1.0 Executive Summary

1.1 Project Overview

SmartWatt Energy, Inc. (SmartWatt) is pleased to provide this Investment Grade Audit for Madison County, NY. We developed the following report to identify, document, and present a full complement of infrastructure improvements and cost reduction strategies for Madison County. SmartWatt is providing this report to fulfill the requirements of Project ID SMEI.002 under the Master Services Agreement between National Grid and SmartWatt Energy.

We greatly value the support we have received from Madison County staff during the IGA and look forward to expanding our partnership with National Grid and the County by implementing the Facility Improvement Measures described in the report through a Utility Energy Services Contract (UESC).

This report provides the scope of work, energy savings estimates, and cost proposal for infrastructure improvement and cost reduction strategies at eight buildings in the County:

- County Office Building
- Veterans Building
- Facilities Maintenance Garage
- Courthouse
- DSS
- Public Health
- Jail
- Wampsville Highway Department

SmartWatt will complete the scope of work described in this proposal for an installed cost of **$2,740,518.** SmartWatt will procure incentives from National Grid with an estimated value of **$172,777.** If the value of the incentives exceeds the estimated value of $172,777, the full incentive value will be provided to the County at the completion of the project implementation. Thus, the overall project cost to the County after incentives is **$2,567,740.**

1.2 Summary of Proposed Facility Improvement Measures (FIMs)

SmartWatt previously conducted a Preliminary Feasibility Assessment (PFA) to document the potential energy savings and budgetary costs. The Facility Improvement Measures (FIMs) identified in the PFA were evaluated in detail and the FIMs shown in Table 1 were selected by the County for implementation.

The 9 FIMs identified in this report will result in a total annual energy cost savings of $101,323/yr, which translates to a 23% reduction in annual utility costs. In addition, annual replacement savings of $12,325 are identified associated with the long life of LED lighting as compared to the existing lamps and ballasts. Annual repair and replacement savings of $91,995 have also been identified. Our project maximizes the financial benefit of the UESC by combining longer payback capital improvement items with shorter

payback measures—in turn giving Madison County the flexibility to tailor the selection to achieve shorter paybacks, greater energy independence, or other objectives as the County sees fit.

Table 1 provides savings, implementation price, and National Grid incentive for the recommended FIMs. The FIM recommendations presented will provide Madison County the ability to accomplish the following:

- Reduce annual electricity consumption by 26%
- Decrease annual natural gas consumption by 18%
- Decrease the energy intensity from 91 kBtu/ft^2 to 72 kBtu/ft^2

Table 1 - Summary: Recommended Facility Improvement Measures (FIMs)

FIM Name	Annual Utility Savings ($/yr)	Annual Repair & Replacement Savings ($/yr)	FIM Cost	National Grid Incentive	Net Customer Cost (minus Incentives)
1 - Lighting Upgrades	$48,495	$12,325	$503,946	$72,162	$431,784
2 - Replace Water Source Heat Pumps	$21,103	$60,000	$1,504,219	$32,893	$1,471,326
3 - Building Envelope Improvements	$7,819	$0	$108,743	$14,851	$93,892
4 - EMS Upgrades	$8,882	$0	$127,611	$21,885	$105,726
5 - Install ECM Motors	$549	$0	$1,880	$940	$940
6 - Replace Boilers in Jail	$2,325	$20,628	$206,280	$6,000	$200,280
7 - Install DHW Heaters in Jail	$1,140	$11,327	$113,273	$2,400	$110,873
8 - Window Tinting at County Office Bldg	$8,628	$0	$125,894	$18,332	$107,562
9 - Replace Transformers	$2,381	$0	$48,673	$3,316	$45,358
TOTAL	**$101,323**	**$104,280**	**$2,740,518**	**$172,777**	**$2,567,740**

1.3 Project Guidelines and Goals

SmartWatt has worked with the following objectives in mind for the Madison County Facilities:

- Reduce energy costs for the County's facilities.
- Maintain or improve existing environment within each facility.
- Provide and improve operational control of the County's equipment and systems.

Additional benefits to the County will include:

- No requirement for a referendum and voter approval.
- This project will not affect the Counties debt limit, or ability to bond future capital projects.
- Work performed under a normal, properly planned and executed schedule and not under an emergency situation.
- Guarantees quality engineering, construction and long-term performance under a turnkey approach.
- Portion of project will be offset by incentives from National Grid totaling **$172,777.**

1.4 Utility Incentives Summary

During this study, we confirmed that several of the facility improvement measures (FIMs) listed in this IGA, are eligible for incentives through National Grid. SmartWatt will work directly with National Grid to provide the incentives indicated in Table 1. SmartWatt will fill out the required forms and provide for

the County's review and signature. The incentives will be paid to SmartWatt and provided to the funding source to reduce the total amount financed by $172,777. Any additional incentives received will be provided to the County by SmartWatt.

1.5 Environmental Benefits

In addition to reducing energy consumption, these turnkey improvements give Madison County the opportunity to reduce its carbon footprint, reducing harmful environmental impacts. The positive impact this project will have on the environment is quantifiable. Most of the energy generated by power plants in the United States comes from burning fossil fuels. By reducing your energy consumption, fewer fossil fuels are consumed which means less pollution. For the Madison County area, the project will reduce green house gases by about:

- 752 metric tons CO_{2e} each year

Figure 1 illustrates the reduction in green house gases each year in terms of equivalencies of familiar items.

Figure 1 - Green House Reduction Equivalencies

152 Vehicles Off the Road **617 Acres of Carbon Sequestered by Trees** **Energy for 69 Homes**

1.6 Other Measures Considered But Not Recommended

A few FIMs identified during the PFA were evaluated during the IGA that did not meet the goals of the County. These items were presented during a scope review session and removed from consideration for the reasons described in Table 2.

Table 2 – FIMs Investigated but Not Recommended

Potential FIM	Description	Reason Not Recommended
Lighting Upgrades (Courthouse and Morrisville Highway Department)	Upgrade lighting to LED.	Facility future use uncertain.
Building Envelope Upgrades at Morrisville Highway Department	Replace seals on human and garage bay doors.	Facility future use uncertain.
Building Envelope Upgrades at Landfill Bldg #2	An evaluation of infiltration and thermal improvements was conducted for this building.	The building primarily uses waste oil for space heating which is free to the County. The small volume of propane used resulted in a payback of over 100 years. Thus, the measure was excluded due to poor economic return on investment.
Water Conservation	A detailed water assessment was performed that included all County buildings in the project scope. Improvements evaluated included sinks, toilets, urinals, and cell flush valves at the Jail.	The County pays a very low rate for water and has minimal sewer charges for its largest water consuming facility (the Jail which utilizes a septic tank). The payback of 62 years greatly exceeds the expected equipment life. The existing units were determined to be operational for several years and not in need of immediate replacement.
Transformers at the Courthouse	High efficiency transformers were evaluated at several buildings including the Courthouse.	Facility future use uncertain.
Replace Skylights at County Office Building	Replace 64 skylights above the atrium with a Kalwall structure to reduce energy losses and prevent water damage from failing skylights.	County has opted not to include at this time. Will consider options and may look to implement at a later date.

2.0 Facility Description

2.1 Facility Locations

Madison County is located in the Mohawk Valley region of New York State. SmartWatt Energy Engineers audited ten building locations in Madison County as summarized in Table 3. The total square footage of the sites audited is about 299,961 ft^2.

Table 3 - Facility Summary

Facility	Address	Square Footage
County Office Building	138 N Court Street, Wampsville, NY	54,180
Veterans Building	138 N Court Street, Wampsville, NY	24,200
Facilities Maintenance Garage	138 N Court Street, Wampsville, NY	5,000
DSS	133 N Court Street, Wampsville, NY	47,882
Courthouse	138 N Court Street, Wampsville, NY	34,020
Public Health	138 N Court Street, Wampsville, NY	15,244
Jail	138 N Court Street, Wampsville, NY	55,440
Hwy Department (Wampsville)	5 Donald Hicks Dew Drive, Wampsville, NY	38,798
Hwy Department (Morrisville)	85 Cedar Street, Morrisville, NY	18,797
Landfill Bldg 2	6663 Buyea Rd, Canastota, NY	6,400

Although the Morrisville Highway Department and Landfill Building #2 were assessed no Facility Improvement Measures are recommended for these two sites and they are excluded from the remainder of the report.

County Office Building

The County Office Building (COB) is a two story building with a basement floor that was built in 1969. The building is typically occupied from 8:00 AM to 6:00 PM.

This building has three boilers (Patterson-Kelley Mach 150 condensing units) and two chillers (Trane Series R 170 tons) that generate hot and cold water that serves the air handling units in the County Office Building, Courthouse, and Public Health. There are five fan coil units (FC 1-5) that provide heating and cooling throughout the facility. Each of the fan coils has a 7.5 HP supply fan.

This building shares utility meters with the Courthouse and Public Health building for electricity, natural gas, and water.

Annual utility spend for all three buildings is approximately $181,629.

The building is equipped with a pneumatic / digital Johnson Controls Energy Management System (EMS). This system provides controls for the majority of the heating and cooling equipment. The EMS can be accessed from a graphical user interface in the Maintenance Supervisors' office.

Veterans Building

The Veterans Building is a two story office building built in 1994. The hours of operation are Monday; 7:30 AM-6:00 PM, Tuesday; 7:30 AM – 8:00 PM, Wednesday; 7:30 AM – 5:00 PM, Thursday; 7:30 AM-5:00 PM, and Friday 7:30 AM-5:00 PM.

The Veterans Building has two condensing 750 MBH Patterson-Kelley Mach series boilers. One of the boilers serves the water source heat pump loop, while the other boiler serves perimeter fin tube radiation. The heat pump loop is served by a cooling tower located on the roof. The building has a total of 22 water source heat pumps ranging in size from 1.5 to 3.5 tons each. There is a dedicated make up air unit used to supply outside air to the heat pumps that are located throughout the facility. The building is equipped with a pneumatic / digital Johnson Controls Building Management System.

Utilities are electric, natural gas, and water. Annual utility spend is approximately $35,828.

Maintenance Garage

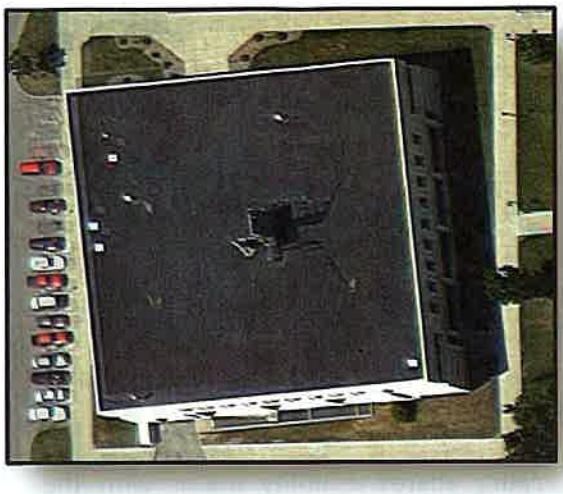
The Maintenance Garage is located adjacent to the Jail. The building consists of garage bays for trucks, file storage rooms, and a break room. The operational hours are 7:30 AM to 4:00 PM, Monday through Friday.

The Maintenance Garage is heated with infrared heaters in the truck bays, along with electric baseboard and gas fired unit heaters in the break room.

Utilities are electric, natural gas, and water, with an average utility spend of about $4,242.

Department of Social Services

The Department of Social Services (DSS) is a two-story office building located across the street from the County Complex. The hours of operation are Monday through Friday 7:30 AM - 5:00 PM, with a cleaning crew in the facility until approximately 8:30pm.



The DSS has fifty one (51) water source heat pumps located throughout the facility that are being served by two Patterson-Kelley Mach 750 condensing boilers located in the basement. The loop is also served by a cooling tower located on the roof. Two 10 ton heat pumps (HP-1 and HP-2) in the basement supply outside air to the majority of the smaller heat pumps located throughout the facility. The building has a Johnson Controls EMS. This system provides control for all the WSHPs located throughout the building with a graphical user interface located in the Maintenance Supervisor's office.

Utilities are electric, natural gas, and water. Annual utility spend is approximately $74,236.

Courthouse

The County Courthouse is located adjacent to the County Office Building. The typical hours of operation are 8:00 AM – 6 PM Monday through Friday.

The Courthouse is being served by the boilers and chillers located in the County Office Building. The building is conditioned with 2 Fan Coil Units (FCU 101 and FCU 102, each with 3 HP supply fans) and 2 Air Handling Units (AHU-1 and AHU-2, each with 5 HP supply fans).

This building shares utility meters (electric, natural gas, and water) with the County Office Building and Public Health building. Annual utility spend for all three buildings is approximately $181,629.

The building is controlled by a central EMS system located in the Maintenance Supervisor's Office.

Public Health

The Public Health Building is occupied from 8:00 AM to 5 PM, Monday - Friday. It is located next to the County Office Building. The building consists primarily of office space.

There is one multizone air handling unit with twelve zones, located in the basement. The unit has heating and cooling coils that are being served from the central plant located in the County Office Building. The air handling unit has a 15 HP supply fan.

This building shares a utility meter with the Courthouse and County Office Building. Annual utility spend for all three buildings is approximately $181,629.

The building is also controlled with the Johnson Controls EMS.

Jail/PSB

The County Jail is located northeast of the Maintenance Garage. The building operates 24 hours/ day. The facility is divided into Public Service space which is primarily office space for the County Sherriff department and the Jail which typically houses about 60 inmates.

The building is conditioned by 39 water source heat pumps which range in size between ¾ - 5.4 tons. The heat-pumps are supplied by three boilers (2 Precision Model G300 boilers and one Patterson-Kelley Thermific boiler with an output of 1,020 MBH) and a cooling tower. There is an isolation chamber located towards the center of the building. This area is under negative pressure and the unit has its own dedicated exhaust and supply air for the purposes of containing infectious diseases. The building's HVAC equipment is controlled via the Johnson Controls EMS.

The building has its own electric, gas, and water meters. Annual utility spend is approximately $111,169.

Wampsville Highway Department

The Wampsville Highway Department facility reviewed in this project consists of a two story office building and the maintenance garage as shown in the picture to the right. The facility is typically occupied between 7 AM and 5 PM on weekdays with additional use as required for winter plowing.

The garage area is heated with infrared heaters and is not cooled. The total annual utility spend for these two buildings is about $41,860.

3.0 Utility Usage Overview

3.1 Utility Usage and Cost Summary

The County currently spends **$448,784** annually on utilities for the following eight buildings included in the recommended Scope of Work:

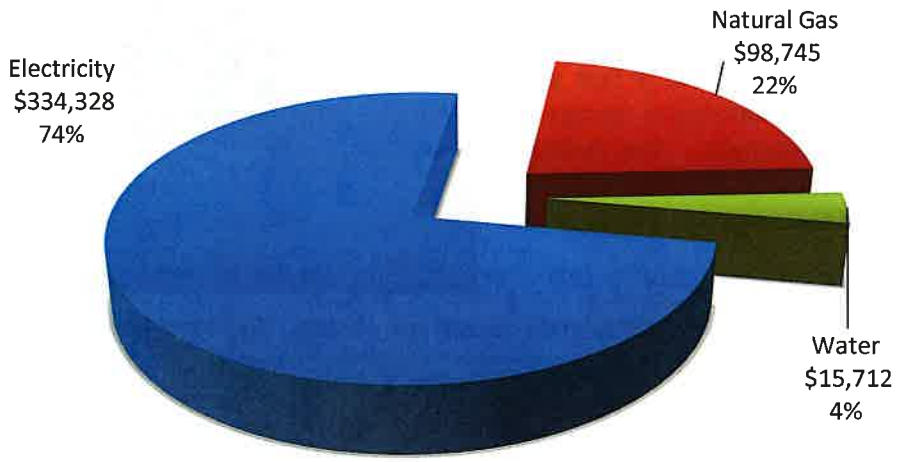
- County Office Building
- Veterans Building
- Facilities Maintenance Garage
- Courthouse
- DSS
- Public Health
- Jail
- Wampsville Highway Department

Table 4 and Figure 2 summarize the energy cost allocated to natural gas, electric, and water/sewer consumption for the eight total buildings assessed in our investigation for the baseline period (January 2014 – December 2014). Figure 2 indicates that electricity accounts for the vast majority (74%) of the County's utility costs.

Table 4 –Annual Utility Usage and Cost Summary

Electricity		Natural Gas		Water & Sewer	
kWh/yr	$/yr	NG (therm/yr)	$/yr	Water (CCF/yr)	$/yr
3,569,710	$ 334,328	127,033	$ 98,745	5,634	$ 15,712

Figure 2 - Annual Utility Costs



3.2 Utility Rate Review

Utilities and energy sources for the buildings reviewed in the County are electricity, natural gas, and water/sewer. Table 5 lists the utilities and energy sources and the current supplier of each source.

Table 5 - Utility/Energy Sources

Utility/Energy Type	Company
Electricity Supply	Constellation Energy
Electricity Transmission/Distribution	National Grid
Natural Gas Supply	Direct Energy
Natural Gas Distribution	National Grid
Water/Sewer	City of Oneida

To determine the cost savings potential for a reduction in energy usage or water conservation the incremental cost of the utility was determined. Electricity and natural gas distribution costs (National Grid) are based on the average for billing during the 2014 baseline period. Electricity and natural gas supply costs are based on the current contract with the supply company in use. Water rates are based on the baseline period billing data provided by the County. The rates used to calculate savings are summarized in Table 6.

Table 6 -Utility Rates Summary

Building	Electricity Distribution ($/kWh)	Electricity Supply ($/kWh)	Electricity Total ($/kWh)
County Office Building	$0.032	$0.058	$0.090
Veterans Building	$0.039	$0.058	$0.096
Facilities Maintenance Garage	$0.032	$0.058	$0.090
DSS	$0.032	$0.058	$0.090
Courthouse	$0.032	$0.058	$0.090
Public Health	$0.032	$0.058	$0.090
Jail	$0.031	$0.058	$0.089
Hwy Department (Wampsville)	$0.082	$0.058	$0.140

Building	NG Distribution ($/therm)	NG Supply ($/therm)	NG Total ($/therm)	Water & Sewer ($/CCF)
County Office Building	$0.177	$0.574	$0.751	$2.92
Veterans Building	$0.243	$0.574	$0.817	$3.47
Facilities Maintenance Garage	$0.395	$0.574	$0.969	$5.51
DSS	$0.284	$0.574	$0.858	$3.39
Courthouse	$0.177	$0.574	$0.751	$2.92
Public Health	$0.177	$0.574	$0.751	$2.92
Jail	$0.209	$0.574	$0.783	$2.52
Hwy Department (Wampsville)	$0.395	$0.574	$0.810	$2.92

3.3 Baseline Annual Energy Usage

This section summarizes the baseline period energy usage for the seven buildings audited. Table 7 presents a summary of the average utility consumption for each building by energy source for the baseline year (2014). A summary of the baseline period usage and cost data are provided in Appendix A.

Table 7 –Baseline Utility Usage Summary

Facility	Electric Usage (kWh/yr)	Natural Gas Usage (therm/yr)	Water Usage (CCF/yr)
County Office Building	1,531,617	48,628	1,526
Veterans Building	270,880	11,080	337
Facilities Maintenance Garage	12,194	2,399	33
DSS	732,000	5,828	538
Courthouse	-	-	-
Public Health	-	-	-
Jail	851,400	32,525	3,200
Hwy Department (Wampsville)	171,619	26,573	
Total	**3,569,710**	**127,033**	**5,634**

Figures 3 to 5 indicate the electricity, natural gas, and water usage percentages for each building. The pie charts show that the three buildings (County Office Building, Courthouse, and Public Health) that share utility meters constitute the majority of the energy usage in the County.

Figure 3 – Electricity Usage by Building

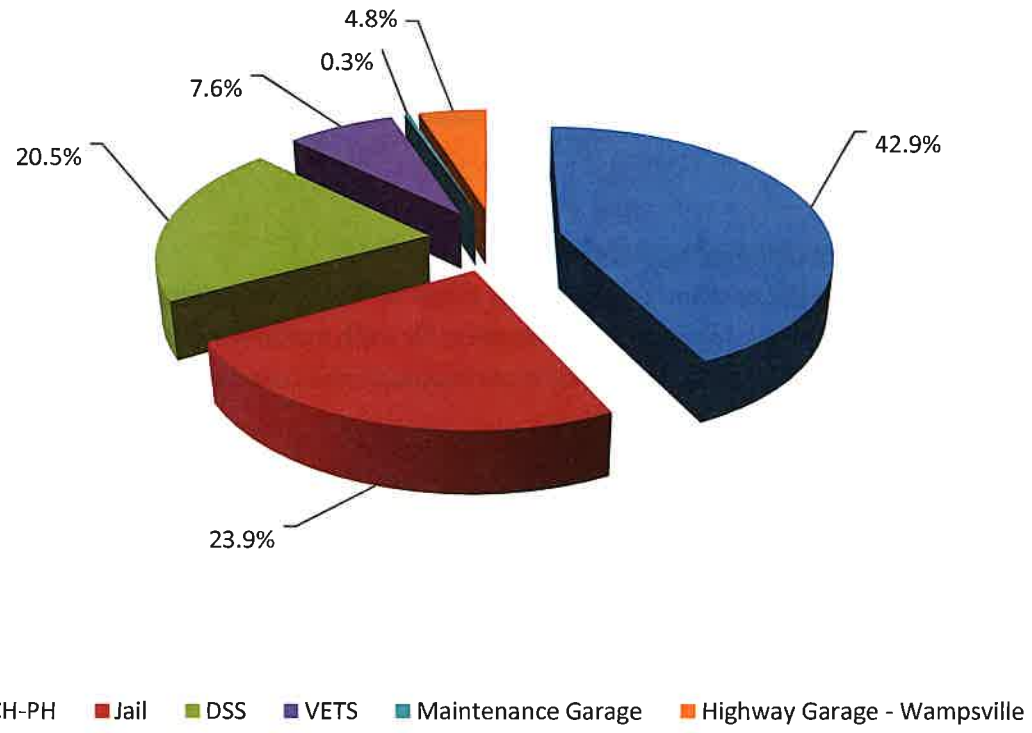


Figure 4 – Natural Gas Usage by Building

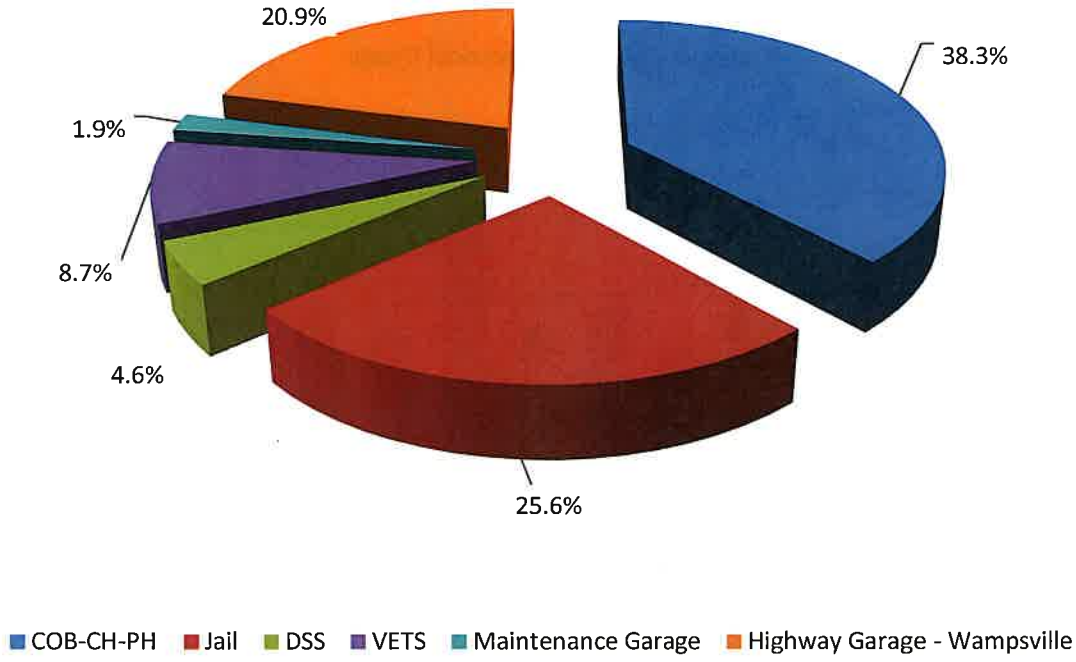
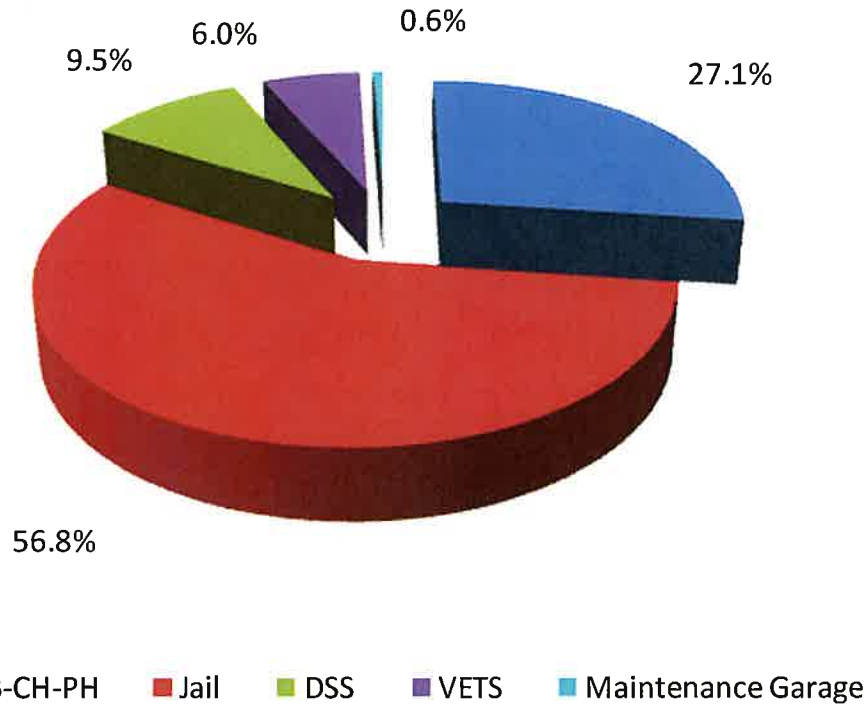


Figure 5 – Water Usage by Building



Figures 6 and 7 display the monthly utility usage for electricity and natural gas during the baseline period (2014). Figure 8 shows quarterly water consumption for the baseline period (2014). Annual usage and cost data for energy and water/sewer is provided in Appendix A in tabular form.

Figure 6 – Baseline Electrical Usage

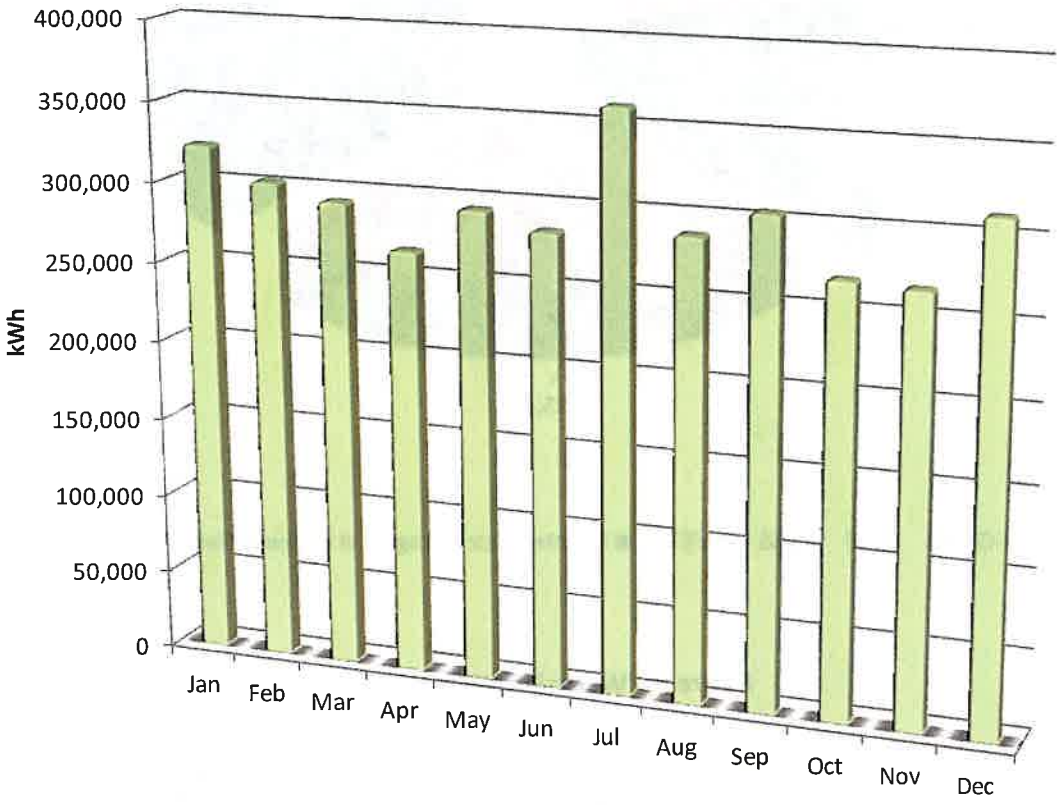


Figure 7 – Baseline Natural Gas Usage

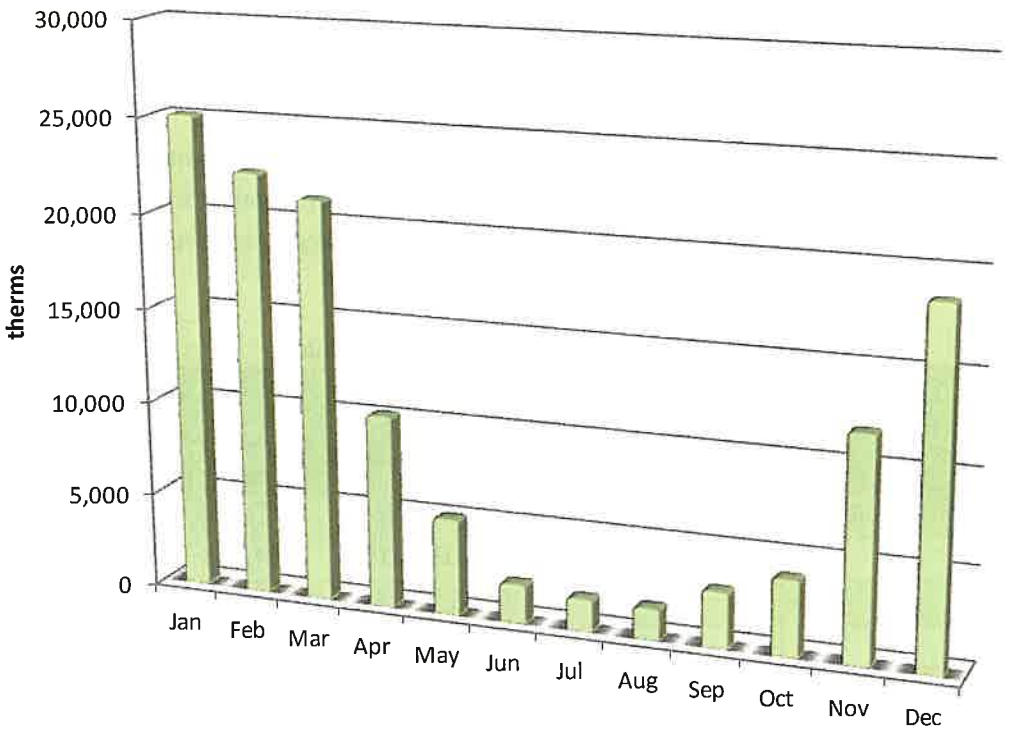
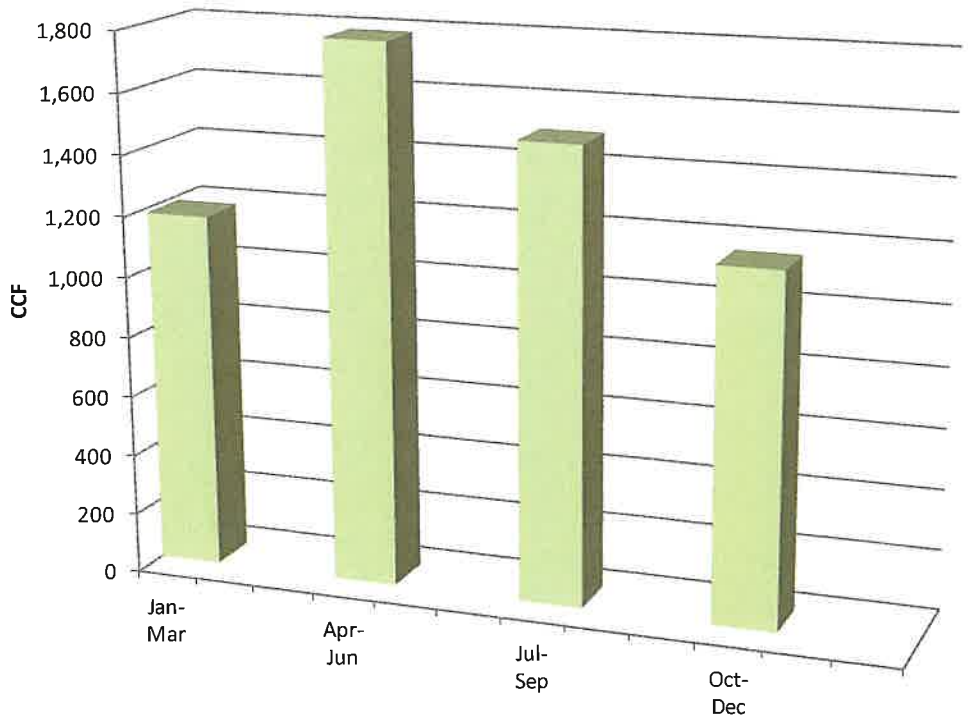


Figure 8 – Baseline Water Usage



3.4 Reconciliation of Usage to Baseline

The data used for the energy/water baseline have been reviewed and no unusual findings were present. The meter readings were based on actual readings during the baseline period (calendar year 2014).

3.5 Utility Benchmarking – Energy Utilization Index

The Energy Utilization Index (EUI) provides a summary of a building's energy intensity. Tracking your EUI over time provides insight into the energy usage behavior of your facility. Table 8 summarizes the annual average energy (electricity and natural gas) usage, cost, and energy intensity for the baseline period.

Table 8 - Average Energy Intensity Summary

Facility	Square Footage	Annual Energy Usage (kBtu/yr)	Annual Energy Cost ($)	EUI (kBtu/ft^2)	Cost per Square Foot ($/ft^2)
COB / Courthouse / Public Health	103,444	10,090,209	$177,166	98	$1.71
Veterans Building	24,200	2,032,513	$34,658	84	$1.43
Maintenance Garage	5,000	281,518	$4,061	56	$0.81
DSS	47,882	3,081,116	$72,413	64	$1.51
Jail	55,440	6,158,328	$103,094	111	$1.86
Highway Garage – Wampsville	42,984	3,243,036	$41,680	75	$0.97