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**Local Government Energy Program
Energy Audit Final Report**

For

***T. Baldwin Demarest Elementary School
Old Tappan Board of Education
Old Tappan, NJ 07675***

Project Number: LGEA07



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INTRODUCTION

On July 7th & 8th, Steven Winter Associates, Inc. (SWA) performed an energy audit and assessment for the Old Tappan Board of Education. The audit included a review of the T. Baldwin Demarest Elementary School (TBD) and the Charles DeWolf Middle School (CDW). Both buildings are located on the same site and across the sports field from each other in Old Tappan, NJ. A separate Energy Audit Final Report is issued for the CDW School.

This report contains the energy audit findings for the TBD School. Current conditions and energy-related information were collected in order to analyze and facilitate the implementation of energy conservation measures for the building.

The TBD School building was built in 1964 and houses the Old Tappan Elementary School. Several upgrades to the infrastructure and mechanical systems have occurred over the years, with major renovations in the late 1970s and 1999. The building consists of 60,000 square feet of conditioned main space. The building houses approximately 55 teachers / staff and 425 students during school hours and when school is in session. During the summer program 15 teachers / staff and 35 students use the facility. Sometimes, sport activities continue in the gym after hours and on weekends. A few times a year adult classes and community meetings take place in the evening.

The school building is normally operated on weekdays from 7:00 am to 4:00 pm with special school events occurring periodically 7:00 pm to 11:00 pm.

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

EXECUTIVE SUMMARY

The energy audit performed by Steven Winter Associates (SWA) encompasses the T. Baldwin Demarest Elementary (TBD) School building located at 1 School St., Old Tappan, New Jersey 07675-7261. The TBD School building is a one story building with a combined floor area of 60,000 square feet. The building is comprised of several sections (or wings) added on to the original 1964 building in the late 1970s and 1999. One central boiler room serves the entire building.

Based on the field visits performed by the SWA staff on July 7th & 8th, 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 use.

In 2008, the most recent year, the TBD School building consumed 335,541 kWh or \$56,082 worth of electricity and 37,751 therms or \$61,727 worth of natural gas. The joint energy consumption for the school, including both electricity and natural gas, was 4,920 MMBtus of energy that cost a total of \$117,809. A few unusual utility fluctuations showed up for a couple of months on the utility bills which may be due to adjustments between estimated and actual meter readings. The Old Tappan Board of Education should demand a full accounting from the energy providers and ask that billings be based only on realistic and actual meter readings.

SWA benchmarked the TBD School building using the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. The building performance rating received is a score of 25 when compared to other buildings of its kind. This indicates that there are good opportunities for the TBD School to decrease energy use (natural gas or electric use or a combination thereof) to reach a more desirable Energy Star benchmark rating, even as high as 75.

Based on the assessment of the TBD School, SWA has separated the investment opportunities into three recommended categories. These are summarized as follows.

Category I Recommendations: Capital Improvements - Upgrades not directly associated with energy savings

- Classroom Old Pneumatically Controlled Unit Ventilators - The existing pneumatically controlled unit ventilators, which serve a major portion (~60%) of the TBD Elementary School, have been reasonably well-maintained but have reached the end of their useful life and should to be replaced. This recommendation cannot be cost justified by energy savings alone. However, the age and condition of the equipment warrant attention and this recommendation is intended to provide guidance to help the building management staff prioritize upgrades within the facility. SWA recommends installing more efficient updated unit ventilators, similar to ones installed ten years ago. A design professional should be consulted to determine the proper equipment and configuration appropriate for this upgrade.
- Only a couple of older rooftop exhaust fans that are at the end of their useful lives should be replaced to insure classroom proper Indoor Air Quality and comply with ASHRAE latest ventilation standard 62-2004 requirements for classroom ventilation of 10 cfm/person with 0.12 cfm/ft².

Category II Recommendations: Operations and Maintenance - Low Cost / No Cost Measures

- Controls Optimization - SWA recommends that the schedules for all rooftop equipment and unit ventilators serving key public spaces be reviewed and optimized. During periods when the spaces are not occupied, the equipment may be shut-off or controlled to minimize the amount of fresh air conditioned by the equipment. The cost and effort associated with implementation of this recommendation will depend

upon the capabilities of the existing building automation control system. Energy and cost savings associated with this recommendation will vary, depending upon the current occupancy schedules and means of control utilized.

- Weather Stripping / Air Sealing - Doors and vestibules should be observed annually for deficient weather-stripping and replaced as needed. Any other accessible gaps or penetrations in the thermal envelope penetrations should also be sealed with caulk or spray foam.
- Water Efficient Fixtures & Controls - Adding controlled on / off timers on all lavatory faucets is a cost-effective way to reduce domestic hot water demand and save water. Building staff can also easily install faucet aerators and / or low-flow fixtures to reduce water consumption. Routine maintenance practices that identify and quickly address water leaks are a low-cost way to save water and energy. Retrofitting with more efficient water-consumption fixtures / appliances will save both energy and money through reduced energy consumption for water heating, while also decreasing water / sewer bills.
- 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.

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

At this time, SWA recommends a total of **6** Energy Conservation Measures (ECMs) for the TBD School building. The total investment cost for these ECMs with incentives is **\$179,630**. SWA estimates a first year savings of **\$38,389** with a simple payback of **4.7 years**. SWA estimates that implementing the recommended ECMs will reduce the carbon footprint of the TBD School building by **273,758 lbs of CO₂**. SWA recommends starting with retro-commissioning to flush out all the conditions that are operating outside the design of the heating / cooling control system. That will establish a baseline for what needs to be adjusted, fixed or replaced. Other ECMs could be performed as funding is available and in order of payback.

There are various incentives that the Old Tappan Board of Education could apply for that could also help lower the cost of installing the ECMs. SWA recommends that the TBD School building apply for the NJ SmartStart program through the New Jersey Office of Clean Energy. This incentive can help provide technical assistance for the building in the implementation phase of any energy conservation project. A new NJ Clean Power program, Direct Install, to be rolled out after October 2009 and administered by TRC, could also assist to cover 80% of the capital investment.

Specifically, the building could qualify for \$940 for installing the recommended wall-mounted occupancy sensors. The TBD School building could also take advantage of incentives based on the installation of a photovoltaic (PV) system. Currently, the New Jersey Office of Clean Energy offers a Renewable Energy Incentive program that would pay \$5,000 for the installation of a 5kW PV system. There is also an incentive that issues a Solar Renewable Energy Certificate for every 1,000kWh (1MWh) of electricity generated that can be sold or traded for the current market rate of electricity. There is also a utility-sponsored loan program through Rockland Electric that would allow the building to pay for the installation of the PV or Wind system through a loan issued by Rockland Electric.

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

PROPOSED													
ECM #	ECM description	Installed Cost		1st year energy savings					SPP	LoM	Lifetime	ROI %	Annual Carbon Reduced (lbs of CO2)
		Estimate \$	Source	Use	Unit	Demand	Unit	Savings / year \$			Cost Savings \$		
1	Retro-Commissioning	\$60,000	Similar Projects	33,554	kWh	130.9	kW	13,601	4.4	12	133,782	10.2	90,136
				3,775	therms	-	-						
2	Upgrade to digital controls for pneumatically operated ventilator units	\$111,000	Similar Projects	31,604	kWh	123.3	kW	20,599	5.4	12	202,616	6.9	150,388
				9,153	therms	-	-						
3	Install CO2 sensors in the gym	\$4,000	Similar Projects, RS Means, Lit Search	2,458	kWh	9.6	kW	1,218	3.3	12	11,980	16.6	9,147
				494	therms	-	-						
4.1	replace 20 incandescent lamps to CFL	\$400	RS Means, Lit Search	2,306	kWh	9.0	kW	420	1.1	20	5,354	61.9	3,159
4.2	install 47 occupancy sensors with INCENTIVES	\$4,230	RS Means, Lit Search, NJ Clean Energy Program	15,276	kWh	59.6	kW	2,551	1.7	20	35,473	36.9	20,928
	Total Proposed	\$179,630		-	-	332	kW	\$38,389	4.7	12	382,925	9.3	273,758

Definitions:

SPP – Simple Payback (years)

LoM: Life of Measure (years)

ROI: Return on Investment (%)

Assumptions:

Discount Rate: 3.2% per DOE FEMP Guidelines

Energy Price Escalation Rate: 0% per DOE FEMP Guidelines

CONSIDERED													
ECM #	ECM description	Installed Cost		1st year energy savings					SPP	LoM	Lifetime	ROI, %	Annual Carbon Reduced (lbs of CO2)
		Estimate \$	Source	Use	Unit	Demand	Unit	Savings / year \$			Cost Savings \$		
4.3	replace school internal lights: T 12s to T 8s with INCENTIVES (incl. 75% labor)	\$77,145	RS Means, Lit Search, NJ Clean Energy Program	15,046	kWh	58.7	kW	2,513	32.2	20	34,941	-2.7	20,614
5	Install 5 kW Wind System	\$40,000	RS Means, Lit Search	13,000	kWh	50.7	kW	2,171	18.4	25	36,975	-0.3	17,810
6	Install 5 kW PV System (with \$1/W INCENTIVE)	\$30,000	RS Means, Lit Search	5,902	kWh	23.0	kW	986	30.4	25	16,787	-1.8	8,086

Definitions:

SPP – Simple Payback (years)

LoM: Life of Measure (years)

ROI: Return on Investment (%)

Assumptions:

Discount Rate: 3.2% per DOE FEMP Guidelines

Energy Price Escalation Rate: 0% per DOE FEMP Guidelines

1. HISTORIC ENERGY CONSUMPTION

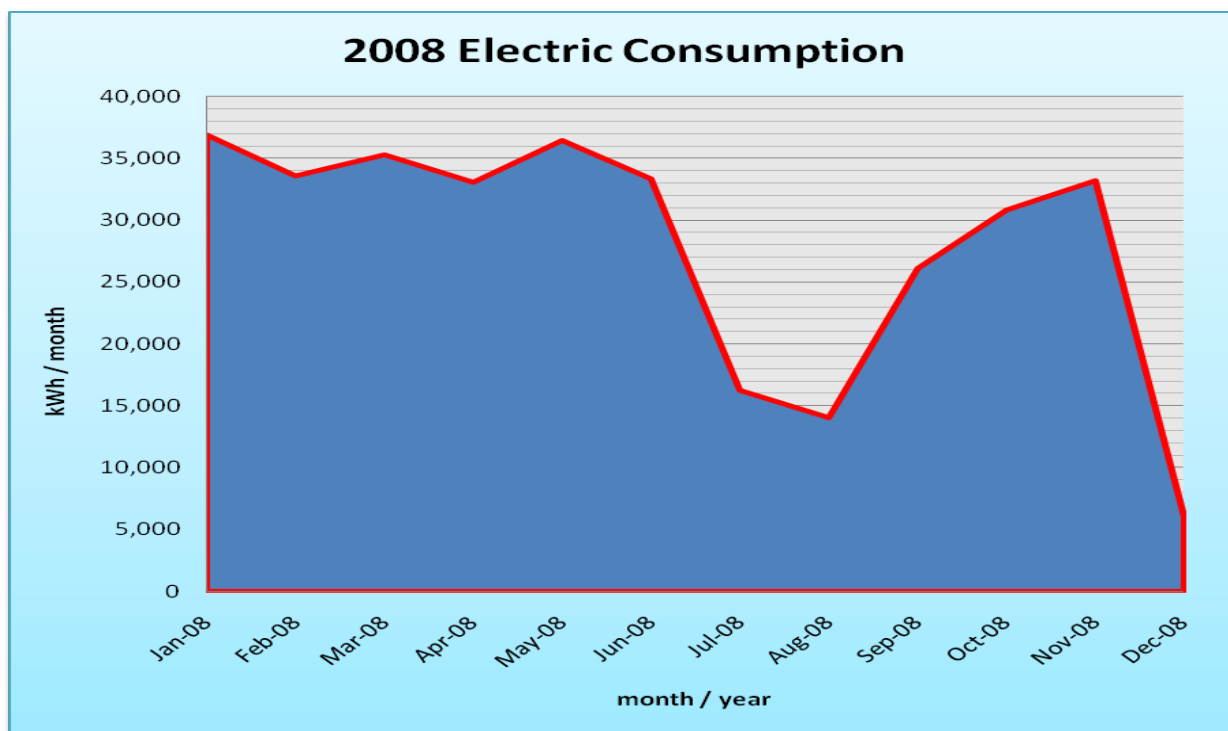
1.1. Energy usage and cost analysis

SWA analyzed utility bills from March 2007 through Feb 2009 that were received from the utilities supplying the TBD School building with electric and natural gas.

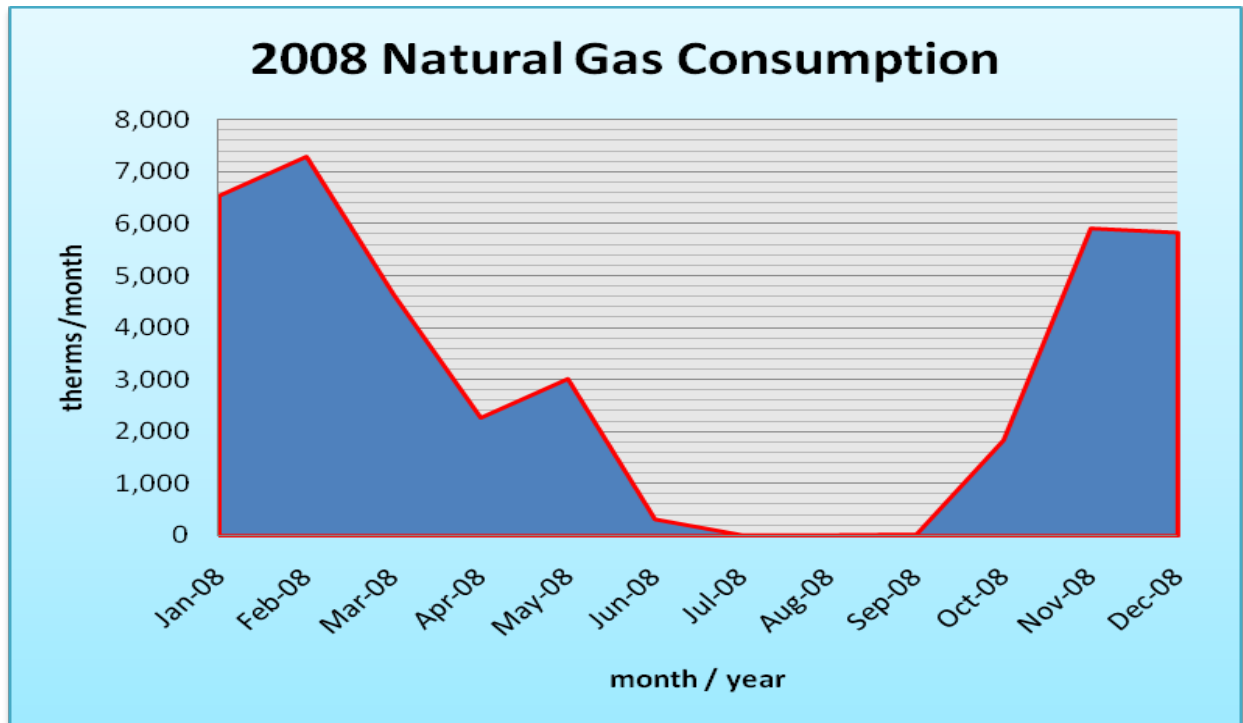
Electricity - The TBD School building is currently served by two electric meters (one being for some of the exterior lighting with somewhat low throughput). The TBD School building currently buys electricity from Rockland Electric at **an average rate of \$0.167/kWh** based on 12 months of utility bills for 2008. The TBD School building purchased **approximately 335,541 kWh or \$56,082 worth of electricity** in the previous year. The average monthly demand was 110 kW. The unusual electric fluctuations shown in Jan 09 and Dec 08 may be due to adjustments between estimated and actual meter readings. The Old Tappan Board of Education should demand a full accounting from Rockland Electric and ask that billings be based only on realistic and actual meter readings.

Natural Gas - The TBD School building is currently served by a single meter for natural gas. The TBD School building currently buys natural gas from Hess Corp. with PSE&G transporting the natural gas at **an average aggregated rate of \$1.635/therm** based on 12 months of utility bills for 2008. The TBD School building purchased **approximately 37,751 therms or \$61,727 worth of natural gas** in the previous year. The unusual natural gas fluctuations shown in March, April, May 08 and other months may be due to adjustments between estimated and actual meter readings. The Old Tappan Board of Education should demand a full accounting from Hess Corp. and PSE&G, and ask that billings be based only on realistic and actual meter readings.

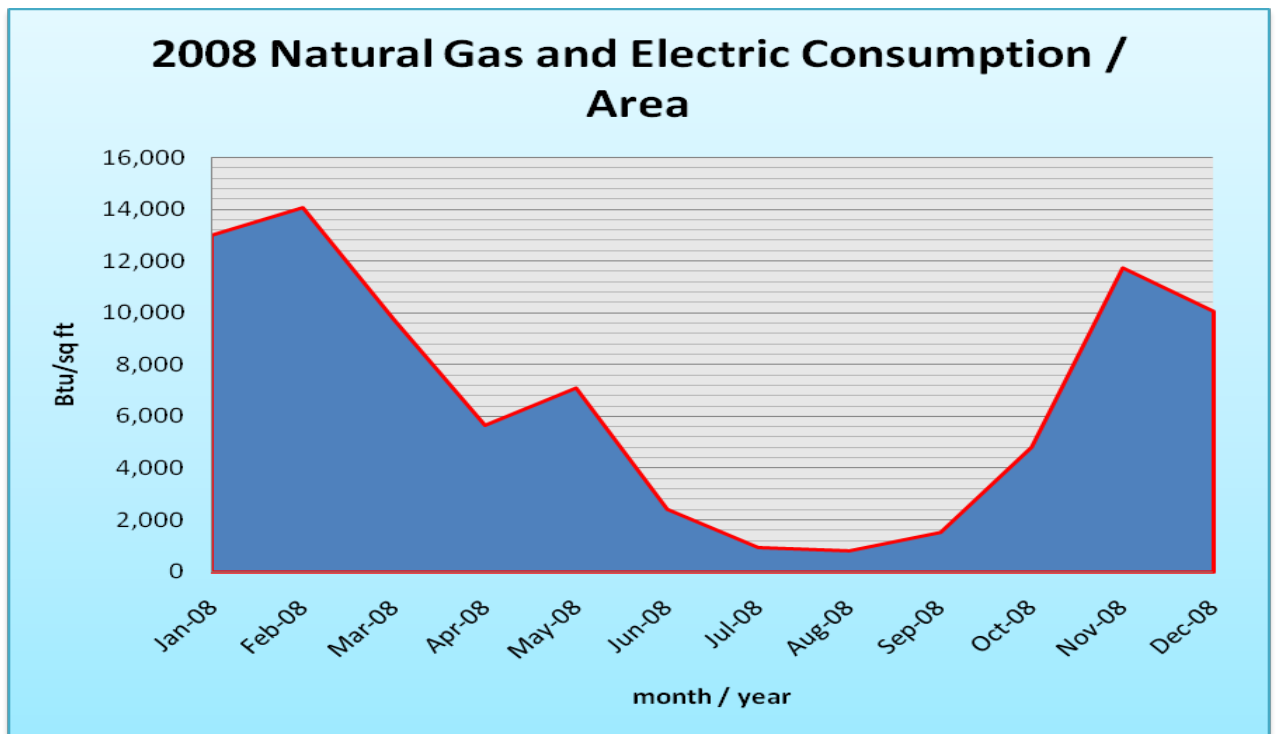
The following chart shows electricity use for the TBD School building based on utility bills for the 12 month period of January 2008 - December 2008.



The following chart shows the natural gas consumption for the TBD School building, based on utility bills for the 12 month period of January 2008 - December 2008.

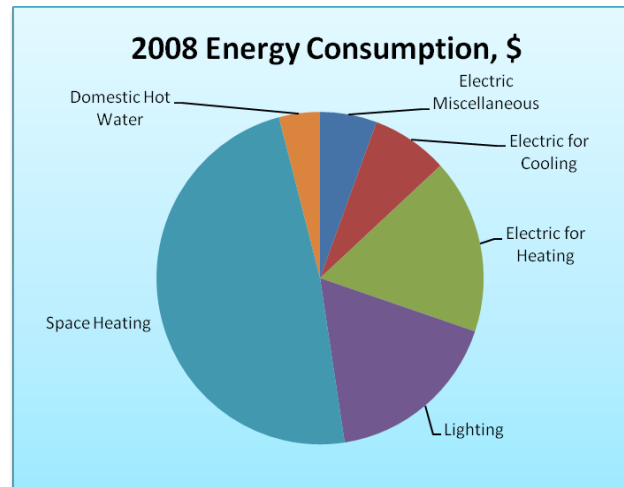
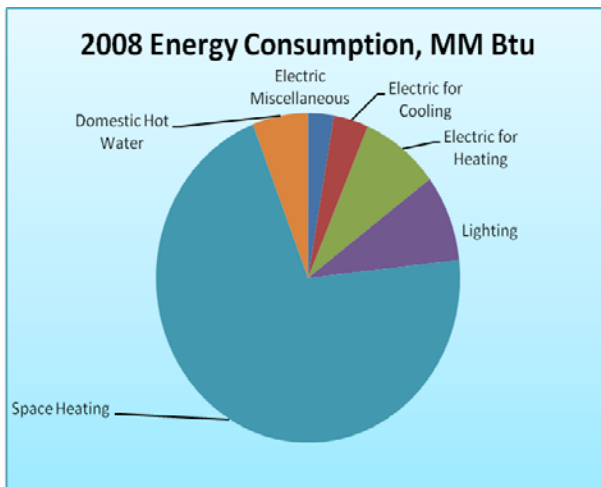


The following chart shows combined natural gas and electric consumption in Btu/ft² for the TBD School building, based on utility bills for the 12 month period of January 2008 - December 2008.



The following table and chart pies show energy use for the TBD School building based on utility bills for the 12 month period of January 2008 - December 2008. Note electrical cost at \$49/MM Btu of energy is approximately 3 times as expensive to use as natural gas at \$16/MM Btu.

2008 Annual Energy Consumption / Costs					
	MM Btu	% MM Btu	\$	% \$	\$/MM Btu
Electric Miscellaneous	135	3%	\$6,589	6%	\$49
Electric for Cooling	182	4%	\$8,898	8%	\$49
Electric for Heating	411	8%	\$20,107	17%	\$49
Lighting	418	9%	\$20,487	17%	\$49
Building Space Heating	3,484	71%	\$56,970	48%	\$16
Domestic Hot Water	291	6%	\$4,757	4%	\$16
Totals	4,920	100%	\$117,809	100%	\$24



1.2. Utility rate

The TBD School building currently purchases electricity from Rockland Electric at a general service market rate for electricity use (kWh) with a separate (kW) demand charge. The TBD School building currently pays an average rate of approximately \$0.167/kWh based on 12 months of utility bills for 2008.

The TBD School building currently purchases natural gas supply from Hess Corp. at a general service market rate for natural gas (therms). PSE&G acts as the transport company. There is one gas meter that provides natural gas service to the TBD School building currently. The average aggregated rate (supply and transport) for the meter is approximately of \$1.635/therm based on 12 months of utility bills for 2008.

A few unusual utility fluctuations showed up for a couple of months on the utility bills which may be due to adjustments between estimated and actual meter readings. The Old Tappan Board of Education should demand a full accounting from the energy providers and ask that billings be based only on realistic and actual meter readings.

1.3. Energy benchmarking

The TBD School building information and utility data were entered into the U.S. Environmental Protection Agency's (EPA) Energy Star Portfolio Manager Energy benchmarking system. The building performance rating received is a score of 25 when compared to other buildings of its kind. This indicates that there are good opportunities for the TBD School to decrease energy use (natural gas or electric use or a combination thereof) to reach a more desirable Energy Star benchmark rating even as high as 75.

Buildings achieving an Energy Star rating of 75 or higher and professionally verified to meet current indoor environmental standards are eligible to apply for the Energy Star award and receive the Energy Star plaque to convey superior performance to students, parents, taxpayers, and employees. These ratings also greatly help when applying for Leadership in Energy and Environmental Design (LEED) building certification to the United States Green Building Council (USGBC). Per the LGEA program requirements, SWA has assisted the TBD School to create an *Energy Star Portfolio Manager* account and share the TBD School facilities information to allow future data to be added and tracked using the benchmarking tool. SWA has shared this Portfolio Manager site information with the Old Tappan Board of Education (user name: oldtappanboe, password with Doug Barrett, Business Administrator / Board Secretary Old Tappan Board of Education) and TRC Energy Services (user name: TRC-LGEA).



STATEMENT OF ENERGY PERFORMANCE Old Tappan - Elementary School

Building ID: 1801557
For 12-month Period Ending: November 30, 2008¹
Date SEP becomes ineligible: N/A

Date SEP Generated: July 30, 2009

Facility	Facility Owner	Primary Contact for this Facility
Old Tappan - Elementary School 1 School Street Old Tappan, NJ 07675	N/A	N/A

Year Built: 1964
Gross Floor Area (ft²): 60,000

Energy Performance Rating² (1-100) 25

Site Energy Use Summary³

Natural Gas (kBtu) ⁴	3,709,441
Electricity (kBtu)	1,230,518
Total Energy (kBtu)	4,939,959

Energy Intensity⁵

Site (kBtu/ft ² /yr)	82
Source (kBtu/ft ² /yr)	133

Emissions (based on site energy use)

Greenhouse Gas Emissions (MtCO ₂ e/year)	316
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Electric Distribution Utility

Rockland Electric Co

National Average Comparison

National Average Site EUI	65
National Average Source EUI	106
% Difference from National Average Source EUI	26%
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 Standards⁶ 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:

1. 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.
2. 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.
3. Values represent energy consumption, annualized to a 12-month period.
4. Natural Gas values in this form are converted to kBtu with adjustments made for elevation based on Facility zip code.
5. Values represent energy intensity, annualized to a 12-month period.
6. 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 we welcome suggestions for reducing this level of effort. Send comments (including OMB control number) to the Director, Collection Strategies Division, U.S., EPA (2622), 1200 Pennsylvania Ave., NW, Washington, DC 20460.

EPA Form 5900-16

2. FACILITY AND SYSTEMS DESCRIPTION

2.1. Building Characteristics

The TBD School building consists of a couple of single-story wings built at several different times, with major renovations in the late 1970s and 1999. The building consists of 60,000 square feet of conditioned main space. The TBD School building, built in 1964 and renovated several times consist mostly of classrooms, gymnasium (added ten years ago), special activity rooms and administrative offices.

2.2. Building occupancy profiles

The peak occupancy for the TBD School building is approximately 55 teachers / administrators and 425 students at any given time during weekdays, while school is in session, September through June. During the summer months, 15 teachers / staff continue administrative work and about 35 students use the building. Evening and community events occur periodically afterhours and weekend. The building is typically occupied from 7:00 AM to 4:00 PM on weekdays only, throughout the entire year. Special school events occur periodically 7:00 AM to 11:00 PM.

2.3. Building envelope

2.3.1. Exterior Walls

The exterior walls consist of 8" CMU blocks with either a brick veneer or split block finish and some EIFS (Exterior Insulated Finishing System) installed in the gymnasium parapet area. 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 school could contract a separate envelope inspection during cooler months.

Except in the parapet area of the new gymnasium and under the soffit in the original school building, where some signs of bird's nesting were observed, overall, exterior and interior finishes of the envelope walls were found to be in age-appropriate, good condition.



2.3.2. Roof

The flat areas are constructed of a dark colored modified bitumen roof with some parapets decorated with standing seam metal mansard type roofing. Light colored newer asphalt shingles cover some of the inclined classroom areas. The specified 4" foam insulation over the steel decking could not be verified on flat roofs and the visual R-19 fiberglass batts under sloped roofs is inadequate. As mentioned under 2.3.1 Exterior Walls, a separate envelope inspection should be conducted during cooler months. SWA suggests basing further insulation related improvement discussions on the outcome of those future findings.

Flashing issues were identified mostly around the perimeter of the TBD Elementary School. Upon further inspection, the installed cap flashing seams on the parapets show signs of leakage. This can be seen on exterior wall surfaces as vertical lines. Identified problems like flashing or other water related issues are pointed out in this report simply since any moisture inside exterior walls can have substantial effect on insulation and other energy related issues.

Warranty and performance of the asphalt roofs might be compromised due to what seemed clogged or dirty soffit ventilation strips. A ridge vent was identified but attic access could not be provided and therefore unobstructed airflow from soffit vents to the ridge vents could not be inspected. SWA suggests replacing and possibly enlarging the vent strips.



2.3.3. Base

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

2.3.4. Windows

The building contains fixed and casement aluminum-framed windows with single-glazing. These windows appear to be original to the building. In context of other energy measures proposed in this report and in an effort to maximize the cost-benefit factor for improvements, SWA recommends to

delay window replacements at this time and make it part of the next major capital improvement / renovation project. Windows considered for replacement should have the following outline specifications besides conforming to local code and regulations: the windows shall be aluminum frame thermally manufactured as double hung commercial type modules. The clear, low-e, argon filled dual glazing should be 2 independent panes. The walls should be extruded aluminum with integral poured-in-place thermal barrier. All horizontal rails should be of tubular shape and joinery should be butted and coped with stainless steel screws. Air infiltration shall not exceed 0.10 cfm/sf of unit. The conductive thermal transmittance (U-Value) shall not be more than 0.51 BTU/hr•ft²•°F.

The installed cost of approximately 135 replacement window units of the type outlined above is estimated to cost \$60,000, based on similar projects. Annual energy estimated savings for the TBD School with new windows is \$5,710. This results in a payback period of over 10.5 year simple payback. While considering that most of the building walls are of old construction and poorly insulated, it is assumed that replacing windows with improved thermal insulation qualities will save approximately 25% of the energy load differential when compared to a similar well insulated building. Window replacement rebates and tax incentives are available only for residential buildings at this time.

In the meanwhile, operable commercial grade blinds for more glair and thermal control can be an economical solution throughout the building where necessary, while selected window films are only effective on thermally manufactured window frames or tight vinyl frames.

2.3.5. Exterior doors

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

2.3.6. Building air tightness

Based on a visual inspection, the TBD School building was observed to be a relatively well-sealed building. There were no major observed deficiencies of air tightness within the building besides a couple of the exterior doors. Classroom occupants should be made aware more often to keep doors closed since the corridors are not air-conditioned nor heated to the same temperature levels.

2.4. HVAC Systems

2.4.1. Heating

In the TBD Elementary School, pumps re-circulate hot water through approximately 35 unit ventilators serving the classrooms. Each unit ventilator contains a heating coil, fan assembly, damper, filter, and controls within a metal cabinet located on the outside wall of each classroom. 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 in the top of the unit ventilators. The proportion of outside air is controlled by the position of the fresh air dampers. Separately, classroom air is purged via rooftop exhaust fans. In the winter, water is heated by 4 AO Smith Duramax (1,448 M Btu/hr output each) hot water boilers.

The TBD Elementary School building contains 5 rooftop units (RTUs) that provide cooling for some of the common areas and offices. One stand alone RTUs with 60 Ton Direct Expansion (DX) coils for cooling and hot water heating coils is dedicated to the gymnasium.

The TBD School building has flexibility in terms of energy reduction from the current setup of heating and cooling systems. 60 % of the building and mainly classrooms still operate 1970s vintage unit ventilators, pneumatically controlled. The pneumatic thermostats in most classrooms are not operational and repair parts are very difficult to come by. SWA recommends replacing the older unit ventilators with newer electronically controlled with the next major renovation. SWA evaluated replacing the existing 10 year old installed heating system and recommends that newer system is left intact. SWA also recommends replacing the inoperable pneumatic classroom controls with newer electronic Direct Digitally Controllers (DDC) tied in to the Building Management System (BMS). There may be opportunities to contain the cooling / heating to only areas that require it per an advanced agreed upon schedule. SWA also recommends re-to-commissioning the HVAC equipment and especially the associated controls to insure that they are operating at the designed efficiency.

2.4.2. Cooling

The TBD Elementary School building uses RTUs, described in the previous Heating 2.4.1 section, to cool a few of the common areas. The TBD Elementary School building contains 5 rooftop units (RTUs) that provide cooling for some of the common areas and offices. One stand alone RTUs with 60 Ton Direct Expansion (DX) coils for cooling and hot water heating coils is dedicated to the gymnasium.

There are ~20 window A/C units (various vintage) throughout the building operated as special students need them and replaced as they breakdown. SWA recommends that filters be periodically cleaned for good indoor air quality and to maintain unit efficiency. The school could stay with the existing AC window units as long as when the units are replaced, they are replaced with properly sized units per http://www.energystar.gov/index.cfm?c=roomac.pr_properly_sized and Energy Star high efficiency units with EER of >11 per <http://www.green-energy-efficient-homes.com/window-ac-units.html>.

2.4.3. Ventilation

The TBD Elementary School building uses rooftop units and rooftop exhaust fans to purge building air. Classroom fresh air is provided via the unit ventilators and outside grills. The RTUs and A/C units also pull fresh air from the outside in order to provide adequate ventilation in the building spaces they are servicing.

2.4.4. Domestic Hot Water

There is one ten year old 98 gal AO Smith Domestic Hot Water heater in the TBD School building. It serves the locker rooms, gym office teacher and science rooms. SWA does not recommend making any changes to this unit now.

More efficient water-consuming fixtures and appliances save both energy and money through reduced energy consumption for water heating, as well decreased water and sewer bills. SWA recommends adding controlled on / off timers on all lavatory faucets to reduce domestic hot water demand and save water. Building staff can also easily install faucet aerators and / or low-flow fixtures to reduce

hot water consumption. In addition, routine maintenance practices that identify and quickly address water leaks are a low-cost way to save water and energy.

2.5. Electrical systems

2.5.1. Lighting

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

Exit Lights - The building has mostly 5W CFL exit signs installed. These are low energy users. SWA recommends that any newly installed exit signs be LED type exit signs.

Exterior Lighting - The exterior lighting was surveyed during the building audit: a mix of 400 Watt and 175 Watt perimeter hi pressure sodium lamps and a number of incandescent soffit lamps. SWA recommends replacing the incandescent lamps with lower energy CFL bulbs. Since this lighting is mainly for Safety as well as for Security, SWA has deemed it not cost effective to replace exterior hi pressure sodium lamp lighting at this time. All exterior lighting is controlled by photocells. There is not any immediate need to upgrade this lighting (except for the incandescent) or photocells.

2.5.2. Appliances and process

Appliances, such as refrigerators, that are over 10 years of age should be replaced with newer efficient models with the Energy Star label. For example, Energy Star refrigerators use as little as 315 kWh / yr. When compared to the average electrical consumption of older equipment, Energy Star equipment results in a large savings. Look for the Energy Star label when replacing appliances and equipment, including: 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>.

Computers left on in classrooms 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 classrooms use approximately 3-5 watts of electricity when turned off. SWA recommends all computers and all classrooms 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 TBD School computers are generally programmed for the power save mode, to shut down after a period of time that they have not been used.

Educating both students and staff is a great way for schools to save energy while raising awareness about the importance of energy-efficiency. Prizes and challenges can be used to get classes involved in finding creative ways to reduce and monitor energy usage throughout the school. There are many free resources available to help Students, Parents, and School Administrators incorporate energy into school curricula and every day activities. The US Department of Energy offers free information for hosting energy efficiency educational programs and K-12 lesson plans, for more information please visit: <http://www1.eere.energy.gov/education/> . NJ Clean Energy will also be coming out soon with a Teach Program for students, teachers and school maintenance staff.

2.5.3. Elevators

The TBD School building is single story buildings and therefore does not contain any elevator equipment.

2.5.4. Others electrical systems

There are not currently any other electrical systems installed at the TBT School building.

3. EQUIPMENT LIST

Inventory

Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Heating / Cooling Systems							
	11-12 newer unit class unit ventilators	located in recently renovated classrooms by outer wall	Trane 9' long Vu VB15011...	Electric	Classrooms	1999	60%
	24-25 older unit ventilators; with 3/4" control valves, 1/10 HP damper motor, 115 V, 2.2 amps, 1 Ph	located in classrooms by outer wall	Nesbitt - 6' long; Holtzer Cabot damper motor #3957LJ, RWC5419	Electric	Classrooms	1960s-70s	0% (operating beyond their usable expected life)
	4 hot water boilers	boiler room	AO Smith Duramax DB/DW-720-1810, each 1,810M Btu/hr input, 1,448M Btu/hr output each	Natural Gas	Elementary School	1999	60%
	4 recirculation hot water pumps	boiler room	7.5 HP Taco FE150 6E251E210, Baldor motor Cat#M32191, SF 1.15	Electric	Elementary School	1999	60%
	32 exhaust fans - roof top - classroom ventilators	rooftop	32 Greenheck (various size - one per classroom)	Electric	Classrooms	1999	60%
	4 older exhaust fans - roof top - classroom ventilators	rooftop	4 Penn (various size - one per classroom) ~1/3 HP each	Electric	Classrooms	1970's	0% (operating beyond their usable expected life)
continued on next page							

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.

Building System	Description		Model #	Fuel	Space Served	Equip Age	Estimated Remaining Useful Life %
Heating / Cooling Systems							
	5 x RTUs (with economizers and DX coils) for A/C for small group instruction, media center / library, teachers' room and conference room	rooftop	2 - Trane - (~2 Tons); 3 - Trane (~4 Tons) - TCD085C30ABC	Electric	Elementary School (selected spaces)	1999	60%
	1 x 60 Ton RTU (2 compressors) for the newer gym; heating via hot water coils - only this unit	rooftop	Trane SXHFC40EOT45C3...	Electric	New Gym	1999	60%
	~18-20 window A/C units throughout the building	several classrooms, can be relocated	various	Electric	Elementary School (selected spaces)	10-15 years old	varies
	~7 dehumidifiers throughout the building	several classrooms, can be relocated	various	Electric	Elementary School (selected spaces)	2-5 years old	varies
	controls: electronic for renovated areas, pneumatic balance of spaces	new BMS in boiler room	Andover electronic; Honeywell pneumatics	Electric	Elementary School	1999 for electronic	60% for electronic; 0% for pneumatic which are beyond their usable expected life
Domestic Hot Water	98 gal (94 gal measured)	boiler room	AO Smith BT 100 300 - input 75,100 Btu/hr, 80% thermal eff.	Natural Gas	Locker rooms, gym office, teacher and science rooms	1999	25%
Lighting	See details - Appendix A	per Appendix A	-	Electric	whole school	varies	varies, average 25%

4. ENERGY CONSERVATION MEASURES

Based on the assessment of the TBD School building, SWA has separated the investment opportunities into three recommended categories:

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

Category I Recommendations: Capital Improvements

- Classroom Old Pneumatically Controlled Unit Ventilators - The existing pneumatically controlled unit ventilators, which serve a major portion (~60%) of the TBD Elementary School, have been reasonably well-maintained but have reached the end of their useful life and should to be replaced. This recommendation cannot be cost justified by energy savings alone. However, the age and condition of the equipment warrant attention and this recommendation is intended to provide guidance to help the building management staff prioritize upgrades within the facility. The existing equipment is inefficient relative to newer electronically controlled technology, and based on discussions with building staff, appear to be high maintenance, requiring hard-to-find spare parts, and creating discomfort and inability for proper room temperature control. SWA recommends installing more efficient updated unit ventilators, similar to ones installed ten years ago. A design professional should be consulted to determine the proper equipment and configuration appropriate for this upgrade.
- Only a couple of older rooftop exhaust fans that are at the end of their useful lives should be replaced to insure classroom proper Indoor Air Quality and comply with ASHRAE latest ventilation standard 62-2004 requirements for classroom ventilation of 10 cfm/person with 0.12 cfm/ft².

Category II Recommendations: Operations and Maintenance

- Controls Optimization - SWA recommends that the schedules for all rooftop equipment and fan heat coil units serving key public spaces be reviewed and optimized. During periods when the spaces are not occupied, the equipment may be shut-off or controlled to minimize the amount of fresh air conditioned by the equipment. The cost and effort associated with implementation of this recommendation will depend upon the capabilities of the existing building automation control system. Energy and cost savings associated with this recommendation will vary, depending upon the current occupancy schedules and means of control utilized.
- Weather Stripping / Air Sealing - Doors and vestibules should be observed annually for deficient weather-stripping and replaced as needed. The perimeter of all window frames should also be regularly inspected and any missing or deteriorated caulking should be re-caulked to provide an unbroken seal around the window frames. Weather stripping comes in different types and sizes. One recommendation could be airtight nylon brush seal which is superior to any other weather stripping on the market. It can cover a gap from 1/8" up to 6", providing an almost airtight seal (98%-99%) that will control or eliminate energy loss (heating and cooling) and keep out light, dirt, dust, sand, insects, and small rodents. Any other accessible gaps or penetrations in the thermal envelope penetrations should also be sealed with caulk or spray foam.
- Water Efficient Fixtures & Controls - Adding controlled on / off timers on all lavatory faucets is a cost-effective way to reduce domestic hot water demand and save water. Building staff can also easily install faucet aerators and / or low-flow fixtures to reduce water consumption. There are many retrofit options, which can be installed now or incorporated as equipment is replaced. Routine maintenance practices that identify and quickly address water leaks are a low-cost way to save water and energy. Retrofitting with more efficient water-consumption fixtures / appliances will save both energy and money through reduced energy consumption for water heating, while also decreasing water / sewer bills.

- 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 for 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

ECM#	Description
1	Undertake retro-commissioning of building systems and controls to optimize performance
2	Upgrade primary classroom controls to digital programmable controls tied into the Building Management System
3	Install Carbon Dioxide sensors to control and improve Indoor Air Quality in the gymnasium as well as reduce energy costs
4	Upgrade school lighting: incandescent to CFLs, occupancy sensors for some offices, Exit fluorescents to LED and T12 magnetic fixtures to T8 electronic fixtures
5	Install a 5kW Wind system to reduce annual electric consumption and demand as well as become an educational tool for the school
6	Install a 5kW PV system to reduce annual electric consumption and demand as well as become an educational tool for the school

ECM#1: Retro-Commissioning

Description:

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

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

Installation cost:

Estimated installed cost: \$60,000

Source of cost estimate: Similar projects

Economics (without incentives):

ECM description	Installed Cost		1st year energy savings					SPP	LoM	Lifetime	ROI %	Annual Carbon Reduced (lbs of CO2)
	Estimate \$	Source	Use	Unit	Demand	Unit	Savings / year \$			Cost Savings \$		
Retro-Commissioning	\$60,000	Similar Projects	33,554	kWh	130.9	kW	13,601	4.4	12	133,782	10.2	90,136
			3,775	therms	-	-						

Assumptions: Since the utility bills have some accounting fluctuations, it is difficult to determine the amount of energy used for heating and cooling the TBD Elementary School. Based on experience with similar schools, SWA estimated the heating and cooling energy consumption. Typical savings for retro-commissioning range from 5-20%, as a percentage of the total space conditioning consumption. SWA assumed 10% savings. Estimated costs for retro-commissioning range from \$0.50-\$2.00 per square foot. SWA assumed \$1.00 per square foot of a total square footage of 60,000. SWA also assumed on the average 1 hr/wk operational savings when systems are operating per design vs. the need to make more frequent adjustments and included this with the annual savings.

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

Options for funding ECM:

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

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

ECM#2: Upgrade Classroom Controls to Digital

Description:

In 1999 about 40% of the TBD School was upgraded to newer electrically Direct Digitally Controlled (DDC) unit ventilators and a Building Management System (BMS). 60 % of the building and mainly classrooms still operate 1970s vintage unit ventilators, pneumatically controlled. The pneumatic thermostats in most classrooms are not operational and repair parts are very difficult to come by. Temperature control in these spaces is controlled with difficulty, mostly in the on / off mode and from the associated boiler room. The comfort temperatures in these classrooms make it a challenge to keep focused on learning and teaching at times. These spaces are not setback at night or after-hours and additional energy is used to keep the spaces warm, which would not be expanded if controls were properly operating.

SWA proposes that the TBD School replace the existing pneumatic controls to the older unit ventilators with electronic programmable type and tie them into the newer BMS. SWA also recommends that the 1970 vintage older unit ventilators be replaced as they break down, since they are beyond their usable expected life. As new systems are installed, they should be commissioned to follow a preset schedule as agreed and designed.

Installation cost:

Estimated installed cost: \$111,000

Source of cost estimate: Similar projects

Economics (without incentives):

ECM description	Installed Cost		1st year energy savings					SPP	LoM	Lifetime	ROI %	Annual Carbon Reduced (lbs of CO2)
	Estimate \$	Source	Use	Unit	Demand	Unit	Savings / year \$			Cost Savings \$		
Upgrade to digital controls for pneumatically operated fan heat coils	\$111,000	Similar Projects	31,604	kWh	123.3	kW	20,599	5.4	12	202,616	6.9	150,388
			9,153	therms	-	-						

Assumptions: Since the utility bills have some accounting fluctuations, it is difficult to determine the energy used for heating and cooling the TBD Elementary School. Based on experience with similar schools, SWA estimated the heating / cooling energy use. SWA assumed typical savings for scheduled setbacks of 10 deg F. Estimated DDC costs / installation are based on similar project and ~\$1,000 for each input / output. SWA also assumed on the average 10 hrs/year operational savings when systems are operating smoothly with electronic controls vs. the need to make more frequent repairs / adjustments with old pneumatic controls and included this with the annual savings.

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

Options for funding ECM: *This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.*

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

ECM#3: Carbon Dioxide Controls in the Gymnasium

Description:

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

Installation cost:

Estimated installed cost: \$4,000

Source of cost estimate: RS Means; Published and established costs

Economics:

ECM description	Installed Cost		1st year energy savings					SPP	LoM	Lifetime	ROI %	Annual Carbon Reduced (lbs of CO2)
	Estimate \$	Source	Use	Unit	Demand	Unit	Savings / year \$			Cost Savings \$		
Install CO2 sensors in the gym	\$4,000	Similar Projects, RS Means, Lit Search	2,458	kWh	9.6	kW	1,218	3.3	12	11,980	16.6	9,147
			494	therms	-	-						

Assumptions: SWA assumes thermal savings based on heating and cooling loads calculated using modeling and by conducting the billing analysis. In order to estimate savings for this measure, SWA assumed in the model an occupancy reduction equivalent to a conservative 10% (in view that the space is rarely used at the full designed capacity) of the total heating and cooling used for the gymnasium based on the described use schedules.

Rebates/financial incentives:

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

Options for funding ECM:

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

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

ECM#4: Upgrade existing lighting

Description:

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

Installation cost:

Estimated installed cost: \$4,630

Source of cost estimate: RS Means; Published and established costs

Economics (Some of the options considered with incentives):

ECM description	Installed Cost		1st year energy savings					SPP	LoM	Lifetime	ROI %	Annual Carbon Reduced (lbs of CO2)
	Estimate \$	Source	Use	Unit	Demand	Unit	Savings / year \$			Cost Savings \$		
replace 20 incandescent lamps to CFL	\$400	RS Means, Lit Search	2,306	kWh	9.0	kW	420	1.1	20	5,354	61.9	3,159
install 47 occupancy sensors with INCENTIVES	\$4,230	RS Means, Lit Search, NJ Clean Energy Program	15,276	kWh	59.6	kW	2,551	1.7	20	35,473	36.9	20,928
Total Proposed	\$4,630		17,581	kWh	68.6	kW	2,795	1.7	20	40,827	39.1	24,087

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

ECM description	Installed Cost		1st year energy savings					SPP	LoM	Lifetime	ROI, %	Annual Carbon Reduced (lbs of CO ₂)
	Estimate \$	Source	Use	Unit	Demand	Unit	Savings / year \$			Cost Savings \$		
replace school internal lights: T12s to T8s with INCENTIVES (incl. 75% labor)	\$77,145	RS Means, Lit Search, NJ Clean Energy Program	15,046	kWh	58.7	kW	2,513	32.2	20	34,941	-2.7	20,614

Assumptions: SWA calculated the savings for this measure using measurements taken the day of the field visit and using the billing analysis. SWA also assumed an aggregated 1 hr/yr to replace aging burnt out lamps vs. newly installed and included this with the annual savings.

Rebates/financial incentives:

*NJ Clean Energy - Wall Mounted occupancy sensors (\$20 per control)
Maximum incentive amount is \$940.*

NJ Clean Energy – Prescriptive Lighting Incentive, Incentive based on installing T5 or T8 lamps with electronic ballasts in existing facilities (\$10-\$30 per fixture, depending on quantity of lamps). Maximum incentive amount is \$12,510.

Options for funding the Lighting ECM:

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

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

ECM#5: Install 5kW Wind system

Please see section 5: RENEWABLE AND DISTRIBUTED ENERGY MEASURES

ECM#6: Install 5kW PV system

Please see section 5: RENEWABLE AND DISTRIBUTED ENERGY MEASURES

5. RENEWABLE AND DISTRIBUTED ENERGY MEASURES

5.1. Existing systems

There are currently no existing renewable energy systems.

5.2. Wind

ECM#5: Install 5kW Wind system

Description:

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

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

The installation of a renewable Wind power generating system could serve as a good educational tool and exhibit for the school.

Installation cost:

Estimated installed cost: \$40,000

Source of cost estimate: Similar projects

ECM description	Installed Cost		1st year energy savings					SPP	LoM	Lifetime	ROI %	Annual Carbon Reduced (lbs of CO2)
	Estimate \$	Source	Use	Unit	Demand	Unit	Savings / year \$			Cost Savings \$		
Install 5 kW Wind System	\$40,000	RS Means, Lit Search	13,000	kWh	50.7	kW	2,171	18.4	25	36,975	-0.3	17,810

Economics (without incentives):

Assumptions: SWA estimated the cost and savings of the system based on past wind projects. SWA projected physical dimensions based on a 5kW-Enviro Energies turbine system.

The installed cost of a vertical type wind turbines 5kW (5,000 Watts) can be as low as \$7 / Watt depending on the manufacturer. For further references see <http://www.arcnewable.com/products/5-kw/> and <http://www.ecogeek.org/component/content/article/1796>

Rebates/financial incentives:

NJ Clean Energy - Renewable Energy Incentive Program, Incentive at this time only for vertically spinning high altitude turbines

<http://www.njcleanenergy.com/renewable-energy/programs/renewable-energy-incentive-program>

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

Options for funding ECM:

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

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

5.3. Solar Photovoltaic

ECM#6: Install 5kW PV system

Description:

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

There are many possible locations for a 5kW PV installation on the building roofs. A typical solar panel used for calculations has an area of approximately 10.7 square feet and can generate a peak kW of up to 123 Watts. Based on a 5kW system, approximately 41 panels would be necessary and would take up 435 square feet.

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

Installation cost:

Estimated installed cost: \$30,000

Source of cost estimate: Similar projects

Economics (with some incentives):

ECM description	Installed Cost		1st year energy savings					SPP	LoM	Lifetime	ROI %	Annual Carbon Reduced (lbs of CO2)
	Estimate \$	Source	Use	Unit	Demand	Unit	Savings / year \$			Cost Savings \$		
Install 5 kW PV System (with \$1/W INCENTIVE)	\$30,000	RS Means, Lit Search	5,902	kWh	23.0	kW	986	30.4	25	16,787	-1.8	8,086

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

The installed cost of a 5kW (5,000 Watts) photovoltaic solar system has dropped dramatically over the last two years and the cost of an installed system can be around \$6/Watt: \$3/watt for the panels, another \$1.50-2/watt for the inverters and mounting system and about \$1/watt for the install. For smaller systems, the cost per watt goes up a little and for larger ones the costs go down. For further references see <http://www.greenbuildingtalk.com/Forums/tabid/53/forumid/15/postid/60916/view/topic/Default.aspx>

Rebates/financial incentives:

NJ Clean Energy - Renewable Energy Incentive Program, Incentive based on \$1.00 / watt Solar PV application. Incentive amount for this application is \$5,000.

<http://www.njcleanenergy.com/renewable-energy/programs/renewable-energy-incentive-program>

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

Options for funding ECM:

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

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

5.4. Solar Thermal Collectors

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

5.5. Combined Heat and Power

Description:

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

5.6. Geothermal

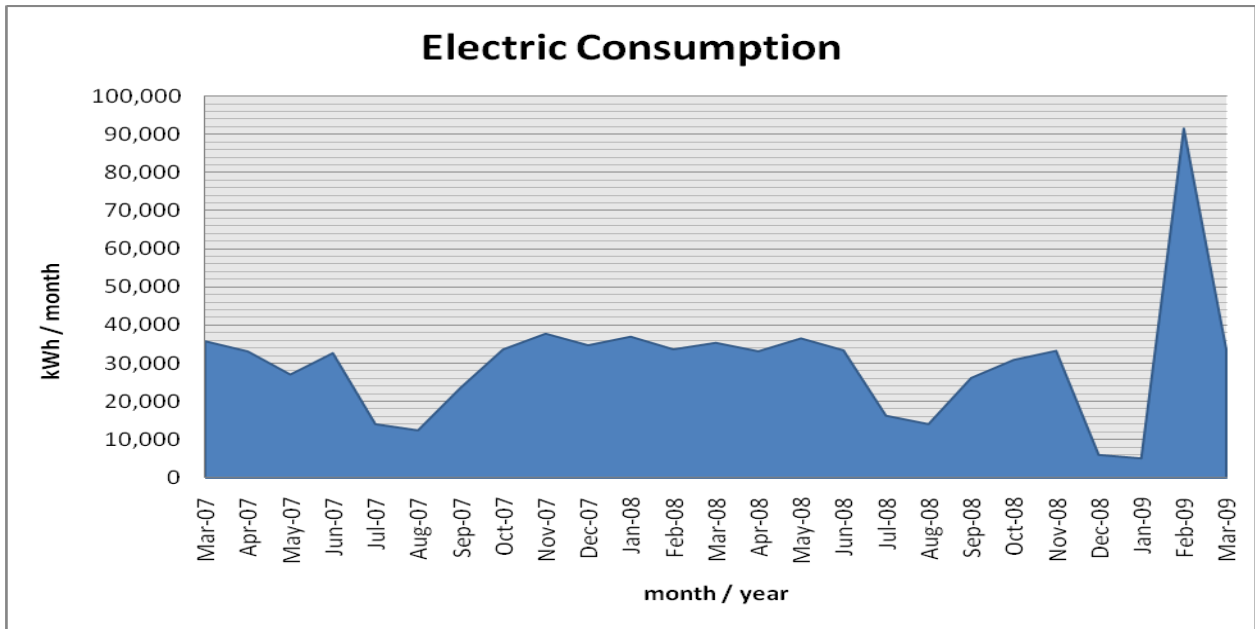
Description:

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

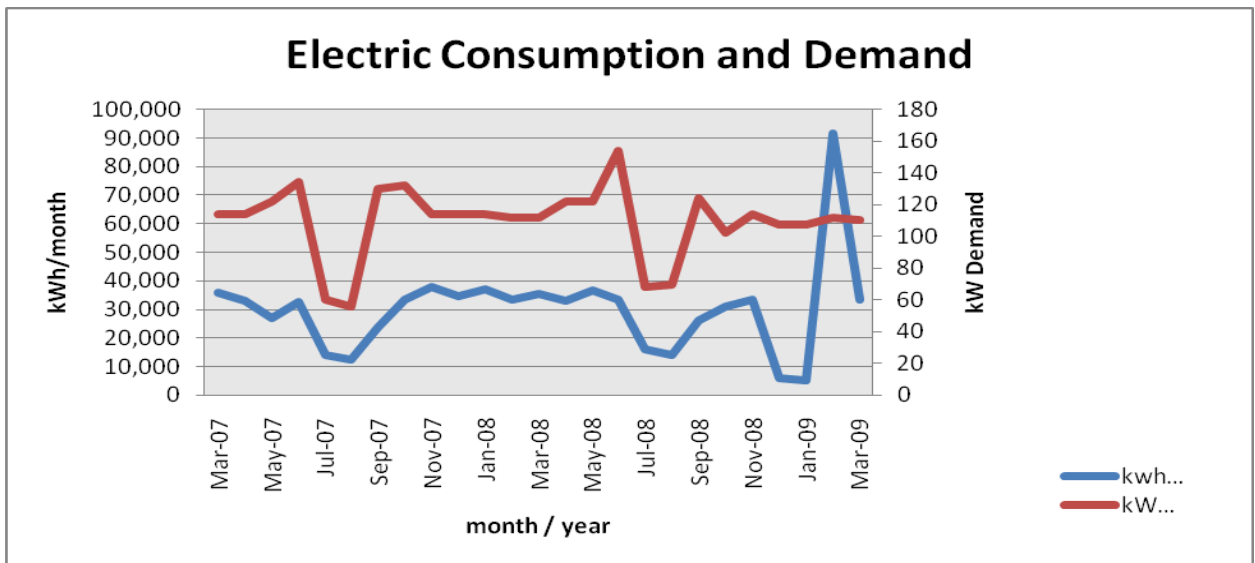
6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

6.1. Load profiles

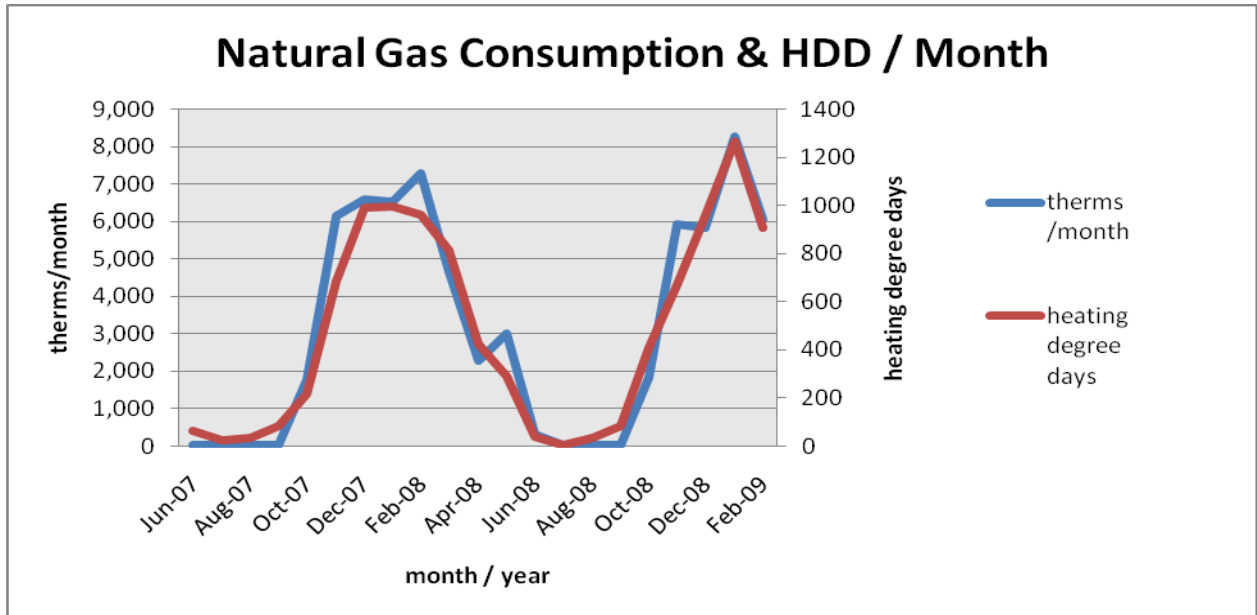
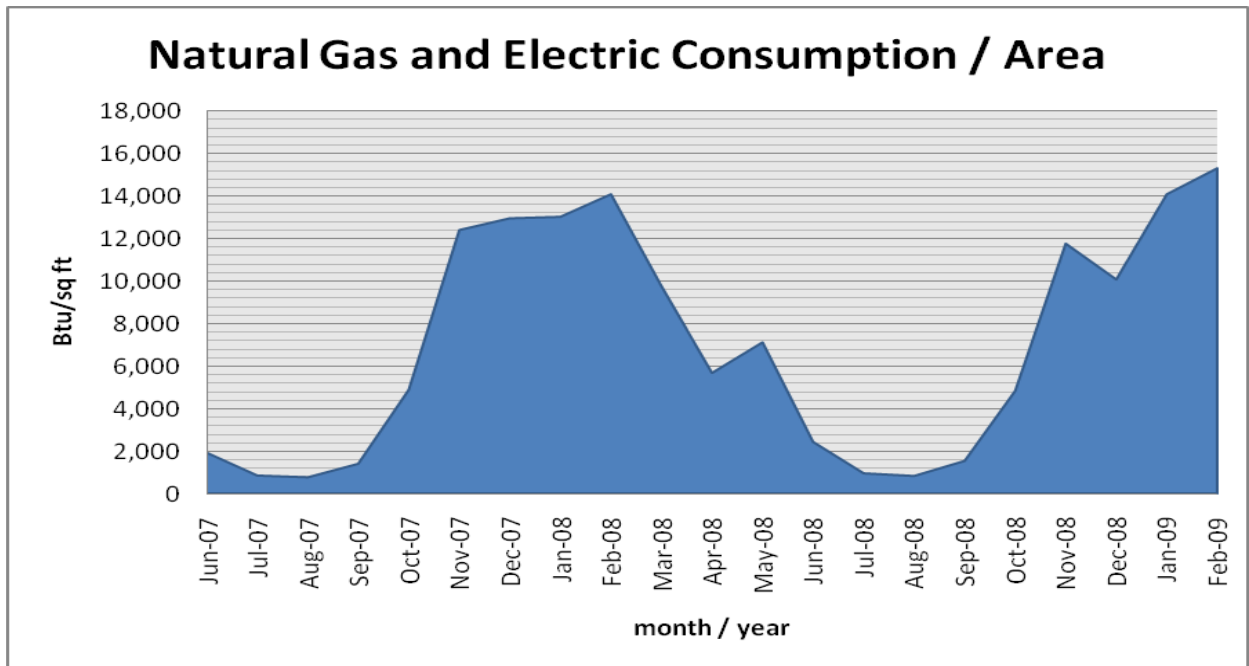
The following are charts that show the annual electric and natural gas load profiles for the TBD Elementary School building.



The unusual electric fluctuations shown in Feb 09, Jan 09 and Dec 08 may be due to adjustments between estimated and actual meter readings. The Old Tappan Board of Education should demand a full accounting from Rockland Electric and ask that billings be based only on realistic and actual meter readings. Also, note below how the electrical Demand peaks (except for unusual fluctuation anomalies) follow the electrical consumption peaks.



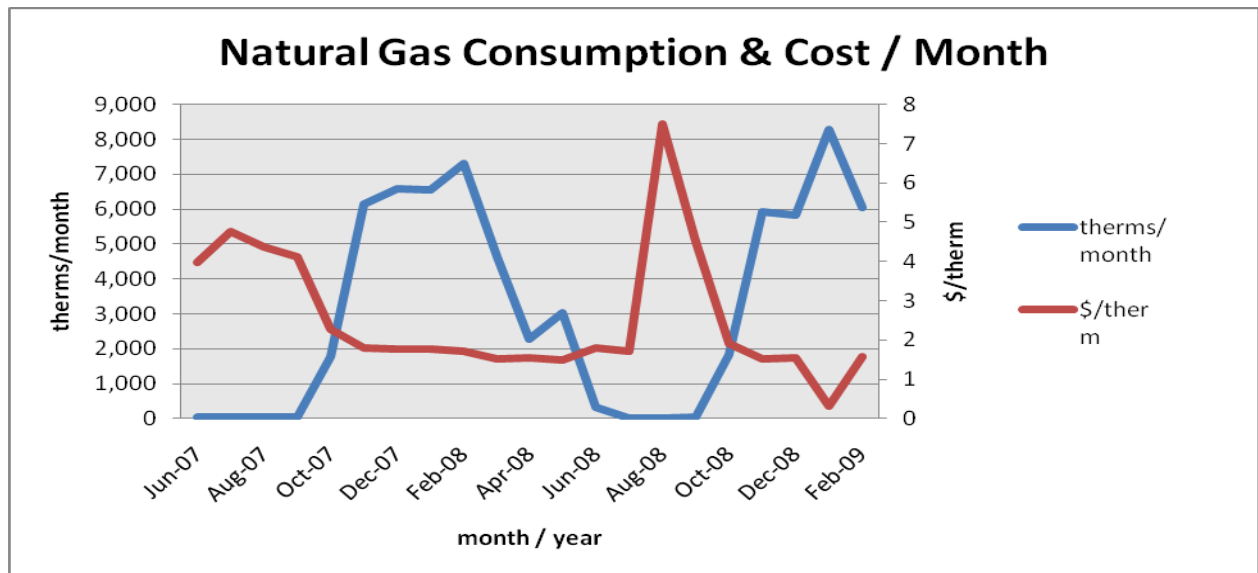
The following is a chart of the natural gas annual load profile for the building, peaking in the coldest months of the year and a chart showing gas consumption mimicking the “heating degree days” curve.



6.2. Tariff analysis

Currently, natural gas is provided to the TBD Elementary School building via one gas meter with PSE&G acting as the transport company. Gas supply is provided by Hess Corporation at a general service rate. The suppliers’ general service rate for natural gas charges a market-rate price based on use and the TBD School billing does not breakdown demand costs for all periods. Demand prices are reflected in the utility

bills and can be verified by observing the price fluctuations throughout the year. Typically, the natural gas prices increase during the heating months when natural gas is used by the hot water boiler units. The high gas price per therm fluctuations shown on the following chart may be due to high energy costs that occurred in 2008 and low use caps for the non-heating months.

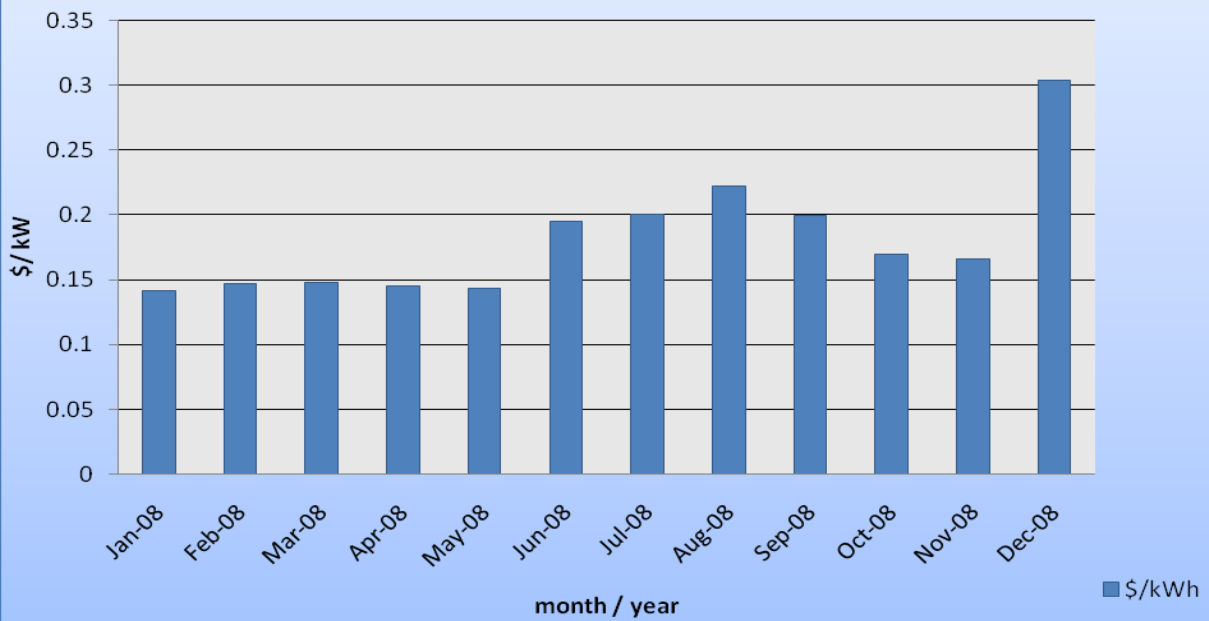


The TBD School building is direct-metered (via one main meter and a minor outside lighting meter) and currently purchases electricity from Rockland Electric at a general service rate. The general service rate for electric charges are market-rate based on use and the TBD School billing does show a breakdown of demand costs. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year. Typically, the electricity prices increase during the cooling months when electricity is used by the rooftop air-handling units. The Old Tappan Board of Education should demand / receive a proper monthly billing based on actual readings from all energy suppliers.

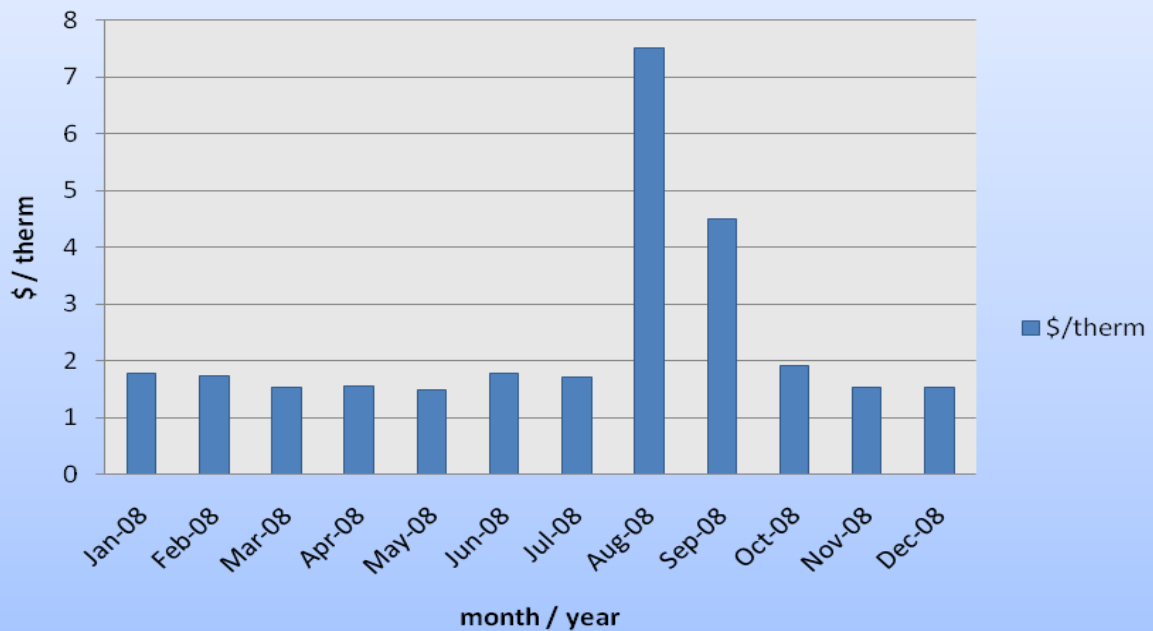
6.3. Energy Procurement strategies

The TBD School receives natural gas via one incoming meter. One company, Hess Corp., supplies the gas, another, PSE&G, transports it. There isn't and ESCO engaged in the process. An Energy Services Company (ESCO) is a consultancy group that engages in a performance based contract with a client firm to implement measures which reduce energy consumption and costs in a technically and financially viable manner. Electricity is also purchased directly for the TBD School from Rockland Electric without an ESCO. SWA analyzed the utility rate for natural gas and electricity supply over an extended period. Electric bill analysis shows fluctuations up to 40% over the most recent 12 month period. Natural gas bill analysis shows fluctuations up to 70% over the most recent 12 month period. Some of these fluctuations may have been caused by adjustments between estimated and actual meter readings, others may be due to unusual high and escalating energy costs in 2008. SWA recommends that the Old Tappan Board of Education further explore opportunities of purchasing both natural gas and electricity from ESCOs in order to reduce rate fluctuation and ultimately reduce the annual cost of energy for the TBD School. Appendix B contains a complete list of third party energy suppliers for the Old Tappan service area. The Old Tappan Board of Education may want to consider partnering with other school districts, municipalities, townships and communities to aggregate a substantial electric and natural gas use for better leveraging in negotiations with ESCOs and of improving the pricing structures. This sort of activity is happening in many parts of the country and in New Jersey. The following charts show the TBD School monthly spending for energy in 2008.

2008 Unit Cost Paid for Electricity



2008 Unit Cost Paid for Natural Gas



7. METHOD OF ANALYSIS

7.1. Assumptions and tools

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

7.2. Disclaimer

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

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

Appendix A: Lighting Study

T. Baldwin Demarest Elementary School Existing Lighting Conditions														Proposed Lighting											
#	Bldg	Flr	Location in Building	Measured Lighting Level in Foot-candles	Fixture Type	Ballast Type	No. of Fixtures	No. of Lamps	Type of Lamp	Watts/Lamp	Hrs/Day	Energy Use (Watt hours / day)	Controls	Day-lighting possible?	Fixture Type	Ballast Type	No. of Fixtures	No. of Lamps	Type of Lamp	Watts/ Lamp	Hrs/Day	Energy Use (Watt hours/ day)	Controls	Total Power (Watts)	further W-hr/day reduction with occupancy sensors
1	TBD	1st	Main Hallway	14	1F34T12	M	28	1	F	34	16	15232	1 S	n	1F32T8	E	28	1	F	32	16	11424	1 S	896	
2	TBD	1st	Main Hallway	-	1CF5Exit	-	2	1	CFL	5	24	240	-	n	Exit LED	-	2	1	CFL	5	24	240	-	10	
3	TBD	1st	Classroom #109	40	3F34T12	M	18	3	F	34	8	14688	1 S	Yes	3F32T8	E	18	3	F	32	8	11016	1 S	1728	2,754
4	TBD	1st	Classroom #110	50	3F34T12	M	18	3	F	34	8	14688	1 S	Yes	3F32T8	E	18	3	F	32	8	11016	1 S	1728	2,754
5	TBD	1st	Classroom #111	55	3F34T12	M	18	3	F	34	8	14688	1 S	Yes	3F32T8	E	18	3	F	32	8	11016	1 S	1728	2,754
6	TBD	1st	Bathroom	15	3F20T12	M	1	3	F	20	8	480	1 S	n	3F32T8	E	1	3	F	32	8	360	1 S	96	144
7	TBD	1st	Bathroom	15	1F34T12	M	1	1	F	34	8	272	1 S	n	1F32T8	E	1	1	F	32	8	204	1 S	32	82
8	TBD	1st	Bathroom	15	incand	N/A	1	1	I	60	8	480	1 S	n	CFL	-	1	1	CFL	15	8	120	1 S	15	48
9	TBD	1st	Janitor Closet	15	2F34T12	E	2	2	F	34	1	136	1 S	n	2F32T8	E	2	2	F	32	1	128	1 S	128	
10	TBD	1st	Kitchen #116	35	2F34T12	M	6	2	F	34	6	2448	1 S	n	2F32T8	E	6	2	F	32	6	1836	1 S	384	734
11	TBD	1st	Hallway	15	1F34T12	M	5	1	F	34	16	2720	1 S	n	1F32T8	E	5	1	F	32	16	2040	1 S	160	
12	TBD	1st	Hallway	-	1CF5Exit	-	2	1	CFL	5	24	240	-	n	Exit LED	-	2	1	CFL	5	24	240	-	10	
13	TBD	1st	Classroom #105	65	3F34T12	M	24	3	F	34	8	19584	1 S	Yes	3F32T8	E	24	3	F	32	8	14688	1 S	2304	3,672
14	TBD	1st	Bathroom	20	incand	N/A	1	2	I	60	6	720	1 S	n	CFL	-	1	2	CFL	15	6	180	1 S	30	72
15	TBD	1st	Storage Closet	15	1F34T12	M	4	1	F	34	1	136	1 S	n	1F32T8	E	4	1	F	32	1	102	1 S	128	
16	TBD	1st	Toilet	10	incand	N/A	1	2	I	100	6	1200	1 S	n	CFL	-	1	2	CFL	15	6	180	1 S	30	72
17	TBD	1st	Hallway	7	1F34T12	M	5	1	F	34	16	2720	1 S	n	1F32T8	E	5	1	F	32	16	2040	1 S	160	
18	TBD	1st	Bathroom	15	incand	N/A	1	2	I	100	6	1200	1 S	n	CFL	-	1	2	CFL	15	6	180	1 S	30	72
19	TBD	1st	Bathroom	15	incand	N/A	1	2	I	100	6	1200	1 S	n	CFL	-	1	2	CFL	15	6	180	1 S	30	72
20	TBD	1st	#106	100	3F34T12	M	24	3	F	34	8	19584	1 S	Yes	3F32T8	E	24	3	F	32	8	14688	1 S	2304	3,672
21	TBD	1st	Hallway	35	3F32T8	E	3	3	F	32	16	4608	1 S	n	3F32T8	E	3	3	F	32	16	4608	1 S	288	
22	TBD	1st	Hallway	-	1CF5Exit	-	2	1	CFL	5	24	240	-	n	Exit LED	-	2	1	CFL	5	24	240	-	10	
23	TBD	1st	#107	80	4F32T8	E	14	4	F	32	8	14336	1 S	Yes	4F32T8	E	14	4	F	32	8	14336	1 S	1792	3,584
24	TBD	1st	Storage Closet	25	3F32T8	E	1	3	F	32	1	96	1 S	n	3F32T8	E	1	3	F	32	1	96	1 S	96	
25	TBD	1st	Toilet	50	3F32T8	E	1	3	F	32	1	96	1 S	n	3F32T8	E	1	3	F	32	1	96	1 S	96	
26	TBD	1st	Gymnasium #108	30	Metal Halide	N/A	9	1	HPS	250	12	27000	1 S	n	Metal Halide	-	9	1	250	12	12	27000	1 S	108	
27	TBD	1st	Gymnasium #109	30	Halogen Flood	N/A	6	1	Halogen	100	12	7200	1 S	n	Halogen Flood	-	6	1	100	12	12	7200	1 S	72	
28	TBD	1st	#114	20	2F32T8	E	6	2	F	32	8	3072	1 S	n	2F32T8	E	6	2	F	32	8	3072	1 S	384	768
29	TBD	1st	Bathroom	7	1F20T12	M	1	1	F	20	8	160	1 S	n	1F32T8	E	1	1	F	32	8	120	1 S	32	48
30	TBD	1st	Bathroom	7	1F34T12	M	1	1	F	34	8	272	1 S	n	1F32T8	E	1	1	F	32	8	204	1 S	32	82
31	TBD	1st	Boiler Room #117	10	2F32T8	E	6	2	F	32	2	768	1 S	n	2F32T8	E	6	2	F	32	2	768	1 S	384	
32	TBD	1st	Classroom #116	50	3F34T12	M	18	3	F	34	8	14688	1 S	Yes	3F32T8	E	18	3	F	32	8	11016	1 S	1728	2,754
33	TBD	1st	Classroom #118	90	3F34T12	M	18	3	F	34	8	14688	1 S	Yes	3F32T8	E	18	3	F	32	8	11016	1 S	1728	2,754
34	TBD	1st	Classroom #119	90	3F34T12	M	18	3	F	34	8	14688	1 S	Yes	3F32T8	E	18	3	F	32	8	11016	1 S	1728	2,754
35	TBD	1st	Classroom #120	75	3F34T12	M	18	3	F	34	8	14688	1 S	Yes	3F32T8	E	18	3	F	32	8	11016	1 S	1728	2,754
36	TBD	1st	Classroom #121	70	3F34T12	M	18	3	F	34	8	14688	1 S	Yes	3F32T8	E	18	3	F	32	8	11016	1 S	1728	2,754
37	TBD	1st	#210	40	2F34T12	M	14	2	F	34	8	7616	1 S	Yes	2F32T8	E	14	2	F	32	8	5712	1 S	896	1,428
38	TBD	1st	#203	60	3F32T8	E	4	3	F	32	8	3072	1 S	Yes	3F32T8	E	4	3	F	32	8	3072	1 S	384	768
39	TBD	1st	#204	60	3F32T8	E	6	3	F	32	8	4608	1 S	Yes	3F32T8	E	6	3	F	32	8	4608	1 S	576	1,152
40	TBD	1st	#205	65	3F34T12	M	18	3	F	34	8	14688	1 S	Yes	3F32T8	E	18	3	F	32	8	11016	1 S	1728	2,754
41	TBD	1st	Teachers Room	60	3F32T8	E	10	3	F	32	6	5760	1 S	n	3F32T8	E	10	3	F	32	6	5760	1 S	960	2,304
42	TBD	1st	Bathroom	50	3F32T8	E	1	3	F	32	4	384	1 S	n	3F32T8	E	1	3	F	32	4	384	1 S	96	
43	TBD	1st	Bathroom	60	3F32T8	E	1	3	F	32	4	384	1 S	n	3F32T8	E	1	3	F	32	4	384	1 S	96	
44	TBD	1st	Classroom #208	45	3F32T8	E	12	3	F	32	8	9216	1 S	Yes	3F32T8	E	12	3	F	32	8	9216	1 S	1152	2,304
45	TBD	1st	Classroom #207	65	3F34T12	M	18	3	F	34	8	14688	1 S	Yes	3F32T8	E	18	3	F	32	8	11016	1 S	1728	2,754
46	TBD	1st	Classroom #209	50	3F34T12	M	18	3	F	34	8	14688	1 S	Yes	3F32T8	E	18	3	F	32	8	11016	1 S	1728	2,754
47	TBD	1st	Storage Closet	10	1F34T12	M	1	1	F	34	1	34	1 S	Yes	1F32T8	E	1	1	F	32	1	26	1 S	32	
48	TBD	1st	#210	40	2F32T8	E	2	2	F	32	8	1024	1 S	Yes	2F32T8	E	2	2	F	32	8	1024	1 S	128	256
49	TBD	1st	Bathroom	30	1F34T12	M	2	1	F	34	1	68	1 S	n	1F32T8	E	2	1	F	32	1	51	1 S	64	
50	TBD	1st	Bathroom	30	2F32T8	E	2	2	F	32	8	1024	1 S	n	2F32T8	E	2	2	F	32	8	1024	1 S	128	410
51	TBD	1st	Utility Closet	20	incand	N/A	1	1	I	100	1	100	1 S	n	CFL	-	1	1	CFL	15	1	15	1 S	15	
52	TBD	1st	Hallway	-	1CF5Exit	-	1	1	CFL	5	24	120	-	n	Exit LED	-	1	1	CFL	5	24	120	-	5	
53	TBD	1st	#213	20	4F32T8	E	12	4	F	32	8	12288	1 S	Yes	4F32T8	E	12	4	F	32	8	12288	1 S	1536	3,072
54	TBD	1st	Classroom #212	55	3F34T12	M	18	3	F	34	8	14688	1 S	Yes	3F32T8	E	18	3	F	32	8	11016	1 S	1728	2,754

T. Baldwin Demarest Elementary School Existing Lighting Conditions														Proposed Lighting													
#	Bldg	Fir	Location in Building	Measured Lighting Level in Foot-candles	Fixture Type	Ballast Type	No. of Fixtures	No. of Lamps	Type of Lamp	Watts/L amp	Hrs/ Day	Energy Use (Watt hours/ day)	Controls	Day-lighting possible?	Fixture Type	Ballast Type	No. of Fixtures	No. of Lamps	Type of Lamp	Watts/ Lamp	Hrs/ Day	Energy Use (Watt hours/ day)	Controls	Total Power (Watts)	further W-hr/day reduction with occupancy sensors		
55	TBD	1st	Classroom #215	55	3F34T12	M	18	3	F	34	8	14688	1 S	Yes	3F32T8	E	18	3	F	32	8	11016	1 S	1728	2,754		
56	TBD	1st	Classroom #216	55	3F34T12	M	18	3	F	34	8	14688	1 S	Yes	3F32T8	E	18	3	F	32	8	11016	1 S	1728	2,754		
57	TBD	1st	Hallway	-	1CF5Exit	-	1	1	CFL	5	24	120	-	n	Exit LED	-	1	1	CFL	5	24	120	-	5			
58	TBD	1st	Classroom #217	55	3F34T12	M	18	3	F	34	8	14688	1 S	Yes	3F32T8	E	18	3	F	32	8	11016	1 S	1728	2,754		
59	TBD	1st	Classroom #214	55	3F34T12	M	18	3	F	34	8	14688	1 S	Yes	3F32T8	E	18	3	F	32	8	11016	1 S	1728	2,754		
60	TBD	1st	Hallway	20	1F34T12	M	5	1	F	34	16	2720	1 S	n	1F32T8	E	5	1	F	32	16	2040	1 S	160			
61	TBD	1st	Gymnasium	10	Metal Halide	N/A	12	1	HPS	175	12	25200	1 S	n	Metal Halide	-	12	1	175	12	12	25200	1 S	144			
62	TBD	1st	Gymnasium	-	1CF5Exit	-	4	1	CFL	5	24	480	-	n	Exit LED	-	4	1	CFL	5	24	480	-	20			
63	TBD	1st	Gymnasium	10	1F32T8	E	4	1	F	32	12	1536	1 S	n	1F32T8	E	4	1	F	32	12	1536	1 S	128			
64	TBD	1st	Storage Closet	25	3F32T8	E	2	3	F	32	1	192	1 S	n	3F32T8	E	2	3	F	32	1	192	1 S	192			
65	TBD	1st	Bathroom	35	3F32T8	E	2	3	F	32	8	1536	1 S	n	3F32T8	E	2	3	F	32	8	1536	1 S	192	614		
66	TBD	1st	Hallway	55	3F32T8	E	4	3	F	32	16	6144	1 S	n	3F32T8	E	4	3	F	32	16	6144	1 S	384			
67	TBD	1st	#315	45	3F32T8	E	12	3	F	32	1	1152	1 S	n	3F32T8	E	12	3	F	32	1	1152	1 S	1152			
68	TBD	1st	Hallway	40	3F32T8	E	4	3	F	32	16	6144	1 S	n	3F32T8	E	4	3	F	32	16	6144	1 S	384			
69	TBD	1st	Hallway	-	1CF5Exit	-	1	1	CFL	5	24	120	-	n	Exit LED	-	1	1	CFL	5	24	120	-	5			
70	TBD	1st	#316	45	3F32T8	E	12	3	F	32	1	1152	1 S	n	3F32T8	E	12	3	F	32	1	1152	1 S	1152			
71	TBD	1st	Hallway	-	1CF5Exit	-	4	1	CFL	5	24	480	-	n	Exit LED	-	4	1	CFL	5	24	480	-	20			
72	TBD	1st	Hallway	50	3F32T8	E	12	3	F	32	16	18432	1 S	n	3F32T8	E	12	3	F	32	16	18432	1 S	1152			
73	TBD	1st	Storage/ Office	25	3F32T8	E	2	3	F	32	8	1536	1 S	n	3F32T8	E	2	3	F	32	8	1536	1 S	192			
74	TBD	1st	Gym Vestibule	30	3F32T8	E	1	3	F	32	12	1152	1 S	n	3F32T8	E	1	3	F	32	12	1152	1 S	96			
75	TBD	1st	Locker Rm Girls	40	3F32T8	E	2	3	F	32	8	1536	1 S	n	3F32T8	E	2	3	F	32	8	1536	1 S	192	614		
76	TBD	1st	#306	65	3F32T8	E	6	3	F	32	1	576	1 S	n	3F32T8	E	6	3	F	32	1	576	1 S	576			
77	TBD	1st	Adjacent Room	45	3F32T8	E	6	3	F	32	1	576	1 S	n	3F32T8	E	6	3	F	32	1	576	1 S	576			
78	TBD	1st	Locker Rm Boys	40	3F32T8	E	2	3	F	32	8	1536	1 S	n	3F32T8	E	2	3	F	32	8	1536	1 S	192	614		
79	TBD	1st	#305	40	2F32T8	E	18	2	F	32	4	4608	1 S	n	2F32T8	E	18	2	F	32	4	4608	1 S	1152			
80	TBD	1st	#304	45	2F32T8	E	2	2	F	32	4	512	1 S	n	2F32T8	E	2	2	F	32	4	512	1 S	128			
81	TBD	1st	Hallway	-	1CF5Exit	-	4	1	CFL	5	24	480	-	n	Exit LED	-	4	1	CFL	5	24	480	-	20			
82	TBD	1st	#303	65	3F32T8	E	4	3	F	32	4	1536	1 S	n	3F32T8	E	4	3	F	32	4	1536	1 S	384			
83	TBD	1st	Library #307	50	3F32T8	E	36	3	F	32	12	41472	1 S	n	3F32T8	E	36	3	F	32	12	41472	1 S	3456			
84	TBD	1st	Storage #310	45	3F32T8	E	2	3	F	32	1	192	1 S	n	3F32T8	E	2	3	F	32	1	192	1 S	192			
85	TBD	1st	Office #209	50	4F32T8	E	4	4	F	32	8	4096	1 S	Yes	4F32T8	E	4	4	F	32	8	4096	1 S	512	1,638		
86	TBD	1st	AV Storage #308	50	4F32T8	E	1	4	F	32	2	256	1 S	Yes	4F32T8	E	1	4	F	32	2	256	1 S	128			
87	TBD	1st	#302	75	3F32T8	E	4	3	F	32	4	1536	1 S	n	3F32T8	E	4	3	F	32	4	1536	1 S	384			
88	TBD	1st	Storage #301	20	3F32T8	E	1	3	F	32	1	96	1 S	n	3F32T8	E	1	3	F	32	1	96	1 S	96			
89	TBD	1st	Closet	30	2F32T8	E	1	2	F	32	1	64	1 S	n	2F32T8	E	1	2	F	32	1	64	1 S	64			
90	TBD	1st	Office #103	95	3F32T8	E	4	3	F	32	8	3072	1 S	n	3F32T8	E	4	3	F	32	8	3072	1 S	384	1,229		
91	TBD	1st	Office #102	95	3F32T8	E	4	3	F	32	8	3072	1 S	n	3F32T8	E	4	3	F	32	8	3072	1 S	384	1,229		
92	TBD	1st	Nurse	75	4F32T8	E	8	4	F	32	8	8192	1 S	Yes	4F32T8	E	8	4	F	32	8	8192	1 S	1024	3,277		
93	TBD	1st	Bathroom	40	4F40T12	M	1	4	F	40	8	1280	1 S	Yes	4F32T8	E	1	4	F	32	8	960	1 S	128	384		
94	TBD	1st	Office Principal	40	4F40T12	M	4	4	F	40	10	6400	1 S	Yes	4F32T8	E	4	4	F	32	10	4800	1 S	512	1,920		
95	TBD	1st	Gym Closet	2	incand	N/A	1	1	I	150	1	150	1 S	n	CFL	-	1	1	CFL	30	1	30	1 S	30			
96	TBD	1st	Gym Closet	2	incand	N/A	1	1	I	65	1	65	1 S	n	CFL	-	1	1	CFL	15	1	15	1 S	15			
97	TBD	1st	Stage	-	incand	N/A	16	1	I	125	0.5	1000	1 S	n	incand	-	16	1	I	125	0.5	1000	1 S	2000			
98	TBD	ext	exterior spotlight	-	HPS lights	-	3	1	HPS	400	12	14400	photo-cells	N/A	HPS lights	-	3	1	400	12	12	14400	photo-cells	36			
99	TBD	ext	exterior spotlight	-	HPS lights	-	8	1	HPS	175	12	16800	photo-cells	N/A	HPS lights	-	8	1	175	12	12	16800	photo-cells	96			
100	TBD	ext	soffit light	-	CF30	-	12	1	CFL	30	12	4320	photo-cells	N/A	CF30	-	12	1	CFL	30	12	4320	photo-cells	360			
101	TBD	ext	soffit light	-	incand	N/A	12	1	I	70	12	10080	photo-cells	N/A	CFL	-	12	1	CFL	15	12	2160	photo-cells	180			
				TOTALS exterior								45,600										37,680					
				TOTALS interior								557,545										474,139	62,336	80,399			
annual consumption (kWh)												122,578											88,564	includes occupancy sensors			
estimated cost (\$/year)												\$20,470											\$14,790				
Canfield Ave. School total light power (Watt)												73,310											62,336				
Canfield Ave. School light power density (Watt/sq ft)												1.22											1.04				
Proposed Annual Savings (kWh)												34,014															
Proposed Annual Cost Savings (\$)												\$5,680															
Proposed Investment (\$)												\$81,775															
surface area (sq ft)												60,000											60,000				
Legend: TBD - T. Baldwin Demarest Elementary School; M - magnetic; E- electronic; F- fluorescent; incand - incandescent; CFL - compact fluorescent lamp; HPS - high pressure sodium																											

Legend: TBD - T. Baldwin Demarest Elementary School; M - magnetic; E - electronic; F - fluorescent; incand - incandescent; CFL - compact fluorescent lamp; HPS - high pressure sodium

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

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

ROCKLAND ELECTRIC SERVICE TERRITORY
Last Updated: 06/15/09

Supplier	Telephone & Web Site	Customer Class	Environmental Label
BOC Energy Services, Inc. 575 Mountain Avenue Murray Hill, NJ 07974	(800) 247-2644 www.boc.com	C/I ACTIVE	
Direct Energy Services, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com	C/I ACTIVE	
Glacial Energy of New Jersey, Inc. 207 LaRoche Avenue Harrington Park, NJ 07640	(877) 569-2841 www.glacialenergy.com	C/I ACTIVE	Available For Review
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07097	(800) 437-7872 www.hess.com	C/I ACTIVE	
Liberty Power Delaware, LLC Park 80 West, Plaza II, Suite 200 Saddle Brook, NJ 07663	(866) 769-3799 www.libertypowercorp.com	C/I ACTIVE	
Liberty Power Holdings, LLC Park 80 West, Plaza II, Suite 200 Saddle Brook, NJ 07663	(866) 769-3799 www.libertypowercorp.com	C/I ACTIVE	
Sempra Energy Solutions The Mac-Cali Building 581 Main Street, 8th Floor	(877) 273-6772 www.semprasolutions.com	C/I ACTIVE	

Woodbridge, NJ 07095			
Strategic Energy, LLC 55 Madison Avenue, Suite 400 Morristown, NJ 07960	(888) 925-9115 www.sel.com	C/I ACTIVE	
Suez Energy Resources NA, Inc. 333 Thornall Street 6th - Floor Edison, NJ 08837	(888) 999-8374 www.suezenergyresources.com	C/I ACTIVE	

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PSE&G SERVICE TERRITORY

Last Updated: 06/15/09

Supplier	Telephone & Web Site	Customer Class
Cooperative Industries 412-420 Washington Avenue Belleville, NJ 07109	800-6BUYGAS (6-289427) www.cooperativenet.com	C/I ACTIVE
Direct Energy Services, LLP 120 Wood Avenue, Suite 611 Iselin, NJ 08830	866-547-2722 www.directenergy.com	R/C/I INACTIVE
Dominion Retail, Inc. 395 Highway 170 - Suite 125 Lakewood, NJ 08701	866-275-4240 http://retail.dom.com	R/C ACTIVE
Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701	800-805-8586 www.gesc.com	R/C/I ACTIVE
UGI Energy Services, Inc. d/b/a GASMARK 704 East Main Street, Suite 1 Moorestown, NJ 08057	856-273-9995 www.ugienergyservices.com	C/I ACTIVE
Great Eastern Energy 116 Village Riva, Suite 200 Princeton, NJ 08540	888-651-4121 www.greateastern.com	C/I ACTIVE
Hess Energy, Inc. One Hess Plaza Woodbridge, NJ 07095	800-437-7872 www.hess.com	C/I ACTIVE

Hudson Energy Services, LLC 545 Route 17 South Ridgewood, NJ 07450	877- Hudson 9 www.hudsonenergyservices.com	C ACTIVE
Intelligent Energy 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024	800-724-1880 www.intelligentenergy.org	R/C/I ACTIVE
Keil & Sons 1 Bergen Blvd. Fairview, NJ 07002	1-877-Systrum www.systrumenergy@aol.com	R/C/I ACTIVE
Metromedia Energy, Inc. 6 Industrial Way Eatontown, NJ 07724	877-750-7046 www.metromediaenergy.com	C ACTIVE
Metro Energy Group, LLC 14 Washington Place Hackensack, NJ 07601	888-53-Metro www.metroenergy.com	R/C ACTIVE
MxEnergy, Inc. 510 Thornall Street, Suite 270 Edison, NJ 088327	800-375-1277 www.mxenergy.com	R/C ACTIVE
NATGASCO (Mitchell Supreme) 532 Freeman Street Orange, NJ 07050	800-840-4GAS www.natgasco.com	C ACTIVE
Pepco Energy Services, Inc. 112 Main Street Lebanon, NJ 08833	800-363-7499 www.pepco-services.com	C/I ACTIVE
PPL EnergyPlus, LLC 811 Church Road - Office 105 Cherry Hill, NJ 08002	800-281-2000 www.pplenergyplus.com	C/I ACTIVE

Sempra Energy Solutions The Mac-Cali Building 581 Main Street, 8th fl. Woodbridge, NJ 07095	877-273-6772 800-2 SEMPRA www.semprasolutions.com	C/I ACTIVE
South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037	800-756-3749 www.sjindustries.com/sje.htm	C/I ACTIVE
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928	800-225-1560 www.spragueenergy.com	C/I ACTIVE
Stuyvesant Energy LLC 10 West Ivy Lane, Suite 4 Englewood, NJ 07631	800-646-6457 www.stuyfuel.com	C ACTIVE
Woodruff Energy 73 Water Street Bridgeton, NJ 08302	800-557-1121 www.woodruffenergy.com	R/C/I ACTIVE

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