

MERIDIAN TOWNSHIP PHASE II ENERGY EFFICIENCY PROJECT - PART 1

FINAL REPORT

May 18, 2015

Submitted by Bob Tinker, RA, LEED AP

for Michigan Energy Options, 405 Grove St, East Lansing, MI 48823

Introduction

This report completes the scope of work for developing an ECM list for all township owned buildings. Four tasks were undertaken.

- 1 - Review Energy Audits with Township Staff to identify ECMs not implemented
- 2 - Conduct walk-thru audits for buildings & facilities not audited
- 3 - Prioritize recommendations for further building ECMs
- 4 - Report on findings. (Each ECM to include specifications, implementation cost, energy & dollar savings, simple payback years, and utility rebates available.)

The information is presented in 7 Sections.

Section 1 offers general comments & recommendations that grew out of analysis of the data that was gathered.

Section 2 presents an overview of the 2014 energy consumption of Meridian township properties broken down into 5 facility groups:

- Large Buildings
- Lift Stations
- Fire Stations
- All Other Sites
- Historic Village

Sections 3 through 7 describe and analyze each of the five facility groups. The analysis includes the 2014 energy consumption of each building in the group, results of energy audits conducted for target facilities, and enumeration of ECM recommendations by building. The narratives should be thoroughly reviewed for important recommendations that occur throughout the text.

SECTION 1 - General Comments & Recommendations

Planet Footprint Service

Meridian Township has contracted with Planet Footprint to gather electric and gas utility data for all township owned locations, provide quarterly reports on energy consumption, and track energy savings from ECMs that are undertaken by the township. Such a service is indispensable for monitoring energy use for the large number of township facilities.

Discussions with Planet Footprint staff were undertaken to explore ways that the service can be more useful to the township. Other available services that could be provided were identified.

- Emissions reporting (this can be done for Meridian)
- Measures Reporting (to look at the energy/water efficiency projects, how much they cost, how much was expected to be saved and how much was realistically saved. This is already done for Meridian)
- Interval data analysis (not part of Meridian's current subscription)
- Finance Footprint (premium utility bill service where we look at all incoming bills, check them to make sure they are right and build a payment file for the Accounts Payable staff to upload).

While working with the Planet Footprint website and reviewing quarterly reports, the auditor discovered several issues around data access and readability. First, data cannot be analyzed directly within the web site. If Meridian Township desires this capability, it will need to determine what analysis processes are desired so that this functionality can be built into the web site. The auditor is familiar with on line analysis tools provided by DTE Energy as part of its smart meter residential program. Capabilities similar to the DTE website could be beneficial to the township staff for keeping track of specific buildings or groups of buildings.

Second, specific data for multiple locations is not easily available for download from the web site. Although Planet Footprint staff provided information in spreadsheets as requested for this report, it would be more convenient to have direct access of the data on line.

Third, the display of consumption information for all meters at once in quarterly reports is awkward. It would be easier to view the data and see comparisons if it was displayed in subgroups in vertical listings rather than the horizontal format. This report provides an example of this suggestion in how the facilities are grouped and the data is displayed.

Lastly, the creation of quarterly reports does not allow for quick remediation of problems that may be found. Nor can one person keep track of all these assets. This role should be spread over the organization. Perhaps those on the energy committee can be tapped to review data for facility groups. Planet Footprint can help enable this.

Energy Management System

One of the major energy efficiency projects undertaken in 2012 was updating the Energy Management System (EMS) used by Meridian Township to control the larger buildings that have complicated HVAC systems. One major improvement was to allow the head of facilities to access the control software remotely, thus providing quick response to problems that arise and to requests for comfort setting changes. The new system should now be able to run daily start up and shut down routines to effectively save on energy consumption. One capability of the EMS that is underutilized is analysis of stored operational data to better understand the complexities of HVAC response to the exterior environment. Training for interested staff in this capability may be useful in obtaining additional significant energy savings.

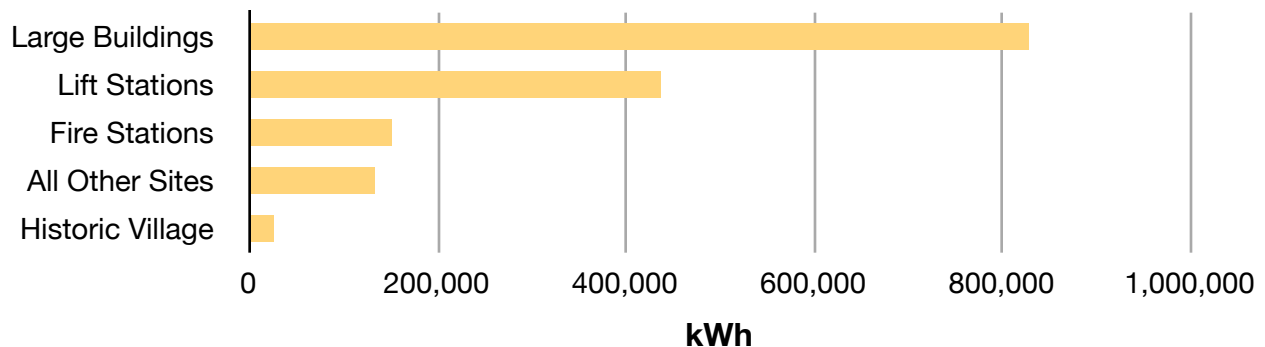
Retro-commissioning Follow Up

Another major 2012 project was retro-commissioning for the HVAC systems in the larger township buildings. Documentation of this process by the implementation contractor is sparse. It is unclear what actionable data was collected or how systems have been modified. This made evaluation for additional HVAC ECMs difficult. The township may want to revisit the contract for the retro-commissioning to determine what deliverables were expected and to obtain all available data gathered as part of that process. Some recommissioning of these systems may want to be undertaken where calculated potential energy savings did not occur. During future scheduled or emergency maintenance of HVAC systems, it is highly recommended that work be fully documented as to the date, equipment involved, remedy, cost if any, result of intervention, and energy savings potential.

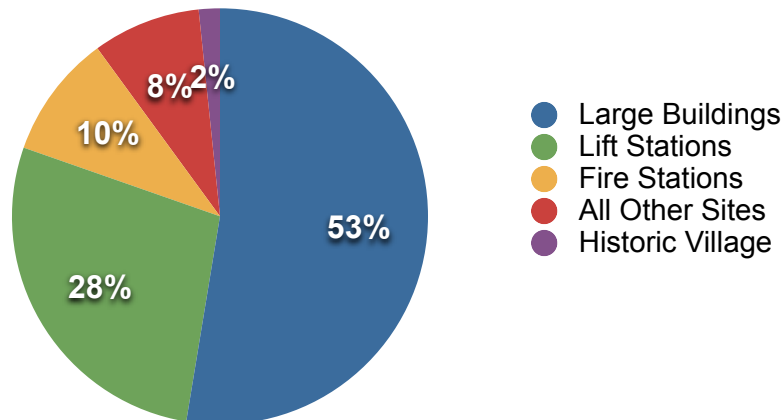
SECTION 2 - Township Facilities Summary of Existing Energy Consumption

The following charts display the 2014 total annual consumption for electricity (in kWh) and gas (in CCF) for 5 categories of Meridian Township facilities. The first category includes the 3 largest township buildings: the Municipal Building, the Public Safety Building and the Service Center Building. The Lift Stations category includes 31 locations around the township for Water Infrastructure. There are 3 Fire Station facilities. The Historic Village has 6 buildings on site. The last category includes 13 other township buildings or facilities at separate locations.

Township Facilities Electrical Consumption - 2014



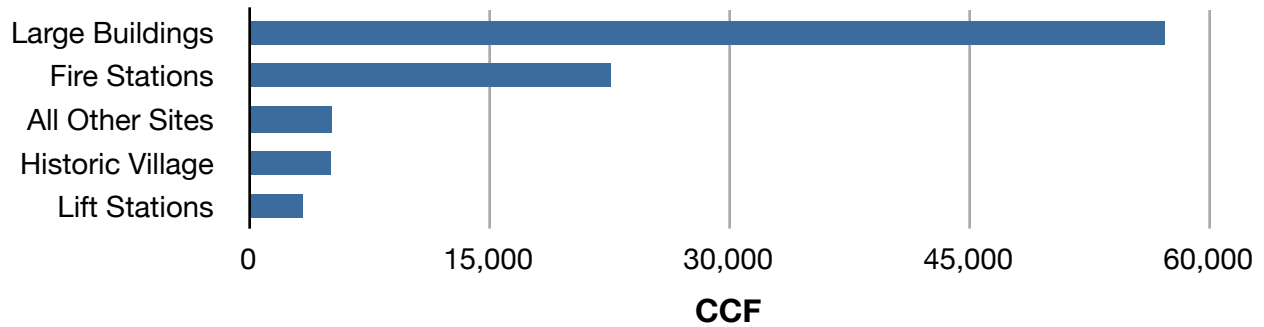
Electricity Consumption by Share



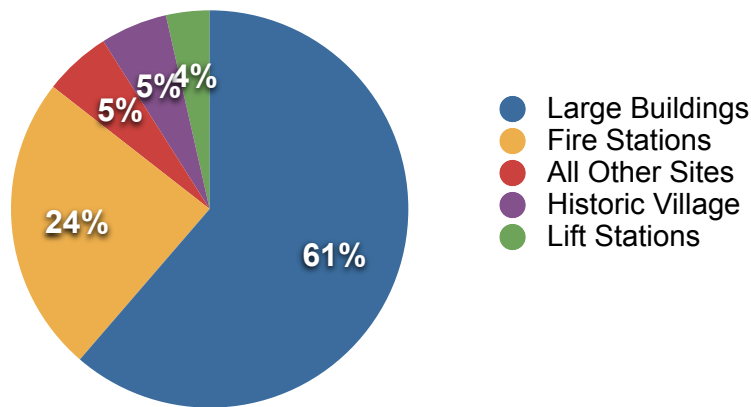
The three largest township buildings constitute over half of the total electricity consumption. These buildings previously had energy audits and energy retrofit projects effecting electrical consumption. This report documents the remaining potential for energy savings for these three buildings. The Lift Stations use more than 1/4 of the electrical energy. Walk through energy audits were conducted of the largest of these facilities. The results of this effort are provided in the this report. The Fire Stations are responsible for 10% of electrical use. One of the three fire stations was previously audited and a second was audited for this report. The Historic Village constitutes just 2% of electricity consumption. A walk through audit was conducted for the Historic

Village. The electricity consumption for the remainder of all township facilities amounts to about 8% of the total. The Nature Center previously had an energy retrofit project. Both this building and the Activity Center were audited for this report.

Township Facilities Gas Consumption - 2014



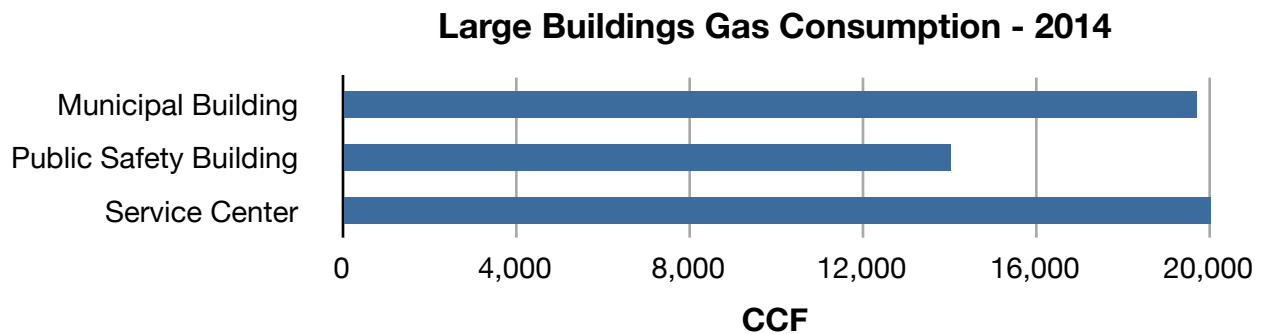
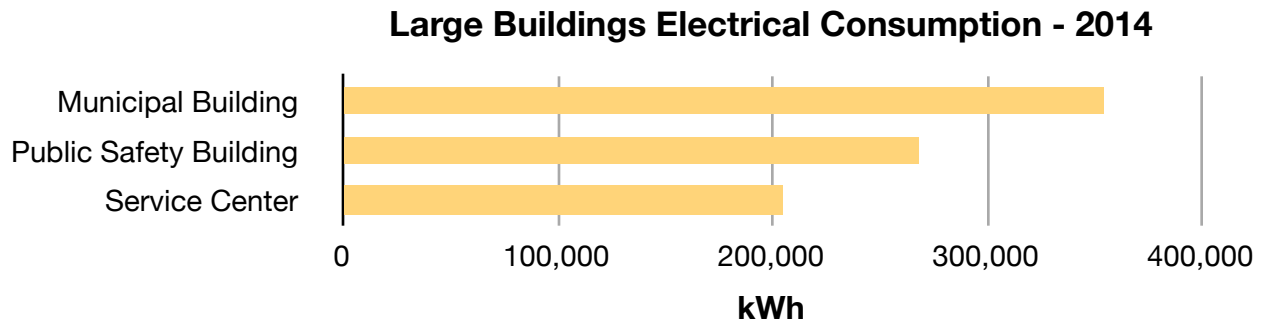
Gas Consumption by Share



The three largest township buildings constitute almost 2/3 of the total gas consumption. These buildings previously had energy audits and energy retrofit projects effecting gas consumption. This report documents the remaining potential for energy savings for these three buildings. The Fire Stations gas consumption amounts to almost 1/4 of the total. One of the three fire stations was previously audited and a second was audited for this report. The Historic Village and the Other Sites Category both use about 5% of the total gas. Analysis of gas consumption and discussions with management indicate that the Historic Village buildings are not insulated. The Nature Center previously had an energy retrofit project. Both this building and the Activity Center were audited for this report. The Lift Stations constitute just 4% of gas consumption. The largest of these facilities was audited for potential energy savings.

SECTION 3 - Large Buildings Analysis & Recommendations

The charts below show the annual electrical and gas consumption for the three largest township buildings.



Each of these buildings received an ASHRAE Level II energy audit during the summer of 2010. The full TEA Reports are available in PDF format and should be reviewed as reference to the following narrative. Energy conservation measures (ECMs) recommended in the energy audit reports were implemented for all three buildings. Based on a spreadsheet provided for this report, the ECMs that were undertaken are described herein. Some of these ECMs were common to all buildings. The existing T8 linear fluorescent fixtures were retrofitted with 28 Watt energy saver lamps. Occupancy sensors for the control of lighting and ventilation were installed. Demand controlled ventilation was instituted. And the HVAC systems underwent a retro-commissioning process. The energy management system that allows digital control of the HVAC systems was also upgraded.

Unfortunately, the documentation for these efforts is sparse so that knowing exactly what was accomplished or having direct correlation with the audit reports was not possible. It is recommended that future energy saving efforts be better documented so that analysis of the results can be more useful.

The Service Center had additional ECMs implemented including high bay lighting in the vehicle garage and exterior lighting on the building and in the soffit of the fueling station roof. There was also insulation applied to the exterior block walls above the drop ceilings. Additionally, an air leak sealing procedure in this area was undertaken.

The following tables display the electric and gas Energy Utilization Indices (EUIs), both at the time of the initial energy audit in 2009 and for the 2014 calendar year, for the three largest township buildings. Each EUI is calculated by converting annual electrical and gas energy to MBTU (thousands of BTUs) and then dividing by the area of each building in square feet. EUI (MBTU/SF) is a measure used to compare the energy intensity of different buildings and to analyze energy savings following the implementation of an energy efficiency project.

ELECTRICITY EUI	2009	2014	% Change
Municipal Building	53,063	47,386	-10.7%
Public Safety	64,861	51,237	-21.0%
Service Center	22,554	16,419	-27.7%

Although the Municipal Building has the largest electrical energy consumption, the Public Safety Building is the most energy intensive, probably because it has specialized functions and equipment. The Service Center had the most energy efficiency work implemented and achieved the greatest energy savings at 27.7%. The Public Safety Building gets 24 hour use and obtained 21.0% annual electricity savings. The Municipal Building recorded a more modest 10.7% reduction in electrical consumption. The HVAC systems for this building may benefit from further tweaking through the EMS.

GAS BASE EUI	2009	2014	% Change
Municipal Building	6,432	2,316	-64.0%
Public Safety	5,196	4,692	-9.7%
Service Center	1,800	2,976	65.3%

The Base Gas EUI related mostly to domestic hot water use. Whatever happened during the retro-commissioning and EMS tweaking process for the Municipal Building, it resulted in a 64.0% reduction in gas use. The Public Safety Building achieved a respectable 9.7% lower energy use. However, the Service Center experienced a 65.3% increase in gas use. This may be due to changes in vehicle washing procedures. This may be an activity to analyze more closely.

GAS HEATING EUI	2009	2014	% Change
Municipal Building	63,760	60,669	-4.8%
Public Safety	41,546	46,844	12.8%
Service Center	39,065	42,734	9.4%

The Gas Heating EUIs in the table above have been normalized for the severity of the heating season as determined by the heating degree days for each year. The Municipal Building achieved a 4.8% reduction in gas use for space heating. However, the other two buildings experienced consumption increases. It should be noted that all electrical consumption eventually degrades to low temperature heat that effects the interior

temperature. As electricity use decreases, this heat energy may have to be replaced by the gas heating system. These buildings had about two times the electrical savings as the Municipal Building. Further EMS tweaking may help to ameliorate this effect.

The tables that follow present information regarding the unimplemented energy conservation measures for each of the three large township buildings. The calculations have been updated to reflect current electricity prices, which have increased to \$0.135/kWh, and current gas prices, which have decreased to \$0.725/CCF.

It should be noted that the large township facilities are all on a demand rate for electricity. Under this rate structure, a building is charged a lower price per kWh, but it is assessed an additional charge based on the highest level of KW demand reached each month. Generally, this produces a lower overall cost to the customer. When implementing recommendations that save electricity, those that do not reduce demand may not capture the full economic benefit. Since actual bills were not available for this report, there is no way to separate out consumption from demand. Therefore, this report uses a blended rate based on total consumption and cost. That value is \$0.11/kWh. Actual dollar savings may be less if demand is not reduced.

The table below includes items from the original TEA Report for the Municipal Building which are not believed to have yet been implemented. The recommendation for roof insulation was dropped as not cost effective at this time. The recommendation for retrofitting exterior soffit canopy fixtures was dropped because neither a suitable LED fixture nor lamp could be located.

Municipal Building Recommendation Table

TYPE	ECM	Cost Est. (\$)	Savings Est. (\$/Yr)	Savings kWh/Yr	Savings CCF/Yr	Rebate Est. (\$)	ROI (Yr)
Shell	None	0	0	0	0	0	0
HVAC	Energy Recovery Ventilation	\$14,000	\$3,129.37	8,887	2,968	\$750	4.2
HVAC	Condensing Boilers	\$18,000	\$2,407.00	0	3,320	\$1,240	7.5
DHW	None	0	0	0	0	0	0
Electrical	Beverage Machine Timer	\$150	\$66.00	600.0	0	\$65	1.3
Electrical	Air Handler VFDs	\$8,000	\$1,235.52	11,232.0	0	\$600	6.0
Lighting	None	0	0	0	0	0	0
	TOTALS	\$40,150	\$6,837.89	20,719	6,288	\$2,655	5.5

The table below includes items from the original TEA Report for the Public Safety Building which are not believed to have yet been implemented. The recommendation for new condensing boilers was dropped as not currently cost effective. Revisiting the HVAC commissioning process is an added recommendation. This recommissioning should focus on gas savings involving the operation of the terminal reheat coils. Gas consumption remains well above predicted levels for base load and space heating.

Public Safety Building Recommendation Table

TYPE	ECM	Cost Est. (\$)	Savings Est. (\$/Yr)	Savings kWh/Yr	Savings CCF/Yr	Rebate Est. (\$)	ROI (Yr)
Shell	None	0	0	0	0	0	0
HVAC	Recommissioning for Gas	\$1,500	\$688.75	0	950	0	2.2
HVAC	Energy Recovery Ventilation	\$9,000	\$1,728.48	3,863	1,798	\$725	4.8
DHW	None	0	0	0	0	0	0
Electrical	Beverage Machine Timer	\$150	\$66.00	600.0	0	\$65	1.3
Lighting	Wallpack/Sign LED	\$1,000	\$101.58	923.5	0	\$92	8.9
TOTALS		\$11,650	\$2,584.81	5,386	2,748	\$882	4.2

The table below includes items from the original TEA Report for the Service Center which are not believed to have yet been implemented.

Service Center Recommendation Table

TYPE	ECM	Cost Est. (\$)	Savings Est. (\$/Yr)	Savings kWh/Yr	Savings CCF/Yr	Rebate Est. (\$)	ROI (Yr)
Shell	Complete	0	0	0	0	0	0
HVAC	Exhaust Fan Timer	\$500	\$1,022.87	2,464.0	1,037	0	0.5
DHW	Pump Timer	\$150	\$60.39	549.0	0	\$44	1.8
Electrical	Beverage Machine Timer	\$150	\$66.00	600.0	0	\$65	1.3
Lighting	Complete	0	0	0	0	0	0
TOTALS		\$800	\$1,149.26	3,613	1,037	\$109	0.6

Replacement of exterior walkway and street lighting at the Marsh Road Campus is a project being planned that has an actual budget for implementation. It is not clear to which building each fixture is connected, so retrofit options are presented in the summary table below. The calculated retrofits are for induction fluorescent technology. LED is also a popular replacement which may have a slightly larger energy savings, but generally large wattage LED fixtures will be more expensive and shorter lived than induction fluorescent. Comparison quotes for each technology is highly recommended.

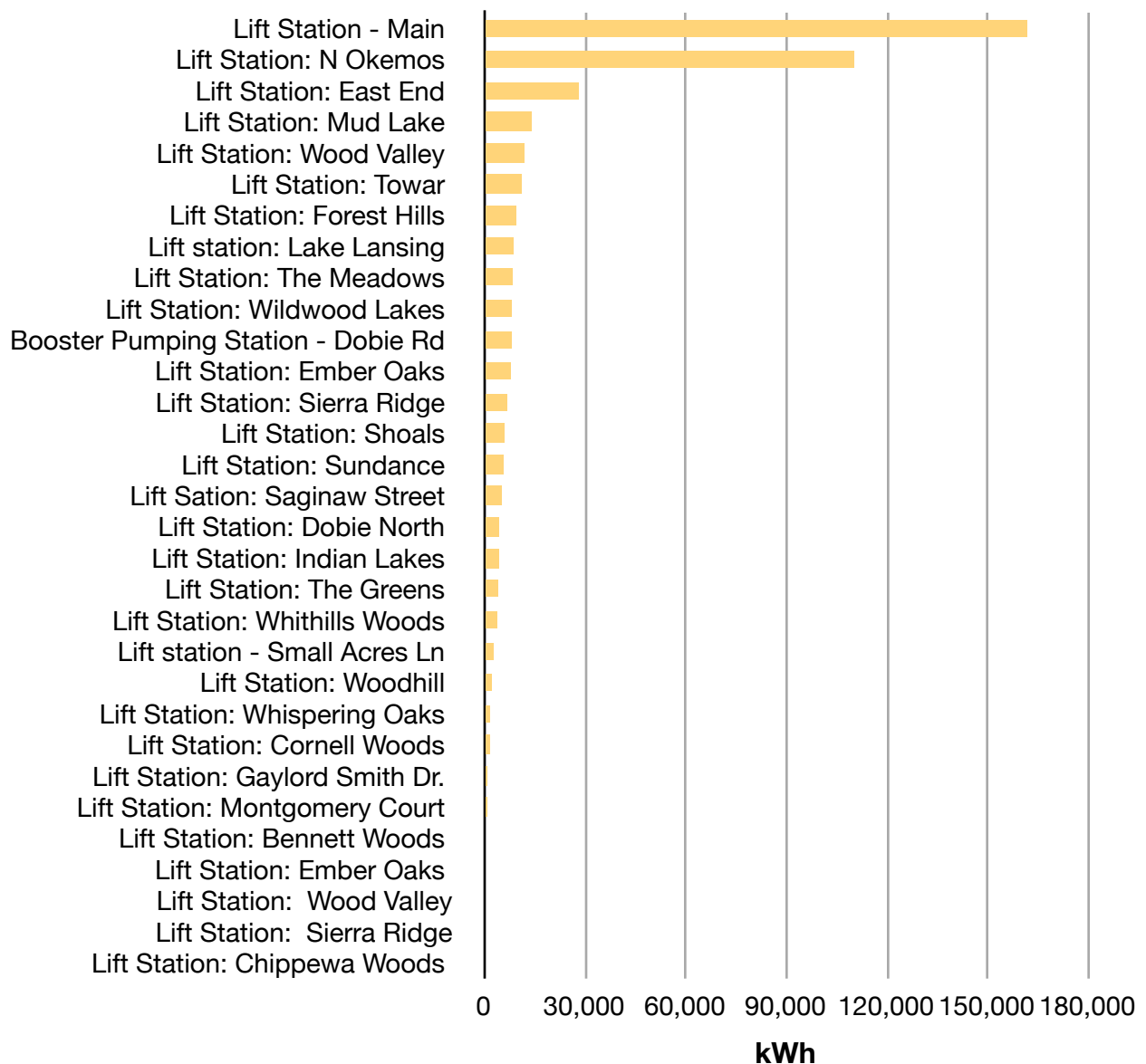
Marsh Road Campus Lighting Recommendation Table

EXISTING	NEW	Qty	Savings kWh/Yr	Cost Est. (\$)	Savings Est. (\$/Yr)	Rebate Est. (\$)	ROI (Yr)
HID 150	Retrofit IF/LED-174W to 82W	20	7,388	\$7,000	\$812.64	\$736	7.7
HID 250	New IF/LED-290W to 118W	6	4,143	\$2,700	\$455.78	\$413	5.0
HID 300	New IF/LED-310W to 118W	5	3,854	\$2,250	\$423.98	\$384	4.4
HID 400	New IF/LED-455W to 265W	5	3,814	\$2,500	\$419.57	\$380	5.1
	TOTALS	\$36	19,200	\$14,450	\$2,111.97	\$1,913	5.9

SECTION 4 - Lift Stations Analysis & Recommendations

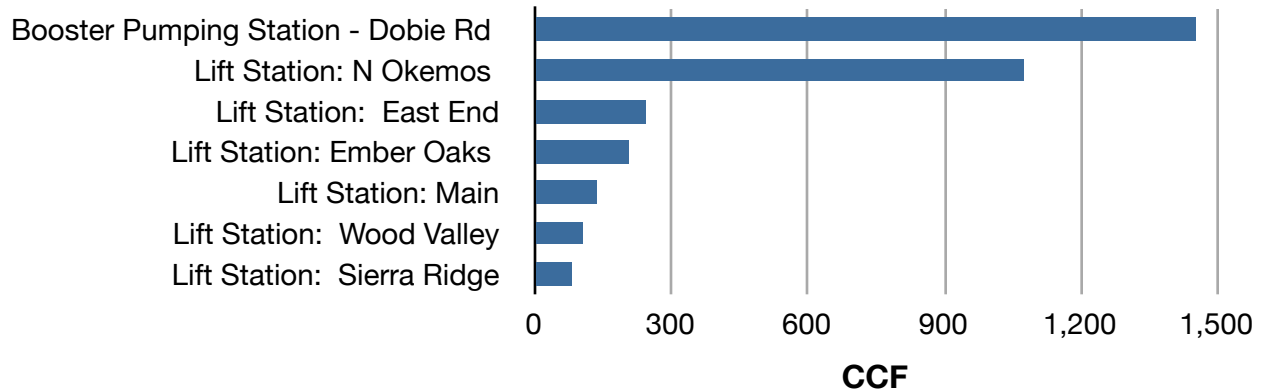
The chart below shows the annual electrical consumption for each of 31 Water Infrastructure locations. Over 62% of the total is used by just 2 locations. Walk through energy audits were conducted for these two locations. Both facilities were found to be clean, modern, and up to date. The lighting systems were efficient. The pumping equipment was controlled by variable speed drives providing the most efficient power when needed. No improvements are recommended. The remaining locations are pumping stations that are active on an as needed basis. The larger of these pumps may benefit from variable speed drives in the future.

Water Infrastructure Electrical Consumption - 2014



The chart below shows the annual gas consumption for 7 Water Infrastructure locations. The use of gas is for space heating to keep the pumping equipment from freezing and to heat fresh air that is code required for such facilities. Gas consumption is not significant except for two locations. These are equipped with direct fired rooftop heating only units. The sensor controls for these two facilities may want to be checked to determine if the current, apparently large, ventilation rates are really necessary.

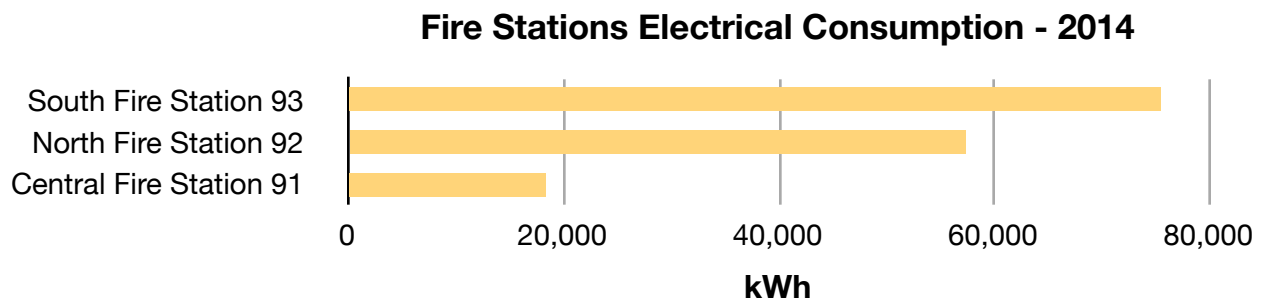
Water Infrastructure Gas Consumption - 2014



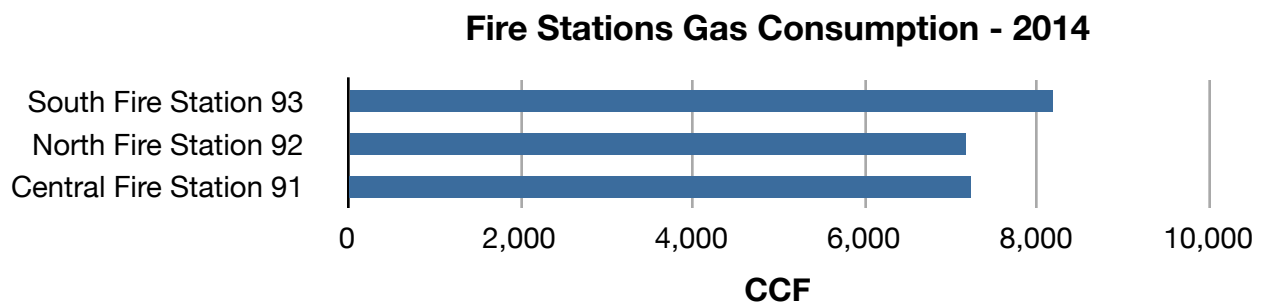
The Meridian Township Water Infrastructure is generally in good energy efficient shape. Should replacement of energy using equipment be anticipated in the future, such as improved pumps and controls or lighting, management should be in contact with Consumers Energy during the planning process to determine and reserve incentives that may be available.

SECTION 5 - Fire Stations Analysis and Recommendations

The chart below shows the annual electrical consumption for the 3 Fire Station locations. The South Fire Station has the largest consumption of electricity. This building was previously audited. In October of 2011, its base electrical consumption dropped by about 40% and has stayed there at that level. This report discusses the reasons for this energy reduction and presents additional potential energy savings as determined from that audit. The North Fire Station received an energy audit for inclusion in this report. The Central Fire Station has been closed for some time but still shows significant electricity use. A site visit to document this energy use is recommended and steps should be taken to eliminate unneeded equipment operation.



The chart below shows the annual gas consumption for the 3 Fire Station locations. The South Fire Station had slightly more consumption of gas than the other two. This building was previously audited. This report presents the potential gas energy savings as determined from that audit. The North Fire Station received an energy audit for inclusion in this report. The Central Fire Station has been closed for some time but still shows consumption nearly equal to that for the South & North. A site visit to document this energy use is recommended and steps should be taken to eliminate unneeded equipment operation.



South Fire Station Analysis & Recommendations

The South Fire Station received an ASHRAE Level II energy audit in July of 2010. The full TEA Report is available in PDF format and should be reviewed as reference to the following narrative. One of the major findings of the audit report was that electrical energy consumption was more than 40% higher than that predicted by the electrical inventory for the building. Review of the electrical consumption records from Planet Footprint revealed that between October and November 2011, the base electrical consumption of the South Fire Station dropped by about 40% and has remained at this level since. There were three recommendations relevant to this issue in the TEA report for the fire station that were apparently implemented at that time.

First, it was recommended that the electric meter be checked for accuracy. This was done, but the findings did not indicate a need to replace or repair the meter. Second, it was noted that the mechanical plans called for the installation of electric preheaters in each of the 3 fresh air intakes to the building furnace/air handlers. These heaters were found to be operative and were disconnected as recommended. Lastly, the amount of fresh air being brought into the building was found to be excessive. The air intake dampers were adjusted to reduce the ventilation rate. The current value of the base electrical energy reduction is about \$5,000 annually. There would be additional substantial savings in electricity for space cooling and savings in gas for space heating. The value of these savings as determined by the original audit amount to about \$1,200 annually.

There are no records indicating that any other recommendations from the TEA Report for the South Fire Station were implemented. The table that follows presents information regarding the unimplemented energy conservation measures. The calculations have been updated to reflect current utility prices, which have increased to \$0.135/kWh, and current gas prices, which have decreased to \$0.725/CCF.

South Fire Station Recommendation Table

TYPE	ECM	Cost Est. (\$)	Savings Est. (\$/Yr)	Savings kWh/Yr	Savings CCF/Yr	Rebate Est. (\$)	ROI (Yr)
Shell	None	0	0	0	0	0	0
HVAC	None	0	0	0	0	0	0
DHW	Pump Timer	\$125	\$39.40	358.2	0	\$29	2.4
Electrical	Occupancy Sensors	\$255	\$70.27	638.8	0	\$75	2.6
Lighting	28W T8	\$420	\$85.88	685.3	0	\$53	4.3
Lighting	Incandescent to CFL	\$38	\$12.34	94.0	0	\$8	2.4
Lighting	Wallpack/Sign LED	\$1,200	\$313.46	2,730.2	0	\$272	3.0
Lighting	Pole Induction	\$1,100	\$174.40	1525.7	0	\$152	5.4
	TOTALS	\$3,138	\$695.75	6,032	0	\$588	3.7

The South Fire Station, like the other large township facilities, is on a demand rate for electricity. Under this rate structure, a building is charged a lower price per kWh, but it is assessed an additional charge based on the highest level of KW demand reached each month. Generally, this produces a lower overall cost to the customer. When implementing recommendations that save electricity, those that do not reduce demand may not reflect the full economic benefit. Since actual bills were not available for this report, there is no way to separate out consumption from demand. Therefore, this report uses a blended rate based on total consumption and cost. That value is \$0.11/kWh. Actual dollar savings will be less if demand is not reduced.

EUI calculations for the gas space heating consumption for the South Fire Station approach 100,000 MBTU/SF. This is twice the energy intensity of any large township building. The base gas use was noted in the original energy audit report as being far above expectations for this type of facility. This has also increased since then. Inspection of the gas meter, gas piping, and all gas-fired equipment is highly recommended to determine to cause of such excessive consumption.

North Fire Station Analysis & Recommendations

A walk through energy audit was conducted for the North Fire Station. The building is a masonry walled and wood framed structure on a concrete floor slab with a gabled roof.

SHELL The vehicle garage has concrete block walls. These have vinyl exterior siding and may be insulated on the outside with rigid foam insulation. The remainder of the building has 2X4 wood stud exterior walls that are insulated with fiberglass. There is a second floor mechanical room and storage space with access to attic areas. The attics have 12" of blown cellulose insulation.

The wood windows in the building are fixed or casement/awning type and have double pane glass. The pedestrian doors and overhead vehicular doors are insulated metal with single pane vision glass. Weatherstripping on the doors should be checked annually.

HVAC The building is heated with two, 80% efficient, gas-fired furnaces located on the second floor. Air-conditioning is provided by remote condensing units mounted on a concrete pad outside of the building. The mechanical plans for the building were not available for review at the time of the site visit. The fresh air intake vents should be inspected to determine the amount of ventilation provided. If it is excess, like the South Station was, the ventilation damper can be set to a more appropriate level.

This report evaluates replacement of the furnaces with 95% efficient condensing units with variable speed fans. The A/C units may also be replaced at the same time. New air-conditioning condenser units with SEER ratings of 16 or greater will be cost effective. The attic inspection found one major length of ductwork that should be insulated. Other attic ductwork should be checked for insulation and air tightness.

ELECTRICAL There are significant quantities of office equipment in the building. Instructions to turn off all equipment when leaving the building should be posted. The use of smart power strips is encouraged. All computers should be programmed to enter sleep mode when not being actively used. The kitchen has an older refrigerator and a microwave. New kitchen equipment should be Energy Star rated. There are areas and rooms of the building where occupancy sensors to control lighting and ventilation are recommended.

LIGHTING The incandescent lighting in the building has mostly been converted to CFLs except for 2 in the shower room. These reflector lamps can be replaced with LED equivalents. The remainder of the lighting fixtures, except for the garage, are efficient T8 linear fluorescent technology. These can be relamped with energy saver 28 watt lamps. The site visit noted that a significant number of lamps had failed. A group relamping will save on future maintenance and operating costs. The vehicular garage has 8 foot T12 high output fluorescent fixtures than can be retrofitted with T8 HO technology. The garage also contains some HID fixtures that can be replaced with more efficient and long lasting induction fluorescent fixtures. The exterior of the building has a couple of HID wall packs that can be replaced with LED equivalents.

The following table summarizes the economics of the recommendations in the previous narrative. ROI (Return On Investment) includes the utility rebates. The cost of electricity is estimated at \$0.11/kWh. The cost of gas is estimated at \$0.725/CCF.

North Fire Station Recommendation Table

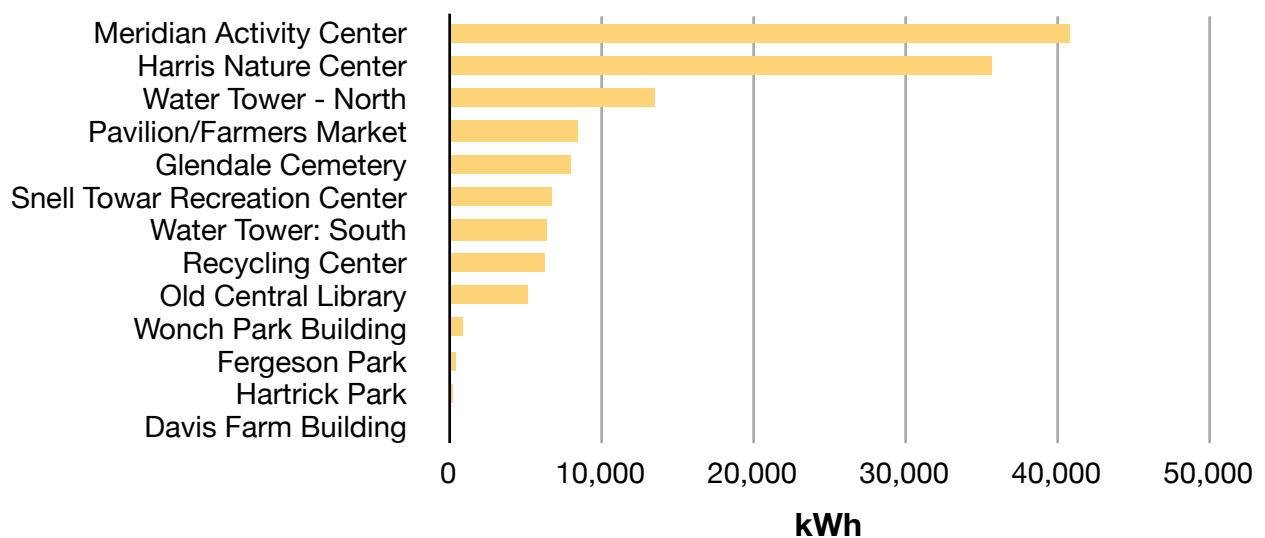
TYPE	ECM	Cost Est. (\$)	Savings Est. (\$/Yr)	Savings kWh/Yr	Savings CCF/Yr	Rebate Est. (\$)	ROI (Yr)
Shell	None	0	0	0	0	0	0
HVAC	Insulate Ductwork	\$200	\$66.56	272	51	\$60	2.1
HVAC	95% AFUE Furnaces	\$9,000	\$780.70	900	940	\$540	10.8
DHW	None	0	0	0	0	0	0
Electrical	Occupancy Sensors	\$915	\$301.97	2,745.2	0	\$175	2.5
Lighting	8ftT12HO to T8HO	\$305	\$154.27	1,138.8	0	\$78	1.5
Lighting	28W T8	\$833	\$121.34	969.4	0	\$74	6.3
Lighting	High Bay Induction	\$1,650	\$299.63	2,496.6	0	\$200	4.8
Lighting	Wallpack LED	\$210	\$46.17	401.5	0	\$40	3.7
Lighting	Wallpack LED	\$325	\$99.16	883.3	0	\$88	2.4
	TOTALS	\$13,438	\$1,869.80	9,807	991	\$1,254	6.5

SECTION 6 - Other Township Sites Analysis & Recommendations

The chart below shows the annual electrical consumption for each of 13 township facilities at separate scattered locations. About 58% of the total is used by just 2 locations. The Harris Nature Center has previously conducted energy retrofits. This building was revisited with a walk through energy audit. The Meridian Activity Center is currently used as a business incubator resource with erratic hours of operation. A walk through energy audit was also conducted for this building. The results of these audits are provided later in this section of the report.

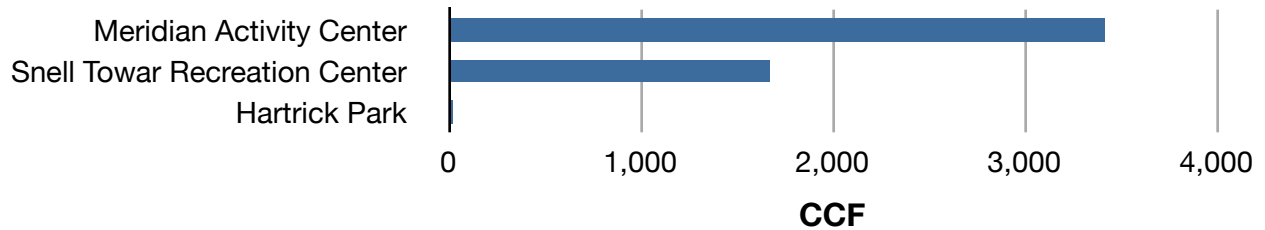
The remaining properties have electrical consumption similar to that for a large residence. Based on site visits to the Glendale Cemetery and Farmers Market Pavilion, this consumption is believed to be mostly for interior and exterior lighting. There are opportunities to update to more efficient lighting: linear fluorescent to T8 technology, incandescent to CFL or LED, and exterior HID to LED or induction. Occupancy Sensors may also be beneficial in some instances. Both Consumers & BWL offer rebates for lighting retrofits. Malfunctioning timer or photocell controls on exterior lighting fixtures, as observed at the Pavilion restroom entries, should be given immediate attention and may be candidates for an LED replacement.

Other Township Sites Electrical Consumption - 2014



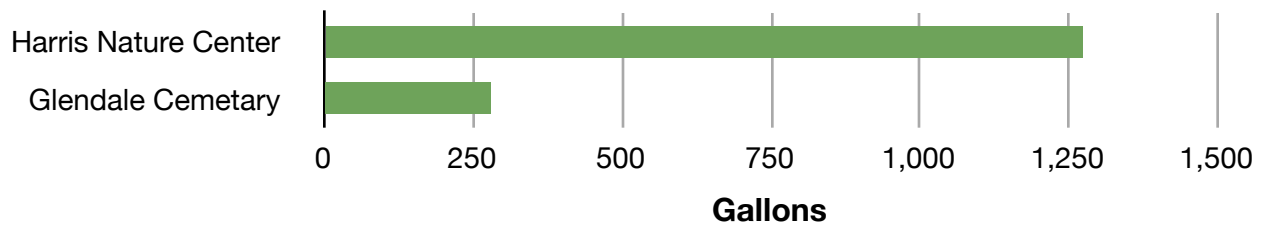
The chart below shows the annual gas consumption for 3 township facilities at separate scattered locations. The Meridian Activity Center gas consumption, the largest of these, is discussed in the audit results provided later in this section of the report.

Other Township Sites Gas Consumption - 2014



Two of the scattered sites use propane for space heating. The Harris Nature Center propane consumption is discussed in the audit results provided later in this section of the report.

Other Township Sites Propane Consumption - 2014



Harris Nature Center Analysis & Recommendations

A walk through energy audit was conducted for the Harris Nature Center. The building is a wood framed residential type structure with a basement/crawlspace foundation and gabled roof.

SHELL The exterior 2X4 wood stud walls are insulated with fiberglass. There is a walk-up attic below the gabled roof. The insulation in the attic was recently upgraded. The rim joist in the basement was insulated with spray foam. The foam has begun to detach from the studs. The insulator should be contacted to see if remediation is required. The crawlspace walls also appear to have been insulated at that time.

The wood windows in the building are fixed or casement/awning type and have double pane glass. The main entry has an air-lock vestibule. The doors are half glazed with single pane glass. Weatherstripping on the doors should be checked annually.

HVAC The building is heated by a new high efficiency (92%) propane furnace located in the basement. Air-conditioning is provided by a remote condensing unit mounted on a concrete pad outside of the building. There is a programmable thermostat for the heating & cooling system. Correct programming of the thermostat is the most important action to save on operating costs of the HVAC system. There is a small electric domestic hot water tank in the basement. It has extra insulated added as well as pipe insulation.

ELECTRICAL There are significant quantities of office equipment in the building. Instructions to turn off all equipment when leaving the building should be posted. The use of smart power strips is encouraged. All computers should be programmed to enter sleep mode when not being actively used. The kitchen has an efficient refrigerator and a microwave. The basement has two dehumidifiers which are large energy users. Only the most efficient equipment should be used and regular maintenance is important. The Nature Center contains a number of terrarium and aquarium displays that utilize special LED lighting and heat lamps for the specimens.

LIGHTING The lighting in the building has mostly been converted from incandescent to CFLs. The vanity fixtures in the main restrooms still have incandescent lamps that can be replaced with CFLs or LEDs. There are also a few linear fluorescent fixtures that have efficient T8 technology. The installation of occupancy sensors is recommended for the restrooms and other areas.

The exterior wall mounted lighting includes one HID entry fixture on a motion detector and one LED flood lamp to illuminate the flag pole. There are also torpedo shaped incandescents in two fixtures attached to the entry arch. These can be retrofitted with LEDs. In addition, there are 5 light pole using 150 Watt HPS technology. These can be retrofitted with induction technology.

The following table summarizes the economics of the recommendations in the previous narrative. ROI (Return On Investment) includes the utility rebates. The cost of electricity is estimated at \$0.142/kWh. The cost of gas is estimated at \$0.725/CCF.

Harris Nature Center Recommendation Table

TYPE	ECM	Cost Est. (\$)	Savings Est. (\$/Yr)	Savings kWh/Yr	Savings CCF/Yr	Rebate Est. (\$)	ROI (Yr)
Shell	None	0	0	0	0	0	0
HVAC	None	0	0	0	0	0	0
DWH	None	0	0	0	0	0	0
Electrical	Occupancy Sensors	\$340	\$72.46	510.3	0	\$100	3.3
Lighting	Incandescent to LED	\$152	\$107.60	729.6	0	\$50	1.0
Lighting	HID to Induction	\$1,625	\$272.26	1,846.9	0	\$184	5.3
	TOTALS	\$2,117	\$452.32	3,086.8	0	\$334	3.9

Meridian Activity Center Analysis & Recommendations

A walk through energy audit was conducted for the Activity Center. The building is masonry walled with a flat roof. It originally housed a bank. It is currently for sale.

SHELL The exterior concrete block walls are furred out and insulated on the inside. The walls above the drop ceiling may not be insulated. This should be checked and insulation installed. Wood decking is applied over the steel roof trusses. The existing roll roofing is in fair shape. It covers probably an inch or two of insulation. When reroofing is needed, a white single ply membrane with 4 to 5 inches of insulation is recommended.

The bay windows on the south wall have double pane glass. The remainder of the windows in the building are only single pane. Replacement windows with high performance glazing or Low-E exterior storm windows are recommended. The main entry has an air-lock vestibule. The doors are fully glazed with single pane glass. Weatherstripping on the doors should be checked annually.

HVAC The building is heated by two old furnaces. Air-conditioning is provided by remote condensing units mounted on a rack outside the rear of the building. All equipment is old and in poor condition. Replacement is recommended. There are programmable thermostats for each of the two heating and cooling zones. These were found not to be programmed for set backs when the building is not occupied. One had the fan operating continuously. Until replacement is accomplished, programming the two thermostats for hours of operation will provide large energy savings.

ELECTRICAL There are significant quantities of office equipment in the building. Instructions to turn off all equipment when leaving the building should be posted. All computers should be programmed to enter sleep mode when not being actively used. The vending machine, water cooler/heater, and Bunn coffee maker should be placed on timers to shut off after hours.

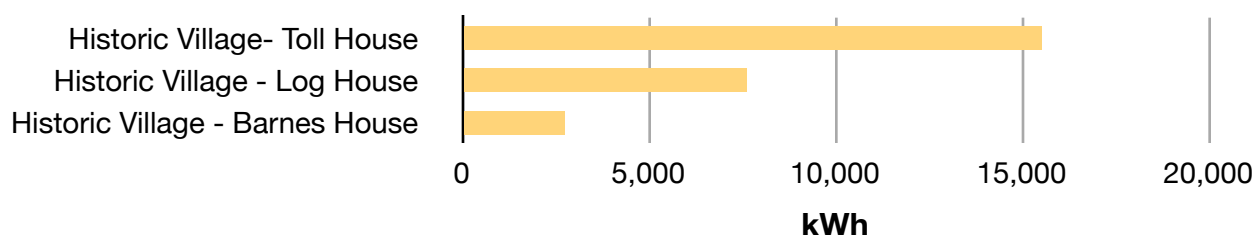
LIGHTING The lighting in the building is mainly linear fluorescent, 2 lamp, 4 foot acrylic wrap fixtures mounted to the acoustic ceiling end to end. Some fixtures are not functioning, probably from burned out lamps, but may still be using power. These fixtures have standard T12 40 Watt lamps and energy saving ballasts, an old and inefficient technology. These can easily be retrofitted with T8 lamps and ballasts for significant energy savings with quick payback. There are a few lighting fixtures that may still use incandescent lamps. These can easily be retrofitted with CFLs or LEDs. Over half of the lighting was on at the time of the audit when no one was in the building. The installation of occupancy sensors is recommended.

The exterior roof soffit lighting is HID. One of these was operating during the day indicating that a timer or photocell may be malfunctioning. These fixtures may want to be replaced with LEDs. There are also 2 pole mounted HID fixtures that may want to be replaced with induction fluorescent technology.

SECTION 7 - Historic Village Analysis & Recommendations

As shown below, the Historic Village has only three electric meters for the 6 buildings on site, so, except for the Barnes House, the actual consumption for each building cannot be determined from the billing history. If the consumption is averaged over all buildings, the electricity use for each is similar to that used by a modest single family home. Since these buildings do not have typical modern household appliances in them, the electrical consumption is thought to be due mainly to interior and exterior lighting. An on-site walk through of the Village determined that almost all of the lighting fixtures use incandescent lamps. It is believed that incandescent lamps will best compliment the historic nature of the buildings. However, there currently are both CFL and LED lamp shapes identical to the incandescent that could be used as replacements. These technologies would consume from 75% to 90% less energy, saving over \$1,300 annually. Incentives are still available from Consumers Energy which would mostly pay for new LED lamps.

Historic Village Electrical Consumption - 2014



The chart below shows the gas consumption for each of the 6 buildings on the Historic Village site. Four of these buildings have annual consumption significantly greater than a modest single family home. This appears to indicate that the buildings have uninsulated attics and/or walls. Management may want to consider a study to evaluate ways of insulating these buildings without creating maintenance problems. An architect or other insulation specialist may want to be retained. Energy savings of a least 1/3, valued at over \$1,100, could be expected. These buildings also have single pane windows. For energy savings and to protect the primary windows from damage from the elements, the installation of exterior Low-E storm windows may want to be considered. Updating the heating equipment may also provide significant savings.

Historic Village Gas Consumption - 2014

