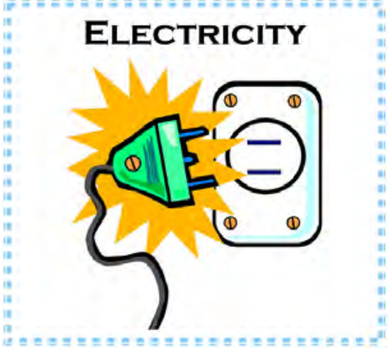
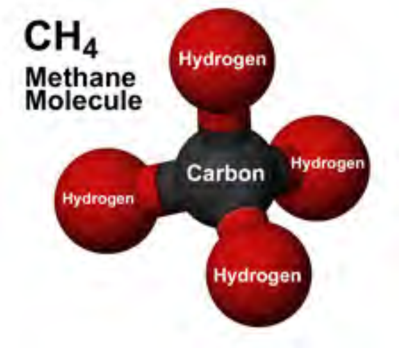
Energy Savings at the City of Montpelier Water Resource Recovery Facility

June 2015





City of Montpelier Water Resource Recovery Facility

2008 average daily electric usage was 5,040 kilowatt-hours

2013 average daily electric usage was 4,230 kilowatt-hours (16% reduction)

Second half of 2014 was 3,350 kilowatt-hours

34% reduction since 2008, which should translate into ~$75,000 year in savings

Oil usage reduced over 50% from 2010 to present

Facility Parameters

- 1964 Primary Facility, two 123,000 gallon anaerobic digesters
- 1982 Secondary Treatment
  - 3.97 Design Flow
  - BOD 3,640 lbs/day
  - TSS 3,960 lbs/day
- 1999 Anaerobic digesters reconditioned/Komline Sanderson Belt Filter presses (two, one GBT)
- 2001 330,000 gallon anaerobic digester
- 2002 Phosphorus upgrade 0.8 mg/L phosphorus limit (4.4 mg/L 2014 influent average)
- 2002 Septage/Leachate receiving

- 2007 UV disinfection from gaseous chlorine and gaseous sulfur dioxide
- 2008 53 kW solar panel system/effluent pump station
- 2008 Staff reduced from 7 to 6 operators/ $300,000 yearly deficit
- 2009 6 to 5 operators
- 2010 5 to 4 operators/I became Chief Operator/Energy Conservation enacted/ increased septage leachate receiving/cross training/**better morale**

3.2 Preliminary Treatment

As raw wastewater flows into the treatment plant site, it is directed to a step screen to remove rags and debris from the wastewater. The Huber step screen was installed as part of the Headworks upgrade project in 2007. The unit uses a low horsepower drive motor intermittently that is activated based on differential level across the screen. The screenings are deposited into a wash press and conveyed to a bin for disposal.

After screening the flow enters an aerated grit chamber where low-pressure air is introduced into the tank through course bubble diffusers with a 3 hp blower that operates continuously (the blower is located in the Secondary Building). The air is used to prevent lighter organics from settling as the flow moves through the chamber while the heavier grit settles out and is collected in the tank hopper. Based on power measurements, the on-line blower was drawing 1.8 kW or 15,768 kWh annually.

One of two available 15 hp grit pumps is activated 4 hours/week to remove the grit from the chamber. The grit is pumped through a low hp classifier/cyclone where the grit is separated from the flow and conveyed to a bin for disposal. The remaining flow stream is redirected back to the treatment process. With the short run time, the overall energy use of the pumps is minimal (1976 kWh annually). However, normal operation is to activate the grit pumps during the day when electrical demand is highest. This mode of operation is adding another 9.5 kW of demand that could be avoided if by alternating equipment activation with the dewatering system operation. The savings for this project is reviewed in OM #7.

3.3 Septage/Leachate

The City accepts a significant amount of septage and leachate at the facility. This flow is first discharged through a Lakeside screen receiving system before being directed with motorized valves to either the leachate or septage tank. The screen is activated only when flow is discharged into the unit and is powered by a low horsepower motor.

Two 50,000-gallon tanks are used for accepting leachate and septage. Each tank is equipped with three 3 hp mixers that are activated and deactivated based on level controls. The mixers have low energy use and are only activated when required.

Accepting septage and leachate flow creates a significant revenue source for the facility. However accepting this waste also requires a tank-cleaning cost of $4,000 every 3-4 months. To help extend the time in between cleanings, the facility uses a 40 hp blower continuously to keep the contents mixed. Based on a power measurement of 20.9 kW, the blower uses over 183,084 kWh in annual energy use.

3.4 Primary Treatment

After grit removal, flow is directed to a splitter box where it flows to two 79' long x 25' wide parallel rectangular primary sedimentation basins with an average depth of 8'. Each clarifier has a 1 hp collector drive that operates only when the primary sludge pumps are operated. The tank systems include a scum/sludge traveling bridge collector, weir collection system and discharge channel. Solids are pushed to the south end of the tanks by the moving bridges and conveyed to the tank hopper with the cross collectors.

The facility does not typically measure primary effluent BOD. However in 2006, primary effluent BOD measurements were taken for several weeks. The measurements indicated that BOD removals were approximately 50%, which is higher than most New England facilities that are typically in the 30% to 40% range. From an energy perspective, the primary treatment process can be one of the most important systems in the plant. The higher the BOD removal efficiency of the primary clarifiers, the lower the energy needed for the higher energy biological process. In addition to reducing aeration system energy, higher BOD levels also increasing the primary to secondary sludge ratio, which can improve digester performance (discussed more in digester section) and dewatering solids.

Settled primary sludge is pumped from the sedimentation basins to Digester #3 with Penn Valley diaphragm pumps equipped with 15 hp motors. The pumps are operated 3-1/2 hrs/day, 7 days/week. As discussed for the grit pumps, if these pumps can be alternated with other non-critical process equipment, peak demand costs will be reduced. This is reviewed in OM #7.

3.5 Lifting Screw Pumps

After primary treatment, flow is directed to the screw pump distribution channel where three Archimedes screw pumps are available to lift the flow approximately 25 ft to the aeration system. The screw pumps are rated for a maximum flow of 4200 gpm (6 mgd) at 39 rpm and are belt driven with a 40 hp motor and gear reducer. The system was originally designed to have one pump operate for normal flows and when the sump level exceeded 4,200 gpm to automatically activate a second screw pump.

At the time, activation of the second pump is done manually when high flows are anticipated and during the winter months since the off-line pump can accumulate ice that creates start-up problems. Typically the staff activates a second pump in December and runs it continuously until March to avoid ice issues.

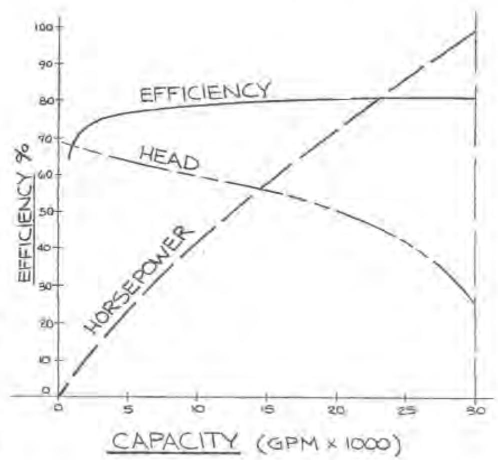
A more efficient system would include covers over the screw pumps to protect the units from ice build-up (which Barre VT uses on its screw pumps) and an automatic control system to activate the second pump only when required. However, as shown on the sample performance curve, screw pumps have a unique characteristic that automatically reduces motor load as flows decrease and maintains a fairly high efficiency even down at low loads.

During our site visit we collected flow and kW data to estimate screw pump efficiency (one pump on line). This calculation was based on the following measurements:

Measured Power: 9.7 kW
Influent Flow: 1.8 mgd (1250 gpm) & Lift: 25'
Efficiency: Motor: 90%, Belt drive: 95%,
Gear Drive: 97%

$$\text{Pump Efficiency} = \frac{1250 \text{ gpm} * 25' * .746}{3960 * 9.7 \text{ kW} * 86\% \text{ eff.}}$$

Pump Efficiency = 71%



With the existing pump loading at only 30%, the pump efficiency appears to be reasonable. As can be seen on the typical performance curve this is expected for this type of pump. To gain an increase in equipment system efficiency we have recommended replacing the existing belts with cog type belts to gain approximately 3%. This measure is reviewed in OM #6.

3.6 Aeration System

The aeration system consists of four parallel tanks, fine bubble diffusers, and four positive displacement blowers with a dissolved oxygen control system.

Each of the aerations tanks measures 39' x 39' x 18' deep and all four tanks are used year round. The 9" EPDM fine bubble diffusers were installed in 2005 and appear to be in fair condition based on the bubble patterns in the tank. The oxygen transfer efficiency (OTE) of the diffusers was also verified to be similar to new condition based on comparing process loads with estimated airflow delivered by the blowers. This simple comparison estimated the diffuser OTE to be approximately 2 % per foot of submergence or 34% based on a diffuser depth of 16.5'.

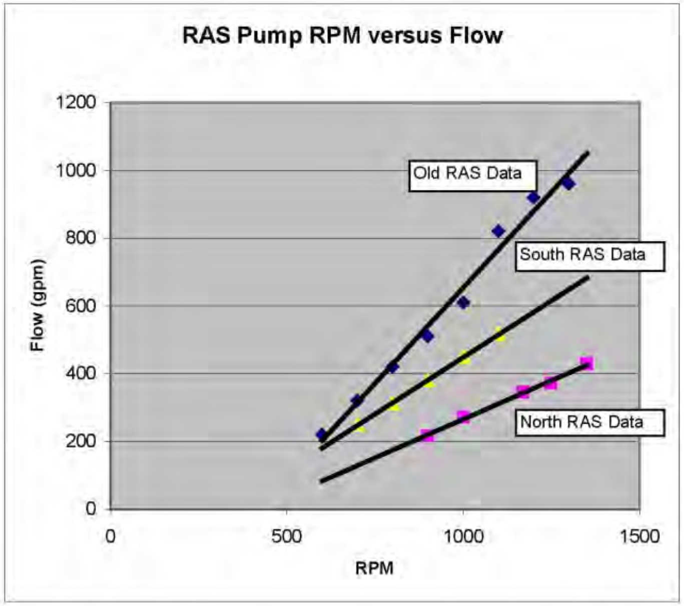
Air is supplied to the diffusers with two 75 hp 412 J Roots blowers equipped with VFDs and one 40 hp Roots 418 J blower unit also equipped with a VFD (this unit is run full speed). Normal operation is to operate one 75 Hp unit during the cold weather months and one 75 hp and 40 hp blower in parallel during warm weather (approximately 8 months).

3.7 Secondary Clarifiers & RAS Pumps

After the aeration system, flow is directed to two 76' diameter secondary clarifiers with a side water depth of 14'. The secondary clarifiers are a low energy process that removes suspended solids from the effluent prior to discharging to the disinfection system. Each secondary clarifier uses a 1 hp collector drive to collect the settled sludge and operates continuously. This low energy system does not contribute significantly to overall facility energy use.

A portion of the sludge settled in the clarifier is returned to the aeration tanks with the return activated sludge (RAS) pumps. Each clarifier uses one 25 hp RAS pump equipped with VFDs that is adjusted by facility staff to maintain a suitable flow rate for the process. As shown in Figure 3.6, with the accuracy of the existing flow meters questionable, the staff was using a chart put together years ago for a general guide on what to expect for flow at various RAS speeds. However, during out site visit we used a portable flow meter and found that the existing pump flows were less than expected as shown below.

Figure 3.6: SCADA Aeration Screen



The above data shows that the RAS pumps appear to be operating at lower flows than the original design, but given the low average energy use (less than 4 kW) measured for the pumps, we have not recommended improving the pumps as long as the flow is adequate for process requirements.

3.8 Disinfection

After the secondary clarifiers, flow is directed to the UV disinfection system. The "C-3" 150 system installed at the facility is manufactured by Calgon and includes two parallel channels with four banks. Bank 1A and 1B is located in the first channel and Banks 2A and 2B is used in the second channel. Each bank has vertical modules that secure the lamps. The original design included controls to activate and deactivate banks as needed based on flow. The controls also include a UV intensity monitor that can automatically vary the output of the bulbs as required. A summary of system specifications obtained from Calgon is provided below.

Table 3.8: UV System Parameters

UV System Parameter	Value
Peak Flow Design	12 mgd
Average Flow Design	2.0 mgd
Number of Channels	2
Number of Banks/Channel	2
Number of Racks/Bank	5
Number of Lamps/Rack	14
Total Number of Lamps	280
Wattage of lamps	180 Watts
Total Power Consumption per Bank	12.65 kW

During our site visit we measured 10.8 kW for Bank 2A and 10.6 kW for Bank 2B. Each of these banks should be using approximately 12.65 kW at full power. The lower power draw could be due to a slightly lower intensity setting or the possibility of several bulbs not working.

Based on discussions with Calgon, they believe that the existing flow controls are operable and that there may be some hardware issues that need to be resolved to allow the system to operate as designed. They indicated that if the system controls are working properly, for the average 2012/2013-plant flow of 1.86 mgd, one bank should be activated with bulbs at ~60% intensity. Having the system operate at this level would draw approximately 8.6 kW instead of the current power draw of 21.4 kW, which would save 112,128 kWh annually. This improvement is reviewed in ECM #3.

3.9 Storm Pump System

The storm water pump system is used when flow exceeds 11.0 MGD. The flow is pumped with two vertical pumps if effluent flows exceed a weir positioned in the discharge channel. Facility staff indicated that these pumps are rarely used and do not contribute significantly to energy use.

We would expect the electric unit heater in the station to use more energy over the course of a year than the pumps. To keep this energy use to a minimum we recommend setting the thermostat to maintain 45 to 50 degrees.

3.10 Biofilter Odor Control System

The biofilter odor control system is manufactured by Biorim and located adjacent to the primary sedimentations basin. Foul air is exhausted from the covered leachate/septage tanks and the headworks building to the unit.

The Biorim system consists of a 30' container that holds inorganic biofiltration media. The media is designed to perform consistently for a period of 10 years. This can be compared to a typical biofilter system composed of organic media where the media must be replaced every three to four years.

The Biorim system equipment includes an irrigation system and humidification chamber where heated water is circulated from a storage tank with a 3 horsepower pump system. The current cycle is programmed to activate the irrigation pump for 5 minutes and then shut the unit off for 10 minutes. The water is maintained at a temperature of between 80 and 90 degrees, which requires a heating element to operate on a regular basis during the cold weather months. During our site visit, we measured a 10 kW power draw.

The exhaust fan is driven by a 20 hp motor equipped with a VFD that draws the air continuously through the system for treatment. We observed a VFD speed of 33 Hz which facility staff had taken the initiative to reduce to optimize system energy use. At this speed, the motor was only drawing approximately 4.0 kW.

Although facility staff has optimized fan operation, we believe that the heater is set higher than needed for the process. During our second visit, the heater was maintaining a lower temperature (approximately 50 degrees) due to an adjustment from the service rep. If this temperature is maintained, we anticipate reducing heater-operating hours from approximately 3500 hours to 1000 hours. Savings for this adjustment is presented in OM #1.

3.11 Sludge Thickening

Before the waste activated sludge is pumped to the digesters it is thickened with the gravity belt thickener (GBT). Normal operation is to operate the WAS pumps and the GBT 5 hours/day, 5 days/week. This thickens the waste activated sludge from 1 % to approximately 6% solids. After thickening, the sludge is deposited in the TWAS tank and aerated with a 5 hp blower approximately 8 hours/day, 5 days/week before being pumped to Digester #3. This is a low energy process with minimal energy use.

3.12 Sludge Dewatering

The facility uses one out of the two available belt filter presses 8 hrs/day 5 days week to dewater the digester sludge. In the past, two units were operated at a flow rate of 130 gpm. However this was improved by increasing the flow to 260 gpm to process the same amount of sludge with only one unit.

A large heat recover unit equipped with supply and exhaust fans is used to ventilate the building 8 months out of the year when the press is operated.

3.13 Anaerobic Digesters

The anaerobic digester system consists of one heated primary tank (#3) and two secondary tanks (#1 and #2) that are not heated. Digesters #1 and #2 are 30' in diameter and Digester #3 is 35' diameter. All three units are equipped with floating covers and gas mixing systems Digester #1 and #3 are equipped with sludge recirculation/heat exchanger systems.

Primary and thickened secondary sludge is pumped intermittently to Digester #3. As discussed previously, settled primary sludge is pumped from the primary sedimentation basins to Digester #3 approximately 3-1/2 hrs/day, 7 days/week. Thickened waste activated sludge is pumped by one of two pumps 5 hours/day, 5 days/week. When sludge is pumped from the primary and TWAS sludge pumps, it is directed through the heat exchanger for preheating before being distributed to the primary digesters. To maintain tank temperature, controls activate the sludge recirculation pumps to circulate sludge through the heat exchanger to maintain the sludge at 95 deg F.

From Digester #3 the overflow is directed to Digester Tanks #1 and #2. These tanks are primarily for solids/liquid separation and are not heated. As sludge accumulates in these tanks it is pumped to the belt filter press for dewatering.

Excess gas from the digesters is vented through the pressure relief valve on each cover since the flare has not worked for years. Recent quotes to install a new waste gas burner and pressure relief/flame trap range from $45,000 to $65,000. Although there is no energy savings associated with this improvement, flaring the gas instead of releasing it directly to the atmosphere provides a greater environmental benefit by destroying the methane and converting it to carbon dioxide. Even though carbon dioxide is also a greenhouse gas, methane is over 20 times more potent than CO_2. This improvement is summarized in OM #2. Digester gas flow is currently not recorded since the existing meters are not accurate. To determine typical values, we went back to 2004 and 2005 for digester gas flow data. This data is summarized below

Easy stuff

- Fixed Digester Gas System
- New burner head installed on boiler
- Cost was approximately $10,000
- Environmental benefits as the flare had not worked since 2004
- No maintenance on digesters since 2001
- Oil usage dropped from over 30,000 gallons a year to approximately 15,000 gallons a year
- Installed $5 toggle switch to lock out oil in summer

Heating Generator Building

Heating Generator Building

- New Assistant Chief Operator/mechanic for previous 35 years stated that we should look into getting a block heater for the generator as the building is uninsulated and we were using 50 to 100 gallons of oil from the generator belly tank heating the building. Turned down thermostat to 40 degrees F.

Email from Efficiency Vermont 2010

- Good to meet you yesterday. Thanks for the informative tour of your plant. There are opportunities for energy savings we should pursue.
- The data loggers are available at this time and I think we should get them installed as soon as we can. I will scheduled 4 loggers. I think we should install them on the 75 hp blower, 40 hp blower and the screw. We can discuss the 4th meter at the time of installation. It takes about 15 minutes to install a meter. The majority of that time is opening the cabinet. The meters will measure volts, amps, power factor and kW with a date and time stamp. I will schedule them for at least 3 weeks. Also I will bring a spot kW meter so we can measure other loads that do not change with time. Specifically that mixer you pointed out that no longer has a function. Incidentally if that 2hp mixer is loaded to 75% it costs $1,591/year to operate. I realize there is an element of risk and some cost to remove the mixer thus I am willing to pay you to remove it.
- Attached is our metering agreement. I will need a signed copy before the meter installation.

Chemical Mixer

- Mixer was at discharge of aeration tanks to mix sodium aluminate as it was added to process
- Cost approximately $1,500 per year to operate
- Concern about process as turbidity had gone up before, talked to Lab Tech
- Efficiency Vermont paid $350 to remove

ENERGY EVALUATION

Montpelier Wastewater Treatment Facility & Pump Stations

City of Montpelier
949 Dog River Road
Montpelier, Vermont 05602

PROCESS ENERGY SERVICES, LLC
WATER ♦ WASTEWATER ♦ INDUSTRIAL

The objectives of the report included the following:

- Provide an overview of facility systems to determine how electrical energy, and fuel oil is being used at the facilities.

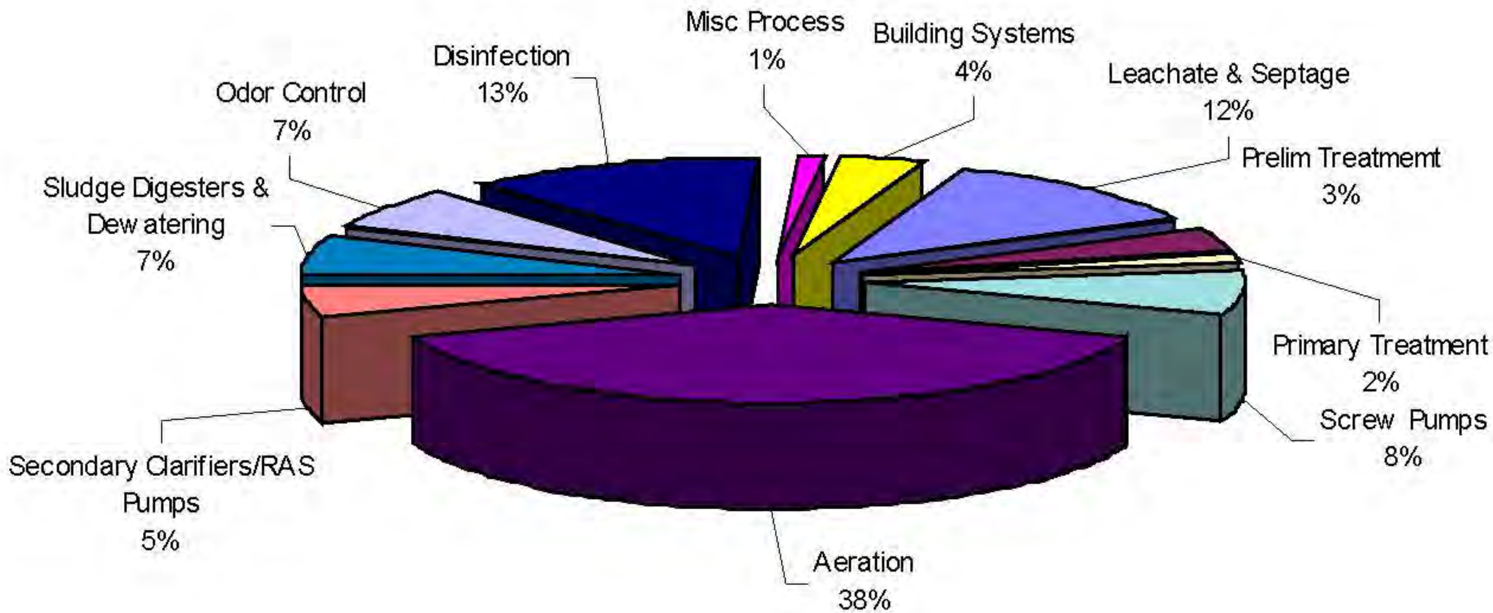
- Assemble energy, flow and equipment operational information based on the data collected to develop an energy balance that will serve as a baseline of system energy use.

- Identify and develop new potential cost saving projects.

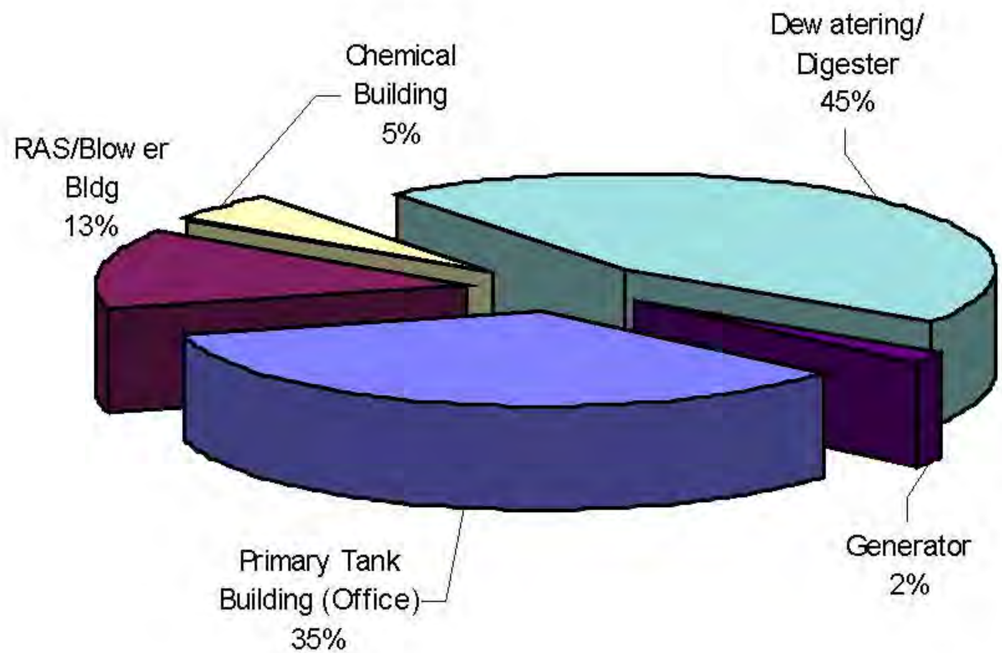
- Package the improvements as an interactive group of cost effective projects.

As cost savings projects were developed, each measure was prioritized based on ease of implementation, cost effectiveness and ability for each project to support subsequent measures. The projects have been categorized as energy conservation measures (ECMs), for projects that require a capital investment, operational measures (OMs) for fast payback improvements that can be done at minimal cost or projects that have long term benefits but savings are not easily quantified, and energy supply measures (ESMs) for improvements that may reduce energy costs without reducing energy consumption (i.e. alternative energy supplier and rate schedule changes). We have also included several energy management practices (EMPs) that are essential for a successful energy management program.

Facility Energy Use



Facility Fuel Use



PROJECT EVALUATION ECONOMIC SUMMARY

2012/2013 Annual Electric Energy Costs

Wastewater Treatment Plant	$ 193,490
PS #1 Lower State Street	$ 1,125
PS #2 Lower State Street Station	$ 787
PS #3 Barre Street Station	$ 1,273
PS #4 Interstate Station	$ 1,944
PS #5 O'Brien Station	$ 1,471
PS #6 Cummins Street Station	$ 404
PS #7 Ballfield Station	$ 807
PS #8 Hebert Rd Station	$ 1,129
Total	**$ 202,430**

201/2013 Annual Fuel Oil & Propane Energy Costs (WWTF)

Primary Tank Building (Control Building)	$ 9,079
Secondary Tank Building (RAS/Blower Bldg)	$ 3,501
Chemical Building	$ 1,346
Garage (Dewatering/Digester)	$ 11,737
Generator	$ 402
Propane	$ 0
Total	**$ 26,065**

Wastewater Facility Projected Annual Cost and Savings Summary

	Calculated Savings	Percent of Costs
Electric Cost Savings	$ 79,094	39%
Fuel Oil Savings	$ 13,146	50%
Total Annual Savings/Percent of Total Costs	**$ 92,240**	**40%**

Project Costs/Payback

Estimated Cost of Projects	**$247,040**
Simple Payback	**2.7 Years**

Based on 604,631 kWh savings, emission unit source: U.S. EPA eGrid 2007.

Fuel Oil Reduced Emissions

Carbon Dioxide (22.2 lbs/gallon)	91,198	lbs/year
Sulfur Oxides (0.142 lbs/gallon)	583	lbs/year
Nitrous Oxides (0.02 lbs/gallon)	82	lbs/year

Based on 4,108 gallons of fuel oil saved, emission unit source: U.S. EPA Office of Air Quality Planning & Standards.

Some of the key building blocks of a successful energy management program include the following tasks:

- Designating an Energy Program Manager.
- Establishing an Energy Policy.
- Selecting an Energy Management Team.
- Developing a baseline of existing facility energy use to track energy use/process data.
- Performing a comprehensive energy evaluation.

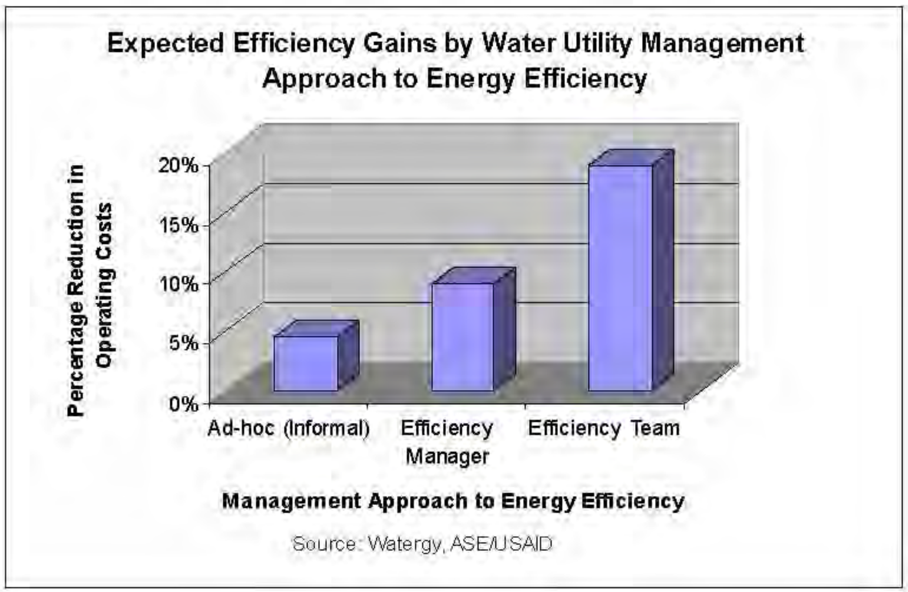


Table 2.1: Facility Benchmarking

Name of Facility	Annual Flow (MG)	Annual Energy Use (kWh)	kWh/MG
VT WWTF (from EPA Database)	693	754,000	1088
MA WWTF (from EPA Database)	584	995,880	1705
York, ME WWTF (2011 data)	470	812,400	1,729
Lebanon, NH WWTF (2010 data)	683	1,415,200	2,072
Montpelier WWTF (2012-2013 data)	**679**	**1,652,441**	**2,434**
NH WWTF (from EPA Database)	548	1,348,200	2,460

As shown in Table 2.1, electrical energy use/million gallons treated for the Montpelier WWTF is higher than most of the plants in the EPA and Process Energy's database. This general value is a starting point to begin the process of benchmarking since it does not consider specific systems or levels of treatment for each facility. If the facility is able to implement the recommended measures in the report, the annual benchmark value will be reduced to 1543 kWh/mg, which will rank at as one of the most efficient under 5 mgd facilities in New England.

Table 3.1: Five Years of Energy Use

Year	WWTF Energy Use (kWh)	Total Flow (MG)	KWh/MG
2008	1,832,960	764	2399
2009	1,694,720	689	2460
2010	1,627,010	664	2450
2011	1,549,988	781	1984
2012/2013	1,652,441	679	2434

As shown in Figure 3.1, in 2012/2013, monthly facility energy use appears to match facility flow. There is also a minimal seasonal change indicating that electric heat does not represent a significant energy load.

Figure 3.1: WWTF 2012 Monthly Energy and Flow

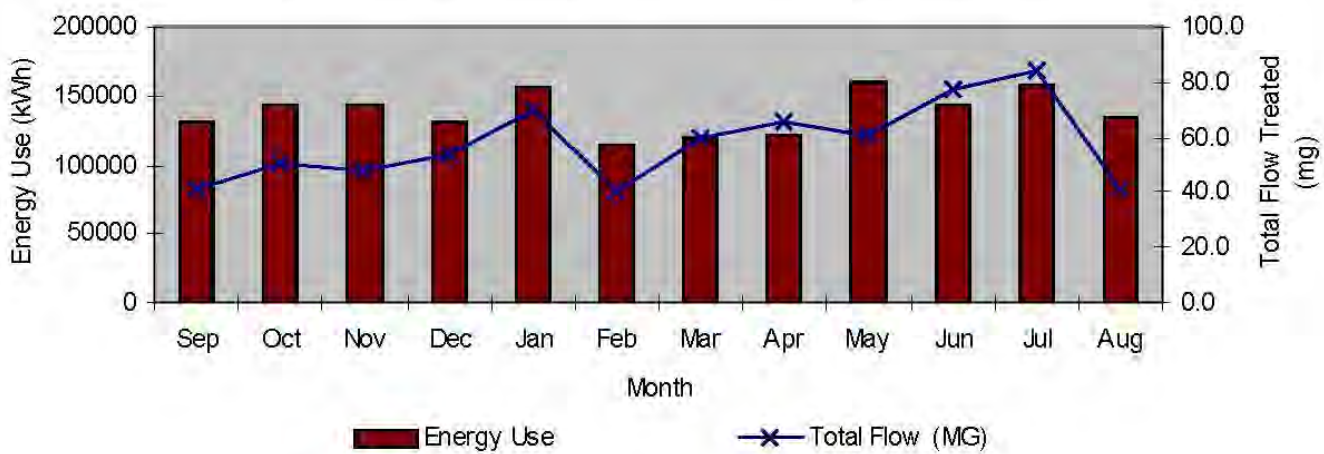
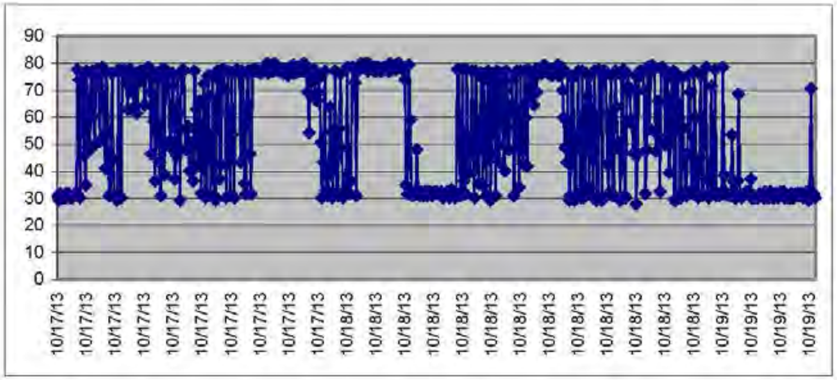


Figure 3.2: 75 hp Blower Amperage VFD Speed Overcompensation



During other days, the 75 hp blower may remain at minimum speed for the majority of the time as shown below.

Figure 3.3: 75 hp Blower Amperage VFD Speed at Minimum Level

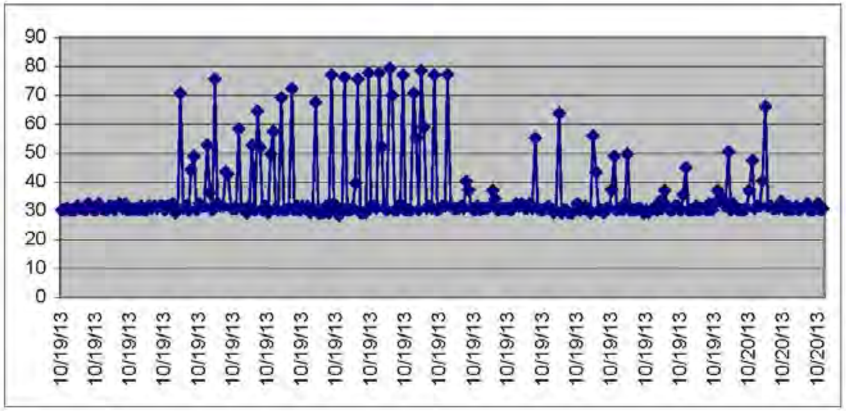


Table 3.2: 2012 Process Data Used for Baseline

2012/2013 Month	Average Total Daily Flow (MGD)	Primary Effluent BOD (mg/l)	Secondary BOD (mg/l)	Primary Effluent Ammonia (mg/l)	Final Effluent Ammonia (mg/l)	Wastewater Temperature (deg C)
Sep-12	1.42	104.8	7.0	28.5	5.0	19.6
Oct-12	1.68	171.2	5.6	28.5	5.0	17.5
Nov-12	1.50	171.6	6.0	28.5	5.0	14.1
Dec-12	1.78	134.8	10.0	28.5	5.0	*10.7*
Jan-13	1.74	69.2	10.0	28.5	5.0	8.9
Feb-13	1.49	84.8	14.0	28.5	5.0	8.1
Mar-13	2.06	88.0	12.0	28.5	5.0	8.1
Apr-13	2.25	100.4	15.0	28.5	5.0	9.6
May-13	1.84	171.2	12.0	28.5	5.0	14.1
Jun-13	2.67	116.4	7.0	28.5	5.0	15.8
Jul-13	2.48	90.0	5.0	28.5	5.0	18.5
Aug-13	*1.43*	118.8	10.0	28.5	5.0	19.4

Average facility dissolved oxygen data from the monthly operating reports is shown in Table 3.3.

Table 3.3: DO Levels

2012/2013 Month	DO #1 (mg/l)	DO #2 (mg/l)	DO #3 (mg/l)	DO #4 (mg/l)	Average DO (mg/l)
Sep-12	6.0	4.3	6.5	7.8	6.2
Oct-12	6.4	4.2	6.4	7.9	6.2
Nov-12	5.3	3.6	3.7	6.0	4.7
Dec-12	4.7	2.9	3.7	4.0	3.8
Jan-13	2.7	3.6	4.8	2.8	3.5
Feb-13	4.5	4.0	4.5	2.4	3.9
Mar-13	4.9	4.2	3.8	3.7	4.2
Apr-13	4.5	4.1	4.6	4.6	4.5
May-13	4.3	4.5	6.2	7.1	5.5
Jun-13	3.9	3.9	4.7	7.1	4.9
Jul-13	3.8	4.2	4.2	6.3	4.6
Aug-13	4.0	3.1	4.2	5.4	4.2

Model calculations were done using the parameters in Table 3.4.

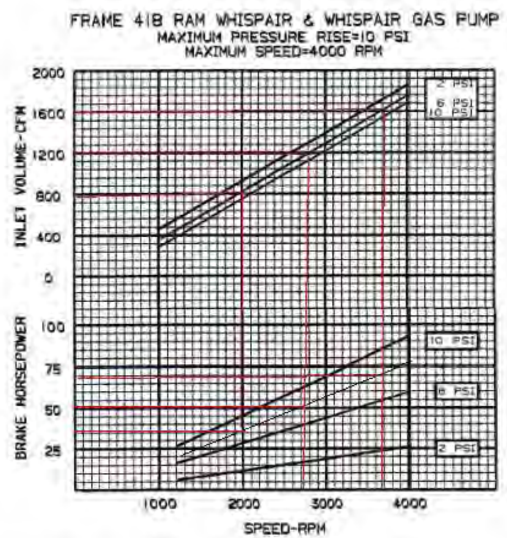
Diffuser SOTE was estimated to be 33% based on 2.0%/ft and a diffuser depth of 16.5 (18' SWD). Using process loads, SOTE, and dissolved oxygen levels, we estimated monthly airflow in Table 3.5.

Table 3.5: Calculated Airflow

2012/2013 Month	SOTR	SOTE	DO (mg/l)	Airflow (scfm)
Sep-12	22,351	33%	6.2	2,771
Oct-12	29,105	33%	6.2	3,608
Nov-12	15,649	33%	4.7	1,940
Dec-12	13,294	33%	3.8	1,648
Jan-13	8,439	33%	3.5	1,046
Feb-13	8,119	33%	3.9	1,007
Mar-13	12,157	33%	4.2	1,507
Apr-13	15,883	33%	4.5	1,969
May-13	24,402	33%	5.5	3,025
Jun-13	25,699	33%	4.9	3,186
Jul-13	19,393	33%	4.6	2,404
Aug-13	11,460	33%	4.2	1,421

To calculate average blower energy use, we used the blower curve below to develop a kW versus airflow relationship. During the summer months, the total airflow value was adjusted based on the constant speed operation of the 40 hp 416J blower unit.

Figure 3.4: 75 hp Blower Curve



A summary of baseline blower energy use is shown below.

Based on the data in Table 3.12 we calculated average Btu/hr values to estimate a sludge heating requirement of 164,175 Btu/hr (using 2004/2005 gas flow data) as shown in Table 3.13.

Table 3.13: Digester Sludge Heating Requirements

2004/2005	Warm Weather Heat for Sludge (Btu/hr)	Cold Weather Heat for Sludge (Btu/hr)	Warm Weather Digester Heat Loss (Btu/hr)	Cold Weather Digester Heat Loss (Btu/hr)	Sludge Heating Requirements (Btu/hr)	Excess Gas for Space heating (Btu/hr)
Jul-04	80,580		30,020		110,600	397,449
Aug-04	89,533		33,355		122,889	430,558
Sep-04	94,010		35,023		129,033	443,378
Oct-04		112,812		73,946	186,758	473,746
Nov-04		125,347		82,162	207,509	418,719
Dec-04		131,614		86,270	217,884	506,656
Jan-05		137,882		90,378	228,259	494,259
Feb-05		137,882		90,378	228,259	395,659
Mar-05		106,545		69,837	176,382	412,997
Apr-05	80,580		30,020		110,600	584,087
May-05	85,057		31,687		116,744	581,794
Jun-05	98,487		36,691		135,177	396,420
Total	**89,533**	**125,347**	**33,355**	**82,162**	**164,175**	**461,310**

Using the above data, the excess gas available compared to the space heating required (based on 2012 fuel use) for the dewatering building is shown below in Table 3.14. Based on the estimated gas data, it appears that no fuel oil would be required, however as shown below in 2012-2013 this was not the case.

Table 3.14: Dewatering/Digester Building Heating Requirements

Month	Gas Available for Space heating (Btu/hr)	Estimated Gas required for Space Heating (Btu/hr)	2012-2013 Gallons of Supplemental Fuel	Fuel Oil Heat Value (Btu/hr)	Excess Gas Available (Btu/hr)
Jul	397,449		225.0	58,685	456,134
Aug	430,558		425.0	58,685	489,243
Sep	443,378		300.0	58,685	502,063
Oct	473,746	38,356	0	58,685	494,074
Nov	418,719	76,712	650.0	58,685	400,692
Dec	506,656	95,890	822.7	58,685	469,451
Jan	494,259	134,247	0	58,685	418,698
Feb	395,659	134,247	499.9	58,685	320,098
Mar	412,997	95,890	215.2	58,685	375,791
Apr	584,087	57,534	129.9	58,685	585,238
May	581,794		0	58,685	640,479
Jun	396,420		400.0	58,685	455,105
Total/Avg	**461,310**	**90,411**	**3,668**	**58,685**	**467,255**

We believe the reason supplemental fuel oil is required is due to venting of the gas. If the above data is close to what how the system is currently operating at, approximately 74% of the gas generated may be vented.

Using the 2004-2005 gas flow data and pricing from a recent evaluation, we developed a preliminary cost benefit analysis for the project. As shown in Table 3.15, the project is still not cost effective even if gas use was increased by 50% (and the C30 unit was upgraded to a C65 kW unit)

Table 3.15: Microturbine Evaluation Cost Benefit Summaries

Project Parameters	Using 2004-2005 Data	Increase Gas Production by 50%
Total Gas Production	9,127,072	13,690,608
Annual kWh Projected Energy Savings (90% uptime)	236,520	512,460
Annual kWh Parasitic Energy Use (8 kW)	70,080	70,080
Total Electric Cost Savings	$16,644	$44,238
Annual Maintenance Costs ($10,000 based on Essex, VT)	($10,000)	($10,000)
Supplemental Heating for Digesters	0	0
Net Annual Savings	$6,644	$ 43,090
Estimated Project Cost	$550,500	$619,250
Simple Payback	N/A	14.4 years

A more detailed review of the project is shown in NR #1. Based on the long payback and the uncertainty of the gas flow data, the project is not recommended at this time.

RECOMMENDED COST SAVING PROJECTS

No	Cost Saving Measures	Fuel Savings (gallons)	Annual Energy Savings (kWh)	First Year Annual Savings ($)	Initial Cost ($)	Adjusted Simple Payback (yrs)
	ENERGY MANAGEMENT PRACTICES					
EMP 1	Formalize Energy Management Program	--	--	--	--	--
EMP 2	Benchmark System Performance	--	--	--	--	--
	Total for EMPs	--	--	--	--	--
	OPERATIONAL MEASURES					
OM 1	Reduce Biofilter Water Temperature	--	24,500	$1,960	--	--
OM 2	Digester Gas System Improvements	--	--	--	$100,000	--
OM 3	Optimize Use of Honeywell EMS	1,271	--	$4,067	--	--
OM 4	Pump Station Heater Adjustments	--	6,900	$1,380	--	--
OM 5	Install Overflow Pump Gravity Line	--	1,095	$668	$500	< 1 year
OM 6	Screw Pump Synchronous Belts	--	2,500	$258	$300	1.2 years
OM 7	Alternate Equipment Operation	--	--	$3,866	--	--
	Total for OMs	**1,271**	**34,995**	**$12,199**	**$100,800**	**--**
	ENERGY CONSERVATION MEASURES					
ECM 1	Septage/Leachate Tank Water Jet System	--	183,084	$26,533	$53,750	2.1 years
ECM 2	New Aeration System Controls	--	274,424	$28,010	$34,500	1.2 years
ECM 3	UV Control System Improvements	--	112,128	$9,389	$20,000	2.1 years
ECM 4	Digester Underground Heating Loops	2,837	--	$9,079	$33,125	3.6 years
	Total for ECMs	**2,837**	**569,636**	**$73,011**	**$141,375**	**1.9 years**
	ENERGY SUPPLY MEASURES					
ESM 1	Power Factor Correction Capacitors	--	--	$2,300	$4,865	2.1 years
ESM 2	Participate in Demand Response Program	--	--	$4,730	--	--
	Total for ESMs	--	--	**$7,030**	**$4,865**	< 1 year
	Total Electric Energy Savings & Cost	--	604,631	$79,094	$213,915	2.7 years
	Total Fuel Oil Energy Savings & Cost	4,108	--	$13,146	$33,125	2.5 years
	Total	**4,108**	**604,631**	**$92,240**	**$247,040**	**2.7 years**
	NOT RECOMMENDED AT THIS TIME					
NR 1	Microturbine using digester gas	--	--	$6,648	$550,500	--

3.15 Renewable Energy

In 2009, the facility installed PV solar panel arrays on several of the site buildings. The original system proposal indicated that the facility could expect to save approximately 62,191 kWh/year or $8,022/year in savings (based on $0.129/kWh).

Table 3.16: Solar PV Array Projected Original Savings

Area	Panel Rating	Original Proposal kWh Savings Estimate	Original Proposal Annual Cost Savings
Garage Array #1	16.5 kW	15,274	$1,970
Garage Array #2	16.5 kW	16,899	$2,180
Office Bldg Array	18.8 kW	19,000	$2,451
Blower Bldg Array	10.6 kW	11,018	$1,421
Total	**--**	**62,191**	**$8,022**

The actual savings for 12 months of utility bills from September 2012 to August 2013 was 45,214 kWh and resulted in a credit of $2,305 ($0.06/kWh).

Major savings

- We had operated Aeration Tank Dissolved Oxygen setpoint at 4.0 mg/L due to S. Natans. Reduced setpoint to 2.0 mg/L and closely monitor tanks
- We operate one 75 HP Aeration Roots Blower year round on VFD. For 8 months a year we operated a 40 HP Roots Blower with it. We programmed it so it is now on dissolved oxygen (D.O.) setpoint control instead of always on. This has reduced the runtime from 24 hours a day to approximately 5-10 hours per day Monday-Friday, during peak loading days and it is now off on weekends
- Turned off Bio-filter water heater, coils failed after audit
- Turned off 40 HP Blower to septage and leachate tanks; monitored results; per positive results have left it off

Savings

- Switched effluent sampling location: turned off 1.5 horsepower effluent sample pump which was operating 24 hours a day
- Eliminated the use of two positive displacement 5 HP diadisk pumps from one hour per day by adding pipe
- Replaced existing air conditioning units with energy efficient, energy star, heat pumps (August 2014) which will reduce boiler usage during fall and spring months
- The domestic hot water heater in the main office building was found to be a 240 volt unit that was improperly installed on a 208 volt breaker. The unit was removed and replaced by a tankless instant on propane

Savings

- Pump Station Heater Adjustments completed
- Honeywell thermostat settings optimized
- Transitioned to ManagerPlus maintenance program (completed January 2014) from written records, improving maintenance and thus efficiency of equipment
- Switch from V-belts to notched belts: screw pumps and ROOTS blowers
- The fan speed on the biofilter was reduced (approximately 25%) using the VFD in the unit
- Fixed leaking air blowoffs for aeration blowers
- Stopped project to heat UV building

Savings

- Installed new more efficient primary pump, 6 inch Penn Valley replacing 4 inch Penn Valley which cut pumping time down from roughly 7 hours per day to 3.5 hours a day
- Installed new RAS flow meters. Found out one pump has harder time pumping, pumps now on flow pacing control using VFD's instead of fixed speed operation, this will reduce power consumption and should thicken RAS concentrations at night which will then reduce gravity belt thickener run times
- Operated one lifting screw this last winter instead of two, rotated screws when temperature was above 32 F
- The three lifting screws are now on the transducer controls instead of the floats. Since it also all on SCADA now we were able to fine tune the on/off points and have adjustable delays so the lag screw is now activated less which also saves energy

Net Zero Montpelier selected as semifinalist in $5 million energy prize

- News Release — City of Montpelier
  Jan. 14, 2015
- Today, Montpelier officially advances to the Semifinal round of the Georgetown University Energy Prize (GUEP), a national competition that is challenging communities across the U.S. to rethink their energy use. At a press event in Washington, D.C. today, Montpelier was announced as one of the 50 communities who are leading the way on energy efficiency.
- "Montpelier has set an ambitious goal to eliminate or offset fossil fuel use in the Capital City completely in 15 years," said Montpelier Mayor John Hollar. "Supported by the Montpelier Energy Advisory Committee (MEAC), our goals will be reached as we come together as a community to change our energy use habits. The GUEP opportunity not only provides even more motivation to act but an opportunity to collaborate with two other Vermont communities to achieve our goals. We look forward to rolling up our sleeves and moving ahead."
- District Heat online winter 2014-2015, using wood chips to heat parts of City

MONTPELIER MUNICIPAL GOVERNMENT ELECTRIC (KWH) DEMAND

			FY 2011	FY 2012	FY 2013	FY 2014
TRAFFIC						
Meter Number	E14629959	Cor Elm/Sch St	2,179	2,492	2,046	2,030
	E15665566	Northfield St	10,746	10,090	9,574	9,520
	E14625655	Memorial Dr/Bailey Ave	7,459	6,546	6,041	7,374
	E15026230	19A Main St	246	61	0	0
	E14625516	78 Main/Barre St	5,242	5,142	5,220	4,761
	E14625409	Cr State/Bailey Ave	3,573	3,557	4,001	3,910
	E15764760	135 Main St	253	68	0	0
	E14627561	30 River St	1,881	1,985	1,425	1,334
	E15265356	Taylor St Traffic Lights	5,517	5,772	5,808	6,601
STREETS						
	E15204168	Stonecutters Way	18,878	18,096	18,785	13,378
	E15302203	Stonecutters Way	13,167	13,084	14,540	13,986
	E14593062	Elm St P3	21,720	24,244	25,878	24,251
	E14625553	2/20	1,082	1,701	770	404
	E14627469	Pioneer St Bridge Lights	3,352	3,676	4,491	2,715
	E14625624	Montpelier H 2 Liter Dpty	9,809	9,394	9,902	10,030
	E14709306	E State St	39,269	35,587	35,619	28,153
	E15323029	Taylor St Dpw	2,241	2,734	2,345	2,746
	E15202676	53 Main S/E State St	1,260	1,200	1,417	1,724
	E15204104	Memorial Dr Bike Path	9,402	1,017	1,114	307
	E15440700	Memorial Dr Football Field	-	-	1,550	5,460
	E14625654	Green Mtn Dr	3,654	4,012	4,056	4,102
	E15206291	Rec Cemetery Pk	270	1,447	1,705	1,644
	E14625622	Memorial Dr Dpw Office	4,795	3,909	3,859	4,054
	E14625633	Bailey Ave Bridge Lights	3,073	4,117	3,776	3,617
	E15244466	Rte 2/Route 2 Roundabout Lts	8,178	8,301	7,753	5,500
City Hall						
	E14991729	39 Main St City Hall	192,260	189,600	188,040	224,782
	E15200379	Ev Charging Station		35	1,576	3,200
Equipment						
	E15200413	111 Dog River Rd	23,520	22,960	16,480	1,880
	E15152690	745 Dog River Rd	31,280	46,800	44,640	43,360
Fire Dept.						
	E15300425	51 Main St	59,463	55,119	54,200	51,000
Police Dept.						
	E15200566	1 Pitkin Ct	141,320	149,320	142,880	144,107
Senior Center						
	E15114080	58 Barre St Panel	-	9,869	32,279	45,350
Parks						
	E15275214	Hubbard Pk Dr	1,786	2,049	1,880	1,703
Green Mt Cemetery						
	E15256204	Lower State St	8,613	6,377	8,535	11,652
Parking						
	E15266276	Main St/N Branch Lt	2,317	2,379	2,762	3,294
Sewer						
	E15112421	River St Emp Pumping Station	7,900	6,422	5,003	6,204
	E15209984	285 Barre St	6,782	6,782	6,277	6,123
	E15114065	Elm St	4,758	4,376	3,728	4,644
	E15114672	E State St	6,932	5,856	4,833	5,310
	E15224409	Jimbers Rd Pump	7,495	5,667	4,384	4,820
	E15114011	Cummings St Pump Sta	1,398	731	2,287	2,533
	E14791977	Lower State St	5,220	5,172	6,008	6,518
	E15113341	Rte 2 E Montpelier Rd	14,190	10,766	11,570	12,609
WWTF						
	102030	Dog River Rd	1,515,373	1,565,262	1,631,106	1,590,724
Water						
	E15239268	1969 Farm Tank/Garage	1,996	1,492	2,793	3,062
	E15205952	Brookfield Rd	103	299	164	176
	199023	Berlin 1 Water Filt Pl	479,480	404,840	462,840	440,457
	E15263396	Shed Rd	4,875	3,960	3,731	4,813
	E15200221	Country Rd	506	690	459	962
	E14555979	E Terrace St	101	125	218	219
	E14792412	615 Gallison Hl Rd	7,707	5,917	5,407	2,706
	E15114055	Cate St	10,727	9,640	14,250	13,253
	E14792101	25 Terrace St	32,796	20,510	20,007	23,100
UES						
			250,840	233,840	225,120	222,614
MSMS						
			303,440	258,080	229,880	289,899
MHS						
			453,650	446,900	597,463	541,739
			3,971,509	3,892,049	3,894,893	3,831,413

MONTPELIER MUNICIPAL GOVERNMENT ELECTRIC

	FY 2011	FY 2012	FY 2013	FY 2014
Traffic	36,788	37,123	36,135	35,185
Streets	124,758	127,371	120,255	122,180
City Hall	199,560	189,635	189,616	229,657
Equipment	54,800	69,760	61,120	45,240
Fire Dept.	59,463	55,119	54,200	51,000
Police Dept.	141,320	149,320	142,880	144,107
Senior Center		9,869	32,279	45,350
Parks	1,786	2,049	1,880	1,703
Green Mt. Cemetery	8,613	6,377	8,535	11,652
Parking	2,317	2,379	2,762	3,294
Sewer	54,470	47,972	44,160	46,763
WWTF	1,515,373	1,565,262	1,631,106	1,590,724
Water	556,281	499,710	519,282	509,271
UES	250,840	233,840	225,120	222,614
MSMS	303,440	258,080	229,880	289,899
MHS	453,650	446,900	597,463	541,739
	3,971,509	3,892,049	3,894,893	3,831,413

MONTPELIER MUNICIPAL GOVERNMENT INJECTED PV (KWH)

			FY 2011	FY 2012	FY 2013	FY 2014
Meter Number	WWTF (62.4kWp)					
	775271	10.6 kWp	16,500	19,710	19,229	14,063
	775272	16.6 kWp	9,311	11,317	10,966	10,054
	775273	16.5 + 16.5 kWp	26,796	30,916	29,034	23,199
	DPW Garage (4.5 kW ac)					
	E15079600				5,216	4,880
		TOTAL (kWh)	52,644	61,946	64,410	56,946
		in MMBtu	180	211	220	194

WWTF PV PREDICTED AT TIME OF SALE

		Predicted generation kWh annual			
	Installed	1	2	3	4
Office array (kWp)	18.8	19,598	19,402	19,206	19,010
Garage 1 (kWp)	16.5	15,274	15,121	14,968	14,815
Garage 2 (kWp)	16.5	16,899	16,730	16,561	16,392
Blower (kWp)	10.6	11,018	10,907	10,797	10,687
Total Installed kWp	62.4	62,789	62,160	61,532	60,904

PERFORMANCE OF WWTF PV

	FY 2011	FY 2012	FY 2013	FY 2014
predicted	62,789	62,160	61,532	60,904
actual	52,844	61,946	59,209	52,116
diff	9,945	214	2,323	8,788
	-16%	-0.3%	-4%	-14%

MONTPELIER MUNICIPAL THERMAL DEMAND - OIL (GALLONS)

	FY 2011	FY 2012	FY 2013	FY 2014
City Hall/ Fire	22,894	16,745	21,538	1,650
DPW Garage/ Water Fund/ Fire	5,502	7,503	8,001	6,500
Police Station	3,209	2,886	2,991	653
WWTP	23,100	10,630	10,548	13,192
Senior Center		200	372	122
UES	32,612	33,801	34,900	18,012
MSMS	20,099	18,198	21,197	20,526
MHS	33,605	32,499	27,408	36,806
	118,127	105,717	105,417	95,816

MONTPELIER MUNICIPAL THERMAL DEMAND - PROPANE (GALLONS)

	FY 2011	FY 2012	FY 2013	FY 2014
DPW Garage/ Water Fund/ Fire	23,499	9,109	17,036	20,347
WWTP	30	34		247
Cemetery	1,015	803	1,249	1,309
	24,544	9,946	18,285	21,903

MONTPELIER MUNICIPAL THERMAL DEMAND -DISTRICT HEAT (MMBTUS)

	FY 2011	FY 2012	FY 2013	FY 2014
City Hall/ Fire	-	-	-	1,303
Police Station				238
UES				820

MONTPELIER MUNICIPAL THERMAL DEMAND - WOOD PELLETS (TONS)

	FY 2011	FY 2012	FY 2013	FY 2014
Senior Center			14.2	15.3

MONTPELIER WWTF DIGESTER GAS PRODUCTION ESTIMATE

	FY 2011	FY 2012	FY 2013	FY 2014
WWTF CH4 from Digesters (MMBtus)	5,119.4	5,388.8	5,672.5	5,971.0
Estimates for % burned in furnace replacing oil	20%	60%	60%	60%
BTU value harnassed (MMBtus)	1,024	3,233	3,403	3,583
Equivalent of Heating Oil (gal)	7,382	23,313	24,540	25,832
% of Gas lost to atmosphere (est)	80%	40%	40%	40%
Fugitive GHG emissions tCO2e	2,185.0	1,092.5	1,092.5	1,150.0

MONTPELIER MUNICIPAL THERMAL ENERGY DEMAND - OIL (BTUS)

	FY 2011	FY 2012	FY 2013	FY 2014
City Hall/ Fire	3,175,168,860	2,322,364,050	2,987,105,220	228,838,500
DPW Garage/ Water Fund/ Fire	763,072,380	1,040,591,070	1,109,658,690	901,485,000
Police Station	445,056,210	400,259,340	414,821,790	90,564,570
WWTP	3,203,739,000	1,474,274,700	1,462,902,120	1,830,291,930
Senior Center	0	27,738,000	51,659,251	16,975,656
UES	4,522,958,280	4,687,860,690	4,840,281,000	2,498,084,280
MSMS	2,787,530,310	2,523,880,620	2,939,811,930	2,846,750,940
MHS	4,660,677,450	4,507,286,310	3,801,215,520	5,104,624,140
	19,558,202,490	16,984,254,780	17,607,455,521	13,517,615,016

MONTPELIER MUNICIPAL THERMAL ENERGY DEMAND - PROPANE (BTUS)

	FY 2011	FY 2012	FY 2013	FY 2014
DPW Garage/ Water Fund/ Fire	2,146,234,167	831,952,297	1,555,948,988	1,858,352,551
WWTP	2,739,990	3,105,322		22,559,281
Cemetery	92,702,995	73,340,399	114,074,917	119,554,897
	2,241,677,152	908,398,018	1,670,023,905	2,000,466,699

MONTPELIER MUNICIPAL THERMAL ENERGY DEMAND -DISTRICT HEAT (BTUS)

	FY 2011	FY 2012	FY 2013	FY 2014
City Hall/ Fire				1,498,450,000
Police Station				273,700,000
UES				943,448,960

MONTPELIER MUNICIPAL THERMAL ENERGY DEMAND - WOOD PELLETS (BTUS)

	FY 2011	FY 2012	FY 2013	FY 2014
Senior Center			214,020,000.0	229,140,000.0

MONTPELIER MUNICIPAL THERMAL ENERGY DEMAND - BIOGAS (BTUS)

	FY 2011	FY 2012	FY 2013	FY 2014
WWTF harnessed from biogas	1,023,877,225	3,233,296,500	3,403,470,000	3,582,600,000

MONTPELIER MUNICIPAL THERMAL ENEGY DEMAND ALL FUEL SOURCES TOTAL(BTUS)

	FY 2011	FY 2012	FY 2013	FY 2014
City Hall/ Fire	3,175,168,860	2,322,364,050	2,987,105,220	1,727,288,500
DPW Garage/ Water Fund/ Fire	2,909,306,547	1,872,543,367	2,665,607,678	2,759,837,551
Police Station	445,056,210	400,259,340	414,821,790	364,264,570
WWTP	4,230,356,215	4,710,676,522	4,866,372,120	5,435,451,181
Senior Center	0	27,738,000	265,679,251	246,115,656
UES	4,522,958,280	4,687,860,690	4,840,281,000	3,441,533,240
MSMS	2,787,530,310	2,523,880,620	2,939,811,930	2,846,750,940
MHS	4,660,677,450	4,507,286,310	3,801,215,520	5,104,624,140
Cemetery	92,702,995	73,340,399	114,074,917	119,554,897
	22,823,756,867	21,125,949,298	22,894,969,426	22,045,420,675

MONTPELIER MUNICIPAL ENERGY DEMAND (BTUS)

		FY 2011	FY 2012	FY 2013	FY 2014
Electricty	Traffic	125,520,656	126,663,676	123,292,620	121,996,060
	Streets	432,498,296	434,589,852	437,606,060	416,895,220
	City Hall	660,426,720	647,034,620	646,969,792	778,062,244
	Equipment	186,977,600	238,021,120	208,541,440	154,358,880
	Fire Dept.	202,955,996	188,066,028	184,930,400	174,012,000
	Police Dept.	482,183,840	509,479,840	484,776,960	491,966,044
	Senior Center	0	33,673,028	110,135,948	222,974,200
	Parks	6,093,832	6,991,188	6,414,560	5,810,636
	Green Mt. Cemetery	29,387,556	21,758,324	29,189,660	39,756,624
	Parking	7,905,604	8,117,148	9,423,944	11,239,128
	Sewer	185,851,640	163,680,464	150,673,920	166,379,356
	WWTP GMP	5,170,452,676	5,340,673,944	5,565,333,672	5,427,550,288
	Water	1,904,854,772	1,705,020,756	1,771,790,184	1,737,632,652
	UES	883,162,080	795,132,480	768,109,440	759,558,968
	MSMS	1,035,337,280	853,272,960	753,642,560	716,175,388
	MHS	2,237,180,160	2,207,495,760	2,038,543,756	1,848,413,468
Thermal	City Hall/ Fire	3,175,168,860	2,322,364,050	2,987,105,220	1,727,288,500
	DPW Garage/ Water Fund/ Fire	2,909,306,547	1,872,543,367	2,665,607,678	2,759,837,551
	Police Station	445,056,210	400,259,340	414,821,790	364,264,570
	WWTF	4,230,356,215	4,710,676,522	4,866,372,120	5,435,451,181
	Senior Center	0	27,738,000	265,679,251	246,115,656
	UES	4,522,958,280	4,687,860,690	4,840,281,000	3,441,533,240
	MSMS	2,787,530,310	2,523,880,620	2,939,811,930	2,846,750,940
	MHS	4,660,677,450	4,507,286,310	3,801,215,520	5,104,624,140
	Cemetery	92,702,995	73,340,399	114,074,917	119,554,897
Vehicles	Diesel	3,855,924,880	2,866,310,304	3,920,040,392	3,662,935,904
	Unleaded	5,865,690,000	4,888,535,000	5,348,765,000	4,450,270,000
TOTAL (Btus)		**46,096,160,455**	**42,160,465,790**	**45,453,149,734**	**43,231,407,735**
TOTAL (MMBtus)		**46,096**	**42,160**	**45,453**	**43,231**

SELECT ENERGY DEMAND (BTUS)

	FY 2011	FY 2012	FY 2013	FY 2014
WWTF				
Thermal	4,230,356,215	4,710,676,522	4,866,372,120	5,435,451,181
Electric	5,170,452,676	5,340,673,944	5,565,333,672	5,427,550,288
Totals (MMBtus)	**9,401**	**10,051**	**10,432**	**10,863**

MONTPELIER MUNICIPAL ENERGY DEMAND SUMMARY (MMBTUS)

	FY 2011	FY 2012	FY 2013	FY 2014
Electricity	13,551	13,280	13,289	13,073
Thermal	22,824	21,126	22,895	22,045
Vehicles	9,722	7,755	9,269	8,113
Total (MMBtus)	**46,096**	**42,160**	**45,453**	**43,231**

MONTPELIER MUNICIPAL GOVERNMENT GHG (TCO2E) ELECTRICITY

	FY 2011	FY 2012	FY 2013	FY 2014
Traffic	12.14	12.25	11.92	11.80
Streets	41.83	42.03	42.32	40.32
City Hall	63.87	62.58	62.57	75.25
Equipment	18.08	23.02	20.17	14.93
Fire Dept	19.63	18.19	17.89	16.83
Police Dept	46.64	49.28	46.89	47.58
Senior Center	0.00	3.26	10.65	21.57
Parks	0.59	0.68	0.62	0.56
Green Mt. Cemetery	2.84	2.10	2.82	3.85
Parking	0.76	0.79	0.91	1.09
Sewer	17.98	15.83	14.57	16.09
WWTF	500.07	516.54	538.26	524.94
Water	184.23	164.91	171.36	168.06
UES	85.42	76.90	74.29	73.46
MSMS	100.14	82.53	72.89	69.27
MHS	216.37	213.50	197.16	178.77
	1,310.60	1,284.38	1,285.31	1,264.37

MONTPELIER MUNICIPAL GOVERNMENT VEHICLE FUEL GHG (TCO2E)

	2011	2012	2013	2014
Diesel	306	228	311	291
Unleaded	454	378	414	344
Total tCO2e	760	606	725	685

MONTPELIER MUNICIPAL THERMAL GHG EMISSIONS (TC02E)

		FY 2011	FY 2012	FY 2013	FY 2014
Oil	City Hall/Fire	270.15	197.59	254.15	19.47
	DPW Garage/ Water Fund/ Fire	64.92	88.54	94.41	76.70
	Police Station	37.87	34.05	35.29	7.71
	WWTF	272.58	125.43	134.47	155.72
	Senior Center	0.00	2.36	4.40	1.44
	UES	384.82	398.95	411.82	212.54
	MSMS	237.17	214.74	250.12	242.21
	MHS	396.54	383.49	323.41	434.31
Propane	DPW Garage/ Water Fund/ Fire	136.29	52.83	98.81	118.01
	WWTF	0.17	0.29	0.09	1.43
	Cemetery	5.89	4.66	7.24	7.59
District Heat	City Hall/Fire				121.49
	Police Station				23.29
	UES				80.27
Wood Pellets	Senior Center				
CH4 biogas/ fugitive	WWTF	2,185.00	1,092.50	1,092.50	1,150.00
	Total tCO2e	3,991.40	2,595.24	2,696.63	2,658.19

MONTPELIER MUNICIPAL GHG EMISSIONS (TC02E) TOTAL

			FY 2011	FY 2012	FY 2013	FY 2014
Electricity	Electricity	Traffic	12.14	12.25	11.92	11.80
		Streets	41.83	42.03	42.32	40.32
		City Hall	63.87	62.58	62.57	75.25
		Equipment	18.08	23.02	20.17	14.93
		Fire Dept	19.63	18.19	17.89	16.83
		Police Dept	46.64	49.28	46.89	47.58
		Senior Center	0.00	3.26	10.65	21.57
		Parks	0.59	0.65	0.62	0.56
		Green Mt. Cemetery	2.84	2.10	2.82	3.85
		Parking	0.76	0.79	0.91	1.09
		Sewer	17.98	15.83	14.57	16.09
		WWTF	500.07	516.54	538.26	524.94
		Water	184.23	164.91	171.36	168.06
		UES	85.42	76.90	74.29	73.46
		MSMS	100.14	82.53	72.89	69.27
		MHS	216.37	213.90	197.16	178.77
Vehicles	Vehicle Fuels	Diesel	306.10	227.54	311.19	290.78
		Unleaded	453.95	378.33	413.95	344.41
Thermal	Oil	City Hall/ Fire	270.15	197.59	254.15	19.47
		DPW Garage/ Water Fund/ Fire	64.92	88.54	94.41	76.70
		Police Station	37.87	34.05	35.29	7.71
		WWTF	272.58	125.43	134.47	155.72
		Senior Center	0.00	2.36	4.40	1.44
		UES	384.82	398.96	411.82	212.54
		MSMS	237.17	214.74	250.12	242.21
		MHS	396.54	383.49	323.41	434.31
	Propane	DPW Garage/ Water Fund/ Fire	136.29	52.83	98.81	118.01
		WWTF	0.17	0.29	0.00	1.43
		Cemetery	5.89	4.66	7.24	7.59
	District Heat	City Hall/ Fire	0.00	0.00	0.00	127.49
		Police Station	0.00	0.00	0.00	23.29
		UES	0.00	0.00	0.00	80.27
	Wood Pellets	Senior Center	0.00	0.00	0.00	0.00
Fugitive Emissions	Digester Biogas	WWTF	2,185.00	1,092.50	1,092.50	1,150.00
			6,062.06	4,485.49	4,707.08	4,557.75

MONTPELIER MUNICIPAL GHG EMISSIONS (TC02E)

	FY 2011	FY 2012	FY 2013	FY 2014
Electricity	1,310.60	1,284.38	1,285.31	1,264.37
Vehicles	760.06	605.87	725.14	635.19
Thermal	1,806.40	1,502.74	1,604.13	1,508.19
Fugitive Emissions	2,185.00	1,092.50	1,092.50	1,150.00
Totals	6,062.06	4,485.49	4,707.08	4,557.75

MONTPELIER MUNICIPAL 2014 COMPARISONS

	FY 2014 tCO2	FY 2014 MMBtus	Avg tCO2e/ MMBtu
Electricity	1,264.37	13,072.78	0.10
Vehicles	635.19	8,113.21	0.08
Thermal	1,508.19	22,045.42	0.07
Totals	3,407.75	43,231.41	0.24

MONTPELIER MUNICIPAL 2014

	FY 2014 tCO2	FY 2014 Btus
Electricity	37%	30%
Vehicles	19%	19%
Thermal	44%	51%
Totals	100%	100%

MONTPELIER MUNICIPAL ENERGY DEMAND SUMMARY (MMBTUS)

	FY 2011	FY 2012	FY 2013	FY 2014
Electricity	13,551	13,280	13,289	13,073
Thermal	22,824	21,126	22,895	22,045
Vehicles	9,722	7,755	9,269	8,113
	46,096	42,160	45,453	43,231

THERMAL ENERGY CONSUMED FROM RENEWABLES (MMBTUS)

	FY 2011	FY 2012	FY 2013	FY 2014
Biogas WWTF	1,024	3,233	3,403	3,583
Sr. Center, Pellets			214	229
Totals (MMBtus)	1,024	3,233	3,617	3,812

ELECTRICITY OFFSETS (KWH)

	FY 2011	FY 2012	FY 2013	FY 2014
WWTF PV (58.9 kW ac)	52,844	61,946	59,209	52,116
DPW Garage (4.5 kW ac)			5,210	4,830
TOTALS (kWh)	52,844	61,946	64,419	56,946
in MMBtus	180	211	220	194

NET ZERO FACTOR = % OF ENERGY MET BY TOTAL RENEWABLES AND OFFSETS

	FY 2011	FY 2012	FY 2013	FY 2014
Biogas	1,024	3,233	3,403	3,583
Wood Pellets	0	0	214	229
PV offsets	180	211	220	194
Total Renewables + offsets (MMBtus)	1,204	3,445	3,837	4,006
Total Municipal Energy Demand (MMBtus)	46,096	42,160	45,453	43,231
% of total BTU Demand	2.6%	8.2%	8.4%	9.3%

Recommendations and Observations

- NZM 2030 Municipal Facilities and Operations Baseline:
    - FY2011 Energy Demand = 46,096 MMBtus
    - FY2011 Energy Demand met by renewables and offsets[1] = 2.6%
    - FY2011 GHG Emissions = 6,062 tCO_2e
- The Wattmetrics web monitoring platform lists the Waste Water Treatment Facility (WWTF) PV system size as 49.9 kW ac. This is likely an error. The actual PV installed is 62.4 kWp, and the approved Certificate of Public Good lists the system as 58.94 kW ac.
- The certificate of public good for the WWTF PV was approved Dec 9, 2009 for a 58.939 kW ac NET METERED System. Importantly, the PV system installed and operational today at the WWTF does not appear to be net metered. The PV systems are on 3 separate GMP meters and GMP pays the city a flat rate of $0.06 / kWh for the electricity produced. This warrants a technical discussion. PSB rules
- Vermont State renewable energy policies have changed since the PV system at the WWTF was connected.[2]
- This also raises an important need to clarify who owns the renewable energy credits (RECs). If, for example GMP includes them in the SPEED programme, then Montpelier would not be able to claim the PV systems as contributing to the Net Zero target.

- From 2006-2010, with neither flaring nor burning of digester biogas in the furnace, it's assumed the biogas was released directly into the atmosphere, a comparatively major source of GHG pollution from municipal operations.
- Since 2010/2011, the system has burned as much biogas as possible in the furnace for heating purposes, replacing oil. This is the reason for the significant 54% reduction in heating oil use at the WWTF between FY2011 and FY2012. Nevertheless, in the summer months, the gas likely escapes to the atmosphere.
- The WWTF's new flaring system is scheduled to come on line in the summer of 2015.
- Installing a micro-turbine fueled by the digester biogas would generate an estimated 236,520 kWh/yr as well as produce 200,000 Btus/hr of heat. At $0.06 / kWh the return on investment is estimated at 5.6 years. (see Appendix B) If the electricity were consumed on site, or connected under "net-metering" contracts, <u>the payback would be significantly shorter</u>. Several states pay a premium feed-in-tariffs for biogas generated electricity.
- RECs should be explored for the use of biogas replacing oil or to generate electricity.
- Important to note that the WWTF has become more energy efficient, while at the same time doubling revenue.

1.0 Purpose

The creation of this initial analysis of energy demand and GHG emissions of Montpelier's municipal operations and facilities is to:

- Establish both a starting point and a process to verify and monitor the progress of Montpelier's official priority[1] to transform to a "Net Zero" energy community by 2030.
- Create a distinction between "Municipal Operations and Facilities" and the inherently less precise "Community" energy and GHG inventories.

> **Net-Zero Energy Community:** "one that has greatly reduced energy needs though efficiency gains such that the balance of energy for vehicles, thermal, and electrical energy within the community is met by renewable energy."
>
> *- NREL, 2009; Definition of a Zero Net Energy Community*

Hierarchy of options to move to zero-energy communities (NREL, 2009)

Option Number	Option Name
0	Energy Efficiency and Energy Demand Reduction
1	Use Renewable Energy in the Built Environment & on Unusable Brownfield Sites
2a	Use Renewable Energy on Community Greenfield Sites (A Greenfield site is a site that has not been previously developed or built on, and which could support open space, habitat or agriculture)
2b	Use Renewable Energy Generated Off-site, On-site
3	Purchase New Off-site RECs

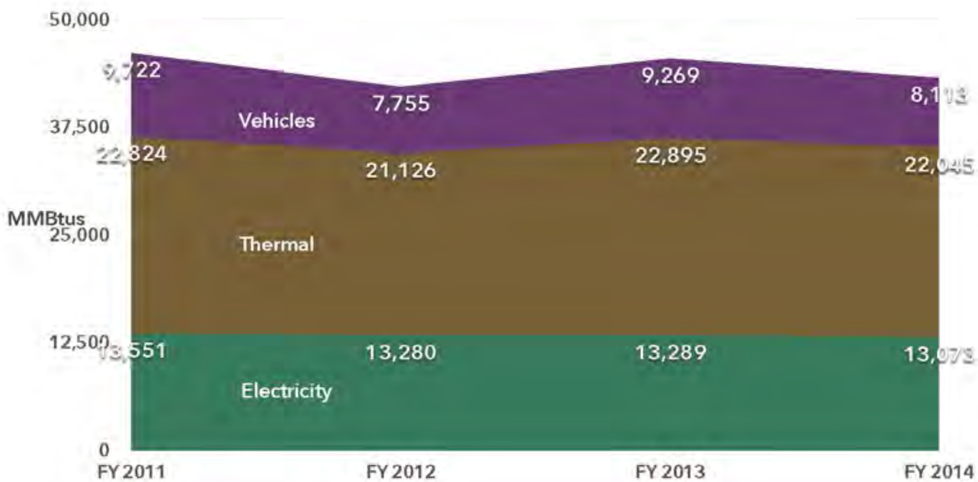
[1] *The Montpelier City Council endorsed the priority of transitioning to a Net Zero energy community by 2030 on Feb. 12, 2014.*

2.0 High Level Summaries

2.1 Municipal Energy Demand[2]

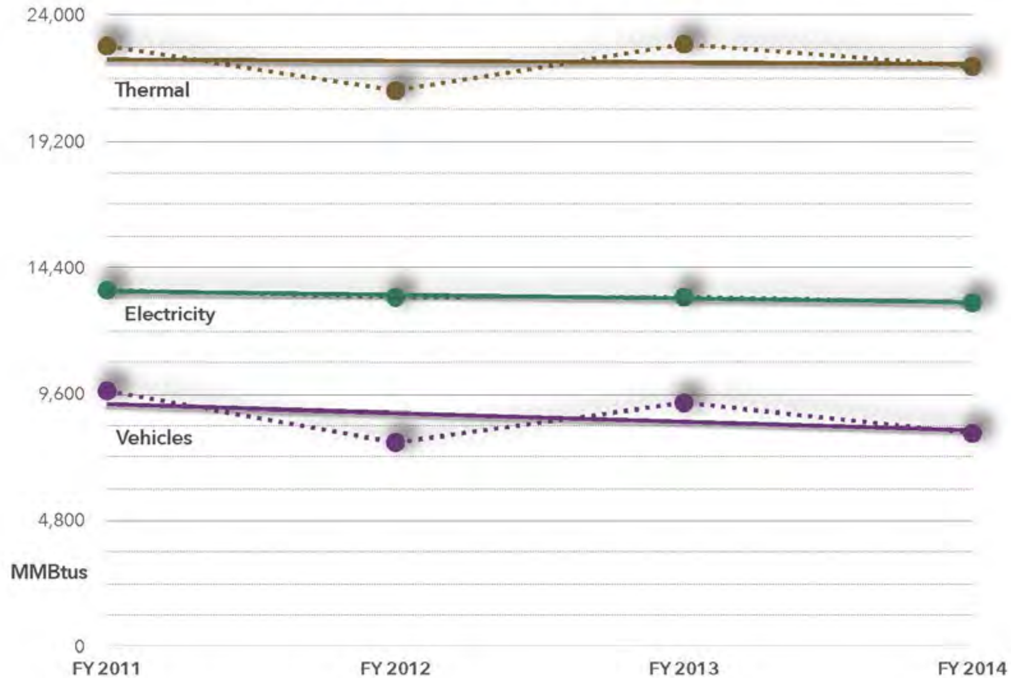
MUNICIPAL ENERGY DEMAND SUMMARY

	FY 2011	FY 2012	FY 2013	FY 2014
Electricity	13,551	13,280	13,289	13,073
Thermal	22,824	21,126	22,895	22,045
Vehicles	9,722	7,755	9,269	8,113
Totals (MMBtus)	46,096	42,160	45,453	43,231

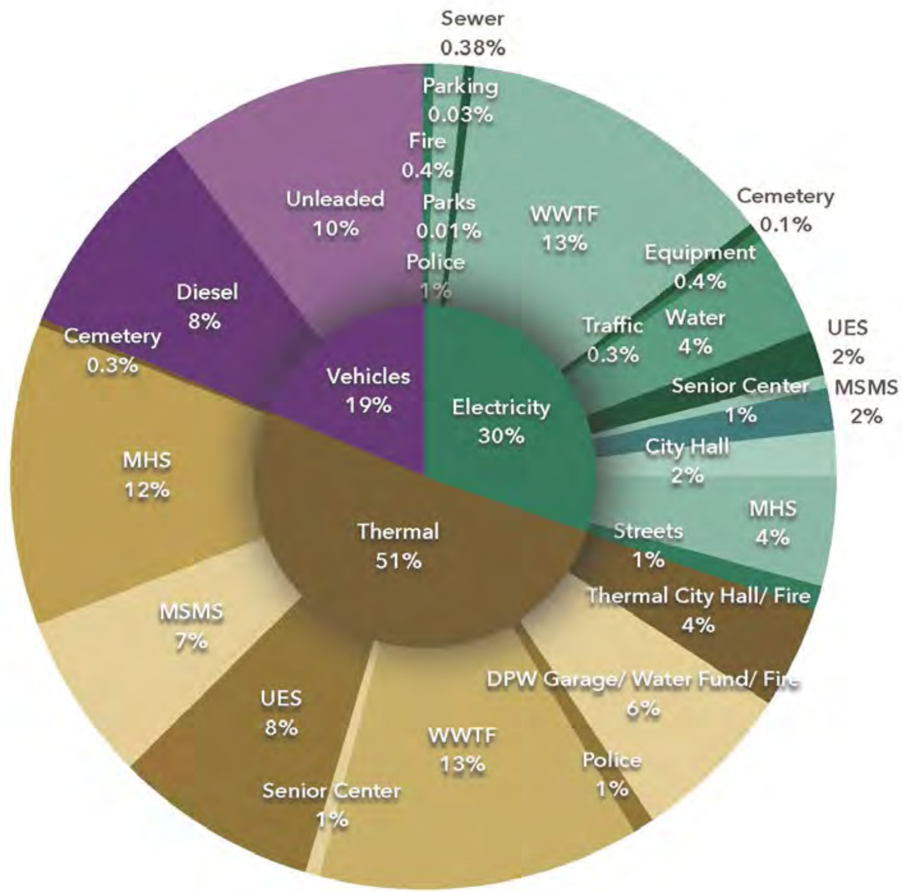


[2] *Total annual energy demand of all Montpelier's municipal facilities and operations, including elementary, middle and high schools. Does not include school busses, nor recreation department. It does not encompass trash collection, nor residential, commercial or industrial energy use.*

TREND LINES - MUNICIPAL ENERGY DEMAND



FY2014 MUNICIPAL ENERGY DEMAND

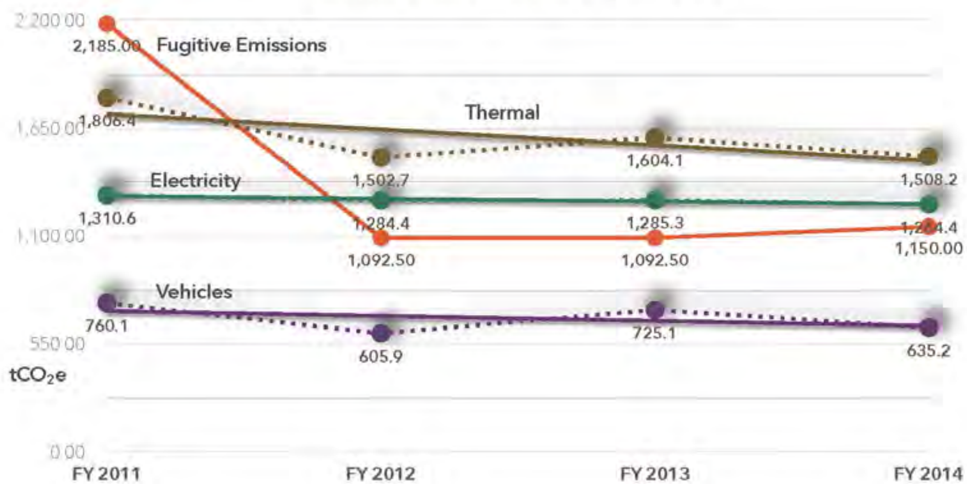


2.2 Municipal GHG Emissions[3]

MONTPELIER MUNICIPAL GHG EMISSIONS

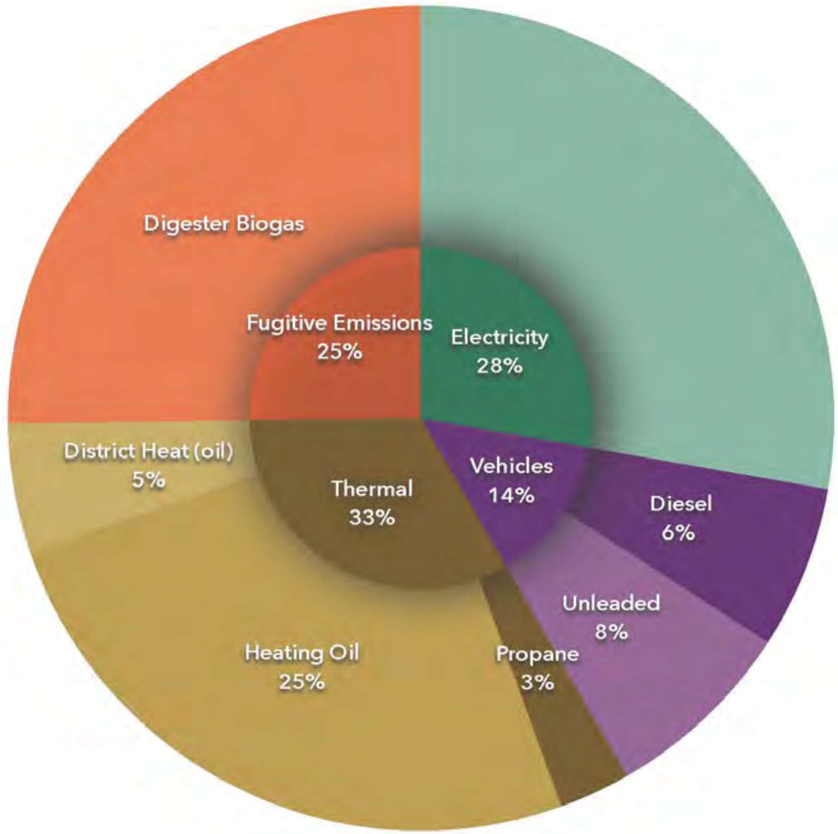
	FY 2011	FY 2012	FY 2013	FY 2014
Electricity	1,310.60	1,284.38	1,285.31	1,264.37
Vehicles	760.06	605.87	725.14	635.19
Thermal	1,806.40	1,502.74	1,604.13	1,508.19
Fugitive Emissions WWTF	2,185.00	1,092.50	1,092.50	1,150.00
Totals (tCO_2e)	**6,062.06**	**4,485.49**	**4,707.08**	**4,557.75**

TREND LINES - GHG EMISSIONS



[3] *Total annual emissions (metric tonnes) of GHG of all Montpelier's municipal facilities and operations, including elementary, middle and high schools. Includes estimates of "fugitive emissions" (leaks) from waste water treatment digester. Does not include school busses, nor recreation department. It does not encompass trash collection, nor landfill emissions nor residential, commercial or industrial energy use.*

FY2014 MUNICIPAL GHG EMISSIONS



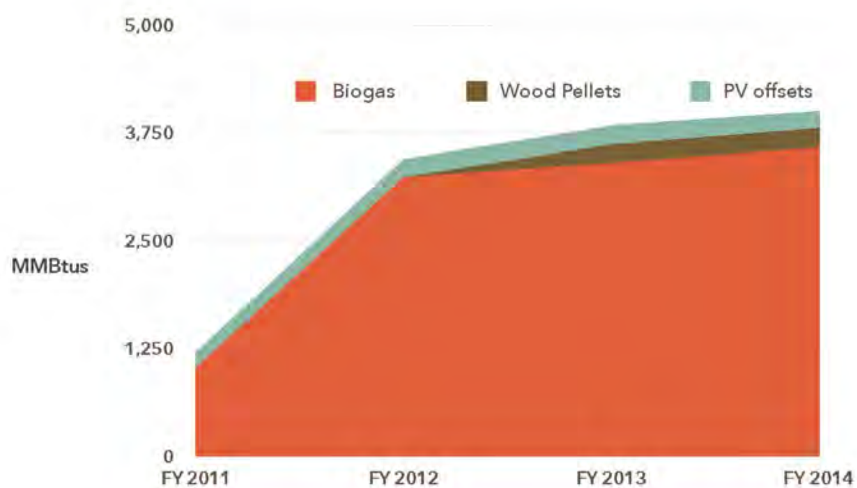
2.3 "Net Zero Factor" = Energy Demand Met by Renewables and Offsets

THERMAL ENERGY CONSUMED FROM RENEWABLES (MMBTUS)

	FY 2011	FY 2012	FY 2013	FY 2014
Biogas WWTF	1,024	3,233	3,403	3,583
Sr. Center , Pellets			214	229
Totals (MMBtus)	**1,024**	**3,233**	**3,617**	**3,812**

ELECTRICITY OFFSETS (KWH)

	FY 2011	FY 2012	FY 2013	FY 2014
WWTF PV (58.9 kW ac)	52,844	61,946	59,209	52,116
DPW Garage (4.5 kW ac)			5,210	4,830
TOTALS (kWh)	**52,844**	**61,946**	**64,419**	**56,946**
in MMBtus	**180**	**211**	**220**	**194**



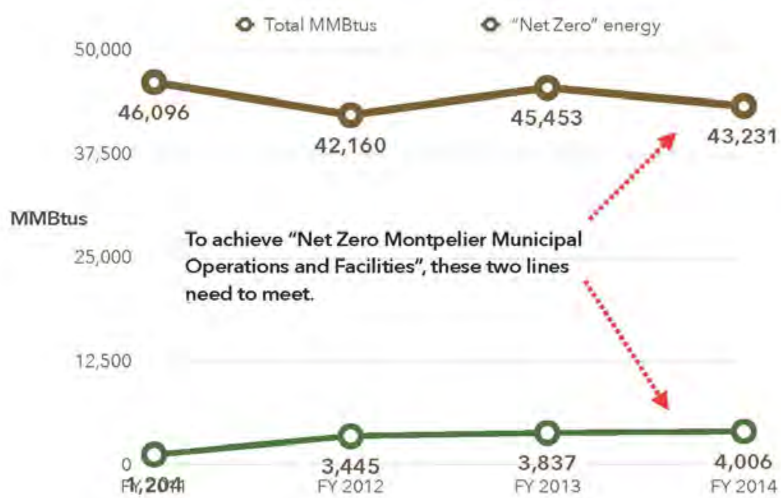
3.0 Conclusions

NZM 2030 Municipal Facilities and Operations Baseline:

- FY2011 Energy Demand = 46,096 MMBtus
- FY2011 Energy Demand met by renewables and offsets[4] = 2.6%
- FY2011 GHG Emissions = 6,062 tCO_2e

NET ZERO FACTOR= % OF ENERGY MET BY TOTAL RENEWABLES + OFFSETS

	FY 2011	FY 2012	FY 2013	FY 2014
Biogas	1,024	3,233	3,403	3,583
Wood Pellets	0	0	214	229
PV offsets	180	211	220	194
Total Renewables + offsets (MMBtus)	1,204	3,445	3,837	4,006
Total Municipal Energy Demand (MMBtus)	46,096	42,160	45,453	43,231
"Net Zero Factor"	2.6%	8.2%	8.4%	9.3%



[4] *Assuming the RECs have not been sold.*

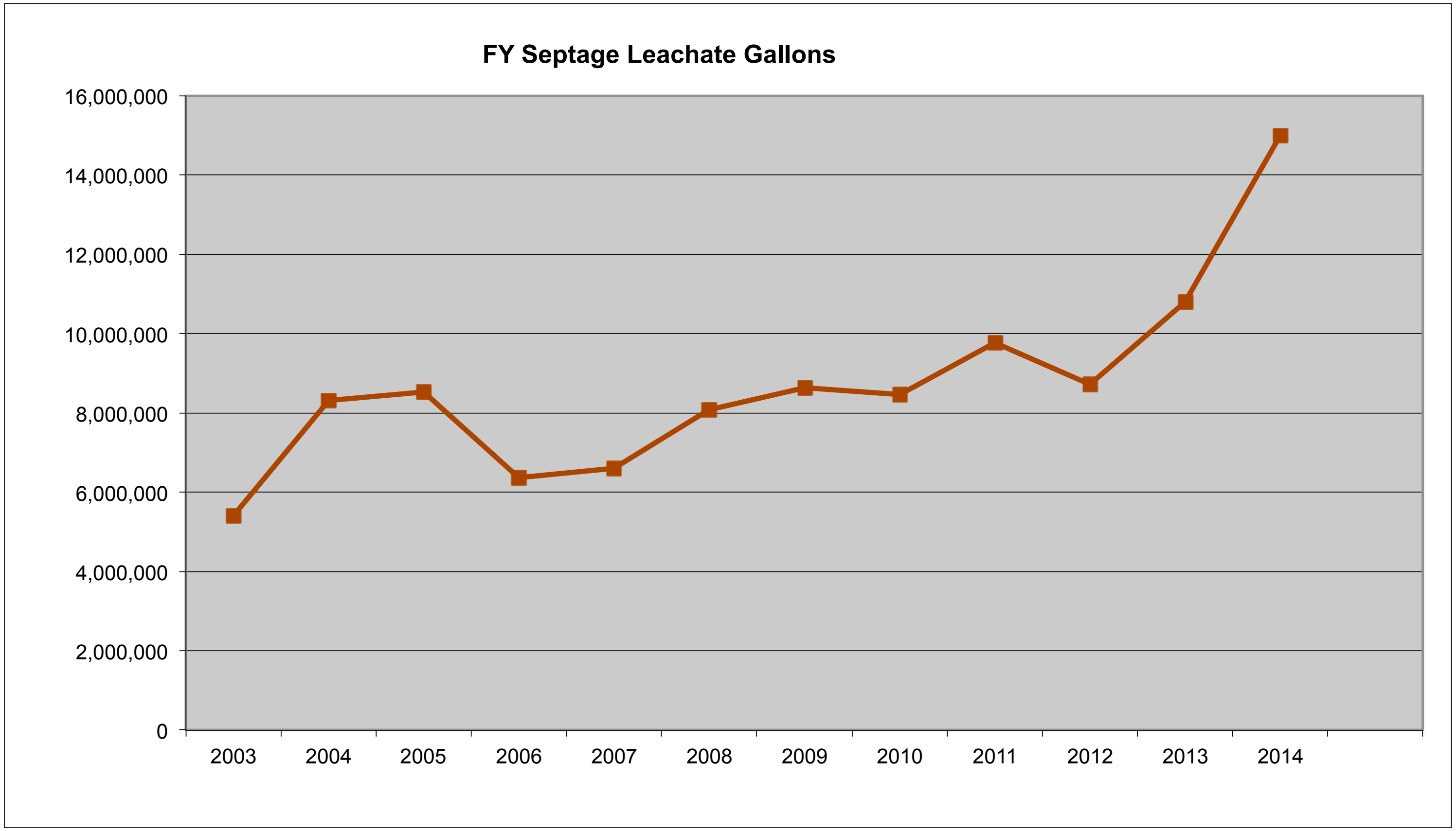
RESULTS

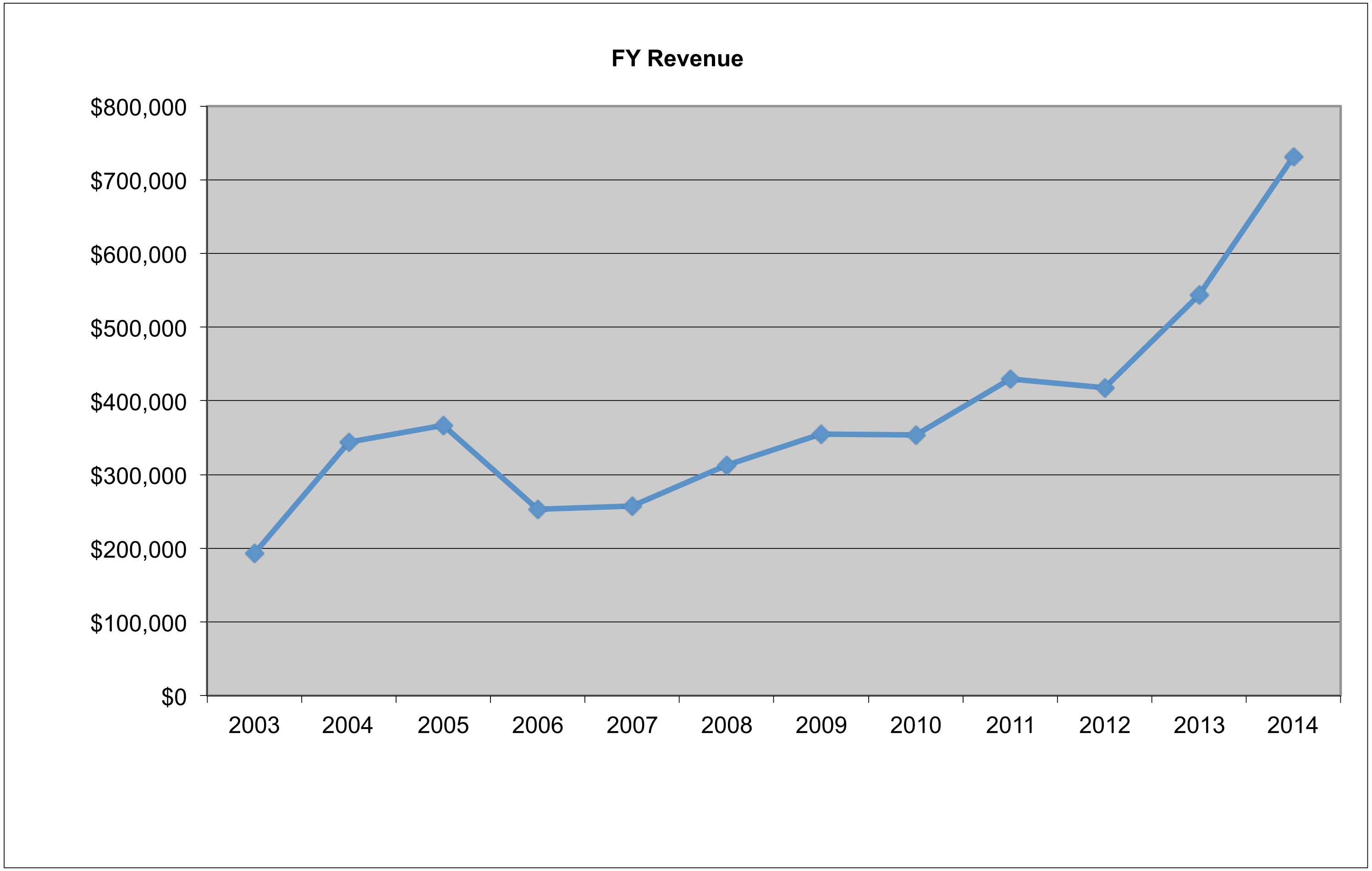
2008 average daily electric usage was 5,040 kilowatt-hours

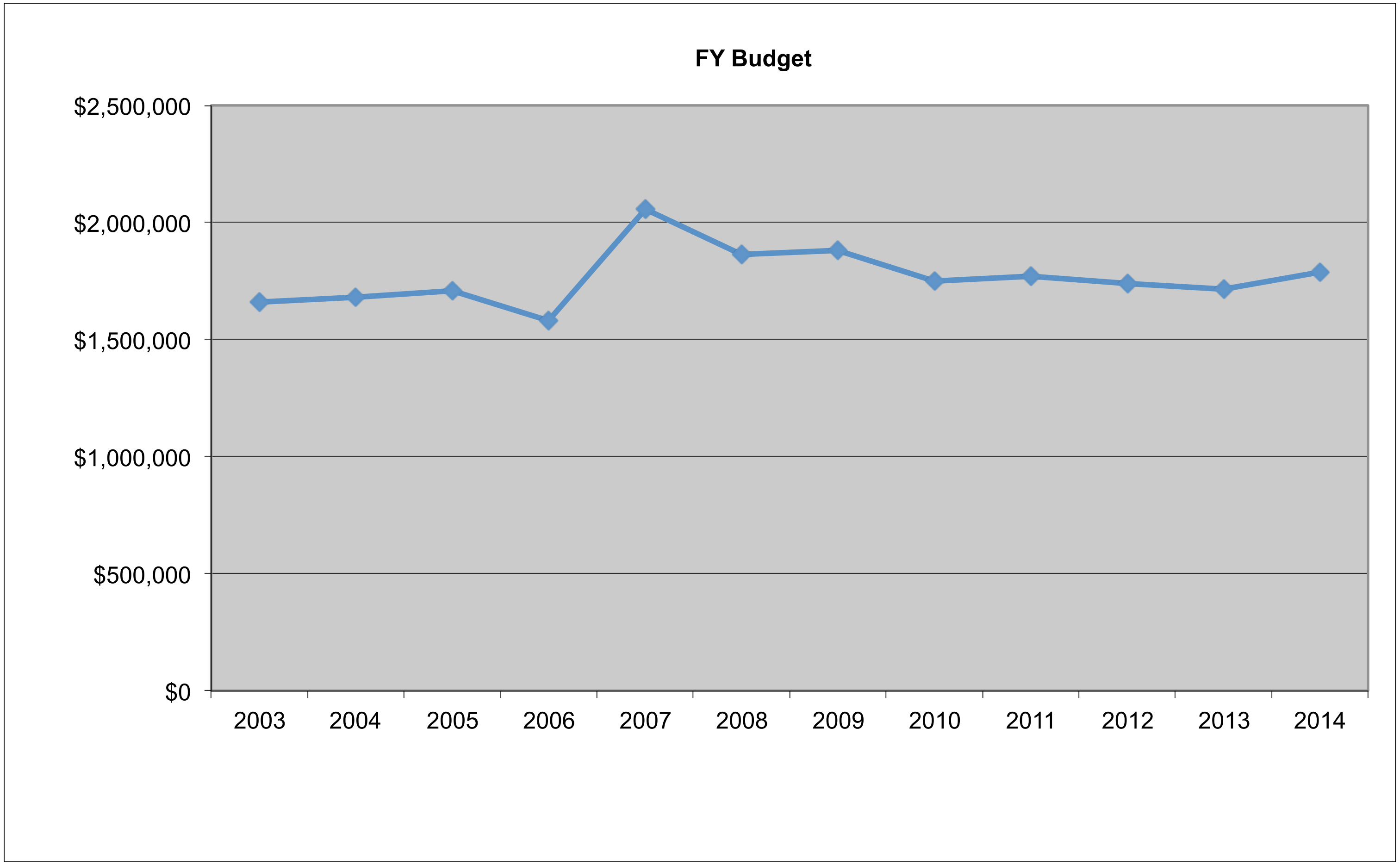
2013 average daily electric usage was 4,230 kilowatt-hours (16% reduction)

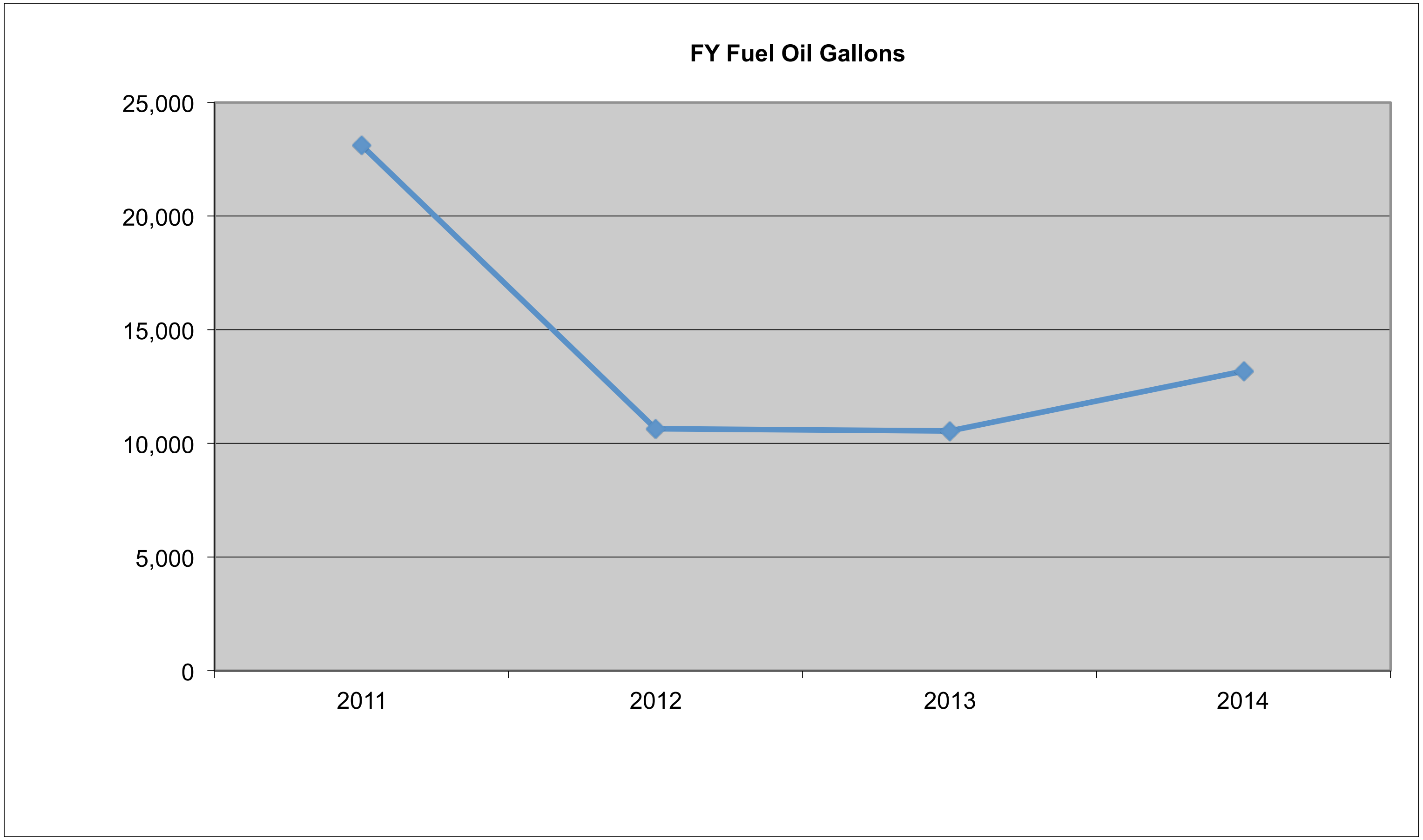
Second half of 2014 was 3,350 kilowatt-hours

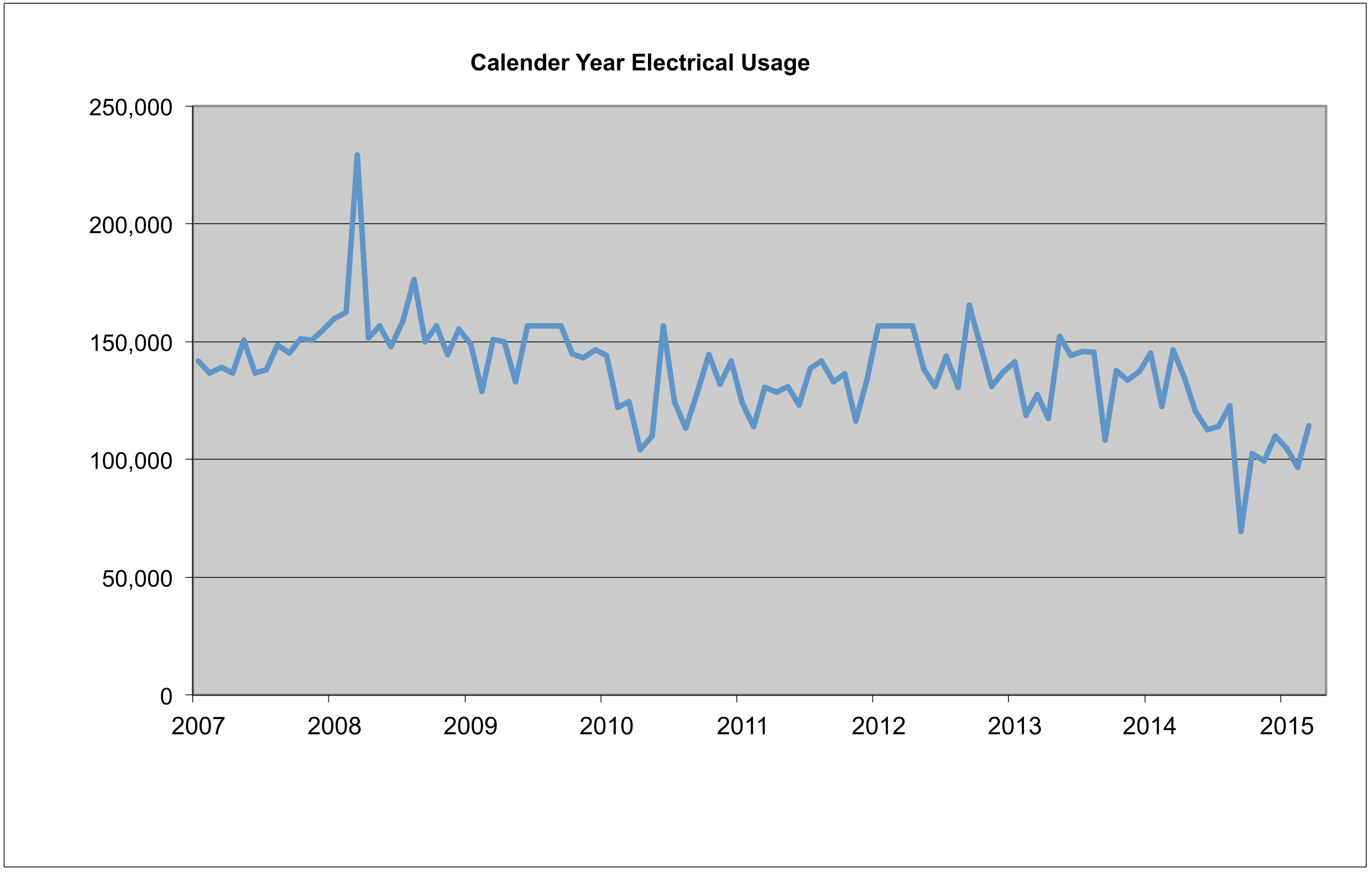
34% reduction since 2008, which should translate into ~$75,000 year in savings


FY Septage Leachate Gallons
16,000,000
14,000,000
12,000,000
10,000,000
8,000,000
6,000,000
4,000,000
2,000,000
0
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014


FY Revenue
$800,000
$700,000
$600,000
$500,000
$400,000
$300,000
$200,000
$100,000
$0
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014


FY Budget
$2,500,000
$2,000,000
$1,500,000
$1,000,000
$500,000
$0
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014


FY Fuel Oil Gallons
25,000
20,000
15,000
10,000
5,000
0
2011
2012
2013
2014


Calender Year Electrical Usage
250,000
200,000
150,000
100,000
50,000
0
2007
2008
2009
2010
2011
2012
2013
2014
2015

Upcoming

2015

- **Electrical Monitoring tied to SCADA**
- **Total Expected Cost of the submetering installation $12,300**
- **Cost Share to be paid by Efficiency Vermont $4,000**
-
- I have gone through the economics of a peak load reduction project and here is what I have found:
- · Per below, the cost to set up the metering and software system to provide real time kW output at or near your desk is $12,344
- · For 2014 your average monthly peak load was 246 kW
- · If a target of 225 kW was set and achieved, yearly billing savings would have been $3,800
- · If a target of 200 kW was set and achieved, yearly billing savings would have been $8,240
- · Efficiency Vermont is prepared to offer $4,000 to the cost of this project, bringing your effective cost down to $8,344
- · Paybacks would, be roughly, 2.2 years at the 225 kW level or 1 year at the 200 kW level
- · Of course, you may set your own targets. Our only requirement is a good faith effort to meet a serious target.
- · You may find other benefits to your process and/or savings opportunities due to this system which we hope you would share with us.

Hardware: $9,944.00 includes window enclosure for 12-channel meter, meter with Modbus TCP protocol, 36 CTs (12 breakers x 3 CTs per breaker).

Installation- Electrical: $900.00 includes mounting and wiring meter enclosure, installation of CTs in Main Distribution Panel, conduit and wire to existing PLC panel for connection to network.

Software- $1,500.00 includes Driver Installation, Driver Configuration, Database creation, Graphics, Historical data collection, trending (no reporting- reporting requirements undefined).

Upcoming

Replacement of 75HP Roots Blower

Hi Bob –

I have gone over the analysis from Aerzen. Based on the usage that was measured at the audit and including the reduction gained from the vfd's, the aerator pumps current usage is approximately $42,600 per year. Aerzen's curves show roughly a 20% reduction using the hybrid system (we can nail this down closer if need be). This would save around $8,500 per year. The hybrid system cost is $76,700. Subtracting the $9,000 you must pay for another pump anyway, the net is $67,700. So you would spend this amount to save $8,500 yearly. There may be other costs, maintenance, depreciation, etc., I'm missing. And Efficiency Vermont could contribute to this project. My question to you is does this economics work for your facility (8 years before incentives). Or conversely, what would it take to make this work?

Thanks.
Josh

2014 ENERGY MANAGEMENT AWARD

AWARDED TO

City of Montpelier
Wastewater Treatment Facility Staff

IN RECOGNITION OF OUTSTANDING PROGRESS TOWARD IMPROVING ENERGY EFFICIENCY AND REDUCING ENERGY BILLS AT THE MONTPELIER WASTEWATER TREATMENT FACILITY

ON BEHALF OF EFFICIENCY VERMONT

Elizabeth M. Gamache

LIZ GAMACHE, DIRECTOR

Efficiency Vermont

TIMES ARGUS

Wastewater heroes

May 22,2015

Wastewater heroes

Bob Fischer has been the chief operator at the Montpelier waste treatment plant for approximately five years. Although many in Montpelier don't know it, Bob and his team have saved the city lots and lots of money. How? Simply put, they do more with less — a lot more with a lot less. The plant is far and away the biggest energy consumer in the city. During the past 10 years, Bob and his team have tripled the volume of sludge processed (more revenue) while cutting, yes, cutting, the amount of electricity used (less costs). Moreover, they have greatly reduced oil consumption and methane emissions at the facility, and they have accomplished all this with a staff that has essentially been cut in half.

How have they done it? By embracing renewables (primarily solar and bio gas) and by teaming up with consultants from Efficiency Vermont to devise more efficient ways of doing business. Their work has not gone unnoticed. In fact, Bob and his team were awarded the 2015 Governor's Award for Environmental Excellence as well as the 2014 Utility Management Award for New England.

With that said, however, I think it is high time that the citizens of Montpelier heard about their good work over these many years. There is more to be done, of course, but Bob Fischer is leading by example when it comes to energy issues, and, on behalf of the Montpelier Energy Advisory Committee, I tip my hat to him.

Geoffrey FitzGerald

Montpelier

Dear Governor's Award Applicant,
I am pleased to inform you that you have been chosen to receive a Governor's Award for Environmental Excellence.
On behalf of all Vermonters, we thank you for your efforts to protect and enhance the state's environment.
Congratulations on your achievements. We are in the process of finalizing a venue and date for the awards ceremony.
You will be receiving this information along with an official letter from the Secretary soon. In the meantime,
I am putting together an article for the Vermont Business Magazine's June issue.
Could you please send me either a logo of your organization, a photo of the people that were involved in the project or a photo of something that represents your project to be included in the article?
Please email this to me by Tuesday, May 12th. Please let me know if you have any questions or concerns.
Sincerely,

Maura Mancini
Environmental Assistance Office
Department of Environmental Conservation
1 National Life Dr. – Davis 1
Montpelier, VT 05620-3704
(802) 522-0218

VERMONT

From: Claudon, Lynnette [mailto:Lynnette.Claudon@state.vt.us]
Sent: Thursday, May 21, 2015 4:19 PM
To: BOB FISCHER
Cc: Pelosi, Robert
Subject: Montpelier CWSRF Project

Hello Bob,

I am writing to find out if in the proposed PList project for Montpelier, if you might be willing to pilot our energy cooperation efforts with efficiency Vermont? If the City is in agreement, then they would co-review the project with FED for efficiency purposes.

Please let me know what you think and if you'd want to meet to discuss it further.

Thanks,

~Lynnette

SOME FREE TOOLS FROM THE INTERNET

Thanks Bob. I've entered flow values into the tool, which translates to an Energy Star score of **63** (out of a 1-100 scale). This is based on the last fuel entry of 6/30/2014, so your score has surely improved drastically over the past ~year.

If the power generated from your solar array is feeding into the plant and offsetting any of the electric usage on your bill—I know folks from MEAC are looking into this—we'll also want to include electricity consumption from this as well. The tool is intended to measure all energy inputs to WWTF operations.

Take a moment to review the attached Data Verification Checklist to ensure I've captured everything accurately. Then we can work to refine values as we go forward.

-Tim

ENERGY STAR® Data Verification Checklist

LEARN MORE AT energystar.gov

63

ENERGY STAR ® Score[1]

Montpelier, City of - WWTF

Primary Function: Wastewater Treatment Plant
Gross Floor Area (ft²): 20,000
Built: 1970

For Year Ending: 06/30/2014
Date Generated: 05/20/2015

1. The ENERGY STAR score is a 1-to-100 assessment of a building's energy efficiency as compared with similar buildings nationwide, adjusting for climate and business activity.

Property & Contact Information

Property Address	**Property Owner**	**Primary Contact**
Montpelier, City of - WWTF 949 Dog River Rd Montpelier, Vermont 05601 **Property ID**: 4338235	______________ , (___)___-_____	___ _______ , (___)___-_____ ______________

1. Review of Whole Property Characteristics

Basic Property Information

1) Property Name: Montpelier, City of - WWTF ☐ **Yes** ☐ **No**

Is this the official name of the property?

If "No", please specify: ______________________________

2) Primary Function: Wastewater Treatment Plant ☐ **Yes** ☐ **No**

Is this an accurate description of the primary use of this property?

3) Location: ☐ **Yes** ☐ **No**

949 Dog River Rd
Montpelier, Vermont 05601

Is this correct and complete?

4) Gross Floor Area: 20,000 ft² ☐ **Yes** ☐ **No**

EPA Energy Use Assessment Tool

Version 2.0 for Excel 2010

Begin Assessment

Note: You may need to decrease your computer's security level to allow the macros within this spreadsheet to function properly. Consult the Macro Instructions for Microsoft Excel 2007 and 2010 that are posted on EPA's Determining Energy Usage website or email EnergyUseTool@epa.gov if you are experiencing macro related problems.

PURPOSE: This spreadsheet-based energy use assessment tool has been designed to allow small and medium sized water and wastewater utilities to self-assess their baseline energy consumption and costs and to identify areas for improved energy efficiency and operational savings. While the tool is not equivalent to a full-scale, comprehensive energy audit, it provides the first step in establishing a baseline of energy consumption and use by collecting energy utility data and conducting a utility bill analysis. The tool includes five (5) elements to take you through the steps to create this baseline: Instructions, General Information, Building Data, Drinking Water (Water Treatment Plant - WTP) / Wastewater (WastewaterTreatment Plant - WWTP) Energy Usage Data, and the Summary Report.

USE: The energy use assessment tool contains several separate worksheets that take you through the process to establish your energy baseline. These worksheets can be accessed using the different colored tabs located at the bottom of the screen. Descriptions of each tab are provided within the worksheet.

THE FOLLOWING KEY APPLIES THROUGHOUT:

	Yellow boxes indicate that data can be entered by the user.
	Light blue boxes indicate that values are calculated using the input data. (They are read only.)
Text in Blue	Blue text consists of instructions for that section of the tool.
	White boxes with an arrow are dropdown lists. Click the arrow and select an option from the pre-populated list.

REQUIRED INFORMATION: We recommend that you compile the following required information before using the energy use assessment tool. This will allow you to use the tool with ease and to its full capability.

- All Plant Utility Data (use and cost information) by month (minimum of 12 months) for up to 5 years of analysis, including all Electric, Natural Gas, Fuel Oil No. 2, Water, and/or Other Utilities
- List of Lighting Fixtures (by type and size) and HVAC equipment nameplate data (horsepower, efficiency rating, full load amp rating) and average motor operating amperage (for each building and room)
- Drinking Water Treatment Plant Information, including monthly treatment/discharge volumes, pump and motor nameplate data (horsepower, efficiency rating, full load amp rating) and average motor operating amperage
- Wastewater Treatment Plant Information, including monthly treatment/discharge volumes, pump and motor nameplate data (horsepower, efficiency rating, full load amp rating) and average motor operating amperage

USER INSTRUCTIONS:

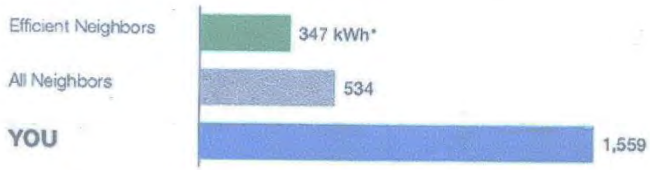
For a full list of energy saving products and services for purchase, including rebates from Efficiency Vermont, visit:

EfficiencyVermont.com/Connect

ROBERT K. FISCHER
278 HILL ST.
BARRE VT 05641-3938

Last Month Neighbor Comparison

You used **192% more** electricity than your neighbors.



* kWh: A 100-Watt bulb burning for 10 hours uses 1 kilowatt-hour.

How you're doing:

You used more than average

Turn over for ways to save →

Who are your Neighbors?

All Neighbors: Approximately 100 occupied, nearby homes (avg 0.18 mi away)

Efficient Neighbors: The most efficient 20 percent from the "All Neighbors" group