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Local Government Energy Program
Energy Audit Final Report

For

The Community Center
Township of Hanover
Whippany, NJ 07981

Project Number: LGEA14

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INTRODUCTION

On July 2nd and 27th Steven Winter Associates, Inc. (SWA) performed an energy audit and assessment for the Township of Hanover municipal buildings. The audit included a review of the Community Center, Municipal Building, Department of Public Works, Monroe Hall and the Parks and Recreation Garage. All these buildings are located in Whippany, NJ. A separate Energy Audit Final Report is issued for each of the referenced buildings.

This report addresses the Community Center located at 15 North Jefferson Road, Whippany, NJ 07981. Current conditions and energy-related information were collected in order to analyze and facilitate the implementation of energy conservation measures for the building.

The Community Center building was built in 1992 and houses the community gymnasium and the administrative offices for various community events. Several minor upgrades to the infrastructure and mechanical systems have occurred over the years. The building consists of 11,765 square feet of conditioned main space. The building houses approximately 8 staff members at various times during the year and is occupied about 70 hours / week. The building is normally operated evenings, less during the summer time, and can accommodate approximately 100 people at special community events. Recent schedules are Mon - Fri - 6:00 am to 9:30 pm, Sat - 7 am to 6 pm and Sun - 12 pm to 6 pm.

The goal of this energy audit is to provide sufficient information to the Township of Hanover to make decisions regarding the implementation of the most appropriate and most cost effective energy conservation measures for the Community Center building.

EXECUTIVE SUMMARY

The energy audit performed by Steven Winter Associates (SWA) encompasses the Community Center located at 15 North Jefferson Road, Whippany, NJ 07981. The Community Center is a one story building comprising of a combined floor area of 11,765 square feet. This 1992 building has had several minor renovations over the years. Mechanical rooms on the mezzanine and ground floor house the building furnaces and HVAC equipment.

Based on the field visits performed by the SWA staff on July 2nd and 27th, 2009 and the results of a comprehensive energy analysis, this report describes the site's current conditions and recommendations for improvements. Suggestions for measures related to energy conservation and improved comfort are provided in the scope of work. Energy and resource savings are estimated for each measure that results in a reduction of heating, cooling, and electric usage.

In 2008, the most recent year, the Community Center consumed 235,200 kWh or $39,306 worth of electricity and 7,653 therms or $10,291 worth of natural gas. The joint energy consumption for the building, including both electricity and natural gas, was 1,568 MM-Btus of energy that cost a total of $49,598.

SWA has entered energy information about the Community Center in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. This Recreational facility is comprised of non-eligible (Other) space type. SWA encourages the Township of Hanover to continue entering utility data in *Energy Star Portfolio Manager* in order to track weather normalized source energy use over time. EPA is continually working to expand the available space types.

Based on the assessment of the Community Center, SWA has separated the recommendations into three categories. These are summarized as follows:

Category I Recommendations: Capital Improvements

- New Reznor Furnaces - Replace the existing high maintenance main four duct mounted Reznor furnaces that are rusting on the outside and are at end of their useful operating lives. SWA recommends their replacement with newer units and understands that the Township of Hanover is prioritizing capital investment based on budget constraints. This recommendation cannot be cost justified by energy savings alone. The estimated cost for the overall replacement work of 4 furnaces is $25,000 based on other similar past projects. The new furnaces need to be properly specified by a design engineer and commissioned prior to start-up.

Category II Recommendations: Operations and Maintenance

- Controls Optimization - SWA recommends that the schedules for all air handling, cooling and heating equipment serving key public spaces be reviewed and optimized. During periods when the spaces are not occupied, the equipment may be shut-off or controlled to minimize the amount of fresh air conditioned by the equipment. The cost and effort associated with implementation of this recommendation will depend upon the capabilities of the existing building automation control system. Energy and cost savings associated with this recommendation will vary, depending upon the current occupancy schedules and means of control utilized.
- Weather Stripping / Air Sealing - SWA observed that exterior door weather-stripping in places was beginning to deteriorate. Doors and vestibules should be observed annually for deficient weather-stripping and replaced as needed. Any other accessible gaps or penetrations in the thermal envelope penetrations should also be sealed with caulk or spray foam.

- Flashing Leaks - SWA recommends fixing parapet cap flashing seams and end caps where signs of leakage are visible.
- Water Efficient Fixtures & Controls - Building staff can also easily install faucet aerators and / or low-flow fixtures to reduce water consumption. There are many retrofit options, which can be installed now or incorporated as equipment is replaced. Retrofitting with more efficient water-consumption fixtures / appliances will save both energy and money through reduced energy consumption for water heating, while also decreasing water / sewer bills.
- Energy Star labeled appliances such as refrigerators should replace older energy inefficient equipment.
- Smart power electric strips with occupancy sensors should be used to power down computer equipment when left unattended for extended periods of time.
- Create an educational program that teaches maintenance personnel how to minimize the energy use in the buildings. The US Department of Energy offers free information on this topic.

Category III Recommendations: Energy Conservation Measures - Upgrades with associated energy savings

At this time, SWA recommends a total of **9** Energy Conservation Measures (ECMs) for the Community Center that are summarized in the following table. The total investment cost for these ECMs with incentives is **$96,987**. SWA estimates a first year savings of **$59,824** with a simple payback of **1.6 years**. SWA estimates that implementing the recommended ECMs will reduce the carbon footprint of the Community Center by **104,827 lbs of CO_2.**

There are various incentives that the Township of Hanover could apply for that could also help lower the cost of installing the ECMs. SWA recommends that the Community Center apply for the NJ SmartStart program through the New Jersey Office of Clean Energy. This incentive can help provide technical assistance for the building in the implementation phase of any energy conservation project. A new NJ Clean Power program, Direct Install, to be rolled out soon, could also assist to cover 80% of the capital investment.

Specifically, the building could qualify for $160 for installing the recommended wall-mounted occupancy sensors and $80 for installing the recommended LED Exit signs. The Community Center could also take advantage of incentives based on the installation of a photovoltaic (PV) system. Currently, the New Jersey Office of Clean Energy offers a Renewable Energy Incentive program that would pay $5,000 for the installation of a 5kW PV system. There is also an incentive that issues a Solar Renewable Energy Certificate for every 1,000kWh (1MWh) of electricity generated that can be sold or traded for the current market rate of electricity. $3,600 of SRECs may be received annually; however it requires proof of performance, application approval and negotiations with the utility. Wind Upfront Incentive Program, Expected performance buy-down (EPBB) is modeled on an annual kWh production of 1-16,000 kWh and may pay $3.20/kWh upfront incentive level. However, it requires proof of performance, application approval and negotiations with the utility. There is also a utility-sponsored loan program through JCP&L that would allow the building to pay for the installation of the PV or Wind system through a loan issued by JCP&L.

The following tables summarize the proposed Energy Conservation Measures (ECM) and their economic relevance.

PROPOSED														
ECM #	ECM description	Installed Cost		1st year energy savings					SPP	LoM	Lifetime	ROI %	Annual Carbon Reduced (lbs of CO2)
		Estimate $	Source	Use	Unit	Demand /mo	Unit	Savings / year $			Cost Savings $		
1	Install Drinks Vending machine misers	$265	www. usatech. com	1,786	kWh	0.7	-	298	0.9	12	2,933	83.9	2,446
2.1	replace 54 incandescent lamps to CFL	$1,080	RS Means, Lit Search	13,122	kWh	5.5	kW	2,261	0.5	7	13,983	170.7	17,977
2.2	install 8 occupancy sensors with INCENTIVES	$720	RS Means, Lit Search, NJ Clean Energy Program	1,322	kWh	0.6	kW	221	3.3	12	2,171	16.8	1,811
2.3	replace 24 x 400 Watt Metal Halide lamps with 24 x 4ft T5 fixtures 6 lamps each (with incentives)	$5,856	RS Means, Lit Search, NJ Clean Energy Program	6,682	kWh	2.8	kW	1,151	5.1	20	16,810	9.4	9,154
2.4	install 4 LED Exit with INCENTIVES	$360	RS Means, Lit Search, NJ Clean Energy Program	389	kWh	0.2	kW	65	5.5	20	948	8.2	533
3	Retro-Commission-ing	$14,706	Similar Projects	23,520	kWh	9.8	kW	6,780	2.2	12	66,689	29.5	41,173
				765	therms	-	-						
4	Install CO2 sensors for Community Center demand control ventilation	$4,000	Similar Projects, RS Means, Lit Search	2,211	kWh	0.9	kW	691	5.8	12	6,795	5.8	5,837
				240	therms	-	-						
5	Install 5 kW Wind System with INCENTIVE	$40,000	Similar Projects	13,000	kWh	5.0	kW	43,771	0.9	25	745,480	70.5	17,810
6	Install 5 kW PV System (with $1/W INCENTIVE and $600/1MWh SREC)	$30,000	Similar projects	5,902	kWh	5.0	kW	4,586	6.5	25	78,100	6.4	8,086
	Total Proposed	**$96,987**	-	-	-	**30**	**kW**	**$59,824**	**1.6**	**22**	**929,847**	**39.3**	**104,827**

CONSIDERED													
ECM #	ECM description	Installed Cost		1st year energy savings					SPP	LoM	Lifetime	ROI, %	Annual Carbon Reduced (lbs of CO2)
		Estimate $	Source	Use	Unit	Demand /mo	Unit	Savings / year $			Cost Savings $		
2.4	replace building internal lights: T12s to T8s with INCENTIVES (incl. 75% labor)	$19,795	RS Means, Lit Search, NJ Clean Energy Program	3,461	kWh	1.4	kW	578	34.2	20	8,442	-2.9	4,741

Definitions:
SPP – Simple Payback (years)
LoM: Life of Measure (years)
ROI: Return on Investment (%)

Assumptions:
Discount Rate: 3.2% per DOE FEMP Guidelines
Energy Price Escalation Rate: 0% per DOE FEMP Guidelines

1. HISTORIC ENERGY CONSUMPTION

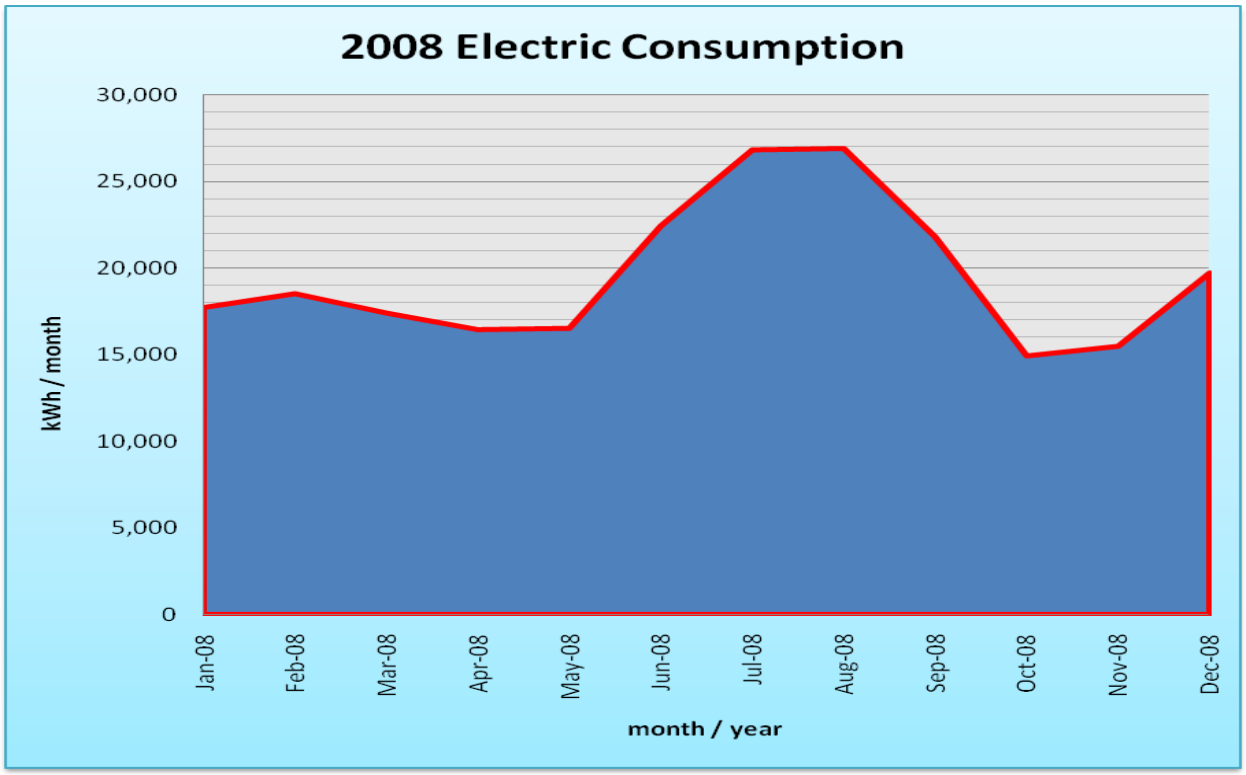
1.1. Energy usage and cost analysis

SWA analyzed utility bills from June 2007 through May 2009 that were received from the utilities supplying the Community Center with electric and natural gas.

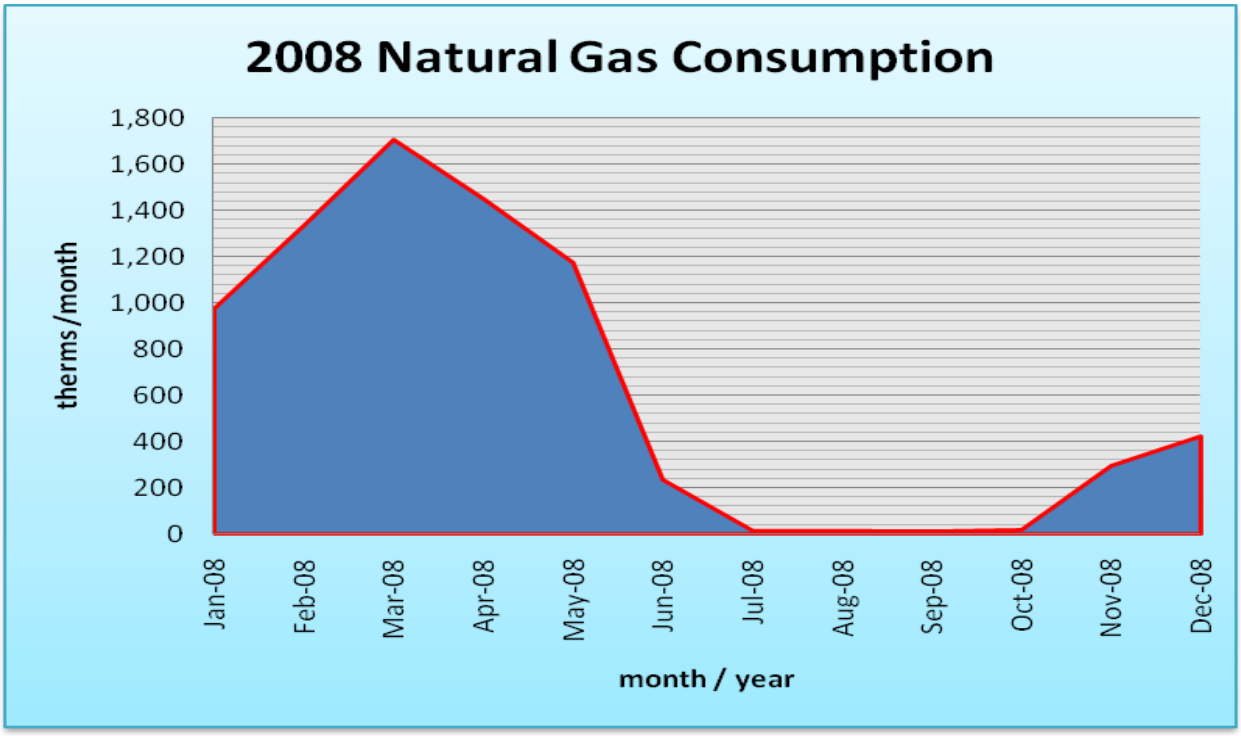
Electricity - The Community Center is currently served by one electric meter. The Community Center currently buys electricity from JCP&L at **an average rate of $0.167/kWh** based on 12 months of utility bills for 2008. The Community Center purchased **approximately 235,200 kWh or $39,306 worth of electricity** in the previous year. The average monthly demand was 98 kW. The Township of Hanover should ensure that JCP&L billings are based only on actual meter readings.

Natural Gas - The Community Center is currently served by one meter for natural gas. The Community Center currently buys natural gas from PSE&G at **an average aggregated rate of $1.34/therm** based on 12 months of utility bills for 2008. The Community Center purchased **approximately 7,653 therms or $10,291 worth of natural gas** in the previous year. The Township of Hanover should ensure that PSE&G billings are based only on actual meter readings.

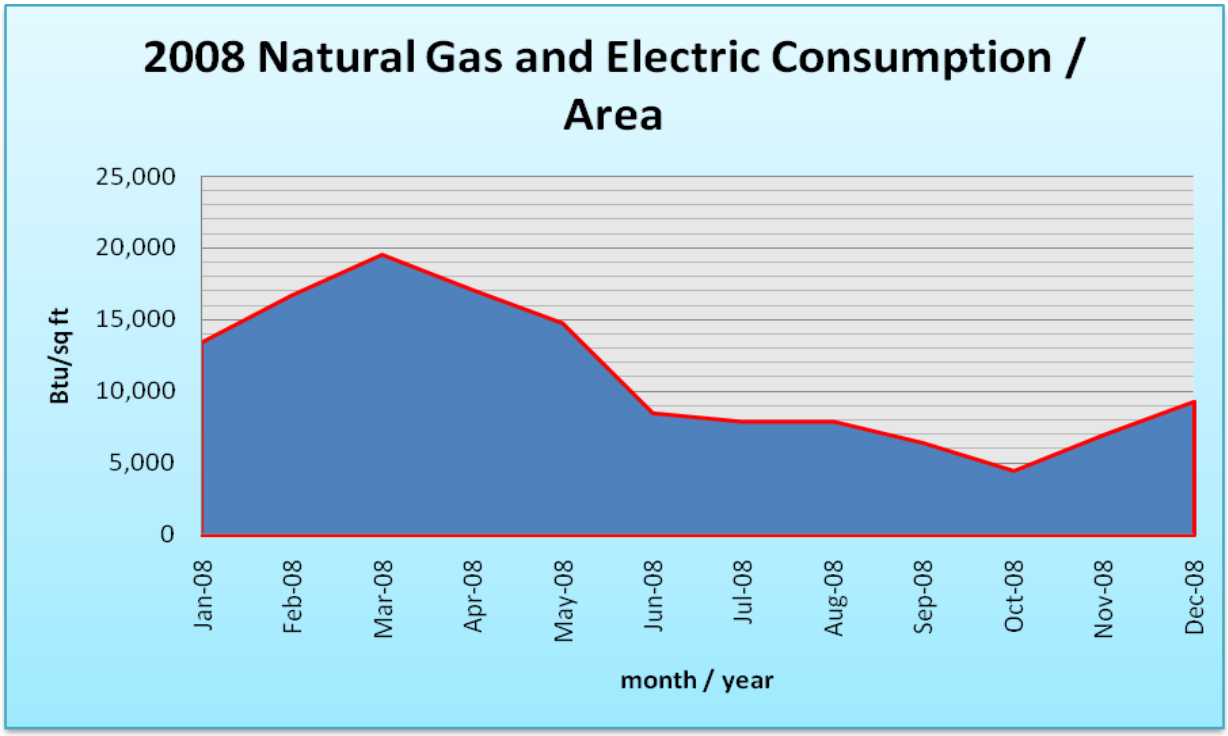
The following chart shows electricity use for the Community Center based on utility bills for the 12 month period of January 2008 - December 2008.



The following chart shows the natural gas consumption for the Community Center based on utility bills for the 12 month period of January 2008 - December 2008.

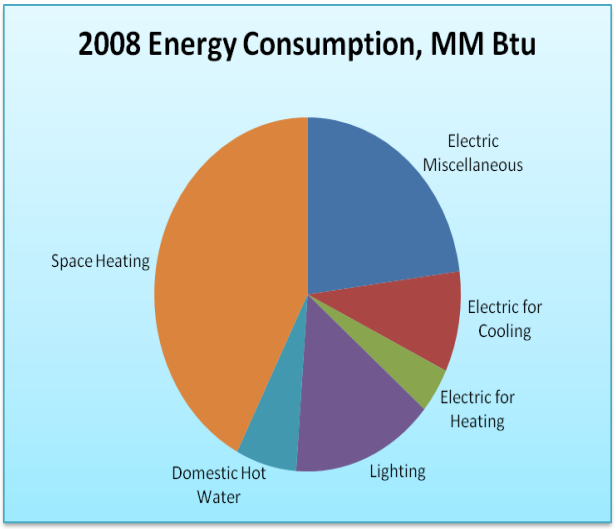


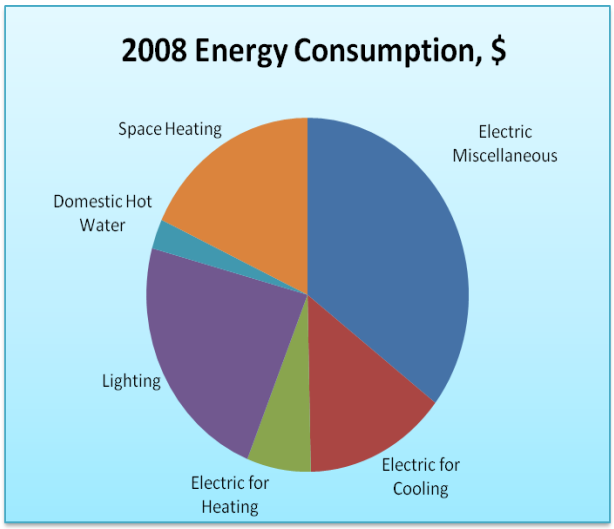
The following chart shows combined natural gas and electric consumption in Btu/ft2 for the Community Center, based on utility bills for the 12 month period of January 2008 - December 2008.



The following table and chart pies show energy use for the Community Center based on utility bills for the 12 month period of January 2008 - December 2008. Note electrical cost at $49/MM-Btu of energy is more than 3.5 times as expensive to use as natural gas at $13/MM-Btu.

2008 Annual Energy Consumption / Costs					
	MM-Btu	% MM Btu	$	% $	$/MM Btu
Electric Miscellaneous	359	23%	$17,588	35%	$49
Electric for Cooling	144	9%	$7,056	14%	$49
Electric for Heating	65	4%	$3,172	6%	$49
Lighting	235	15%	$11,490	23%	$49
Domestic Hot Water	101	6%	$1,352	3%	$13
Building Space Heating	665	42%	$8,939	18%	$13
Totals	1,568	100%	$49,598	100%	$32
Total Electric Use	803	51%	$39,306	79%	$49
Total Gas Use	765	49%	$10,291	21%	$13
Totals	1,568	100%	$49,598	100%	$32





1.2. Utility rate

The Community Center currently purchases electricity from JCP&L Electric at a general service market rate for electricity use (kWh) with a separate (kW) demand charge. The Community Center currently pays an average rate of approximately $0.167/kWh based on 12 months of utility bills for 2008.

The Community Center currently purchases natural gas supply from PSE&G at a general service market rate for natural gas (therms). PSE&G acts also as the transport company. There is one gas meters that

provides natural gas service to the Community Center currently. The average aggregated rate (supply and transport) for the meter is approximately of $1.34/therm based on 12 months of utility bills for 2008.

Some of the minor unusual utility fluctuations that showed up for a couple of months on the utility bills may be due to adjustments between estimated and actual meter readings. The Township of Hanover should ensure that it has full accounting from the energy providers and that billings are based only on actual meter readings.

1.3. Energy benchmarking

SWA has entered energy information about the Community Center in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. This Recreational facility is comprised of non-eligible (Other) space type. Recreation space or "Other" can be used to classify a facility or a portion of a facility where the primary activity does not fall into any of the available space types. Consequently, the Community Center is not eligible to receive a national energy performance rating at this time. SWA encourages the Township of Hanover to continue entering utility data in *Energy Star Portfolio Manager* in order to track weather normalized source energy use over time. EPA is continually working to expand the available space types. As new space types become available, the Township of Hanover will be able to reclassify spaces accordingly if they have previously been entered as "Other". The Site Energy Use Intensity is 135 kBtu/ft^{2}yr compared to the national average for similar type building consuming 65 kBtu/ft^{2}yr. Implementing this report's recommendations will make the building energy consumption better than the national average. Per the LGEA program requirements, SWA has assisted the Township of Hanover to create an *Energy Star Portfolio Manager* account and share the Parks and Recreation Garage facilities information to allow future data to be added and tracked using the benchmarking tool. SWA has shared this Portfolio Manager site information with the Township of Hanover (user name of "Hanovertwp" and same password administered by David W. Leo, Assistant Township Engineer for the Township of Hanover) and TRC Energy Services (user name of TRC-LGEA).

2. FACILITY AND SYSTEMS DESCRIPTION

2.1. Building Characteristics

The Community Center building consists of 11,765 square feet of conditioned main space. It was built in 1992 and has had minor renovations along the years. The Community Center houses a community gymnasium and administrative offices for various community events.

2.2. Building occupancy profiles

The Community Center is normally operated evenings, less during the summer time, and can accommodate approximately 100 people at special community events. The occupancy for the Community Center is approximately 8 staff members at various times during the year and is occupied roughly 70 hours / week. Recent schedules are Mon - Fri - 6:00 am to 9:30 pm, Sat - 7 am to 6 pm and Sun - 12 pm to 6 pm.

2.3. Building envelope

2.3.1. Exterior Walls

The exterior walls consist of either 8" CMU blocks with split block veneer or 6" metal studs, filled with fiberglass batts behind a 4"brick veneer. Due to warm temperature conditions at the time of the

field visits, insulation levels could not be verified with help of infrared technology. If desired, the municipality could contract a separate envelope inspection during cooler months.

With the exception of roof run-off water signs on the split block façade area, due to failing cap flashing seams, overall, exterior and interior finishes of the envelope walls were found to be in age-appropriate, good condition.

The flashing issues identified were mostly around the perimeter of the Community Center. Upon further inspection, the installed cap flashing seams on the parapets show signs of leakage at corners and ends. This can be seen on exterior split face wall surfaces as vertical algae growth lines. Identified problems like flashing or other water related issues are pointed out in this report because any moisture inside exterior walls can have a substantial effect on insulation performance and other energy related issues.

SWA recommends fixing parapet cap flashing seams and end caps where signs of leakage are visible. Rather than fixing flashing problems such as the ones described above with silicon or other type of common caulk, SWA recommends industry standard practices such as joints using a concealed splice plate or end caps properly bent and sealed with a recommended adhesive caulk.

Signs of water runoff from faulty roof cap flashing seams.

2.3.2. Roof

The flat areas are constructed of a dark colored modified bitumen finish roof. The specified 4" foam insulation over the steel decking could not be verified on flat roofs. As mentioned under 2.3.1 Exterior Walls, a separate envelope inspection should be conducted during cooler months. SWA suggests basing further insulation related improvement discussions on the outcome of those future findings.

The low sloped roofs are covered with common asphalt shingles over metal rafters between R-19 fiberglass batt cavity insulation. Warranty and life span of asphalt roof shingles might be compromised due to possible clogged or dirty soffit ventilation strips. A ridge vent was identified but unobstructed airflow from soffit vents to the ridge vents could not be verified. SWA suggests inspection of all roof vents to ensure proper air flow in the attic. Gable end vents should not be considered a substitute or fallback for nonperforming soffit and ridge vents. Where insulation is placed directly on the underside of the sheathing, and without vent baffles, as per asphalt shingle manufacturer, warranty is voided due to faulty installation. In the construction plans available to

SWA, sheathing insulation was specified together with a metal roof type, which is compliant. SWA suggests monitoring those roof areas closely as they most likely will age more quickly than the same asphalt shingle roofs with insulation installed between attic floor joists.

Roof insulation in attic attached directly on underside of sheathing with no specified airspace for air to circulate between sheathing and insulation.

2.3.3. Base

The building's base is a 4" concrete slab-on grade with a perimeter footing. There were no reported problems with water penetration or moisture. The slab edge or perimeter insulation could not be verified and should be confirmed at the time of the above recommended insulation inspection during cooler months for usable infrared data evaluation.

2.3.4. Windows

The building contains fixed and double hung vinyl-framed double glazed windows. Low-E rating could not be verified but no comfort related complaints or signs of condensation were found.

2.3.5. Exterior doors

The aluminum framed exterior doors were observed to be in good condition except for some missing or worn weather-stripping. SWA recommends that the exterior doors of the building be weather-stripped in order to decrease the amount of conditioned air that is lost around each door. SWA also recommends checking the weather-stripping of each door on a regular basis and replacing any broken seals immediately. Tight seals around the doors will help ensure that the building is kept continuously tight and insulated.

Missing or worn weather-stripping at door (typ.)

2.3.6. Building air tightness

Based on a visual inspection, the building was observed to be a relatively well-sealed building. There were no major observed deficiencies of air tightness within the building besides the exterior doors.

2.4. HVAC Systems

2.4.1. Heating

The Community Center heating is provided by two air handling units provided with four duct mounted furnaces manufactured by Reznor.

The two mechanical rooms on the ground floor are equipped with unit heaters manufactured by Reznor.

The main four duct mounted Reznor furnaces are rusting on the outside and are at end of their useful operating lives. SWA recommends their replacement with newer units and understands that the Township of Hanover is prioritizing capital investment based on budget constraints and in consideration that the chiller compressor had to be recently replaced due to a sudden casing crack

There may be opportunities to contain the cooling / heating to only areas that require it per an advanced agreed upon schedule. SWA also recommends retro-commissioning the HVAC equipment and especially the associated controls to insure that they are operating at the designed efficiency.

2.4.2. Cooling

The chiller providing chilled glycol mixed water to the (mezzanine) air handling coils serving the Community Center is located adjacent to the building. The chiller is rated at 65 ton and is model YCAL0071EC46XDBTX, manufactured by York. The two (2) chilled glycol mixed water pumps are installed into a mechanical room (on the ground floor) and are of 3HP each.

There are two mechanical sections at mezzanine level. Each mechanical section houses the following equipment: one Carrier 39ED11 air handling unit and one Carrier 39ED08 air handling unit.

The air handling units are provided with filters, chilled water coils and duct furnaces manufactured by Reznor.

The Township of Hanover already replaced 2 compressors with cracked heads on the York chiller, and changed chilled glycol mixed water pump flow from pull through to push through the chiller. The Johnson Controls system seemed to have controlled the chiller poorly in the past because it did not prevent the compressor head failure. Since then there have been upgrades to the safety controls.

For consistency, the Township of Hanover may want to consider changing the 2 x 2 way valves to 3 way valves to match the other 2 units on cooling controls to the coils.

2.4.3. Ventilation

The Community Center is provided with fresh outside air via the air handling units.

2.4.4. Domestic Hot Water

The domestic hot water is provided by two domestic water heaters which appear to be in good condition; one in each of the two mechanical rooms on the ground floor.

The domestic hot water heater serving the bathrooms is model 42V50-40F, manufactured by Rheem, and has a storage capacity of 50 gallons and an input capacity of 40,000 BTUH.

The domestic hot water heater serving the kitchen is manufactured by Rheem, and has a storage capacity of 40 gallons.

More efficient water-consuming fixtures and appliances save both energy and money through reduced energy consumption for water heating, as well decreased water and sewer bills. SWA recommends adding controlled on / off timers on all lavatory faucets to reduce domestic hot water demand and save water. Building staff can also easily install faucet aerators and / or low-flow fixtures to reduce hot water consumption. In addition, routine maintenance practices that identify and quickly address water leaks are a low-cost way to save water and energy.

2.5. Electrical systems

2.5.1. Lighting

Interior Lighting - The Community Center currently consists of mostly T12 fluorescent fixtures with magnetic ballasts with a few areas retrofitted from T12 to T8 fixtures. Based on measurements of lighting levels for each space, there are not any vastly over-lighted areas. SWA recommends replacing T12 lighting including magnetic ballasts whenever possible with T8 lighting and electronic ballasts. As this option may not be very cost effective, the changeover could take place as fixtures break down and are taken out of service. SWA also recommends installing occupancy sensors in bathrooms, offices and areas that are occupied only part of the day. Since bathrooms are used sporadically throughout the day and lighting is commonly left on far beyond the necessary hours of operation, SWA recommends installing occupancy sensors with time delay and acoustic capabilities. Typically, occupancy sensors have an adjustable time delay that shuts down the lights automatically if no motion or sound is detected within a set time period. The building also has a few lights with incandescent bulbs. SWA recommends replacing all incandescent bulbs with CFLs. See attached lighting schedule in Appendix A for a complete inventory of lighting throughout the building and estimated power consumption.

Exit Lights - The building has mostly LED exit signs installed. These are low energy users. SWA recommends that any newly installed exit signs be LED type exit signs.

Exterior Lighting - The exterior lighting was surveyed during the building audit, and it is a mix of 175 Watt metal halide lamps. Since this lighting is mainly for Safety as well as for Security, SWA has deemed it not cost effective to replace exterior metal halide lamp lighting at this time. All exterior lighting is controlled by timers and photocells. There is not any immediate need to upgrade this lighting or photocells.

2.5.2. Appliances and process

Appliances, such as refrigerators, that are over 10 years of age should be replaced with newer efficient models with the Energy Star label. For example, Energy Star refrigerators use as little as

315 kWh / yr. When compared to the average electrical consumption of older equipment, Energy Star equipment results in a large savings. Look for the Energy Star label when replacing appliances and equipment, including: refrigerators, printers, computers, copy machines, etc. More information can be found in the "Products" section of the Energy Star website at: http://www.energystar.gov.

Computers left on in the building consume a lot of energy. A typical desk top computer uses 65 to 250 watts and uses the same amount of energy when the screen saver is left on. Televisions in meeting areas use approximately 3-5 watts of electricity when turned off. SWA recommends all computers and all appliances (i.e. fridges, coffee makers, televisions, etc) be plugged in to power strips and turned off each evening just as the lights are turned off. The Community Center computers are generally programmed for the power save mode, to shut down after a period of time that they have not been used.

2.5.3. Elevators

The Community Center is a single story building and therefore does not contain any elevator equipment.

2.5.4. Others electrical systems

There is an Onan emergency generator serving the Community Center. There are not currently any other electrical systems installed at the Community Center.

3. EQUIPMENT LIST

Inventory

Township of Hanover Community Center						
Building System	**Description**	**Location**	**Model #**	**Fuel**	**Space Served**	**Estimated Remaining Useful Life %**
Heating, cooling and ventilation	2 package AHU units - 2 Zone; glycol coils; gas fired for forced hot air; preprogrammed on timers; Universal Energy Products controls Drwg 776A	mezzanine mech room	Carrier Model 39ED11	natural gas / electric	Gymnasium	50%
Heating, cooling and ventilation	2 package AHU units - 2 Zone (left and right offices); glycol coils; preprogrammed on timers; Universal Energy Products controls Drwg 776A	mezzanine mech room	Carrier Model 39ED08	natural gas / electric	Office and perimeter areas	50%
Heating, cooling and ventilation	65 Ton Chiller - air cooled, 4 compressor, outside bldg, glycol recirculation through it	back of Community Center	York Model YCAL0071EC46XDBTX	electric	Community Center	85%
Heating, cooling and ventilation	2 pumps (one standby) 3 HP glycol recirculation pump	mech room next to bathrooms	Marathon motor EVE182TTDR5337AA; SF - 1.15; B&G pump Model 1.5x1.5x9.5	electric	Community Center	85%
Heating, cooling and ventilation	Two (2) Reznor duct heaters, 400 MBH, 80% thermal efficiency	mezzanine mech room	SC-400	natural gas	Community Center	0% (at end of useful operating life)
Heating, cooling and ventilation	Two (2) Reznor duct heaters, 125 MBH, 80% thermal efficiency	mezzanine mech room	SC-125	natural gas	Community Center	0% (at end of useful operating life)
Domestic Hot water heater	Water heater manufactured by Rheem with storage capacity of 50 gallons and input capacity of 40,000 BTUH.	mech room next to bathrooms	42V50-40F	natural gas	Community Center Bathrooms	65%
Domestic Hot water heater	Domestic hot water heater manufactured by Rheem with storage capacity of 40 gallons.	mech room next to kitchen	Rheem	electric	Community Center Kitchen	50%
Generators	diesel generator checked weekly	back of Community Center	Onan Quiet Site11	diesel / electric	Community Center	50%
Lighting	See details - Appendix A	See details - Appendix A	-	electric	Community Center	varies, average 60%

Note: The remaining useful life of a system (in %) is an estimate based on the system date of built and existing conditions derived from visual inspection.

4. ENERGY CONSERVATION MEASURES

Based on the assessment of the Community Center, SWA has separated the investment opportunities into three recommended categories:

1. Capital Improvements - Upgrades not directly associated with energy savings
2. Operations and Maintenance - Low Cost / No Cost Measures
3. Energy Conservation Measures - Higher cost upgrades with associated energy savings

Category I Recommendations: Capital Improvements

- New Reznor Furnaces - Replace the existing high maintenance main four duct mounted Reznor furnaces that are rusting on the outside and are at end of their useful operating lives. SWA recommends their replacement with newer units and understands that the Township of Hanover is prioritizing capital investment based on budget constraints. This recommendation cannot be cost justified by energy savings alone. The estimated cost for the overall replacement work of 4 furnaces is $25,000 based on other similar past projects. The new furnaces need to be properly specified by a design engineer and commissioned prior to start-up.

Category II Recommendations: Operations and Maintenance

- Controls Optimization - SWA recommends that the schedules for all air handling, cooling and heating equipment serving key public spaces be reviewed and optimized. During periods when the spaces are not occupied, the equipment may be shut-off or controlled to minimize the amount of fresh air conditioned by the equipment. The cost and effort associated with implementation of this recommendation will depend upon the capabilities of the existing building automation control system. Energy and cost savings associated with this recommendation will vary, depending upon the current occupancy schedules and means of control utilized.
- Weather Stripping / Air Sealing - SWA observed that exterior door weather-stripping in places was beginning to deteriorate. Doors and vestibules should be observed annually for deficient weather-stripping and replaced as needed. The perimeter of all window frames should also be regularly inspected and any missing or deteriorated caulking should be re-caulked to provide an unbroken seal around the window frames. Any other accessible gaps or penetrations in the thermal envelope penetrations should also be sealed with caulk or spray foam.
- Flashing Leaks - SWA recommends fixing parapet cap flashing seams and end caps where signs of leakage are visible.
- Water Efficient Fixtures & Controls - Adding controlled on / off timers on all lavatory faucets is a cost-effective way to reduce domestic hot water demand and save water. Building staff can also easily install faucet aerators and / or low-flow fixtures to reduce water consumption. There are many retrofit options, which can be installed now or incorporated as equipment is replaced. Routine maintenance practices that identify and quickly address water leaks are a low-cost way to save water and energy. Retrofitting with more efficient water-consumption fixtures / appliances will save both energy and money through reduced energy consumption for water heating, while also decreasing water / sewer bills.
- Energy Star labeled appliances such as refrigerators should replace older energy inefficient equipment.
- Smart power electric strips with occupancy sensors should be used to power down computer equipment when left unattended for extended periods of time.
- Create an educational program that teaches maintenance personnel how to minimize the energy use in the buildings. The US Department of Energy offers free information for hosting energy efficiency educational programs and for more information please visit: http://www1.eere.energy.gov/education/

Category III Recommendations: Energy Conservation Measures

Summary table

ECM#	Description
1	Install Vending Misers on Drinks Vending Machines
2	Upgrade building lighting: incandescent to CFLs, occupancy sensors for some offices, Exit fluorescents to LED and T12 magnetic fixtures to T8 electronic fixtures
3	Undertake retro-commissioning of building systems and controls to optimize performance
4	Install Carbon Dioxide sensors to control and improve Indoor Air Quality in the Gymnasium, as well as reduce energy costs
5	Install a 5kW Wind system to reduce annual electric consumption and demand
6	Install a 5kW PV system to reduce annual electric consumption and demand

ECM#1: *Install Vending Miser*

Description:

The Community Center has one Drinks vending machine. Energy vending miser devices are now available for conserving energy with these vending machines. There isn't a need to purchase new machines to reduce operating costs and greenhouse gas emissions. When equipped with the vending miser devices, refrigerated beverage vending machines use less energy and are comparable in daily energy performance to new ENERGY STAR qualified machines. Vending miser devices incorporate innovative energy-saving technology into small plug-and-play devices that installs in minutes, either on the wall or on the vending machine. Vending miser devices use a Passive Infrared Sensor (PIR) to: Power down the machine when the surrounding area is vacant; Monitor the room's temperature; Automatically repower the cooling system at one- to three-hour intervals, independent of sales; Ensure the product stays cold.

If there is a decision in the future to install a snacks vending machine, than with the snacks vending miser device, maximum energy savings can be achieved, that result in reduced operating costs and decreased greenhouse gas emissions with existing machines. Snacks vending miser devices also use a Passive Infrared Sensor (PIR) to determine if there is anyone within 25 feet of the machine. It waits for 15 minutes of vacancy, then powers down the machine. If a customer approaches the machine while powered down, the snacks vending miser will sense the presence and immediately power up.

Installation cost:

Estimated installed cost: $265
Source of cost estimate: www.usatech.com *and established costs*

Economics (without incentives):

ECM description	Installed Cost		1st year energy savings					SPP	LoM	Lifetime	ROI %	Annual Carbon Reduced (lbs of CO2)
	Estimate $	Source	Use	Unit	Demand /mo	Unit	Savings / year $			Cost Savings $		
Install Drinks Vending machine misers	$265	www.usatech.com	1,786	kWh	0.7	-	298	0.9	12	2,933	83.9	2,446

Assumptions: SWA assumes energy savings based modeling calculator found at www.usatech.com. or http://www.usatech.com/energy_management/energy_calculator.php

Rebates/financial incentives:

This measure does not qualify for a rebate or other financial incentive at this time.

Options for funding ECM:

This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.
http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings

ECM#2: *Upgrade Existing Lighting*

Description:

On the day of the site visit, SWA completed a lighting inventory of the Community Center (see Appendix A). The existing lighting consists of many T12 fluorescent fixtures with magnetic ballasts, and a few incandescent lights and T8s. A few of the lights in the Community Center appear to have been upgraded to T8 fixtures and LED lighted Exit signs. SWA has performed an evaluation of upgrading all the T12 magnetic ballast fixtures to T8 electronic ballast fixtures, incandescent bulbs to CFLs and installing occupancy sensors in offices and bathrooms that may be left unoccupied a considerable amount of time throughout the day. The labor in all these installations was evaluated using prevailing electrical contractor wages. The Community Center may decide to perform this work with in-house resources from its Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor, to gain savings. SWA recommends at a minimum that the incandescent bulbs be replaced with CFLs, occupancy sensors be installed in a number of offices and bathrooms. See Appendix A for recommendations.

Installation cost:

Estimated installed cost: $8,016
Source of cost estimate: RS *Means; Published and established costs*

Economics (Some of the options considered with incentives):

ECM description	Installed Cost		1st year energy savings					SPP	LoM	Lifetime	ROI %	Annual Carbon Reduced (lbs of CO2)
	Estimate $	Source	Use	Unit	Demand /mo	Unit	Savings / year $			Cost Savings $		
replace 54 incandescent lamps to CFL	$1,080	RS Means, Lit Search	13,122	kWh	5.5	kW	2,261	0.5	7	13,983	170.7	17,977
install 8 occupancy sensors with INCENTIVES	$720	RS Means, Lit Search, NJ Clean Energy Program	1,322	kWh	0.6	kW	221	3.3	12	2,171	16.8	1,811
replace 24 x 400 Watt Metal Halide lamps with 24 x 4ft T5 fixtures 6 lamps each (with incentives)	$5,856	RS Means, Lit Search, NJ Clean Energy Program	6,682	kWh	2.8	kW	1,151	5.1	20	16,810	9.4	9,154
install 4 LED Exit with INCENTIVES	$360	RS Means, Lit Search, NJ Clean Energy Program	389	kWh	0.2	kW	65	5.5	20	948	8.2	533
Total Proposed	$8,016		21,515	kWh	9.0	kW	3,698	2.2	3	10,152	9.1	29,475

Economics (Option with incentives considered that do not appear cost effective):

ECM description	Installed Cost		1st year energy savings					SPP	LoM	Lifetime	ROI, %	Annual Carbon Reduced (lbs of CO2)
	Estimate $	Source	Use	Unit	Demand /mo	Unit	Savings / year $			Cost Savings $		
replace building internal lights: T12s to T8s with INCENTIVES (incl. 75% labor)	$19,795	RS Means, Lit Search, NJ Clean Energy Program	3,461	kWh	1.4	kW	578	34.2	20	8,442	-2.9	4,741

Assumptions: SWA calculated the savings for this measure using measurements taken the day of the field visit and using the billing analysis. SWA also assumed an aggregated 3 hr/yr to replace aging burnt out lamps vs. newly installed and included this with the annual savings.

Rebates/financial incentives:

NJ Clean Energy – LED Exit signs ($10-$20 per fixture)
Maximum incentive amount is $80.

NJ Clean Energy - Wall Mounted occupancy sensors ($20 per control)
Maximum incentive amount is $160.

NJ Clean Energy - Prescriptive Lighting Incentive, Incentive based on installing T5 or T8 lamps with electronic ballasts in existing facilities ($10-$30 per fixture, depending on quantity of lamps). Maximum incentive amount is ($600 + $3,210=) 3,810

Options for funding the Lighting ECM:

This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.
http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings

ECM#3: *Retro-Commissioning*

Description:

Retro-commissioning is a process that seeks to improve how building equipment and systems function together. Depending on the age of the building, retro-commissioning can often resolve problems that occurred during design or construction and / or address problems that have developed throughout the building's life. Owners often undertake retro-commissioning to optimize building systems, reduce operating costs, and address comfort complaints from building occupants.

Since the systems at the Community Center have undergone renovations in the last ten years, and the building continues to struggle with thermal comfort control, SWA recommends undertaking retro-commissioning to optimize system operation as a follow-up to completion of the upgrades. There have been concerns from the Maintenance Department that the control systems are not operating as designed. The retro-commissioning process should include a review of existing operational parameters for both newer and older installed equipment. In particular, SWA observed potential energy savings associated with optimizing the scheduled operating hours and outdoor air fraction of mezzanine equipment serving large public areas, such as the gymnasium. During retro-commissioning, the individual loop temperatures should also be reviewed to identify opportunities for optimizing system performance.

Installation cost:

Estimated installed cost: $14,706; Source of cost estimate: Similar projects

Economics (without incentives):

ECM description	Installed Cost		1st year energy savings					SPP	LoM	Lifetime	ROI %	Annual Carbon Reduced (lbs of CO2)
	Estimate $	Source	Use	Unit	Demand /mo	Unit	Savings / year $			Cost Savings $		
Retro-Commissioning	$14,706	Similar Projects	23,520	kWh	9.8	kW	6,780	2.2	12	66,689	29.5	41,173
			765	therms	-	-						

Assumptions: Since the utility bills have some accounting fluctuations, it is difficult to determine the amount of energy used for heating and cooling the Community Center. Based on experience with similar buildings, SWA estimated the heating and cooling energy consumption. Typical savings for retro-commissioning range from 5-20%, as a percentage of the total space conditioning consumption. SWA assumed 10% savings. Estimated costs for retro-commissioning range from $0.50-$2.00 per square foot. SWA assumed $1.25 per square foot of a total square footage of 11,765. SWA also assumed on the average 1 hr/wk operational savings when systems are operating per design vs. the need to make more frequent adjustments and included this with the annual savings.

Rebates / financial incentives: *There are currently no incentives for this measure at this time.*

Options for funding ECM:

This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.

http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings

ECM#4: *Carbon Dioxide Controls in the Gymnasium*

Description:

On the day of the site visit, SWA observed that there were not any air flow controls for the Community Center based on occupancy. SWA recommends that carbon dioxide sensors be installed (in return air ducts) in the gymnasium to sense occupancy and improve Indoor Air Quality (IAQ). Signals from these sensors need to be taken back to the HVAC air flow controls for programming to regulate the amount of cooling and heating for the gymnasium and vary air flows according to occupancy. Thus, many a time when the Community Center is sparsely occupied, savings will be realized in the heating and cooling of the gymnasium, by bringing into the space the right amount of fresh air (rather than too much unconditioned air).

Installation cost:

Estimated installed cost: $4,000
Source of cost estimate: RS *Means; Published and established costs*

Economics (without incentives):

ECM description	Installed Cost		1st year energy savings					SPP	LoM	Lifetime	ROI %	Annual Carbon Reduced (lbs of CO2)
	Estimate $	Source	Use	Unit	Demand /mo	Unit	Savings / year $			Cost Savings $		
Install CO2 sensors for Community Center demand control ventilation	$4,000	Similar Projects, RS Means, Lit Search	2,211	kWh	0.9	kW	691	5.8	12	6,795	5.8	5,837
			240	therms	-	-						

Assumptions: SWA assumes thermal savings based on heating and cooling loads calculated using modeling and by conducting the billing analysis. In order to estimate savings for this measure, SWA assumed in the model an occupancy reduction equivalent to a conservative 5% (in view that the space is seldom used at the full designed capacity) of the total heating and cooling used for the Community Center based on the described use schedules. This estimate also does not overlap retro-commissioning assumptions.

Rebates/financial incentives:

This measure does not qualify for a rebate or other financial incentive at this time.

Options for funding ECM:

This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.
http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings

ECM#5: *Install 5kW Wind System*

Please see section 5: RENEWABLE AND DISTRIBUTED ENERGY MEASURES

ECM#6: *Install 5kW PV System*

Please see section 5: RENEWABLE AND DISTRIBUTED ENERGY MEASURES

5. RENEWABLE AND DISTRIBUTED ENERGY MEASURES

5.1. Existing systems

There are currently no existing renewable energy systems.

5.2. Wind

ECM#5: *Install 5kW Wind system*

Description:

Wind power production may be applicable for the Community Center location, because of the thermal winds generated in the area. Currently, the Community Center does not use any renewable energy systems. Updated renewable energy systems such as "magnetic" vertical axis wind turbines (MVAWT) can be mounted on building roofs offset a portion of the purchased electricity for the building. Power stations generally have two separate electrical charges: usage and demand. Usage is the amount of electricity in kilowatt-hours that a building uses from month to month. Demand is the amount of electrical power that a building uses at any given instance in a month period. During the summer periods, when electric demand at a power station is high due to the amount of air conditioners, lights, equipment, etc… being used within the region, demand charges go up to offset the utility's cost to provide enough electricity at that given time. Wind systems not only offset the amount of electricity use by a building, but also reduce the building's electrical demand, resulting in a higher cost savings as well. SWA presents below the economics, however does not recommend at this time installing a 5kW Wind system to offset electrical demand for the building and reduce the annual net electric consumption for the building, because there are insufficient guaranteed incentives for NJ rebates at this time to justify the investment. The Community Center is also not eligible for a 30% federal tax credit. The Community Center may consider applying for a grant and / or engage a Wind Power generator / leaser who would install the Wind system and then sell the power at a reduced rate.

There are many possible locations for a 5kW Wind system installation on top of the building ample roof area. The supplier would need to first determine via recorded analysis at the proposed location(s) consistency and wind speeds available. Area winds of 10 mph will run turbines smoothly and capture the needed power. This is a roof-mounted wind turbine (used for generating electricity) that spins around a vertical axis like a merry-go-round instead of like a windmill, as do more traditional horizontal axis wind turbines (HAWTs). A typical 5kW MVAWT wind system has a 20 ft diameter turbine by 10 ft tall.

The installation of a renewable Wind power generating system could serve as a good educational tool and exhibit for the community. **It is very important that Wind measurements and recordings are taken at the chosen location for at least a couple of months to assure that sufficient wind and speed is available for proper operation and to meet incentive requirements.**

Installation cost:

Estimated installed cost: $40,000
Source of cost estimate: Similar projects

Economics (with incentives):

ECM description	Installed Cost		1st year energy savings					SPP	LoM	Lifetime	ROI %	Annual Carbon Reduced (lbs of CO2)
	Estimate $	Source	Use	Unit	Demand /mo	Unit	Savings / year $			Cost Savings $		
Install 5 kW Wind System with INCENTIVE ($3.2/kWh)	$40,000	Similar Projects	13,000	kWh	5.0	kW	43,771	0.9	25	745,480	70.5	17,810

Assumptions: SWA estimated the cost and savings of the system based on past wind projects. SWA projected physical dimensions based on a 5kW-Enviro Energies turbine system. **SWA assumes that the relatively low height (~30 ft) compared to the taller horizontal axis turbines is acceptable to the NJ BPU as long as the average documented annual wind speed is 11 mph at the hub.**

Rebates/financial incentives:

NJ Clean Energy - Renewable Energy Incentive Program, Incentive at this time only for vertically spinning high altitude turbines
http://www.njcleanenergy.com/renewable-energy/programs/renewable-energy-incentive-program

NJ Clean Energy - Wind Upfront Incentive Program, Expected performance buy-down (EPBB) is modeled on an annual kWh production of 1-16,000 kWh for a $3.20/kWh upfront incentive level. This has been incorporated in the above costs, however it requires proof of performance, application approval and negotiations with the utility.

Options for funding ECM:

This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.
http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings

5.3. Solar Photovoltaic

ECM#6: *Install 5kW PV system*

Description:

Currently, the Community Center does not use any renewable energy systems. Renewable energy systems such as photovoltaic panels, can be mounted on the building roofs, and can offset a portion of the purchased electricity for the building. Power stations generally have two separate electrical charges: usage and demand. Usage is the amount of electricity in kilowatt-hours that a building uses from month to month. Demand is the amount of electrical power that a building uses at any given instance in a month period. During the summer periods, when electric demand at a power station is high due to the amount of air conditioners, lights, equipment, etc… being used within the region, demand charges go up to offset the utility's cost to provide enough electricity at that given time. Photovoltaic systems not only offset the amount of electricity use by a building, but also reduce the building's electrical demand, resulting in a higher cost savings as well. SWA presents below the economics, however does not recommend at this time installing a 5kW PV system to offset electrical demand for the building and reduce the annual net electric consumption for the building, because there are insufficient guaranteed incentives from NJ rebates at this time to justify the investment. The Community Center is also not eligible for a 30% federal tax credit. The Community Center may consider applying for a grant and / or engage a PV generator / leaser who would install the PV system and then sell the power at a reduced rate. JCP&L provides the ability to buy SRECs at $600 / MWh or best market offer.

There are many possible locations for a 5kW PV installation on the building roofs. A commercial multi-crystalline 123 watt panel (17.2 volts, 7.16 amps) has 10.7 square feet of surface area (11.51 watts per square foot). A 5kW system needs approximately 41 panels which would take up 435 square feet.

The installation of a renewable Solar Photovoltaic power generating system could serve as a good educational tool and exhibit for the community.

Installation cost:

Estimated installed cost: $30,000
Source of cost estimate: Similar projects

Economics (with some incentives):

ECM description	Installed Cost		1st year energy savings					SPP	LoM	Lifetime	ROI %	Annual Carbon Reduced (lbs of CO2)
	Estimate $	Source	Use	Unit	Demand /mo	Unit	Savings / year $			Cost Savings $		
Install 5 kW PV System (with $1/W INCENTIVE and $600/1MWh SREC)	$30,000	Similar projects	5,902	kWh	5.0	kW	4,586	6.5	25	78,100	6.4	8,086

Assumptions: SWA estimated the cost and savings of the system based on past PV projects. SWA projected physical dimensions based on a typical Polycrystalline Solar Panel by Sharp Electronics (123 Watts, model #ND-123UJF). PV systems are sized based on Watts and physical dimensions for an array will differ with the efficiency of a given solar panel (W/sq ft).

Rebates/financial incentives:

NJ Clean Energy - Renewable Energy Incentive Program, Incentive based on $1.00 / watt Solar PV application. Incentive amount for this application is $5,000.
http://www.njcleanenergy.com/renewable-energy/programs/renewable-energy-incentive-program

NJ Clean Energy - Solar Renewable Energy Certificate Program. Each time a solar electric system generates 1000kWh (1MWh) of electricity, a SREC is issued which can then be sold or traded separately from the power. The buildings must also become net-metered in order to earn SRECs as well as sell power back to the electric grid. $3,600 has been incorporated in the above costs, however it requires proof of performance, application approval and negotiations with the utility.

Options for funding ECM:

This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.
http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings

5.4. Solar Thermal Collectors

Solar thermal collectors are not cost effective for this building and would not be recommended due to the insufficient and not constant use of domestic hot water throughout the building to justify the expenditure.

5.5. Combined Heat and Power

Description:

CHP is not applicable for this building because of existing split system cooling, HW boilers and insufficient domestic hot water use.

5.6. Geothermal

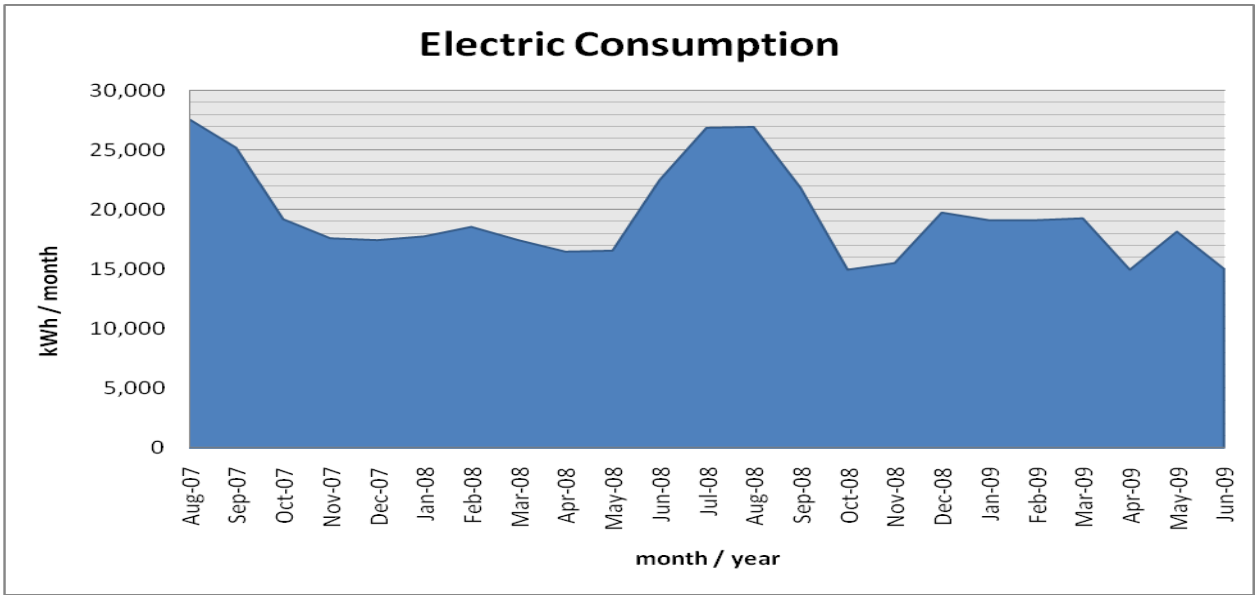
Description:

Geothermal is not applicable for this building because it would not be cost effective to change to a geothermal system at this location.

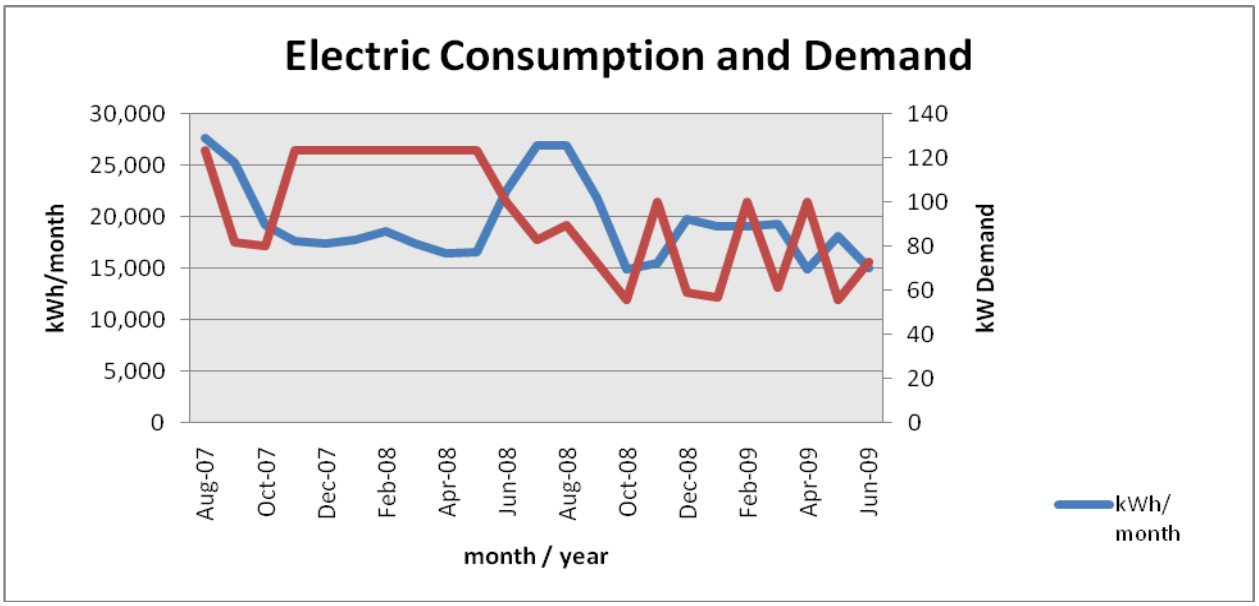
6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

6.1. Load profiles

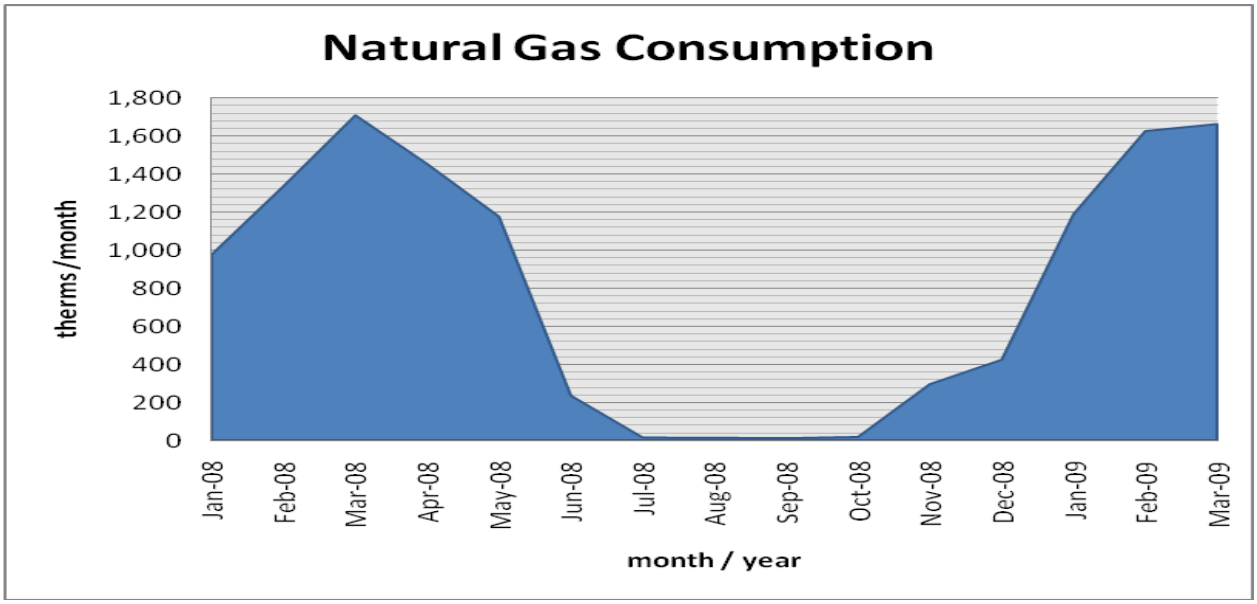
The following are charts that show the annual electric and natural gas load profiles for the Community Center.

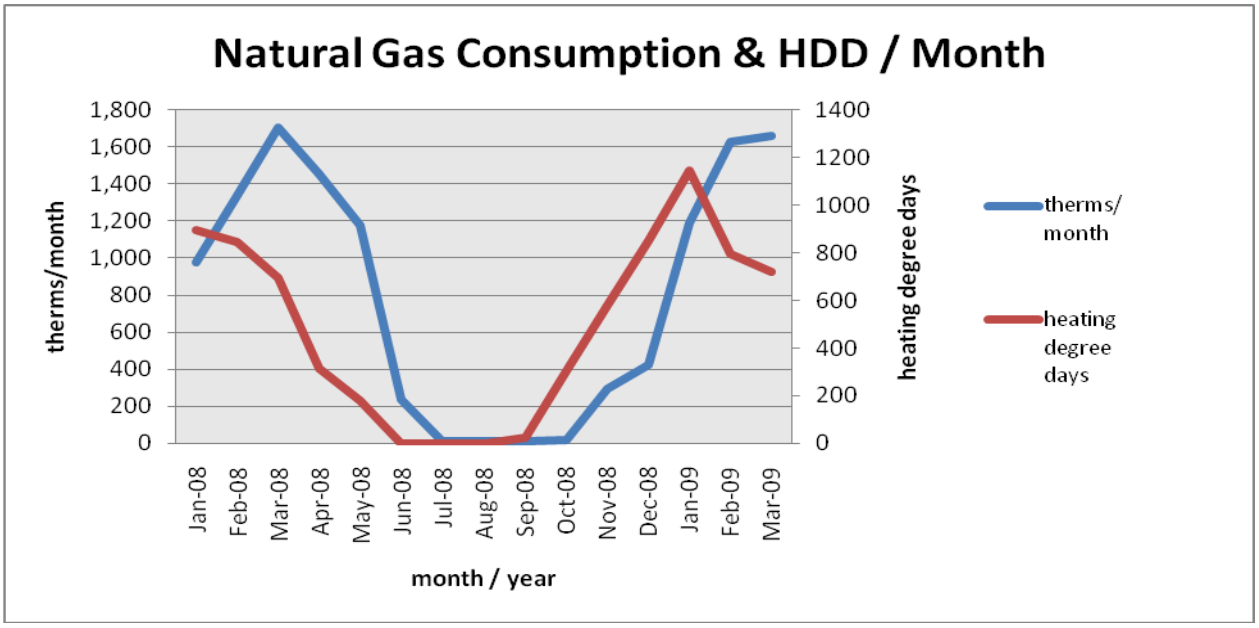


Some minor unusual electric fluctuations shown may be due to adjustments between estimated and actual meter readings. The Township of Hanover should ensure that it has a full accounting from JCP&L and that billings are based only on actual meter readings. Also, note on the following chart how the electrical Demand peaks (except for a few unusual fluctuation anomalies) follow the electrical consumption peaks.



The following is a chart of the natural gas annual load profile for the building, peaking in the coldest months of the year and a chart showing gas consumption mimicking the "heating degree days" curve.

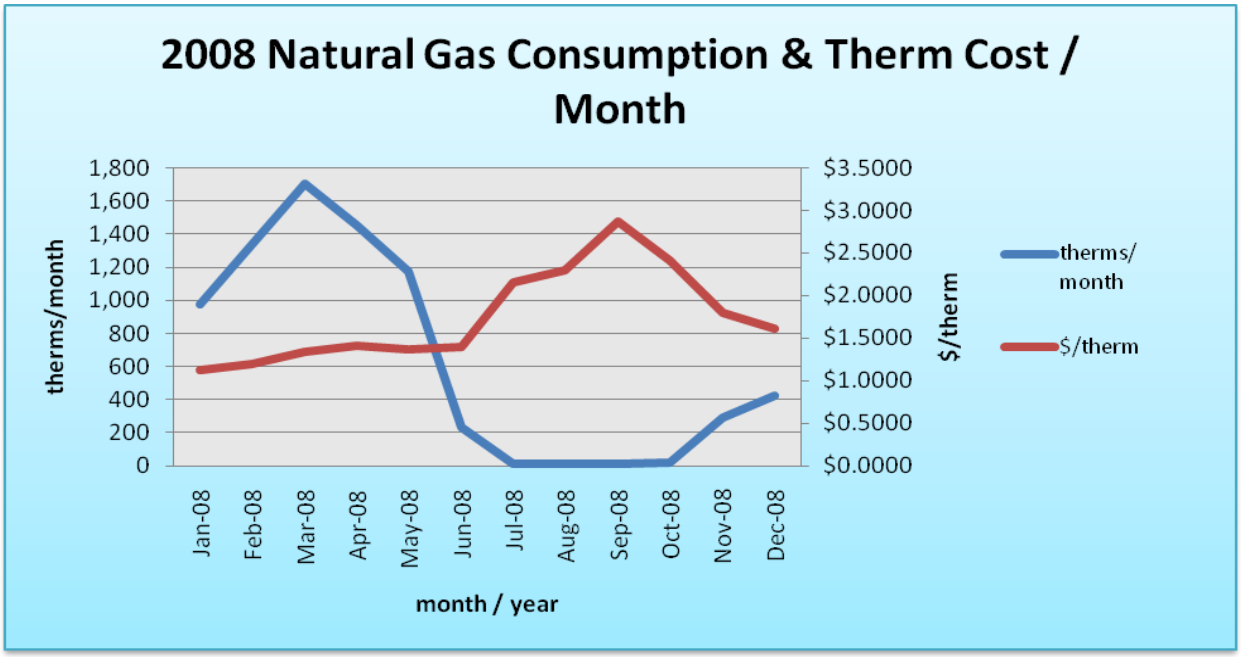




6.2. Tariff analysis

Currently, natural gas is provided to the Community Center via one gas meter with PSE&G acting as the supply and transport company. Gas is provided by PSE&G at a general service rate. The suppliers' general service rate for natural gas charges a market-rate price based on use and the Community Center billing does not breakdown demand costs for all periods. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year. Typically, the natural gas prices increase during the heating months when natural gas is used by the hot air furnace units. The high gas price per therm fluctuations shown on the following chart may be due to high energy costs that

occurred in 2008 and low use caps for the non-heating months. Thus the building pays for fixed costs such as meter reading charges during the summer months.

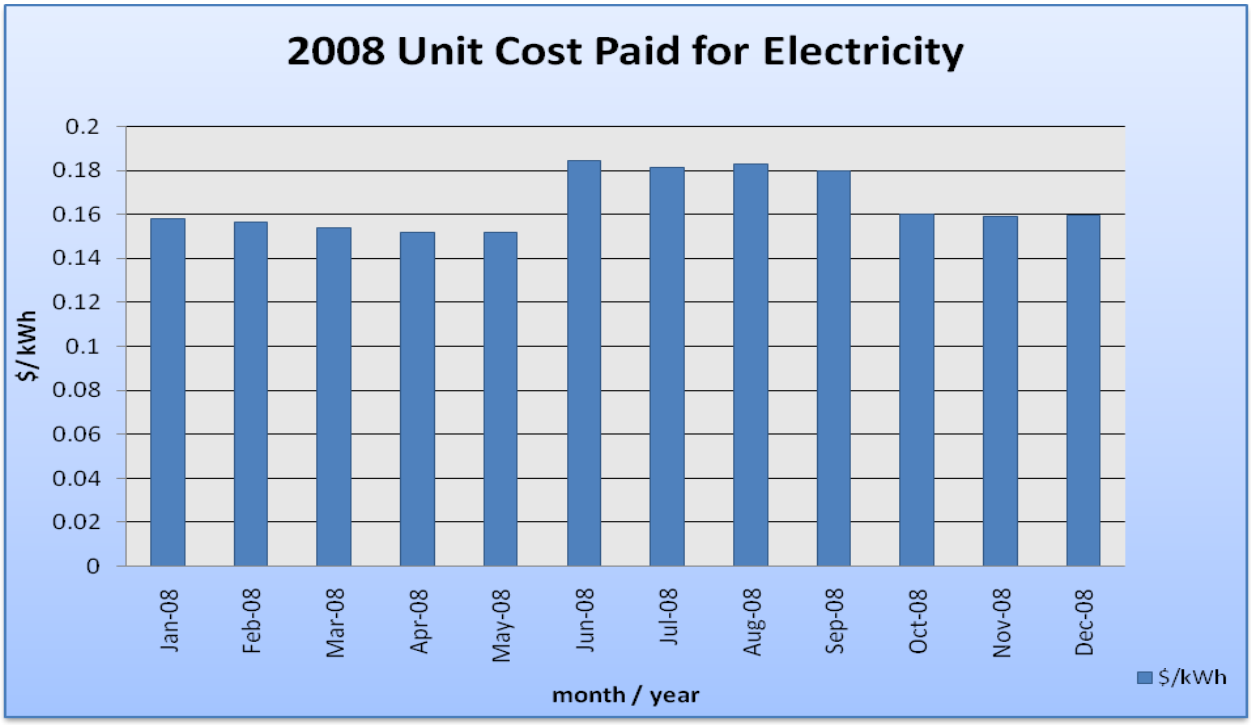


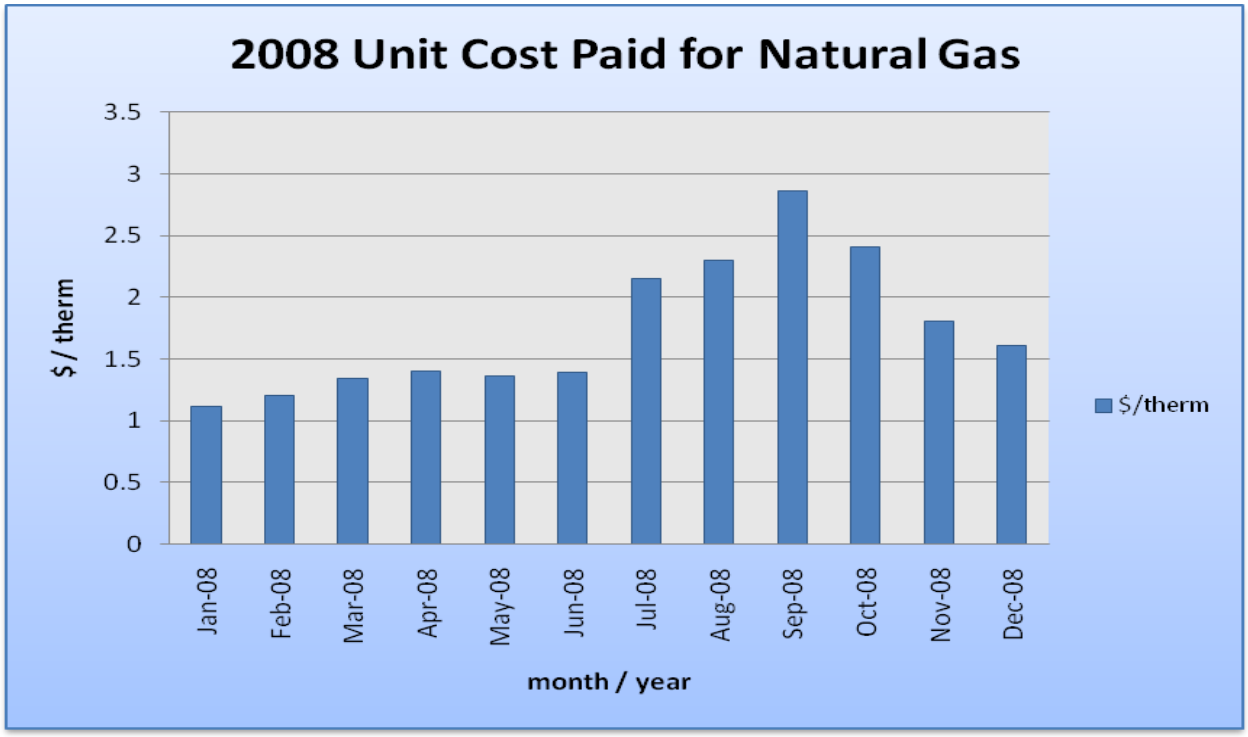
The Community Center is direct-metered (via one main meter) and currently purchases electricity from JCP&L at a general service rate. The general service rate for electric charges are market-rate based on use and the Community Center billing does show a breakdown of demand costs. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year. Typically, the electricity prices increase during the cooling months when electricity is used by the mezzanine air-handling units and chiller in back of the building.

6.3. Energy Procurement strategies

The Community Center receives natural gas via one incoming meter. PSE&G supplies the gas and transports it. There is not and ESCO engaged in the process. An Energy Services Company (ESCO) is a consultancy group that engages in a performance based contract with a client firm to implement measures which reduce energy consumption and costs in a technically and financially viable manner. Electricity is also purchased via one incoming meter directly for the Community Center from JCP&L without an ESCO. SWA analyzed the utility rate for natural gas and electricity supply over an extended period. Electric bill analysis shows fluctuations up to 29% over the most recent 12 month period. Natural gas bill analysis shows fluctuations up to 77% over the most recent 12 month period. Some of these fluctuations may have been caused by adjustments between estimated and actual meter readings, others may be due to unusual high and escalating energy costs in 2008. The average estimated NJ commercial utility rates for electric and gas are $0.150/kWh and $1.550/therm respectively. This building's annual utility costs are $4,001 higher for electric and $1,613 lower for natural gas for a total of $2,388 higher, when compared to the average estimated NJ commercial utility rates. SWA recommends that the Township of Hanover further explore opportunities of purchasing both natural gas and electricity from ESCOs in order to reduce rate fluctuation and ultimately reduce the annual cost of energy for the Community Center. Appendix B contains a complete list of third party energy suppliers for the Hanover service area. The Township of Hanover may want to consider partnering with school districts, municipalities, townships and communities to aggregate a substantial electric and natural gas use for better leveraging in negotiations

with ESCOs and of improving the pricing structures. This sort of activity is happening in many parts of the country and in New Jersey. The following charts show the Community Center monthly spending per unit of energy in 2008.





7. METHOD OF ANALYSIS

7.1. Assumptions and tools

Energy modeling tool:	established / standard industry assumptions
Cost estimates:	RS Means 2009 (Facilities Maintenance & Repair Cost Data) RS Means 2009 (Building Construction Cost Data) RS Means 2009 (Mechanical Cost Data) Published and established specialized equipment material and labor costs Cost estimates also based on utility bill analysis and prior experience with similar projects

7.2. Disclaimer

This engineering audit was prepared using the most current and accurate fuel consumption data available for the site. The estimates that it projects are intended to help guide the owner toward best energy choices. The costs and savings are subject to fluctuations in weather, variations in quality of maintenance, changes in prices of fuel, materials, and labor, and other factors. Although we cannot guarantee savings or costs, we suggest that you use this report for economic analysis of the building and as a means to estimate future cash flow.

THE RECOMMENDATIONS PRESENTED IN THIS REPORT ARE BASED ON THE RESULTS OF ANALYSIS, INSPECTION, AND PERFORMANCE TESTING OF A SAMPLE OF COMPONENTS OF THE BUILDING SITE. ALTHOUGH CODE-RELATED ISSUES MAY BE NOTED, SWA STAFF HAVE NOT COMPLETED A COMPREHENSIVE EVALUATION FOR CODE-COMPLIANCE OR HEALTH AND SAFETY ISSUES. THE OWNER(S) AND MANAGER(S) OF THE BUILDING(S) CONTAINED IN THIS REPORT ARE REMINDED THAT ANY IMPROVEMENTS SUGGESTED IN THIS SCOPE OF WORK MUST BE PERFORMED IN ACCORDANCE WITH ALL LOCAL, STATE, AND FEDERAL LAWS AND REGULATIONS THAT APPLY TO SAID WORK. PARTICULAR ATTENTION MUST BE PAID TO ANY WORK WHICH INVOLVES HEATING AND AIR MOVEMENT SYSTEMS, AND ANY WORK WHICH WILL INVOLVE THE DISTURBANCE OF PRODUCTS CONTAINING MOLD, ASBESTOS, OR LEAD.

Appendix A: Lighting Study

Community Center Existing Lighting Conditions															Proposed Lighting										
#	Bldg	Flr	Location in Building	Measured Lighting Level in Foot-candles	Fixture Type	Ballast Type	No. of Fixtures	No. of Lamps	Type of Lamp	Watts /Lamp	Hrs/ Day	Energy Use (Watt hours / day)	Con-trols	Day-lighting possible?	Fixture Type	Ballast Type	No. of Fixtures	No. of Lamps	Type of Lamp	Watts/ Lamp	Hrs/ Day	Energy Use (Watt hours/ day)	Con-trols	Total Power (Watts)	further W-hr/day reduction with occupancy sensors
1	CC	Grd	Storage Rm	20	T12-4 ft	M	9	2	F	34	2	1224	S	no	**T8 4'**	**E**	**9**	**2**	**F**	**32**	**2**	**918**	**S**	**576**	
2	CC	Grd	Large room	60	MH	NA	24	1	MH	400	4	38400	S	no	MH	-	24	1	MH	400	4	38400	S	9600	
3	CC	Grd	Large room	60	incand	NA	54	1	I	300	4	64800	S	no	**CFL**	**-**	**54**	**1**	**CFL**	**85**	**4**	**18360**	**S**	**4590**	
4	CC	Grd	Large room	60	CFL 13W	-	60	1	CFL	13	4	3120	S	no	CFL 13W	-	60	1	CFL	13	4	3120	S	780	
5	CC	Grd	Large room	60	FI Exit	-	4	1	F	16	24	1536	NA	NA	**Exit LED**	**-**	**4**	**1**	**LED**	**1**	**24**	**96**	**NA**	**4**	
6	CC	Grd	Bathroom Men	20	T12-4 ft	M	6	2	F	34	8	3264	S	no	**T8 4'**	**E**	**6**	**2**	**F**	**32**	**8**	**2448**	**S**	**384**	**612**
7	CC	Grd	Bathroom Men	20	T12-4 ft	M	6	2	F	34	8	3264	S	no	**T8 4'**	**E**	**6**	**2**	**F**	**32**	**8**	**2448**	**S**	**384**	**612**
8	CC	Grd	Billiard Rm	25	T12-4 ft	M	11	4	F	34	4	5984	S	no	**T8 4'**	**E**	**11**	**4**	**F**	**32**	**4**	**4488**	**S**	**1408**	
9	CC	Grd	Billiard Rm	-	LED Exit	NA	1	1	LED	1	24	24	NA	NA	Exit LED	-	1	1	LED	1	24	24	NA	1	
10	CC	Grd	Historical Artifacts	50	T12-4 ft	M	4	4	F	34	4	2176	S	no	**T8 4'**	**E**	**4**	**4**	**F**	**32**	**4**	**1632**	**S**	**512**	
11	CC	Grd	Mechanical Rm 1	20	T12-4 ft	M	4	2	F	34	2	544	S	no	**T8 4'**	**E**	**4**	**2**	**F**	**32**	**2**	**408**	**S**	**256**	
12	CC	Grd	Mechanical Rm 2	20	T12-4 ft	M	4	2	F	34	2	544	S	no	**T8 4'**	**E**	**4**	**2**	**F**	**32**	**2**	**408**	**S**	**256**	
13	CC	Grd	Lunch Rm	10	T12-4 ft	M	4	4	F	34	4	2176	S	no	**T8 4'**	**E**	**4**	**4**	**F**	**32**	**4**	**1632**	**S**	**512**	**408**
14	CC	Grd	Quiet Room	20	T12-4 ft	M	12	4	F	34	4	6528	S	no	**T8 4'**	**E**	**12**	**4**	**F**	**32**	**4**	**4896**	**S**	**1536**	
15	CC	Grd	Quiet Room	-	LED Exit	NA	1	1	LED	1	24	24	NA	NA	Exit LED	-	1	1	LED	1	24	24	NA	1	
16	CC	Grd	Breezeway	15	T 12 - U	M	2	2	F	34	10	1360	S	no	**T8 - U**	**E**	**2**	**2**	**F**	**32**	**10**	**1020**	**S**	**128**	
17	CC	Grd	Breezeway	-	LED Exit	NA	1	1	LED	1	24	24	NA	NA	Exit LED	-	1	1	LED	1	24	24	NA	1	
18	CC	Grd	Kitchen	55	T12-4 ft	M	6	4	F	34	4	3264	S	no	**T8 4'**	**E**	**6**	**4**	**F**	**32**	**4**	**2448**	**S**	**768**	
19	CC	Grd	Storage Rm	70	T12-4 ft	M	1	4	F	34	2	272	S	no	**T8 4'**	**E**	**1**	**4**	**F**	**32**	**2**	**204**	**S**	**128**	
20	CC	Grd	Utility Rm	50	T12-4 ft	M	1	2	F	34	2	136	S	no	**T8 4'**	**E**	**1**	**2**	**F**	**32**	**2**	**102**	**S**	**64**	
21	CC	Grd	Storage Rm	15	T12-4 ft	M	9	2	F	34	2	1224	S	no	**T8 4'**	**E**	**9**	**2**	**F**	**32**	**2**	**918**	**S**	**576**	
22	CC	Grd	Storage Rm 1	30	T12-4 ft	M	1	2	F	34	2	136	S	no	**T8 4'**	**E**	**1**	**2**	**F**	**32**	**2**	**102**	**S**	**64**	
23	CC	Grd	Storage Rm 2	50	T12-4 ft	M	9	2	F	34	2	1224	S	no	**T8 4'**	**E**	**9**	**2**	**F**	**32**	**2**	**918**	**S**	**576**	
24	CC	Grd	Michele's Office	15	T12-4 ft	M	1	4	F	34	8	1088	S	no	**T8 4'**	**E**	**1**	**4**	**F**	**32**	**8**	**816**	**S**	**128**	**204**
25	CC	Grd	Office	15	T12-4 ft	M	1	4	F	34	8	1088	S	no	**T8 4'**	**E**	**1**	**4**	**F**	**32**	**8**	**816**	**S**	**128**	**204**
26	CC	Grd	Hallway	30	T 8 - U	E	4	2	F	31	10	2480	S	no	T 8 - U	E	4	2	F	31	10	2480	S	248	
27	CC	Grd	Hallway	-	LED Exit	-	1	1	LED	1	24	24	NA	NA	Exit LED	-	1	1	LED	1	24	24	NA	1	
28	CC	Grd	Hallway corridor	25	CFL 25W	-	6	1	CFL	35	10	2100	S	no	CFL 25W	-	6	1	CFL	35	10	2100	S	210	
29	CC	Grd	Office	20	T12-4 ft	M	2	4	F	34	8	2176	S	no	**T8 4'**	**E**	**2**	**4**	**F**	**32**	**8**	**1632**	**S**	**256**	**408**
30	CC	Grd	Coat closet	20	T12-4 ft	M	2	4	F	34	2	544	S	no	**T8 4'**	**E**	**2**	**4**	**F**	**32**	**2**	**408**	**S**	**256**	
31	CC	Grd	Office	15	T12-4 ft	M	8	4	F	34	8	8704	S	no	**T8 4'**	**E**	**8**	**4**	**F**	**32**	**8**	**6528**	**S**	**1024**	**1,632**
32	CC	Grd	Super's Office	30	T12-4 ft	M	4	4	F	34	8	4352	S	no	**T8 4'**	**E**	**4**	**4**	**F**	**32**	**8**	**3264**	**S**	**512**	**816**
33	CC	ext	exterior bldg., parking	-	MH lights	-	16	2	MH	175	12	67200	timer	N/A	MH lights	-	16	2	MH	175	12	67200	timer	5600	
				TOTALS exterior								67,200										67,200			
				TOTALS interior								163,804										103,106		31,468	4,896
annual consumption (kWh)												68,755										51,045	includes occupancy sensors		
estimated cost ($/year)												$11,482										$8,524			
Community Center total light power (Watt)												43,790										31,468			
Community Center light power density (Watt/sq ft)												3.72										2.67			
Proposed Annual Savings (kWh)												17,710													
Proposed Annual Cost Savings ($)												$2,958													
Proposed Investment ($)												$21,955													
surface area (sq ft)												11,765										11,765			
Legend: CC - Community Center; M - magnetic; E - electronic; F - fluorescent; incand - incandescent; CFL - compact fluorescent lamp; HPS - high pressure sodium; MH - Metal Halide; S - on/off switch																									

Note: Last table column shows additional electrical savings if the decision is to change out switches to occupancy sensors.

Appendix B: Third Party Energy Suppliers (ESCOs)
http://www.state.nj.us/bpu/commercial/shopping.html

JCP&L ELECTRICAL SERVICE TERRITORY Last Updated: 06/15/09		
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095 (800) 437-7872 www.hess.com	**BOC Energy Services, Inc.** 575 Mountain Avenue Murray Hill, NJ 07974 (800) 247-2644 www.boc.com	**Commerce Energy, Inc.** 4400 Route 9 South, Suite 100 Freehold, NJ 07728 (800) 556-8457 www.commerceenergy.com
Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446 (888) 635-0827 www.newenergy.com	**Direct Energy Services, LLC** 120 Wood Avenue Suite 611 Iselin, NJ 08830 (866) 547-2722 www.directenergy.com	**FirstEnergy Solutions Corp.** 300 Madison Avenue Morristown, NJ 07962 (800) 977-0500 www.fes.com
Glacial Energy of New Jersey, Inc. 207 LaRoche Avenue Harrington Park, NJ 07640 (877) 569-2841 www.glacialenergy.com	**Integrys Energy Services, Inc.** 99 Wood Ave, South, Suite 802 Iselin, NJ 08830 (877) 763-9977 www.integrysenergy.com	**Liberty Power Delaware, LLC** Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663 (866) 769-3799 www.libertypowercorp.com
Liberty Power Holdings, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663 (866) 769-3799 www.libertypowercorp.com	**Pepco Energy Services, Inc.** 112 Main St. Lebanon, NJ 08833 (800) ENERGY-9 (363-7499) www.pepco-services.com	**PPL EnergyPlus, LLC** 811 Church Road Cherry Hill, NJ 08002 (800) 281-2000 www.pplenergyplus.com
Sempra Energy Solutions The Mac-Cali Building 581 Main Street, 8th Floor Woodbridge, NJ 07095 (877) 273-6772 www.semprasolutions.com	**South Jersey Energy Company** One South Jersey Plaza Route 54 Folsom, NJ 08037 (800) 800-756-3749 www.south jerseyenergy.com	**Suez Energy Resources NA, Inc.** 333 Thornall Street 6th Floor Edison, NJ 08837 (888) 644-1014 www.suezenergyresources.com
UGI Energy Services, Inc. 704 East Main Street Suite 1 Moorestown, NJ 08057 (856) 273-9995 www.ugienergyservices.com		

PSE&G NATURAL GAS SERVICE TERRITORY Last Updated: 06/15/09		
Cooperative Industries 412-420 Washington Avenue Belleville, NJ 07109 800-6BUYGAS (6-289427) www.cooperativenet.com	**Direct Energy Services, LLP** 120 Wood Avenue, Suite 611 Iselin, NJ 08830 866-547-2722 www.directenergy.com	**Dominion Retail, Inc.** 395 Highway 170 - Suite 125 Lakewood, NJ 08701 866-275-4240 http://retail.dom.com
Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701 800-805-8586 www.gesc.com	**UGI Energy Services, Inc. d/b/a GASMARK** 704 East Main Street, Suite 1 Moorestown, NJ 08057 856-273-9995 www.ugienergyservices.com	**Great Eastern Energy** 116 Village Riva, Suite 200 Princeton, NJ 08540 888-651-4121 www.greateastern.com
Hess Energy, Inc. One Hess Plaza Woodbridge, NJ 07095 800-437-7872 www.hess.com	**Hudson Energy Services, LLC** 545 Route 17 South Ridgewood, NJ 07450 877- Hudson 9 www.hudsonenergyservices.com	**Intelligent Energy** 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024 800-724-1880 www.intelligentenergy.org
Keil & Sons 1 Bergen Blvd. Fairview, NJ 07002 1-877-Systrum www.systrumenergy@aol.com	**Metromedia Energy, Inc.** 6 Industrial Way Eatontown, NJ 07724 877-750-7046 www.metromediaenergy.com	**Metro Energy Group, LLC** 14 Washington Place Hackensack, NJ 07601 888-53-Metro www.metroenergy.com
MxEnergy, Inc. 510 Thornall Street, Suite 270 Edison, NJ 088327 800-375-1277 www.mxenergy.com	**NATGASCO (Mitchell Supreme)** 532 Freeman Street Orange, NJ 07050 800-840-4GAS www.natgasco.com	**Pepco Energy Services, Inc.** 112 Main Street Lebanon, NJ 08833 800-363-7499 www.pepco-services.com
PPL EnergyPlus, LLC 811 Church Road - Office 105 Cherry Hill, NJ 08002 800-281-2000 www.pplenergyplus.com	**Sempra Energy Solutions** The Mac-Cali Building 581 Main Street, 8th fl. Woodbridge, NJ 07095 877-273-6772 800-2 SEMPRA www.semprasolutions.com	**South Jersey Energy Company** One South Jersey Plaza, Route 54 Folsom, NJ 08037 800-756-3749 www.sjindustries.com/sje.htm
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928 800-225-1560 www.spragueenergy.com	**Stuyvesant Energy LLC** 10 West Ivy Lane, Suite 4 Englewood, NJ 07631 800-646-6457 www.stuyfuel.com	**Woodruff Energy** 73 Water Street Bridgeton, NJ 08302 800-557-1121 www.woodruffenergy.com