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*October 5th, 2009*

**Local Government Energy Program  
Energy audit report**

*For*

***Tewksbury Township Board of Education  
Old Turnpike School  
171 Old Turnpike Road  
Califon, NJ 07830***

***Project Number: LGEA23***



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## **INTRODUCTION**

On August 18<sup>th</sup> and September 3<sup>rd</sup> 2009, Steven Winter Associates, Inc. (SWA) performed an energy audit and assessment of the Old Turnpike School for the Tewksbury Township Board of Education. Current conditions and energy-related information were collected in order to analyze and facilitate the implementation of energy conservation measures for the building.

The Old Turnpike School was built in 1969 and houses the Board of Education, pre-kindergarten and grades five through eight. Additions to the building took place in 1975 and 1994 with other renovations and upgrades in 2004 and 2006. The building consists of 67,385 square feet of conditioned space. The building houses approximately 50 faculty and staff employees with an average attendance of 350 students.

The majority of the building is the school with a wing devoted to the Board of Education and other administrative duties. The building is operated Monday through Friday, 7am to 6pm which includes after school programs. The building has a limited summer and weekend operating schedule, depending on sports and other activities.

Energy data and building information collected in the field were analyzed to determine the baseline energy performance of each building. Using spreadsheet-based calculation methods, SWA estimated the energy and cost savings associated with the installation of each of the recommended energy conservation measures. The findings for the building are summarized in this report.

The goal of this energy audit is to provide sufficient information to the Tewksbury Township Board of Education to make decisions regarding the implementation of the most appropriate and most cost effective energy conservation measures for the Old Turnpike School.

## EXECUTIVE SUMMARY

This document contains the energy audit report for the Old Turnpike School building located at 171 Old Turnpike Road, Califon, NJ 07830. The Old Turnpike School is a one story building with a total floor area of 67,385 square feet. The original structure was built in 1969 with additions in 1975 and 1994. Renovations and/or updates to the building infrastructure occurred in 2004 and 2006.

Based on the field visit performed by Steven Winter Associates (SWA) staff on August 18<sup>th</sup> and September 3<sup>rd</sup> 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 the most recent full year of data collected (March 2008 through March 2009), the Old Turnpike school building consumed approximately 628,288 kWh or \$105,045 worth of electricity and 56,082 therms or \$71,453 worth of natural gas. The average aggregated cost of electricity was calculated to be \$0.17/kWh and the average aggregated cost of natural gas was calculated to be \$1.64/therm. With electricity and gas combined, the building consumed 7,752 MMBtus of energy at a total cost of \$176,498.

SWA benchmarked the Old Turnpike School building using the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. The Portfolio Manager generated a benchmark score of 10 for the building, when compared to a national average. The benchmark rating is based on the facility's source energy use, level of business activity, and geographical location. A score of 10 indicates that this building has high energy usage compared to other schools of the same size. The Old Turnpike School does include Board of Education offices that operate on a different schedule than the school and require additional heating and cooling. It is normal for a school that contains a Board of Education office within the school to have higher energy usage than a school that does not. The Portfolio Manager is also capable of generating a site energy use intensity number using 2008 as a baseline year.

In order to compare commercial buildings equitably, the *Portfolio Manager* ratings convey the consumption of each type of energy in a single common unit. The EPA uses source energy to represent the total amount of raw fuel required to operate the building. The site energy use intensity for the Old Turnpike School building is 109 kBtu/sq.ft/year. After energy efficiency improvements are made, future utility bills can be added to the Portfolio Manager and the site energy use intensity for a different time period can be compared to the year 2008 baseline to track the changes in energy consumption associated with the energy improvements.

SWA recommends a total of 5 Energy Conservation Measures (ECMs) for the Old Turnpike School building. The total investment cost for these ECMs is **\$356,444** without incentives. SWA estimates a first year savings of **\$28,244** with a simple payback of **12.6 years**. SWA estimates that the proposed scope of work will save **13%** of the total energy usage of the building. SWA also estimates that Old Turnpike School building will be able to reduce their carbon footprint by **216,746 lbs of CO2 annually**.

There are various incentives that the Old Turnpike School building could apply for that could also help lower the cost of installing the ECMs. SWA recommends that the Tewksbury Board of Education applies 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.

When pursuing incentives through the SmartStart program, SWA encourages building managers to contact the program provider to obtain more detailed information on the program guidelines and request pre-approval for all planned upgrades. At the time of this report, lighting would be eligible for an incentive of up to \$33,230; boiler replacement would be eligible for an incentive up to \$9,400; domestic hot water installation would be eligible for an incentive up to \$400; and Photovoltaic panels would be eligible for \$1 per Watt installed and additional Solar Renewable Energy Credits (SRECs) earned per year.

Due to the amount of work that is applicable to the Old Turnpike School building, SWA recommends that Tewksbury Board of Education enroll the building in the New Jersey Clean Energy Program's Pay for Performance program. The Pay for Performance program or "P4P" is a program set-up to create financial incentives for buildings to do a detailed building audit and also implement measures that were studied as part of the energy audit. The P4P program currently accepts LGEA participants that are not currently also receiving incentives as part of the Federal block grant program. The deadline to enroll in the P4P program and get additional incentive is December 31<sup>st</sup>, 2009. Applying to this program requires finding an approved partner and working with them to submit the application package. Based on the results of the audit, our proposed scope of work would achieve an energy reduction of 13%. The P4P program requires that a scope of work is developed to show 15% in energy savings over a 12 month period. If the Tewksbury Board of Education decides to move forward with the P4P program, the selected partner should be capable of extending the scope of work to achieve a minimum energy reduction of 15%. Based on the energy audit conducted by SWA and the results of the Energy Star Portfolio Manager report, SWA assumes that the Old Turnpike School would be able to achieve 15% energy reduction at a minimum with a more extensive, detailed scope of work.

For further information on available programs as well as both custom and prescriptive incentives, please visit:

<http://www.njcleanenergy.com/commercial-industrial/programs/programs>

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

**SCOPE OF WORK – SUMMARY TABLE**

ECM Table without Incentives															
ECM #	ECM description	Installed Cost		1st year energy and cost savings						Simple Payback (SPP)	Life of Measure (LoM)	Lifetime Cost Savings (\$)	Return on Invest (ROI)	Annual Carbon Reduction (lbs of CO2)	
		Estimated Cost (\$)	Source	Electric Savings		Fuel Savings		Cost Savings (\$)							
				Consumption	Demand	Natural Gas									
1	Upgrade existing lighting	\$ 155,425	RS Means	62,411	kWh	20	kW	0	Therms	\$ 13,765	11.3	25	\$ 234,435	2.0%	111,747
2	Replace hot water boilers	\$ 91,700	RS Means	0	kWh	0	kW	5,200	Therms	\$ 8,528	10.8	25	\$ 145,244	2.3%	57,320
3	Replace Domestic Hot Water storage tank	\$ 10,450	RS Means	0	kWh	0	kW	200	Therms	\$ 328	31.9	25	\$ 5,586	-1.9%	2,205
4	Perform maintenance on all unit ventilators	\$ 18,869	RS Means	50	kWh	0	kW	2,200	Therms	\$ 3,617	5.2	25	\$ 61,594	9.1%	24,340
5	Install 10kW Photovoltaic system	\$ 80,000	RS Means	11,804	kWh	7	kW	0	Therms	\$ 2,007	39.9	25	\$ 34,177	-2.3%	21,135
<b>Total Scope of Work</b>		<b>\$ 356,444</b>	<b>-</b>	<b>74,265</b>	<b>kWh</b>	<b>27.0</b>	<b>kW</b>	<b>7,600</b>	<b>Therms</b>	<b>\$ 28,244</b>	<b>12.6</b>		<b>\$ 481,035</b>		<b>216,746</b>
<b>Definitions:</b>		<b>Assumptions:</b>													
	SPP: Simple Payback (years)			Discount rate =	3.2%	per DOE FEMP guidelines				Average Electric Rate =	0.17	\$/kWh			
	LoM: Life of Measure (years)			Energy price escalation rate =	0%	per DOE FEMP guidelines				Average Fuel Rate =	1.64	\$/Therm			
	ROI: Return on Investment (%)					Carbon Dioxide per unit Electricity =	1.7905	lbs of CO2/kWh							
				Carbon Dioxide per unit of Fuel =	11.023	lbs of CO2/unit fuel									

*Above table represents entire scope of work with no incentives calculated*

ECM Table with Incentives															
ECM #	ECM description	Installed Cost		1st year energy and cost savings						Simple Payback (SPP)	Life of Measure (LoM)	Lifetime Cost Savings (\$)	Return on Invest (ROI)	Annual Carbon Reduction (lbs of CO2)	
		Estimated Cost (\$)	Source	Electric Savings		Fuel Savings		Cost Savings (\$)							
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2	Replace hot water boilers	\$ 82,300	RS Means	0	kWh	0	kW	5,200	Therms	\$ 8,528	9.7	25	\$ 145,244	3.1%	57,320
3	Replace Domestic Hot Water storage tank	\$ 10,050	RS Means	0	kWh	0	kW	200	Therms	\$ 328	30.6	25	\$ 5,586	-1.8%	2,205
4	Perform maintenance on all unit ventilators	\$ 18,869	RS Means	50	kWh	0	kW	2,200	Therms	\$ 3,617	5.2	25	\$ 61,594	9.1%	24,340
5	Install 10kW Photovoltaic system	\$ 70,000	RS Means	11,804	kWh	7	kW	0	Therms	\$ 2,007	34.9	25	\$ 34,177	-2.0%	21,135
<b>Total Scope of Work</b>		<b>\$ 303,414</b>	<b>-</b>	<b>74,265</b>	<b>kWh</b>	<b>27.0</b>	<b>kW</b>	<b>7,600</b>	<b>Therms</b>	<b>\$ 28,244</b>	<b>10.7</b>		<b>\$ 481,035</b>		<b>216,746</b>
<b>Definitions:</b>		<b>Assumptions:</b>													
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	ROI: Return on Investment (%)					Carbon Dioxide per unit Electricity =	1.7905	lbs of CO2/kWh							
				Carbon Dioxide per unit of Fuel =	11.023	lbs of CO2/unit fuel									

*Above table represents entire scope of work with maximum incentives calculated*

# 1. HISTORIC ENERGY CONSUMPTION

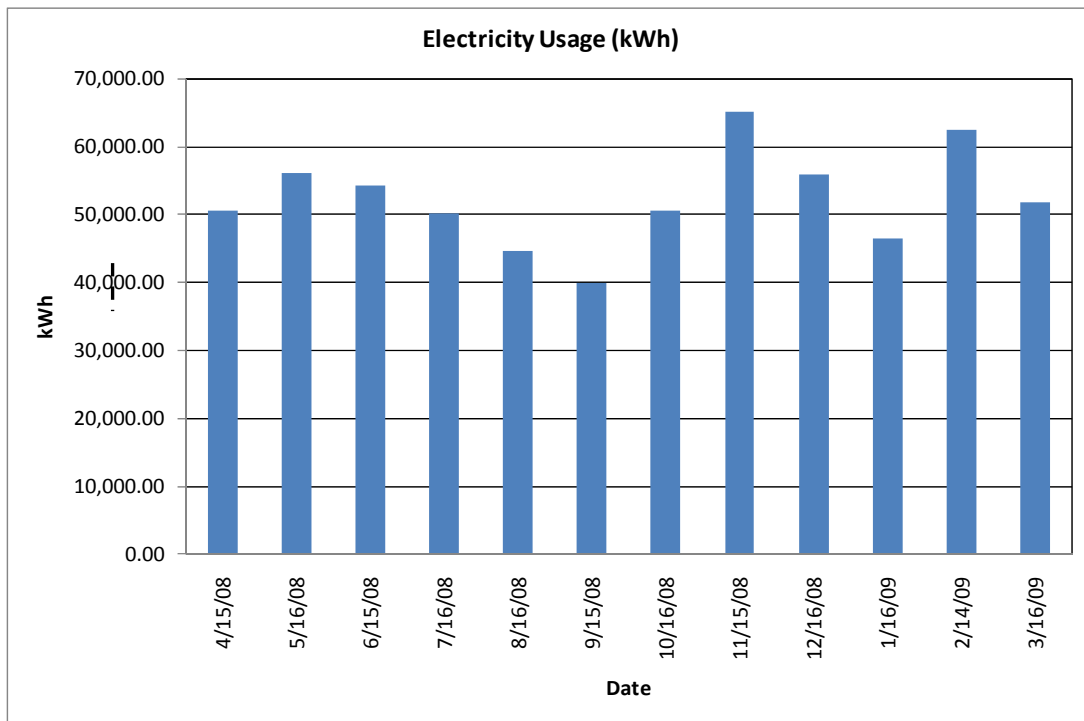
## 1.1. Energy usage and cost analysis

SWA received and analyzed utility bills from March 2008 through March 2009 that were received from the Tewksbury Board of Education.

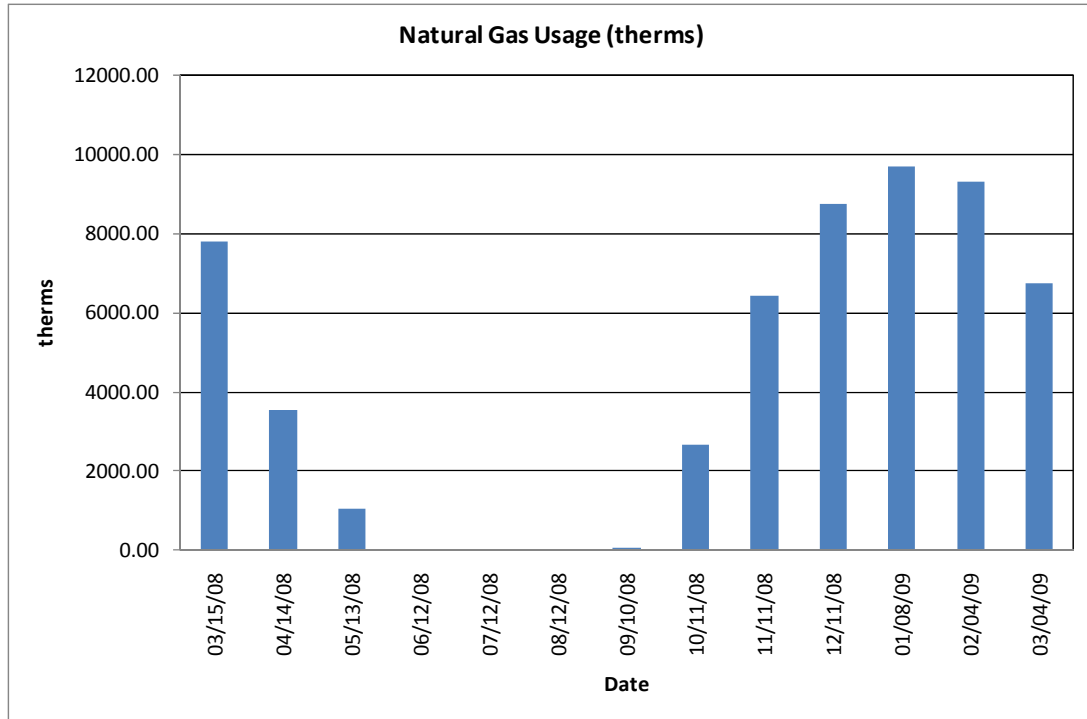
Electricity – The Old Turnpike School has two electric meters for incoming electricity supply. One meter is used for the general electric use of the building; the other is used for the speed limit signs in the front circle. The building purchases electricity from JCP&L at an **average aggregated rate of \$0.17/kWh** based on March 2008 through March 2009 electric bills. The building purchased **approximately 628,288 kWh or \$105,045 worth of electricity from March 2008 through March 2009**. Based on the same time period, the building also has an **average monthly demand of 187.5 kW and monthly peak demand of 225 kW**.

Natural Gas – The Old Turnpike School has one gas meter for incoming natural gas from PSE&G. Between March 2008 and March 2009, the building purchased **approximately 56,082 therms or \$71,453 worth of natural gas**. To account for the additional costs associated with transportation and delivery fees, an **average total gas rate of \$1.64 per therm** was assumed in this report.

The following chart shows electricity usage for the Old Turnpike School based on utility bills for the 2008 - 2009 billing period.



The following chart shows the natural gas usage for the Old Turnpike School based on utility bills for the year March 2008 to March 2009.



In the above chart, the natural gas usage follows a heating trend as expected. During the summer it is clear that the natural gas usage is very minimal which reflects that heat is not being used and the DHW load is minimal.

### 1.2. Utility rate

The Old Turnpike School currently buys electricity from JCP&L and gas from PSEG at the general service rate. The general service rate is a typical rate where customers pay for natural gas based on usage and electricity based on usage with the addition of an electrical charge demand. The Old Turnpike School uses JCP&L account #100009516046 and PSE&G account #5280526711, both for the service address of 171 Old Turnpike Road, Califon, NJ. Electricity for the building was billed at an average rate of **\$0.17/kWh**. Natural Gas for the building was billed at an average rate of **\$1.64/therm**.

### 1.3. Energy benchmarking

The Old Turnpike School building information and utility data were entered into the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. Per the LGEA program requirements; SWA has helped the Tewksbury Board of Education set up a Portfolio Manager account and has shared all building and utility data. SWA recommends that the Tewksbury Board of Education maintains this Portfolio Manager account and adds future utility bills to the account. For reference, the Portfolio Manager Homepage can be accessed at the link below.

[http://www.energystar.gov/index.cfm?c=evaluate\\_performance.bus\\_portfoliomanager](http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager)



## STATEMENT OF ENERGY PERFORMANCE

### Tewksbury BoE - Old Turnpike School

Building ID: 1870028  
 For 12-month Period Ending: February 28, 2009<sup>1</sup>  
 Date SEP becomes ineligible: N/A

Date SEP Generated: October 04, 2009

<b>Facility</b> Tewksbury BoE - Old Turnpike School 171 Old Turnpike Road Califon, NJ 07830	<b>Facility Owner</b> N/A	<b>Primary Contact for this Facility</b> N/A
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Year Built: 1969  
 Gross Floor Area (ft<sup>2</sup>): 67,385

Energy Performance Rating<sup>2</sup> (1-100) 10

#### Site Energy Use Summary<sup>3</sup>

Electricity - Grid Purchase(kBtu)	2,182,612
Natural Gas (kBtu) <sup>4</sup>	5,137,296
Total Energy (kBtu)	7,319,908

#### Energy Intensity<sup>5</sup>

Site (kBtu/ft <sup>2</sup> /yr)	109
Source (kBtu/ft <sup>2</sup> /yr)	188

#### Emissions (based on site energy use)

Greenhouse Gas Emissions (MtCO <sub>2</sub> e/year)	606
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#### Electric Distribution Utility

Jersey Central Power & Lt Co

#### National Average Comparison

National Average Site EUI	71
National Average Source EUI	122
% Difference from National Average Source EUI	54%
Building Type	K-12 School

Stamp of Certifying Professional
Based on the conditions observed at the time of my visit to this building, I certify that the information contained within this statement is accurate.

#### Meets Industry Standards<sup>6</sup> for Indoor Environmental Conditions:

Ventilation for Acceptable Indoor Air Quality	N/A
Acceptable Thermal Environmental Conditions	N/A
Adequate Illumination	N/A

**Certifying Professional**  
N/A

#### Notes:

- Application for the ENERGY STAR must be submitted to EPA within 4 months of the Period Ending date. Award of the ENERGY STAR is not final until approval is received from EPA.
- The EPA Energy Performance Rating is based on total source energy. A rating of 75 is the minimum to be eligible for the ENERGY STAR.
- Values represent energy consumption, annualized to a 12 month period.
- Natural Gas values in units of volume (e.g. cubic feet) are converted to kBtu with adjustments made for elevation based on Facility zip code.
- Values represent energy intensity, annualized to a 12 month period.
- Based on Meeting ASHRAE Standard 62 for ventilation for acceptable indoor air quality, ASHRAE Standard 55 for thermal comfort, and IESNA Lighting Handbook for lighting quality.

The government estimates the average time needed to fill out this form is 6 hours (includes the time for entering energy data, PE facility inspection, and notarizing the SEP) and welcomes suggestions for reducing this level of effort. Send comments (referencing OMB control number) to the Director, Collection Strategies Division, U.S., EPA (28221), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460.

EPA Form 5900-16

## 2. FACILITY AND SYSTEMS DESCRIPTION

### 2.1. Building Characteristics

The single story school contains a total floor area of 67,385 square feet. The building was built in 1969 with additions in 1975 and 1994 and other renovations and upgrades in 2004 and 2006. The building houses classrooms, a gymnasium, a cafeteria and various administrative offices.

### 2.2. Building occupancy profiles

The Old Turnpike School currently has approximately 350 students and 50 faculty members. The hours of operation are 7am through 6pm with maintenance occupying the building through 11pm. The school is used for summer sports and occasional evening and weekend activities.

### 2.3. Building envelope

#### 2.3.1. Exterior walls

The exterior walls consist mostly of 4" CMU block with a 4" brick veneer finish and a 2" air space in between, with some window panel accents. 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.

Except in some areas that need masonry re-pointing on the east side of the building, overall, exterior and interior finishes of the envelope walls were found to be in age-appropriate, good condition.

SWA also recommends removal of window air conditioner units if possible in order to reduce the loss of conditioned air. Duct tape is currently installed on some measures and should not be used as a permanent measure. If this is not feasible, SWA recommends a product similar to Chill Stop-R which includes a gasket seal and air barrier to prevent the loss of expensive conditioned air.



*Wall AC sleeve unit seal shows insufficient air sealing*

#### 2.3.2. Roof

The flat roof was constructed at different times (1975, 1994, 2004, and 2006) and consists of various materials but mostly gray colored rubber membrane with some parapets decorated with standing seam metal mansard type roofing attached to exterior walls. Roof leaks were reported and noticed during the field audit in the area of the original 1975 roof section. During the audit it was mentioned that in 2004 and 2006, 2-3" of rigid insulation was added to parts of the roof but could

not be verified. There were signs that water has been pooling on the roof. This can be addressed by forming proper drainage planes with rigid insulation. There were also some roof drains that were either clogged or missing screens, allowing dirt and other obstructions cause more standing water.



*Drain missing screen and allowing debris to gather on roof*

SWA recommends installing new light colored rubber membrane roofing with 3” min. XPS rigid insulation to replace original and leaking roof sections.



*Pooling on older roof section*

### **2.3.3. Base**

The building’s base is 4” concrete slab-on grade with a perimeter footing. There were no reported problems with water penetration or moisture.

### **2.3.4. Windows**

The building contains fixed and operable aluminum-framed windows some with single-glazing. SWA recommends replacing single pane aluminum windows with double pane low-E on the 1969 and 1975 wings of building. SWA also recommends either professionally installed retrofit window foils applied to the inside or operable commercial blinds to control the amount of natural light to enter in an effort to improve thermal and / or glare control.



*Original single glazed aluminum framed windows*

### **2.3.5. Exterior doors**

The metal framed exterior doors were observed to be in good condition except for some missing or worn weather-stripping in the gym area. 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.



*Worn or missing weather-stripping in gymnasium*

### **2.3.6. Building air tightness**

Based on a visual inspection, the building could benefit from tightly sealed windows and doors, plumbing, and wire penetrations. Any water damage due to condensing un-insulated pipes, condensate lines dripping, plumbing leaks, or roof leaks should be repaired immediately and ceiling tiles should be replaced. Ceiling tiles act as an air barrier containing expensive conditioned air from leaking into ceiling or wall cavities.

## **2.4. HVAC systems**

### **2.4.1. Heating**

The Old Turnpike School building uses a mix of Packaged Roof Top Units and a hot water system to supply heat throughout the entire building. The Packaged Roof Top units act as gas furnaces to provide warm air to hallways and large open areas such as the gymnasium and cafeteria.

Most of the rooftop units are in fair to good condition and appear to be working properly. The newest rooftop unit, located in the back corner, away from the parking lot, is currently de-commissioned due to a roof leak where the unit is installed. According to building maintenance staff, the unit is operable but currently covered with a tarp and shut off since it has an installation defect that allows water to enter the building envelope and causes water damage in a bathroom located directly below the unit.



*Rooftop unit shut-off and covered with a tarp*

The hot water heating system at the building consists of two H B smith cast iron boilers with an input of 4,120 kBtuh each and a nameplate efficiency of 80% but is assumed to be around 75% efficient. The units are currently not operable and therefore could not be tested for combustion efficiency. These units feed a hot water system with two pumps that provide hot water to the unit ventilators located in perimeter classrooms around the building. Each unit contains a heating coil, fan assembly, dampers, filters and controls within a metal cabinet located on the outside walls of perimeter classrooms. Each unit is controlled pneumatically by one of two compressors located in the boiler room. Outdoor air is brought directly into the cabinets via grilles located on the outside wall of the classrooms. The unit ventilators are designed to mix room air with outside air, condition the air as necessary, and deliver it to the classrooms through grilles located on top of the unit ventilators. The proportion of outside air is controlled by the position of fresh air dampers. Supply air is brought in through the unit ventilators and then exhausted through return ducts in each classroom and eventually purged by rooftop exhaust fans.

The boilers are currently not operating due to maintenance. The domestic hot water tank has a coil inside of Boiler #1 and relies on this boiler to provide domestic hot water. Since the boilers have not been working since March, there has been no Domestic Hot Water. Before Boiler #1 was shut down for repair, it was noticed short-cycling. The boilers are not set to alternate or cycle. Normally with two boilers, usage is alternated between both boilers to reduce overuse on one boiler. In this particular building, the #1 boiler is the main boiler and does not alternate to Boiler #2. Instead, Boiler #2 is only used when heating demand is not met by Boiler #1 alone.

There is also an issue with the way that the two feed water tanks are piped, which are located above the boilers. The tanks are piped together and therefore both need to be drained at the same time, neither tank is isolated and can be drained separately. In addition, in order to fill the feed water tanks, both boilers need to be completely filled and then the tanks above them. Building maintenance staff noted that the left side tank has a broken bladder and is currently having many problems. Maintenance staff also confirmed that 4 “knuckle joints” were replaced this summer at a cost of \$3,000.

Altogether, the heating plant is inefficient and beyond its useful life. SWA recommends that the boilers are removed and replaced with newer condensing units, if applicable. These units should be sized appropriately and configured to alternate between each boiler to prevent overuse of one boiler. The boiler replacement should include new piping that is properly insulated. The boiler replacement should also include replacing existing hot water circulating pumps with pumps that contain NEMA premium efficiency motors. Currently, all motors are of standard efficiency.

The building contains an out-of-date controls system that uses two compressors to operate valves in the unit ventilators. Building maintenance staff noted that unit ventilators currently operate 24/7 because the timer control is broken. The control system contains no digital interface and gives very limited control over operation of the HVAC system and does not provide any type of system status. Thermostats are located in offices as well as classrooms but give limited control over particular space. These thermostats are not programmable. SWA recommends that the central controls system is upgraded to a Direct Digital Control system with a local graphical interface. This system should be installed with proper functionalities such as an outdoor temperature reset and nighttime setback. Ideally, this system would be set up to operate for typical building operations but could also be manually over-ridden if needed by building maintenance staff. Also, programmable thermostats could be added to allow localized control over each room. If only a portion of the system were being used on any particular day, then programmable thermostats could help reduce heating/cooling in rooms that were not currently being operated.

#### **2.4.2. Cooling**

The Old Turnpike School is cooled in several different ways. The perimeter classrooms are not cooled directly but receive cool air from the hallways that are served from rooftop units that provide heating, ventilation and air-conditioning. A few rooms contain window air conditioner units that are older with a low efficiency and are not sealed properly. The Board of Education offices contain split air-conditioner systems with condensers located directly above each unit on the roof. The activity room and gymnasium are currently not air-conditioned.

There was one American Air Filter condensing unit located on the roof near center of the original roof, near the parking lot that appears to be de-commissioned. This unit was originally serving a smaller utility room. This unit either needs to be replaced or removed and the roof properly sealed. This unit is currently rusting and not only provides air to freely enter and exit the building but also damages the roof surface by allowing rust to sit on the roof. SWA recommends that this condensing unit is removed and the roof properly repaired. Based on observations, this unit has not been operated and there have been no corresponding complaints.



*De-commissioned condensing unit*

#### **2.4.3. Ventilation**

The Old Turnpike School uses both the rooftop units and unit ventilators to provide fresh air to the building. One important part of ventilation is allowing stale air to be exhausted in direct proportion to the amount of fresh air that is supplied to the building. According to building drawings, each exhaust fan should exhaust several classrooms through a ducted system. If one exhaust fan is not working, four or more rooms are potentially not achieving a balance between supply air and return air. When supply air is continually brought into the building without an equal amount of air properly being exhausted, the building becomes positively pressurized and becomes a trap for stale air and humidity. There are approximately 5 rooftop exhaust fans that are currently not working due to either missing belts, broken motors or units that appear to have collapsed under the weight of snow. Exhaust fans should be replaced as they fail to ensure proper ventilation. SWA recommends replacing the existing 5 rooftop exhaust fans that are no longer functional with new direct drive fans. Direct drive fans reduce maintenance costs because they can easily be adjusted with a screw driver and do not contain any belts that need to be replaced. SWA also recommends that exhaust fans that are not replaced at this time, are replaced with direct drive fans as they fail.

#### **2.4.4. Domestic Hot Water**

Domestic Hot Water for the building is provided by a hot water storage tank that is estimated at approximately 500 gallons. The storage tank stores hot water that is heated via a coil located inside of Boiler #1. Since hot water tank is not directly-fired, it relies on Boiler #1 to be operational to be able to provide domestic hot water to the building. Since Boiler #1 is currently not operational, the building has not had domestic hot water since March. When a system uses a hot water storage tank with a coil inside of a boiler, the boiler is required to run during warm months as well as cool months. Schools typically have a relatively small demand for domestic hot water and this storage tank appears to be oversized.

This storage tank is currently wrapped in asbestos. Although this assessment focuses on energy efficiency, the health and safety concerns associated with asbestos should be noted. Asbestos abatement is primarily a safety issue and is not directly associated with a cost payback. However, the existence of asbestos very often impacts the ability of building operators to perform routine maintenance procedures without undertaking appropriate safety measures and incurring associated costs.



As a result of asbestos, the efficiency of building systems often suffers from lack of routine maintenance. During the course of the assessment, appropriate safety precautions were taken with regards to the presence of asbestos. In some cases, this prevented SWA from completing a more

thorough investigation of the existing systems and equipment. To protect the welfare and staff, SWA recommends that asbestos abatement be addressed prior to undertaking any other significant investments in capital improvements.

In addition to the above mentioned hot water tank located in the boiler room. When the pre-kindergarten wing consisting of 4 classrooms was built, a domestic hot water heater was added. This domestic hot water heater is located in the pre-kindergarten wing electrical room and provides domestic hot water to the four nearby classrooms. This unit is newer has an input of 154,000 Btuh and a storage capacity of 89 gallons. Due to the limited use of hot water in these classrooms, this unit is oversized.

In the kitchen, a second domestic hot water heater exists to meet the needs of the kitchen. This unit has an input of 250,000 Btuh and a total capacity of 100 gallons. This unit also appears to be oversized. The unit was installed in 2005 and is in good condition. This unit in combination with a small Hatco booster heater provides hot water to the kitchen for cooking and cleansing needs.

SWA recommends taking appropriate measures for asbestos remediation before any work is undertaken in the boiler room. When all asbestos issues have been solved, SWA recommends that the existing main domestic hot water tank is removed and replaced with a properly sized, direct gas-fired hot water heater. This heater should be direct-fired in order to be able to completely shut down the heating boilers during the summer without the loss of domestic hot water. SWA recommends that the Tewksbury Board of Education hire an engineer to perform domestic hot water load calculations for the building. It may be possible to move the oversized hot water heater from the pre-kindergarten wing to the main boiler room, if the hot water heater is deemed to have a large enough capacity for the general hot water use of the building. If the pre-kindergarten hot water heater is of appropriate size, then the school can re-use this equipment for the main domestic hot water load and install a smaller, appropriately sized electric hot water heater for the four pre-kindergarten classrooms. Since the domestic hot water load is small for the pre-kindergarten wing, then a small electric domestic hot water tank can reduce standby losses that currently exist with the larger, over-sized existing unit.

It is not cost-effective to replace all of the existing water heating equipment with higher efficiency equipment. However, higher efficiency water heating equipment will save energy and should be strongly considered upon replacement of the equipment. Energy saving appliances bearing the ENERGY STAR label should be selected to ensure efficiency performance. Incentives may be available to offset any added costs for the installed equipment.

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 that the aerators in all sinks are retrofitted with low-flow aerators that constrict the volume of water allowed to flow out of the faucets during the time it takes to wash hands, wash dishes, etc. Most of the faucets found in the classrooms had 2.0gpm aerators, while restroom aerators had 0.5gpm aerators. SWA recommends installing 0.5gpm aerators on all faucets in the building. 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 Old Turnpike School currently consists of mostly T12 fluorescent fixtures with magnetic ballasts with a few areas retrofitted to T8 fixtures with electronic ballasts. SWA recommends replacing all T12 lighting including magnetic ballasts whenever possible with T8 lighting and electronic ballasts. SWA also recommends installing occupancy sensors in bathrooms, closets, 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 T12 fluorescent fixtures found in display cases found throughout the building could be retrofitted with T5 bulbs with electronic ballasts. The building also has many fixtures 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 Signs* – The building has mostly fluorescent exit signs installed. SWA recommends all fluorescent exit signs be replaced with more efficient LED fixtures. Exit signs prove cost-effective to upgrade since they operate 24 hours per day.

*Exterior Lighting* – The exterior lighting was surveyed during the building audit, and it is a mix of incandescent, compact fluorescent and metal halide lamps. Since this lighting is mainly for Safety as well as for Security, SWA has deemed it not cost effective to replace the metal halide lamp lighting at this time. SWA recommends the replacement of incandescent lamps to CFLs. The speed limit signs located near the front circle each contain two 25W incandescent bulbs. These bulbs can be retrofitted with 9W CFL bulbs. The timers on the exterior lighting should be maintained and reset during daylight savings time. At the time of the audit all exterior lights were on. SWA recommends installing astronomical timers on exterior lighting.

### **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 315kwh/yr. The refrigerator in the image below uses 1022 kWh/yr, a savings of \$113 per year. 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: window air conditioners, 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>

Appliances such as televisions, air-conditioners, computers, etc. should all be purchased with energy consumption in mind. Replacing purchased equipment for energy efficiency is most likely not cost-effective but if Energy Star and other energy efficient options are always considered; energy consumption can be maintained throughout the entire use of the building.

Building staff should ensure that all appliances are always shut off when rooms are not in use. Computers and other appliances should be shut down, or at least their screens should be when not in use for extended periods of time.

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 Old Turnpike School

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 Old Turnpike School is a one story building and therefore contains no elevators.

### **2.5.4. Other electrical systems**

There are not currently any other electrical systems installed at the Old Turnpike School.

SWA has been told that the Old Turnpike School goes through relatively a lot of lamp bulb and ballast changes throughout the year. SWA recommends that the Old Turnpike School records incoming power phases to the building. Perhaps, ask the utility company, PSE&G, to megger feeds to the main transformer buses. On the whole, megger testing is non destructive. What happens is a DC voltage is applied to the cable under test. It is an insulation test to see if the insulation has been compromised in any way to cause a short circuit when normal power is applied to it. There may be some phase in-balance and/or grounding and recent heavy rains are making the situation worse. Also determine if weekly generator tests are shortening the life of light bulbs in the building. The Township may also want to investigate surge suppressors for the main transformer.

The Old Turnpike School depends on well water for sprinklers, heating boiler water and domestic hot water. There are currently two pumps used for the building in order to draw water from the wells. One pump is located beyond the athletic fields and serves as a source for sprinkler water. The other pump is located between the building and the parking lot and provides water to a storage tank in the boiler room for hot water and heating needs. On the day of the site visit, maintenance staff did not have access to the pumps. As these pumps fail, they should be upgraded with NEMA premium efficiency pumps to reduce electric consumption.

### 3. EQUIPMENT LIST

Building System	Description	Physical Location	Make/ Model	Fuel	Space served	Estimated Remaining useful life %
Heating	Boiler #2, H. B Smith cast iron sectional boiler, Series 450 Mills H-T Boilers, 115.34 HP, Capacity 4,130,000 Btuh, 1974	Mechanical Room	H. B Smith 450 Mills H-T Boilers	Natural Gas	All areas	0%
Heating	Boiler #1, H. B Smith cast iron sectional boiler, Series 4500 Mills Boilers, 98.46 HP, Capacity 4,130,000 Btuh, 1970	Mechanical Room	H. B Smith 4500 Mills Boilers	Natural Gas	All areas	0%
Heating	Attached to Boiler #2, PowerFlame Burner, Max 6300 MBH with 3HP Baldor motor, 82.5% NEMA efficiency	Mechanical Room	PowerFlame Burner, Model #C4-G-25, Baldor Category #VM3158T	Natural Gas	All areas	0%
Heating/Ventilation	Four units, No nameplate available, 1/3 HP motors, 1750 RPM	On top of Gymnasium	NA	Natural Gas/Electricity	All areas	30%
Heating Hot Water Pumps	Pump #1, Armstrong with 5HP Dayton motor, 1760 RPM	Mechanical Room	Armstrong Model #819359-002, Dayton Model #3KXD4A	Electricity	All areas	10%
Heating Hot Water Pumps	Pump #2, Armstrong with 5HP GE motor, 1750 RPM, Nema Nom. Eff. 89.5%	Mechanical Room	Armstrong Model #819359-002, GE Model #5KS184 AD206B	Electricity	All areas	10%
Controls Compressor	Compressor #1, PLP Air compressor with 3/4 HP Baldor motor, NEMA efficiency 75%	Mechanical Room, left of boilers	PLP Air Compressors Model #PLCK-5030, Baldor Motor Cat. #M3112	Electricity	Unit ventilators	10%
Controls Compressor	Compressor #2, Quincy Climate Control compressor with 3/4 HP Marathon electric motor, Cat. No G084, 1725 RPM	Mechanical Room, right of boilers	Quincy Climate Control Compressor, Marathon Electric Model #ZVF56T17D2093E	Electricity	Unit ventilators	10%
Well Water Tank Compressor	Compressor #3, Magnatek Motor, no model numbers, used to keep pressure in black well water tank	Mechanical Room, behind black well water tank	Magnatek Motor	Electricity	Well Water Tank	10%
Distribution System	Unit-ventilators, NA	Perimeter classrooms	NA	Electricity/Hot Water	Perimeter classrooms	20%
Heating/Cooling	Lennox L-Series packaged rooftop unit, heating input 78,000 Btuh, cooling capacity 37,600 Btuh, 3 tons, 11.2 EER, 13.00 EER R-22, Tag C305R	Upper roof, right side when facing school	Lennox L-Series, Model #LGA036HS2Y, ID #11C305R	Electricity/Natural Gas	Hallways	40%
Heating/Cooling	Lennox L-Series packaged rooftop unit, heating input 78,000 Btuh, cooling capacity 50,500 Btuh, 4 tons, 11.3 EER, 13.25 EER R-22, Tag C307R	Upper roof, right side when facing school	Lennox L-Series, Model #LGA048HH3Y, ID #11C307R	Electricity/Natural Gas	Hallways	40%
Heating/Cooling	Carrier Weathermaster forced air furnace with cooling unit, heating input 150,000 Btuh, output 120,000 Btuh, Cooling capacity 46,000 Btuh, Thermal efficiency of 80%, 4 tons, SEER 13.0, EER 11.1, R-22	Upper roof, right side when facing school	Carrier Weathermaster, Model #48HJF005	Electricity/Natural Gas	Hallways	40%
Heating/Cooling	Carrier Weathermaster forced air furnace with cooling unit, Heating input 224,000 Btuh, output 183,680, 82% thermal efficiency, 7.5 tons, EER 11.0, R-22	Lower roof, back of building when facing school	Carrier Weathermaster, Model #48HJF008--531NB	Electricity/Natural Gas	Hallways	40%
Heating/Cooling	Carrier Weathermaster forced air furnace with cooling unit, Heating input 224,000 Btuh, output 183,680, 82% thermal efficiency, 7.5 tons, EER 11.0, R-22	Lower roof, back of building when facing school	Carrier Weathermaster, Model #48HJF008--531NB	Electricity/Natural Gas	Hallways	80%
Heating/Cooling	Carrier Weathermaster forced air furnace with cooling unit, Heating input 224,000 Btuh, output 183,680, 82% thermal efficiency, 7.5 tons, EER 11.0, R-22	Lower roof, back of building when facing school	Carrier Weathermaster, Model #48HJF008--531NB	Electricity/Natural Gas	Hallways	40%
Heating/Cooling	Lennox DX cooling-gas heating-single package unit, Series GCS16, heating input 120,000 Btuh, output 96,000 Btuh, cooling capacity 60,000 Btuh, 5 tons, R-22	Lower roof, left side, near to parking lot	Lennox Model #GCS16-060-120-5Y	Electricity/Natural Gas	Hallways	40%
Cooling	American Air Filter condensing unit, could not read most data from nameplate, R-22	Lower roof, left side, near to parking lot	American Air Filter, Model #CF48-1A, Serial #2311269728	Electricity	Utility Room	40%
Cooling	Amana condensing unit, 1/12 HP fan motor, R-22	Lower roof, left side, near to parking lot	Amana, Model #RCB24C2A, Serial #0306128991	Electricity	Offices	80%
Heating/Cooling	Carrier Weathermaster forced air furnace with cooling unit, Heating input 224,000 Btuh, output 183,680, 82% thermal efficiency, 7.5 tons, EER 11.0, R-22, Tag #LIB1R	Lower roof, left side, near to parking lot	Carrier Weathermaster, Model #48HJF008--531NB	Electricity/Natural Gas	Hallways	40%

Cooling	American Air Filter condensing unit, Deluxe High Efficiency AC, 01/94, R-22	Front roof above offices	American Air Filter, Model #AD036GD	Electricity	Offices	40%
Cooling	Goodman condensing unit, SEER 13.0, R-22	Front roof above offices	Goodman, Model #GSC130361FA	Electricity	Offices	40%
Cooling	Inter-City Products condensing unit, 4/93, R-22	Front roof above offices	Inter-City Products, Model #AD012GD	Electricity	Offices	36%
Cooling	Inter-City Products condensing unit, 4/93, R-22	Front roof above offices	Inter-City Products, Model #AD018GD	Electricity	Offices	36%
Cooling	Dayton condensing unit, R-22	Front roof above offices	Dayton, Model #GCGD12521S1A	Electricity	Offices	40%
Cooling	Carrier condensing unit, R-22	Front roof above offices	Carrier, Model #38TKB042330	Electricity	Offices	40%
Cooling	Inter-City Products condensing unit, 4/93, R-22	Front roof above offices	Inter-City Products, Model #AD012GDP	Electricity	Offices	36%
Cooling	Inter-City Products condensing unit, 4/93, R-22	Front roof above offices	Inter-City Products, Model #AD012GDP	Electricity	Offices	36%
Cooling	Inter-City Products condensing unit, 1/94, R-22	Front roof above offices	Inter-City Products, Model #AD048GD	Electricity	Offices	40%
Cooling	Inter-City Products condensing unit, 8/92, R-22	Front roof above offices	Inter-City Products, Model #AD012GD	Electricity	Offices	32%
DHW Pumps	Pump #3, Armstrong Domestic Hot water pump with Dayton motor, 1760 RPM, NEMA nom. Efficiency 84%, 2HP	Mechanical Room, next to DHW tank	Armstrong pump model #819358003, Dayton motor model #2N982H	Electricity	All areas	10%
DHW Pumps	Pump #4, Armstrong Domestic Hot Water pump with Bell & Gossett AC motor, 1/2 HP, name plate is covered in oil	Mechanical Room, next to DHW tank	Armstrong Model #S55, Bell & Gossett ID #M80070	Electricity	All areas	10%
DHW Pumps	Pump #5, Armstrong Domestic Hot Water pump with Bell & Gossett AC motor, 1/2 HP, name plate is covered in oil	Mechanical Room, next to DHW tank	Armstrong Model #816027-002	Electricity	All areas	10%
Domestic Hot Water	DHW hot water storage tank with coil inside of Boiler #1, estimated at 500 Gallons, entire hot water tank is wrapped in asbestos	Mechanical Room	NA, wrapped in asbestos	-	All areas except Preschool section and kitchen	0%
Domestic Hot Water	AO Smith commercial domestic hot water heater, 89 gallons, Input 154,000 Btuh	Electrical room in Preschool section	AO Smith Commercial, Model #BTC 154 964	Natural Gas	Preschool section	
Domestic Hot Water	AO Smith Master-Fit atmospheric domestic hot water heater, 100 gallons, Input 250,000 Btuh, 242.42 recovery gallons, 4/28/2005	Kitchen	AO Smith Master-Fit, Model #BTR 250A 110	Natural Gas	Kitchen	80%
Domestic Hot Water	Hatco domestic hot water booster heater, 17.25, could not read model numbers	Kitchen	Hatco booster heater	Electric	Kitchen	40%
Lighting	See details appendix A	-	-	-	-	-

**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 this building, SWA has separated the investment opportunities into three categories of recommendations:

##### **Category I Recommendations: Capital Improvements**

- Asbestos Abatement – As noted previously, asbestos was observed in the buildings and is considered a health and safety hazard. Any asbestos on the mechanical systems may impact the ability of the building operations staff to conduct routine maintenance without incurring additional costs associated with proper safety measures. Regardless of the recommendations adopted to upgrade the energy efficiency of the facility, SWA recommends an asbestos abatement project using only licensed asbestos contractors as the first priority.
- Window replacement – The existing windows are single pane windows provides a thermal weakness in the building envelope. It is currently not cost-effective to replace the windows but is recommended that the windows be considered. Single pane glass is conductive to heat transfer and becomes a cold surface during winter and a warm surface during summer. SWA recommends upgrading to windows that are double pane windows that contain a low-e coating as well as frames that provide a thermal break.
- Roof replacement and additional insulation – The existing roof has a minimal insulation value and consists of a dark colored membrane. SWA recommends that this roof is considered to be replaced as part of a capital improvement plan. A minimum of 3” XPS rigid insulation should be added to prevent heat transferring across the roof surface. As part of a roof replacement, a reflective, light-colored surface should be considered in order to deter solar heat gain from entering the building envelope via the roof.

##### **Category II Recommendations: Operations and Maintenance**

- Replace rooftop exhaust fans – There are approximately five rooftop exhaust fans that need to be repaired or replaced. Some of these units have been crushed due to the weight of snow while others may have malfunctioning motors. SWA recommends installing direct-drive exhaust fans that have a speed controller. These fans require less maintenance since they are direct-drive and do not use belts or require constant adjustment. These fans also have a speed controller than can allow a contractor to easily adjust fan speed for testing and balancing. As existing rooftop exhaust fans fail or require significant maintenance, new rooftop exhaust fans should be installed. These fans are energy efficient as well as reduce maintenance costs. Replacing broken exhaust fans will have a negative payback since electric usage will increase as well as the amount of conditioned air that is removed from the building. Replacement of exhaust fans is necessary in order to keep the building ventilation at code levels and also as a health and safety measure.
- Weather Stripping/Air Sealing - SWA observed that exterior door weather-stripping 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 frame. Any other accessible gaps or penetrations in the thermal envelope penetrations should also be sealed with caulk or spray foam.
- Install lighting occupancy sensors – Occupancy sensors should be installed in smaller rooms such as closets and bathrooms. These occupancy sensors may decrease energy usage on a daily basis but are not quantified due to the sporadic use of smaller rooms in school buildings. Occupancy sensors help to reduce the risk of lights being left on for extended periods of time such as nights and weekends.
- Water Efficient Fixtures & Controls - Adding controlled on/off timers on all lavatory faucets is a cost-effect 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-consuming fixtures and appliances will save both energy and money through reduced energy consumption for water heating, while also decreasing water and sewer bills.

- Megger testing – PSE&G should be asked to megger feeds to the main transformer buses. Testing requires a DC voltage to be applied to a cable under test in order to determine if insulation has been compromised in any way. If insulation is compromised, short circuits may occur that change voltages in the building. These voltage changes can shorten the lifetime of lighting fixtures in the building.
- Replace refrigerators – Existing refrigerators in the building such as those in the cafeteria or faculty lounges that are over 10 years old, should be replaced to comply with newer efficiency standards. Refrigerators require power 24 hours per day and can use a lot of electricity over the course of the year.
- Create an educational program that teaches both students and their teachers how to minimize their energy use in the classroom. The US Department of Energy offers free information hosting energy efficiency educational programs and K-12 lesson plans, for more information please visit: <http://www1.eere.energy.gov/education/>

**Category III Recommendations: Energy Conservation Measures**

**Summary table**

<b>ECM#</b>	<b>Description</b>
<b>1</b>	<b>Upgrade existing lighting; See Appendix A for entire lighting retrofit schedule</b>
<b>2</b>	<b>Replace hot water boilers</b>
<b>3</b>	<b>Replace Domestic Hot Water storage tank</b>
<b>4</b>	<b>Perform maintenance on all unit ventilators</b>
<b>5</b>	<b>Install 10kW Photovoltaic system</b>

**ECM#1: Upgrade existing lighting**

**Description:**

The Old Turnpike School currently consists of mostly T12 fluorescent fixtures with magnetic ballasts. These fixtures should be replaced with T8 fixture with electronic ballasts. Display cases are often left on 24 hours per day and contain T12 magnetic fixtures, which can be replaced with T5 electronic fixtures. All remaining incandescent bulbs should be replaced with appropriate CFLs. The gymnasium currently contains thirty-five 400W metal halide bulbs. 400W metal halide bulbs consume 454W of power in order to run and the quality of light diminishes over time. As metal halide bulbs lose their quality of light, they start turning colors which provides an uneven light and causes shadows. SWA recommends replacing these metal halide fixtures with T5 pendant fixtures. These lights hang similar to typical metal halide gymnasium lighting but used only 228W of power to operate and provide a better quality light that will not diminish over time. The fixtures contain four 2' T5 linear bulbs and form a square pendant. The two speed limit signs are used for only two hours per day but each contain two 25W incandescent bulbs. SWA recommends replacing these bulbs with 9W CFL bulbs. In addition to energy savings associated with each lighting upgrade, there will also be annual cost savings due to increased life expected from each new bulb type. Lighting is rated in burn hours to estimate the lifetime of each bulb. With each new fixture there will be an increase in burn hours, thus requiring less bulb replacements. These savings have been incorporated into the annual cost savings.

**Installation cost:**

Estimated installed cost: \$155,425  
 Source of cost estimate: RS Means

**Economics:**

1st year energy and cost savings							Maintenance Cost Savings	Simple Payback (SPP)	Life of Meas. (LoM)	Lifetime Cost Savings	Return on Invest (ROI)
Electricity Savings		Fuel Savings		Energy Cost Savings							
Consumption	Demand	Natural Gas									
62,411	kWh	20	kW	0	Therms	\$13,765	\$0	11.29	25	\$234,435	2.03%

**Assumptions:** SWA calculated the savings for this measure using information collected during the field visit and analysis of historical utility consumption information. The following burn hours have been assumed for each fixture type: CFL bulbs (10,000 hours), Incandescent bulbs (750 hours), T12 bulbs (15,000 hours), T8 bulbs (40,000 hours), Fluorescent exit signs (6,000 hours), LED exit signs (50,000 hours), Metal Halide bulbs (10,000 hours), and T5 bulbs (20,000 hours).

**Rebates/financial incentives:**

*NJ Clean Energy – Prescriptive Lighting Incentive, Incentive based on installing T5 high bay fixtures (\$16-\$284 per fixture)  
 Maximum incentive amount is \$9,940*

*NJ Clean Energy – Prescriptive Lighting Incentive, Incentive based on installing T5 and T8 lamps with electronic ballasts in existing facilities (\$10-\$30 per fixture)  
 Maximum incentive amount is \$23,070*

*NJ Clean Energy – Prescriptive Lighting Incentive, Incentive based on installing LED Exit signs (\$10/\$20 per fixture)  
 Maximum incentive amount is \$220*

**Options for funding ECM:**

*This project may benefit from enrolling in either the NJ Pay-for-Performance program or the NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.*  
<http://www.njcleanenergy.com/commercial-industrial/home/home>

## **ECM#2: Replace hot water boilers**

### **Description:**

Asbestos remediation must occur before hot water boilers are addressed. At the time of the energy audit, both boilers were shut down for maintenance. The existing boilers from the early 1970s and have outlived their useful lifetime. By removing these boilers and replacing with properly sized condensing boilers that modulate, the Old Turnpike School will be able to reduce the amount of natural gas required to heat the building. The new boilers should have an updated control panel that allows them to reset to outdoor temperatures as well as setback at night time. Installing condensing boilers will also allow efficiency to increase by reducing the temperature of hot water that is required to be sent around to each building. Newer boilers are much smaller and would allow building maintenance more room to perform routine maintenance on the boilers. In addition to increasing efficiency, the two new boilers will not contain a domestic hot water coil and should be set up to alternate every 3.5 days. Alternating boilers allows for each boiler to endure the same amount of use, reducing maintenance costs from overusing a single boiler. Piping to and from the boiler should be insulated to reduce heat loss to the pumps. Hot water circulating pumps should also be upgraded to NEMA premium efficiency motors.

### **Installation cost:**

Estimated installed cost: \$91,700 (not including asbestos abatement)

Source of cost estimate: *RS Means*

### **Economics:**

1st year energy and cost savings						Simple Payback (SPP)	Life of Meas. (LoM)	Lifetime Cost Savings	Return on Invest (ROI)	
Electricity Savings			Fuel Savings		Cost Savings					
Consumption	Demand	Natural Gas								
0	kWh	0	kW	5,200	Therms	\$8,528	10.75	25	\$145,244	2.34%

**Assumptions:** SWA calculated the savings for this measure using measurements taken the day of the field visit, and billing analysis. SWA assumes boiler efficiencies are 79% based on nameplate data. It is assumed that newly installed condensing boilers that are correctly piped will increase efficiency to 90%.

### **Rebates/financial incentives:**

*NJ Clean Energy – Gas-fired boilers, Incentive based on installing gas-fired boilers <4000 MBH (\$1.00 per MBH)*

*Maximum incentive amount is \$8,000*

*NJ Clean Energy – Premium motors, Incentive based on installing premium three-phase motors (\$45-\$700 per motor)*

*Maximum incentive amount is \$1,400*

### **Options for funding ECM:**

*This project may benefit from enrolling in either the NJ Pay-for-Performance program or the NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.*

*<http://www.njcleanenergy.com/commercial-industrial/home/home>*

### **ECM#3: Replace Domestic Hot Water storage tank**

**Description:**

Asbestos remediation must occur before the domestic hot water heater is addressed. Old Turnpike School relies on a 500 gallon storage tank for domestic hot water needs of the building. This storage tank contains a coil that is located in Boiler #1 and transfers heat to the water inside of the storage tank. The domestic hot water tank is wrapped in asbestos and must be removed properly. SWA recommends replacing the storage tank with a direct-fired, natural gas heater that is sized for the demands of the building. The right sized domestic hot water heater will reduce natural gas usage by reducing the volume of water that is constantly held at a set temperature. The pricing and savings assume that the hot water tank located in the main boiler room is replaced with a hot water heater. Additional savings will be incurred by having the ability to shut down the heating boilers during the summer and using only the domestic hot water heater to provide domestic hot water. Although this measure is not cost-effective, it is included in the ECM list since it will be necessary to address if the boilers are replaced.

SWA recommends having the domestic hot water heater located in the pre-kindergarten wing evaluated for capacity. It may be possible to move this domestic hot water heater to the main boiler room and install a small, properly-sized, electric hot water heater in the pre-kindergarten wing. The Tewksbury Board of Education would need to hire a contractor to properly size the equipment. If existing equipment can be re-used, installed costs can be reduced.

**Installation cost:**

Estimated installed cost: \$10,450 (not including asbestos abatement)  
 Source of cost estimate: RS Means

**Economics:**

1st year energy and cost savings						Simple Payback (SPP)	Life of Meas. (LoM)	Lifetime Cost Savings	Return on Invest (ROI)	
Electricity Savings		Fuel Savings		Cost Savings						
Consumption	Demand	Natural Gas								
0	kWh	0	kW	200	Therms	\$328	31.86	25	\$5,586	-1.86%

**Assumptions:** SWA calculated the savings for this measure using measurements taken the day of the field visit, and billing analysis. Since the original hot water tank has no efficiency, it is assumed that savings are equivalent of reducing the domestic hot water supply temperature from 135°F to 125°F. Additional savings have not been calculated for properly sizing the domestic hot water. Additional savings have also not been calculated for being able to shutdown the heating boiler during the summer and rely only on the domestic hot water heater.

**Rebates/financial incentives:**

*NJ Clean Energy – Natural gas water heating, Incentive based on installing a gas-fired water heater >50 gallons (\$1.00-\$2.00 per MBH).  
 Maximum incentive amount is \$400.*

**Options for funding ECM:**

*This project may benefit from enrolling in either the NJ Pay-for-Performance program or the NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.  
<http://www.njcleanenergy.com/commercial-industrial/home/home>*

## **ECM#4: Perform maintenance on all unit ventilators**

### **Description:**

The recommended measure consists of hiring a contractor to perform maintenance on each unit ventilator located within the building. Building maintenance staff noted that almost all of the unit ventilators run 24/7 because timers within each unit are broken. Some units may have valves that are broken and stuck in an open position. Switching from a pneumatic controls system to a digital system would not be cost-effective because additional electric wiring would have to be run to each unit ventilator, as well as additional control panels added to the boiler room. SWA recommends that a contractor inspects each unit ventilator and perform a routine maintenance check on each unit. Any timers or valves that are broken should be replaced. The contractor should also check each of the two compressors for any type of failure. In addition to energy savings, there will also be maintenance cost savings with each unit ventilator since the run time of each unit will be decreased. Difference components of the units are beginning to wear as a result of 24 hour per day usage. The lifetime of each unit will be increased since they will now be used for a fraction of the day as opposed to being left all the time. These maintenance savings have not been taken into account when calculating cost savings for this measure since it is not a definitive number that is easy to quantify.

### **Installation cost:**

Estimated installed cost: \$18,869  
Source of cost estimate: *RS Means*

### **Economics:**

1st year energy and cost savings						Simple Payback (SPP)	Life of Meas. (LoM)	Lifetime Cost Savings	Return on Invest (ROI)	
Electricity Savings			Fuel Savings		Cost Savings					
Consumption	Demand	Natural Gas								
50	kWh	0	kW	2,200	Therms	\$3,617	5.22	25	\$61,594	9.06%

**Assumptions:** SWA calculated the savings for this measure using measurements taken the day of the field visit, and billing analysis. *RSMeans* was used to estimate a cost on a per unit basis. An extra cost of 25% was added to the entire scope of work to account for additional work required by some individual units. Savings are based on reducing run time of each unit ventilator and providing more effective control.

### **Rebates/financial incentives:**

*There are currently no incentives for this measure.*

### **Options for funding ECM:**

*This project may benefit from enrolling in either the NJ Pay-for-Performance program or the NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.*  
<http://www.njcleanenergy.com/commercial-industrial/home/home>

**ECM#5: *Install 10kW Photovoltaic system***  
*(See Section 5.2 Solar Photovoltaic)*

**5. RENEWABLE AND DISTRIBUTED ENERGY MEASURES**

**5.1. Existing systems**

*There are currently no existing renewable energy systems.*

**5.2. Solar Photovoltaic**

**ECM#5: *Install 10kW Photovoltaic system***

**Description:**

The recommended measure consists of installing a 10kW Photovoltaic system on the gymnasium roof. This measure does not show a positive payback but has been evaluated at the client’s request. A solar photovoltaic system was evaluated at the request of the client. Although this measure is not cost-effective, the school is a prime candidate for a solar installation due to the amount of elevated gymnasium roof available with a clear South/West exposure. The project could also increase savings by receiving Solar Renewable Energy Certificates (RECs) for every MW of power generated. SWA provided a preliminary screening for Photovoltaic panels; however, if the Tewksbury Board of Education moves forward with this measure a professional solar installer should be hired to maximize the size of the system based on monthly and annual electric demands.

**Installation cost:**

Estimated installed cost: \$80,000  
 Source of cost estimate: *RS Means*

**Economics:**

1st year energy and cost savings						Simple Payback (SPP)	Life of Meas. (LoM)	Lifetime Cost Savings	Return on Invest (ROI)	
Electricity Savings			Fuel Savings		Cost Savings					
Consumption	Demand		Natural Gas							
11,804	kWh	7	kW	0	Therms	\$2,007	39.87	25	\$34,177	-2.29%

**Assumptions:** SWA calculated the savings for this measure using measurements taken the day of the field visit, and billing analysis. The system is sized based on available roof size and would provide electricity much below the baseload of the building. Based on electricity usage alone, a larger system can be installed.

**Rebates/financial incentives:**

*Solar installation program (\$1 per watt installed).  
 Maximum solar incentive \$10,000*

*Market-rate SRECs (assuming SREC=\$600)  
 Maximum incentive assuming 11 SRECs earned per year is \$6,600.*

**Options for funding ECM:**

*This project may benefit from enrolling in either the NJ Pay-for-Performance program or the NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.*  
<http://www.njcleanenergy.com/commercial-industrial/home/home>

### 5.3. Solar Thermal Collectors

*Solar thermal collectors are not cost effective for this project and are not recommended due to the low amount of domestic hot water use throughout the building.*

### 5.4. Combined Heat and Power

*CHP is not applicable to this project because of the HVAC system type and limited domestic hot water usage.*

### 5.5. Geothermal

*Geothermal is not applicable to this project because it would require modifications to the existing heat distribution system, which would not be cost effective.*

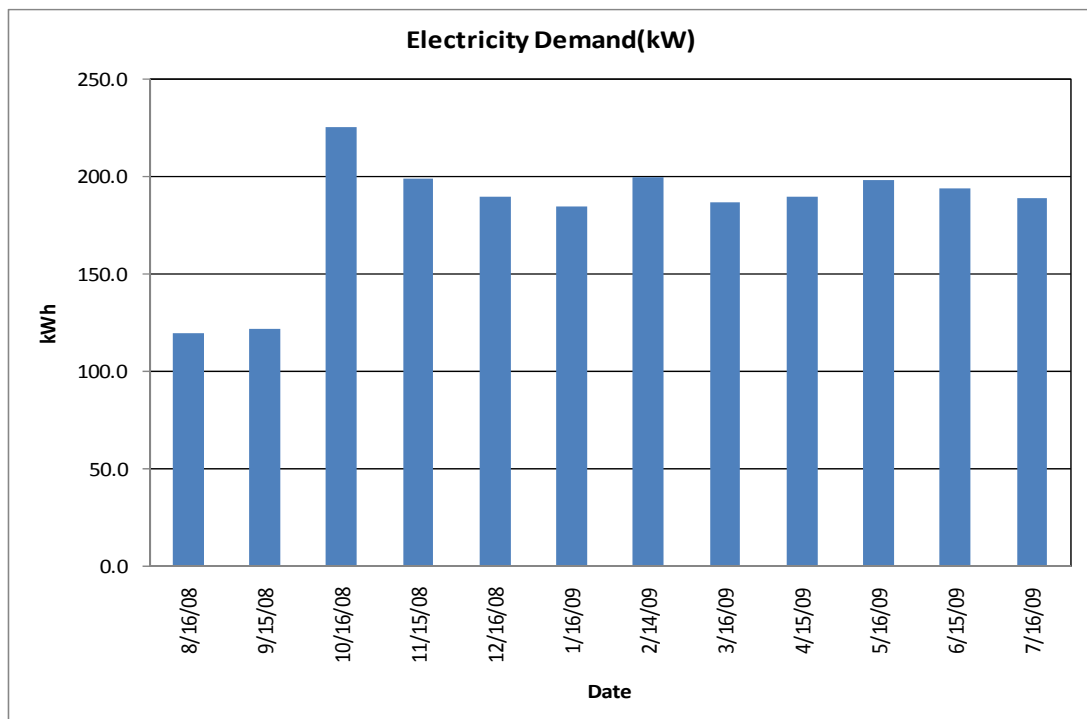
### 5.6. Wind

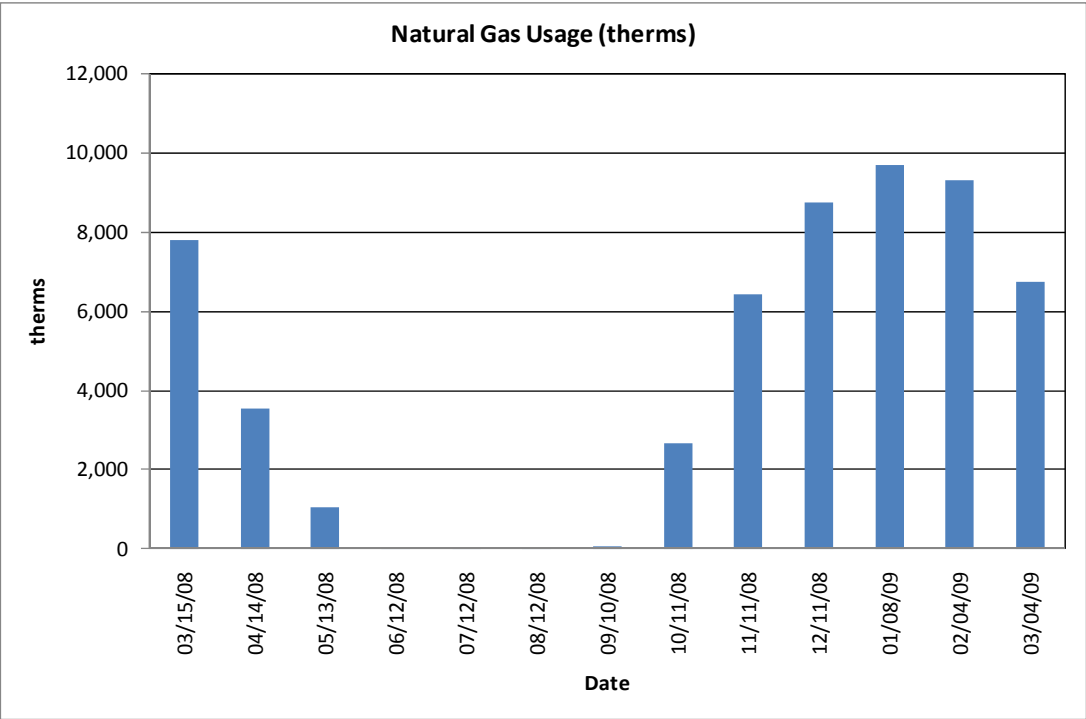
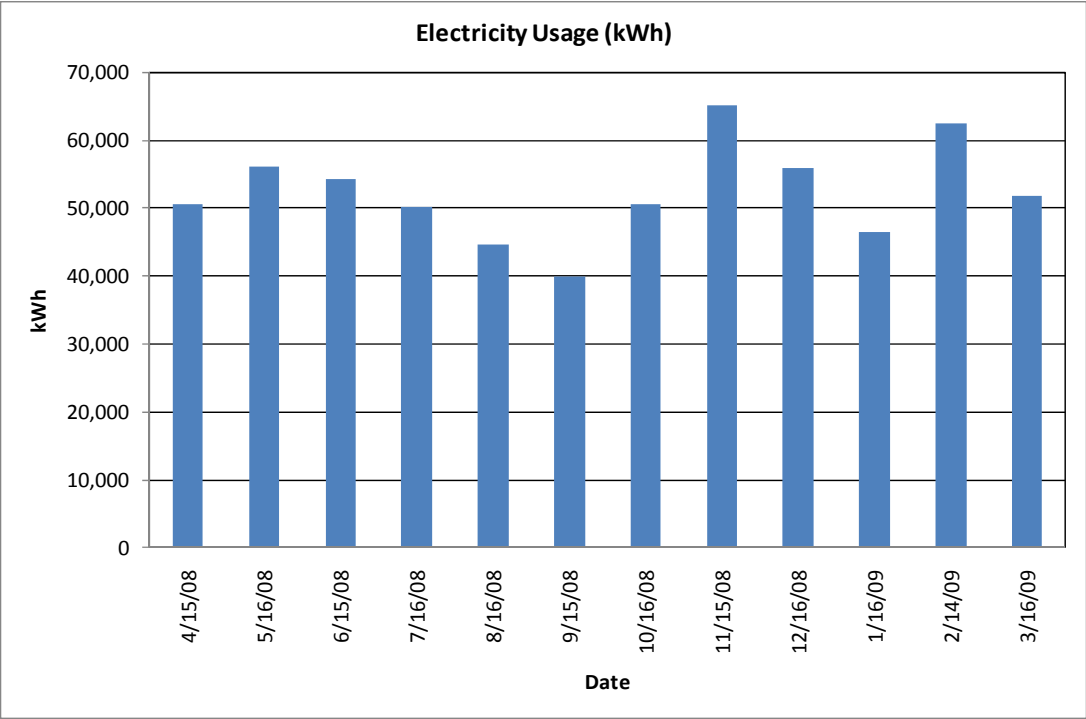
*Wind power production is not appropriate for this location because required land is not available for the wind turbine. Also, the available wind energy resource is very low.*

## 6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

### 6.1. Load profiles

The average electrical peak demand for the previous year was 187.5 kW and the maximum peak demand was 225 kW. The electric and gas load profiles for this project are presented in the following charts. The first chart shows electric demand (in kW) for the previous 12 months and the other two charts show electric and gas usage (in kWh), respectively.



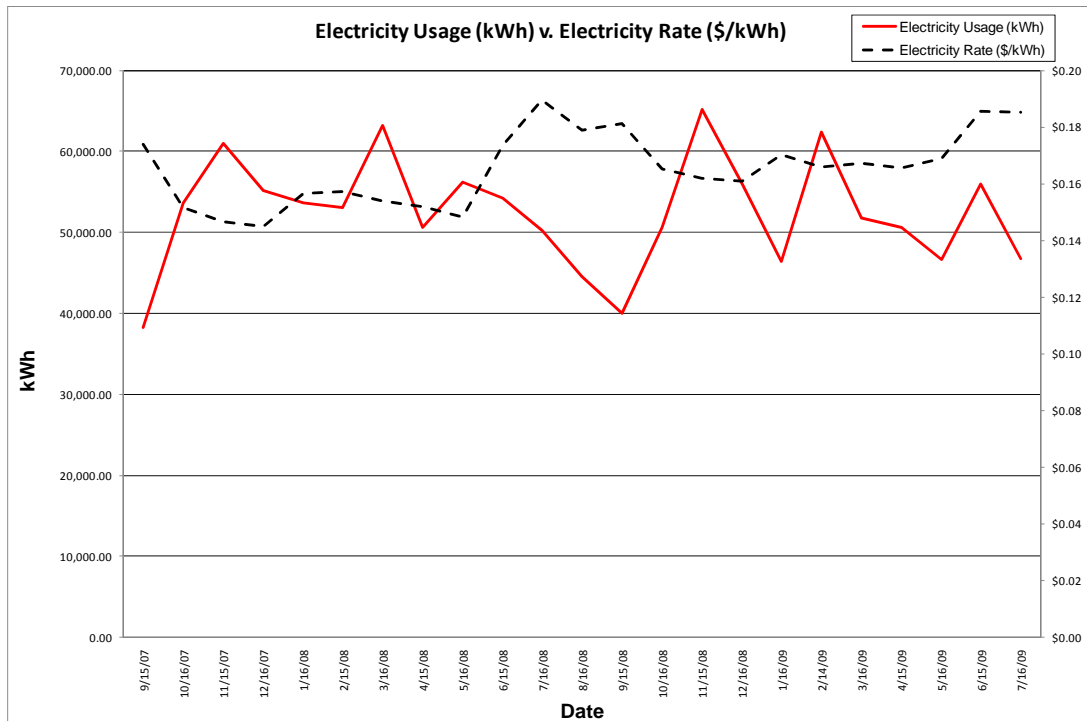


## 6.2. Tariff analysis

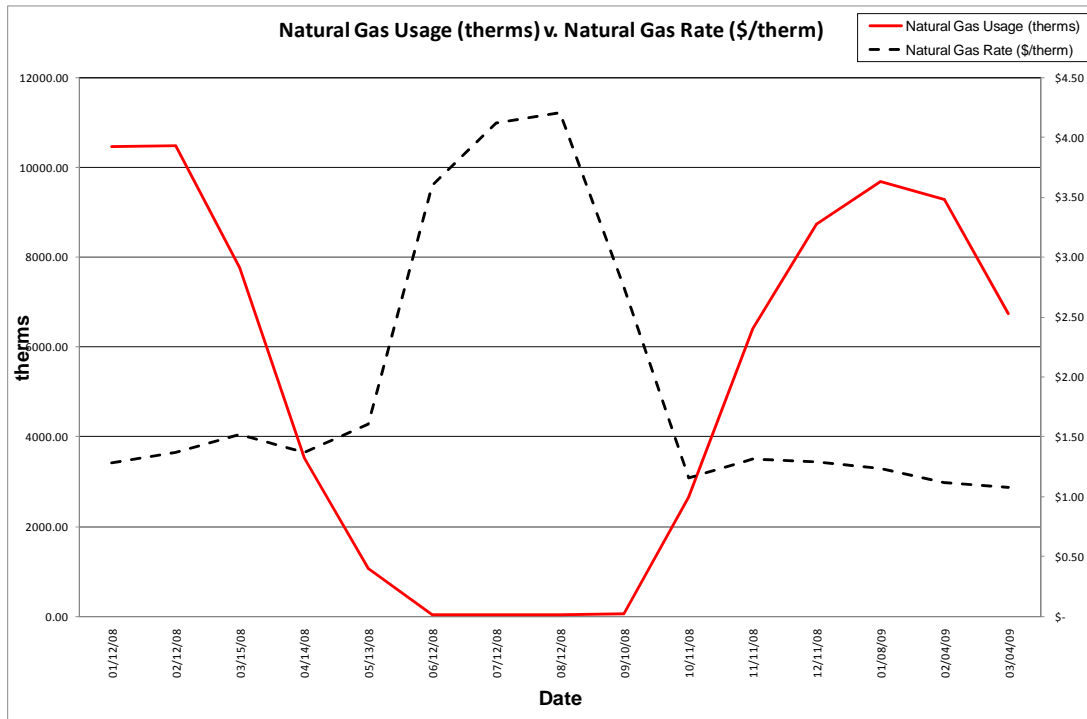
The Old Turnpike School building currently buys electricity from JCP&L at the general service rate, which charges customers based on the market rate of electricity usage as well as monthly peak demand. Gas is purchased from PSEG at the general service rate which charges customers based on the market rate of natural gas usage. General Service rates are appropriate for this building due to its size.

## 6.3. Energy Procurement strategies

Billing analysis shows price fluctuations of over 20% over the course of the year for the building electrical and natural gas accounts. Customers that have a large variation in monthly billing rates can often reduce the costs associated with energy procurement by selecting a third party energy supplier. Contact the NJ Energy Choice Program for further information on Energy Services Companies (ESCOs) that can act as third party energy suppliers. Purchasing electricity from an ESCO can reduce electric rate fluctuation and ultimately reduce the annual cost of energy for the school. Appendix B contains a complete list of third party energy suppliers.



*Electricity prices reflect electricity usage*



*Natural gas prices fluctuate as expected with usage*

The building may be eligible for enrollment in a Demand Response Program because the minimum electric demand each month does greatly exceeds 50 kW, which is the typical threshold for considering this option.

## 7. METHOD OF ANALYSIS

### 7.1. Assumptions and methods

Energy modeling method: Spreadsheet-based calculation methods  
Cost estimates: RS Means 2009 (Facilities Maintenance & Repair Cost Data)  
RS Means 2009 (Building Construction Cost Data)  
RS Means 2009 (Mechanical Cost Data)  
Note: 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

Existing Lighting Conditions														
#	Building	Level/Floor	Room Type	Fixture Type	Ballast Type	No. of Fixtures	No. of Lamps	Watts/Lamp	Hrs/Day	Days used per year	Annual Energy Use (kwh/year)	Controls	Daylighting possible?	Total Power (Watts)
1	School	1st Floor	Bathroom Men	Incandescent	-	1	1	60	2	193	23	Switch	No	60
2	School	1st Floor	Bathroom Men	Incandescent	-	1	1	60	2	193	23	Switch	No	60
3	School	1st Floor	Book Storage Rm	T12 4'	Magnetic	1	2	34	2	193	26	Switch	No	68
4	School	1st Floor	Band Classroom	T12 4'	Magnetic	30	4	40	8	193	7411	Switch	No	4800
5	School	1st Floor	Band Classroom	T12 4'	Magnetic	2	2	40	8	193	247	Switch	No	160
6	School	1st Floor	D400 Classroom	T12 4'	Magnetic	12	4	40	6	193	2223	Switch	No	1920
7	School	1st Floor	Hallway	T8 4'	Electronic	12	3	32	17	193	3780	Keyed switch	No	1152
8	School	1st Floor	Atrium Hallway	Exit Sign Fluorescent	Electronic	2	1	16	24	193	148	None	No	32
9	School	1st Floor	C402 Classroom	T12 4'	Magnetic	12	4	34	8	193	2520	Switch	No	1632
10	School	1st Floor	C404 Classroom	T12 4'	Magnetic	12	4	34	8	193	2520	Switch	No	1632
11	School	1st Floor	preschool Hallway	T8 4'	Electronic	20	3	32	17	193	6300	Keyed switch	No	1920
12	School	1st Floor	preschool Hallway	T8 U Shaped	Electronic	2	2	32	17	193	420	Keyed switch	No	128
13	School	1st Floor	C406 Classroom	T8 4'	Electronic	12	3	32	8	193	1779	Switch	No	1152
14	School	1st Floor	Classroom	T8 U Shaped	Electronic	5	2	32	8	193	494	Switch	No	320
15	School	1st Floor	Hallway	Exit Sign Fluorescent	None	4	1	16	24	193	296	None	No	64
16	School	1st Floor	C405 Classroom	T8 U Shaped	Electronic	6	2	32	8	193	593	None	No	384
17	School	1st Floor	C405 Classroom	T8 4'	Electronic	10	3	32	7	193	1297	Switch	No	960
18	School	1st Floor	Display case	T12 4'	Magnetic	3	1	34	24	193	472	None	No	102
19	School	1st Floor	C311 Classroom	T8 U Shaped	Electronic	6	2	32	8	193	593	None	No	384
20	School	1st Floor	C311 Classroom	T8 4'	Electronic	10	3	32	8	193	1482	Switch	No	960
21	School	1st Floor	C312 Classroom	T8 U Shaped	Electronic	5	2	32	8	193	494	None	No	320
22	School	1st Floor	C312 Classroom	T8 4'	Electronic	12	3	32	8	193	1779	Switch	No	1152
23	School	1st Floor	Electrical rm	T12 4'	Magnetic	2	3	34	2	193	79	Switch	No	204
24	School	1st Floor	Preschool Bathroom	T8 4'	Electronic	2	3	34	8	193	315	Switch	No	204
25	School	1st Floor	Preschool Bathroom	T8 U Shaped	Electronic	1	2	32	8	193	99	Switch	No	64
26	School	1st Floor	Janitor's Closet	Metal Halide	Magnetic	1	1	60	2	193	23	Switch	No	60
27	School	1st Floor	Faculty Bathroom unisex	T8 U Shaped	Magnetic	1	2	32	8	193	99	Switch	No	64
28	School	1st Floor	Faculty Bathroom unisex	T8 4'	Electronic	1	2	32	8	193	99	Switch	No	64
29	School	1st Floor	C310 Classroom	T12 4'	Magnetic	12	4	34	8	193	2520	Switch	No	1632
30	School	1st Floor	C309 Classroom	T12 4'	Magnetic	12	4	34	8	193	2520	Switch	No	1632
31	School	1st Floor	C308 Classroom	T12 4'	Magnetic	12	4	34	8	193	2520	Switch	No	1632
32	School	1st Floor	C307 Classroom	T12 4'	Magnetic	12	4	34	8	193	2520	Switch	No	1632
33	School	1st Floor	C306 Classroom	T12 4'	Magnetic	12	4	34	8	193	2520	Switch	No	1632
34	School	1st Floor	C305 Classroom	T12 4'	Magnetic	12	4	34	8	193	2520	Switch	No	1632
35	School	1st Floor	Band room Hallway	T12 4' ushaped	Magnetic	8	2	34	18	193	1890	Keyed switch	No	544
36	School	1st Floor	Band room Hallway	T12 4' ushaped	Magnetic	10	2	40	18	193	2779	Keyed switch	No	800
37	School	1st Floor	Bathroom boys	T12 4'	Magnetic	4	2	34	8	193	420	Switch	No	272
38	School	1st Floor	Bathroom girls	T12 4'	Magnetic	4	2	34	8	193	420	Switch	No	272
39	School	1st Floor	Janitor's Closet	T12 4'	Magnetic	1	1	34	4	193	26	Switch	No	34
40	School	1st Floor	Girls locker room	T12 4'	Magnetic	23	1	40	8	193	1420	Switch	No	920
41	School	1st Floor	Girls locker room	Incandescent	-	2	1	60	1	193	23	Switch	No	120
42	School	1st Floor	Girl's Coach room	T12 4'	Magnetic	1	4	34	8	193	210	Switch	No	136
43	School	1st Floor	Girl's Coach room	Incandescent	-	1	1	60	8	193	93	Switch	No	60
44	School	1st Floor	Display case	T12 4'	Magnetic	2	2	34	14	193	367	Switch	No	136
45	School	1st Floor	Display case	T12 4' ushaped	Magnetic	2	2	34	14	193	367	Switch	No	136
46	School	1st Floor	Men's coach room	T12 4'	Magnetic	1	4	34	8	193	210	Switch	No	136
47	School	1st Floor	Shower off men's coach room	Incandescent	-	1	1	60	8	193	93	Switch	No	60
48	School	1st Floor	Men's locker room	T12 4'	Magnetic	23	1	34	8	193	1207	Switch	No	782
49	School	1st Floor	Men's locker room	Incandescent	-	2	1	60	4	193	93	Switch	No	120
50	School	1st Floor	Gymnasium	Metal Halide	-	35	1	400	16	193	43232	Keyed switch	No	14000
51	School	1st Floor	Gymnasium - PE equipment	T12 4'	Magnetic	2	2	40	8	193	247	Switch	No	160
52	School	1st Floor	Gymnasium - storage	T12 4'	Magnetic	3	2	34	8	193	315	Switch	No	204
53	School	1st Floor	Janitor's office - receiving	T12 4'	Magnetic	12	2	37	14	193	2399	Switch	No	888
54	School	1st Floor	Janitor's office - receiving	T12 4'	Magnetic	2	2	34	14	193	367	Switch	No	136
55	School	1st Floor	Vocal music Classroom	T12 4'	Magnetic	24	2	34	14	193	4410	Switch	No	1632
56	School	1st Floor	Lab#2 Classroom	T12 4'	Magnetic	24	2	34	8	193	2520	Switch	No	1632
57	School	1st Floor	B202 Classroom	T12 4'	Magnetic	20	2	34	8	193	2100	Switch	No	1360
58	School	1st Floor	B202 Classroom storage	T12 4'	Magnetic	3	2	34	8	193	315	Switch	No	204
59	School	1st Floor	B200 Classroom	T12 4'	Magnetic	28	2	34	8	193	2940	Switch	No	1904
60	School	1st Floor	B200 Classroom art storage	Incandescent	-	2	1	200	3	193	232	Switch	No	400
61	School	1st Floor	Art room hallway	T12 4'	Magnetic	6	2	34	14	193	1102	Switch	No	408
62	School	1st Floor	Boiler Room	15w CFL	-	4	1	15	24	193	278	Switch	No	60
63	School	1st Floor	Boiler Room	Incandescent	-	1	1	300	24	193	1390	Switch	No	300
64	School	1st Floor	Stage	Incandescent	-	9	1	300	0.015	193	8	Switch	No	2700
65	School	1st Floor	Stage	Incandescent	-	108	1	60	0.015	193	19	Switch	No	6480
66	School	1st Floor	All purpose room	T12 4'	Magnetic	25	4	34	8	193	5250	Switch	No	3400
67	School	1st Floor	Kitchen	T12 4'	Magnetic	12	3	37	7	193	1800	Switch	No	1332

68	School	1st Floor	Kitchen	20w CFL	-	3	1	20	7	193	81	Switch	No	60
69	School	1st Floor	Kitchen	Incandescent	-	1	1	60	7	193	81	Switch	No	60
70	School	1st Floor	Kitchen storage	Incandescent	-	1	1	200	7	193	270	Switch	No	200
71	School	1st Floor	Kitchen storage	Incandescent	-	1	1	200	7	193	270	Switch	No	200
72	School	1st Floor	Kitchen storage	20w CFL	-	1	1	20	7	193	27	Switch	No	20
73	School	1st Floor	Kitchen locker room	Incandescent	-	1	1	60	7	193	81	Switch	No	60
74	School	1st Floor	Kitchen bathroom	15w CFL	-	1	1	15	7	193	20	Switch	No	15
75	School	1st Floor	Bathroom boys - 8th grade	T12 4'	Magnetic	2	2	34	8	193	210	Switch	No	136
76	School	1st Floor	Bathroom boys - 8th grade	Incandescent	-	1	1	75	8	193	116	Switch	No	75
77	School	1st Floor	BSI classroom	T12 4'	Magnetic	5	2	34	8	193	525	Switch	No	340
78	School	1st Floor	Guidance counselor	T12 4'	Magnetic	4	2	34	8	193	420	Switch	No	272
79	School	1st Floor	Nurse's office	T12 4'	Magnetic	6	2	34	8	193	630	Switch	No	408
80	School	1st Floor	Nurse's office bathroom	Incandescent	-	1	1	75	8	193	116	Switch	No	75
81	School	1st Floor	Vice Principal office	T12 4'	Magnetic	4	4	34	8	193	840	Switch	No	544
82	School	1st Floor	Office storage closet	Incandescent	-	1	1	150	2	193	58	Switch	No	150
83	School	1st Floor	Main Office restroom	Incandescent	-	1	1	60	2	261	31	Switch	No	60
84	School	1st Floor	Near main office trophy case	13w pin based flourest	-	1	1	15	24	193	69	Switch	No	15
85	School	1st Floor	Main office hallway	T12 2'	Magnetic	12	2	17	14	261	1491	Switch	No	408
86	School	1st Floor	Main office entrance	T12 4'	Magnetic	3	4	34	14	261	1491	Switch	No	408
87	School	1st Floor	Board office entrance	T12 4'	Magnetic	2	2	34	14	261	497	Switch	No	136
88	School	1st Floor	Board office	T12 4'	Magnetic	9	3	34	8	261	1917	Switch	No	918
89	School	1st Floor	Board office	T12 4' ushaped	Magnetic	6	2	34	8	261	852	Switch	No	408
90	School	1st Floor	Business Administrator office	T12 4' ushaped	Magnetic	8	2	34	8	261	1136	Switch	No	544
91	School	1st Floor	Supervisor curriculum room	T12 4' ushaped	Magnetic	8	2	34	8	261	1136	Switch	No	544
92	School	1st Floor	Conference room	T12 4' ushaped	Magnetic	8	2	34	8	261	1136	Switch	No	544
93	School	1st Floor	Superintendent office	T12 4' ushaped	Magnetic	8	2	34	8	261	1136	Switch	No	544
94	School	1st Floor	Office	T12 4'	Magnetic	4	3	40	8	261	1002	Switch	No	480
95	School	1st Floor	A106 Computer Lab	T12 4'	Magnetic	16	3	40	8	193	2964	Switch	No	1920
96	School	1st Floor	A106 Computer Lab IT office	T12 4'	Magnetic	3	3	40	8	193	556	Switch	No	360
98	School	1st Floor	108 Computer / synergistic lab	T12 4'	Magnetic	16	3	34	8	193	2520	Switch	No	1632
99	School	1st Floor	108 Computer / synergistic lab	T12 4'	Magnetic	14	3	34	8	193	2205	Switch	No	1428
99	School	1st Floor	Science room storage	T12 4'	Magnetic	2	3	34	8	193	315	Switch	No	204
100	School	1st Floor	A105 Science lab	T12 4'	Magnetic	14	3	34	8	193	2205	Switch	No	1428
101	School	1st Floor	Science hallway	T12 4'	Magnetic	12	2	34	8	193	1260	Switch	No	816
102	School	1st Floor	Science hallway custodian close	T12 4'	Magnetic	1	2	34	2	193	26	Switch	No	68
103	School	1st Floor	Science hallway	Exit Sign Fluorescent	-	3	1	16	2	193	19	Switch	No	48
104	School	1st Floor	A103 Language arts classroom	T12 4'	Magnetic	12	3	34	8	193	1890	Switch	No	1224
105	School	1st Floor	Bathroom Men faculty	T12 4' ushaped	Magnetic	1	2	34	3	193	39	Switch	No	68
106	School	1st Floor	Bathroom womens faculty	par 38 floodlight	-	1	1	34	3	193	20	Switch	No	34
107	School	1st Floor	Electrical room	T12 4'	Magnetic	2	2	34	0.25	261	9	Switch	No	136
108	School	1st Floor	Board office hallway	T12 4'	Magnetic	9	2	34	14	261	2236	Switch	No	612
109	School	1st Floor	Server room	25w CFL	-	4	1	25	24	193	463	Switch	No	100
110	School	1st Floor	Men's Faculty lavatory	Incandescent	-	1	1	60	4	193	46	Switch	No	60
111	School	1st Floor	Women's Faculty lavatory	Incandescent	-	1	1	60	4	193	46	Switch	No	60
112	School	1st Floor	B206 Classroom	T12 4'	Magnetic	3	3	34	8	193	472	Switch	No	306
113	School	1st Floor	B206 Classroom	Incandescent	-	1	1	60	8	193	93	Switch	No	60
114	School	1st Floor	B206 Classroom	Incandescent	-	1	1	200	0.25	193	10	Switch	No	200
115	School	1st Floor	B208 Classroom	T12 4'	Magnetic	6	2	34	8	193	630	Switch	No	408
116	School	1st Floor	B210 Faculty room	T12 4'	Magnetic	8	3	34	8	193	1260	Switch	No	816
117	School	1st Floor	B214 Classroom	T12 4'	Magnetic	19	2	34	8	193	1995	Switch	No	1292
119	School	1st Floor	B214 Classroom	T12 4'	Magnetic	19	2	34	8	193	1995	Switch	No	1292
120	School	1st Floor	B216 Classroom	T12 4'	Magnetic	19	2	34	8	193	1995	Switch	No	1292
121	School	1st Floor	B213 Classroom	T12 4'	Magnetic	19	2	34	8	193	1995	Switch	No	1292
122	School	1st Floor	B211 Classroom	T12 4'	Magnetic	19	2	34	8	193	1995	Switch	No	1292
123	School	1st Floor	B209 Classroom	T12 4'	Magnetic	19	2	34	8	193	1995	Switch	No	1292
124	School	1st Floor	B207 Classroom	T8 4'	Electronic	35	3	32	8	193	5188	Switch	No	3360
125	School	1st Floor	B205 Library	T8 4'	Electronic	4	3	32	8	193	593	Switch	No	384
126	School	1st Floor	B205 Library office	T8 4'	Electronic	3	3	32	8	193	445	Switch	No	288
127	School	1st Floor	B205 book storage	Exit Sign Fluorescent	None	2	2	16	24	193	296	None	No	64
128	School	1st Floor	B205 library	T12 2'	Magnetic	14	2	17	24	193	2205	None	No	476
128	School	Exterior	Exterior	Metal Halide	None	10	10	250	12	365	109500	Autom. Timer	No	25000
129	School	Exterior	Exterior	Metal Halide	None	5	10	70	12	365	15330	Autom. Timer	No	3500
130	School	Exterior	Speed Limit Signs	25W incandescent	None	2	2	25	2	261	52.2	Autom. Timer	No	100

Proposed Lighting Conditions														
	Building	Level/Floor	Room Type	Fixture Type	Ballast Type	No. of Fixtures	No. of Lamps	Watts/Lamp	Hrs/Day	Days used per year	Annual Energy Use (kwh/year)	Controls	Daylighting possible?	Total Power (Watts)
1	School	1st Floor	Bathroom Men	13w CFL	-	1	1	13	2	193	5	Occupancy Sensor	No	13
2	School	1st Floor	Bathroom Men	13w CFL	-	1	1	13	2	193	5	Occupancy Sensor	No	13
3	School	1st Floor	Book Storage Rm	T8 4'	Electronic	1	2	28	2	193	22	Occupancy Sensor	No	56
4	School	1st Floor	Band Classroom	T8 4'	Electronic	30	4	28	8	193	5188	Switch	No	3360
5	School	1st Floor	Band Classroom	T8 4'	Electronic	2	2	28	8	193	173	Switch	No	112
6	School	1st Floor	D400 Classroom	T8 4'	Electronic	12	4	28	6	193	1556	Switch	No	1344
7	School	1st Floor	Hallway	T8 4'	Electronic	12	3	28	17	193	3307	Occupancy Sensor	No	1008
8	School	1st Floor	Atrium Hallway	LED exit sign	-	2	1	5	24	193	46	None	No	10
9	School	1st Floor	C402 Classroom	T8 4'	Electronic	12	4	28	8	193	2075	Switch	No	1344
10	School	1st Floor	C404 Classroom	T8 4'	Electronic	12	4	28	8	193	2075	Switch	No	1344
11	School	1st Floor	preschool Hallway	T8 4'	Electronic	20	3	32	17	193	6300	Switch	No	1920
12	School	1st Floor	preschool Hallway	T8 U Shaped	Electronic	2	2	32	17	193	420	Switch	No	128
13	School	1st Floor	C406 Classroom	T8 4'	Electronic	12	3	32	8	193	1779	Switch	No	1152
14	School	1st Floor	Classroom	T8 U Shaped	Electronic	5	2	32	8	193	494	Switch	No	320
15	School	1st Floor	Hallway	LED exit sign	-	4	1	5	24	193	93	None	No	20
16	School	1st Floor	C405 Classroom	T8 U Shaped	Electronic	6	2	32	8	193	593	None	No	384
17	School	1st Floor	C405 Classroom	T8 4'	Electronic	10	3	32	7	193	1297	Switch	No	960
18	School	1st Floor	Display case	T5 4'	Electronic	3	1	8	24	193	111	None	No	24
19	School	1st Floor	C311 Classroom	T8 U Shaped	Electronic	6	2	32	8	193	593	None	No	384
20	School	1st Floor	C311 Classroom	T8 4'	Electronic	10	3	32	8	193	1482	Switch	No	960
21	School	1st Floor	C312 Classroom	T8 U Shaped	Electronic	5	2	32	8	193	494	None	No	320
22	School	1st Floor	C312 Classroom	T8 4'	Electronic	12	3	32	8	193	1779	Switch	No	1152
23	School	1st Floor	Electrical rm	T8 4'	Electronic	2	3	28	2	193	65	Switch	No	168
24	School	1st Floor	Preschool Bathroom	T8 4'	Electronic	2	3	34	8	193	315	Switch	No	204
25	School	1st Floor	Preschool Bathroom	T8 U Shaped	Electronic	1	2	32	8	193	99	Switch	No	64
26	School	1st Floor	Janitor's Closet	Metal Halide	Magnetic	1	1	60	2	193	23	Switch	No	60
27	School	1st Floor	Faculty Bathroom unisex	T8 U Shaped	Magnetic	1	2	32	8	193	99	Switch	No	64
28	School	1st Floor	Faculty Bathroom unisex	T8 4'	Electronic	1	2	32	8	193	99	Switch	No	64
29	School	1st Floor	C310 Classroom	T8 4'	Electronic	12	4	28	8	193	2075	Switch	No	1344
30	School	1st Floor	C309 Classroom	T8 4'	Electronic	12	4	28	8	193	2075	Switch	No	1344
31	School	1st Floor	C308 Classroom	T8 4'	Electronic	12	4	28	8	193	2075	Switch	No	1344
32	School	1st Floor	C307 Classroom	T8 4'	Electronic	12	4	28	8	193	2075	Switch	No	1344
33	School	1st Floor	C306 Classroom	T8 4'	Electronic	12	4	28	8	193	2075	Switch	No	1344
34	School	1st Floor	C305 Classroom	T8 4'	Electronic	12	4	28	8	193	2075	Switch	No	1344
35	School	1st Floor	Band room Hallway	T8 4' ushaped	Electronic	8	2	28	18	193	1556	Switch	No	448
36	School	1st Floor	Band room Hallway	T8 4' ushaped	Electronic	10	2	28	18	193	1945	Switch	No	560
37	School	1st Floor	Bathroom boys	T8 4'	Electronic	4	2	28	8	193	346	Occupancy Sensor	No	224
38	School	1st Floor	Bathroom girls	T8 4'	Electronic	4	2	28	8	193	346	Occupancy Sensor	No	224
39	School	1st Floor	Janitor's Closet	T8 4'	Electronic	1	1	28	4	193	22	Occupancy Sensor	No	28
40	School	1st Floor	Girls locker room	T8 4'	Electronic	23	1	28	8	193	994	Occupancy Sensor	No	644
41	School	1st Floor	Girls locker room	13w CFL	-	2	1	13	1	193	5	Occupancy Sensor	No	26
42	School	1st Floor	Girl's Coach room	T8 4'	Electronic	1	4	28	8	193	173	Switch	No	112
43	School	1st Floor	Girl's Coach room	13w CFL	-	1	1	13	8	193	20	Switch	No	13
44	School	1st Floor	Display case	T5 4'	Electronic	2	2	8	14	193	86	Switch	No	32
45	School	1st Floor	Display case	T5 4' ushaped	Electronic	2	2	8	14	193	86	Switch	No	32
46	School	1st Floor	Men's coach room	T8 4'	Electronic	1	4	28	8	193	173	Switch	No	112
47	School	1st Floor	Shower off men's coach room	13w CFL	-	1	1	13	8	193	20	Occupancy Sensor	No	13
48	School	1st Floor	Men's locker room	T8 4'	Electronic	23	1	28	8	193	994	Occupancy Sensor	No	644
49	School	1st Floor	Men's locker room	13w CFL	-	2	1	13	4	193	20	Occupancy Sensor	No	26
50	School	1st Floor	Gymnasium	T5	-	35	1	228	16	193	24642	Switch	No	7980
51	School	1st Floor	Gymnasium - PE equipment	T8 4'	Electronic	2	2	28	8	193	173	Occupancy Sensor	No	112
52	School	1st Floor	Gymnasium - storage	T8 4'	Electronic	3	2	28	8	193	259	Occupancy Sensor	No	168
53	School	1st Floor	Janitor's office - receiving	T8 4'	Electronic	12	2	28	14	193	1816	Switch	No	672
54	School	1st Floor	Janitor's office - receiving	T8 4'	Electronic	2	2	28	14	193	303	Switch	No	112
55	School	1st Floor	Vocal music Classroom	T8 4'	Electronic	24	2	28	14	193	3631	Switch	No	1344
56	School	1st Floor	Lab#2 Classroom	T8 4'	Electronic	24	2	28	8	193	2075	Switch	No	1344
57	School	1st Floor	B202 Classroom	T8 4'	Electronic	20	2	28	8	193	1729	Switch	No	1120
58	School	1st Floor	B202 Classroom storage	T8 4'	Electronic	3	2	28	8	193	259	Occupancy Sensor	No	168
59	School	1st Floor	B200 Classroom	T8 4'	Electronic	28	2	28	8	193	2421	Switch	No	1568
60	School	1st Floor	B200 Classroom art storage	30w CFL	-	2	1	30	3	193	35	Occupancy Sensor	No	60
61	School	1st Floor	Art room hallway	T8 4'	Electronic	6	2	28	14	193	908	Switch	No	336
62	School	1st Floor	Boiler Room	15w CFL	-	4	1	15	24	193	278	Switch	No	60
63	School	1st Floor	Boiler Room	30w CFL	-	1	1	30	24	193	139	Switch	No	30
64	School	1st Floor	Stage	30w CFL	-	9	1	30	0.015	193	1	Switch	No	270
65	School	1st Floor	Stage	13w CFL	-	108	1	15	0.015	193	5	Switch	No	1620
66	School	1st Floor	All purpose room	T8 4'	Electronic	25	4	28	8	193	4323	Switch	No	2800
67	School	1st Floor	Kitchen	T8 4'	Electronic	12	3	28	7	193	1362	Switch	No	1008

68	School	1st Floor	Kitchen	20w CFL	-	3	1	20	7	193	81	Switch	No	60
69	School	1st Floor	Kitchen	13w CFL	-	1	1	13	7	193	18	Switch	No	13
70	School	1st Floor	Kitchen storage	25w CFL	-	1	1	25	7	193	34	Occupancy Sensor	No	25
71	School	1st Floor	Kitchen storage	25w CFL	-	1	1	25	7	193	34	Occupancy Sensor	No	25
72	School	1st Floor	Kitchen storage	20w CFL	-	1	1	20	7	193	27	Switch	No	20
73	School	1st Floor	Kitchen locker room	13w CFL	-	1	1	13	7	193	18	Occupancy Sensor	No	13
74	School	1st Floor	Kitchen bathroom	15w CFL	-	1	1	15	7	193	20	Switch	No	15
75	School	1st Floor	Bathroom boys - 8th grade	T8 4'	Electronic	2	2	28	8	193	173	Occupancy Sensor	No	112
76	School	1st Floor	Bathroom boys - 8th grade	13w CFL	-	1	1	13	8	193	20	Occupancy Sensor	No	13
77	School	1st Floor	BSI classroom	T8 4'	Electronic	5	2	28	8	193	432	Switch	No	280
78	School	1st Floor	Guidance counselor	T8 4'	Electronic	4	2	28	8	193	346	Switch	No	224
79	School	1st Floor	Nurse's office	T8 4'	Electronic	6	2	28	8	193	519	Switch	No	336
80	School	1st Floor	Nurse's office bathroom	13w CFL	-	1	1	13	8	193	20	Occupancy Sensor	No	13
81	School	1st Floor	Vice Principal office	T8 4'	Electronic	4	4	28	8	193	692	Switch	No	448
82	School	1st Floor	Office storage closet	25w CFL	-	1	1	25	2	193	10	Occupancy Sensor	No	25
83	School	1st Floor	Main Office restroom	13w CFL	-	1	1	13	2	261	7	Occupancy Sensor	No	13
84	School	1st Floor	Near main office trophy case	3w pin based fluoures	-	1	1	15	24	193	69	Switch	No	15
85	School	1st Floor	Main office hallway	T8 4'	Electronic	12	2	28	14	261	2455	Switch	No	672
86	School	1st Floor	Main office entrance	T8 4'	Electronic	3	4	28	14	261	1228	Switch	No	336
87	School	1st Floor	Board office entrance	T8 4'	Electronic	2	2	28	14	261	409	Switch	No	112
88	School	1st Floor	Board office	T8 4'	Electronic	9	3	28	8	261	1579	Switch	No	756
89	School	1st Floor	Board office	T8 4' ushaped	Electronic	6	2	28	8	261	702	Switch	No	336
90	School	1st Floor	Business Administrator office	T8 4' ushaped	Electronic	8	2	28	8	261	935	Switch	No	448
91	School	1st Floor	Supervisor curriculum room	T8 4' ushaped	Electronic	8	2	28	8	261	935	Switch	No	448
92	School	1st Floor	Conference room	T8 4' ushaped	Electronic	8	2	28	8	261	935	Switch	No	448
93	School	1st Floor	Superintendent office	T8 4' ushaped	Electronic	8	2	28	8	261	935	Switch	No	448
94	School	1st Floor	Office	T8 4'	Electronic	4	3	28	8	261	702	Switch	No	336
95	School	1st Floor	A106 Computer Lab	T8 4'	Electronic	16	3	28	8	193	2075	Switch	No	1344
96	School	1st Floor	A106 Computer Lab IT office	T8 4'	Electronic	3	3	28	8	193	389	Switch	No	252
98	School	1st Floor	108 Computer / synergistic lab	T8 4'	Electronic	16	3	28	8	193	2075	Switch	No	1344
99	School	1st Floor	108 Computer / synergistic lab	T8 4'	Electronic	14	3	28	8	193	1816	Switch	No	1176
99	School	1st Floor	Science room storage	T8 4'	Electronic	2	3	28	8	193	259	Switch	No	168
100	School	1st Floor	A105 Science lab	T8 4'	Electronic	14	3	28	8	193	1816	Switch	No	1176
101	School	1st Floor	Science hallway	T8 4'	Electronic	12	2	28	8	193	1038	Switch	No	672
102	School	1st Floor	Science hallway custodian close	T8 4'	Electronic	1	2	28	2	193	22	Switch	No	56
103	School	1st Floor	Science hallway	LED exit sign	-	3	1	5	2	193	6	Switch	No	15
104	School	1st Floor	A103 Language arts classroom	T8 4'	Electronic	12	3	28	8	193	1556	Switch	No	1008
105	School	1st Floor	Bathroom Men faculty	T8 4' ushaped	Electronic	1	2	28	3	193	32	Occupancy Sensor	No	56
106	School	1st Floor	Bathroom womens faculty	13w CFL	-	1	1	13	3	193	8	Occupancy Sensor	No	13
107	School	1st Floor	Electrical room	T8 4'	Electronic	2	2	28	0.25	261	7	Occupancy Sensor	No	112
108	School	1st Floor	Board office hallway	T8 4'	Electronic	9	2	28	14	261	1842	Switch	No	504
109	School	1st Floor	Sever room	25w CFL	-	4	1	25	24	193	463	Switch	No	100
110	School	1st Floor	Men's Faculty lavatory	13w CFL	-	1	1	13	4	193	10	Occupancy Sensor	No	13
111	School	1st Floor	Women's Faculty lavatory	13w CFL	-	1	1	13	4	193	10	Occupancy Sensor	No	13
112	School	1st Floor	B206 Classroom	T8 4'	Electronic	3	3	28	8	193	389	Switch	No	252
113	School	1st Floor	B206 Classroom	13w CFL	-	1	1	13	8	193	20	Switch	No	13
114	School	1st Floor	B206 Classroom	13w CFL	-	1	1	13	0.25	193	1	Switch	No	13
115	School	1st Floor	B208 Classroom	T8 4'	Electronic	6	2	28	8	193	519	Switch	No	336
116	School	1st Floor	B210 Faculty room	T8 4'	Electronic	8	3	28	8	193	1038	Switch	No	672
117	School	1st Floor	B214 Classroom	T8 4'	Electronic	19	2	28	8	193	1643	Switch	No	1064
119	School	1st Floor	B214 Classroom	T8 4'	Electronic	19	2	28	8	193	1643	Switch	No	1064
120	School	1st Floor	B216 Classroom	T8 4'	Electronic	19	2	28	8	193	1643	Switch	No	1064
121	School	1st Floor	B213 Classroom	T8 4'	Electronic	19	2	28	8	193	1643	Switch	No	1064
122	School	1st Floor	B211 Classroom	T8 4'	Electronic	19	2	28	8	193	1643	Switch	No	1064
123	School	1st Floor	B209 Classroom	T8 4'	Electronic	19	2	28	8	193	1643	Switch	No	1064
124	School	1st Floor	B207 Classroom	T8 4'	Electronic	35	3	32	8	193	5188	Switch	No	3360
125	School	1st Floor	B205 Library	T8 4'	Electronic	4	3	32	8	193	593	Switch	No	384
126	School	1st Floor	B205 Library office	T8 4'	Electronic	3	3	32	8	193	445	Switch	No	288
127	School	1st Floor	B205 book storage	LED exit sign	None	2	2	5	24	193	93	Occupancy Sensor	No	20
128	School	1st Floor	B205 library	T8 2'	Electronic	14	2	12	24	193	1556	None	No	336
128	School	Exterior	Exterior	Metal Halide	None	10	10	250	12	365	109500	Photosensor	No	25000
129	School	Exterior	Exterior	Metal Halide	None	5	10	70	12	365	15330	Photosensor	No	3500
130	School	Exterior	Speed Limit Signs	9W CFL	None	2	2	9	2	261	19	Autom. Timer	No	36

Lighting			
	Energy Use (kWh/year)	Energy Cost (\$/year)	Power Density (W/sqft)
Existing	309,795	\$52,665	1.96
Proposed	265,488	\$45,133	1.54
Savings	44,307	\$7,532	0.42

## Appendix B: Third Party Energy Suppliers (ESCOs)

Third Party Electric Suppliers for JCP&L Service Territory	Telephone & Web Site	Third Party Gas Suppliers for PSEG Service Territory	Telephone & Web Site
<b>Hess Corporation</b> 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 <a href="http://www.hess.com">www.hess.com</a>	<b>Cooperative Industries</b> 412-420 Washington Avenue Belleville, NJ 07109	(800) 628-9427 <a href="http://www.cooperativenet.com">www.cooperativenet.com</a>
<b>BOC Energy Services, Inc.</b> 575 Mountain Avenue Murray Hill, NJ 07974	(800) 247-2644 <a href="http://www.boc.com">www.boc.com</a>	<b>Direct Energy Services, LLC</b> 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 <a href="http://www.directenergy.com">www.directenergy.com</a>
<b>Commerce Energy, Inc.</b> 4400 Route 9 South, Suite 100 Freehold, NJ 07728	(800) 556-8457 <a href="http://www.commerceenergy.com">www.commerceenergy.com</a>	<b>Dominion Retail, Inc.</b> 395 Highway 170, Suite 125 Lakewood, NJ 08701	(866) 275-4240 <a href="http://www.retail.dom.com">www.retail.dom.com</a>
<b>Constellation NewEnergy, Inc.</b> 900A Lake Street, Suite 2 Ramsey, NJ 07446	(888) 635-0827 <a href="http://www.newenergy.com">www.newenergy.com</a>	<b>Gateway Energy Services Corp.</b> 44 Whispering Pines Lane Lakewood, NJ 08701	(800) 805-8586 <a href="http://www.gesc.com">www.gesc.com</a>
<b>Direct Energy Services, LLC</b> 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 <a href="http://www.directenergy.com">www.directenergy.com</a>	<b>UGI Energy Services, Inc.</b> 704 East Main Street, Suite 1 Moorestown, NJ 08057	(856) 273-9995 <a href="http://www.ugienergyservices.com">www.ugienergyservices.com</a>
<b>FirstEnergy Solutions</b> 300 Madison Avenue Morristown, NJ 07926	(800) 977-0500 <a href="http://www.fes.com">www.fes.com</a>	<b>Great Eastern Energy</b> 116 Village Riva, Suite 200 Princeton, NJ 08540	(888) 651-4121 <a href="http://www.greateastern.com">www.greateastern.com</a>
<b>Glacial Energy of New Jersey, Inc.</b> 207 LaRoche Avenue Harrington Park, NJ 07640	(877) 569-2841 <a href="http://www.glacialenergy.com">www.glacialenergy.com</a>	<b>Hess Corporation</b> 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 <a href="http://www.hess.com">www.hess.com</a>
<b>Integrus Energy Services, Inc.</b> 99 Wood Ave, South, Suite 802 Iselin, NJ 08830	(877) 763-9977 <a href="http://www.integrusenergy.com">www.integrusenergy.com</a>	<b>Hudson Energy Services, LLC</b> 545 Route 17 South Ridgewood, NJ 07450	(877) 483-7669 <a href="http://www.hudsonenergyservices.com">www.hudsonenergyservices.com</a>
<b>Liberty Power Delaware, LLC</b> Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(866) 769-3799 <a href="http://www.libertypowercorp.com">www.libertypowercorp.com</a>	<b>Intelligent Energy</b> 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024	(800) 724-1880 <a href="http://www.intelligentenergy.org">www.intelligentenergy.org</a>
<b>Liberty Power Holdings, LLC</b> Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(800) 363-7499 <a href="http://www.libertypowercorp.com">www.libertypowercorp.com</a>	<b>Keil &amp; Sons</b> 1 Bergen Blvd. Fairview, NJ 07002	(877) 797-8786 <a href="http://www.systumenergy.com">www.systumenergy.com</a>
<b>Pepco Energy Services, Inc.</b> 112 Main St. Lebanon, NJ 08833	(800) 363-7499 <a href="http://www.pepco-services.com">www.pepco-services.com</a>	<b>Metro Energy Group, LLC</b> 14 Washington Place Hackensack, NJ 07601	(888) 536-3876 <a href="http://www.metroenergy.com">www.metroenergy.com</a>
<b>PPL EnergyPlus, LLC</b> 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 <a href="http://www.pplenergyplus.com">www.pplenergyplus.com</a>	<b>MxEnergy, Inc.</b> 510 Thornall Street, Suite 270 Edison, NJ 08837	(800) 375-1277 <a href="http://www.mxenergy.com">www.mxenergy.com</a>
<b>Sempra Energy Solutions</b> 581 Main Street, 8th Floor Woodbridge, NJ 07095	(877) 273-6772 <a href="http://www.semprasolutions.com">www.semprasolutions.com</a>	<b>NATGASCO (Mitchell Supreme)</b> 532 Freeman Street Orange, NJ 07050	(800) 840-4427 <a href="http://www.natgasco.com">www.natgasco.com</a>
<b>South Jersey Energy Company</b> One South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 756-3749 <a href="http://www.southjerseyenergy.com">www.southjerseyenergy.com</a>	<b>Pepco Energy Services, Inc.</b> 112 Main Street Lebanon, NJ 08833	(800) 363-7499 <a href="http://www.pepco-services.com">www.pepco-services.com</a>
<b>Suez Energy Resources NA, Inc.</b> 333 Thornall Street, 6th Floor Edison, NJ 08837	(888) 644-1014 <a href="http://www.suezenergyresources.com">www.suezenergyresources.com</a>	<b>PPL EnergyPlus, LLC</b> 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 <a href="http://www.pplenergyplus.com">www.pplenergyplus.com</a>
<b>UGI Energy Services, Inc.</b> 704 East Main Street, Suite 1 Moorestown, NJ 08057	(856) 273-9995 <a href="http://www.ugienergyservices.com">www.ugienergyservices.com</a>	<b>Sempra Energy Solutions</b> 581 Main Street, 8th Floor Woodbridge, NJ 07095	(877) 273-6772 <a href="http://www.semprasolutions.com">www.semprasolutions.com</a>
		<b>South Jersey Energy Company</b> One South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 756-3749 <a href="http://www.southjerseyenergy.com">www.southjerseyenergy.com</a>
		<b>Sprague Energy Corp.</b> 12 Ridge Road Chatham Township, NJ 07928	(800) 225-1560 <a href="http://www.spragueenergy.com">www.spragueenergy.com</a>
		<b>Stuyvesant Energy LLC</b> 10 West Ivy Lane, Suite 4 Englewood, NJ 07631	(800) 646-6457 <a href="http://www.stuyfuel.com">www.stuyfuel.com</a>
		<b>Woodruff Energy</b> 73 Water Street Bridgeton, NJ 08302	(800) 557-1121 <a href="http://www.woodruffenergy.com">www.woodruffenergy.com</a>