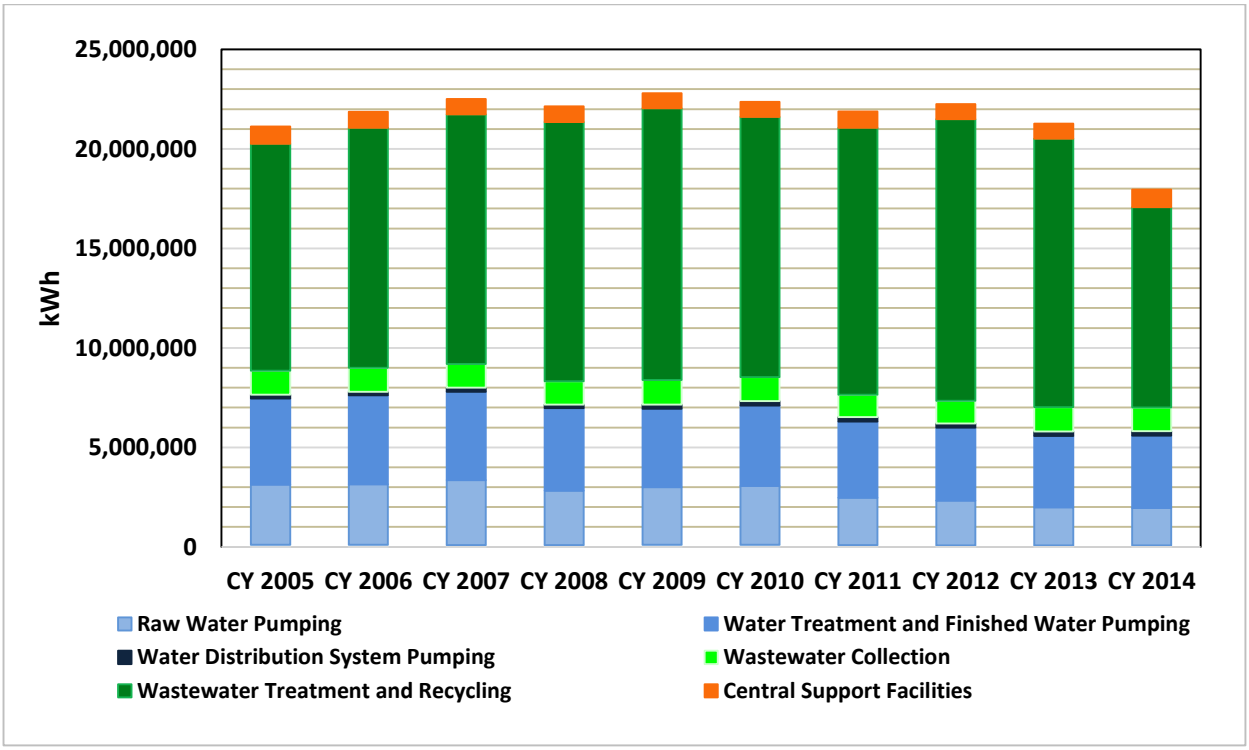
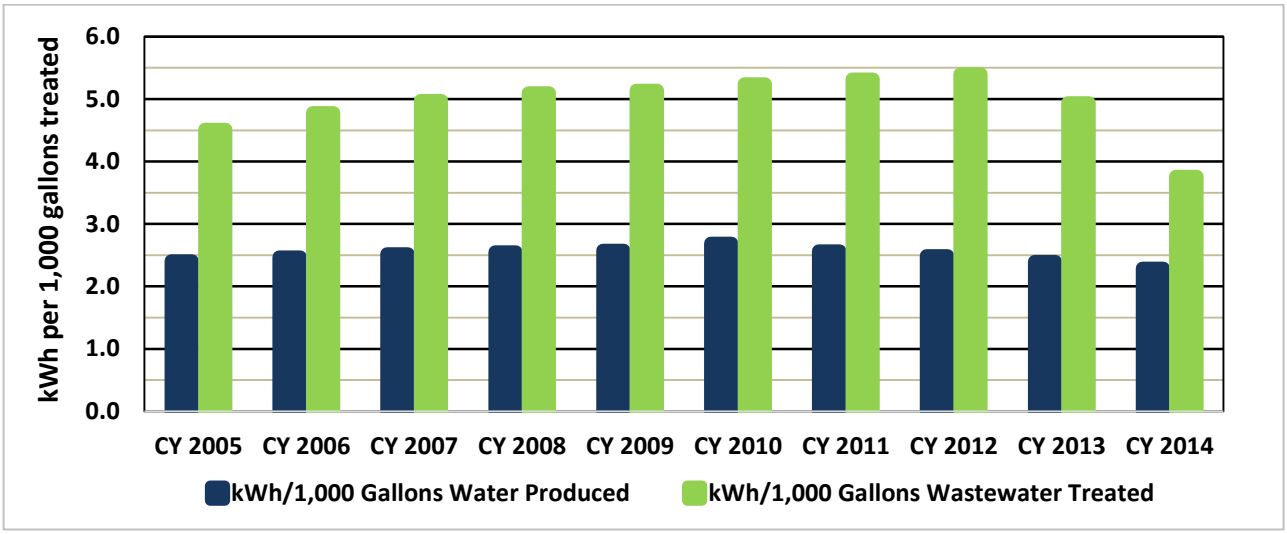


Figure 2 shows electrical energy use per 1,000 gallons – or ***energy use intensity (EUI)*** – for our water supply and treatment operations, and our wastewater collection, treatment and recycling operations (including the reclaimed water system, as noted above).

This EUI analysis only reflects electricity use at our facilities directly associated with water and wastewater pumping, piping, and treatment. It does not take into account the electricity use for the Administration Building, Operations Center, or lake offices and recreation facilities, since energy use at those support facilities is not directly affected by changes in water and wastewater demands.

Figure 2. Electrical Energy Use Intensity, By Calendar Year (CY) for Water and Wastewater Service



Key observations from Figures 1 and 2 are:

- ✓ In CY 2014, wastewater collection, treatment and recycling and reclaimed water pumping accounted for 63% of our total annual electrical energy use, and water supply, treatment, and distribution accounted for 32%. Only about 5% of our annual electricity use is for support facilities (Administration Building, Operations Center, and offices and buildings at our lakes).

- ✓ Our total electrical energy use in CY 2014 was 15% lower than in CY 2005. It was almost 20% lower than in CY 2010, when we experienced our highest use of electricity.

- ✓ EUI for wastewater collection, treatment and recycling in CY 2014 was 17% lower than in CY 2005, and 30% less than the EUI high of CY 2012. The primary reason for the savings has been the recent installation of the new energy efficient blowers, mixers, and aeration system at the Mason Farm Wastewater Treatment Plant (WWTP).

- ✓ The major reductions in electricity use for wastewater collection, treatment and recycling occurred despite the addition of several new energy-using processes at the WWTP since 2005. These include the ultraviolet light disinfection system; filter facilities; rotary press for biosolids dewatering, reclaimed water pumping facilities, and odor control improvements.

- ✓ Water supply and treatment EUI for CY 2014 is about 5% lower than CY 2005, and 15% less than the high of CY 2010. This reduction likely reflects energy savings associated with the installation of new, more efficient pumps and pump controllers, such as variable frequency drives (VFDs), and efficiency improvements resulting from the optimization of our filter operations at the WTP.

- ✓ CY 2014 EUI for water supply and treatment was 2.29 kWh/1,000 gallons produced and EUI for wastewater collection, treatment and recycling was 3.76 kWh/1,000 gallons treated. The combined annual total EUI for CY 2014 was more than 17% lower than the prior year, and nearly 24% lower than CY 2010, which had the highest combined EUI for any of the past ten years.

The Mason Farm WWTP and the Jones Ferry Road Drinking Water Treatment Plant (WTP) are our two largest energy-using facilities. Tables 1 and 2 show the estimated proportion of electricity use by major process/function for the WWTP and WTP, respectively.

Table 1. Estimated Percent of Total Annual Electricity Use at Mason Farm WWTP, by Major Functional Area

Functional Area/Process	% of Total
Aeration Blowers	27.6%
Solids Processing	25.6%
Influent Pumping	10.5%
RCW	8.9%
Intermediate Pumping	5.2%
Odor	4.7%
UV	4.6%
Secondary Clarifiers	3.7%
Post-Aeration	2.4%
Primary Clarification	2.3%
Aeration Basins	2.2%
Other	1.6%
Filters	0.7%

Table 2. Estimated Percent of Total Annual Electricity Use at Jones Ferry Road WTP, by Major Functional Area

Functional Area/Process	% of Total
Finished Water Pumping	70.0%
Drinking Water Treatment	20.5%
Solids Processing	7.0%
Generator Building	2.5%

As shown in Table 2, finished water pumping accounts for the largest portion of electrical energy use at the WTP. When drinking water is produced at the Jones Ferry Road WTP, it flows into a storage tank at the plant, from which the water is then pumped out for delivery to customers through the drinking water distribution system. The clearwell has an overflow elevation of 465 feet above Mean Sea Level (MSL). Our water distribution system is divided into two pressure zones – the 642 zone (in which the elevated storage tanks have an overflow elevation of 642 feet MSL) and the 740 zone (which has one elevated tank with an overflow elevation of 740 feet MSL). Our four large finished water pumps at the WTP deliver the drinking water at the required pressures and flow rates to meet customer demands while also supporting fire protection services.

Raw water pumping represents our third largest use of electricity. Raw water must be pumped from University Lake and Cane Creek Reservoir, through transmission mains that are about 1.33 miles and 10.95 miles, respectively, to the Jones Ferry Road WTP. The University Lake Raw Water Pump Station

is at an elevation of about 340 feet MSL, while the Cane Creek Raw Water Pump Station is at 461 feet MSL. The highest elevation along the Cane Creek raw water transmission main is 580 feet MSL. The Jones Ferry Road WTP is at 479 feet MSL.

Figures 3 and 4 show the relationship between electricity use per 1,000 gallons pumped and average-day monthly water pumping volumes for the University Lake Raw water Pump Station and the Cane Creek Raw Water Pump Station, respectively.

Both graphs show that EUI at the pump stations generally declines as average-day water pumping rates increase. This is because our pumps generally run more efficiently at higher pumping rates.

Figure 3. Monthly Electricity Use Intensity vs. Average-Day Water Pumped: University Lake Raw Water Pump Station for January 2006 – December 2014

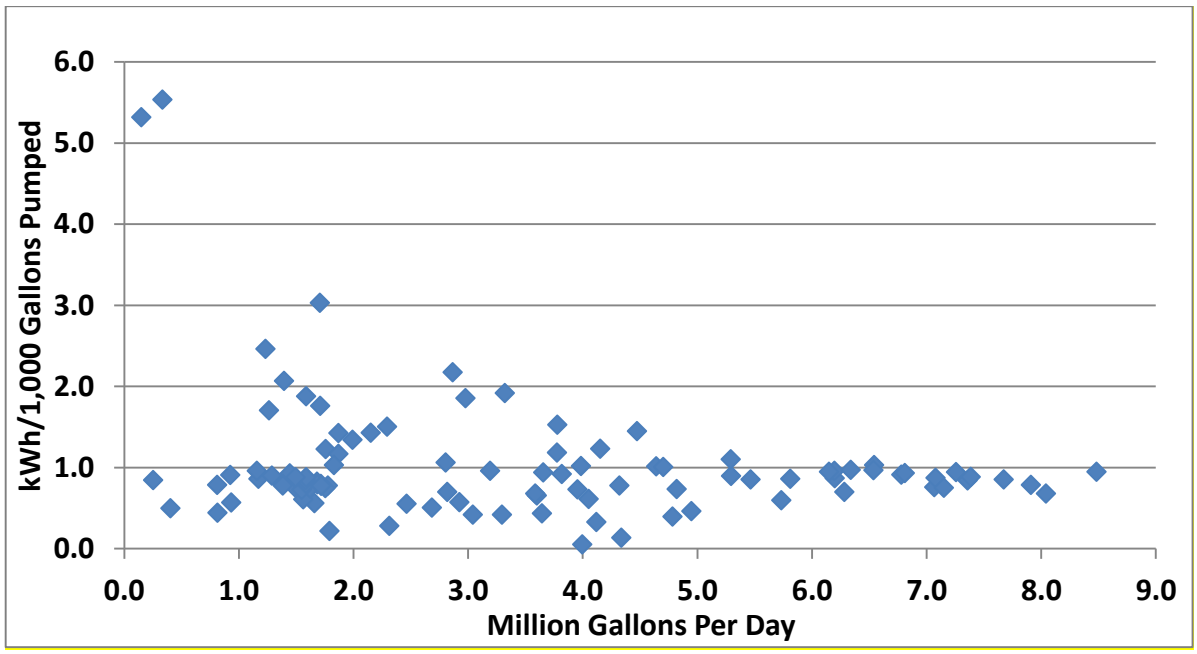
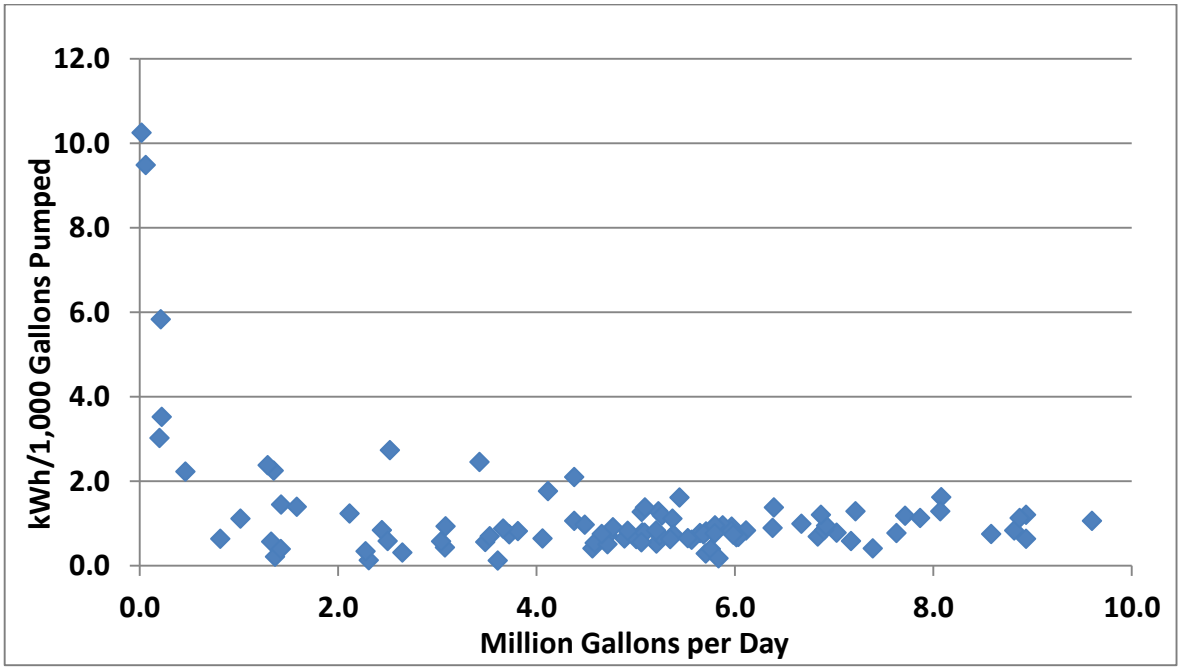
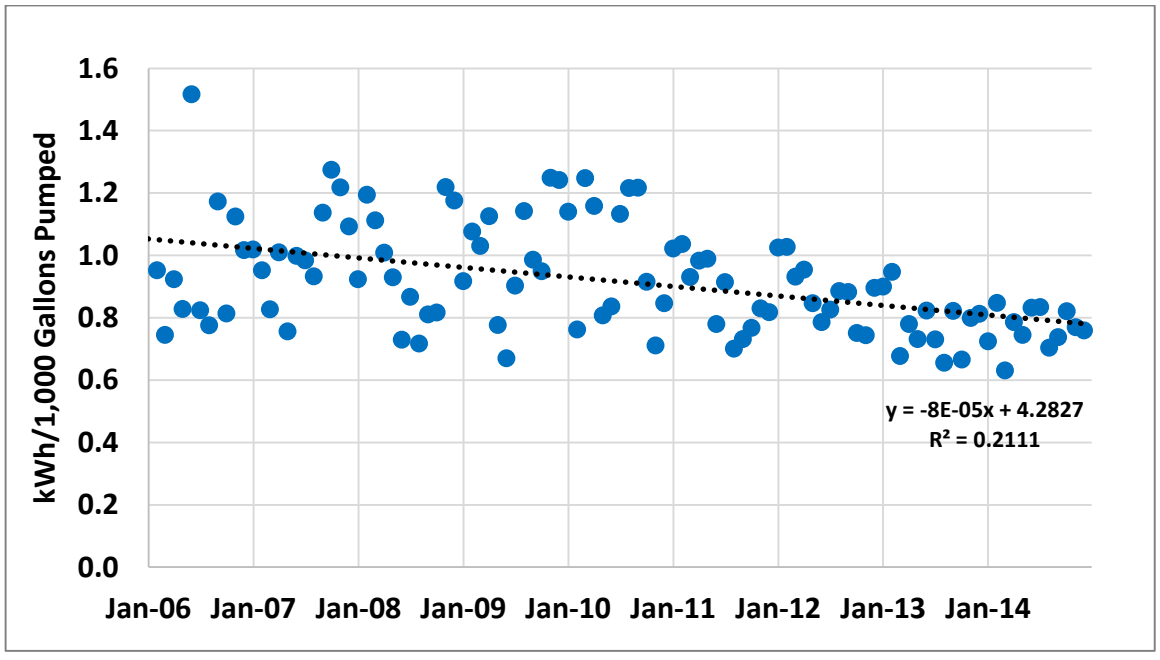


Figure 4. Monthly Electricity Use Intensity vs. Average-Day Water Pumped: Cane Creek Raw Water Pump Station for January 2006 – December 2014



Because our goal is to optimize the operation of our raw water pumping facilities as a system, it is important to consider their combined EUI. Figure 5 shows the historical combined electrical EUI for the two stations, by month. The trend line on the graph shows that EUI for raw water pumping has dropped in recent years, and is now about 20% lower than in 2006.

Figure 5. Historical Combined Electricity Use Intensity vs. Average-Day Water Pumped for University Lake and Cane Creek Raw Water Pump Stations for January 2006 – December 2014



3.2 Use of Major Standby Power Generators on Duke Energy's Curtailable Plan

At four of our major facilities, we have installed major standby power generators which can be automatically activated by Duke Energy if needed to curtail peak power demands on Duke Energy's facilities. We receive monthly billing credits for those generators. Table 3 lists the locations and capacities (KW) of those generators, and the total annual billing credits we received from Duke Energy for those generators in Calendar Year 2014.

These generators are essential for ensuring continuous operation of our major facilities at times when Duke Energy service is unavailable.

Table 3. Major Standby Power Generators for Which OWASA Receives Billing Credits From Duke Energy

Facility	Generator Capacity (KW)	Annual Billing Credits
Jones Ferry Road Water Treatment Plant	1,000 1,500	$16,700
Cane Creek Raw Water Pump Station	1,135	$12,600
Rogerson Drive Wastewater Pump Station	600	$3,800
Mason Farm Wastewater Treatment Plant	2,000 2,700	$65,000
Total Standby Generator Credits in Fiscal Year 2014		**$98,100**

3.3 Use of Natural Gas and WWTP Biogas

Figure 6 shows historical natural gas use across the major functional areas, based on monthly billing data for our eight different natural gas accounts for the ten-year period from Calendar Year 2005 to 2014.

Our largest use of natural gas occurs at the Mason Farm WWTP, where it is used mostly as supplemental fuel for running the two boilers that provide heat for the anaerobic digestion (solids treatment) process. Methane – or "biogas" – is produced as a by-product of the digestion process, and is used as the primary fuel in our boilers at the plant.

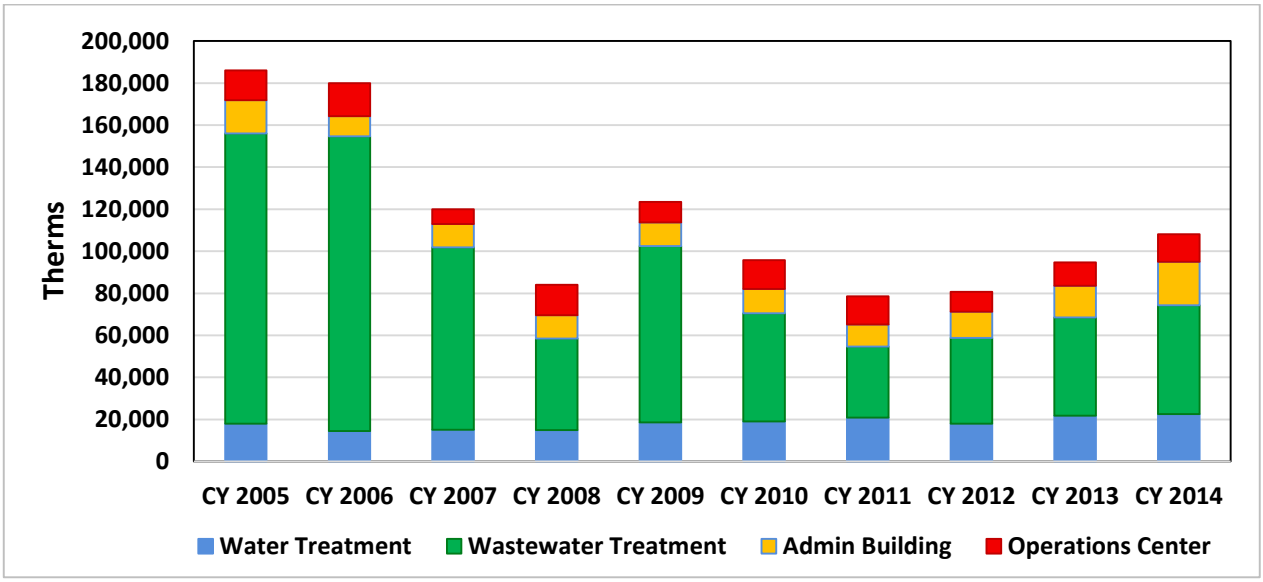
We do not have equipment to accurately measure the volume of the biogas we produce or beneficially use at the WWTP. We also do not have equipment to treat or condition the biogas to remove impurities (such as hydrogen sulfide and siloxanes) or moisture before it is used in the boilers. When biogas quality, flow, or pressure rates prevent us from using the biogas in our boilers, we must switch over to using natural gas to ensure continuous operation of the boilers.

We generate more biogas than we use in the boilers. The excess biogas must be burned rather than released directly into the atmosphere for two reasons: (1) the untreated biogas contains impurities such as hydrogen sulfide that can cause major odor problems if released directly into the atmosphere, and (2) on a pound

for pound basis, methane has a global warming potential that is 25 times greater than carbon dioxide over a 100-year period. When methane is burned, it combines with oxygen to form carbon dioxide and water. We use natural gas to run the pilot light for our biogas flare.

In addition to the uses at the WWTP, we use natural gas in our main office buildings and at the WTP for domestic hot water heating and for running our boilers that provide hot water for space heating.

Figure 6. Natural Gas Purchases, By Calendar Year (CY), By Major Functional Area



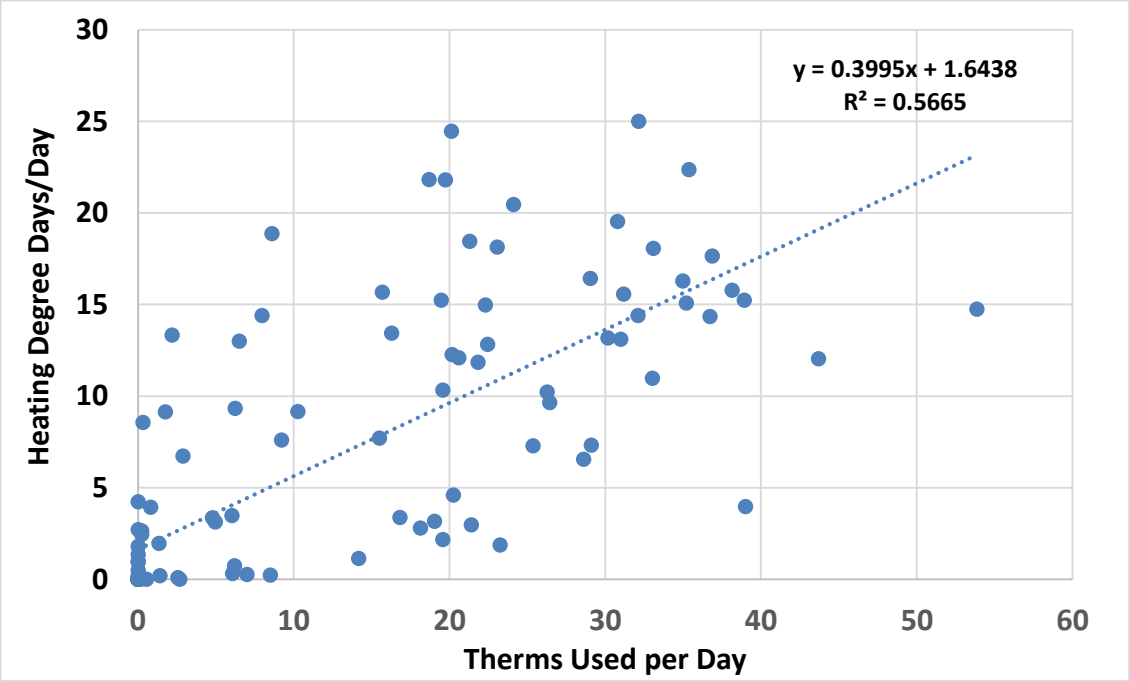
Key observations from the above graph are:

- ✓ The wastewater collection, treatment and recycling functions account for about 48% of our total annual natural gas use. Water supply, treatment, and distribution accounts for about 22% and central office and operations facilities account for the remaining 30%.

- ✓ In CY 2005 and CY 2006, natural gas use was considerably higher at the WWTP as a result of plant construction activities that impacted our storage and use of biogas to heat the digesters.

In facilities where natural gas is used for space heating, that use varies with changes in temperature. An example of this is provided in Figure 7, which shows a positive relationship between monthly natural gas use per day and heating degree days for the Operations Center. Heating degree days are a measure of heating load on a facility as a result of the outdoor temperature. When the daily outdoor temperature is one degree below a stated temperature reference point it is defined as one heating degree day. For example, if the temperature was 10 degrees below the reference temperature for a 30-day period, there would be 300 heating degree days in that month. We have used 65 degrees Fahrenheit as the reference point for the graph in Figure 7.

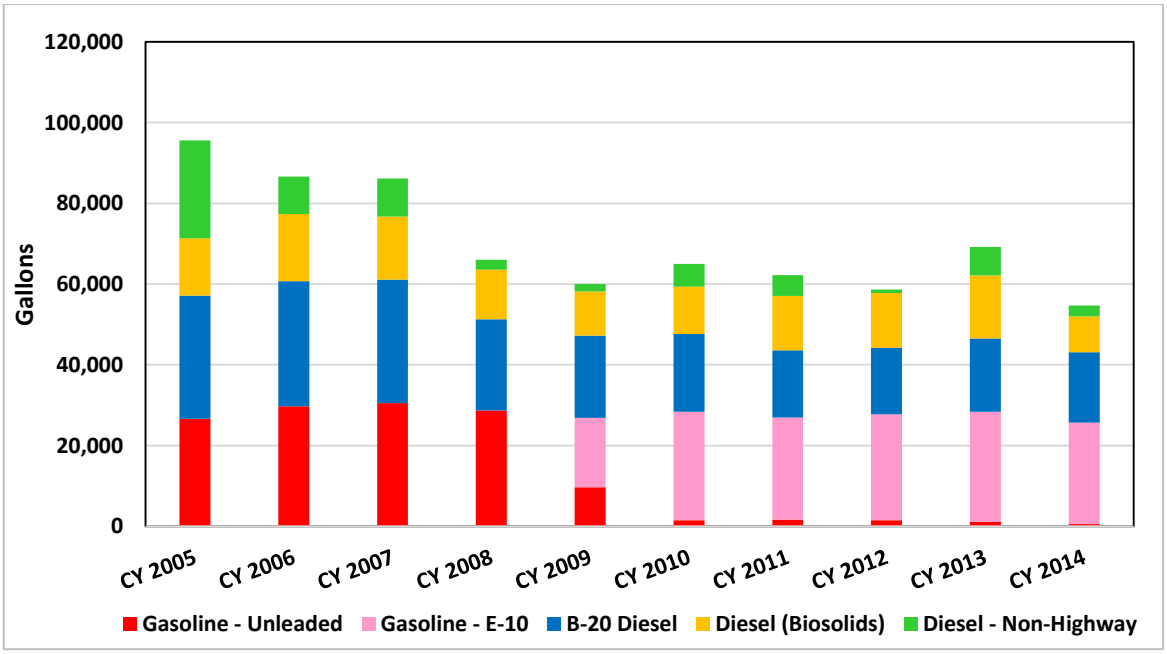
Figure 7. Relationship Between Natural Gas Use/Day and Heating Degree Days for the Operations Center (July 2006 through December 2014)



3.3 Fuel Purchases for Vehicles, Work Equipment, and Standby Power Generators

Figure 8 shows historical gallons of fuel purchases for our vehicles, major work equipment, and standby power generators.

Figure 8. Fuel Use for Vehicles and Equipment, By Calendar Year (CY)
(Use is assumed to occur in year fuel was purchased. CY 2006 and 2007 include partial estimates for Diesel.)



Key observations from this graph are:

- ✓ Our overall use of fuel for vehicles has been declining. Contributing factors are (a) we are dewatering more biosolids and using contract services for transport and spreading of liquid biosolids; therefore, we are using less diesel fuel for hauling liquid biosolids, and (b) we have reduced truck miles driven as a result of operational efficiencies (such as radio-read metering and use of mobile computing technology to receive and complete field service orders).

- ✓ The non-highway diesel gallons shown for CY 2005 are very high because it reflects the fuel purchase we made to initially fill a new 20,000 gallon diesel fuel storage tank at the WWTP.

- ✓ In CY 2009, we began to purchase E-10 gasoline in place of regular gasoline. E-10 gasoline has a lower BTU value than regular gasoline; therefore, fuel economy declines and more gallons of fuel must be used. The U.S. Environmental Protection Agency reports that use of E-10 reduces vehicle fuel efficiency by 1.5 to 3%.

3.4 Summary of Total Energy Use

Figure 9 shows total annual energy consumption by energy source, in MMBTUs. A key observation is that our electrical energy use generally accounts for 85 to 90% of our total annual energy consumption.

Figure 9. Total Energy Use, By Calendar Year (CY), in Million BTUs

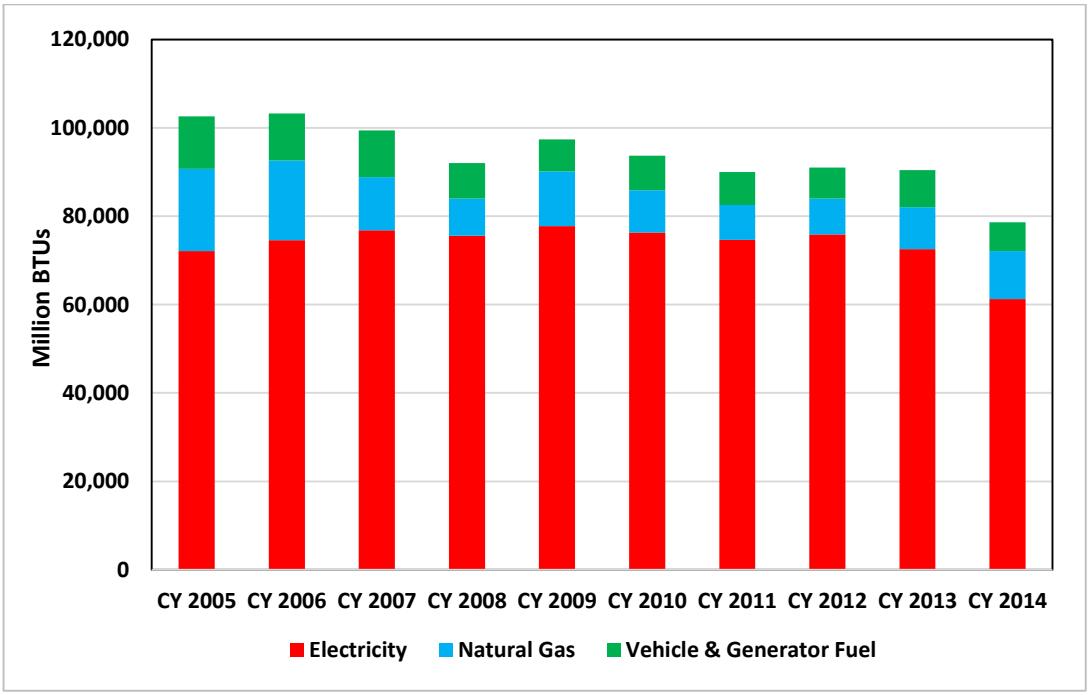
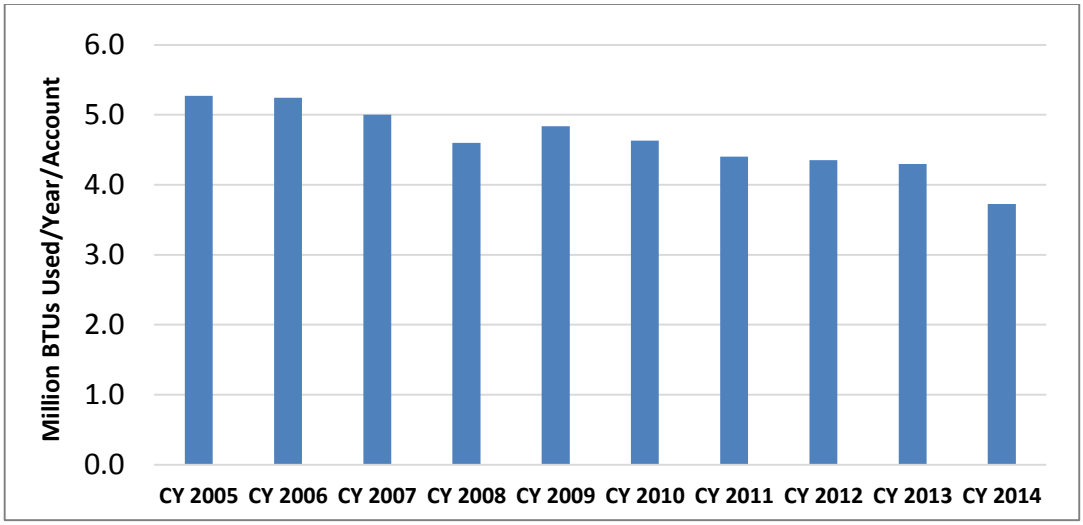


Figure 10 shows millions of BTUs of energy used per year per customer account served by OWASA. This graph shows that BTUs used per customer account served has declined by about 29% since 2005.

Figure 10. Million BTUs of Energy Use per Customer Account, By Calendar Year (CY)



3.5 Summary of GHG (Carbon) Emissions Associated With Our Energy Use

Figure 11 shows total annual GHG emissions – expressed in tons of carbon dioxide equivalents (CO_2e) – associated with our use of energy. As discussed in the Project Charter, this analysis includes Scope 1 and Scope 2 emissions, excluding direct emissions from our water and wastewater treatment processes. Scope 1 sources are owned or controlled by OWASA, and for this analysis include emissions from our fuel use for generators, natural gas-fueled equipment, and our vehicles. Scope 2 emissions occur outside of our facility boundaries, such as emissions caused by the production of the electricity we use.

In addition to not including emissions from our treatment processes, the GHG emission estimates shown in Figure 11 do not include Scope 3 emissions, which are associated with activities such as employee travel in personal vehicles, travel in airplanes for business use, or emissions generated by the manufacture and transport of goods purchased by OWASA.

Figure 11. Total Carbon Emissions From Our Use of Energy Use, By Calendar Year (CY), in Tons

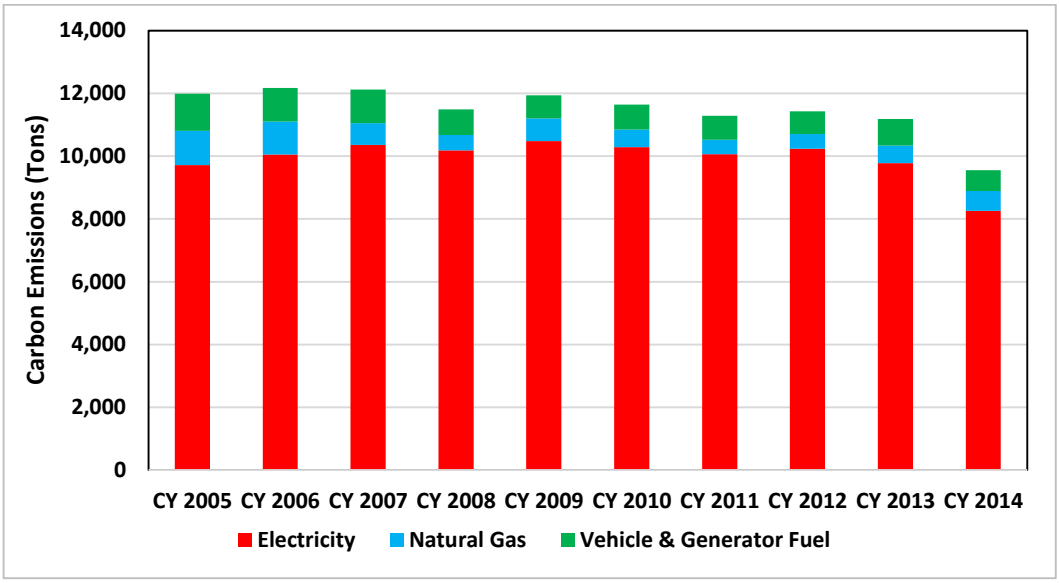
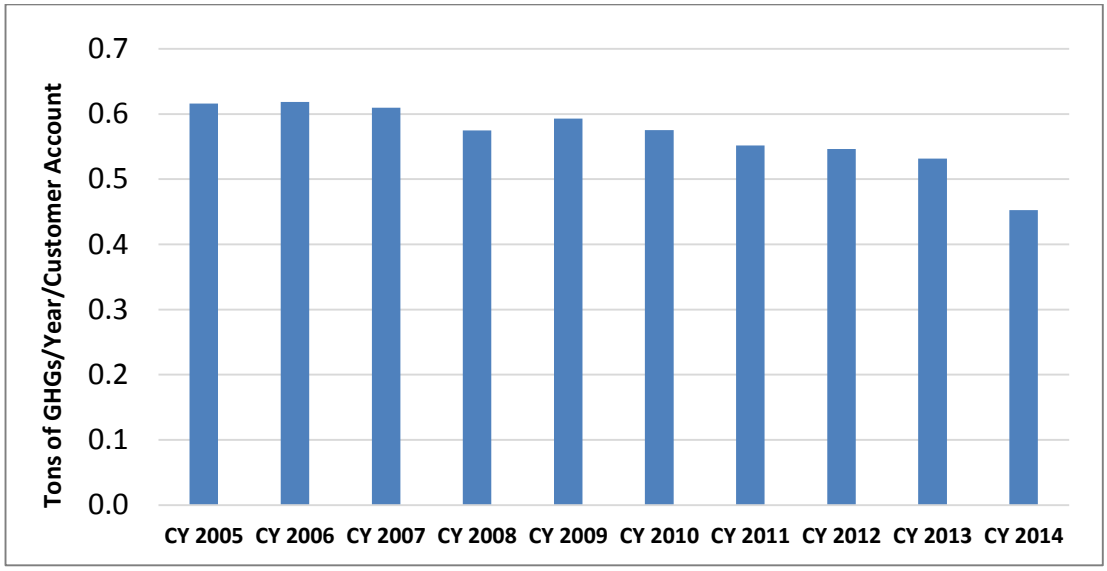


Figure 12 shows tons of total carbon emissions per year per customer account served by OWASA. This graph shows that carbon emissions per customer account served has declined by about 26% since 2005.

Figure 12. Total Carbon Emissions per Customer Account, By Calendar Year (CY), in Tons



3.6 Selecting a "Baseline" Year for Our Plan

A best practice in energy management is to establish a baseline period against which future progress is to be measured. There is no standard method for determining the appropriate baseline year, and there are many examples of different baseline years that agencies have set for their energy management and GHG emission reduction programs.

The U.S. Environmental Protection Agency's 2012 guidance on GHG accounting and reporting states that Federal agencies are to use Fiscal Year 2008 as their baseline year. However, the agency's guidance for the proposed Clean Power Plan specifies 2005 as the baseline year.

At the local level, the Town of Chapel Hill and San Jose, California have set 2005 as their baseline year. The University of North Carolina at Chapel Hill and Elon University have set 2008 as the baseline, whereas Duke University and Stanford University use 2007.

There is no clear choice as to what our preferred baseline should be. Calendar Years 2005 and 2006 were non-drought years; however, our WWTP (which accounts for the majority of our electrical energy use) was undergoing construction during that period. Calendar Years 2009 and 2010 were also non-drought years, and may be an appropriate baseline period.

The Project Charter references Calendar Year 2010 as the baseline, and staff recommends that year be established as our baseline.

4.0 Overview of Energy Management Strategies to Date

This section summarizes a number of important energy management measures we have implemented to reduce energy use and costs. These include general management strategies as well as site-specific energy efficiency improvements.

4.1 General Energy Management Strategies

- ✓ We track energy use and costs, and meet annually with Duke Energy to review electrical energy usage and applicable rate schedules for each of our accounts. Where possible, we make adjustments to ensure we are being charged the most economical rates for each of our accounts. As a result of these reviews, we recently worked with Duke Energy to change the power feed arrangements at the WWTP, which enabled us to avoid an annual cost increase of more than a $60,000.

- ✓ We seek financial support for our energy efficiency efforts. Two examples are the receipt of a $6.56 million, 20-year, no-interest loan from the North Carolina Clean Water State Revolving Fund for our recent energy efficiency improvements at the WWTP, and receipt of a $168,000 custom financial incentive payment from Duke Energy for that same project. We have also obtained no-cost and low-cost energy auditing services through Duke Energy, the State Energy Office, and the North Carolina Waste Reduction Partners Program.

- ✓ We shift pumping operations to off-peak periods when possible to reduce electricity costs. This strategy does not reduce total energy use, but it helps reduce our peak demand on Duke Energy's generation capacity, and provides cost savings under Duke Energy's time-of-day electrical rates.

- ✓ As our customers have become more efficient in their use of water, we save energy throughout our water and wastewater pumping and treatment operations. Our water line renewal and replacement program has enabled us to operate our system with minimal water losses due to leaks, thereby further reducing our energy requirements for water supply, treatment, and distribution.

- ✓ During condition assessment field work for our comprehensive asset management program, we identify pumps and motors in need of corrective maintenance. We include funding to address those needs in our annual budget and capital improvements program.

- ✓ We buy the most fuel-efficient vehicles that meet our service needs, provided that can be done at a reasonable cost.

- ✓ We have obtained energy audits and studies to help inform and guide our energy efficiency investments. Examples of these are:

  University Lake Raw Water Pump Station: Pump Station Evaluation for Addition of a One (1) MGD Raw Water Pump. August 2006. McKim & Creed.

  Cane Creek Raw Water Transmission Facility Improvements. February 1, 2002. Hazen and Sawyer. This study included an evaluation of the existing 2-speed raw water pumps at Cane Creek Reservoir.

  HVAC Energy Survey Report for Orange Water and Sewer Authority. December 31, 2007. State Energy Office and NCSU Industrial Extension Service.

  Lighting Energy Survey Report for Orange Water and Sewer Authority. December 31, 2007. State Energy Office and NCSU Industrial Extension Service.

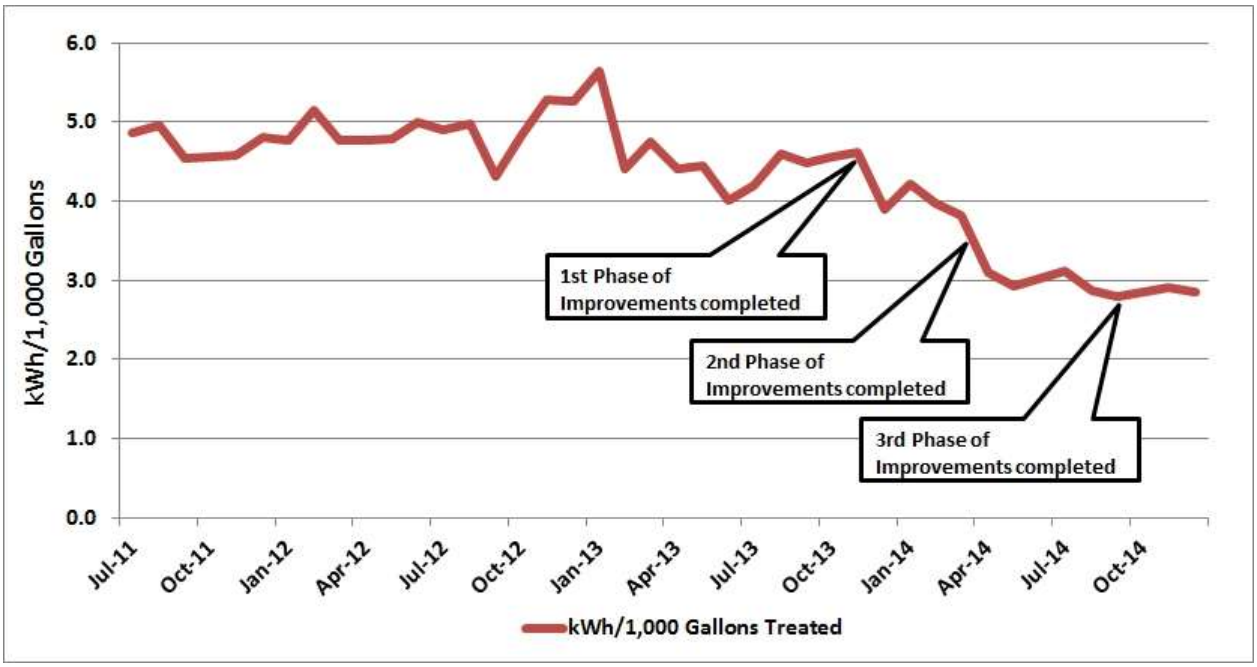
  Mason Farm Wastewater Treatment Plant Hydraulic and Treatment Capacity Study. March 2010. Hazen and Sawyer.

  OWASA Biogas Utilization Study. August 24, 2011. Brown and Caldwell.

4.2 Examples of Some of Our Energy Efficiency Improvements

- ✓ In September 2014, we completed installation of a fine bubble diffused aeration system, energy efficient blowers and mixers at the Mason Farm WWTP. As shown in Figure 13, these improvements have reduced energy use intensity at the WWTP by about 30%, which is an ***annual energy savings of more than 3 million kWh***.

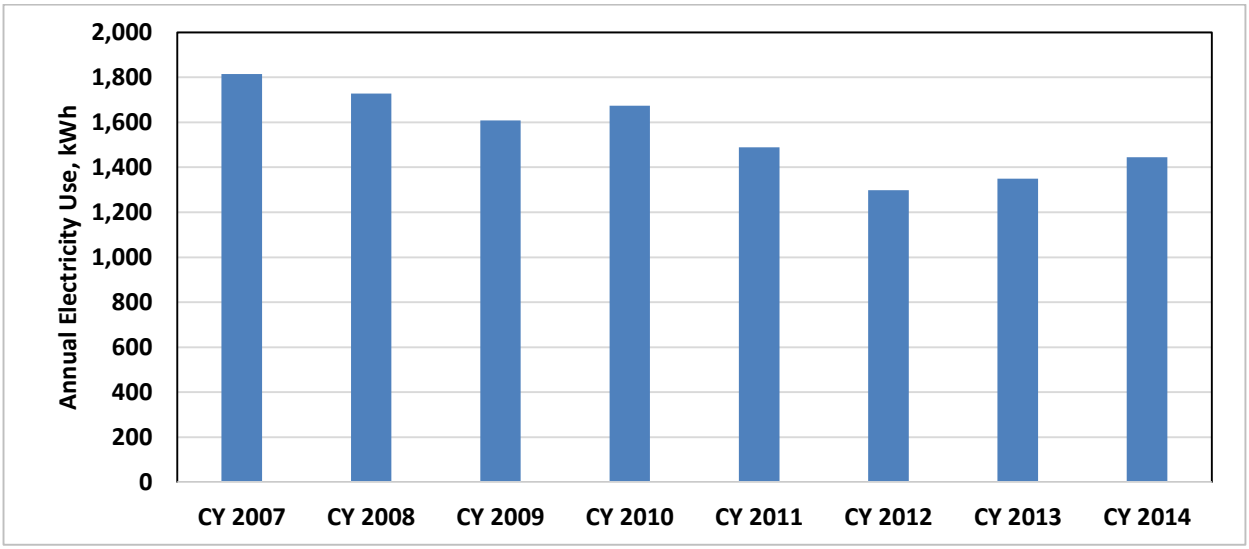
Figure 13. Mason Farm WWTP Electrical Energy Use Intensity: July 2011 – December 2014



- ✓ We save energy by meeting certain non-drinking water demands with reclaimed water instead of drinking water. We estimate that *it takes about 35% less energy to meet water demands with reclaimed water instead of drinking water* from our reservoirs and WTP. At the current reclaimed water demand level of about 0.65 million gallons per day, this equates to an ***annual energy savings of about 190,000 kWh***.

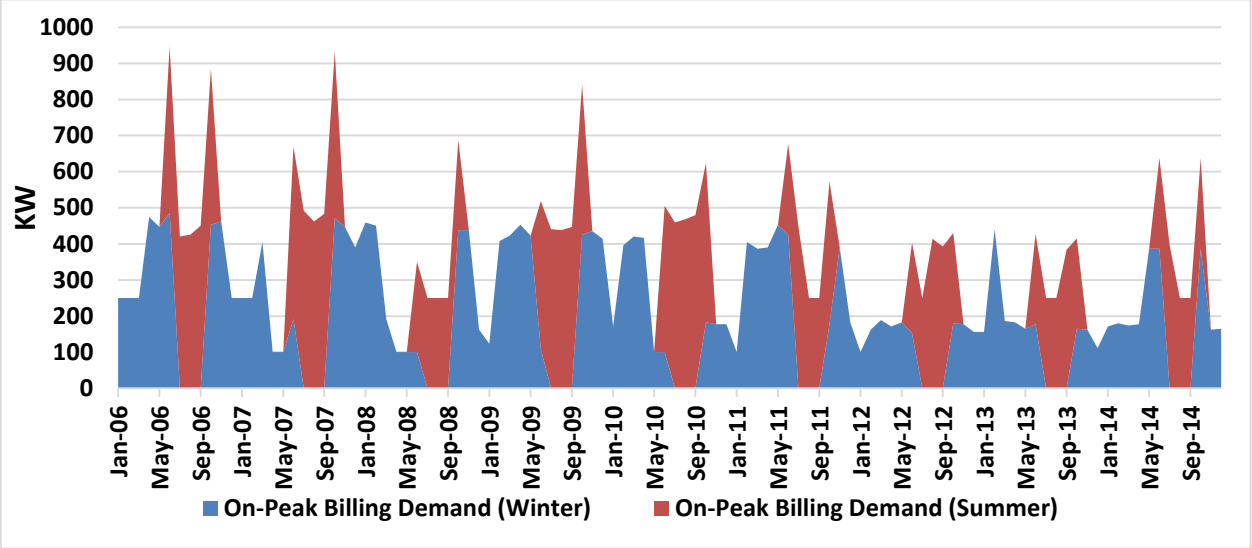
- ✓ We have installed energy efficient pumps, motors and motor controls at many of our facilities. Examples are the variable speed, horizontal split case pump at the WTP, the VFD for Finished Water Pump #7, and replacement of the Heritage Hills Wastewater Pumping Station, which has resulted in ***annual energy savings of almost 10,000 kWh***, or 20%. (See Figure 14.)

Figure 14. Annual Electrical Energy Use at Heritage Hills Wastewater Pumping Station



✓ We also installed a new, low-flow pump and VFD at University Lake which has enabled us to better optimize system-wide raw water pumping across a wide range of demand conditions. This pump has been an important contributing factor to the reduction in EUI for raw water pumping which was previously illustrated in Figure 5. As shown in Figure 15, installation of that pump has helped us reduce peak power demands at the Cane Creek Raw Water Pumping Station, which contributes to lower monthly electricity bills for that station.

Figure 15. Peak Electricity Demand at Cane Creek Raw Water Pumping Station



- ✓ In September 2002 we implemented a system to recycle treated process water back to the head of the WTP. This system has enabled us to reduce raw water withdrawals and energy requirements for pumping by about 7%. At current raw water withdrawal rates and energy use, the ***estimated annual energy savings is more than 130,000 kWh***.

- ✓ Since 2004, we have eliminated four wastewater pumping stations (Lloyd Street, Starlite Drive, Cleland Drive, and North Forest Hills) by extending the gravity sewer system. The ***estimated annual energy savings has been about 18,500 kWh***.

- ✓ We have installed more efficient lights and lighting controls at several facilities, including the Administration Building, Operations Center, WWTP, and WTP. We replaced several lights on a portion of the exterior basins at the WTP, and eliminated several fixtures that were no longer needed.

- ✓ Several of our information technology improvements have improved the energy efficiency of our operations. Some key strategies have been:

  - ✓ Servers, personal computers, monitors, printers and copiers are Energy Star rated.

  - ✓ Through server virtualization, we have significantly reduced the amount of equipment in our server room. Excluding the phone system (which we cannot presently virtualize) we have reduced the number of physical servers from 24 to 8. This has reduced electrical consumption for the servers and also reduced the waste heat generated which reduces our server room cooling requirements.

  - ✓ We have deployed mobile technology so field personnel can remotely access our Geographic Information System and asset information in the field, and receive and complete service and work orders electronically. These improvements help reduce our costs, use of vehicle fuel, and use of paper, printing, and copying.

  - ✓ We have implemented an automated call system that we use to notify customers that their accounts are overdue and they could be disconnected for non-payment. Since implementation, the average monthly cutoffs have fallen from about 160 per month to 80 per month. That represents 80 fewer trips in a crew truck to turn water off and then turn water back on. This reduces fuel use and carbon emissions, and reduces costs.

Table 4 summarizes estimated annual energy and cost savings from several of the above energy initiatives, assuming our Fiscal Year 2014 average electricity cost of about $0.07/kWh. The Mason Farm WWTP energy cost savings estimate also reflects the savings resulting from a major reduction in the fixed monthly contract demand charges for the WWTP.

Table 4. Estimated Annual Energy and Cost Savings From Selected Energy Management Measures

Energy Management Measure	Estimated Annual kWh Savings	Estimated Annual Cost Savings at Current Average Cost/kWh *(Based on 2014 average cost of $0.07/kWh)*
New blowers, mixers, and aeration system at Mason Farm WWTP	3,000,000	$250,000
Reconfigured Duke Energy power feed arrangement at Mason Farm WWTP	Avoided new Extra Facilities Charges	$60,000
New low-flow raw water pump with VFD at University Lake	380,000	$26,600
Use of reclaimed water instead of drinking water to meet UNC demands	190,000	$13,300
Process water recycling at Jones Ferry Road WTP	130,000	$9,100
Elimination of four wastewater pumping stations	18,500	$1,300
Heritage Hills Wastewater Pump Station Replacement	10,000	$700
TOTAL ESTIMATED ANNUAL SAVINGS FROM ABOVE MEASURES:	**3,728,500 kWh**	**$361,000**

4.3 Renewable Energy and Green Fleet Strategies

- ✓ As discussed in Section 3.3, we use a portion of the methane gas at the WWTP as fuel for up to two boilers that provide heat for the anaerobic digesters at the plant.

- ✓ We use B-20 diesel (regular diesel blended with 20 percent biodiesel) in many of our trucks. We also piloted the use of B-100 biodiesel fuel in one of our biosolids tanker trucks. However, that trial was discontinued due to problems with fuel quality.

- ✓ We have three gas-electric hybrid vehicles in our fleet.

5.0 Background Information Regarding Potential Goals and Objectives for Energy Management

The Board-approved Charter for the Energy Management Plan (EMP) states that we will address the following objectives, which are organized along the three pillars of sustainability: social performance, environmental performance, and financial performance.

Social Performance: Our EMP will impact the people and communities we serve.

1) Strategies will be evaluated against their impacts on the community.
2) We will inform and engage our customers and stakeholders in our energy planning efforts.
3) We will inform and involve our employees in our energy management efforts.

Environmental Performance: Our EMP will help us preserve natural resources; conserve energy, water, and other natural resources; minimize waste and pollution emissions, and reduce our environmental impacts.

4) We will seek to reduce our energy use per million gallons per day of water, wastewater, and reclaimed water used in our community compared to our 2010 baseline energy use (or other baseline year as determined appropriate and for which historical data is available).
5) Energy management, energy efficiency, and renewable energy alternatives will be evaluated against their relative effect on energy use and GHG emissions.
6) Where practical, we will implement energy management strategies that enhance the reliability and resiliency of our water, wastewater, and reclaimed water facilities and operations.

Financial Performance: The economic well-being of our customers and our community depend on our ability to manage energy services, use, and costs so that we can ensure high quality and reliable services at an acceptable financial cost to our customers.

7) Energy management, energy efficiency, and renewable energy alternatives will be evaluated against their relative life-cycle financial costs (capital and operating and maintenance costs).
8) The selected set of strategies will represent a reasonable balance of financial considerations with our social and environmental performance objectives.
9) To ensure that the selected strategies are cost-effective for our community, the selected mix of measures will have a positive financial payback.
10) We will seek funding support for our program, such as: federal, state, and foundation grants; energy utility incentives; revenues from renewable energy credits and carbon trading; etc.

As we evaluate opportunities to improve energy efficiency, invest in renewable energy projects, and reduce our carbon footprint, we must consider and decide how we will balance all of these important but oftentimes conflicting values. We will also need to decide how we will value environmental and social benefits as we evaluate cost-effectiveness. We hope one important outcome of the Plan will be to establish an evaluation and decision-making framework which we can use to guide our energy management efforts.

The performance goals we establish for the Plan will be very important, as they will drive our future energy management activities and continuous improvement efforts. Therefore, they need to be clear and measurable, and also serve as a basis for tracking, measuring, evaluating, and reporting on our progress.

The Board may wish to provide some initial guidance as to *potential* goals and targets for our Plan, then revise and finalize those after considering information about the scope, costs, and benefits of alternative energy management strategies that we will be evaluating in the coming months.

As we move forward with this effort, some key policy questions for the Board's consideration are:

1. **Should we establish time-bound targets for (a) reductions in our use of non-renewable energy and generation of related greenhouse gas emissions, and (b) the percentage of our energy needs that should be met from renewable energy sources? Is there a preferred technical basis for establishing those targets?**

Examples of Goals and Objectives Established by Other Agencies

Portland Water Bureau set a goal of reducing annual use of electricity by 5% by July 2012 compared to the 2005-2008 baseline period.

American Water has a goal of reducing Energy Use Intensity by 8% compared to a 2008-2010 baseline. It also has a goal of reducing greenhouse gases by 16% from a 2007 baseline. The target completion date is 2017.

Southern Nevada Water Authority has established the following goals:

- *have a 100% alternative-fueled vehicle fleet by 2015*
- *20% of energy needs to be met by renewable sources by 2015*

Tampa Bay Water (FL) has a goal of meeting 10% of its energy needs through alternative energy sources within the next 10 years.

Encina Wastewater Authority (CA) has established a Target Energy Independence goal to self-generate 95% of the total WWTP electrical needs by 2020, and to beneficially use all the biogas produced at the WWTP.

The East Bay Municipal Utility District (California) established a goal of meeting all of its WWTP energy needs with biogas by 2010. The WWTP is now a net energy producer that sells renewable energy to the grid after meeting all the plant's power demands.

Several States, local governments, and other countries have based their reduction targets on specific science-based assessments, such as that done by the International Panel on Climate Change (IPCC). The IPCC has concluded that the following GHG reductions are needed to stabilize global CO_2 levels to 450 parts per million:

- *40% below 1990 levels by 2020*
- *80% to 95% below 1990 levels by 2050*

2. **Should we establish guidelines for applicable financial payback thresholds for different types of energy efficiency and renewable energy investments, or for our overall plan?**

3. **Should our financial evaluations include consideration of the "social cost of carbon"? If so, how will we determine what that value should be? *(The Federal Interagency Working Group on Social Cost of Carbon has addressed this question in a May 2013 report "Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis – Under Executive Order 12866.")***

4. **As we consider funding requirements for energy efficiency and renewable energy strategies and compare those against other competing operating and capital needs, what are the criteria and relative weights we will use for that evaluation?**

Examples of Evaluation Criteria Established by Other Agencies

- *Initial capital cost*
- *Financial performance over the life of the project (rate of return; net present value)*
- *Degree to which strategy helps resolve an existing or expected problem*
- *Degree to which strategy has been proven at a scale relevant to our operations*
- *Extent to which strategy reduces greenhouse gas emissions*
- *Impact on the community and public visibility*
- *Impact on employees*
- *Extent to which project contributes to energy cost stabilization*

5. **Should we allow other parties to construct, own, and operate renewable energy facilities on OWASA lands or facilities, such as a rooftop solar photovoltaic (PV) system at the Administration Building or a biogas-to-energy project at the WWTP, provided we have the option to purchase the system at a future date?** ***(We have never done this; however, it is a strategy that many other utilities have implemented.)***

Examples of Goals and Objectives Established by Other Agencies

Phoenix (AZ) has a goal of meeting 15% of its electrical energy requirements with renewable energy by 2025. The city plans to achieve this through renewable energy installations that are either city-owned or city-sponsored

6. **As one strategy for offsetting our carbon emissions, should we consider "purchasing" renewable energy on the open market (such as through NC GreenPower), or otherwise pay other parties to reduce their carbon emissions?**

Examples of Goals and Objectives Established by Other Agencies

Tualatin Valley Water District (Oregon) has a goal of purchasing green power for 100 percent of the electrical energy requirements for its operations.

5.1 Potential Starting Point for Draft Objectives for Our Plan

As a starting point, staff proposes the following two draft, interim quantifiable objectives for the Energy Management Plan. These objectives reflect consideration of the proposed projects included in our Capital Improvements Plan for Fiscal Years 2016 – 2020, as well as the energy efficiency improvements we have made since 2010.

1. Reduce use of purchased electricity by 30% by Calendar Year 2020 compared to the Calendar Year 2010 baseline. *(As discussed in Section 3.1, electricity use during Calendar Year 2014 was almost 20% below the Calendar Year 2010 baseline level, so the above objective would amount to an additional 10 percent reduction in electricity use by 2020.)*

2. Reduce use of purchased natural gas by 5% by Calendar Year 2020 compared to the Calendar Year 2010 baseline.

We also propose the following programmatic objectives as a starting point for Board consideration:

1. Complete energy efficiency lighting retrofits at the Administration Building, Operations Center, Water Treatment Plant, and Wastewater Treatment Plant by FY 2018, with the target of achieving a financial payback within five (5) years of completing those improvements.

2. Beneficially use all WWTP biogas by 2022, provided the preferred strategy is projected to have a positive payback within the expected useful life of the required equipment.

3. Retain a qualified consultant to complete a study of the heating and air conditioning systems at the Administration Building by FY 2017 to determine the scope, costs, expected energy savings from improving or replacing those systems.

4. Retain a qualified consultant to help guide and implement major energy efficiency lighting projects at our facilities.

5. Formally engage local governments and partners in discussions about potential development of a biogas-to-energy project at the Mason Farm WWTP, such as a combined heat and power project or treating and compressing biogas for use as vehicle fuel.

6. Seek proposals for third-party development of solar power systems on OWASA property, such as rooftop solar at the Administration Building.

Additional objectives can be considered as we and the community consider the results of the technical analyses of alternative energy efficiency and renewable energy strategies.

6.0 Next Steps

Staff will revise this TM to address the NRTS Committee's comments, questions, and guidance. If needed, we will have a follow-up meeting with the Committee to review and discuss the revised TM prior to submittal to the Board of Directors.

After this TM is finalized, staff will proceed to evaluate alternative strategies for meeting proposed goals and objectives established by the Board. Those alternatives will be summarized in TM #2, which will be presented in draft form for review and guidance from the Committee.

In accordance with the community engagement plan for this project, staff will post this document on our website, and provide it to stakeholders on our project distribution list. We will include information about the date and time at which this will be discussed by the Committee and Board of Directors, and ways that interested citizens can provide the questions, comments, and feedback regarding our efforts.

Acronyms Used in Technical Memorandum #1

BTU	British Thermal Unit (a measure of the heating value, or energy content, of fuel. One BTU is the amount of energy needed to heat one pound of water by one degree Fahrenheit.)
B-20	A blend of diesel fuels that consists of 20% biodiesel and 80% petroleum diesel (B-20 is the most common biodiesel blend in the United States)
CO_2	Carbon Dioxide, a naturally occurring chemical compound that is also a major greenhouse gas
CY	Calendar Year
E-10	A blend of gasoline composed of 10% ethanol and 90% gasoline (E-10 is classified as "substantially similar" to gasoline by the U.S. Environmental Protection Agency (EPA) and is legal for use in any gasoline-powered vehicle; however, it does not qualify as an alternative fuel under the Energy Policy Act of 1992)
EMP	Energy Management Plan
EUI	Energy Use Intensity (for this report, Energy Use Intensity refers to the units of energy required per 1,000 gallons of drinking water produced and wastewater treated)
GHG	Greenhouse Gases, which are gases that trap heat in the atmosphere (for this report, GHGs are expressed in carbon dioxide equivalents)
kWh	Kilowatt-hour, which is a unit of energy equivalent to one kilowatt of power expended for one hour of time
MMBTU	One million British Thermal Units
MSL	Mean Sea Level
NRTS	Natural Resources and Technical Systems Committee
OWASA	Orange Water and Sewer Authority
TM	Technical Memorandum
VFD	Variable Frequency Drive
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

Estimated Range of Energy Savings for CIP Projects Planned for FY 2016 - FY 2020

CIP No.	Project Name	Estimated Annual Energy Savings	Energy Units	Comments
270-11-b	University Lake Pump Station - Replace Pump Nos. 1 - 3 pumps & motors	6,400	kWh	200, 200, & 400 HP pumps, install VFDs; assumed 10% reduction in kWh use at station since station use has already dropped due to new variable speed pump
270-16	Cane Creek Pump Station Rehabilitation/Replacement	112,000	kWh	Motor rewind plus install VFDs; assumed 10% reduction in total use at station
270-27	Cane Creek Reservoir Office HVAC Replacement	5,200	kWh	New heat pump system; assumed HVAC accounts for 50% of total kWh use office, then assumed 40% reduction in that portion of kWh use
272-36	WTP Lighting Improvements	186,500	kWh	Assumed 50% of Triad Energy's prior estimated savings
275-76	Advanced Meter Infrastructure (AMI) System	TBD	vehicle fuel	
277-01	Pump Station Recapitalization	TBD	kWh	No specific projects identified at this time
277-24	Eastowne Pump Station Rehabilitation	1,600	kWh	Assumed 3% reduction in kWh use at station; install VFDs
277-31	Rogerson Drive Pump Station Rehabilitation	TBD	kWh	Install 2 new VFDs for soft starts; savings may be offset by additional equipment
277-33	Chapel Hill North Pump Station Rehabilitation	1,800	kWh	Assumed 10% reduction in kWh use at station; new controls
277-36	Heritage Hills Pump Station and Eubanks Road Pump Station Rehabilitation	4,700	kWh	Assumed 7% reduction in kWh use at stations; install PLC & VFD
278-43	Mason Farm WWTP Biogas-to-Energy Combined Heat and Power		kWh	Assumes 275 KW engine; also
278-54	WWTP Intermediate Pump Stations (IPS) Rehabilitation/Replacement	TBD	kWh	This is just the study phase; could identify potential savings
278-59	WWTP and WW PS LED Lighting Upgrades	114,400	kWh	Assumed 50% of Triad Energy's prior estimated savings
278-67	WWTP Boilers Control Systems Upgrade	TBD	therms	May enable more efficient use of biogas
278-69	WWTP Biosolids Conveyance and Loading Improvements	TBD	vehicle fuel	Biosolids transport requirements would be reduced
278-71	WWTP Filtrate Side Stream Treatment	250,000	kWh	Based on preliminary guidance from Brown and Caldwell
280-06	Administration Building HVAC System Upgrade	TBD TBD	kWh therms	Study will inform savings estimate

682,600 Estimated annual kWh savings
3.1% % of 2010 kWh use - 22,366,547