Honeywell

Honeywell Building Solutions

December 1, 2010

ENERGY SAVINGS PLAN

Presented To:

Frankford Township School District

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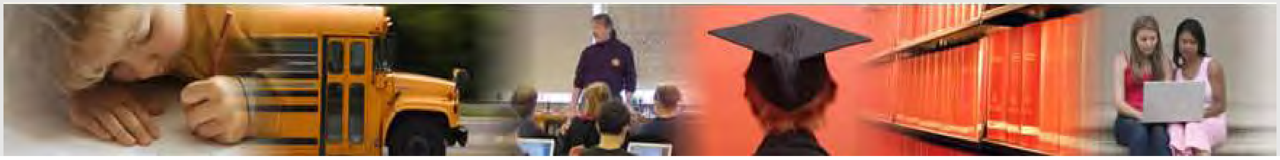

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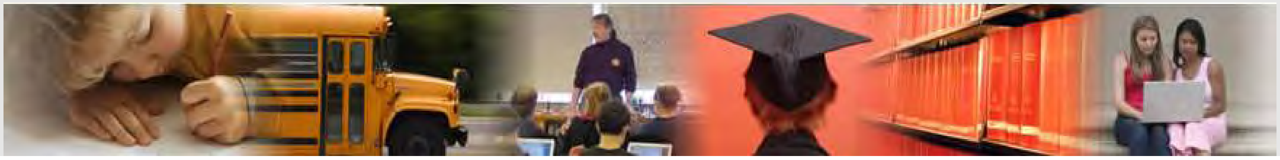

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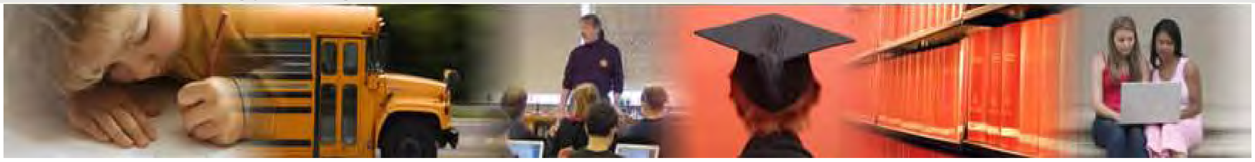


Executive Summary and Overview

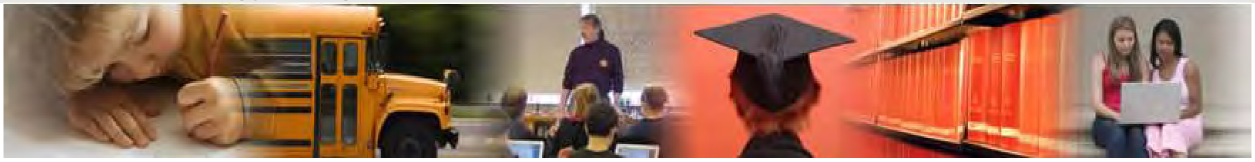
Honeywell is pleased to submit an energy savings plan for the Frankford School District in response to the RFP issued in July of 2010.

Based on Honeywell's extensive experience in working with school districts, we are confident that we will be able to deliver a financially viable, comprehensive solution for your buildings that will address existing facility concerns. Our plan will encompass projects that achieve both energy and operational efficiencies and create a more comfortable and safe environment via an actionable Energy Savings Improvement Program (ESIP) in accordance with NJ PL2009, c.4.

The Energy Savings Plan is the core of the ESIP process. It describes the energy conservation measures that are planned and the cost calculations that support how the plan will pay for itself in reduced energy costs. Under the law, the Energy Savings Plan (ESP) must address the following elements:

- The results of the energy audit;
- A description of the energy conservation measures (ECMs) that will comprise the program;
- An estimate of greenhouse gas reductions resulting from those energy savings;
- Identification of all design and compliance issues and identification of who will provide these services;
- An assessment of risks involved in the successful implementation of the plan;
- Identify the eligibility for, and costs and revenues associated with the PJM Independent System Operator for demand response and curtail-able service activities;
- Schedules showing calculations of all costs of implementing the proposed energy conservation measures and the projected energy savings;
- Maintenance requirements necessary to ensure continued energy savings, and describe how they will be provided; and
- If developed by an ESCO, a description of, and cost estimates of a proposed energy savings guarantee.

It is the intent of this document to provide all the required information for the Frankford School District to determine the next steps in implementing an ESIP throughout the districts' buildings. The next step is to develop a specific agreement authorizing Honeywell to proceed with an implementation program that meets the requirements of the law and of your RFP.



The ECMs selected by the School District will serve as the basis of that agreement and may be of any combination of projects outlined in this plan so long as they pay for themselves in accordance with PL2009, C.4.

Our ESP is organized to clearly define compliance with the law in a structure that provides for an informed decision in selecting ECMs, as well as projecting costs, savings and greenhouse gas reductions.

Section A: Independent Energy Audit – This section includes, as reference, the independent energy audit as previously received by the Board in March of 2010. The entire audit is included in Section A, and a comparison can be made of the ECMs outlined in that audit to the additional ECMs described in the overall ESP.

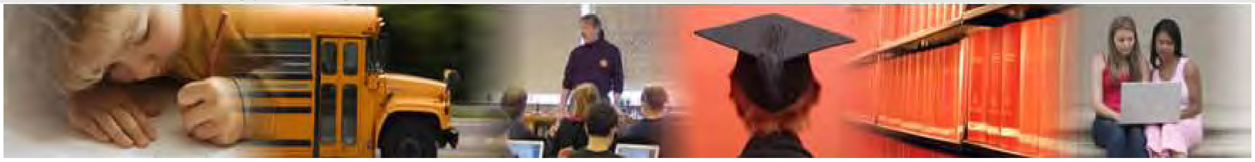
The remainder of this section includes a baseline Preliminary Utility Analysis (PUA) which is an overview of the current usage within the District and a cost per square foot by school for utility expenses. This report clearly defines the current expenses for the School District and compares it to the costs of other school districts in the region as a benchmark. Within this benchmarking process, we have identified that the schools have between a 128 and 180 Energy Use Intensity (EUI) rating. This rating indicates where the schools' energy use compares to the regional mean standard for energy efficiency and consumption. This indicates that there is room for improvement within the plan we have outlined for the District.

Section B: Identified Energy Conservation Measures – This section includes a more detailed description of the ECMs we have selected and identified for your District. It is specific by school, scope, savings methodology and environmental impact. It is intended to provide an overview of the projects and not detailed specifications for construction. It identifies ALL potential ECMs for the District for the purposes of inclusion in the program. Final selected ECMs are to be determined by the School District in conjunction with Honeywell during the Project Development Phase of the ESIP process.

Section C: Financial Analysis – This section spells out the financial impact of each ECM in simple payback terms without financing costs and in accordance with PL2009, c.4.

In addition to the first spreadsheet that outlines ALL ECMs considered, we have identified a SAMPLE recommended project along with a SAMPLE cash flow. We have also included another group of ECM's as a POTENTIAL projects for your consideration. Ultimately, during the Project Development Phase we will provide you with recommendations and the school district will select the direction of the projects based on your goals and objectives.

All ECM's – This scenario will not meet the requirements of the 15-year term in accordance with PL 2009, C.4. However, it is important to identify these projects within this energy plan for potential implementation at a later date under the current ESIP legislation.



Recommended Sample Project – This is an overview of a project that may be accomplished in the School District that will not add additional burden on your tax payers. It can be funded completely through energy and operational savings. When structured financially, the School District will not incur any out of pocket costs and pay for all upgrades from money that is already being spent elsewhere in the District. Over the term of the project, the School District will be in a positive cash flow situation.

The School District is well positioned to implement a program that can pay for itself within the requirements of the law while upgrading your facilities with zero impact on your taxpayer base.

Section D: Energy Calculations and Greenhouse Gas Reduction Summary – This section includes all the required energy calculations to ensure compliance with the law and to confirm the energy savings can and will be achieved. These calculations are in fact subject to an independent third-party engineering firm review for verification.

A summary of all savings include a **reduction in 320,728 kWh** (kilowatt hours of electricity), **26,954.8 Therms** (Gas) and **347.5 Tons of Greenhouse Gas (GHG) emissions**. It is the equivalent of removing **60.7 cars** from the road for an entire year and is the same as planting **36.6 acres of forest**.

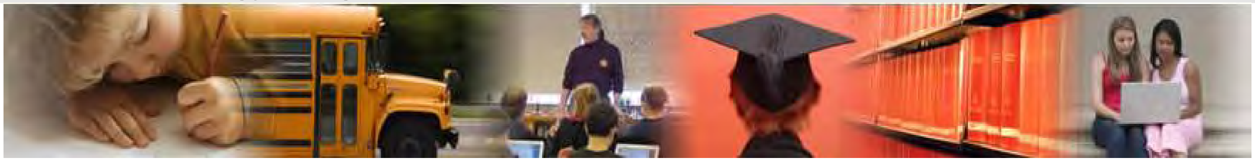
Section E: M&V/Preventive Maintenance Summary – This section includes all available methods of verification and measurement of calculating energy savings. These methods are compliant with the International Measurement and Verification protocols as well as other protocols previously approved by the Board of Public Utilities in New Jersey. This section also includes the recommended maintenance requirements for each type of equipment that may be included in this program. Consistent maintenance is essential to achieving the energy savings outline in this plan

Section F: Design Approach – This section includes a summary of Honeywell's best practices in the successful implementation of an ESIP project. It provides an overview of our project management procedure, construction management and a sample time frame for the overall completion of the project. Within the sample schedule, we clearly define the stage designated for compliance with architectural, engineering and bidding procedures in accordance to New Jersey Public Contracts Law.

We welcome this opportunity to partner with your District in the improved operation and efficiency of your facilities with the successful implementation of this energy savings plan.

Sincerely,

Joseph J. Coscia
Account Executive
Honeywell International



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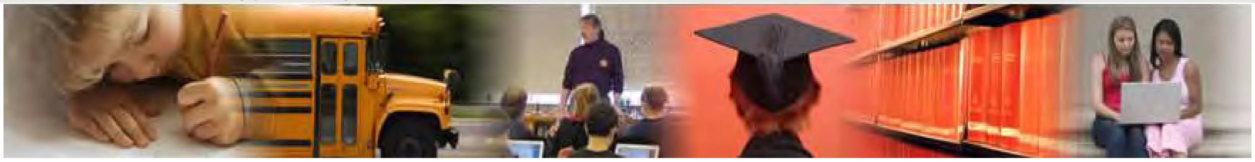
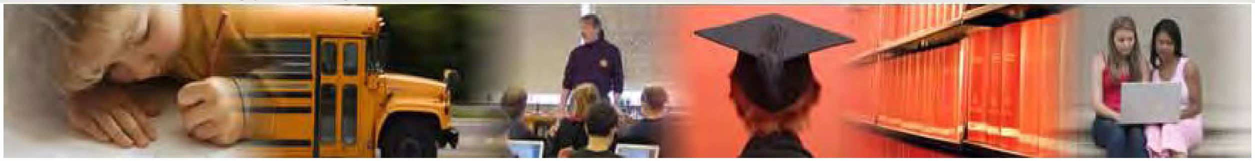


Audit Reports
Section A

- **Independent Audit Report**
- **Preliminary Utility Analysis**



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March 10, 2010

Local Government Energy Program
Energy Audit Report

Frankford Township School

Branchville, NJ 07826

Project Number: LGEA52

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INTRODUCTION

On February 11th, 2010 Steven Winter Associates, Inc. (SWA) performed an energy audit and assessment for the Frankford Township School building. The building is located at 2 Pines Rd, Branchville, NJ 07826, in Sussex County. The current conditions and energy-related information were collected in order to analyze and facilitate the implementation of energy conservation measures for the building.

The one story Frankford Township School building was originally built in 1950, with additions constructed in 1958, 1968, and 1974. The building houses the Frankford Elementary and Middle School, grades one through eight. The building consists of approximately 90,000 square feet of conditioned spaces. The building includes classrooms, administrative offices, cafeteria, a library, music room, home economics room, a computer lab, an all purpose room, and boiler rooms. The building is occupied on weekdays with 630 students from 8am to 4pm and 105 faculty / staff employees from 6am to 11pm, September through mid-June.

The goal of this Local Government Energy Audit (LGEA) is to provide sufficient information to the Frankford Township School Board of Education to make decisions regarding the implementation of the most appropriate and most cost effective energy conservation measures for the Frankford Township School building.

Launched in 2008, the LGEA Program provides subsidized energy audits for municipal and local government-owned facilities, including offices, courtrooms, town halls, police and fire stations, sanitation buildings, transportation structures, schools and community centers. The Program will subsidize 75% of the cost of the audit. If the net cost of the installed measures recommended by the audit exceeds the remaining cost of the audit, then that additional 25% will also be paid by the program. The Board of Public Utilities (BPUs) Office of Clean Energy has assigned TRC Energy Services to administer the Program.

EXECUTIVE SUMMARY

The energy audit performed by Steven Winter Associates (SWA) encompasses the Frankford Township School building located at 2 Pines Rd, Branchville, NJ 07826. The one story Frankford Township School building was originally built in 1950, with additions constructed in 1958, 1968, and 1974. The building consists of approximately 90,000 square feet of conditioned spaces. The building includes both the elementary and middle school.

Based on the field visits performed by the SWA staff on February 11th 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 and cooling energy use.

From April 2008 to March 2009 the Frankford Township School building consumed 590,800 kWh or $98,277 worth of electricity at an approximate rate of $0.166/kWh and 41,458 gallons (58,041 therms) or $86,354 worth of fuel oil #2 at an approximate rate of $2.083/gallon ($1.488/therm). The joint energy consumption for the building, including both electricity and fuel oil #2, was 7,820MMBtu of energy that cost a total of $184,631.

SWA has entered energy information about the Frankford Township School building in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. The building received a score of 59 when compared to similar school buildings. Buildings achieving an Energy Star rating of 75 are eligible to apply for the Energy Star award and receive the Energy Star plaque to convey superior performance. These ratings also greatly help when applying for Leadership in Energy and Environmental Design (LEED) building certification through the United States Green Building Council (USGBC). SWA encourages the Board of Education to continue entering utility data in *Energy Star Portfolio Manager* in order to track weather normalized source energy use over time.

The Site Energy Use Intensity is 86.0 kBtu/ft^{2}yr compared to the national average of a school building consuming 94.0 kBtu/ft^{2}yr. Implementing the recommendations included in this report will reduce the building energy consumption by approximately 14.5 kBtu/ft^{2}yr. There may be energy procurement opportunities for the Frankford Township School to reduce annual utility costs, which are $6,703 higher, when compared to the average estimated NJ commercial utility rates.

Based on the assessment of the Frankford Township School building, SWA has separated the recommendations into three categories (See Section 4 for more details). These are summarized as follows:

Category I Recommendations: Capital Improvement Measures

- Insulate exterior walls
- Replace wood doors in classrooms
- Replace 1972 roof section
- Replace single pane windows
- Upgrade building per ADA requirements
- Replace unit ventilators
- Replace (2) H&V units serving the Large Gym and Multipurpose Room
- Replace (1) H&V units serving the Small Gym

- In lieu of DX cooling systems recommended above, add chilled water cooling system
- In lieu of DX cooling systems recommended above, add conventional water source heat pumps
- In lieu of chilled water or DX cooling systems recommended above, add geothermal cooling and heating system
- Upgrade Building Management System (BMS)
- Replace common area heating equipment
- Replace window air conditioners
- Upgrade electric service
- Provide code minimum ventilation air to all rooms lacking adequate ventilation
- Consider replacement of the 1968 Bally walk-in cooler/freezer
- Consider replacement of the reach-in milk cooler in cafeteria
- Install premium motors when replacements are required

Category II Recommendations: Operations and Maintenance

- Correctly install fiberglass batt attic insulation (air seal prior to installation)
- Inspect and replace gasketing around door into the walk-in refrigeration boxes in the Kitchen and outside.
- Water levels in the expansion tanks and the integrity of the tank bladder should be checked to confirm proper operation.
- Use Energy Star labeled appliances
- Maintain roofs
- Maintain downspouts
- Provide weather stripping / air sealing
- Preventative exterior wall maintenance
- Use smart power electric strips
- Create an energy educational program

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

At this time, SWA highly recommends a total of **8** Energy Conservation Measures (ECMs) for the Frankford Township School building that are summarized in Table 1. The total investment cost for these ECMs is **$23,977**. SWA estimates a first year savings of **$9,188** with a simple payback of **2.6 years**. SWA estimates that implementing the highly recommended ECMs will reduce the carbon footprint of the Frankford Township School building by **76,353 lbs of CO_2**, which is equivalent to removing approximately 6 cars from the roads each year or avoiding the need of 186 trees to absorb the annual CO_2 generated. SWA also recommends **3** ECMs with payback greater than 5 years summarized in table 2, which result in a first year savings of **$905**. SWA also recommends **7** Over 10 year Payback and End of Life Cycle ECMs with a total first year savings of **$33,295** that are summarized in Table 3.

Institutional buildings with an average annual peak demand over 200 kW (Frankford Township School peak demand is about 206 kW) are eligible to participate in the NJ Clean Energy Pay for Performance program. Incentives for electricity and fuel oil #2 savings will be paid based on actual savings, provided that the minimum performance threshold of 15% savings has been achieved. To participate, select a Program Partner from an approved partner list and submit Application Package with your Partner's assistance. Reducing 15% of the energy use at Frankford Township School will be challenging without undertaking significant investment.

There are various incentives that Township of Lower could apply for that could also help lower the cost of installing the ECMs. SWA recommends that the Frankford Township School 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, could also assist to cover 80% of the capital investment. SWA strongly encourages that the Frankford Township School proceeds to move forward with the Direct Install program in order to offset the cost of the recommended lighting measures.

Renewable ECMs require application approval and negotiations with the utility and proof of performance. There is also a utility-sponsored loan program through JCP&L that would allow the building to pay for the installation of the PV system through a loan issued by the utility.

The following tables summarize the proposed Energy Conservation Measures (ECMs) and their economic relevance. In order to clearly present the overall energy opportunities for the building and ease the decision and choice of which ECM to implement, SWA calculated each ECM independently and did not incorporate slight/potential overlaps between some of the summarized ECMs (i.e. lighting change influence on heating/cooling).

Table 1 - Highly Recommended 0-5 Year Payback ECMs

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
2	Install 3 Drinks vending machine misers	www.usatech.com and established costs	$ 837	$ -	$ 837	4,316	1.4	-	0	$ -	$ 699	12	$ 8,390	1.2	902	75	112	$ 8,500	5,913
3.4	11 New motion sensors to be installed with incentives	RS Means, lit search	$ 2,420	$ 220	$ 2,200	5,902	1.2	N/A	0	$ -	$ 956	15	$ 14,342	2.3	552	37	43	$ 9,051	8,086
4.1	Replace (2) 7.5 Hp hot water circulator pump motors with Premium Efficiency	similar projects, DOE International Motor Master selection & savings analysis	$ 1,112	$ 162	$ 950	2,173	0.5	-	0	$ -	$ 361	20	$ 7,214	2.6	659	33	38	$ 4,417	2,977
3.3	88 New occupancy sensors to be installed with incentives	RS Means, lit search	$ 19,360	$ 1,760	$ 17,600	40,404	8.4	N/A	2	$ -	$ 6,545	15	$ 98,182	2.7	458	31	37	$ 59,421	55,354
4.4	Replace (2) 3 Hp domestic hot water pump motor with Premium Efficiency	similar projects, DOE International Motor Master selection & savings analysis	$ 714	$ 108	$ 606	1,113	0.2	-	-	$ -	$ 185	20	$ 3,695	3.3	510	25	30	$ 2,143	1,525
1	Replace old refrigerator with 18 cu ft Energy Star refrigerator	Energy Star purchasing and procurement site, similar projects	$ 750	$ -	$ 750	1,200	0.1	-	-	$ -	$ 199	12	$ 804	3.8	7	1	1	$ (83)	501
5.1	Replace Cooler Evap Fan Motor with Premium Efficiency Motor	Manufacturer's Operations Data, DOE International Motor Master Savings analysis	$ 500	$ -	$ 500	800	0.2	-	-	$ -	$ 133	20	$ 2,656	3.8	431	22	26	$ 1,476	1,096
4.2	Replace (2) 2 Hp hot water circulator pump motors with Premium Efficiency	similar projects, DOE International Motor Master selection & savings analysis	$ 642	$ 108	$ 534	658	0.1	-	-	$ -	$ 109	20	$ 2,185	4.9	309	15	20	$ 1,091	901
	TOTALS		**$ 26,335**	**$ 2,358**	**$ 23,977**	**56,566**	**12.1**	**0**	**2.0**	**$ -**	**$ 9,188**		**$ 137,469**	**2.6**				**$ 86,016**	**76,353**

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

Table 2 - Recommended 5-10 Year Payback ECMs																				
ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
5.2	Replace Freezer Evap Fan Motor with Premium Efficiency Motor	Manufacturer's Operations Data, DOE International Motor Master Savings analysis	$ 500	$ -	$ 500	600	0	0	0.0	$ -	$ 100	20	1,992	5.0	298	15	19	$ 982	822
4.3	Replace (2) 1.5 Hp domestic hot water pump motor with Premium Efficiency	similar projects, DOE International Motor Master selection & savings analysis	$ 606	$ 90	$ 516	584	0	0	0.0	$ -	$ 97	20	1,939	5.3	276	14	18	$ 926	800
11	Demand Control Ventilation for Cafeteria & MP Room AHUs	RS Means Cost Data & Similar Projects	$ 6,000	$ -	$ 6,000	680	0	400	0.5	$ -	$ 708	15	10,620	8.5	77	5	8	$ 2,452	5612
	TOTALS		**$ 7,106**	**$ 90**	**$ 7,016**	**1864**	**0.3**	**400**	**0.5**	**$ -**	**$ 905**		**14,551**	**7.8**				**$ 4,360**	**7,234**

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
Table 3 - Recommended Over 10 Year Payback and End of Life Cycle ECMs																			
7a	Cost to replace boilers with modulating high efficiency oil-fired boilers	Similar Projects	$ 170,000	$ -	$ 170,000	-	-	9,000	10	$ 1,820	$ 15,210	25	$ 334,755	11.2	124	5	7	$ 94,857	105,300
3.1	823 New T8 fixtures to be installed with incentives	RS Means, lit search	$ 154,183	$ 24,690	$ 129,493	21,529	4.5	-	1	$ 6,995	$ 10,482	15	$ 157,236	12.4	21	1	3	$ (6,146)	29,495
8a	Replace (1) packaged 6-ton electric cooling rooftop HVAC unit with high efficiency unit	similar projects	$ 16,000	$ 438	$ 15,562	1,750	0.4	-	-	$ 900	$ 1,191	15	$ 4,358	13.1	15	1	2	$ (1,350)	2,398
6	Utilize tank type domestic water heater instead of boilers	Similar Projects	$ 16,000	$ -	$ 16,000	-	-	790	1	$ -	$ 1,175	15	$ 17,630	13.6	10	1	1	$ (1,969)	9,243
10a	Replace reach-in stainless steel refrigerator with 42 cu ft Energy Star refrig	Energy Star purchasing and procurement site, similar projectsefficiency unit	$ 13,000	$ -	$ 13,000	4,130	0.9	-	-	$ -	$ 644	12	$ 7,731	20.2	(41)	(3)	(7)	$ (6,587)	5,658
3.2	8 New pulse start metal halide fixtures to be installed with incentives	RS Means, lit search	$ 5,798	$ 200	$ 5,598	1,739	0.4	-	0	$ (51)	$ 231	15	$ 3,465	24.2	38	3	(5)	$ (2,879)	2,382
9a	Replace 40 exhaust fans with premium efficiency units	similar projects, DOE Motor Master International	$ 128,000	$ -	$ 128,000	7,000	1.5	-	0	$ 3,200	$ 4,362	10	$ 11,620	29.3	(66)	(7)	N/A	$ (90,791)	9,590
	TOTALS		**$ 502,981**	**$25,328**	**$ 477,653**	**36,148**	**7.6**	**9,790**	**12**	**$12,864**	**$ 33,295**		**$ 536,795**					**$ (14,866)**	**164,066**

Table 4 - Renewable Energy ECMs																				
ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
12	Install 151.2 kW PV rooftop system with incentives	similar projects	$ 1,171,800	$ -	$ 1,171,800	161,025	151.0	N/A	6.1	0	$ 123,345	25	$ 668,254	9.5	92.5	3.7	8.2	$ 552,593	220,604
12a	Install 49.7 kW PV rooftop system with incentives	similar projects	$ 385,175	$49,700	$ 335,475	53,920	50.0	N/A	2.0	0	$ 41,303	25	$ 223,768	8.1	654	26.2	43.8	$1,598,883	73,870

1. HISTORIC ENERGY CONSUMPTION

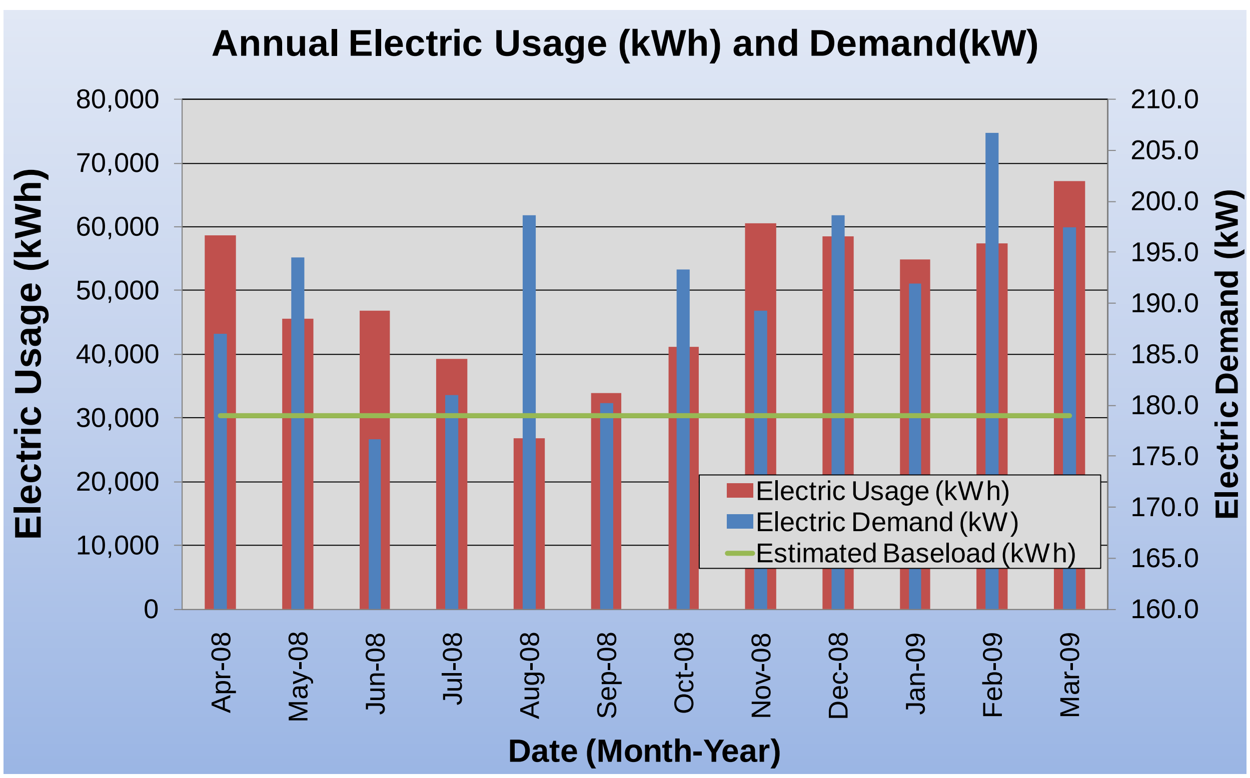
1.1. Energy usage and cost analysis

SWA analyzed utility bills from April 2008 through March 2009 that were received from the BOE and the oil company supplying the Frankford Township School building fuel oil #2.

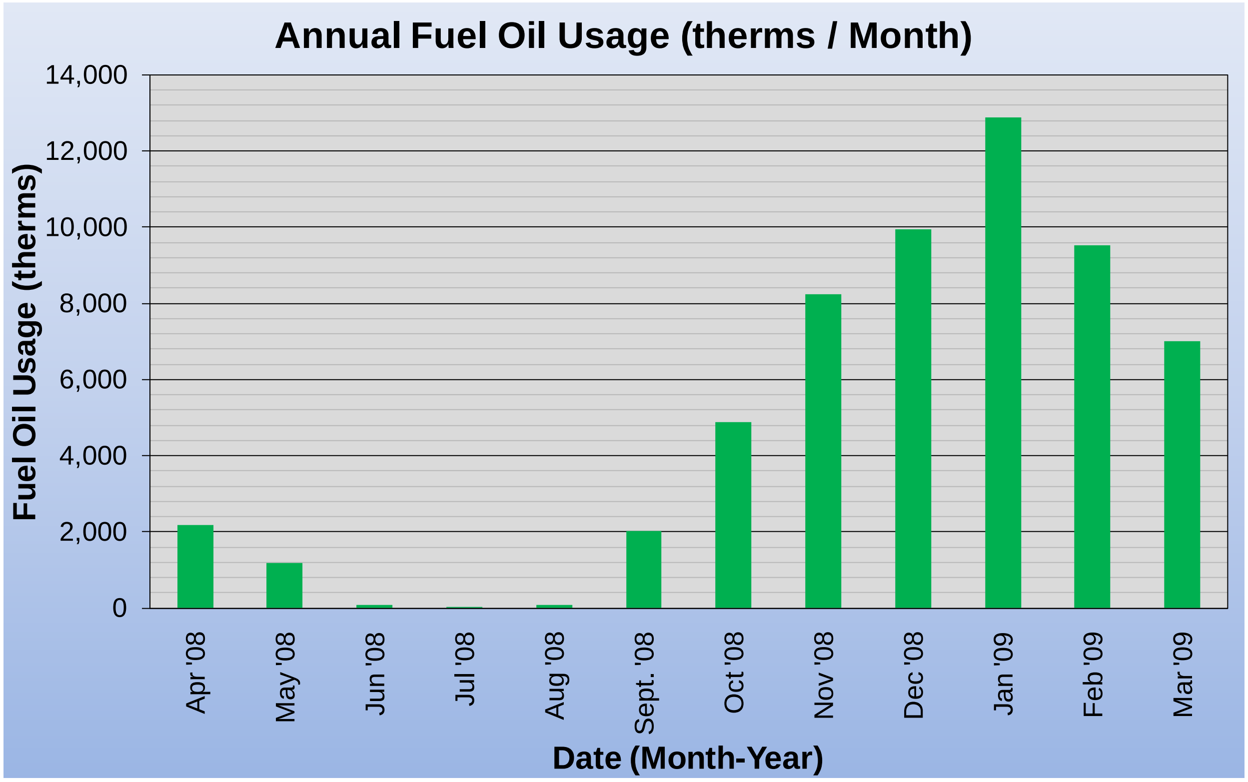
Electricity - The Frankford Township School building is currently served by one electric meter. The Frankford Township School building currently buys electricity from JCP&L at **an average rate of $0.166/kWh** based on 12 months of utility bills from April 2008 to March 2009. The Frankford Township School building purchased **approximately 590,800 kWh or $98,277 worth of electricity** in the previous year. The average monthly demand was 191 kW.

Fuel oil #2 - The Frankford Township Frankford Township School building is currently receiving deliveries for fuel oil #2. The Frankford Township School building currently buys fuel oil #2 from Finch Fuel Oil at **an average aggregated rate of $2.083/gallon or $1.488/therm** based on 12 months of oil receipts for April 2008 to March 2009. The Frankford Township Frankford Township School building purchased **approximately 41,458 gallons (58,041 therms) or $86,354 worth of fuel oil #2** in the previous year.

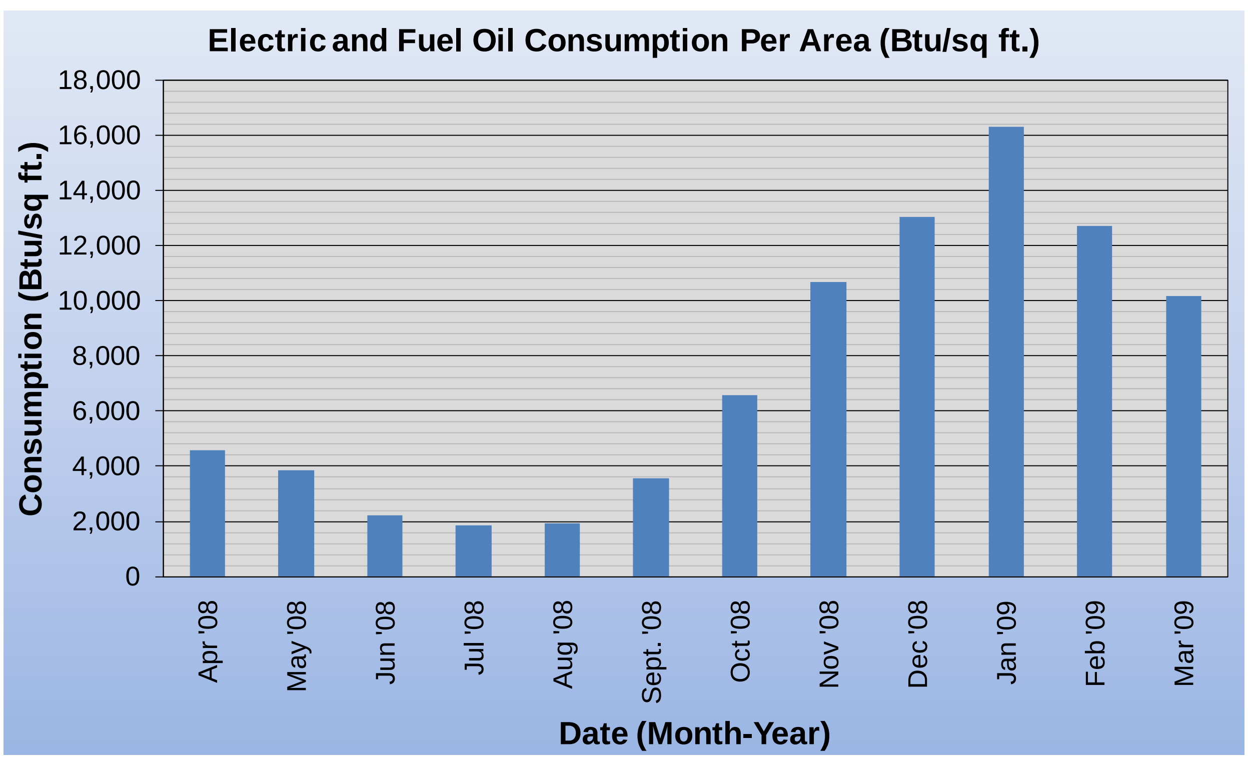
The following chart shows electricity use for the Frankford Township School building based on utility bills for the 12 month period of April 2008 to March 2009.



The following chart shows the fuel oil #2 estimated energy used for the Frankford Township School building based on receipts for the 12 month period of April 2008 to March 2009. SWA estimated the monthly energy use based on HDD and assumed 1,230 therms used for DHW:

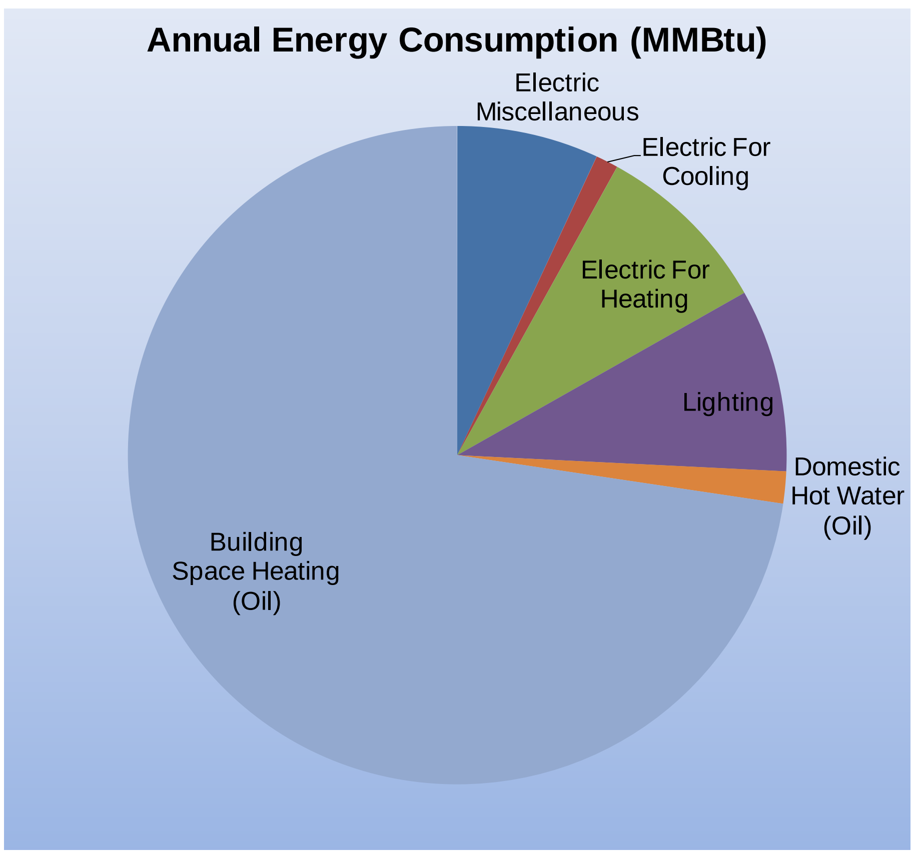


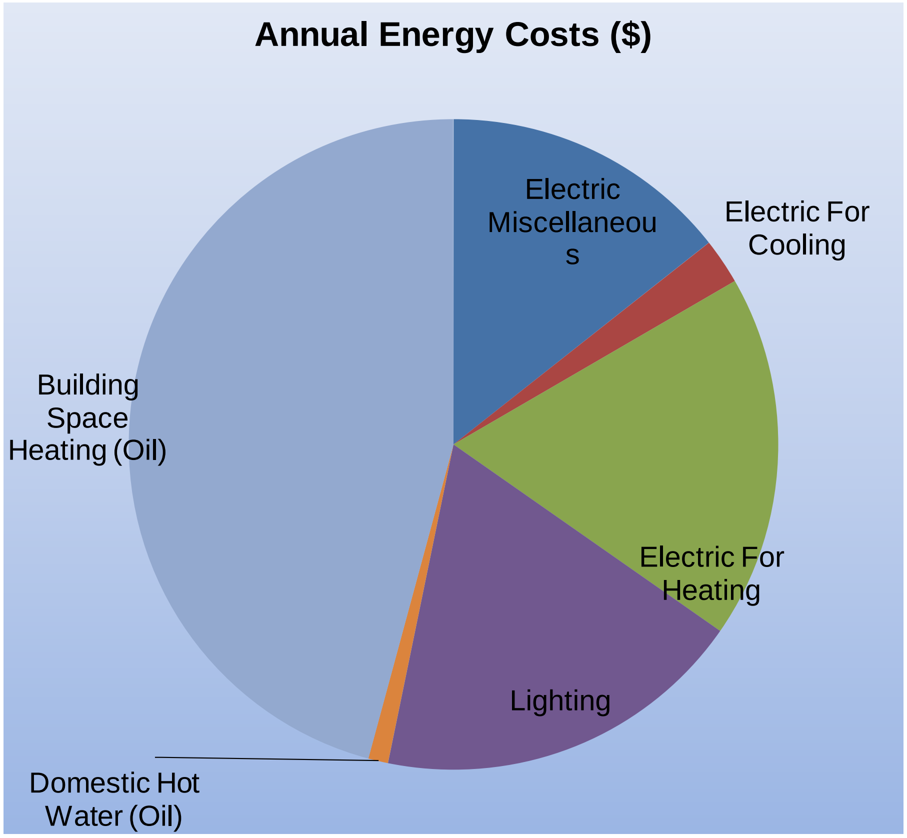
The following chart shows combined fuel oil #2 and electric consumption in Btu/sq ft for the Frankford Township School building based on utility bills and oil receipts for the 12 month period of April 2008 to March 2009.



The following table and pie chart show energy use for the Frankford Township School building based on utility bills for the 12 month period of April 2008 to March 2009. Note electrical cost at $49/MMBtu of energy is more than 3.2 times as expensive to use as fuel oil #2 at $15/MMBtu.

Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	$	% $	$/MMBtu
Electric Miscellaneous	544	7%	$26,503	14%	49
Electric For Cooling	86	1%	$4,205	2%	49
Electric For Heating	685	9%	$33,389	18%	49
Lighting	701	9%	$34,180	19%	49
Domestic Hot Water (Oil)	123	2%	$1,824	1%	15
Building Space Heating	5,681	73%	$84,529	46%	15
Totals	7,820	100%	$184,631	100%	
Total Electric Usage	2,016	26%	$98,277	53%	49
Total Oil Usage	5,804	74%	$86,354	47%	15
Totals	7,820	100%	$184,631	100%	





1.2. Utility rate

The Frankford Township School building currently purchases electricity from its utility at a general service market rate for electricity use (kWh) with a separate (kW) demand charge. The Frankford Township School building currently pays an average rate of approximately $0.166/kWh based on the 12 months of utility bills of April 2008 to March 2009.

The Frankford Township School building currently purchases fuel oil #2 supplied by Finch Fuel Oil at the prevailing market rates for fuel oil #2. The average aggregated rate (supply and transport) for the oil is approximately $2.083/gallon ($1.48/therm) based on 12 months of fuel oil bills for April 2008 to March 2009.

1.3. Energy benchmarking

SWA has entered energy information about the Frankford Township School building in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. The building received a score of 59 when compared to other school buildings of its kind. 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 that conveys superior energy 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).

The Site Energy Use Intensity is 86.0 kBtu/sqft compared to the national average intensity of school buildings consuming 94.0 kBtu/sqft. Implementing this report's highly recommended Energy Conservations Measures (ECMs) will reduce use by approximately 2.0 kBtu/sqft with an additional 12.5 kBtu/sqft from the other recommended measures. Additionally, the building can offset 6.1 kBtu/sqft from installing a 151.2 kW PV rooftop system. These recommendations could account for at least 20.6 kBtu/sq ft yr reduction, which when implemented would make the building energy consumption even lower.

SWA has created the Portfolio Manager site information for Frankford Township School Board of Education. Access is also allowed to TRC. This information can be accessed at the following: https://www.energystar.gov/istar/pmpam/ with the following:

Username: FrankfordTwpSchool
Password: FRANKFORDSCHOOL

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Frankford Township School District - Township School

Building ID: 2051577
For 12-month Period Ending: March 31, 2009[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: March 02, 2010

Facility
Frankford Township School District - Township School
2 Pines Road
Branchville, NJ 07826

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1950
Gross Floor Area (ft²): 90,000

Energy Performance Rating[2] (1-100) 59

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	2,015,810
Fuel Oil (No. 2) (kBtu)	5,749,831
Natural Gas - (kBtu)[4]	0
Total Energy (kBtu)	7,765,641

Energy Intensity[5]	
Site (kBtu/ft²/yr)	86
Source (kBtu/ft²/yr)	139

Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	730

Electric Distribution Utility
FirstEnergy - Jersey Central Power & Lt Co

National Average Comparison	
National Average Site EUI	94
National Average Source EUI	152
% Difference from National Average Source EUI	-8%
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[6] 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 units of volume (e.g. cubic feet) 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.

EPA Form 5900-16

2. FACILITY AND SYSTEMS DESCRIPTION

2.1. Building Characteristics

The one story Frankford Township School building was originally built in 1950, with additions constructed in 1958, 1968, and 1974. The building consists of approximately 90,000 square feet of conditioned spaces. The building includes classrooms, administrative offices, cafeteria, a library, music room, home economics room, a computer lab, an all purpose room, and boiler rooms.

2.2. Building occupancy profiles

The building houses the Frankford Elementary and Middle School, grades one through eight. The building is occupied on weekdays with 630 students from 8am to 4pm and 105 faculty / staff employees. The building remains unoccupied over the weekend. There is a scheduled two-week summer program that runs irregularly.

2.3. Building envelope

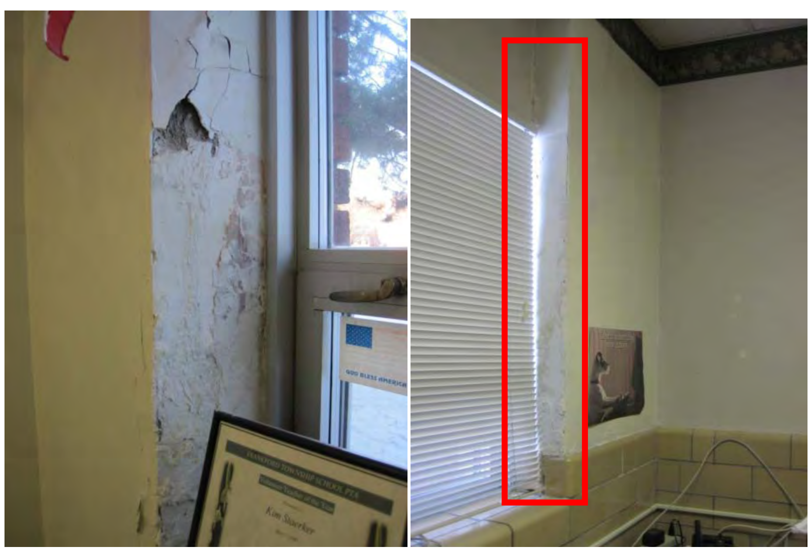
2.3.1. Exterior Walls

The exterior wall assemblies consist of a brick veneer (with EIFS above certain windows), aluminum framed window wall panels with certain sections containing 2x6 wood framed walls or with CMU (Concrete Masonry Unit) walls. Interior wall finishes are a mixture of lath and plaster, tile, painted CMU and gypsum wall board. During the next major renovation, SWA recommends insulating the exterior walls to the current local building code by adhering 2" polyiso boards (Polyisocyanurate) together with furring strips and gypsum wall boards to the inside of the painted CMU walls.

Exterior wall assembly (portion of Elementary School)

Exterior wall assembly types

Water damage EIFS



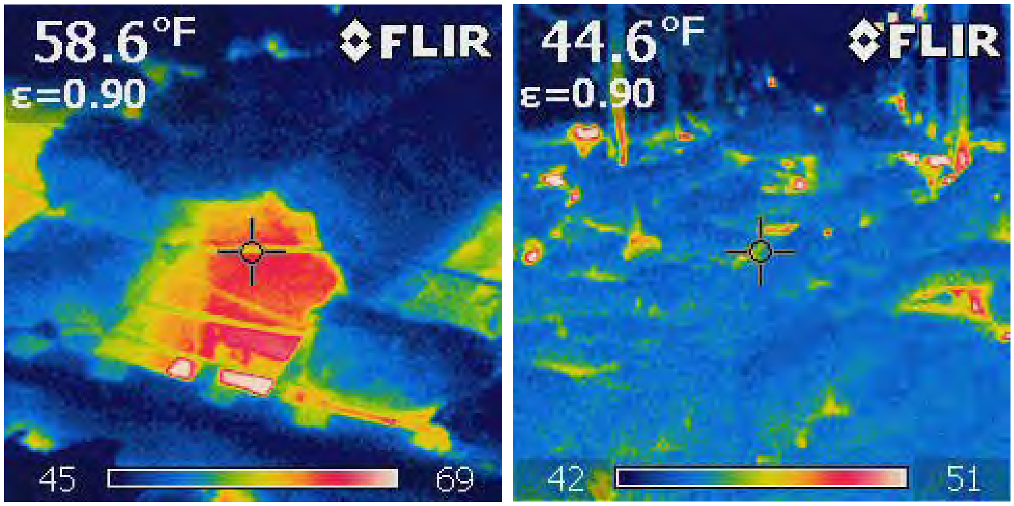
Interior wall finish – lath and plaster wall damage

Overall the exterior wall assemblies of the building appear to be in excellent condition with no major issues of concern. There were no additional areas of concern mentioned to SWA at the time of the building audit. SWA recommends regular maintenance to exterior walls, re-pointing brick veneer, caulking around windows or doors, and removing all damage due to insects or rodents. Attention and maintenance should be given to these areas as uncontrolled roof water runoff can potentially penetrate exterior walls and cause energy losses and structural damage. Special attention should be given to roof drainage to avoid water damage to exterior wall assemblies.

2.3.2. Roof

The Frankford Township School roof sections were upgraded in 1996 (pitched asphalt roof section,) in 2001 for EPDM roof section (over classrooms & gymnasium), 1972 for the EPDM roof section over the kitchen, small gym and classrooms and the 2009 EPDM roof section was installed over the music rooms, science lab, and computer lab. At the time of the audit SWA was not able to access the roof due to snow and safety concerns. SWA auditors were told that in-house maintenance personnel perform regular maintenance on all roof sections. Also, SWA was told that during the 2009 roof upgrade additional sealing seams and re-tarring was done around the perimeter of the building. A full set of building drawings was not available to confirm insulation levels for the flat roof sections of the building. The pitched roof section of the building contains approximately 12" of faced fiberglass batts haphazardly placed on the attic floor. This area contains sufficient insulation although SWA recommends installing the fiberglass batts evenly both between the ceiling joists and across the ceiling joists. In order for insulation to perform effectively an air barrier should be installed and in constant and even contact with the insulation. As seen in infrared images below there is considerable heat loss of expensive conditioned air due to penetrations from areas below and from inconsistent insulation. Before removing and installing insulation properly SWA suggests air sealing all penetrations including top-plates, plumbing, HVAC ductwork, electrical penetrations, etc, with (fire-rated) caulk or foam. Improvements such as these may offer further comfort benefits and help to reduce energy loss.

Fiberglass insulation haphazardly displaced



Infrared images showing heat loss with missing batt insulation and haphazard installation

Image showing damaged ceiling tiles in classroom

At the time of the audit, SWA was told there are no roof leaks or roof maintenance issues. Damaged ceiling tiles should be checked and replaced in concern for indoor air quality. Regular maintenance should be performed to prevent potential damage to the integrity of the roofing system. When it is time for roof replacement (considering the 1972 roof section), SWA recommends an Energy Star certified roof membrane and rigid insulation (3”) assembly.

2.3.3. Base

There is a CMU walled tunnel under the Elementary School portion of the building with uninsulated walls (under the A wing of the building). According to building staff the purpose of the design was for under-floor hot air flow, but it is no longer used. The rest of the building’s base is an uninsulated 4” concrete slab-on grade with a perimeter footing and concrete block stem walls. At the time of the audit snow was melting off the roof and water was pooling in certain areas due to either insufficient grading and/or the downspouts not extending far enough from the base of the building. SWA recommends extending downspouts, installing french drains, or connecting downspouts underground storm water system. No water seepage through the slab or other issues related to thermal performance was detected.

Water pooling at base of building due to extreme weather condition

2.3.4. Windows

The windows of the school building are single pane, aluminum framed windows and appear to be in fair condition. The seals of the windows are ineffective and do not provide an air tight seal from exterior conditions, increasing the loss of expensive conditioned air. The windows are non-thermal break single glazed with un-insulated panels above them and are energy inefficient. SWA recommends replacement of the single pane windows as part of capital improvement and suggests replacing the existing windows with double-glazed thermal break low-E aluminum framed units. Regular maintenance should be performed, re-caulking around the perimeter of windows (exterior and interior) to ensure a tight seal.

Open window on day of audit, approximately 28°F

Additionally window AC units should be removed for winter conditions. If removal of these units is not feasible, SWA recommends airtight covers such as Chill Stop-R or a gasketed cover for optimum performance.

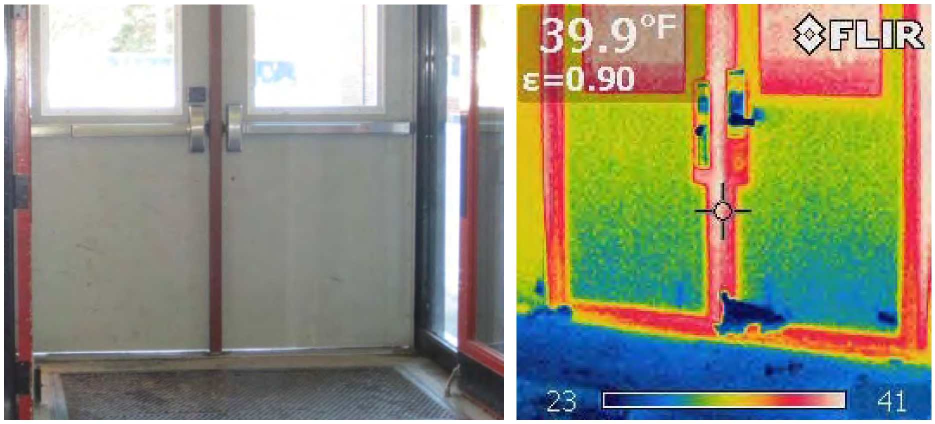
Single pane aluminum framed windows

2.3.5. Exterior doors

At the time of the audit SWA was told all main exterior doors were replaced in 2000. The FRP exterior doors were inspected and observed to be in very good condition. The exterior wood doors found in various classrooms are in need of replacement. Bubbling of paint (seen in the image below) may lead to rot or warping of the door.

Older exterior wood door (serving as exit from classroom)

SWA recommends checking the weather-stripping of each door on a regular basis and replacing any broken seals. Tight seals around doors will help ensure the building to be is kept continuously insulated. When exterior doors or garage doors warrant replacement SWA recommends upgrading existing doors with doors containing a higher R-value with effective seals.



Exterior types of doors all requiring maintenance to verify air tight seals

2.3.6. Building air tightness

In addition to the above mentioned recommendations SWA suggests air sealing, caulking and / or insulating around all plumbing, electrical, HVAC and structural envelope penetrations. This should include bottom and top plates, recessed light fixtures, electrical boxes, chimney walls and window, or sleeve air conditioner units. If units cannot be removed SWA recommends Chill Stop-R or similar tight sealing gasketed cover to prevent loss of expensive conditioned air.

Window air conditioner units left in winter conditions; Infrared image showing loss of heated air around perimeter of unit (also aluminum windows frames heated by sun)

PVC pipe entering building should be sealed with foam or caulk

2.4. HVAC Systems

Frankford Township School is primarily heated by hot water, but there are also some small offices where the A wing and B wing meet that are heated by electric baseboard heaters. Hot water is provided by two heating plants, each housed in a separate boiler room. One plant contains two (2) boilers that heat the A wing and B wing, and one plant has one boiler that serves the C wing and D wing. There is no natural gas service to the building and no utility natural gas mains nearby available for connection. Boilers are served by number 2 fuel oil from an underground storage tank located outside the B wing. The A wing was originally built in 1950 and renovated in 1988. The B wing was added in 1958, the C wing was added in 1968 and the D wing was added in 1974.

2.4.1 Heating

The classrooms in the A wing contain hot water terminal units in the form of ceiling-mounted unit ventilators. In addition, the Media Center and the Art Room both contain two (2) ceiling-mounted unit ventilators and each of the Elementary School offices each contain a ceiling-mounted unit ventilator (six (6) total offices).This equipment was installed as part of a 1988 renovation to this wing of the building. These unit ventilators are in good condition and appear to be operating.

The classrooms in the remaining wings contain wall mounted unit ventilators. It appears that all of the original unit ventilators from the 1958, 1968 and 1974 construction of these wings are still present in the building. This equipment is in fair to poor condition. In total, the school contains approximately sixty (60) Nesbitt unit ventilators of varying ages.

Unit Ventilators in B Wing (Left) and C Wing (Right)

The building also contains enclosed wall mounted and ceiling mounted finned tube radiation in the corridors, vestibules, toilet rooms and in the Middle School offices.

Each unit ventilator contains a heating coil, fan assembly, damper, filter and controls within a metal cabinet. Equipment was designed to introduce outdoor air via a grille and damper located on the outside wall. The units are designed to mix room air with outside air, heat the air as required, and deliver the air to the occupied space. The older wall mounted unit ventilators deliver the air directly through a grille on the top of the unit. The air from the ceiling-mounted units is discharged through a grille on the front face of the unit directly into the room.

The Large Gymnasium, which also serves as the Cafeteria and Multipurpose Room, is heated by two (2) heating and ventilating (H&V) units, with fresh air provided via rooftop vents. There is one vertical unit located in a small room adjacent to the kitchen. The second unit is horizontal type and is mounted above the Stage. The Small Gym is heated by a large H&V unit suspended from the roof with fresh air provided through a wall louver.

H&V Unit Suspended From Roof in Small Gym

The Kitchen Storage room that contains the walk-in cooler/freezer is heated by a hot water H&V unit located above the Middle School Copy Room, with fresh air provided via a rooftop vent.

The Boy's and Girl's Locker Rooms are heated via hot water cabinet unit heaters suspended from the ceiling.

The Occupational Therapy, Speech and Child Study Team offices, which are located where the A wing and B wing meet, are heated by electric baseboard heaters. The offices also have curtain walls and single pane windows, and it was reported by the staff in these offices that the electric baseboard heaters run constantly during the heating season. These rooms are in close proximity to the A/B wing boiler room, and replacing these electric baseboard units with hot water unit ventilators, along with providing insulated walls and windows, would yield savings in energy and operating costs.

The heating hot water for the A wing and B wing is produced by two (2) oil-fired hot water boilers located in the A/B boiler room. There are two (2) sets of floor-mounted hot water pumps that distribute the heating water out to the two wings. These pumps operate in lead-lag fashion, so only one of each pair is operating at one time. This hot water heating system is piped in a primary pumping arrangement.

The boilers have a capacity of 2,247 MBH and 2,403 MBH respectively. The boilers are cast iron sectional type. One boiler was installed in 1986 and the other boiler was installed in 1992. According to their age, the boilers have about 6 years and 11 years respectively remaining on their expected service life of 30 years, as published in the 2007 ASHRAE HVAC Applications Handbook. The burners were installed in 1986 and 1992 respectively, and are fed from a 10,000 gallon underground oil storage tank that is adjacent to the B Wing. The first burner is beyond its expected service life and the second burner is approaching its expected service life of 21 years, as published in the 2007 ASHRAE HVAC Applications Handbook.

Energy savings could be achieved by replacing these boilers with higher efficiency packaged oil-fired boilers with burner modulation, but this upgrade cannot be justified by energy savings alone.

A/B wing boilers

It is assumed that the circulating pumps were installed in 1986 and 1992 when each boiler was replaced. SWA recommends that the pump motors are replaced with premium efficiency motors.

The heating hot water for the C and D wings is produced by one (1) hot water boiler located in the C/D wing boiler room. There are two (2) sets of hot water pumps that distribute the heating water out to the two wings. One set is floor-mounted and one set is pipe-mounted. These pumps operate in lead-lag fashion, so only one of each pair is operating at one time. This hot water heating system is piped in a primary pumping arrangement.

The boiler has a capacity of 3,330 MBH. The boiler was reportedly installed in 1992. According to its age, the boiler has about 12 years remaining on their expected service life of 30 years, as published in the 2007 ASHRAE HVAC Applications Handbook. The burner is approaching its expected service life of 21 years, as published in the 2007 ASHRAE HVAC Applications Handbook.

Energy savings could be achieved by replacing this boiler with a higher efficiency packaged oil-fired boiler with burner modulation, but this upgrade cannot be justified by energy savings alone.

C/D wing boiler

It is assumed that the circulating pumps were installed in 1992 when the boiler was replaced. SWA recommends that the pump motors are replaced with premium efficiency motors.

Pneumatic Control System Panel in C/D Wing Boiler Room

The building contains two (2) pneumatic controls systems to control the equipment in each pair of wings. The air compressors were noted to run often and in several instances, the thermostats were observed to make a hissing noise indicative of leaking compressed air.

There were no complaints about the ability of the heating system to provide adequate heat to the building occupants. It was reported that the thermostats provide little to no control over the heating equipment and that most areas experience overheating during the heating season. This is leading to excessive operation of the boilers. In addition, it was reported that the fans for several of the unit ventilators and the exhaust fans for the gyms run during unoccupied hours. The expected service life of a pneumatic controls system is 20 years per 2007 ASHRAE HVAC Applications Handbook. Based on these facts, SWA recommends that the pneumatic controls system be replaced with an electronic DDC controls system for all of the equipment in the building.

2.4.2 Cooling

The majority of the cooling is in the form of 1-2 ton window air conditioning units in several classrooms and offices, totaling about 20 in all. Most of these units are not Energy Star rated. The TV Studio and adjacent offices are cooled by a packaged DX cooling only HVAC unit mounted on grade beside the entrance to the Middle School. The equipment is about 15 years old and is therefore at the end of its expected service life of 15 years per 2007 ASHRAE HVAC Applications Handbook. The unit appeared to be in fair condition.

It should be noted that Room 54 in the D-Wing contains 20 computers and no mechanical cooling system. SWA recommends that either window air conditioning or a ductless DX split system is provided for this room due to the expected high heat load from the computers.

Packaged HVAC Unit on Grade Serving TV Studio

2.4.3 Ventilation

As mentioned above, the grilles on the Nesbitt unit ventilators provide fresh air to the classrooms and the Art Room and Library in the A-Wing. SWA recommends that this equipment be replaced as part of a capital improvement, and that the new equipment provided with a means of providing a code compliant level of outside air to the spaces.

The Large Gymnasium, which also serves as the Cafeteria and Multipurpose Room, is ventilated by two (2) heating and ventilating (H&V) units, with fresh air provided via rooftop vents. There is one vertical unit located in a small room adjacent to the kitchen. The second unit is horizontal type and is mounted above the Stage. The Small Gym is ventilated by a large H&V unit suspended from the roof with fresh air provided through a wall louver.

The Kitchen Storage room that contains the walk-in cooler/freezer is ventilated by a hot water H&V unit located above the Middle School Copy Room, with fresh air provided via a rooftop vent.

The Boy's and Girl's Locker Rooms are ventilated via rooftop exhaust fans with makeup air provided from the Multipurpose Room H&V unit.

The kitchen contains a commercial cooking exhaust hood with corresponding rooftop exhaust fans. There is no dedicated makeup air unit so the makeup air is provided the H&V units that serve the Large Gymnasium, Cafeteria and Multipurpose Room.

It appears that the following rooms are not provided with code minimum ventilation air: Elementary Guidance Office (A-Wing), Elementary Janitor's Closet (A-Wing), Nurse's Office (A-Wing), OT/Speech/Child Study Team Offices (A-Wing), Middle School Guidance Office and adjacent Room P1(D-Wing), Middle School Copy Room (D-Wing) . This condition must be addressed during the capital improvement work recommended herein.

The building has a number of exhaust fans on the roof above the corridors, toilet rooms and classrooms of the B, C and D Wings. These fans are original to the respective wings and are beyond their expected service life. There is a pitched roof with attic space above the A Wing, and the classrooms, Art Room and Library are provided with attic-mounted exhaust fans ducted to a wall grille to relieve the fresh air intake and aid in the overall ventilation of these spaces. The toilet rooms are also exhausted via attic-mounted fans. The fans in the A-wing are 22 years old and are beyond their expected service life of 20 years based on the

2007 ASHRAE HVAC Applications Handbook. SWA recommends that this equipment is replaced as part of a capital improvement project, and that it is designed to provide code minimum ventilation rates.

Typical Rooftop Exhaust Fan

2.4.4 Domestic Hot Water

The hot water boilers produce the domestic hot water for the majority of the school. Boiler #2 in the A/B Boiler Room contains two (2) tankless water heater sections that provide domestic hot water for the A and B wings of the school. The Boiler in the C/D Boiler Room contains multiple tankless heater sections that provide domestic hot water for the C and D Wings of the school. Both systems incorporate a hot water recirculating pump. Due to this method of providing domestic hot water, the boilers must be fired even during mild weather when there would normally be no space heating load. SWA recommends providing separate tank-type domestic water heaters to handle the domestic water heating load. This will provide energy savings by allowing the school to not fire the boilers during mild weather.

There is also one (1) electric tank type domestic water heater located in the PTA storage room in the D Wing, presumably serving the toilet rooms in that wing. Replacement would not yield significant energy savings but should be considered due to age.

Typical Tankless Boiler Immersion Domestic Water Heater in A/B Boiler

Updated bathrooms with sensors for toilets and sinks (with 0.5gpm aerators)

2.4.5 Commercial Kitchen Equipment

There is one (1) walk-in cooler/freezer at the rear of the kitchen. This equipment was installed with the construction of the C Wing in 1968 and is in fair condition. The rooftop compressors have been replaced in recent years and are fairly efficient. The cooler was labeled as using R-22 refrigerant and the freezer uses R-502 refrigerant. The evaporator fans are original to the cooler and freezer and the Frankford School could realize some energy savings by replacing these fans with more energy efficient fans.

There is also one (1) walk-in freezer located outside the building, adjacent to the D-Wing. This freezer is much newer than the interior unit and utilizes fractional horsepower evaporator fans. This freezer is in very good condition and utilizes R-404a refrigerant.

There is one (1) 6-door stainless steel electric reach-in commercial refrigeration unit located in the kitchen that utilizes R-12 refrigerant. It is estimated that this equipment was installed in 1976 and is in relatively good condition. However, SWA recommends that the unit is replaced based on potential energy savings and the fact that R-12 is listed by the EPA as an ozone-depleting substance and production of this refrigerant was banned by the Clean Air Act in 1996.

The kitchen also contains one (1) reach-in milk cooler that also uses R-401a as its refrigerant. There was no accessible nameplate found during our survey, but it is estimated that this equipment was installed with the 1976 addition, and it is in fair condition.

In addition to the kitchen equipment, there are two (2) residential style refrigerators in the Home Economics classroom, and one in the B Wing Faculty Lounge, and in the Middle School Copy Room. None of the refrigerators were noted to be Energy Star rated.

The kitchen also contains several pieces of commercial-style cooking equipment, including (2) electric convection ovens and (2) electric range/ovens. There is a large kitchen hood provided for this equipment. The Kitchen also contains a tall electric heated storage cabinet. The makeup air is likely provided via transfer from the adjacent Cafeteria H&V units.

2.5. Electrical systems

2.5.1. Lighting

Interior Lighting - The Frankford Township School building currently consists of mostly older inefficient T12 bulbs with magnetic ballasts. SWA recommends upgrading to high performance T8 fluorescent fixtures with electronic ballasts. There are also fixtures found to contain incandescent bulbs (as seen in the image below). SWA recommends upgrading these fixtures with compact fluorescent bulbs. Based on measurements of lighting levels for each space, there are not any vastly over-illuminated areas. SWA recommends installing occupancy sensors in classrooms, closets, offices and areas where payback on savings is justified. 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. See attached lighting schedule in Appendix A for a complete inventory of lighting throughout the building and estimated power consumption.

Incandescent bulbs in faculty lounge bathroom

Exit Lights - Exit signs were found to be LED type.

Exterior Lighting - The exterior lighting surveyed during the building audit was found to be a mix of CFLs and Metal Halide fixtures. Some of the exterior lighting is controlled by photocell sensors. SWA is recommending photocell sensors for all exterior lighting or timers.

Exterior lights left on during daylight hours

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. Building management should select Energy Star label appliances and equipment when replacing: 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. SWA recommends consulting with the vendor that supplies all vending machines, requesting Energy Star models when the contract is due for renewal. Also, energy vending miser devices are now available for conserving energy usage by Drinks and Snacks vending machines. When equipped with the vending miser devices, vending machines use less energy and are comparable in daily energy performance to new ENERGY STAR qualified machines.

Two vending machines in Cafeteria, one vending machine in faculty lounge

SWA also recommends removal of all unnecessary appliances throughout the school. Small personal refrigerators, additional microwaves, or other appliances add to the school electrical load.

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. coffee makers, televisions, etc) be plugged in to power strips and turned off each evening just as the lights are turned off.

Smartboards & Computers left on in vacant classrooms

2.5.3. Elevators

The Frankford School is a single story building and there is no elevator.

2.5.4. Emergency Generator

There is one (1) 150KW diesel emergency generator on site. The generator serves all A Wing loads, all Gym and Kitchen loads, the walk-in cooler and freezers, the boiler rooms and the emergency lighting loads in the B, C and D Wings. This generator was installed 2007 and is in good condition.

Emergency Generator

3. EQUIPMENT LIST

Inventory

Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Heating	Boiler, hot water, cast iron sectional	A/B Boiler Room	HB Smith Model 28A-11 11 Sections, 2,247 MBH Serial #02622	No. 2 Fuel Oil	A Wing	1986	20%
Heating	Boiler burner, A Wing Boiler	A/B Boiler Room	Peabody Gordon-Piatt Model #HR10.1-0-20 22.5 gph oil	No. 2 Fuel Oil	A Wing	1986	0%
Heating	Boiler, hot water, cast iron sectional	A/B Boiler Room	HB Smith Model 28A-11 11 Sections, 2,403 MBH Serial # N91131	No. 2 Fuel Oil	B Wing	1991	35%
Heating	Boiler burner, B Wing Boiler	A/B Boiler Room	Gordon-Piatt Model #HR10.1-0-30 25 gph oil max (15 gph min)	No. 2 Fuel Oil	B Wing	1991	0-10%
Heating	(2) Hot Water Supply Pumps	A/B Boiler Room	Bell & Gossett 1510 Series, 7.5 HP	Electric	A Wing	1986	0%
Heating	(2) Hot Water Supply Pumps	A/B Boiler Room	Bell & Gossett 1510 Series, 2 HP	Electric	B Wing	1991	0-10%
Automatic Temp Controls	Air Compressor	A/B Boiler Room	Colt Industries Duplex, (2) 1/2 HP Serial # FF106-155265301	Electric	A & B Wings	Est. 1986	0%
Heating	Fuel Oil Pump Set	A/B Boiler Room	GE Model# 5KC35JN10H (2) 1/4 HP	Electric	A & B Wings	Est. 1986	20%
Domestic Water	Hot Water Recirculating Pump	A/B Boiler Room	Bell & Gossett Series 100, 1/12 HP	Electric	A & B Wings	Est. 2005	50%
Heating	Hydronic Unit Heater	A/B Boiler Room	Trane Model# UHSA-038W-2C-AAC Serial# 092G08642	Electric	A/B Boiler Room	1992	10-20%
Heating	Boiler, hot water, cast iron sectional	C/D Boiler Room	HB Smith Model 28A-15 15 Sections, 3,330 MBH Serial #N92-210	No. 2 Fuel Oil	C & D Wings	1992	40%
Heating	Boiler burner,A Wing Boiler	C/D Boiler Room	Power Flame Model #C3-OB Serial # 089259703 38 gph oil	No. 2 Fuel Oil	C & D Wings	1992	10%
Heating	(2) Hot Water Supply Pumps	C/D Boiler Room	Bell & Gossett Model# 903574 1-1/2 HP	Electric	C Wing	1992	0%
Heating	(2) Hot Water Supply Pumps	C/D Boiler Room	Bell & Gossett Model# 1-1/2 BB-989F 3HP	Electric	D Wing	1992	10%

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Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Automatic Temp Controls	Air Compressor	C/D Boiler Room	Nameplate Not Noted Estimated Duplex, (2) 1/2 HP	Electric	C & D Wings	Est. 1992	10%
Heating	Fuel Oil Pump Set	C/D Boiler Room	Nameplate Not Noted (2) 1/4 HP	Electric	C & D Wings	Est. 1992	30%
Heating/ Ventilation	Hot Water Heating & Ventilating Unit	Small Gym	Nameplate Not Accessible 6,000 CFM, 1 HP per Original Design Documents	Electric	Small Gym	1974	0%, operating past expected useful life
Heating/ Ventilation	Hot Water Heating & Ventilating Unit	Above MS Copy Room	Nameplate Not Accessible 1,520 CFM, 1/2 HP per Original Design Documents	Electric	Kitchen Storage/Walk-In Box Area	1974	0%, operating past expected useful life
Heating/ Ventilation	Hot Water Heating & Ventilating Unit	Kitchen Storage	Nameplate Not Accessible Est. 3,000 CFM, 1 HP	Electric	Large Gym/Cafeteria	1968	0%, operating past expected useful life
Heating/ Ventilation	Hot Water Heating & Ventilating Unit	Above Stage	Nameplate Not Accessible Est. 3,000 CFM, 1 HP	Electric	Multipurpose Room	1968	0%, operating past expected useful life
Heating/ Ventilation	(26) hot water unit ventilators	A Wing	Nesbitt, CFM ranges from 1,000-1,500 CFM	Electric	A Wing Classrooms, Offices, Art Room & Library	1988	0%, operating past expected useful life
Heating/ Ventilation	(7) hot water unit ventilators	B Wing	Nesbitt, CFM ranges from 1,250-1,500 CFM	Electric	B Wing Classrooms	1958	0%, operating past expected useful life
Heating/ Ventilation	(9) hot water unit ventilators	C Wing	Nesbitt, CFM ranges from 1,250-1,500 CFM	Electric	C Wing Classrooms	1968	0%, operating past expected useful life
Heating/ Ventilation	(18) hot water unit ventilators	D Wing	Nesbitt, CFM ranges from 1,250-1,500 CFM	Electric	D Wing Classrooms	1974	0%, operating past expected useful life
Ventilation	+/- 25 Attic-mounted exhaust fans	A Wing	Varies, Approx 100-500 CFM ea., all fractional HP	Electric	A Wing Classrooms, Offices, Art Room & Library	1988	0%, operating past expected useful life
Ventilation	+/- 5 Roof-mounted exhaust fans	B Wing	Varies, Approx 1 HP ea.	Electric	B Wing	1958	0%, operating past expected useful life
Ventilation	+/- 12 Roof-mounted exhaust fans	C Wing	Varies, Fractional HP.	Electric	C Wing	1968	0%, operating past expected useful life
Ventilation	+/- 20 Roof-mounted and Wall-Mounted (Small Gym) exhaust fans	D Wing	Varies, Fractional HP.	Electric	D Wing	1974	0%, operating past expected useful life

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Building System	**Description**	**Location**	**Model #**	**Fuel**	**Space Served**	**Year Installed**	**Estimated Remaining Useful Life %**
Cooling	(20) window AC units throughout the building	various class-rooms	Varies, Approx. 1-2 tons each	Electric	Various classrooms and officesthroughout building	varies	varies, estimating 25-50%
Heating	Hydronic Unit Heater	Kitchen	Nesbitt Model #2CJ21	Electric	Kitchen	1968	0%, operating past expected useful life
Heating	Hydronic Unit Heater	Kitchen Storage	Nesbitt Model #2CJ21	Electric	Kitchen Storage	1968	0%, operating past expected useful life
Cooling	Packaged HVAC Unit	Exterior on Grade	Carrier Model# 50HJ007521 Serial# 3595G20900	Electric	TV Studio	1995	0%
Refriger.	Walk-in Cooler/Freezer	Kitchen Storage	Bally Model# BF-100A Serial# F0002	Electric	Kitchen	1968	0%
Refriger.	Walk-in Freezer	Exterior	W.A. Brown Evap fans - Heatcraft Model # LSF090BMC6K Serial D06G07377	Electric	Kitchen	Est. 2005	60%
Refriger.	(2) Vending Machines	Cafeteria	Dixie-Narco M# DN 501EMC7S11-9 R-134a; 11A Dixie-Narco M# 501-ET/S IL-9	Electric	Cafeteria	Unknown	Unknown
Refriger.	Reach-in Stainless steel refrigerator	Kitchen	Traulsen & Co. Model# AHT 3-32NUT	Electric	Kitchen	Est.1975	0%
Refriger.	Reach-in milk cooler	Kitchen	No Nameplate	Electric	Kitchen	Est.1975	0%
Cooking	(2) Electric Convection Ovens	Kitchen	Blodgett Model #EF-111 Serial# 969EF10 Serial# 776EF14 11 kW @ 208V-3-phase	Electric	Kitchen	Est.1975	0%
Cooking	(2) Electric Range Ovens	Kitchen	No Nameplate	Electric	Kitchen	Est.1975	0%
Lighting	See details - Appendix A	Building	-	Electric	Building		

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

4. ENERGY CONSERVATION MEASURES

Based on the assessment of the Frankford Township School builidng, 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

- Insulate exterior walls - SWA recommends insulating the exterior walls of at least the original structure by adhering 2" polyiso boards (Polyisocyanurate) together with furring strips and gypsum wall boards to the inside of the painted CMU walls.

- Replace wood doors in classrooms with insulated FRP gasketed exterior doors. Investigate R values of doors for improved energy conservation.

- Replace 1972 roof section – Due to age and end of life condition, SWA recommends replacement of the 38 year old single-ply EPDM roof sections with an Energy Star certified membrane and insulation (3" rigid) assembly. Maintenance should be performed at regular intervals with a roofing contractor to prevent future roof leaks or to prevent future damages to the roof assembly. It is also advisable to upgrade any questionable roof integrity areas before photovoltaics are installed, as any repairs after the system is installed will be costly.

- Replace windows - SWA evaluated, as part of a capital improvement plan, replacing all single-pane windows (approximately 2407 sq ft) with newer models with thermal breaks, dual glazing and a low-e rating. A licensed contractor should assess and calculate accurate window areas and rough openings for replacement. Proper flashing and caulking should be performed upon installation of the new windows.

  The building contains approximately 2407 square feet of single-pane fixed and casement aluminum-framed windows with single-glazing. In context of other energy measures proposed in this report and in an effort to maximize the cost-benefit factor for improvements, SWA recommends that these windows be replaced with 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 sq ft °F. Upgrade building per ADA requirements - SWA recommends that the Frankford Township School Board of Education do as much as possible to comply with the latest ADA regulations.

- Replace unit ventilators - Replace 60 Nesbitt unit ventilators originally installed when the respective wing was constructed (7 in 1958 B Wing, 9 in 1968 C Wing and 18 in 1974 D Wing) except the (26) A Wing units which were replaced in 1988. The B, C and D Wing units are well beyond their expected service life. The A Wing units are also beyond their expected service life by a few years. Considering the increased maintenance repair costs and that replacement parts are difficult to find, SWA recommends replacement of this equipment. There is better control offered by the newer, electronically controlled units, although energy savings are negligible. Typical specifications for the new units can be as follows:

"The fans should be double inlet forward curved of centrifugal variety; have a maximum speed of 1,000 rpm with permanent split capacitor motors. The fan housing should be constructed of heavy gauge metal to help reduce air noise during operation. Wheel motors are to be premium efficiency, single speed, and permanent split capacitor with overload protection. Each fan should be equipped with a three speed switch for air balancing. An ultra-low leak, blade type outside air damper will ensure low leakage of the outside air when the equipment is not operating. The unit shall have a solid-state defrost control system and two separate filters. The air-to-air heat exchanger should be designed to support two air streams in a counter-flow direction. The heat exchanger matrix shall permit less than one percent of cross contamination between the air streams. The heat exchanger shall have an effectiveness of approximately 80% with equal airflow."

Energy savings from the proposed units do not justify the economics for replacement, and is hence recommended as capital improvement. The estimated cost of 60 new fan coil ventilators is $575,000.

- The Frankford Township School may wish to consider adding DX cooling as part of the equipment replacement. In this case, it should be recognized that cooling will result in an increase in energy usage versus providing heating and ventilation only. The estimated budget installed cost for DX coil and air cooled condensing units for the unit ventilators is an additional $220,000. ***Note that the addition of air conditioning may require an upgrade to the existing electric service. The cost of the electric service upgrade is broken out separately below but should be included if the cooling option above is incorporated.***

- Replace (2) H&V units serving the Large Gym and Multipurpose Room - The hot water heating only ventilation system for the Large Gym and Multipurpose Room is beyond its expected service life. SWA recommends that this equipment is replaced as part of a capital improvement project, and that it is designed to provide code minimum ventilation rates. The estimated budget installed cost for (2) hot water H&V units for the Large Gym and Multipurpose Room is $95,000.The Frankford Township School may wish to consider providing DX cooling as part of this system to make the room more functional in warm weather, but should recognize that this will increase energy usage versus providing a heating and ventilation system only. If cooling is desired, it is strongly recommended that a system is provided that utilizes a heat recovery wheel for pretreatment of the outside air and CO2 sensors for demand control ventilation. This is a replacement in kind recommendation which offers negligible energy savings. The estimated budget installed cost for (2) rooftop H&V units with DX cooling and heat recovery wheel is $140,000. ***Note that the addition of air conditioning may require an upgrade to the existing electric service. The cost of the electric service upgrade is broken out separately below but should be included if the cooling option above is incorporated.***

- Replace (1) H&V units serving the Small Gym - The hot water heating only ventilation system for the Small Gym is beyond its expected service life. SWA recommends that this equipment is replaced as part of a capital improvement project, and that it is designed to provide code minimum ventilation rates. The estimated budget installed cost for (1) hot water H&V units for the Small Gym is $45,000.The Frankford Township School may wish to consider providing DX cooling as part of this system to make the room more functional in warm weather, but should recognize that this will increase energy usage versus providing a heating and ventilation system only. If cooling is desired, it is strongly recommended that a system is provided that utilizes a heat recovery wheel for pretreatment of the outside air and CO_2 sensors for demand control ventilation. These additional features may require rooftop equipment with side discharge ductwork that would be ducted through the current outside air louver opening, which would involve some residual architectural and/or structural work. This is a replacement in kind recommendation which offers negligible energy savings. The estimated budget installed cost for (1) rooftop H&V unit with DX cooling and heat recovery wheel is $80,000. ***Note that the addition of air conditioning may require an upgrade to the existing electric service. The cost of the electric service upgrade is broken out separately below but should be included if the cooling option above is incorporated.***

- In lieu of DX cooling systems recommended above, add chilled water cooling system along with unit ventilator and H&V unit upgrades -- The estimated budget installed cost for the addition of a chiller, pumps, piping and required terminal equipment is $1,750,000. ***Note that the addition of air conditioning may require an upgrade to the existing electric service. The cost of the electric service upgrade is broken out separately below but should be included if the cooling option above is incorporated.***

- In lieu of DX cooling systems recommended above, add conventional water source heat pump system throughout school with heat exchanger and cooling tower -- The estimated budget installed cost for the addition of the heat exchanger and cooling tower as well as demolition and replacement of all piping to be compatible with this system type is $2,100,000. ***Note that the addition of air conditioning may require an upgrade to the existing electric service. The cost of the electric service upgrade is broken out separately below but should be included if the cooling option above is incorporated.***

- In lieu of chilled water or DX cooling systems recommended above, add geothermal cooling and heating system -- Note that the existing boilers could remain but would have limited use. The estimated budget installed cost for the addition of geothermal wells, pumps, and electric heat pump unit ventilators and electric heat pump terminal equipment is $3,000,000. ***Note that the addition of air conditioning may require an upgrade to the existing electric service. The cost of the electric service upgrade is broken out separately below but should be included if the cooling option above is incorporated.***

- Upgrade Building Management System (BMS) - Currently, the building is controlled by an antiquated, pneumatic temperature control system The BMS should be upgraded to a new Direct Digital Control (DDC) system similar to the Johnson Metasys system to control the new unit ventilators and other equipment replaced as part of the capital improvement recommendations. This upgrade will result in energy savings via improved temperature control and by the elimination of the air compressors. In addition, it was reported by the Supervisor of Buildings & Grounds that about half of the unit ventilators run for 24 hours per day on school days between September and June. In addition, the H&V units and exhaust fans serving the Cafeteria and Multipurpose Room operate from 6:00 am to 11:00 pm on school days. The outside air dampers should open and fans should operate at 8:00 am and close/deenergize at 2:30 pm on each school day. The new DDC system will incorporate this sequence of operation for this equipment. The estimated installed cost of the new controls system is $375,000, including all control, wiring, web-based controller for direct communication and remote control to monitor and alarm all HVAC equipment and all programming, engineering, training and start-up. It is estimated that proper shut-off of the unit ventilators, H&V units and fans listed above will save about 50,000 kwh and approximately 3,900 therms annually.

- Replace common area heating equipment - such as finned tube radiation and cabinet unit heaters in the toilet rooms, vestibules and corridors. This equipment is in fair condition, but age and wear have reduced the heat transfer capacity. This equipment should be replaced with more modern equipment suited for the intended use. These changes cannot be justified based on energy savings alone. However, replacement is strongly recommended along with upgrades to other portions of the heating system. This is a replacement in kind recommendation which offers negligible energy savings.

- Replace window air conditioners – Several of the existing window air conditioners still have some useful life remaining (on the average 0-5 years left) but replacement should be considered with modern, energy efficient systems. The window air conditioners should be replaced with split systems to allow for closing up of the existing window or wall penetrations. These upgrades cannot be justified by energy savings alone but will result in a decrease in energy usage versus the existing equipment. In addition, some of the existing systems utilize R-22 refrigerant, which is not an ozone-friendly refrigerant. Newer systems should be specified with R-410A refrigerant.

- Upgrade electric service – The existing electric service is rated for 1,600 amperes at 208V-3-phase. Based on recent electric demand data from the local utility, there is spare capacity for additional loads in the existing electric service. If cooling is added per some of the recommended capital improvement measures listed above, an upgrade to the electric service is required. The estimated electric service requirement for the addition of air conditioning is 4,000 amps at 208V-3-phase. The estimated budget cost for this upgrade is $150,000.

- The following rooms are not provided with code minimum ventilation air: Elementary Guidance Office (A-Wing), Elementary Janitor's Closet (A-Wing), Nurse's Office (A-Wing), OT/Speech/Child Study Team Offices (A-Wing), Middle School Guidance Office and adjacent Room P1(D-Wing), Middle School Copy Room (D-Wing) . As part of the recommended unit ventilator replacements, provide these rooms with a unit ventilator or other air handling system with outside air provisions.

- Consider replacement of the 1968 Bally walk-in cooler/freezer with a newer model. Although the compressor and condenser package has been replaced, the wall and roof panels of the box itself are likely not insulated to the levels of current walk-in coolers. This is a replacement in kind recommendation which cannot be recommended based on energy savings alone.

- Consider replacement of the reach-in milk cooler in cafeteria with more modern, higher efficiency model.

- Install premium motors when replacements are required - Select NEMA Premium motors when replacing motors that have reached the end of their useful operating lives.

Category II Recommendations: Operations and Maintenance

- Inspect and replace gasketing around door into the walk-in refrigeration boxes in the Kitchen and outside. Ineffective gasketing allows infiltration of warm air into the walk-in box, which increases the run-time of the compressors.

- Water levels in the expansion tanks and the integrity of the tank bladder should be checked to confirm proper operation.

- Use Energy Star labeled appliances - such as Energy Star refrigerators that should replace older energy inefficient equipment.

- Maintain roofs - SWA recommends regular maintenance to verify water is draining correctly.

- Maintain downspouts - Repair / install missing downspouts as needed to prevent water / moisture infiltration and insulation damage.

- Provide 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. Any other accessible gaps or penetrations in the thermal envelope penetrations should also be sealed with caulk or spray foam.

- Preventative exterior wall maintenance - SWA recommends as part of the maintenance program to install proper flashing, correct masonry efflorescence and seal wall cracks and penetrations wherever necessary in order to keep insulation dry and effective.

- Use smart power electric strips - in conjunction with occupancy sensors to power down computer equipment when left unattended for extended periods of time.

- Create an energy educational program - that teaches how to minimize their energy use. The US Department of Energy offers free information for hosting energy efficiency educational programs and plans, for more information please visit: http://www1.eere.energy.gov/education/

Category III Recommendations: Energy Conservation Measures

Summary table

ECM#	Table 1 - Highly Recommended 0-5 Year Payback ECMs
2	Install 3 Drinks vending machine misers
3.4	11 New motion sensors to be installed with incentives
4.1	Replace (2) 7.5 Hp hot water circulator pump motors with Premium Efficiency
3.3	88 New occupancy sensors to be installed with incentives
4.4	Replace (2) 3 Hp domestic hot water pump motor with Premium Efficiency
1	Replace old refrigerator with 18 cu ft Energy Star refrigerator
5.1	Replace Cooler Evap Fan Motor with Premium Efficiency Motor
4.2	Replace (2) 2 Hp hot water circulator pump motors with Premium Efficiency
	Table 2 - Recommended 5-10 Year Payback ECMs
5.2	Replace Freezer Evap Fan Motor with Premium Efficiency Motor
4.3	Replace (2) 1.5 Hp domestic hot water pump motor with Premium Efficiency
11	Demand Control Ventilation for Cafeteria & MP Room AHUs
	Table 3 - Recommended Over 10 Year Payback and End of Life Cycle ECMs
7a	Cost to replace boilers with modulating high efficiency oil-fired boilers
3.1	823 New T8 fixtures to be installed with incentives
8a	Replace (1) packaged 6-ton electric cooling rooftop HVAC unit with high efficiency unit
6	Utilize tank type domestic water heater instead of boilers
10a	Replace reach-in stainless steel refrigerator with 42 cu ft Energy Star refrig
3.2	8 New pulse start metal halide fixtures to be installed with incentives
9a	Replace 40 exhaust fans with premium efficiency units
	Table 4 - Renewable Energy Generation Measures
12	Install 151.2 kW PV rooftop system with incentives
12a	Install 49.7 kW PV rooftop system with incentives

ECM#1: *Replace Old Refrigerator with Energy Star Model*

Description:

On the days of the site visit, SWA observed an older refrigerator in the Faculty lounge which is not Energy Star rated (using as much as 1,700 kWh/yr). Appliances, such as refrigerators, that are over 10-12 years of age should be replaced with newer efficient models with the Energy Star label. SWA recommends the replacement of the existing refrigerator which is operating at the end of its useful lives with a more modern, ENERGY STAR®, energy efficient appliance. Besides saving energy, the replacement will also keep the kitchen area cooler. In addition, the existing systems utilize R-12 refrigerant, which is not an ozone-friendly refrigerant. Newer systems should be specified with R-134A or R-404A refrigerant. When compared to the average electrical consumption of older equipment, Energy Star equipment results in 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.

Installation cost:

Estimated installed cost: $750
Source of cost estimate: *Energy Star purchasing and procurement site, similar projects, Manufacturer and Store established costs*

Economics:

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
1	Replace old refrigerator with 18 cu ft Energy Star refrigerator	Energy Star purchasing and procurement site, similar projects	750	0	750	1200	0.1	0	0	0	194	12	804.00	3.9	7	1	1	-83	501

Assumptions: SWA calculated the savings for this measure using measurements taken the day of the field visit and using the billing analysis. SWA assumed one annual call to a refrigeration contractor to perform minor repairs on old refrigerators.

Rebates/financial incentives:

NJ Clean Energy - There are not any incentives at this time offered by the state of NJ for this energy conservation measure.

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#2: *Install Vending Misers on all soda vending machines*

Description:

The Frankford Township School building has three drinks vending machines (located in the Large Gymnasium (2) and Faculty Lounge (1)). Energy vending miser devices are now available for conserving energy with these machines. There is not a need to purchase new machines to reduce operating costs and greenhouse gas emissions. When equipped with the vending miser devices, refrigerated beverage vending machines or coolers use less energy and are comparable in daily energy performance to new ENERGY STAR qualified machines. Vending miser devices incorporate innovative energy-saving technology into small plug-and-play devices that installs in minutes, either on the wall or on the vending machine. Vending miser devices use a Passive Infrared Sensor (PIR) to: Power down the machine when the surrounding area is vacant; Monitor the room's temperature; Automatically repower the cooling system at one- to three-hour intervals, independent of sales; Ensure the product stays cold.

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

Installation cost (including labor):

Estimated installed cost: $837
Source of cost estimate: www.usatech.com *and established costs*

Economics (without incentives):

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
2	Install 3 Drinks vending machine misers	www.usatech.com and established costs	837	0	837	4,316	1.4	0	0.2	0	699	12	8,390	1.2	902	75	112	8,500	5,913

Assumptions: SWA assumes energy savings based on 85 operating hours/week; the modeling calculator found at www.usatech.com or http://www.usatech.com/energy_management/energy_calculator.php

Rebates/financial incentives:

NJ Clean Energy - There are not any incentives at this time offered by the state of NJ for this energy conservation measure.

Options for funding ECM:

This project may benefit from applying for grant funding for school districts in regular operating districts (ROD) to offset a portion of the cost of implementation.

http://www.state.nj.us/education/facilities/projectapplication/rod/

This project may benefit from applying for a grant from the State of New Jersey Energy Efficiency and Conservation Block Grant (EECBG) Program to offset a portion of the cost of implementation.

http://www.state.nj.us/recovery/infrastructure/eecbg_program_criteria.html

ECM#3: *Building Lighting Upgrades*

Description:

On the day of the site visit, SWA completed a lighting inventory of the Frankford Township School building (see Appendix A). The existing lighting consists of mostly older inefficient T12 fluorescent fixtures with magnetic ballasts. SWA recommends upgrades to high performance T8 fluorescent bulbs with efficient electronic ballasts. All incandescent bulbs should be replaced with compact fluorescents, using a quarter of the energy. SWA has performed an evaluation of installing occupancy sensors in classrooms, offices and closets where the payback is justified. The labor in all these installations was evaluated using prevailing electrical contractor wages. The Frankford Township School Board of Education 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 obtain savings.

Installation cost (including labor):

Estimated installed cost: $181,761
Source of cost estimate: RS *Means; Published and established costs, NJ Clean Energy Program*

Economics (with incentives):

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	Est. operating cost, 1st yr savings, $	est. energy & operating 1st year cost savings, $	life of measure, yrs	Est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
3.1	823 New T8 fixtures to be installed with incentives	RS Means, lit search	154,183	24,690	129,493	21,529	4.5	0	0.8	6,995	10,482	15	157,236	12.4	21	1	3	-6,146	29,495
3.2	8 New pulse start metal halide fixtures to be installed with incentives	RS Means, lit search	5,798	200	5,598	1,739	0.4	0	0.1	-51	231	15	3,465	24.2	38	3	-5	-2,879	2,382
3.3	88 New occupancy sensors to be installed with incentives	RS Means, lit search	19,360	1,760	17,600	40,404	8.4	0	1.5	0	6545	15	98,182	2.7	458	31	37	59,421	55,354
3.4	11 New motion sensors to be installed with incentives	RS Means, lit search	2,420	220	2,200	5,902	1.2	0	0.2	0	956	15	14,342	2.3	552	37	43	9,051	8,086
	TOTALS		181,761	26,870	154,891	69,575	14	0	2.6	6,944	18,215	-	273,226	42	-	-	77	59,447	95,317

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA also assumed an aggregated 4 hrs/yr to replace aging burnt out lamps vs. newly installed.

Rebates/financial incentives:

NJ Clean Energy - Wall Mounted occupancy and motion sensors ($20 per control)
Maximum incentive amount is $1,980.

NJ Clean Energy - T8 lamps with electronic ballast in existing facilities ($10-30 per fixture, depending on quantity and lamps)
Maximum incentive amount is $24,690.

NJ Clean Energy – Pulse start metal halide fixtures ($25 per fixture)
Maximum incentive amount is $200.

Options for funding ECM:

This project may benefit from applying for grant funding for school districts in regular operating districts (ROD) to offset a portion of the cost of implementation.

http://www.state.nj.us/education/facilities/projectapplication/rod/

This project may benefit from applying for a grant from the State of New Jersey Energy Efficiency and Conservation Block Grant (EECBG) Program to offset a portion of the cost of implementation.

http://www.state.nj.us/recovery/infrastructure/eecbg_program_criteria.html

ECM#4: *Install Premium Efficiency Motors on Heating Hot Water Circulators*

Description:

The A/B boiler room houses two sets of two (2) floor-mounted circulator pumps as part of the hot water heating system to serve the hot water unit ventilators and other hot water terminal units listed in this report. The pumps are in relatively good condition. One pair of pumps serves the A wing of the building. Each pump is rated at 7.5 Hp. The other two pumps serve the B wing, and each pump is rated at 2 Hp. In addition, the C/D boiler room houses one set of two (2) floor-mounted circulator pumps and one set of two (2) pipe-mounted circulator pumps as part of the hot water heating system to serve the hot water unit ventilators and other hot water terminal units listed in this report. These pumps are in fair to good condition. The pair of pipe-mounted pumps serves the C wing of the building. Each pump is rated at 1.5 Hp. The other two pumps serve the D wing, and each pump is rated at 3 Hp. Each set operates in a lead-lag fashion. All pump motors are standard efficiency. The Frankford Township School will realize energy savings by utilizing premium efficiency motors for the pumps.

Installation cost:

Estimated installed cost: $3,075
Source of cost estimate: Similar projects and DOE Motor Master International selection & savings analysis

Economics (with incentives):

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
4.1	Replace (2) 7.5 Hp hot water circulator pump motors with Premium Efficiency	similar projects, DOE International Motor Master selection & savings analysis	1,112	162	950	2,173	0.5	0	0.1	0	361	20	7,214	2.6	659	33	38	4,417	2,977
4.2	Replace (2) 2 Hp hot water circulator pump motors with Premium Efficiency	similar projects, DOE International Motor Master selection & savings analysis	642	108	534	658	0.1	0	0	0	109	20	2,185	4.9	309	15	20	1,091	901
4.3	Replace (2) 1.5 Hp domestic hot water pump motor with Premium Efficiency	similar projects, DOE International Motor Master selection & savings analysis	606	90	516	584	0.1	0	0	0	97	20	1,939	5.3	276	14	18	926	800
4.4	Replace (2) 3 Hp domestic hot water pump motor with Premium Efficiency	similar projects, DOE International Motor Master selection & savings analysis	714	108	606	1,113	0.2	0	0	0	185	20	3,695	3.3	510	25	30	2,143	1,525

Assumptions: SWA calculated the savings for this measure using nameplate data taken and using the billing analysis. The DOE Motor Master International selection and calculator was used with the assumption that one of each set of heating water pumps operates for the heating season. According to weather bin data for Newark, each set of pumps considered should operate for approximately 5,000 hours per year.

Rebates/financial incentives:

NJ Clean Energy – Premium three-phase motors ($45-$700 per motor)
Maximum incentive amount is $468.

Options for funding ECM:

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

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

ECM#5: *Install Premium Efficiency Motors on Walk-In Box Evaporator Fans*

Description:

There is one combination walk-in cooler and freezer box in the Kitchen of the Frankford Township School. Typically, the evaporator and condenser fans of walk-in coolers will operate 24 hours per day, 7 days per week. The walk-in freezer fans run about 18 hours per day, 7 days per week with the off times occurring while the system runs a defrost cycle. The fan motors are fractional horsepower. The motors on these fans are standard efficiency, shaded pole motors. The Frankford Township School will realize energy savings by utilizing premium efficiency motors for these fans

Installation cost:

Estimated installed cost: $1,000
Source of cost estimate: Similar projects and DOE Motor Master International selection & savings analysis

Economics (with incentives):

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
5.1	Replace Cooler Evap Fan Motor with Premium Efficiency Motor	Manufacturer's Operations Data, DOE International Motor Master Savings analysis	500	0	500	800	0.2	0	0	0	133	20	2,656	3.8	431	22	26	1,476	1,096
5.2	Replace Freezer Evap Fan Motor with Premium Efficiency Motor	Manufacturer's Operations Data, DOE International Motor Master Savings analysis	500	0	500	600	0.1	0	0	0	100	20	1,992	5	298	15	19	982	822

Assumptions: SWA calculated the savings for this measure using nameplate data taken and using the billing analysis. The DOE Motor Master International selection and calculator was used with the assumption that the cooler fans operate for 8,760 hours per year and the freezer fans operate for 6,570 hours per year.

Rebates/financial incentives:

NJ Clean Energy – There are no incentives available since these motors are fractional horsepower. Maximum incentive amount is $0.

Options for funding ECM:

This project may benefit from applying for grant funding for school districts in regular operating districts (ROD) to offset a portion of the cost of implementation.

http://www.state.nj.us/education/facilities/projectapplication/rod/

This project may benefit from applying for a grant from the State of New Jersey Energy Efficiency and Conservation Block Grant (EECBG) Program to offset a portion of the cost of implementation.

http://www.state.nj.us/recovery/infrastructure/eecbg_program_criteria.html

ECM#6: Install Tank-Type Domestic Water Heaters

Description:

Currently a boiler in each boiler room produces the domestic hot water for the entire year. Due to this method of providing domestic hot water, the boilers must be fired even during mild weather when there would normally be no space heating load. SWA recommends providing separate tank-type domestic water heaters to handle the domestic water heating load and make required piping modifications to reconnect to the existing domestic water piping system. This will provide energy savings by allowing the school to not fire the boilers during mild weather. Frankford Township School may wish to install two (2) ASME-rated heaters, one in each boiler room, that meet the current requirements of ASHRAE/IESNA Standard 90.1 (similar to AO Smith model COF-199) and remove or disconnect the boiler immersion heaters. Aside from the higher efficiency of the heaters, there should be a savings due to reduced standby losses compared to the current insulated storage tanks. The associated recirculating pump in the A/B Boiler Room appears to be operating adequately and replacement of the pump motor would yield negligible savings since it is fractional horsepower.

Installation cost:

Estimated installed cost: $16,000
Source of cost estimate: Similar projects

Economics (with incentives):

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
6	Utilize tank type domestic water heater instead of boilers	Similar Projects	16,000	0	16,000	0	0	790	0.9	0	1,175	15	17,630	14	10	1	1	-1,969	9,243

Assumptions: SWA calculated the savings for this measure using nameplate data taken and using the billing analysis. The efficiency of the existing boiler is in the range of 65-70%, and a new high efficiency oil water heater would operate with an efficiency of approximately 81%.

Rebates/financial incentives:

NJ Clean Energy does not offer rebates for oil-fired heating
Maximum incentive amount is $0.

Options for funding ECM:

This project may benefit from applying for grant funding for school districts in regular operating districts (ROD) to offset a portion of the cost of implementation.

http://www.state.nj.us/education/facilities/projectapplication/rod/

This project may benefit from applying for a grant from the State of New Jersey Energy Efficiency and Conservation Block Grant (EECBG) Program to offset a portion of the cost of implementation.

http://www.state.nj.us/recovery/infrastructure/eecbg_program_criteria.html

ECM#7: *Replace Boilers with New High Efficiency Modulating Boilers*

Description:

The current hot water boilers range in age from 18 to 24 year old and are relatively inefficient as compared to more modern equipment. SWA recommends providing two (2) packaged cast iron sectional boilers with modulating burners in each boiler room (similar to Weil-McLain 88 Series 2), sized in accordance with the building heating load. This will provide energy savings by providing a thermal efficiency of approximately 85% versus the estimated 65-70% of the currently operating boilers. These boilers would incorporate a two-pass flue fuel oil #2 design, would be CSD-1 code-compliant with low water cutoff and manual high level aquastat.

Installation cost:

Estimated installed cost: $170,000
Source of cost estimate: Similar projects

Economics (with incentives):

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
7a	Cost to replace boilers with modulating high efficiency oil-fired boilers	Similar Projects	170,000	0	170,000	0	0	9,000	10	1,820	15,210	25	334,755	11	124	5	7	94,857	105,300
7b	Incremental cost to replace boilers with modulating high efficiency oil-fired boilers	Similar Projects	12,000	0	12,000	0	0	2,470	2.7	1,820	5,495	25	91,872	2.2	1045	42	46	83,683	28,899

Assumptions: SWA calculated the savings for this measure using nameplate data taken and using the billing analysis. SWA estimated that the annual fuel oil #2 usage for the water heating system is approximately 52,250 therms. The efficiency of the existing boiler is in the range of 65-70%, and a new modulating oil water heater similar to the one mentioned above would operate with an efficiency of approximately 85%.

Rebates/financial incentives:

NJ Clean Energy does not offer rebates for oil-fired heating
Maximum incentive amount is $0.

Options for funding ECM:

This project may benefit from applying for grant funding for school districts in regular operating districts (ROD) to offset a portion of the cost of implementation.

http://www.state.nj.us/education/facilities/projectapplication/rod/

This project may benefit from applying for a grant from the State of New Jersey Energy Efficiency and Conservation Block Grant (EECBG) Program to offset a portion of the cost of implementation.

http://www.state.nj.us/recovery/infrastructure/eecbg_program_criteria.html

ECM#8: *Replace Packaged HVAC Unit with a High Efficiency Unit*

Description:

The packaged rooftop HVAC unit serving the TV Studio was installed in 1995 and at the end of its expected service life of 15 years. SWA recommends replacement of this equipment to see an increase in operating efficiency. This upgrade cannot be justified by energy savings alone.

The current equipment has a cooling Energy Efficiency Ratio (EER) of approximately 9.0. The new equipment should have a minimum 11.5 EER rating, preferably closer to 12.5 or 13.0. The higher EER will involve increased cost for the equipment over units with lower EER, but 11.5 EER is the minimum required for this equipment capacity to qualify for a NJ Clean Energy Program rebate. The equipment shall be Energy Star certified and ASHRAE 90.1 compliant. The equipment shall utilize R-410A refrigerant. The compressors shall be fully hermetic, scroll type with on demand crankcase heaters for cooling duty and induced draft fuel oil #2 combustion for heating duty. Evaporator fan wheel shall be steel with a corrosion-resistant finish, shall be double-inlet type with forward-curved blades and shall be dynamically balanced. Fan motors shall be continuous operation, open-drip proof with sealed, permanently lubricated ball bearings. Evaporator and condenser coils shall have aluminum lanced plate fins mechanically bonded to seamless internally grooved copper tubes with all joints brazed. Heat exchanger shall be aluminized 20-gage steel coated with 1.2 mil aluminum-silicone alloy or similar for corrosion resistance. The estimated simple payback on this recommendation is greater than 25 years.

Installation cost:

Estimated installed cost: $16,000
Source of cost estimate: Similar projects

Economics (with incentives):

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
8a	Replace (1) packaged 6-ton electric cooling rooftop HVAC unit with high efficiency unit	similar projects	16,000	438	15,562	1,750	0.4	0	0	900	1,191	15	4,358	13	15	1	2	-1,350	2,398
8b	Incremental cost to replace (1) packaged electric cooling rooftop HVAC unit with high efficiency unit	similar projects	3,000	438	2,562	938	0.2	0	0	900	1,056	15	2,336	2.4	518	35	41	10,041	1,285

Assumptions: SWA calculated the savings for this measure using nameplate data taken the days of the field visit.

Rebates/financial incentives:
NJ Clean Energy – Unitary HVAC and Split Systems ($73-$92 per ton)
Maximum incentive amount is $438.

Options for funding ECM*: This project may benefit from applying for grant funding for school districts in regular operating districts (ROD) to offset a portion of the cost of implementation.*

http://www.state.nj.us/education/facilities/projectapplication/rod/

This project may benefit from applying for a grant from the State of New Jersey Energy Efficiency and Conservation Block Grant (EECBG) Program to offset a portion of the cost of implementation.

http://www.state.nj.us/recovery/infrastructure/eecbg_program_criteria.html

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#9: Replace Exhaust Fans with High Efficiency Units

Description:

Several of the building rooftop exhaust fans are in fair to poor condition and beyond their expected service life. These fans should be considered for replacement. Some of the fans are not operating at all. SWA recommends replacement of approximately forty (40) of the building exhaust fans that are operating beyond their useful lives. The motors are small, in the fractional to 1 horsepower range, and replacement units will have small energy savings over the existing.

Installation cost:

Estimated installed cost: $128,000
Source of cost estimate: Similar projects

Economics (with incentives):

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
9a	Replace 40 exhaust fans with premium efficiency units	similar projects, DOE Motor Master International	128,000	0	128,000	7,000	1.5	0	0.1	3,200	4,362	10	11,620	29	-66	-7	N/A	-90,791	9,590
9b	Incremental cost to replace 40 exhaust fans with premium efficiency units	similar projects, DOE Motor Master International	15,000	0	15,000	7,000	0.5	0	0.1	3,200	4,362	10	11,620	3.4	191	19	26	22,209	9,590

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis.

Rebates/financial incentives:

NJ Clean Energy – There is no incentive since these motors are fractional horsepower
Maximum incentive amount is $0.

Options for funding the ECM: *This project may benefit from applying for grant funding for school districts in regular operating districts (ROD) to offset a portion of the cost of implementation.*

http://www.state.nj.us/education/facilities/projectapplication/rod/

This project may benefit from applying for a grant from the State of New Jersey Energy Efficiency and Conservation Block Grant (EECBG) Program to offset a portion of the cost of implementation.

http://www.state.nj.us/recovery/infrastructure/eecbg_program_criteria.html

ECM#10: *Replace Old Commercial sized Refrigerators and Freezers with Energy Star Models*

Description:

On the days of the site visits, SWA observed that there is an existing solid door commercial refrigerator in the kitchen area which is not Energy Star rated (using approximately 5,600 kWh/yr). Appliances, such as refrigerators, that are over 10-12 years of age should be replaced with newer efficient models with the Energy Star label. SWA recommends the replacement of the existing refrigerator which is operating at the end of their useful life with a more modern, ENERGY STAR®, energy efficient system. Besides saving energy, the replacement will also keep the kitchen and other areas cooler. In addition, the existing systems utilize R-12 refrigerant, which is not an ozone-friendly refrigerant. Newer systems should be specified with R-134A or R-404A refrigerant. When compared to the average electrical consumption of older equipment, Energy Star equipment results in 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.

Installation cost:

Estimated installed cost: $13,000
Source of cost estimate: *Energy Star purchasing and procurement site, similar projects, Manufacturer and Store established costs*

Economics:

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
10a	Replace reach-in stainless steel refrigerator with 42 cu ft Energy Star refrig	Energy Star purchasing and procurement site, similar projectsefficiency unit	13,000	0	13,000	4,130	0.9	0	0	0	644	12	7,731	20	-41	-3	-7	-6,587	5,658
10b	Incremental cost to replace reach-in stainless steel refrigerator with 42 cu ft Energy Star refrig	Energy Star purchasing and procurement site, similar projectsefficiency unit	3,000	0	3,000	4,130	0.9	0	0	0	644	12	7,731	4.7	158	13	19	3,413	5,658

Assumptions: SWA calculated the savings for this measure using measurements taken the day of the field visit, using the billing analysis and assuming 24 hour per day operation for 180 school days per year.

Rebates/financial incentives:

NJ Clean Energy - There are not any incentives at this time offered by the state of NJ for this energy conservation measure.

Options for funding the 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#11: *Provide Demand Control Ventilation for Cafeteria and Multipurpose Room Air Handling Units*

Description:

The air handling units for the Cafeteria and Multipurpose Room provide a fixed amount of outside air during occupied hours. Conditioning outside air can be a significant portion of the heating load seen by the air handling unit. Demand control ventilation involves providing carbon dioxide (CO_2) sensors in the occupied space to estimate occupancy. When the space is underutilized or unoccupied during occupied hours, the CO_2 sensors can partially or totally shut down the outside air intake damper to the air handling unit. This control method can greatly reduce the heating or cooling load seen by the air handling unit and therefore save energy. The Frankford Township School will realize energy savings by installing the required control devices and incorporating this control method into the new BMS system programming.

Installation cost:

Estimated installed cost: $6,000
Source of cost estimate: RS Means Cost Data & Similar Projects

Economics (with no incentives):

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
11	Demand Control Ventilation for Cafeteria & MP Room AHUs	RS Means Cost Data & Similar Projects	6,000	0	6,000	680	0.1	400	0.5	0	708	15	10,620	8.5	77	5	8	2,452	5,612

Assumptions: SWA calculated the savings for this measure using nameplate data taken and using the billing analysis. SWA estimated that the Cafeteria is unutilized for 60% of the day, and the Multipurpose is unutilized for 40% of the day, for 180 school days in a calendar year.

Rebates/financial incentives:

There are no utility rebates available for this work.

Options for funding ECM:

This project may benefit from applying for grant funding for school districts in regular operating districts (ROD) to offset a portion of the cost of implementation.

http://www.state.nj.us/education/facilities/projectapplication/rod/

This project may benefit from applying for a grant from the State of New Jersey Energy Efficiency and Conservation Block Grant (EECBG) Program to offset a portion of the cost of implementation.

http://www.state.nj.us/recovery/infrastructure/eecbg_program_criteria.html

ECM#12: *Install 151.2 kW PV system*

Description:

Currently the Frankford Township School does not use any renewable energy systems. Renewable energy systems such as photovoltaic panels, can be mounted on the building roofs, and can offset a portion of the purchased electricity for the building. Power stations generally have two separate electrical charges: usage and demand. Usage is the amount of electricity in kilowatt-hours that a building uses from month to month. Demand is the amount of electrical power that a building uses at any given instance in a month period. During the summer periods, when electric demand at a power station is high due to the amount of air conditioners, lights, equipment, etc… being used within the region, demand charges go up to offset the utility's cost to provide enough electricity at that given time. Photovoltaic systems not only offset the amount of electricity use by a building, but also reduce the building's electrical demand, resulting in a higher cost savings as well. It is recommended at this time that the Frankford Township School further review installing a 151.2 kW PV system to offset electrical demand and reduce the annual net electric consumption for the building, and review guaranteed incentives from NJ rebates to justify the investment. Frankford Township School is also not eligible for a 30% federal tax credit. Instead, the Frankford Township 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. JCP&L provides the ability to buy SREC's at $600/MWh or best market offer.

There are many possible locations for a 151.2 kW PV installation on the building roofs. A commercial crystalline 230 watt panel has 17.5 square feet of surface area (13.1 watts per square foot). Considering the shading on the roof of this facility, a 151.2 kW system needs approximately 720.0 panels which would take up 12,600 square feet. The installation of a renewable Solar Photovoltaic power generating system could serve as a good educational tool and exhibit for the community.

Installation cost:

Estimated installed cost: $1,171,800
Source of cost estimate: Similar Projects

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
12	Install 151.2 kW PV rooftop system with incentives	similar projects	1,171,800	0	1,171,800	161,025	151	N/A	6.1	0	123,345	25	668,254	9.5	92.5	3.7	8.2	552,593	220,604

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 (230 Watts, model #ND-U230C1). PV systems are sized based on Watts and physical dimensions for an array will differ with the efficiency of a given solar panel (W/sq ft).

Rebates/financial incentives:

NJ Clean Energy - Renewable Energy Incentive Program, Incentive based on $1.00 / watt Solar PV application for systems 50kW or less. Incentive amount for this application is $0 for the proposed option.

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. A total annual SREC credit of $96,600 has been incorporated in the above costs, however it requires proof of performance, application approval and negotiations with the utility.

Options for funding ECM:

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

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

ECM#12A: ***Install 49.7 kW PV system***

Description:

Should funding or grant money not be available for a 151.2 kW photovoltaic system making it infeasible, an alternative recommendation to ECM#4 regarding would be for the Frankford Township School to consider installing a 49.7 kW PV system to offset electrical demand and reduce the annual net electric consumption for the building, and review guaranteed incentives from NJ rebates to justify the investment. As mentioned above, NJ Clean Energy incentives are available for systems no larger than 50 kW. A 49.7 kW PV system would qualify for such incentives JCP&L provides the ability to buy SREC's at $600/MWh or best market offer.

There are many possible locations for a 49.7 kW PV installation on the building roofs. A commercial crystalline 230 watt panel has 17.5 square feet of surface area (13.1 watts per square foot). Considering the shading on the roof of this facility, a 49.7 kW system needs approximately 236.0 panels which would take up 4,130 square feet. The installation of a renewable Solar Photovoltaic power generating system could serve as a good educational tool and exhibit for the community.

Installation cost:

Estimated installed cost: $385,175
Source of cost estimate: Similar Projects

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
12a	Install 49.7 kW PV rooftop system with incentives	similar projects	385,175	49,700	335,475	53,920	50	N/A	2	0	41,303	25	223,768	8.1	654	26.2	43.8	1,598,883	73,870

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 (230 Watts, model #ND-U230C1). PV systems are sized based on Watts and physical dimensions for an array will differ with the efficiency of a given solar panel (W/sq ft).

Rebates/financial incentives:

NJ Clean Energy - Renewable Energy Incentive Program, Incentive based on $1.00 / watt Solar PV application for systems 50kW or less. Incentive amount for this application is $49,700 for the proposed option.

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. A total annual SREC credit of $31,200 has been incorporated in the above costs, however it requires proof of performance, application approval and negotiations with the utility.

Options for funding ECM:

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

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

5. RENEWABLE AND DISTRIBUTED ENERGY MEASURES

5.1. Existing systems

There are not currently any existing renewable energy systems.

5.2. Wind

Description:

A Wind system is not applicable for this building because the area does not have winds of sufficient velocity to justify installing a wind turbine system.

5.3. Solar Photovoltaic

Please see the above recommended ECM#12 or 12a.

5.4. Solar Thermal Collectors

Description:

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

5.5. Combined Heat and Power

Description:

CHP is not applicable for this building because of insufficient thermal baseload.

5.6. Geothermal

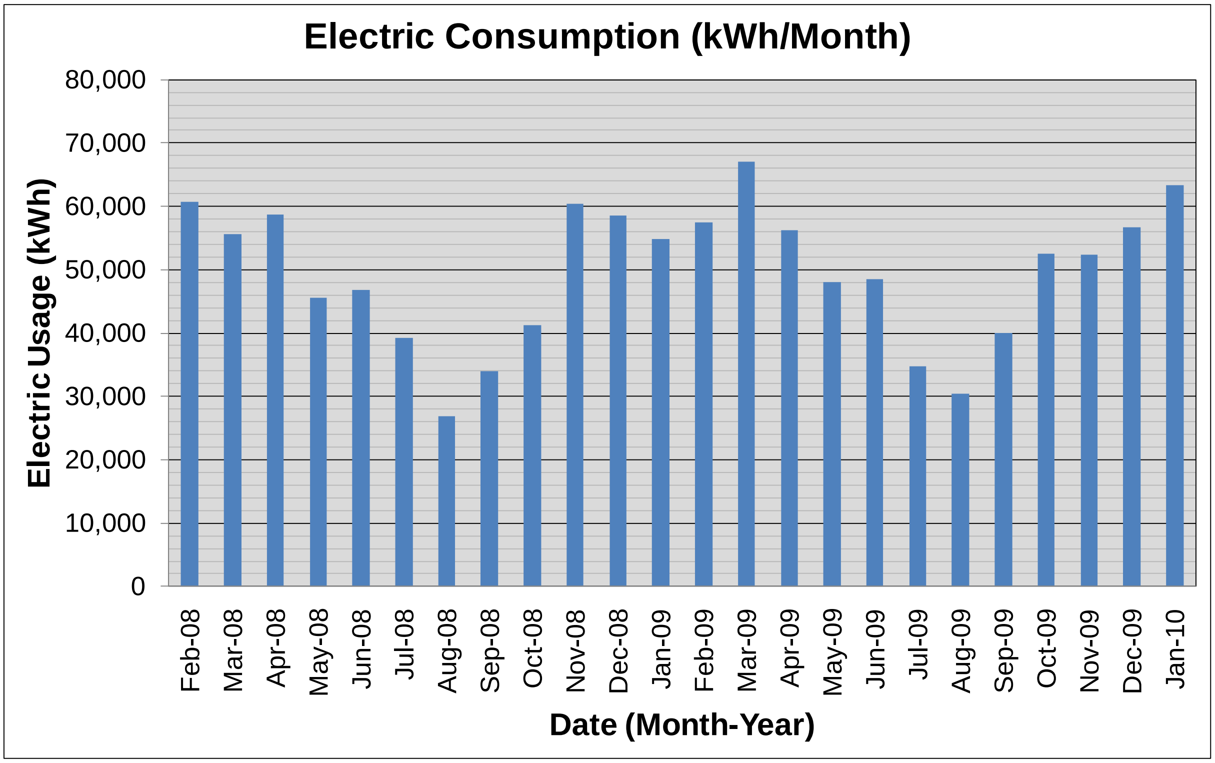
Description:

*Currently, the building is heated but not cooled. Should the school district investigate the addition of air conditioning to the school's HVAC system, an estimated energy savings analysis versus other systems can be studied. Several system types have been studied and the system summaries and estimated costs have been presented in the **Capital Improvements** section above.*

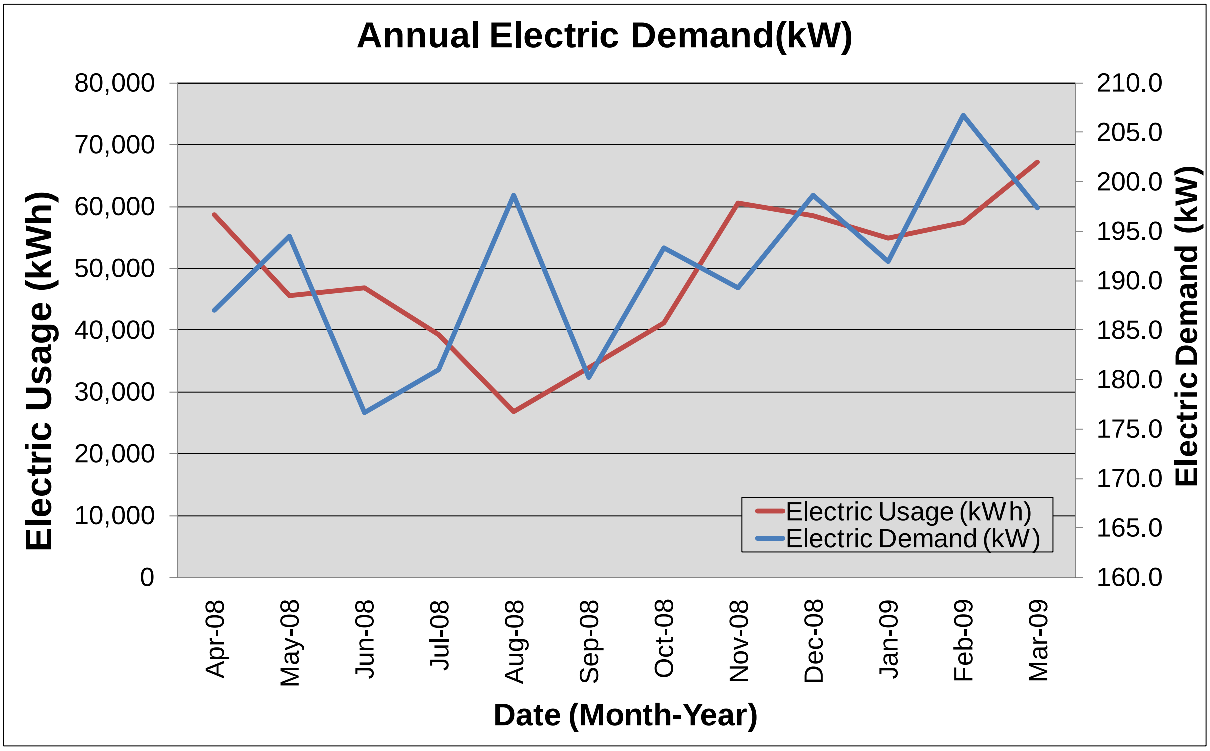
6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

6.1. Load profiles

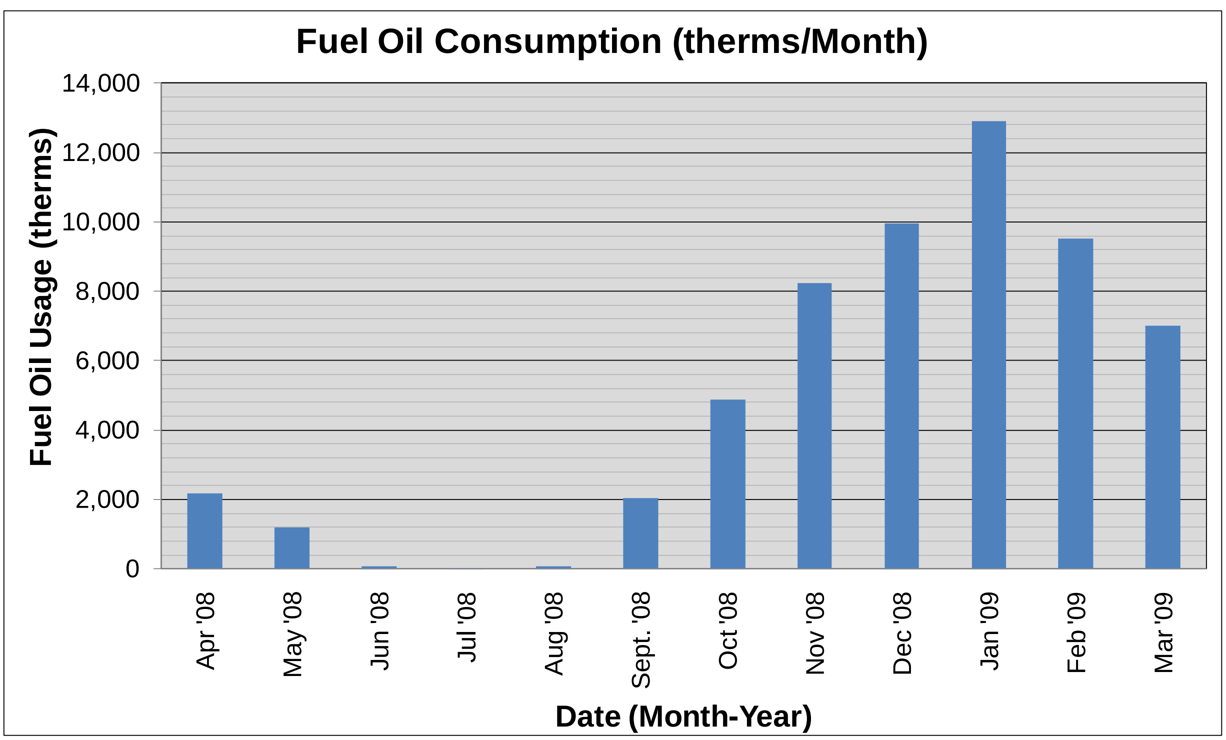
The following charts show annual electric and fuel oil #2 load profiles for the Frankford Township School:

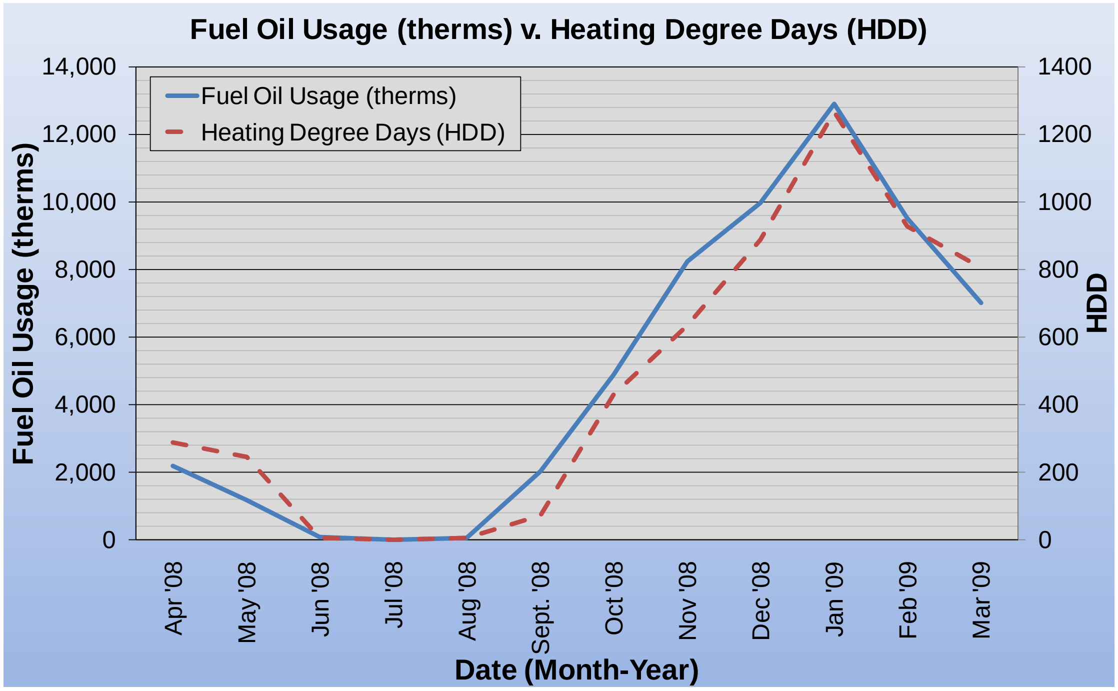


Some minor unusual electric fluctuations shown may be due to adjustments between estimated and actual meter readings. Also, note on the following chart how the electrical Demand peaks (except for a few unusual fluctuation anomalies) follow the electrical consumption peaks – our observation that it is either a faulty meter read or input error on the part of utility.



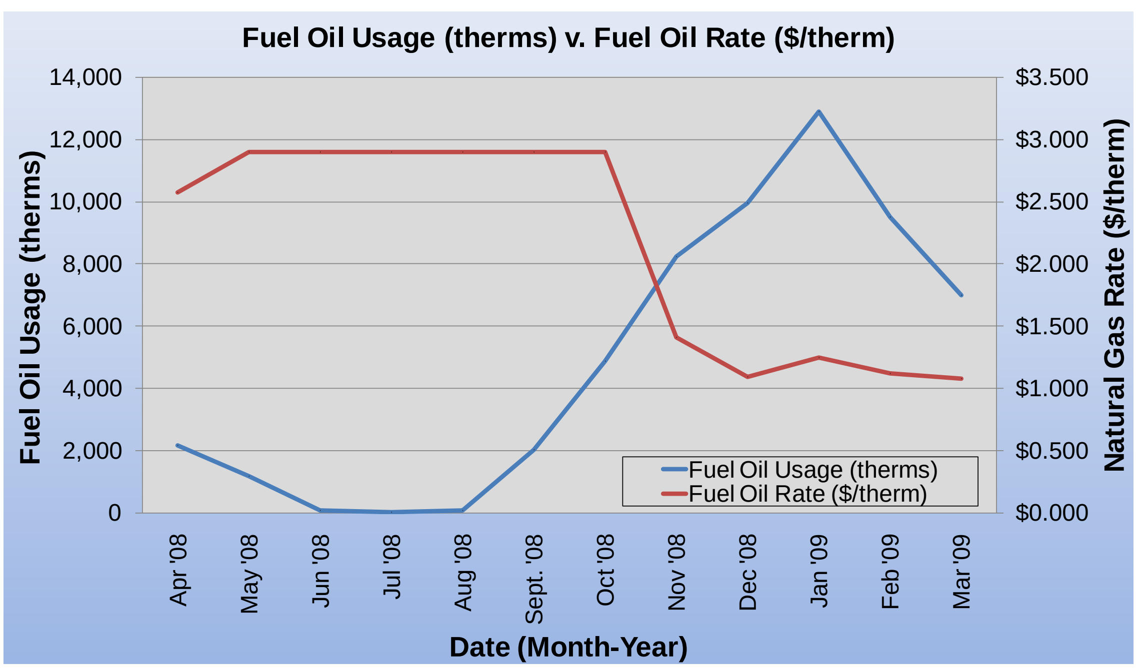
The following chart shows the estimated use of fuel oil #2 annual load for the building, peaking in the coldest months of the year and another chart showing fuel oil #2 consumption following the "heating degree days" curve; the annual oil use has been tailored to follow the HDD curve and excludes assumed 1226 therms of annual use for DHW.





6.2. Tariff analysis

Currently, fuel oil #2 is supplied to the Frankford Township School building by Flinch Fuel oil, sold to the Township School at a the prevailing market rate. Typically, the fuel oil #2 prices increase during the heating months when fuel oil #2 is used by the hot water boiler units. The high fuel oil #2 price per therm in the summer may be due to high energy costs that occurred in 2008. The price for the months of June to September is flat because the school did not purchase any fuel during this period, only using the fuel purchased in April/May.



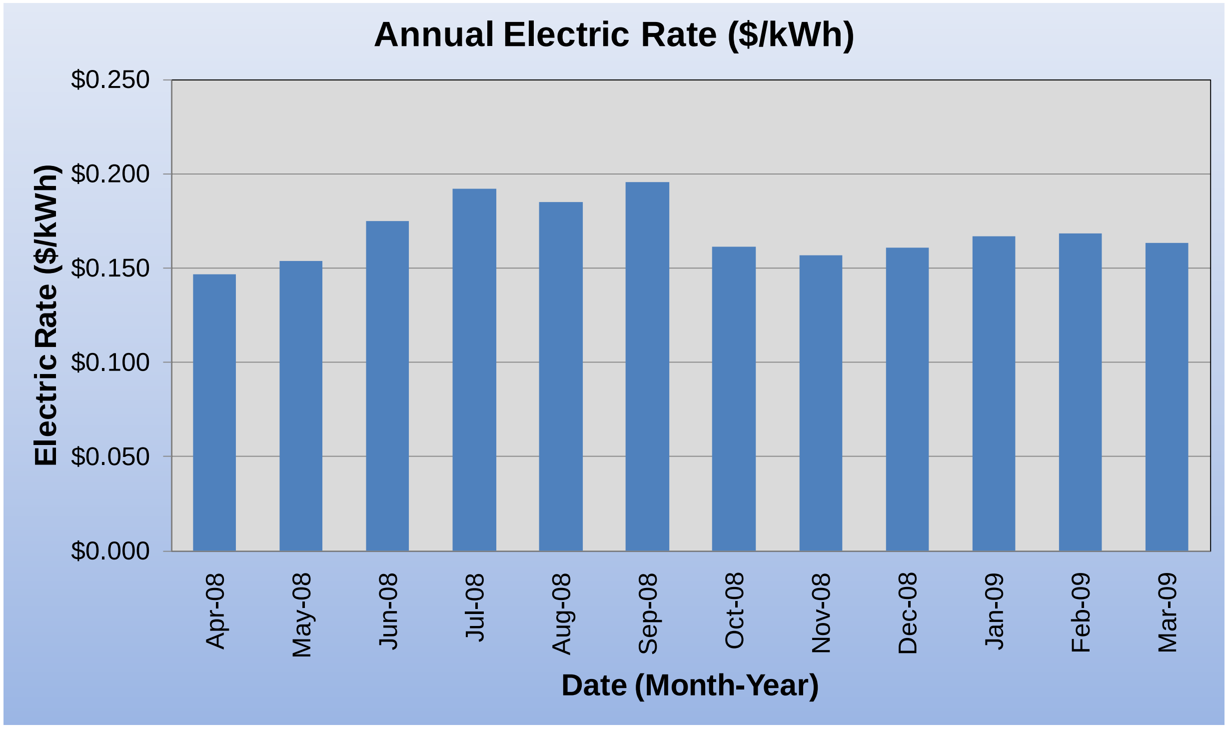
The Frankford Township School building is direct-metered (via one main meter) and currently purchases electricity from the local utility at a general service rate. The general service rate for electric charges are market-rate based on use and the Frankford Township School building billing does show a 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 air conditioning equipment.

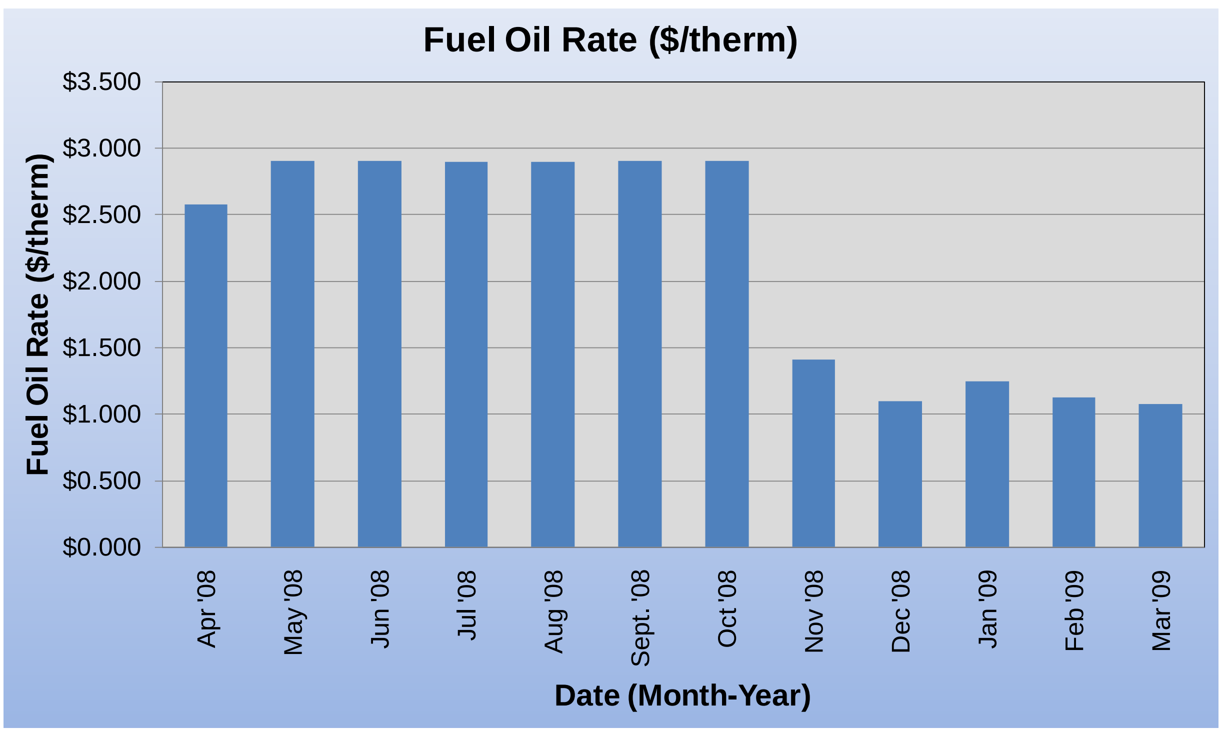
6.3. Energy Procurement strategies

The Frankford Township School building receives fuel oil #2 from Flinch Fuel oil supplies the fuel oil #2 and transports it. There is not an ESCO engaged in the process. An Energy Services Company (ESCO) is a consultancy group that engages in a performance based contract with a client firm to implement measures which reduce energy consumption and costs in a technically and financially viable manner. Electricity is also purchased via one incoming meter directly for the Frankford Township School building from Frankford Township electric utility consortium without an ESCO. SWA analyzed the utility rate for fuel oil #2 and electricity supply over an extended period. Electric bill analysis shows fluctuations up to 20% over the most recent 12 month period. Some of these fluctuations may have been caused by adjustments between estimated and actual meter readings, others may be due to unusual high and escalating energy costs in 2008. The average estimated NJ commercial utility rates for electric and fuel oil #2 are $0.150/kWh and $2.19/gallon respectively. The Frankford Township School building annual electric cost is $6,703 higher for electric when compared to the average estimated NJ commercial electric rates. The fuel oil was purchased at competitive rates.

SWA recommends that the Frankford Township School Board of Education further explore opportunities of purchasing electricity from an ESCO in order to reduce rate fluctuation and ultimately reduce the annual cost of energy for the Frankford Township School building. Appendix B contains a complete list of third party energy suppliers for the Frankford Township service area. The Frankford Township School Board of Education may want to consider partnering with other school districts, municipalities, townships and communities to aggregate a substantial electric and fuel oil #2 use for better leveraging in negotiations with their local utility and ESCOs. This sort of activity is happening in many parts of the country and in New Jersey. Also, the Frankford Township School building would not be eligible for enrollment in a Demand Response Program, because there isn't the capability at this time (without a large capital investment) to shed a minimum of 150 kW electric demand when requested by the utility during peak demand periods, which is the typical threshold for considering this option.

The following charts show the Frankford Township School building monthly spending per unit of energy in 2008.


Annual Electric Rate ($/kWh)
Electric Rate ($/kWh)
$0.250
$0.200
$0.150
$0.100
$0.050
$0.000
Apr-08
May-08
Jun-08
Jul-08
Aug-08
Sep-08
Oct-08
Nov-08
Dec-08
Jan-09
Feb-09
Mar-09
Date (Month-Year)


Fuel Oil Rate ($/therm)
Fuel Oil Rate ($/therm)
$3.500
$3.000
$2.500
$2.000
$1.500
$1.000
$0.500
$0.000
Apr '08
May '08
Jun '08
Jul '08
Aug '08
Sept. '08
Oct '08
Nov '08
Dec '08
Jan '09
Feb '09
Mar '09
Date (Month-Year)

7. METHOD OF ANALYSIS

7.1. Assumptions and tools

Energy modeling tool:	Established / standard industry assumptions, E-Quest
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

Location			Existing Fixture Information												Retrofit Information													Annual Savings		
Marker	Floor	Room Identification	Fixture Type	Ballast	Lamp Type	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Controls	Operational Hours per Day	Operational Days per Year	Ballast Wattage	Total Watts	Energy Use kWh/year	Category	Fixture Type	Lamp Type	Ballast	Controls	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Operational Hours per Day	Operational Days per Year	Ballast Watts	Total Watts	Energy Use kWh/year	Fixture Savings (kWh)	Controls Savings (kWh)	Total Savings (kWh)
1	1	Classroom (42)	Recessed	M	4'T12	12	4	34	S	9	184	24	1,920	3,180	T8	ecesse	4'T8	E	OS	12	4	32	7	184	13	1692	2101	378	700	1078
2	1	Classroom (43)	Recessed	M	4'T12	12	4	34	S	9	184	24	1,920	3,180	T8	ecesse	4'T8	E	OS	12	4	32	7	184	13	1692	2101	378	700	1078
3	1	Classroom (44)	Recessed	M	4'T12	12	4	34	S	9	184	24	1,920	3,180	T8	ecesse	4'T8	E	OS	12	4	32	7	184	13	1692	2101	378	700	1078
4	1	Classroom (45)	Recessed	M	4'T12	12	4	34	S	9	184	24	1,920	3,180	T8	ecesse	4'T8	E	OS	12	4	32	7	184	13	1692	2101	378	700	1078
5	1	Classroom (41)	Recessed	M	4'T12	12	4	34	S	9	184	24	1,920	3,180	T8	ecesse	4'T8	E	OS	12	4	32	7	184	13	1692	2101	378	700	1078
6	1	Classroom (46)	Recessed	M	4'T12	12	4	34	S	9	184	24	1,920	3,180	T8	ecesse	4'T8	E	OS	12	4	32	7	184	13	1692	2101	378	700	1078
7	1	Classroom (47)	Recessed	M	4'T12	12	4	34	S	9	184	24	1,920	3,180	T8	ecesse	4'T8	E	OS	12	4	32	7	184	13	1692	2101	378	700	1078
8	1	Classroom (40A)	Recessed	M	4'T12	4	2	34	S	9	184	15	332	550	T8	ecesse	4'T8	E	OS	4	2	32	7	184	6	280	348	86	116	202
9	1	Classroom (49)	Recessed	M	4'T12	12	4	34	S	9	184	24	1,920	3,180	T8	ecesse	4'T8	E	OS	12	4	32	7	184	13	1692	2101	378	700	1078
10	1	Classroom (50)	Recessed	M	4'T12	12	4	34	S	9	184	24	1,920	3,180	T8	ecesse	4'T8	E	OS	12	4	32	7	184	13	1692	2101	378	700	1078
11	1	Classroom (51)	Recessed	M	4'T12	12	4	34	S	9	184	24	1,920	3,180	T8	ecesse	4'T8	E	OS	12	4	32	7	184	13	1692	2101	378	700	1078
12	1	Classroom (53)	Recessed	M	4'T12	16	4	34	S	9	184	24	2,560	4,239	T8	ecesse	4'T8	E	OS	16	4	32	7	184	13	2256	2802	503	934	1437
13	1	Classroom (54)	eiling Suspende	M	4'T12	12	3	34	S	9	184	20	1,464	2,424	T8	g Susp	4'T8	E	OS	12	3	32	7	184	10	1272	1580	318	527	845
14	1	Classroom (55)	eiling Suspende	M	4'T12	15	4	34	S	9	184	24	2,400	3,974	T8	g Susp	4'T8	E	OS	15	4	32	7	184	13	2115	2627	472	876	1348
15	1	Classroom (56)	eiling Suspende	M	4'T12	16	3	34	S	9	184	20	1,952	3,233	T8	g Susp	4'T8	E	OS	16	3	32	7	184	10	1696	2106	424	702	1126
16	1	Storage Closet (560)	Ceiling Mounted	M	4'T12	3	2	34	S	2	184	20	264	97	T8	ng Mou	4'T8	E	S	3	2	32	2	184	6	210	77	20	0	20
17	1	office (56C)	Ceiling Mounted	M	4'T12	1	2	34	S	2	184	15	83	31	T8	ng Mou	4'T8	E	S	1	2	32	2	184	6	70	26	5	0	5
18	1	Office (56D)	Ceiling Mounted	M	4'T12	1	2	34	S	9	184	15	83	137	T8	ng Mou	4'T8	E	S	1	2	32	9	184	6	70	116	22	0	22
19	1	Classroom (57)	Recessed	M	4'T12	16	3	34	S	9	184	20	1,952	3,233	T8	ecesse	4'T8	E	OS	16	3	32	7	184	10	1696	2106	424	702	1126
20	1	Hallway	Recessed	E	2'T8	8	2	17	S	17	184	3	296	926	C	ecesse	2'T8	E	MS	8	2	17	13	184	3	296	694	0	231	231
21	1	Hallway	Recessed	N	LED	1	1	5	N	24	365	0	5	44	N/A	ecesse	LED	N	N	1	1	5	24	365	0	5	44	0	0	0
22	1	Hallway	Recessed	N	LED	1	1	5	N	24	365	0	5	44	N/A	ecesse	LED	N	N	1	1	5	24	365	0	5	44	0	0	0
23	1	Hallway	Recessed	E	2'T8	4	2	17	N	17	184	3	148	463	C	ecesse	2'T8	E	MS	4	2	17	13	184	3	148	347	0	116	116
24	1	Classroom (30)	Recessed	E	4'T8	10	2	32	S	9	184	6	700	1,159	C	ecesse	4'T8	E	OS	10	2	32	7	184	6	700	869	0	290	290
25	1	Cafeteria	eiling Suspende	N	MV	8	1	400	S	8	184	0	3,200	4,710	N/A	g Susp	CFL	N	OS	8	1	250	6	184	0	2000	2208	1766	736	2502
26	1	Gymnasium	eiling Suspende	N	MV	5	1	400	S	9	184	0	2,000	3,312	N/A	g Susp	CFL	N	OS	5	1	250	7	184	0	1250	1553	1242	518	1760
27	1	Gymnasium	Exit Sign	N	LED	2	1	5	N	9	365	1	12	39	N/A	xit Sig	LED	N	N	2	1	5	9	365	1	12	39	0	0	0
28	1	Gymnasium	eiling Suspende	M	4'T12	20	2	34	S	9	184	15	1,660	2,749	T8	g Susp	4'T8	E	OS	20	2	32	7	184	6	1400	1739	431	580	1010
29	1	Kitchen	eiling Suspende	M	4'T12	21	2	34	S	9	184	15	1,743	2,886	T8	g Susp	4'T8	E	OS	21	2	32	7	184	6	1470	1826	452	609	1061
30	1	Kitchen	eiling Suspende	M	4'T12	1	2	34	S	9	184	15	83	137	T8	g Susp	4'T8	E	S	1	2	32	9	184	6	70	116	22	0	22
31	1	Kitchen office	Recessed	M	4'T12	4	2	34	S	9	184	15	332	550	T8	ecesse	4'T8	E	OS	4	2	32	7	184	6	280	348	86	116	202
32	1	Kitchen closet	eiling Suspende	M	4'T12	3	2	34	S	9	184	15	249	412	T8	g Susp	4'T8	E	OS	3	2	32	7	184	6	210	261	65	87	152
33	1	Classroom (28)	eiling Suspende	M	4'T12	35	2	34	S	9	184	15	2,905	4,811	T8	g Susp	4'T8	E	OS	35	2	32	7	184	6	2450	3043	753	1014	1768
34	1	Office phys Ed	eiling Suspende	M	4'T12	6	2	34	S	9	184	15	498	825	T8	g Susp	4'T8	E	OS	6	2	32	7	184	6	420	522	129	174	303
35	1	Classroom (26)	eiling Suspende	M	4'T12	20	2	34	S	9	184	15	1,660	2,749	T8	g Susp	4'T8	E	OS	20	2	32	7	184	6	1400	1739	431	580	1010
36	1	Hallway	eiling Suspende	M	4'T12	12	2	34	S	17	184	15	996	3,115	T8	g Susp	4'T8	E	MS	12	2	32	13	184	6	840	1971	488	657	1145
37	1	Classroom (24)	eiling Suspende	M	4'T12	20	2	34	S	9	184	15	1,660	2,749	T8	g Susp	4'T8	E	OS	20	2	32	7	184	6	1400	1739	431	580	1010
38	1	Classroom (22)	eiling Suspende	M	4'T12	20	2	34	S	9	184	15	1,660	2,749	T8	g Susp	4'T8	E	OS	20	2	32	7	184	6	1400	1739	431	580	1010
39	1	Hallway	Recessed	M	4'T12	8	2	34	S	17	184	15	664	2,077	T8	ecesse	4'T8	E	MS	8	2	32	13	184	6	560	1314	325	438	763
40	1	Hallway	Exit Sign	N	LED	2	1	5	N	24	365	1	12	105	N/A	xit Sig	LED	N	N	2	1	5	24	365	1	12	105	0	0	0
41	1	Bathroom Women	Recessed	N	4'T8	2	3	32	OS	7	184	10	212	273	N/A	ecesse	4'T8	N	OS	2	3	32	7	184	10	212	273	0	0	0
42	1	Bathroom Women	Recessed	E	T8 U-Shap	1	2	32	OS	7	184	6	70	90	T8	ecesse	U-Sh	E	OS	1	2	32	7	184	6	70	90	0	0	0
43	1	Bathroom Men	Recessed	E	T8 U-Shap	1	2	32	OS	7	184	6	70	90	T8	ecesse	U-Sh	E	OS	1	2	32	7	184	6	70	90	0	0	0
44	1	Bathroom Men	Recessed	E	4'T8	2	3	32	OS	7	184	10	212	273	N/A	ecesse	4'T8	E	OS	2	3	32	7	184	10	212	273	0	0	0
45	1	Classroom (29)	eiling Suspende	M	4'T12	20	2	34	S	9	184	15	1,660	2,749	T8	g Susp	4'T8	E	OS	20	2	32	7	184	6	1400	1739	431	580	1010
46	1	Classroom (31)	eiling Suspende	M	4'T12	20	2	34	S	9	184	15	1,660	2,749	T8	g Susp	4'T8	E	OS	20	2	32	7	184	6	1400	1739	431	580	1010
47	1	Classroom (33)	eiling Suspende	M	4'T12	20	2	34	S	9	184	15	1,660	2,749	T8	g Susp	4'T8	E	OS	20	2	32	7	184	6	1400	1739	431	580	1010
48	1	Classroom (35)	eiling Suspende	M	4'T12	40	2	34	S	9	184	15	3,320	5,498	T8	g Susp	4'T8	E	OS	40	2	32	7	184	6	2800	3478	861	1159	2020
49	1	Office (35A)	eiling Suspende	M	4'T12	2	2	34	S	2	184	15	166	61	T8	g Susp	4'T8	E	S	2	2	32	2	184	6	140	52	10	0	10
50	1	Office (35B)	eiling Suspende	M	4'T12	2	2	34	S	2	184	15	166	61	T8	g Susp	4'T8	E	S	2	2	32	2	184	6	140	52	10	0	10
51	1	Display case	Recessed	N	CFL	3	1	42	S	2	184	0	126	46	N/A	ecesse	CFL	N	S	3	1	42	2	184	0	126	46	0	0	0
52	1	Classroom (37B)	Recessed	N	4'T12	4	4	34	S	9	184	24	640	1,060	T8	ecesse	4'T8	E	OS	4	4	32	7	184	13	564	700	126	233	359
53	1	Classroom (37A)	Recessed	N	4'T12	4	4	34	S	9	184	24	640	1,060	T8	ecesse	4'T8	E	OS	4	4	32	7	184	13	564	700	126	233	359
54	1	Conference room	Recessed	N	4'T12	2	4	34	S	9	184	24	320	530	T8	ecesse	4'T8	E	OS	2	4	32	7	184	13	282	350	63	117	180
55	1	MS Principal office	Recessed	N	4'T12	4	4	34	S	9	184	24	640	1,060	T8	ecesse	4'T8	E	OS	4	4	32	7	184	13	564	700	126	233	359
56	1	S Principal office hallw	Recessed	N	4'T12	1	4	34	S	9	184	24	160	265	T8	ecesse	4'T8	E	OS	1	4	32	7	184	13	141	175	31	58	90
57	1	Hallway	Recessed	M	4'T12	6	4	34	S	17	184	24	960	3,003	T8	ecesse	4'T8	E	MS	6	4	32	13	184	13	846	1985	357	662	1018

Location			Existing Fixture Information													Retrofit Information													Annual Savings		
Marker	Floor	Room Identification	Fixture Type	Ballast	Lamp Type	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Controls	Operational Hours per Day	Operational Days per Year	Ballast Wattage	Total Watts	Energy Use kWh/year	Category	Fixture Type	Lamp Type	Ballast	Controls	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Operational Hours per Day	Operational Days per Year	Ballast Watts	Total Watts	Energy Use kWh/year	Fixture Savings (kWh)	Controls Savings (kWh)	Total Savings (kWh)
58	1	Hallway	Recessed	E	2'T8	7	2	17	S	17	184	3	259	810	C	ecesse	2'T8	E	MS	7	2	17	13	184	3	259	608	0	203	203
59	1	Hallway display	Recessed	N	Halogen	2	1	35	S	17	184	0	70	219	N/A	ecesse	aloge	N	S	2	1	35	17	184	0	70	219	0	0	0
60	1	Copy room	Recessed	E	4'T12	3	2	34	S	9	184	15	249	412	T8	ecesse	4'T8	E	OS	3	2	32	7	184	6	210	261	65	87	152
61	1	Bathroom Women	Recessed	E	4'T8	4	3	32	OS	7	184	10	424	546	N/A	ecesse	4'T8	E	OS	4	3	32	7	184	10	424	546	0	0	0
62	1	Bathroom Men	Recessed	E	4'T8	4	3	32	OS	7	184	10	424	546	N/A	ecesse	4'T8	E	OS	4	3	32	7	184	10	424	546	0	0	0
63	1	Bathroom Men	Recessed	E	T8 U-Shape	1	2	32	OS	7	184	6	70	90	T8	ecesse	U-Sha	E	OS	1	2	32	7	184	6	70	90	0	0	0
64	1	Bathroom Women	Recessed	E	T8 U-Shape	1	2	32	OS	7	184	6	70	90	T8	ecesse	U-Sha	E	OS	1	2	32	7	184	6	70	90	0	0	0
65	1	Hallway	Recessed	E	2'T8	16	2	17	S	17	184	3	592	1,852	C	ecesse	2'T8	E	MS	16	2	17	13	184	3	592	1389	0	463	463
66	1	Hallway	Recessed	E	2'T8	12	2	17	S	17	184	3	444	1,389	C	ecesse	2'T8	E	MS	12	2	17	13	184	3	444	1042	0	347	347
67	1	Classroom (20)	Ceiling Mounted	E	4'T12	18	2	34	S	9	184	15	1,494	2,474	T8	ng Mou	4'T8	E	OS	18	2	32	7	184	6	1260	1565	388	522	909
68	1	Classroom (25)	Ceiling Mounted	E	4'T12	18	2	34	S	9	184	15	1,494	2,474	T8	ng Mou	4'T8	E	OS	18	2	32	7	184	6	1260	1565	388	522	909
69	1	Faculty rm bathroom	Sconce	E	Inc	1	2	60	S	9	184	0	120	199	N/A	Sconce	CFL	N	OS	1	2	15	7	184	0	30	37	149	12	161
70	1	Faculty rm bathroom	Sconce	E	Inc	1	2	60	S	9	184	0	120	199	N/A	Sconce	CFL	N	OS	1	2	15	7	184	0	30	37	149	12	161
71	1	aculty rm phone boot	Ceiling Mounted	M	2'T12	1	2	17	S	9	184	3	37	61	T8	ng Mou	2'T8	E	OS	1	2	17	7	184	1	35	43	3	14	18
72	1	Classroom (18)	Ceiling Mounted	M	4'T12	18	2	34	S	9	184	15	1,494	2,474	T8	ng Mou	4'T8	E	OS	18	2	32	7	184	6	1260	1565	388	522	909
73	1	Classroom (23)	Ceiling Mounted	M	4'T12	18	2	34	S	9	184	15	1,494	2,474	T8	ng Mou	4'T8	E	OS	18	2	32	7	184	6	1260	1565	388	522	909
74	1	Classroom (16)	Ceiling Mounted	M	4'T12	18	2	34	S	9	184	15	1,494	2,474	T8	ng Mou	4'T8	E	OS	18	2	32	7	184	6	1260	1565	388	522	909
75	1	Classroom (14)	Ceiling Mounted	M	4'T12	18	2	34	S	9	184	15	1,494	2,474	T8	ng Mou	4'T8	E	OS	18	2	32	7	184	6	1260	1565	388	522	909
76	1	Bathroom Women	Recessed	E	4'T8	3	3	32	OS	7	184	10	318	410	T8	ecesse	4'T8	E	OS	3	3	32	7	184	10	318	410	0	0	0
77	1	Bathroom Men	Recessed	E	4'T8	3	3	32	OS	7	184	10	318	410	T8	ecesse	4'T8	E	OS	3	3	32	7	184	10	318	410	0	0	0
78	1	Bathroom Men	Recessed	E	T8 U-Shape	1	2	32	OS	7	184	6	70	90	T8	ecesse	U-Sha	E	OS	1	2	32	7	184	6	70	90	0	0	0
79	1	Bathroom Women	Recessed	E	T8 U-Shape	1	2	32	OS	7	184	6	70	90	T8	ecesse	U-Sha	E	OS	1	2	32	7	184	6	70	90	0	0	0
80	1	Office	Ceiling Mounted	M	4'T12	4	2	34	S	9	184	15	332	550	T8	ng Mou	4'T8	E	OS	4	2	32	7	184	6	280	348	86	116	202
81	1	Hallway	Recessed	E	2'T8	4	2	17	S	17	184	3	148	463	T8	ecesse	2'T8	E	MS	4	2	17	13	184	3	148	347	0	116	116
82	1	Classroom (15B)	Ceiling Mounted	E	4'T12	2	2	34	S	9	184	15	166	275	T8	ng Mou	4'T8	E	OS	2	2	32	7	184	6	140	174	43	58	101
83	1	Classroom (15A)	Ceiling Mounted	M	4'T12	4	2	34	S	9	184	15	332	550	T8	ng Mou	4'T8	E	OS	4	2	32	7	184	6	280	348	86	116	202
84	1	Classroom (12D)	Ceiling Mounted	M	4'T12	4	4	34	S	9	184	24	640	1,060	T8	ng Mou	4'T8	E	OS	4	4	32	7	184	13	564	700	126	233	359
85	1	Classroom (12C)	Ceiling Mounted	M	4'T12	4	4	34	S	9	184	24	640	1,060	T8	ng Mou	4'T8	E	OS	4	4	32	7	184	13	564	700	126	233	359
86	1	Classroom (12B)	Ceiling Mounted	M	4'T12	4	4	34	S	9	184	24	640	1,060	T8	ng Mou	4'T8	E	OS	4	4	32	7	184	13	564	700	126	233	359
87	1	Classroom (12A)	Ceiling Mounted	M	4'T12	4	4	34	S	9	184	24	640	1,060	T8	ng Mou	4'T8	E	OS	4	4	32	7	184	13	564	700	126	233	359
88	1	er Room With Work S	Ceiling Mounted	M	8'T12	2	2	80	S	4	184	24	368	271	T8	ng Mou	8'T8	E	OS	2	2	59	3	184	13	262	145	78	48	126
89	1	Classroom (21)	Recessed	M	4'T12	11	4	34	S	9	184	24	1,760	2,915	T8	ecesse	4'T8	E	OS	11	4	32	7	184	13	1551	1926	346	642	988
90	1	Classroom bath (21A	Recessed	M	4'T12	1	2	34	S	9	184	15	83	137	T8	ecesse	4'T8	E	OS	1	2	32	7	184	6	70	87	22	29	51
91	1	Classroom walkthroug	Recessed	M	4'T12	1	2	34	S	2	184	15	83	31	T8	ecesse	4'T8	E	S	1	2	32	2	184	6	70	26	5	0	5
92	1	Classroom (19)	Recessed	M	4'T12	6	4	34	S	9	184	24	960	1,590	T8	ecesse	4'T8	E	OS	6	4	32	7	184	13	846	1051	189	350	539
93	1	Library	Recessed	M	4'T12	19	4	34	S	9	184	24	3,040	5,034	T8	ecesse	4'T8	E	OS	19	4	32	7	184	13	2679	3327	598	1109	1707
94	1	Nurse's	Recessed	M	4'T12	2	4	34	S	9	184	24	320	530	T8	ecesse	4'T8	E	OS	2	4	32	7	184	13	282	350	63	117	180
95	1	Nurse's	Recessed	M	12 U-Shap	2	2	34	S	9	184	15	166	275	T8	ecesse	U-Sha	E	OS	2	2	32	7	184	6	140	174	43	58	101
96	1	Nurse's bath	Recessed	M	12 U-Shap	1	2	34	S	9	184	15	83	137	T8	ecesse	U-Sha	E	OS	1	2	32	7	184	3	67	83	26	28	54
97	1	Office Area	Recessed	M	4'T12	12	4	34	S	9	184	24	1,920	3,180	T8	ecesse	4'T8	E	OS	12	4	32	7	184	13	1692	2101	378	700	1078
98	1	Office	Recessed	M	4'T12	1	4	34	S	9	184	24	160	265	T8	ecesse	4'T8	E	OS	1	4	32	7	184	13	141	175	31	58	90
99	1	Office conference	Recessed	M	4'T12	4	4	34	S	9	184	24	640	1,060	T8	ecesse	4'T8	E	OS	4	4	32	7	184	13	564	700	126	233	359
100	1	Office conference	Recessed	M	12 U-Shap	2	2	34	S	9	184	15	166	275	T8	ecesse	U-Sha	E	OS	2	2	32	7	184	6	140	174	43	58	101
101	1	Office bath	Sconce	N	Inc	1	3	60	S	9	184	0	180	298	N/A	Sconce	CFL	N	OS	1	3	15	7	184	0	45	56	224	19	242
102	1	Office hallway	Ceiling Mounted	M	4'T12	1	2	34	S	9	184	15	83	137	T8	ng Mou	4'T8	E	OS	1	2	32	7	184	6	70	87	22	29	51
103	1	Office closet	Ceiling Mounted	E	4'T8	1	4	32	S	4	184	13	141	104	T8	ng Mou	4'T8	E	S	1	4	32	4	184	13	141	104	0	0	0
104	1	Entrance Hallway	Recessed	E	4'T12	13	4	34	S	17	184	24	2,080	6,506	T8	ecesse	4'T8	E	MS	13	4	32	13	184	13	1833	4300	773	1433	2206
105	1	Hallway	Recessed	M	4'T12	8	4	34	S	17	184	24	1,280	4,004	T8	ecesse	4'T8	E	MS	8	4	32	13	184	13	1128	2646	475	882	1358
106	1	Hallway	Exit Sign	N	LED	3	1	5	N	24	365	1	18	158	N/A	xit Sig	LED	N	N	3	1	5	24	365	1	18	158	0	0	0
107	1	Classroom (15)	Recessed	M	4'T12	12	3	34	S	9	184	20	1,464	2,424	T8	ecesse	4'T8	E	OS	12	3	32	7	184	10	1272	1580	318	527	845
108	1	Classroom office	Recessed	M	4'T12	1	2	34	S	4	184	15	83	61	T8	ecesse	4'T8	E	S	1	2	32	4	184	6	70	52	10	0	10
109	1	Office (13)	Recessed	M	12 U-Shap	1	2	34	S	9	184	15	83	137	T8	ecesse	U-Sha	E	OS	1	2	32	7	184	6	70	87	22	29	51
110	1	Office (13A)	Recessed	M	4'T12	1	4	34	S	9	184	24	160	265	T8	ecesse	4'T8	E	OS	1	4	32	7	184	13	141	175	31	58	90
111	1	Office (13B)	Recessed	M	4'T12	4	4	34	S	9	184	24	640	1,060	T8	ecesse	4'T8	E	OS	4	4	32	7	184	13	564	700	126	233	359
112	1	Office	Recessed	M	12 U-Shap	1	2	34	S	9	184	15	83	137	T8	ecesse	U-Sha	E	S	1	2	32	9	184	6	70	116	22	0	22
113	1	Office bath	Ceiling Mounted	M	4'T12	1	2	34	S	9	184	15	83	137	T8	ng Mou	4'T8	E	S	1	2	32	9	184	6	70	116	22	0	22
114	1	Office closet	Ceiling Mounted	M	4'T12	1	2	34	S	9	184	15	83	137	T8	ng Mou	4'T8	E	S	1	2	32	9	184	6	70	116	22	0	22
115	1	Janitor's Closet	Ceiling Mounted	M	4'T12	1	2	34	S	4	184	15	83	61	T8	ng Mou	4'T8	E	S	1	2	32	4	184	6	70	52	10	0	10
116	1	Bathroom Women	Recessed	E	4'T8	4	3	32	OS	7	184	10	424	546	T8	ecesse	4'T8	E	OS	4	3	32	7	184	10	424	546	0	0	0
117	1	Bathroom Men	Recessed	E	4'T8	4	3	32	OS	7	184	10	424	546	T8	ecesse	4'T8	E	OS	4	3	32	7	184	10	424	546	0	0	0
118	1	Bathroom Men	Recessed	E	T8 U-Shape	1	2	32	OS	7	184	6	70	90	T8	ecesse	U-Sha	E	OS	1	2	32	7	184	6	70	90	0	0	0

Location			Existing Fixture Information												Retrofit Information													Annual Savings		
Marker	Floor	Room Identification	Fixture Type	Ballast	Lamp Type	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Controls	Operational Hours per Day	Operational Days per Year	Ballast Wattage	Total Watts	Energy Use kWh/year	Category	Fixture Type	Lamp Type	Ballast	Controls	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Operational Hours per Day	Operational Days per Year	Ballast Watts	Total Watts	Energy Use kWh/year	Fixture Savings (kWh)	Controls Savings (kWh)	Total Savings (kWh)
119	1	Bathroom Women	Recessed	E	T8 U-Shape	1	2	32	OS	7	184	6	70	90	T8	ecesse	U-Sha	E	OS	1	2	32	7	184	6	70	90	0	0	0
120	1	Classroom 13	Recessed	M	4'T12	3	3	34	S	9	184	20	366	606	T8	ecesse	4'T8	E	OS	3	3	32	7	184	10	318	395	79	132	211
121	1	Classroom 13	Recessed	M	2'T12	2	3	20	S	9	184	24	168	278	T8	ecesse	2'T8	E	OS	2	3	17	7	184	4	110	137	96	46	142
122	1	Classroom 13 bath	Recessed	M	2'T12	1	2	20	S	9	184	16	56	93	T8	ecesse	2'T8	E	OS	1	2	17	7	184	3	37	46	31	15	47
123	1	Classroom (10)	Recessed	M	4'T12	9	4	34	S	9	184	24	1,440	2,385	T8	ecesse	4'T8	E	OS	9	4	32	7	184	13	1269	1576	283	525	809
124	1	Classroom (11)	Recessed	M	4'T12	8	4	34	S	9	184	24	1,280	2,120	T8	ecesse	4'T8	E	OS	8	4	32	7	184	13	1128	1401	252	467	719
125	1	Classroom bath	Recessed	M	4'T12	1	2	34	S	2	184	15	83	31	T8	ecesse	4'T8	E	S	1	2	32	2	184	6	70	26	5	0	5
126	1	Classroom (8)	Recessed	M	4'T12	8	3	34	S	9	184	20	976	1,616	T8	ecesse	4'T8	E	OS	8	3	32	7	184	10	848	1053	212	351	563
127	1	Classroom (9)	Recessed	E	4'T8	8	4	32	S	9	184	13	1,128	1,868	C	ecesse	4'T8	E	OS	8	4	32	7	184	13	1128	1401	0	467	467
128	1	Classroom (7)	Recessed	E	4'T8	9	4	32	S	9	184	13	1,269	2,101	C	ecesse	4'T8	E	OS	9	4	32	7	184	13	1269	1576	0	525	525
129	1	Classroom (5)	Recessed	E	4'T8	9	4	32	S	9	184	13	1,269	2,101	C	ecesse	4'T8	E	OS	9	4	32	7	184	13	1269	1576	0	525	525
130	1	Classroom (3)	Recessed	E	4'T8	9	4	32	S	9	184	13	1,269	2,101	C	ecesse	4'T8	E	OS	9	4	32	7	184	13	1269	1576	0	525	525
131	1	Classroom (2)	Recessed	E	4'T8	9	4	32	S	9	184	13	1,269	2,101	C	ecesse	4'T8	E	OS	9	4	32	7	184	13	1269	1576	0	525	525
132	1	Classroom (1)	Recessed	E	4'T8	9	4	32	S	9	184	13	1,269	2,101	C	ecesse	4'T8	E	OS	9	4	32	7	184	13	1269	1576	0	525	525
133	1	Hallway	Recessed	M	4'T8	5	2	32	S	17	184	6	350	1,095	C	ecesse	4'T8	E	OS	5	2	32	13	184	6	350	821	0	274	274
134	1	Hallway	Exit Sign	N	LED	2	1	5	N	24	365	1	12	105	N/A	xit Sig	LED	N	N	2	1	5	24	365	1	12	105	0	0	0
135	1	Hallway	Recessed	M	4'T8	12	2	32	N	17	184	6	840	2,628	C	ecesse	4'T8	E	OS	12	2	32	13	184	6	840	1971	0	657	657
136	1	Classroom (4)	Recessed	E	4'T8	8	4	32	S	9	184	13	1,128	1,868	C	ecesse	4'T8	E	OS	8	4	32	7	184	13	1128	1401	0	467	467
137	1	Classroom (6)	Recessed	E	4'T8	8	4	32	S	9	184	13	1,128	1,868	C	ecesse	4'T8	E	OS	8	4	32	7	184	13	1128	1401	0	467	467
138	1	Boiler Rm	Ceiling Mounted	M	4'T12	7	2	34	S	2	184	15	581	214	T8	ng Mou	4'T8	E	S	7	2	32	2	184	6	490	180	33	0	33
139	1	Janitor's Closet	Ceiling Mounted	M	4'T12	2	2	34	S	4	184	15	166	122	T8	ng Mou	4'T8	E	S	2	2	32	4	184	6	140	103	19	0	19
140	1	Boiler Rm	Ceiling Mounted	M	4'T12	9	2	34	S	24	184	15	747	3,299	T8	ng Mou	4'T8	E	S	9	2	32	24	184	6	630	2782	517	0	517
141	Ext	Exterior	Screw-in	N	MH	7	1	70	PC	12	365	18	616	2,698	PSMH	crew-i	PSMH	N	PC	7	1	45	12	365	10	385	1686	1012	0	1012
142	Ext	Exterior	Screw-in	N	CFL	10	1	23	S	12	365	0	230	1,007	C	crew-i	CFL	N	PC	10	1	23	9	365	0	230	756	0	252	252
143	Ext	Exterior	Screw-in	N	MH	1	1	400	PC	12	365	100	500	2,190	PSMH	crew-i	PSMH	N	PC	1	1	275	12	365	59	334	1463	727	0	727
Totals:						**1,028**	**377**	**5,741**				**2,155**	**115,038**	**205,473**						**1,028**	**377**	**4,951**			**1,175**	**99,986**	**137,079**	**26,798**	**41,596**	**68,394**
Rows Highlighed Yellow Indicate an Energy Conservation Measure is recommended for that space																														

Proposed Lighting Summary Table			
Total Surface Area (SF)	90,000		
Average Power Cost ($/kWh)	0.1660		
Exterior Lighting	**Existing**	**Proposed**	**Savings**
Exterior Annual Consumption (kWh)	5,895	3,905	**1,991**
Exterior Power (watts)	1,346	949	**397**
Total Lighting	**Existing**	**Proposed**	**Savings**
Annual Consumption (kWh)	199,578	133,174	**68,394**
Lighting Power (watts)	113,692	99,037	**14,655**
Lighting Power Density (watts/SF)	1.26	1.10	**0.16**
Estimated Cost of Fixture Replacement ($)	159,761		
Estimated Cost of Controls Improvements ($)	22,000		
Total Consumption Cost Savings ($)	**18,493**		

Legend				
Fixture Type	**Lamp Type**	**Control Type**	**Ballast Type**	**Retrofit Category**
Exit Sign	LED	N (None)	N/A (None)	N/A (None)
Screw-in	Inc (Incandescent)	S (Switch)	E (Electronic)	T8 (Installl new T8)
Pin	1'T5	OS (Occupancy Sensor)	M (Magnetic)	T5 (Install new T5)
Parabolic	2'T5	T (Timer)		CFL (Install new CFL)
Recessed	3'T5	PC (Photocell)		LEDex (Install new LED Exit)
2'U-shape	4'T5	D (Dimming)		LED (Install new LED)
Circiline	2'T8	DL (Daylight Sensor)		D (Delamping)
Exterior	3'T8	M (Microphonic Sensor)		C (Controls Only)
	4'T8			PSMH (Install new Pulse-Start Metal Halide)
	6'T8			
	8'T8			
	2'T12			
	3'T12			
	4'T12			
	6'T12			
	8'T12			
	CFL (Compact Fluorescent Lightbulb)			
	MR16			
	MV (Mercury Vapor)			
	MH (Metal Halide)			
	HPS (High Pressure Sodium			
	LPS (Low Pressure Sodium)			

Appendix B: Third Party Energy Suppliers (ESCOs)

http://www.state.nj.us/bpu/commercial/shopping.html

Third Party Electric Suppliers for JCPL Service Territory	Telephone & Web Site
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com
BOC Energy Services, Inc. 575 Mountain Avenue Murray Hill, NJ 07974	(800) 247-2644 www.boc.com
Commerce Energy, Inc. 4400 Route 9 South, Suite 100 Freehold, NJ 07728	(800) 556-8457 www.commerceenergy.com
Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446	(888) 635-0827 www.newenergy.com
Direct Energy Services, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com
FirstEnergy Solutions 300 Madison Avenue Morristown, NJ 07926	(800) 977-0500 www.fes.com
Glacial Energy of New Jersey, Inc. 207 LaRoche Avenue Harrington Park, NJ 07640	(877) 569-2841 www.glacialenergy.com
Integrys Energy Services, Inc. 99 Wood Ave, South, Suite 802 Iselin, NJ 08830	(877) 763-9977 www.integrysenergy.com
Liberty Power Delaware, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(866) 769-3799 www.libertypowercorp.com
Liberty Power Holdings, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(800) 363-7499 www.libertypowercorp.com
Pepco Energy Services, Inc. 112 Main St. Lebanon, NJ 08833	(800) 363-7499 www.pepco-services.com
PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com
Sempra Energy Solutions 581 Main Street, 8th Floor Woodbridge, NJ 07095	(877) 273-6772 www.semprasolutions.com
South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 756-3749 www.southjerseyenergy.com
Suez Energy Resources NA, Inc. 333 Thornall Street, 6th Floor Edison, NJ 08837	(888) 644-1014 www.suezenergyresources.com
UGI Energy Services, Inc. 704 East Main Street, Suite 1 Moorestown, NJ 08057	(856) 273-9995 www.ugienergyservices.com

Appendix C

Glossary and Method of Calculations

Glossary of ECM Terms

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Net ECM Cost: The net ECM cost is the cost experienced by the customer, which is typically the total cost (materials + labor) of installing the measure minus any available incentives. Both the total cost and the incentive amounts are expressed in the summary for each ECM.

Annual Energy Cost Savings (AECS): This value is determined by the audit firm based on the calculated energy savings (kWh or Therm) of each ECM and the calculated energy costs of the building.

Lifetime Energy Cost Savings (LECS): This measure estimates the energy cost savings over the lifetime of the ECM. It can be a simple estimation based on fixed energy costs. If desired, this value can factor in an annual increase in energy costs as long as the source is provided.

Simple Payback: This is a simple measure that displays how long the ECM will take to break-even based on the annual energy and maintenance savings of the measure.

ECM Lifetime: This is included with each ECM so that the owner can see how long the ECM will be in place and whether or not it will exceed the simple payback period. Additional guidance for calculating ECM lifetimes can be found below. This value can come from manufacturer's rated lifetime or warranty, the ASHRAE rated lifetime, or any other valid source.

Operating Cost Savings (OCS): This calculation is an annual operating savings for the ECM. It is the difference in the operating, maintenance, and / or equipment replacement costs of the existing case versus the ECM. In the case where an ECM lifetime will be longer than the existing measure (such as LED lighting versus fluorescent) the operating savings will factor in the cost of replacing the units to match the lifetime of the ECM. In this case or in one where one-time repairs are made, the total replacement / repair sum is averaged over the lifetime of the ECM.

Return on Investment (ROI): The ROI is expresses the percentage return of the investment based on the lifetime cost savings of the ECM. This value can be included as an annual or lifetime value, or both.

Net Present Value (NPV): The NPV calculates the present value of an investment's future cash flows based on the time value of money, which is accounted for by a discount rate (assumes bond rate of 3.2%).

Internal Rate of Return (IRR): The IRR expresses an annual rate that results in a break-even point for the investment. If the owner is currently experiencing a lower return on their capital than the IRR, the project is financially advantageous. This measure also allows the owner to compare ECMs against each other to determine the most appealing choices.

Calculation References

ECM = Energy Conservation Measure
AOCS = Annual Operating Cost Savings
AECS = Annual Energy Cost Savings
LOCS = Lifetime Operating Cost Savings
LECS = Lifetime Energy Cost Savings
LCS = Lifetime Cost Savings

NPV = Net Present Value
IRR = Internal Rate of Return
DR = Discount Rate

Net ECM Cost = Total ECM Cost – Incentive
LECS = AECS X ECM Lifetime
AOCS = LOCS / ECM Lifetime
LCS = LOCS+LECS

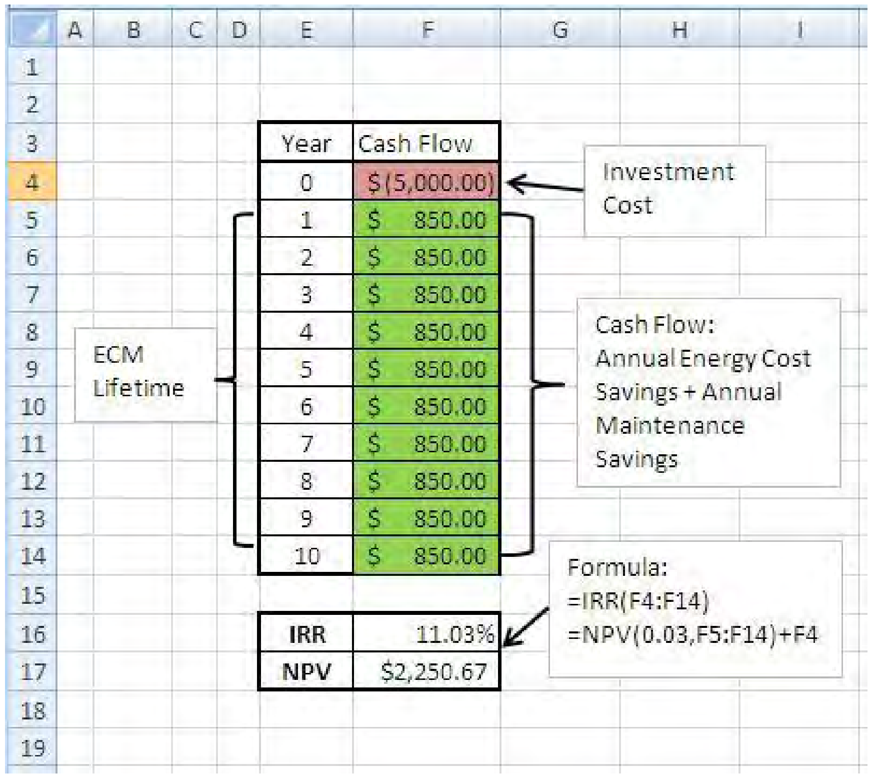
Note: The lifetime operating cost savings are all avoided operating, maintenance, and / or component replacement costs over the lifetime of the ECM. This can be the sum of any annual operating savings, recurring or bulk (i.e. one-time repairs) maintenance savings, or the savings that comes from avoiding equipment replacement needed for the existing measure to meet the lifetime of the ECM (e.g. lighting change outs).

Simple Payback = Net ECM Cost / (AECS + AOCS)
Lifetime ROI = (LECS + LOCS – Net ECM Cost) / Net ECM Cost
Annual ROI = (Lifetime ROI / Lifetime) = (AECS + OCS) / Net ECM Cost – 1 / Lifetime

It is easiest to calculate the NPV and IRR using a spreadsheet program like Excel.

Excel NPV and IRR Calculation

In Excel, function =IRR(values) and =NPV(rate, values) are used to quickly calculate the IRR and NPV of a series of annual cash flows. The investment cost will typically be a negative cash flow at year 0 (total cost - incentive) with years 1 through the lifetime receiving a positive cash flow from the annual energy cost savings and annual maintenance savings. The calculations in the example below are for an ECM that saves $850 annually in energy and maintenance costs (over a 10 year lifetime) and takes $5,000 to purchase and install after incentives:



Year	Cash Flow
0	$(5,000.00)
1	$ 850.00
2	$ 850.00
3	$ 850.00
4	$ 850.00
5	$ 850.00
6	$ 850.00
7	$ 850.00
8	$ 850.00
9	$ 850.00
10	$ 850.00

IRR	11.03%
NPV	$2,250.67

ECM and Equipment Lifetimes

Determining a lifetime for equipment and ECM's can sometimes be difficult. The following table contains a list of lifetimes that the NJCEP uses in its commercial and industrial programs. Other valid sources are also used to determine lifetimes, such as the DOE, ASHRAE, or the manufacturer's warranty.
Lighting is typically the most difficult lifetime to calculate because the fixture, ballast, and bulb can all have different lifetimes. Essentially the ECM analysis will have different operating cost savings (avoided equipment replacement) depending on which lifetime is used.

When the bulb lifetime is used (rated burn hours / annual burn hours), the operating cost savings is just reflecting the theoretical cost of replacing the existing case bulb and ballast over the life of the recommended bulb. Dividing by the bulb lifetime will give an annual operating cost savings.

When a fixture lifetime is used (e.g. 15 years) the operating cost savings reflects the avoided bulb and ballast replacement cost of the existing case over 15 years minus the projected bulb and ballast replacement cost of the proposed case over 15 years. This will give the difference of the equipment replacement costs between the proposed and existing cases and when divided by 15 years will give the annual operating cost savings.

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NJCEP C & I Lifetimes

Measure	Measure Life
Commercial Lighting — New	15
Commercial Lighting — Remodel/Replacement	15
Commercial Custom — New	18
Commercial Chiller Optimization	18
Commercial Unitary HVAC — New - Tier 1	15
Commercial Unitary HVAC — Replacement - Tier 1	15
Commercial Unitary HVAC — New - Tier 2	15
Commercial Unitary HVAC — Replacement Tier 2	15
Commercial Chillers — New	25
Commercial Chillers — Replacement	25
Commercial Small Motors (1-10 HP) — New or Replacement	20
Commercial Medium Motors (11-75 HP) — New or Replacement	20
Commercial Large Motors (76-200 HP) — New or Replacement	20
Commercial VSDs — New	15
Commercial VSDs — Retrofit	15
Commercial Comprehensive New Construction Design	18
Commercial Custom — Replacement	18
Industrial Lighting — New	15
Industrial Lighting — Remodel/Replacement	15
Industrial Unitary HVAC — New - Tier 1	15
Industrial Unitary HVAC — Replacement - Tier 1	15
Industrial Unitary HVAC — New - Tier 2	15
Industrial Unitary HVAC — Replacement Tier 2	15
Industrial Chillers — New	25
Industrial Chillers — Replacement	25
Industrial Small Motors (1-10 HP) — New or Replacement	20
Industrial Medium Motors (11-75 HP) — New or Replacement	20
Industrial Large Motors (76-200 HP) — New or Replacement	20
Industrial VSDs — New	15
Industrial VSDs — Retrofit	15
Industrial Custom — Non-Process	18
Industrial Custom — Process	10
Small Commercial Fuel oil #2 Furnace — New or Replacement	20
Small Commercial Fuel oil #2 Boiler — New or Replacement	20
Small Commercial Fuel oil #2 DHW — New or Replacement	10
C&I Fuel oil #2 Absorption Chiller — New or Replacement	25
C&I Fuel oil #2 Custom — New or Replacement (Engine Driven Chiller)	25
C&I Fuel oil #2 Custom — New or Replacement (Fuel oil #2 Efficiency Measures)	18
O&M savings	3
Compressed Air (GWh participant)	8

Honeywell

Honeywell Energy Analysis Team (HEAT)

Preliminary Utility Analysis

Frankford Township School District
Branchville, NJ

Helping customers manage energy resources to improve financial performance

Executive Summary

Honeywell would like to thank you for the opportunity of providing you with this Preliminary Utility Analysis. A one year detailed billing analysis was completed for all utility data provided by you. The facility's electric and oil consumption were compared to a benchmark of typical facilities of similar use and location.

Through our Energy Services offerings, Honeywell's goal is to form a long term partnership for the purpose of meeting your current infrastructure needs by focusing to:

- Improve Operational Cost Structures
- Ensure Satisfaction
- Upgrade Infrastructure While Reducing Costs
- Meet Strategic Initiatives
- Leverage Teamwork
- Pursue Mutual Interests
- Provide Financing Options

How does it work?

Under an energy retrofit solution, Honeywell installs new, energy efficient equipment and optimizes your facility, as part of a multi-year service contract. Most of these improvements are cost-justified by energy and operational savings. Some of the energy conservation measures provide for a quick payback, and as such, would help offset other capital intensive energy conservation measures such as, boilers, package rooftop units, domestic hot water heaters, etc. The objective is to provide you with reduced operating costs, increased equipment reliability, optimized equipment use, and improved occupant comfort.

After review of the utility analysis, you can authorize Honeywell to proceed with the development of a detailed engineering report. The report development phase allows Honeywell to prepare an acceptable list of proposed energy conservation measures, which are specific to the selected facility. Some examples of typical Energy Conservation Measures include:

- Lighting
- Energy Efficient Motors
- Control Systems
- Boilers
- Chillers
- Variable Speed Drives
- Steam Systems
- Package Rooftop Units
- Domestic Hot Water Heaters
- Power Factor Correction

Why Honeywell?

- Honeywell is one of the world leaders in providing infrastructure improvements
- With Honeywell as your building partner, you gain the advantage of more than 115 years of leadership in building services
- Honeywell has the infrastructure and manpower in place to manage and successfully implement your project
- Honeywell has over 30 years experience in the energy retrofit marketplace with over $3 Billion in customer energy savings
- Honeywell provides you with "Single Source Responsibility" - from Engineering to Implementation, Servicing and Financing (if desired)

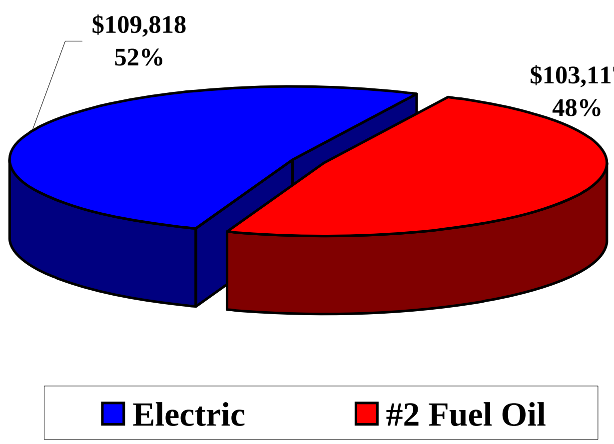
Historical Summary

Utility Analysis Period:
September 2009 - August 2010

	Current Year (9/09 - 8/10)	
	Electric	#2 Fuel Oil
Utility Costs*	$109,818	$103,117
Utility Usage (kWh, Gallons)	641,070	46,273
$ Cost/Unit (kWh, Gallons)	$0.17130	$2.228
Electric Demand (kW)	3,154	

* Costs include energy and demand components, as well as taxes, surcharges, etc.

Actual Cost by Utility - 9/09 - 8/10



Total Cost = $212,935

Energy Benchmarking

The calculation of EUI (Energy Use Intensity) is shown below.   EUI, expressed in kBtu/sf, is normalized for floor area, the most dominant influence on energy use in most buildings. Its use usually provides a good approximation of how your building's energy performance compares to others. Site EUI indicates the rate at which energy is used at your building (the point of use). Source EUI indicates the rate at which energy is used at the generation sources serving your building (the point of source) and indicates the societal energy penalty due to your building   The lower the EUI, the higher the rating, indicating that the building is more efficient than other buildings. The greater the EUI, the lower the rating, indicating that there is an opportunity for higher potential benefits from operational improvements.

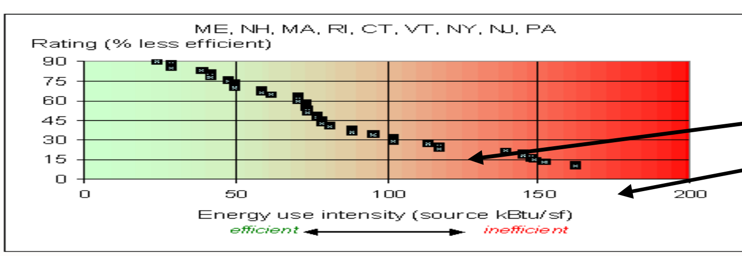
To compare the buildings shown below to each other, and to determine the ranking of the buildings from having the most to the least opportunity for demand-side improvements from a financial perspective, please see the Site EUI ranking below.

The Source EUI below has been applied to a Department of Energy statistical model from the Oak Ridge National Laboratory web site, http://eber.ed.ornl.gov/benchmark. The Department of Energy has estimated energy use and cost reductions for building source EUI ratings (percentiles) in the table below. Please see the DOE Regional Source EUI Comparison graph below to rate your building in relation to the regional distribution of similar type buildings. (Note: The Source EUI includes the inefficiencies of electrical generation and transmission. A reduction in 'electrical' source EUI includes a benefit in terms of reduction of air pollution emissions and green house gases, and is thus an indicator of societal benefit.)

Source EUI Rating for your Building	Energy use and cost reduction potential (%)	Walk-thru energy assessment recommended?
above 60%	**below 25%**	**No**
40 to 60%	**20 to 35%**	**Maybe**
20 to 40%	**35 to 50%**	**Yes**
Below 20%	**above 50%**	**Definitely**

Site EUI Rank		Annual Total Electrical Use (kWh)	Annual Total Non-Electrical Fuel Use (Gallons)	Building Gross Floor Area (sq-ft)	Site EUI Rating	Source EUI: Annual Total Source Energy Use per Sq-Ft (kBtu/sf)	Rating (Regional Source EUI Comparison)
1	Frankford Township School	598,160	39,239	90,579	**83**	**128**	**0.23**
2	Branchville School	42,910	7,034	7,881	**143**	**180**	**0.00**

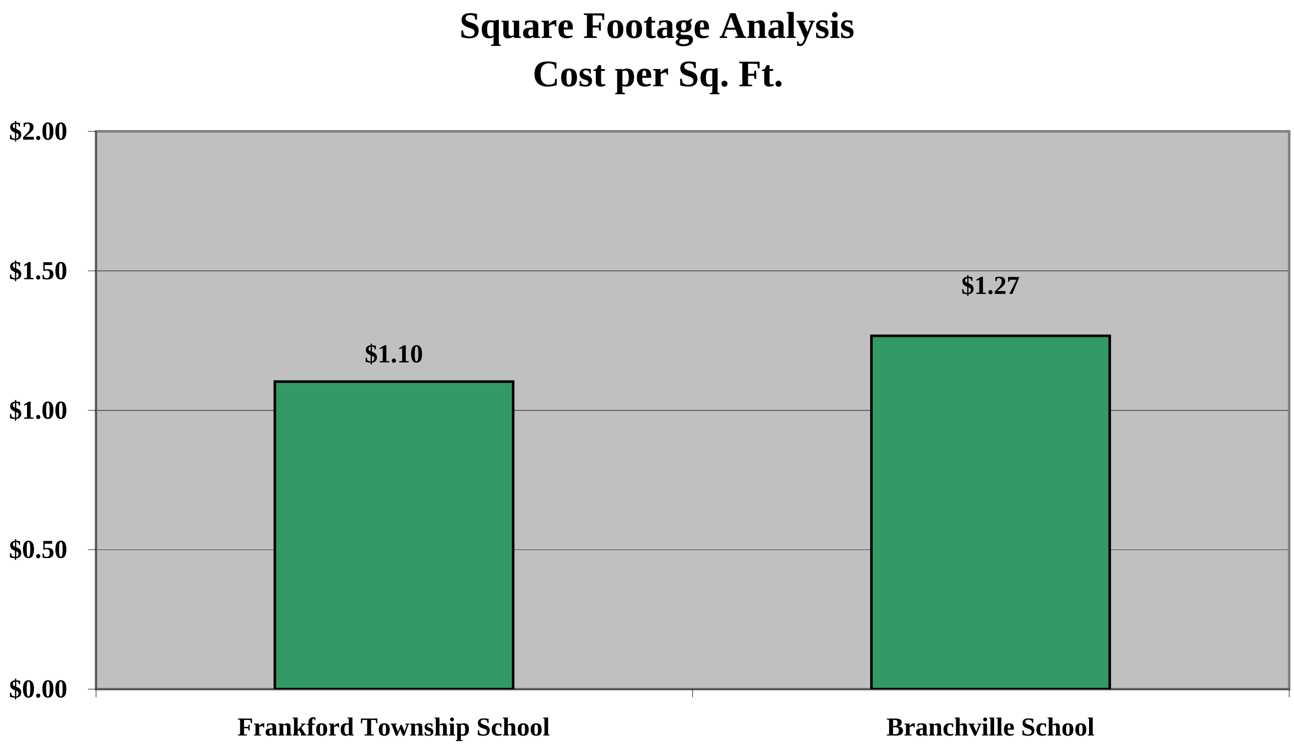
(Elementary/Middle Schools)

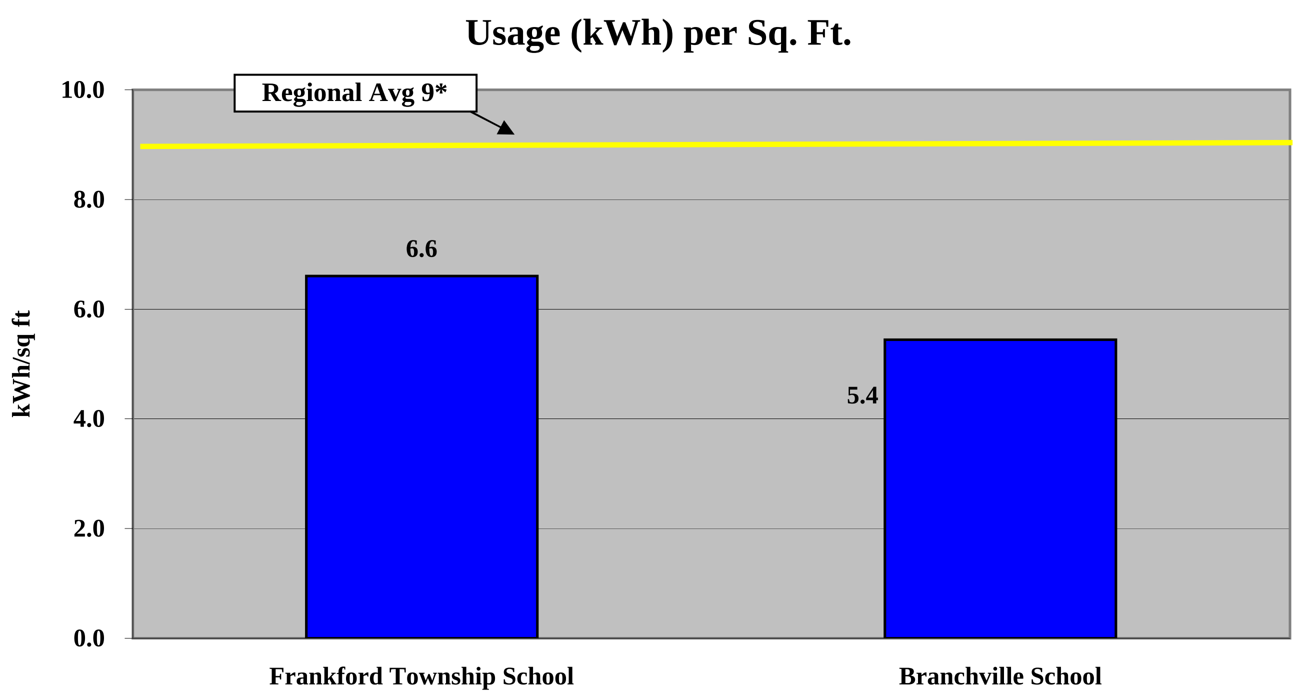


Source EUI	Est Regional Rating	Building
128	23%	Frankford Township School
180	0%	Branchville School

Utility Analysis - Electric

Frankford Township and Branchville Schools should be targeted for a more intensive building analysis due to their lower efficiency.

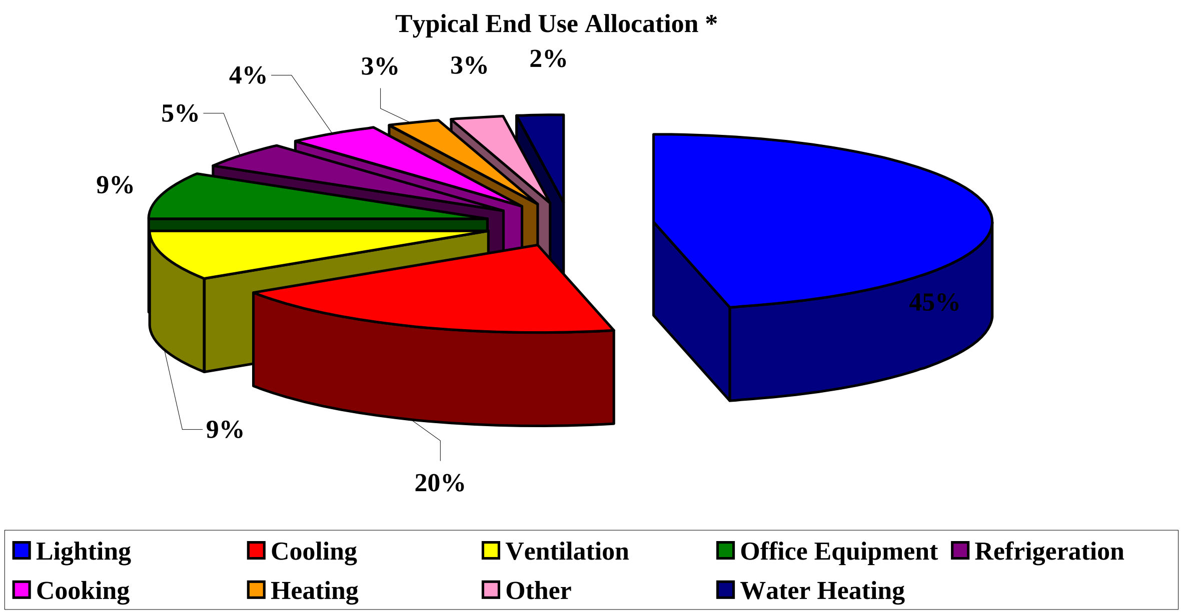




*Source: Nashville Gas Commercial Benchmark Data by Business Segment and Climate Zone - Schools Climate Zone 3

Utility Analysis - Electric

Sources of Electric Consumption

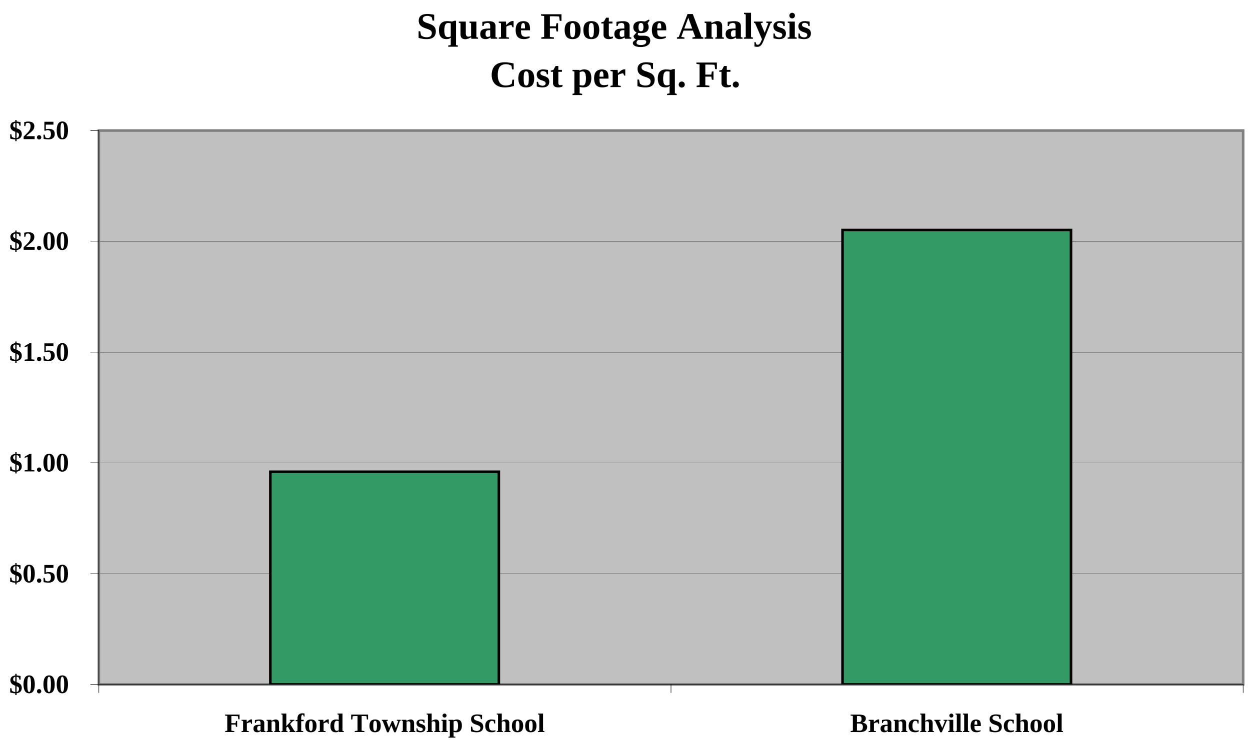


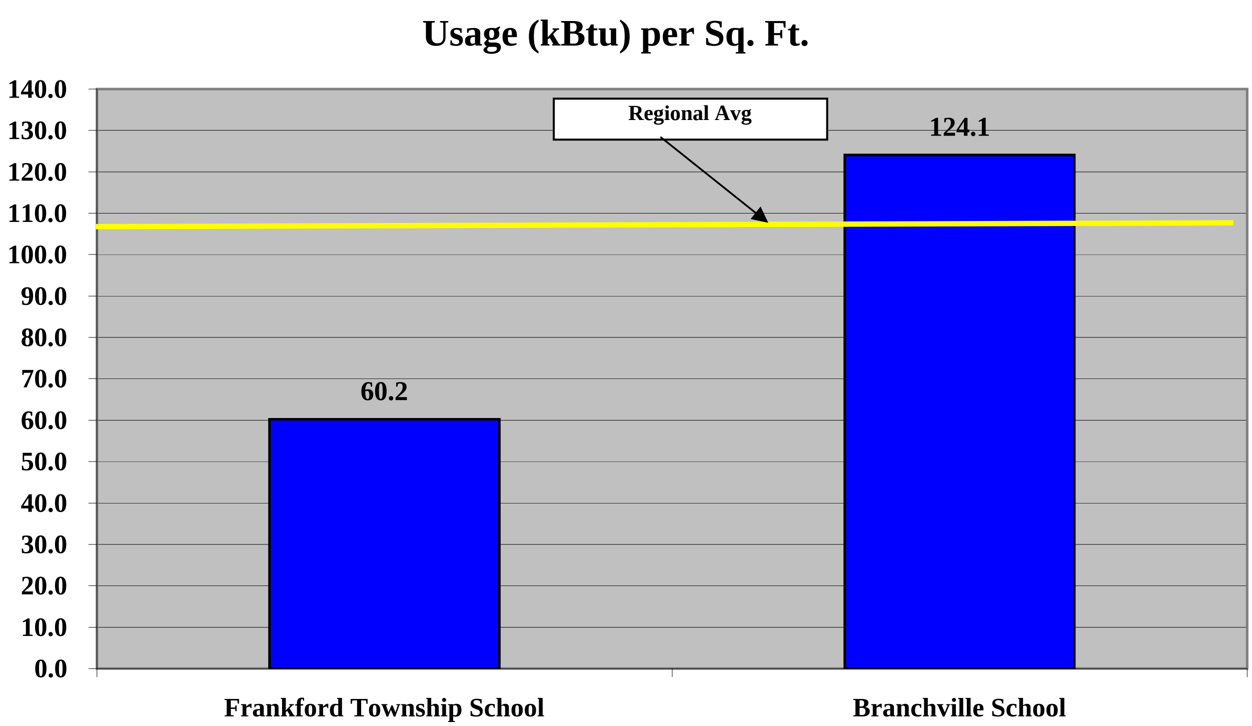
**This allocation is generic and is not a representation of the actual end use in your buildings included in this report.

Typical Allocation Applied to Your Electric Cost**

Lighting	$50,846
Cooling	$21,524
Ventilation	$10,103
Office Equipment	$9,444
Refrigeration	$5,161
Cooking	$4,832
Heating	$2,745
Other	$2,745
Water Heating	$2,416
Your 2009 Total Cost	**$109,818**

Utility Analysis - #2 Fuel Oil

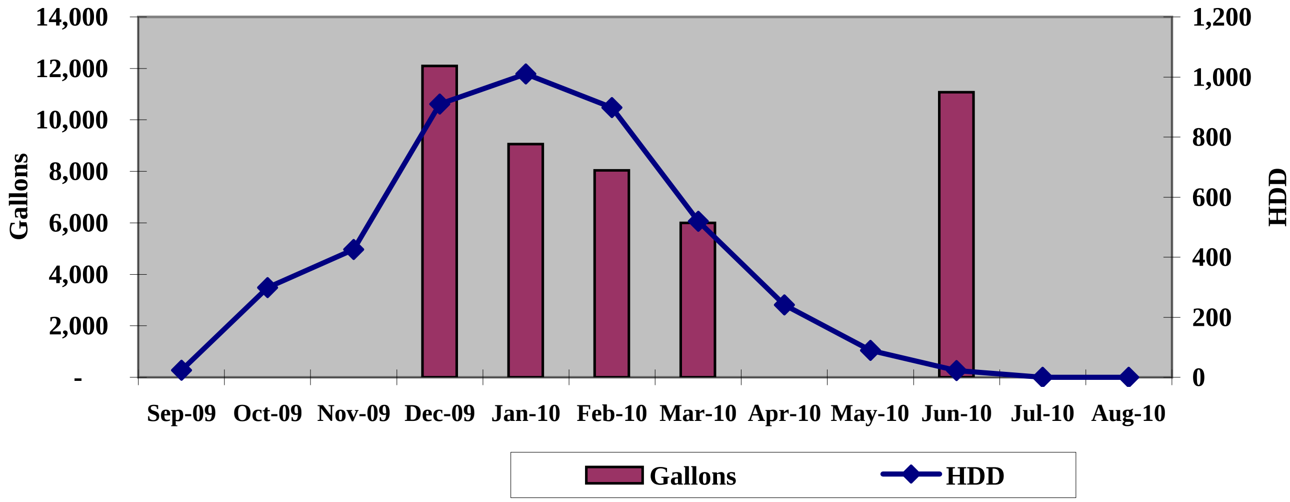




*Source: Nashville Gas Commercial Benchmark Data by Business Segment and Climate Zone - Schools Climate Zone 3

Utility Analysis - #2 Fuel Oil

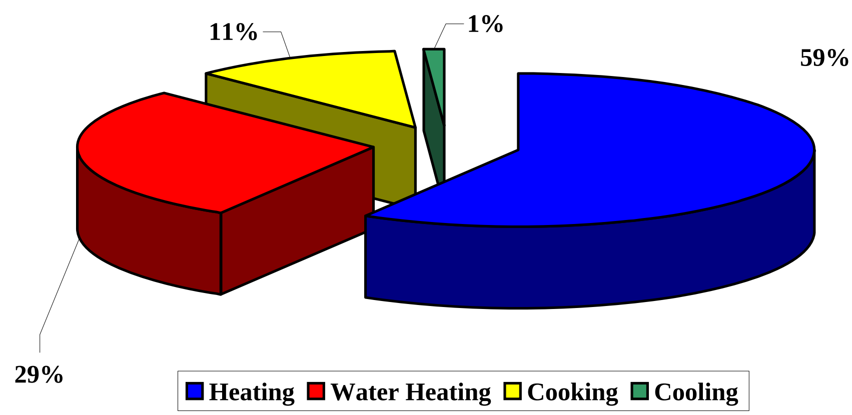
Your 9/09-8/10 Fuel Oil Usage and Heating Degree Days



There is a direct correlation between your gas usage and heating degree days, indicating that the vast majority of your natural gas usage is for space heating. There may be energy-saving opportunities available to convert kitchen equipment and water heating to more energy-efficient equipment that uses natural gas.

Sources of Fuel Oil Usage

Typical End Use Allocation *



**This allocation is generic and is not a representation of the actual end use in your buildings included in this report.

Typical Allocation Applied to Your Oil Cost**

Heating	$60,117
Water Heating	$29,801
Cooking	$11,755
Cooling	$1,134
Your 9/09-8/10 Total Cost	**$103,117**

*Source: Nashville Gas Commercial Benchmark Data by Business Segment and Climate Zone - Schools Climate Zone 3

Annual Emissions & Environmental Impact

Frankford Township School District

Calendar Year: 1/09 - 12/09

Zip Code 07826

The following energy usage, cost and pollution have been quantified:

Total Annual Electric usage	641,070	kWh
Annual Fuel Oil usage	64,319	Therms

Annual Greenhouse Gas Emissions

CO2	1,486,864	pounds
SO2	5,314	pounds
NOx	1,112	pounds

This is equivalent to one of the following:

129	No. of passenger vehicles - annual greenhouse gas emissions
75,864	Gallons of gasoline consumed - CO_2 emissions
1,568	Barrels of oil consumed - CO_2 emissions
82	No. of homes energy use for one year - CO_2 emissions
17,293	No. of tree seedlings grown for 10 years - carbon sequestered
144	No. of acres of pine or fir forests - carbon sequestered annually
28,101	No. of propane cylinders used for home barbeques - CO_2 emissions
4	No. of railcars' worth of coal burned - CO_2 emissions

Based on the US Environmental Protection Agency -
Clean Energy Power Profiler

Potential Retrofits

Retrofit Description	Utility/Fuel Type	Symptomatic Issues	Common Recommendations for Action
Lighting Retrofit	Electric	Outdated lighting system noted	Replace existing incandescent lamps and fluorescent lamps/magnetic ballasts with higher efficiency lamps/electronic ballasts; replace Exit signs with LED signs
Energy Efficient Motors	Electric	Motors have not been properly maintained	Replace old motors with premium efficiency motors to provide both electric usage and demand savings
Energy Management System/Control Systems	Electric/Fuel Oil	No energy management system present	Install EMS and activate night setback to provide automatic reset of temperatures during unoccupied periods
High Efficiency Boilers	Electric/Fuel Oil	Large aging boiler	Replace boiler with multiple smaller high efficency units and manage using an automated control system
Variable Speed Drives (VSD)	Electric	Air handler fan motors always run at full speed	Replace variable inlet vanes on AHU with VSD on motor
Package Rooftop Units	Electric	Units are very aged and running at low efficiency	Replace current system with a high-efficiency unit with an integrated economizer and a duct system that will allow proper airflow at low or medium fan speed
Domestic Hot Water Heaters	Fuel Oil	Current hot water heaters are corroded and leaking	Replace existing domestic water heaters with new, high efficiency gas fired tankless water heaters
Power Factor Correction	Electric	Electric utility bills showing a power factor of 65%	Install a proper sized capacitor bank that will restore the lagging power factor

Energy Conservation Measures
Section B

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INTRODUCTION

The information used to develop this Section was obtained through building surveys to collect equipment information, interviews with facility personnel, and an understanding of the components to the systems at the sites. The information obtained includes nameplate data, equipment age, condition, the system's design and actual load, operational practices and schedules, and operations and maintenance history. Honeywell has done a review of the ECMs which would provide energy and cost savings to the Frankford Township School District. This report aims to be an assessment of the feasibility and cost effectiveness of such measures, and an indication of the potential for their implementation.

The measures are listed below, as well as a general description of the energy auditing process. More detailed descriptions are also included.

Energy Conservation Measures:

ECM 1A	Vending Misers
ECM 1B	Lighting Retrofit and Motion Sensors
ECM 1C	Replace Refrigerators
ECM 2A	Boiler Combustion Controls
ECM 2B	Boiler Replacements
ECM 2C	Burner Replacements
ECM 2D	Domestic HW Heater Replacement
ECM 2E	AHU Unit Replacement
ECM 3A	BMS System Upgrade
ECM 3B	Demand Control Ventilation
ECM 4A	Building Envelope Improvements
ECM 4B	Window Replacements
ECM 4C	Roof Replacement
ECM 5A	Computer Controllers
ECM 6A	Install Premium Efficient Motors
ECM 6B	Variable Speed Drives on Pump Motors
ECM 7A	Install Photovoltaic Systems
ECM 7B	Wind Power
ECM 7C	Renewable Energy Education
ECM 8A	Kitchen Hood Controllers
ECM 8B	Walk-In Freezer Controllers
ECM 8C	Kitchen Sink Pedal Valves
ECM 9A	Demand Response

ECM	ECM Description	Frankford Township School	Branchville School
1A	Vending Misers	✓	
1B	Lighting Retrofit and Motion Sensors	✓	✓
1C	Replace Refrigerators	✓	
2A	Boiler Combustion Controls	✓	
2B	Boiler Replacements	✓	✓
2C	Burner Replacements	✓	
2D	Domestic HW Heater Replacement	✓	✓
2E	AHU Unit Replacement	✓	
3A	BMS System Upgrades	✓	✓
3B	Demand Control Ventilation	✓	
4A	Building Envelope Improvements	✓	✓
4B	Window Replacements	✓	
4C	Roof Replacement		✓
5A	Computer Controllers	✓	✓
6A	Install Premium Efficient Motors	✓	
6B	Variable Speed Drives on Pump Motors	✓	
7A	Install Photovoltaic Systems	✓	
7B	Wind Power	✓	
7C	Renewable Energy Education	✓	
8A	Kitchen Hood Controllers	✓	
8B	Walk-In Freezer Controllers	✓	
8C	Kitchen Sink Pedal Valves	✓	
9A	Demand Response	✓	✓

Overview

Honeywell's staff has closely evaluated and audited the Frankford Township and Branchville Schools in order to develop the optimum mix of utility saving measures. These selected site-specific measures have been developed using the following process:

- Review Site Audits
- Engineering Team Site Visits
- Develop Measures
- Review Measures with Team

Reject and Accept Measures Based On:

1. Alignment with Critical Success Factors (CSF)
2. Value to the District
3. Economic Financial Payback
4. Equipment Service Life
5. Effect on Current Space Conditions

In developing the proposed measures, the following considerations were critical:

- Reduction of space heating and cooling loads by performing a system review, with complete consideration of current indoor environmental quality standards.
- Review and redesign lighting systems noting reductions in the internal heat gain in the affected spaces.
- Load reduction measures always precede optimization measures.

The following project goals, as called for in RFP, were also critical in the development of our Energy Savings Plan response:

- Automated heating and cooling controls with web based management
- High efficiency boilers and water heaters
- Lighting upgrades to high efficiency fluorescents
- Window replacements
- Air handler replacements and controls
- Alternative energy systems
- Energy usage monitoring
- Energy Education, LEED, Energy Star Process

Bin weather data was used from a 15 year average reported from Newark Liberty International Airport, Newark, NJ. Assumptions for ventilation rates were predicted by using the building's population multiplied by 15 cfm/person during occupied hours.

Reasonable infiltration rates were assumed based on the building's fenestration conditions and expected values for typical school buildings. A reduced infiltration rate was assumed for the unoccupied hours. Envelope heat loss calculations assumed a reasonable heat transmission rate (U value) based on the construction of the buildings. Wall area and glass area were estimated by the energy audit report.

Current efficiencies were derived from assumed boiler efficiencies, and assumed system losses due to thermal losses, distribution losses and loose operational control. The current assumed boiler system efficiencies were then applied to the calculated load and calibrated to last year's actual fuel consumption.

Demand Sensitive Operation

Review existing and proposed thermal loads. For example, the review process will facilitate the application of:

1. Optimized flow rates (water and air)
2. Optimized operation of equipment, matching current occupancy use profiles and considering both outside and indoor space temperatures.

Benefits of Mechanical Improvements

Listed below are some of the benefits that the District would reap from the mechanical portion of the measures:

1. Avoid costly repairs and replace equipment that would have to be replaced in the next five years.
2. Improved compliance with ASHRAE Ventilation Standards.
3. Ability to trend ventilation rates; thus, ensuring compliance through documentation.
4. Operating a more weather sensitive facility.
5. Allowing for a greater capability of central monitoring and trouble shooting via remote.
6. Greater operating flexibility.

Indoor Air Quality

Implementation of new energy-related standards and practices has contributed to a degradation of indoor air quality. In fact, the quality of indoor air has been found to exceed the Environmental Protection Agency (EPA) standards for outdoor air in many homes, businesses, and factories.

The American Council of Governmental Industrial Hygienists (ACGIH) in their booklet "Threshold Limit Values," has published air quality standards for the industrial environment. No such standards currently exist for the residential, commercial, and institutional environments, although the ACGIH standards are typically and perhaps inappropriately used. The EPA has been working to develop residential and commercial standards for quite some time.

Recent studies indicate that for even the healthiest students, indoor air pollution can reduce the ability to learn. As an example, if you were to place a number of students in a room where it's hot, there's little or no air circulation and other children are coughing and sneezing, their ability to concentrate drops significantly. Honeywell has addressed this issue by focusing on the proper operation of the unit ventilators and air handler equipment which will assure IAQ standards are met.

ECM 1A
Vending Misers

The Frankford Township School facility has plug loads, such as vending machines. As such, Honeywell has investigated the use of plug controllers for these areas.

Existing Conditions

Vending machines are located throughout the facility, offering soft drinks to the occupants. A typical cold drink machine consumes over 3,000 kWh annually.

Item	Building	Type	Quantity
1	Frankford Township School	Cold Drinks Machines	3


Proposed Solution

During the site visit, Honeywell noted vending machines providing the opportunity for energy savings by shutting off non-critical loads during the non-occupied periods.

To control the vending machines, Honeywell proposes to install a vending machine occupancy controller (VMOC) to manage the power consumption. Utilizing a Passive Infrared (PIR) Sensor, the VMOC completely powers down a vending machine when the area surrounding it is unoccupied. Once powered down, the VMOC will monitor the room's temperature and use this information to automatically re-power the vending machine at one to three hour intervals, independent of occupancy, to ensure that the vended product stays cold.

The VMOC also monitors electrical current used by the vending machine. This ensures that the unit will never power down a vending machine while the compressor is running, so a high head pressure start never occurs. In addition, the current sensor ensures that every time the vending machine is powered up, the cooling cycle is run to completion before again powering down the vending machine. The Coca Cola Company and Pepsi Corporation approve the proposed controller for use on their machines.

- Using state-of-the-art electronics, VendingMiser is able to automatically determine whether or not the compressor of the vending machine is operating. Therefore, VendingMiser will never short cycle the compressor.
- The VendingMiser uses a custom occupancy sensor to determine if there is anyone within 40 feet of the machine. VendingMiser waits for 15 minutes of vacancy and then completely powers off the vending machine. If the compressor is running, power down is delayed until the cycle-in-process is completed.
- Once powered off, VendingMiser will monitor the room's temperature, and based on this measurement will automatically re-power the vending machine to run a complete cooling cycle, and then powers it down again.
- If a customer approaches the vending machine while powered down, VendingMiser will sense the person's presence and power up immediately.

Interface with Existing Equipment

All of the plug load control devices are easily installed. The vending machine controllers are installed separately from the machine, and implementation will occur during working hours. A period of three (3) weeks will be required to make sure of proper calibration of the sensors.

With respect to the vending machines in your facilities, Honeywell has estimated the number and types of vending machines. During the implementation phase, Honeywell will check with the vendor about the type and specification of the vending machines as it relates to any internal time clocks which may exist inside the machine. Should this be the case, the savings and cost will be adjusted accordingly.

ECM 1B
Lighting Retrofit and Motion Sensors

Existing Conditions

In general, lighting is the largest component of school building's electric usage (approximately 30%). By upgrading the existing lighting to the latest 28-watt electronic T8 technology, substantial cost savings will be achieved. The data and analysis outlined in this report is a snapshot of building conditions as of March 10, 2010.

Currently, there is mainly F32/T8 fixtures in this project. We recommend the installation of the latest technology electronic T8 ballasts and F32/T8 28-watt lamps in the majority of the fixtures, and installing reflectors and de-lamping fixtures whenever possible. Low power ballasts will be used and fixtures will be tandem-wired whenever possible, to save more energy without compromising light levels. The implementation of this efficient lighting design will not only provide cost savings, but also reduce the cooling load of a building. Using the latest technology ballasts and lamps in combination of de-lamping (in some locations) will generate less heat from the lighting fixtures reducing cooling loads and electrical loads which can translate into smaller HVAC equipment being specified, thus decreasing future capital cost outlays.

Proposed Solution

- The existing 2-lamp and 4-lamp F32T12 recessed and ceiling mounted and suspended fixtures present mainly in the classrooms, gymnasium, kitchen, hallways and offices will be retrofitted with electronic ballast, 28-watt T8 lamps and reflector.
- Existing incandescent fixtures will be retrofitted with compact fluorescent lamps.

Lighting Controls

Currently there are no occupancy sensor controls in this school. New sensors will contain the latest dual-sensor technology (passive infrared and ultrasonic activated). The ultrasonic aspect of the sensor will detect "minor" motion while the passive infrared aspect will detect long-range "major" motion. Based on observation, there were lights on in some unoccupied rooms.

For brightly day lit breezeways/hallways, installation of daylight harvesting controls will save substantial energy by turning off lights when natural light levels hit predetermined foot-candle levels. When artificial light is necessary, the lights will automatically turn on.

Changes in Infrastructure

New lamps and ballasts will be installed as part of this ECM.

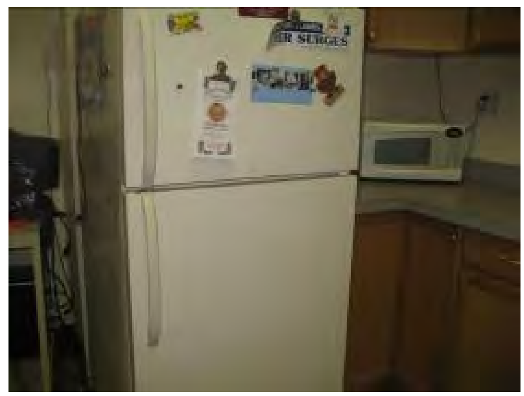
Customer Support and Coordination with Utilities

Coordination efforts will be needed to reduce or limit impact to building occupants.

Environmental Issues

Resource Use	Energy savings will result from reduced electric energy usage. A slight increase in heating energy is resultant from the reduced heat output of more efficient lamps.
Waste Production	All lamps and ballasts that are removed will be properly disposed.
Environmental Regulations	No environmental impact is expected.

ECM 1C
Replace Refrigerators



<u>Existing Conditions</u>

There are three (3) older refrigerators in the lounge areas which are not Energy Star rated (using as much as 1,700 kWh/yr each). The replacement of the existing refrigerators which are operating at the end of their useful lives with more modern, ENERGY STAR®, energy efficient appliances is recommended.

<u>Proposed Solution</u>

Appliances, such as refrigerators, that are over 10-12 years of age should be replaced with newer efficient models with the Energy Star label. Besides saving energy, the replacement will also keep the lounge area cooler. In addition, the existing systems utilize R-12 refrigerant, which is not an ozone-friendly refrigerant. Newer systems should be specified with R-134A or R-404A refrigerant. When compared to the average electrical consumption of older equipment, Energy Star equipment results in large savings. Look for the Energy Star label when replacing appliances and equipment, including: window air conditioners, refrigerators, printers, computers, copy machines, etc.

<u>Equipment Information</u>

Equipment Identification	Product cut sheets and specifications generally used are available upon request. As part of the measure design and approval process, specific product selection will be provided for your review and approval.

<u>Changes in Infrastructure</u>

New Energy Star labeled refrigerators will be installed in the lounge areas. No expansion of the facilities will be necessary.

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ECM 2A
Boiler Combustion Controls

Existing Conditions

The information used in developing this Energy Conservation Measure (ECM) was obtained through interviews with building operators, conditions observed during visits to the buildings, manufacturer's technical literature for existing and new equipment and data obtained through various technical publications.

Honeywell has evaluated the school building's heating and domestic hot water equipment and distribution systems to identify areas for boiler plant optimization.

The three (3) HB Smith hot water boilers at Frankford Township School were manufactured in 1986 and 1992. The fuel used in these boilers is No. 2 fuel oil. The boilers are not equipped with mechanical linkage to control the air/fuel ratio through the firing range.

The A/B wing boiler room has two (2) boilers; one serves the A wing and the other serves the B wing. The A wing boiler can be manually valved to supplement the boiler serving the C and D wings. The A boiler water temperature is currently controlled manually via aquastat on the boiler and there did not appear to be any pressure control. The B boiler has a lead/lag pump pair, a 3-way mixing valve for water temperature control and a 2-way bypass valve for pressure control. All controls are pneumatic.

The C/D wing boiler room has a single hot water boiler and two (2) hot water heating zones, one for the C wing and one for the D wing. Each zone has a lead/lag pump pair, a 3-way mixing valve for water temperature control and a 2-way bypass valve for pressure control.

Proposed Solution

Leaving the pumps on (and shutting the boiler off) effectively cools the water down to ambient temperatures. When a typical water boiler fires on temperature control, it would go directly to high fire, subjecting the boiler to "thermal shock". Repeating this thermal cycling on a daily basis could result in boiler damage. How long the boiler lasts is solely a function of how well it was built, but be aware that shocking the boiler in this manner is not part of modern boiler design or operating strategy.

Another negative side effect of leaving pumps on while shutting boilers off is that while the loop is brought up to temperature, the cold water reduces the stack temperature below what it needs to prevent condensation. So, every cycle is also dropping water through the fire-side of the boiler, effectively accelerating rust and eating the boiler from the inside out. When condensation mixes with combustion gases, it becomes very acidic.

Honeywell recommends reducing the boiler operating temperature closer to the minimum allowed by the manufacturer.

Most current hydronic systems have independent loop temperature control, but Boiler A does not. The independent loop temperature control is most often modulated using a 3-way valve typically mounted above the boiler. This valve allows the water being pumped through the building to be a different, lower temperature than what is going through the boiler. The loop temperature control is then modulated according to outside air temperature. This is done for two major reasons: it saves energy by reducing the loop temperature to the building as the outside air temperature rises during the day and it allows the boiler to operate as a constant temperature. This creates no thermal cycling and no stack condensation.

It is recommended that boilers be left on all winter and building temperatures be controlled via the circulating pumps. By switching off the circulation pumps, the heat to the building is stopped. This can be done nightly during the spring and fall. The water sits in the hot water lines throughout the building and the temperature does not drop so much. The boiler stays at temperature. It stops cycling (and therefore uses little or no fuel oil) because no water is moving and it is quite easy to keep the water in the boiler at 160°F. When the pumps kick back on, the hot water in the boiler and the warm water in the lines limit thermal cycling. During periods of mild weather, the 3-way valve is calling for reduced loop temperature, further reducing the flow of water through the boiler and allowing it to maintain its own operating temperature. This saves both energy and the boiler.

While there are a few exceptions to this, it holds true for the most part. When the outside air is freezing, the pumps must run to prevent the coils from freezing. So, in the dead of winter, there is little you can do in the boiler room. You are relegated to ensuring the 55°F setback is taking place in the building.

In addition, new single phase 120 volt combustion air fans shall be installed in each boiler room and interlocked to the boiler start/stop. This will ensure adequate combustion air.

Energy Savings Methodology and Results
The approach is based upon increasing the efficiency with improved combustion and hot water reset energy savings. The baseline adjustment calculations are included with the energy calculations.

Changes in Infrastructure
None

Customer Support and Coordination with Utilities
Minor support will be required for the interruption of utilities for brief tie-in periods.

Environmental Issues

Resource Use	Energy savings will result from reduced energy.
Waste Production	Any removed parts will be disposed of properly.
Environmental Regulations	No environmental impact is expected.

ECM 2B
Boiler Replacements

Boiler Replacement:
A common misperception of boiler performance is the term *boiler efficiency,* which is often substituted for the user's intended reference to combustion efficiency; traditionally measured at full load. While full load combustion efficiency is an important component to the performance of a boiler, part load operation and thermal efficiency are often overlooked, but significant contributors to overall boiler operation.

Boiler efficiency gains can be measured in three ways: combustion efficiency, thermal efficiency, and seasonal efficiency. Combustion efficiency gains can be realized through optimization of fuel, air mixtures and close control of the combustion process under all load conditions. Overall efficiency, while affected by the combustion process, also considers losses due to radiation, pre- and post- purge cycles on burner startup and shutdown, blow down losses, etc. Reduction of any of these losses will improve the boilers' overall efficiency. Seasonal efficiency is the actual efficiency that is achieved under various load conditions during the course of the heating season.

<u>**Existing Conditions**</u>
Frankford Twp. School

The existing boilers were manufactured in 1986 and 1992. At this age, the overall boiler efficiency is reducing year by year with additional cost of maintenance. Sooner or later the boilers will have to be replaced with new boilers.

<u>Existing Conditions</u>
Branchville School

The existing boilers were manufactured in 1975, however only one of the boilers are currently operating. At this age, the overall boiler efficiency is reducing year by year with additional cost of maintenance. Sooner or later the boilers will have to be replaced with new boilers.

Building	Existing Boilers				
	Boiler Make	Boiler Model	Qty	Output	Burner
Frankford Township School	HB Smith	Series 28	3	2,247 MBH 2,403 MBH 3,330 MBH	No. 2 Fuel Oil
Branchville School	HB Smith	250A Smith-Mills Boiler	2	393 MBH 463 MBH	No. 2 Fuel Oil

<u>Proposed Solution</u>
Replace two of the existing HB Smith boilers with two No. 2 fuel oil fired high efficiency boilers at the Frankford Township School. Replace two of the existing HB Smith boilers with two No. 2 fuel oil fired high efficiency boilers at the Branchville School. We recommend replacing the Frankford Township School boilers with packaged cast iron sectional boilers with modulating burners in each boiler room (similar to Weil-McLain 88 Series), sized in accordance with the building heating load. We recommend replacing the Branchville School boilers with packaged cast iron sectional boilers with modulating burners (similar to Weil-McLain 80 Series), sized in accordance with the building heating load.

The following table indicates the sizes and quantities of new boilers:

Building	PROPOSED				
	Boiler Make	Boiler Model	Qty	Output	Burner
Frankford Township School	Weil-McLain	88 Series	2	2,561 MBH 3,422 MBH	No. 2 Fuel Oil
Branchville School	Weil-McLain	80 Series	2	515 MBH	No. 2 Fuel Oil

Scope of Work:
The following outlines the recommended boiler system modifications at the schools:

Boiler Replacements

- Disconnect existing boilers electric connections
- Disconnect hot water and oil piping from the boilers
- Remove boilers
- Modify base for new boilers if necessary
- Rigging and setting new boilers at the base
- Modify oil and hot water piping before reconnecting them to the unit
- Reconnect piping and air ducts
- Terminate electric power
- Start up and commissioning of new units
- Maintenance operator(s) training

Controls

- BACnet series controller and panel. Connect controller to new communication bus.
- Hot water supply and return temperature sensors.
- Boiler start/stop and status (cycle boiler to maintain hot water setpoint).
- Boiler temperature sensor.
- Pump start/stop and status (typical for 2).

Energy Savings Methodology and Results
In general, Honeywell uses the following approach to determine savings for this specific measure:

Existing Boiler Efficiency	= Existing Heat Production/ Existing Fuel Input
Proposed Boiler Efficiency	= Proposed Heat Production/ Proposed Fuel Input
Energy Savings $	= Heating Production (Proposed Efficiency – Existing Efficiency)

Honeywell

Equipment Information

Manufacturer and Type	Several quality and cost effective manufacturers are available. Honeywell and the customer will determine final selections.
Equipment Identification	As part of the ECM design and approval process, specific product selection will be provided for your review and approval.

Changes in Infrastructure

New boilers will be installed in itemized locations; in addition, training for maintenance personnel will be required as well as an annual maintenance contract with the manufacturer.

O&M Impact

The new boilers will decrease the O&M cost significantly for maintaining the boilers.

Customer Support and Coordination with Utilities

Minor support will be required for the interruption of utilities for brief tie-in periods. Continuity of service must be maintained for the customer.

Environmental Issues

Resource Use	Energy savings will result from greater combustion efficiency, reduced maintenance costs control and setback.
Waste Production	This measure will produce waste byproducts.
Environmental Regulations	Environmental impact is expected; all regulations will be adhered to in accordance with EPA and local code requirements.

ECM 2C
Burner Replacements

Existing Conditions
The boiler burners at the Frankford Township School are Peabody Gordon-Paitt and Power Flame and were installed in 1986 and 1992. The burners are currently oil fired to produce warm air to heat the building. Boiler Burner efficiency is based on AFUE. The annual fuel utilization efficiency (AFUE; pronounced 'A'-'Few') is a thermal efficiency measure of combustion equipment like furnaces, boilers, and water heaters. The AFUE differs from the true 'thermal efficiency' in that it is not a steady-state, peak measure of conversion efficiency, but instead attempts to represent the actual, season-long, average efficiency of that piece of equipment, including the operating transients.

Existing Boiler Burner

Building	EXISTING		
	Burner	Qty	Fuel
Frankford Township School	Peabody Gordon-Paitt	2	Fuel Oil
Frankford Township School	Power Flame	1	Fuel Oil

Proposed System and Scope of Work
This ECM proposes to remove the existing burner units and install high efficiency units at the Frankford Township School.

The following table indicates the sizes and quantities of new high efficiency boiler burners:

Building	PROPOSED	
	Qty	Efficiency Savings
Frankford Township School	3	5%

Scope of Work
The following outlines the recommended heating system modifications for the building:
- Remove and dispose of existing boiler burners
- Furnish and install new boiler burners
- Furnish and install oil line to burners
- Rigging and setting in place above described new equipment

Energy Savings Methodology and Results

In general, Honeywell uses the following approach to determine savings for this specific measure:

Existing Burner Efficiency	= Existing Burner Output/ Existing Fuel Input
Proposed Burner Efficiency	= Proposed Burner Output/ Proposed Fuel Input
Energy Savings $	= Furnace Production (Proposed AFUE– Existing AFUE)

Equipment Information

Manufacturer and Type	Several quality and cost effective manufacturers are available. Honeywell and the customer will determine final selections.
Equipment Identification	As part of the ECM design and approval process, specific product selection will be provided for your review and approval.

Changes in Infrastructure

New burners will be installed in the boiler rooms; in addition training for maintenance personnel will be required as well as an annual maintenance contract with the manufacturer.

Customer Support and Coordination with Utilities

Minor support will be required for the interruption of utilities for brief tie-in periods. Continuity of service must be maintained for the customer.

Environmental Issues

Resource Use	Energy savings will result from greater efficiency.
Waste Production	This measure will produce waste byproducts.
Environmental Regulations	Environmental impact is expected; all regulations will be adhered to in accordance with EPA and local code requirements.

ECM 2D
Domestic Hot Water Unit Upgrades

Existing Conditions
Currently, the Frankford Township School uses two (2) boilers and the Branchville School uses one (1) boiler to make Domestic Hot Water (DHW) year round. The units are HB Smith boilers with separate storage tanks. The Frankford Township School units are about 18 years old and 66% efficient. The Branchville School has 2 H.B. Smith boilers, but currently only one boiler operates. This boiler makes domestic hot water year round. This unit is about 35 years old and 61% efficient.

Existing Domestic Hot Water Heater

School	EXISTING			
	Boiler	Qty	Rating	Efficiency
Frankford Township School	HB Smith	2	2,403 MBH 3,330 MBH	66%
Branchville School	HB Smith	2	393 MBH 463 MBH	61%

Proposed System and Scope of Work
This ECM proposes to install high efficiency propane fired DHW units at the Frankford Township and Branchville Schools.

The following table indicates the size and quantity of the new hot water heaters:

School	PROPOSED			
	New Boiler	Qty	Rating	Efficiency
Frankford Township School	AO Smith BTH-300A	1	300 MBH	96%
Branchville School	AO Smith BTH-120	1	125 MBH	95%

Scope of Work:
The following outlines the recommended domestic hot water heating boiler system modifications for the buildings:

- Furnish and install new domestic hot water heating boilers.
- Furnish and install propane lines to heaters.
- Rigging and setting in place above described new equipment.
- Reconnect the existing domestic water piping to the new boilers.
- Furnish and install new vent piping.
- Insulation of new hot water piping.

Energy Savings Methodology and Results

In general, Honeywell uses the following approach to determine savings for this specific measure:

Existing Boiler Efficiency	= Existing DHW Production/ Existing Fuel Input
Proposed Boiler Efficiency	= Proposed DHW Production/ Proposed Fuel Input
Energy Savings $	= DHW Production (Proposed Efficiency – Existing Efficiency)

Equipment Information

Manufacturer and Type	Several quality and cost effective manufacturers are available. Honeywell and the customer will determine final selections.
Equipment Identification	As part of the ECM design and approval process, specific product selection will be provided for your review and approval.

Changes in Infrastructure

New domestic hot water heaters will be installed in the A/B boiler room of Frankford Township School and the Branchville School boiler room. In addition, training for maintenance personnel will be required as well as an annual maintenance contract with the manufacturer.

Customer Support and Coordination with Utilities

Minor support will be required for the interruption of utilities for brief tie-in periods. Continuity of service must be maintained for the customer.

Environmental Issues

Resource Use	Energy savings will result from greater combustion efficiency.
Waste Production	This measure will produce waste byproducts.
Environmental Regulations	Environmental impact is expected; all regulations will be adhered to in accordance with EPA and local code requirements.

ECM 2E
AHU Unit Replacement

Existing Conditions
The packaged HVAC unit outside on grade serving the office area was installed in 1995 and is at the end of its expected service life of 15 years. The current equipment has a cooling Energy Efficiency Ratio (EER) of approximately 9.0.



Proposed Solution
Honeywell is proposing to replace this AHU with a new energy efficient unit that will provide adequate service with a minimum maintenance costs and save substantial energy costs over the long term.

The new unit shall be installed at the same location as existing. Electrical power shall be reconnected to the new motors. The new unit will be equipped with factory installed microprocessor controls to improve unit efficiency as well as the unit's ability to communicate with the building management system.

Scope of Work:
The following outlines the scope of work to install the AHU stated in the above table:
- Disconnect existing AHU electric connections
- Disconnect piping and air ducts from the unit
- Remove unit from the base
- Modify base for new unit if necessary
- Rigging and setting new unit at the base
- Inspect piping and air ducts before reconnecting them to the unit
- Reconnect piping and air ducts
- Repair duct and piping insulation
- Connect electric power
- Start up and commissioning of new unit
- Maintenance operator(s) training

Equipment Information

Manufacturer and Type	Several quality and cost effective manufacturers are available. The following is an example of equipment being utilized. Honeywell and the District will determine final selections.
Equipment Identification	Product cut sheets and specifications for generally used are available upon request. As part of the measure design and approval process, specific product selection will be provided for your review and approval.

Customer Support and Coordination with Utilities

Coordination of the electrical tie-in will be required.

Environmental Issues

Resource Use	Energy savings will result from a higher efficiency unit.
Environmental Regulations	No environmental impact is expected.

ECM 3A
BMS System Upgrades

<u>General Existing Conditions</u>
Frankford School

The school consists of the original structure built around 1950 that was renovated in 1984 (the 'A' wing) and three additional wings built in 1958, 1968, and 1974 (referred to as the B, C, and D wings respectively). The controls are primarily hot water unit ventilators (approximately 46) with pneumatic controls. There are (4) pneumatically controlled HV units (2 in the large gym/auditorium, 1 in the small gym, and a small unit in the kitchen). There is a small packaged HVAC unit that serves the office area that is controlled by a space mounted electronic thermostat.

<u>Proposed Building Management System Upgrades</u>
Frankford School

Based on conversations with the building manager and on visual inspection, the pneumatic control system is in poor shape. The control tubing is old and cracking and has numerous leaks. The compressors are leaking oil and the dryers did not have automatic drains, indicating that there may be a lot of oil and water in the control tubing that can cause poor operation or failure of control devices. Due to these conditions, it is Honeywell's recommendation that the pneumatic control system be abandoned and a new DDC control system be installed. This will result in improved comfort and less energy waste due to improved control. The system will also require less system maintenance and allow maintenance personnel to monitor the system remotely via any computer with access to the customer's Ethernet.

Unit Ventilators (typical for 46)
Demolish existing pneumatic controls and replace with electronic. This includes the following new devices

- BACnet series controller, connect controller to new communication bus
- Direct coupled damper actuator
- Mixed air sensor
- Filter switch
- Freeze protection stat
- Hot water valve and actuator
- Start/stop relay
- Current sensor for status
- Discharge air sensor
- Space mounted thermostat
- Tie fin tube radiation valves (approximately 3) to the nearest unit ventilator controller

Possible Alternative:
If occupancy sensors are being supplied for lighting, tie second contact on sensor to controller (2 pole sensors need to be supplied).

HV Unit (typical for 4)
Demolish existing pneumatic controls and replace with electronic. This includes the following new devices:

- BACnet series controller, connect controller to new communication bus
- Direct coupled damper actuator
- Mixed air sensor
- Filter switch
- Freeze protection stat
- Hot water valve and actuator
- Start/stop relay
- Current sensor for status
- Discharge air sensor
- Space mounted thermostat
- Add CO_2 sensors and demand control ventilation to the (2) large gym units-listed under separate ECM.

Packaged HVAC Office Unit (typical for 1)
Unit may be replaced through separate ECM. Assume new unit will be BACnet enabled

- Connect unit to new BACnet communication bus

<u>Boiler Room A/B</u>
Boiler A
Demolish existing pneumatic controls and replace with electronic, including the following devices.

- BACnet series controller and panel. Connect controller to new communication bus.
- Hot water supply and return temperature sensors
- Supply/return differential pressure sensor
- Boiler start/stop and status
- Pump start/stop and status (typical for 2)
- Bypass valve and actuator
- 3-way mixing valve and actuator
- Outdoor air sensor

Boiler B

- BACnet series controller and panel. Connect controller to new communication bus.
- Hot water supply and return temperature sensors
- Boiler start/stop and status (cycle boiler to maintain hot water setpoint)
- Boiler temperature sensor
- Pump start/stop and status (typical for 2)

<u>Boiler Room C/D</u>
Demolish existing pneumatic controls and replace with electronic, including the following devices

- BACnet series controller and panel. Connect controller to new communication bus.
- Hot water supply and return temperature sensors
- Supply/return differential pressure sensor
- Boiler start/stop and status
- Boiler temperature sensor
- Pump start/stop and status (typical for 2)
- Bypass valve and actuator
- 3-way mixing valve and actuator

<u>Cabinet Unit Heaters (typical for 13)</u>

- Add BACnet wall mounted hydronic controllers to cycle the fans to maintain space temperature. Connect controllers to communication bus.

<u>Workstation</u>

- Install CP-600 BACnet router (location to be determined). Connect router to BACnet bus and Ethernet port (provided by customer). Add web enabled Comfortpoint workstation with new Dell PC and printer in the building manager's office for monitoring and control of entire system.

<u>**General Existing Conditions**</u>
Branchville School

The original building was built in 1872, with renovations during the 1920's. The controls are primarily hot water unit ventilators with electric controls for the classrooms. Most of the existing systems predominately utilize electric thermostat control. There is no front end or central control of the thermostats which in most cases can be accessed by any facility staff. Any changes that need to be made can only be made at the individual thermostat.

<u>**Proposed Building Management System Upgrades**</u>
Branchville School

Honeywell has a solution, which in the long run and throughout the course of restoring the control system and future upgrades, will be most cost effective. We suggest removing the existing thermostats and install brand new Honeywell WEBSTAT™ controllers at the Branchville School. The WEBSTAT™ is one control system equipped for complete integration of heating, ventilating, cooling, lighting, security, access control and power metering, with no added software cost.

Honeywell WEBSTAT™ offers an affordable, integrated open communications building control system. WEBSTAT is a family of state-of-the-art, web-enabled building information solutions that provide you with amazing flexibility.

More efficient Honeywell WEBSTAT™ allows you to get the most from your people and equipment. Enjoy more power to control your building needs. Designed for change as your building system changes, you can easily reconfigure a workspace, move a department, or make other changes and know that your facility can change as quickly as your business does.

Because WEBSTAT™ utilizes standard Ethernet communication technology; you can leverage the Ethernet backbone of your building, reducing cost as your organization grows.

The Honeywell WEBSTAT™ range of benefits and ROI across multiple business functions:

- Facility and Equipment Management
- Increases system and equipment functionality
- Improves facility operations
- Improves staff comfort, enhancing the user experience
- Reduces downtime caused by equipment failure
- Improves visibility into mission-critical operational assets via a web-based interface for all facilities
- Maintenance & Operations
- Speeds maintenance and problem resolution
- Supports preventive maintenance

- Reduces equipment downtime
- Enables performance-based prioritization of maintenance
- Lowers renovation and construction costs

The Honeywell WEBSTAT™ system is Internet-based, so all your staff needs to access the system is an Internet browser. Branchville School facility staff will simply be able to access your building via Internet Explorer from anywhere in the world, through your existing secure network. .

Honeywell WEBSTAT™ provides super fast functionality such as custom scheduling, additionally the Honeywell WEBSTAT™ is much more user friendly and faster than the current system of individual programmable thermostats.

The proposed upgrade shall include the following:

- Honeywell WEBSTAT™
- Honeywell WEBSTAT™ Y-Pack
- Staged Thermostats
- Remote Sensors
- All necessary Transformers, Switches, Fuses, Misc. Parts ATC Wires, Power Wire, and Low Voltage Wire
- Honeywell Site licensing
- All necessary Configuration for Honeywell System
- All necessary mounting installation, wiring, and hook-up
- All necessary custom trending, alarming, scheduling
- All necessary setup for Internet ready access
- All Training and Warrantee (1 Year)

When the system is commissioned, training on the functionality and operation of the system would be conducted for both Branchville School IT and operations personnel. This training would be focused on basic functionality, as well as component functionality.

Sequence of Operation:
Following sequence of operation shall be utilized where applicable:

1. Provide Day / Night Control (55 degree F).
   Time of Day Scheduling.
   Occupancy Scheduling.

2. Provide Day / Night Control for each zone.
   Time of Day Scheduling.
   Occupancy Scheduling.
   Automatic Operation and Override capability of Day / Night control.

Customer Support and Coordination with Utilities
Minor support will be required for the interruption of utilities for brief tie-in periods.

Energy Savings Methodology and Results
The energy savings for this ECM is realized at the buildings' HVAC equipment due to better control of the HVAC systems, night set-back and set-up temperatures, start/stop etc.

Environmental Issues

Resource Use	Energy savings will result from reduced electric energy usage and better occupant comfort.
Waste Production	This measure will produce no waste byproducts.
Environmental Regulations	No environmental impact is expected.

ECM 3B
Demand Control Ventilation

Existing System:

The air handling units (AHU) serving large one zone spaces such as auditoriums, gymnasiums and cafeterias are often designed for peak occupancy conditions to supply 100% outside air to the space with all return air from space being exhausted. Most of the time these spaces are not fully occupied, which increase energy demand for heating of excessive amount of outside air.

Proposed Solution

Under this proposal, Honeywell will install CO_2 sensors at large one zone rooms that are served by AHUs. The CO_2 sensor will provide the control signal for the air handlers to optimize the quantity of fresh air that is required. This control strategy will reduce the space energy use.

Based on this fact, there is a reduced requirement for outside air to this space. The installation of a CO_2 sensor will read the levels of CO_2 in the space and ensure that only the required air is supplied to meet minimum outdoor air requirements. The amount of outside air is introduced and heated. These control systems will be utilized on the large gymnasium/cafeteria/multipurpose air-handling units.

Proposed System:

Under this proposal, Honeywell will install CO_2 sensors to control the amount of outside air entering this space based on demand. For a large area such as this which has erratic occupancy patterns, you are introducing large quantities of outside air into the space when it is not needed. For a majority of time, this area is used on occasion or empty.

Based on this fact, there is a reduced requirement for outside air to this space. The installation of a CO_2 sensor will read the levels of CO_2 in the space and ensure that only the required air is supplied to meet minimum outdoor air requirements. The amount of outside air is introduced and heated.

School	Areas Served	No. of Units
Frankford Township School	Large Gymnasium/Cafeteria/Multipurpose	2

Energy Savings Methodology and Results

The savings approach is based upon reducing the amount of energy that needs to pre-heat the outside air. The savings are generally calculated as:

Existing Heating BTU & Cost per BTU	= Metered Data from Existing meter readings
Cost of Existing Heating	= Average Site Data $/Therm
Reduction in Heating BTU	= Reduction in Outside air cfm x 1.08 x Delta T x Fan Hours =
Cost of Proposed Heating	BTU x Cost per BTU
Energy Savings $	= Existing Heating Costs – Proposed Heating Costs

The baseline adjustment calculations are included with the energy calculations.

Changes in Infrastructure

None

Customer Support and Coordination with Utilities

Minor support will be required for the interruption of utilities for brief tie-in periods.

Environmental Issues

Resource Use	Energy savings will result from reduced energy.
Waste Production	Any removed parts will be disposed of properly.
Environmental Regulations	No environmental impact is expected.

ECM 4A
Building Envelope Improvements

Existing Conditions for Frankford and Branchville Schools:
Typically, many schools have problems associated with the design and construction of the buildings. Being older, the school building avoids some of the common failure associated with more modern construction. Plus, long-term stewardship of the structure has helped avoid most of the problems often associated with maintenance issues. But there are several significant building envelope retrofit opportunities, which will provide cost savings and comfort improvements to the building occupants.

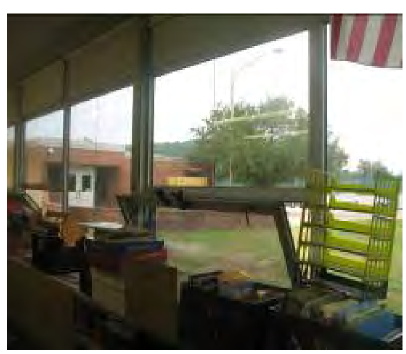
For the most part, the windows at these schools are in fair condition and functioning. The installation of the windows appeared average, but there is air leakage. Windows that have air conditioning units in them are prone to allow leakage. The units are left in all winter. The District may want to consider removing these units during the cold months.

The areas of concern deal with the openings in the "skin" that are mostly "built-in" during the original construction, created during a "retrofit period" and/or have deteriorated.

Air leakage is defined as the "uncontrolled migration of conditioned air through the building envelope." Caused by pressure differences due to wind, chimney (or stack) effect, and mechanical systems, it has been shown to represent the single largest source of heat loss or gain through the building envelopes of nearly all types of buildings. Tests carried out by the National Research Council of Canada on high rise commercial and residential buildings, schools, supermarkets, and houses, have shown levels of 30 % to 50% of heat loss could be attributed to air leakage. Reports detailing this are available for perusal.

Beyond representing potential for energy savings, uncontrolled air leakage can affect thermal comfort of occupants, air quality through ingress of contaminants from the outside, and the imbalance of mechanical systems, and the structural integrity of the building envelope - through moisture migration. Control of air leakage involves the sealing of gaps, cracks and holes, using appropriate materials and systems, to create, if possible, a continuous plane of "air-tightness" to completely encompass the building envelope. Part of this process also incorporates the need to "compartmentalize" components of the building in order to equalize pressure differences.

The buildings were inspected visually to identify locations and severity of air leakage paths. Air leakage paths are detailed in the scope of work below. Floor plans will be used to mark locations of air sealing measures when completed.



Proposed System

Honeywell proposes the sealing of these openings through the use of weather-stripping, caulking, and foam sealing. This sealing will occur, as required, at the locations where the roof meets the wall structures and door openings. This will reduce the air leakage of the buildings, and improve the energy efficiency of the structures by tightening their integrity. Weather-stripping will be replaced at the doors where required, and window perimeters will be caulked adequately.

Benefits

The sealing of the school buildings will allow for more efficient operation of the buildings by reducing heating and cooling losses throughout the year. In addition, the draftiness of the buildings, along with hot and cold spots, will be reduced as a result of this measure. A reduction in air infiltration will also minimize potential concerns for dirt infiltration or indoor air quality.

Scope of Work:

The Scope of work at Frankford Township School District may include but is not be limited to the following:

- Weather-strip doors
- Seal roof/wall intersections
- Seal penetrations
- Install window weather strip
- Seal window perimeters with caulk
- Seal a/c units
- Seal passive roof vents
- Seal and insulate the attic

Energy Savings Methodology and Results

The energy savings for this ECM are realized at the buildings' HVAC equipment. The improved building envelopes will limit conditioned air infiltration through openings in the buildings' air barrier. Less infiltration means less heating required by the heating system.

Changes in Infrastructure

Building envelopes will be improved with little or no noticeable changes.

Customer Support and Coordination with Utilities

Minimal coordination efforts will be needed to reduce or limit impact to building occupants.

Environmental Issues

Resource Use	Energy savings will result from reduced HVAC energy usage and better occupant comfort.
Waste Production	Some existing caulking and weather-stripping will be removed and disposed of properly.
Environmental Regulations	No environmental impact is expected.

ECM 4B
Window Replacements

Existing Conditions

The existing windows at the Frankford Township School are mainly single pane, aluminum framed windows and appear to be in fair condition. The seals of the windows are ineffective and do not provide an air tight seal from exterior conditions, increasing the loss of expensive conditioned air. The windows are non-thermal break single glazed with un-insulated panels above them and are energy inefficient. Typically, windows contribute to more than 50% of the summertime cooling and more than 25% of the winter heating loads of a building. Window blinds/shades can decrease the solar radiation entering through windows during the summer and limit heat loss during the winter. The resulting energy savings can be substantial.

Proposed Solution

Honeywell proposes the installation of double-glazed, thermally broken, low Emissivity, aluminum framed windows of approximately 2,400 square feet of the building. This will increase the insulation value of the windows, thus improving the U-Value of the windows.

Recommended Applications:

- Cooling-load-dominated buildings (by restricting solar heat gain)
- Buildings where occupants have complaints of excessive heat in the summer
- Building with clear single-pane glass

Energy Savings Methodology

Energy savings will result from significantly reducing the heating requirement of the perimeter and the front entrance way. In general, Honeywell uses the following approach to determine savings for this specific measure:

Heating Energy Savings $	= ((Heat Loss Rate per square foot of Existing Windows – Heat Loss Rate per square foot of Proposed Windows) x Cost/Therm)/(Boiler Efficiency))

Product Information

Manufacturer and Type	Several quality and cost effective manufacturers are available. The following is an example of equipment being utilized. Honeywell and the District will determine final selections.
Equipment Identification	As part of the measure design and approval process, specific product selection will be provided for the District's review and approval.

Changes in Infrastructure

The existing single-pane windows will be replaced with double-pane windows that will reduce the amount of heat loss through the windows.

Customer Support and Coordination with Utilities

Coordination will be required to gain access to the individual rooms for window installations.

Environmental Issues

Resource Use	Energy savings will result from the reduction of heat loss from the uninsulated windows resulting in lower fuel consumptions. The equipment uses no other resources.
Waste Production	Any removed parts will be disposed of properly.
Environmental Regulations	No environmental impact is expected.

ECM 4C
Roof Replacements

Existing Conditions

The roof installed at the Branchville School is beyond its useful life and should be replaced. The heat loss and heat gains occur due to a low R-value of the existing roof insulation and will be improved through the replacement with energy efficient roofing materials. Additionally, the rate of infiltration that occurs due to the leakage on the roof around perimeters is also a major cause of energy loss.

The upgrade will result in improved savings and comfort for those affected in the building. The District also wishes that this roof be replaced. Overall, through the implementation of this measure the school will reduce its heating fuel usage costs each year.

Proposed System

- Replace a total of approximately 7,800 SF of surface roof system with a smooth-surfaced built-up over ¾" of perlite coverboard over 2" polyisocyanurate insulation (or equal).

Energy Savings Methodology and Results

Following approach is used to determine savings for this specific measure:

Existing Roof Efficiency	= Existing U + Existing Infiltration Rate
Proposed Roof Efficiency	= Proposed U + Proposed Infiltration Rate
Energy Savings (Btu)	= UAΔTproposed – UAΔTexisting
Winter Savings(Therms)	= Energy Savings/Boiler Eff./100,000

Interface with Building:

The new roof will be constructed to match existing, maintaining contours of the existing building.

Energy Savings Methodology and Results

The energy savings for this ECM are realized at the building's HVAC equipment. The improved building envelope will limit conditioned air infiltration through openings in the building air barrier. Less infiltration means less heating required by HVAC systems.

Changes in Infrastructure

Building envelopes will be improved with little or no noticeable changes.

Customer Support and Coordination with Utilities

Minimal coordination efforts will be needed to reduce or limit impact to building occupants.

Environmental Issues

Resource Use	Energy savings will result from reduced HVAC energy usage and better occupant comfort.
Waste Production	Existing roof materials will be removed and disposed of properly.
Environmental Regulations	No environmental impact is expected.

ECM 5A
Computer Controllers

Existing Conditions
During our preliminary energy audit it was brought to our attention that the Frankford Township School and Branchville School have in inventory and are using approximately 225 and 5 desktop personal computers (PC), respectively.

Desktop Computers: Energy waste is inherent in large PC networks. While most PCs have energy-saving settings such as stand-by hibernate, and shutdown, over 80% of users disable their low-power settings. Installation of a network-level control over the power settings of all Microsoft Windows-based PCs, from Windows 95 to XP solves this problem by giving the District IT personnel control of these settings. Network managers can easily configure and maintain PC power settings across distributed networks, to automatically send PCs into low-power states as needed. A PC in a school setting wastes 100 to 400 kWh of energy a year by remaining on during unoccupied periods. Ideally, everyone would use the built-in energy saving function on their machine; however, as indicated above these existing energy-saving features are rarely enabled.

The CRT computer monitors consume 3 times more energy than the flat LCD monitors while they are in an "idle" mode.

Proposed System
Desktop Computers: Honeywell proposes to install a centralized personal computer power management system to control approximately two hundred twenty-five (225) computers at the Frankford Township School and five (5) computers at the Branchville School. The software by Verdiem called "Surveyor," enables control of the operation of computers in the schools. Surveyor delivers desktop computer energy management that does not interfere with user or IT needs. Surveyor keeps computers running when users need them, and accurately determines when computers are inactive so they can be powered down through network-wide power consumption and savings reports. Surveyor is a computer energy management solution that analyzes CPU, disk, keyboard, mouse, and application activity before taking power management actions. It is also a solution that is available for both Windows and Mac computers. Surveyor is the 'green' software solution for desktop and laptop computers.

School	Desktop Computers
Frankford Township School	225
Branchville School	5
TOTAL	**230**

Following are the key features of Surveyor:

Intelligent Configuration Settings

- Definitions can be based on CPU, disk, keyboard, mouse and application activity
- Shutdown without the loss of user productivity

Flexible Scheduling

- Options to turn off the monitor, and standby, hibernate or shutdown the computer
- Schedule Wake-on-LAN, shutdown, or restart events for a single, daily, weekly, or monthly occurrence
- Schedule a temporary window where Surveyor will not enforce energy management policies

Compatibility Options

- Customize the deployment as well as update and control the client workstations
- Recognizes and accommodates to Deep Freeze maintenance schedules

Customized Inactivity Definitions

- Employ energy saving actions when CPU or disk activity falls below a defined level
- Prevent the workstation from employing power saving actions when a particular application is running

Enterprise Control

- Verdiem Core Console provides unified workstation management capabilities
- Workstation grouping makes managing large deployments easy
- Disable and override a workstation's operating system energy management settings

Savings Reports

- Generate enterprise power consumption and savings reports through Verdiem Core Console
- Detailed workstation utilization reporting allows you to see how much power you are saving based upon your regional electricity cost.
- Audit mode provides a baseline measure of the energy being consumed, making it easy to determine the true value of the savings generated when Surveyor's features are enabled.

Scope of Work

Honeywell proposes to purchase and install Surveyor by Verdiem for the network level control of the electric consumption of the computers in the schools. Surveyor is an easy-to-deploy software utility that addresses network energy waste, and reduces operating costs without impacting PC users. Surveyor measures, manages, and minimizes the energy consumed by the network's PC clients through one centralized interface. It provides IT departments with a powerful approach to automate energy-efficient "best practices" throughout their networks, while it adds new control and flexibility to traditional PC power management.

Honeywell will work with the District to install and rapidly deploy the Surveyor software on the PC network. This single day installation plan will address server and client installation, basic administrative configurations, logical power management profile groupings, and energy consumption reporting. Ongoing technical support and product revisions are also available, with an annual energy audit to ensure maximized energy savings.

Predominately, the benefit is the energy savings from the system. It also adds security to the PC network because the most secure PC is the one that is off. Additionally the software provides rudimentary asset inventory views, including last-logged-in user, IP address, machine names, hardware and processor type.

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ECM 6A
Install Premium Efficient Motors

Existing Conditions

The A/B boiler room at Frankford Township School houses two sets of two (2) floor-mounted circulator pumps as part of the hot water heating system to serve the hot water unit ventilators and other hot water terminal units. One pair of pumps serves the A wing of the building. Each pump is rated at 7.5 HP. The other two pumps serve the B wing, and each pump is rated at 2 HP. In addition, the C/D boiler room houses one set of two (2) floor-mounted circulator pumps and one set of two (2) pipe-mounted circulator pumps as part of the hot water heating system to serve the hot water unit ventilators and other hot water terminal units. The pair of pipe-mounted pumps serves the C wing of the building. Each pump is rated at 1.5 HP. The other two pumps serve the D wing, and each pump is rated at 3 HP. Each set operates in a lead-lag fashion. All pump motors are standard efficiency.

Proposed Solution

Honeywell proposes to replace two (2) pump motors with new 7.5 HP high efficiency motors.

The scope of work will be as follows:

- Remove and dispose of old standard efficiency motors.
- Inspect all couplings and replace as needed.
- Install new premium efficiency motors on the existing pumps.
- Align the couplings to EASA standards.
- Start up of the pumping system.

The motors that were identified in the building are listed as follows:

Bldg.	Equipment Description	Qty	Motor HP	Proposed Efficiency
Frankford Township School	Boiler Room	2	7.5	92%

Equipment Information

Manufacturer and Type	Several quality and cost effective manufacturers are available. The following is an example of equipment being utilized. Honeywell and the District will determine final selections. MagneTek, Inc. - 26 Century Blvd. Suite 600 - Nashville, TN 37214 (800) - MAGNETEK Baldor Electric Corp. – 5711 R.S. Boreham Jr. St., PO Box 2400, Fort Smith, AR, 72901 – (501) 646-4711
Equipment Identification	Product cut sheets and specifications generally used are available upon request. As part of the measure design and approval process, specific product selection will be provided for your review and approval.

Changes in Infrastructure

New motors will be installed in place of the old motors. No expansion of the facilities will be necessary.

ECM 6B
Install Variable Frequency Drives on Pump Motors

Existing Conditions

The hot water circulating pumps at Frankford Township School are planned to replace the electric motors with premium efficiency electric motors. The water distribution system is pumped at the constant volume without controlling the water flow. This results in unnecessary excess of pumping power even with a decreased building load.

Proposed Solution

Honeywell proposes installing Variable Frequency Drives (VFD) on the large hot water loop pump motors to provide more flow controllability and saving electric energy for unnecessary pumping volume. The new VFDs will not only save electrical energy, but will help control building loop temperature especially during shoulder months when thermal loads are at a minimum.

The selected pumps are listed below in the table:

Bldg.	Equipment Description	Qty	Motor HP	Remarks
Frankford Township School	HW Loop Pump	2	7.5	Install VFD

The scope of work will be as follows:

1. Install VFDs on the pumps.
2. Install wiring and controls on the new VFDs.
3. Measure and verify the pre and post-retrofit voltage, amperage and RPM.

Equipment Information

Equipment Identification	Product cut sheets and specifications generally used are available upon request. As part of the measure design and approval process, specific product selection will be provided for your review and approval.

Changes in Infrastructure

New VFDs will be installed on the wall near the pumps and disconnect. No expansion of the facilities will be necessary.

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ECM 7A
Install Photovoltaic System

Honeywell recommends the installation of a Photovoltaic System for the Frankford Township School that will generate electric power from solar energy. Although the returns are not ideal, this system will be appropriate to this site, and will assist in promoting the "Green Power" image of the District and will be a model for future duplication.

Proposed System:
The proposed system is a nominal kW-dc system with a DC/AC converter as is listed in the following table:

School ID	Panel Size (W)	Solar System Power (kW)
Frankford Township School	270	151

Photovoltaic System
Solar cells are converters. They take the energy from sunlight and convert that energy into another form of energy, electricity. Solar cells convert sunlight to electricity without any moving parts, noise, pollution, radiation, or maintenance. The conversion of sunlight into electricity is made possible with the special properties of semi-conducting materials.

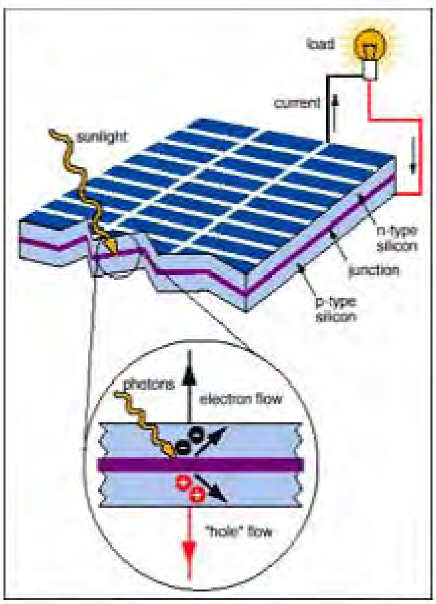
Semi-Conductors
Most solar cells are made from silicon, which is a "semi-conductor" or a "semi-metal," and has properties of both a metal and an insulator. Solar cells are made by joining two types of semi-conducting material: P-type and N-type. P-type semiconductors are manufactured to contain negative ions, and N-type semiconductors are manufactured to contain positive ions. The positive and negative ions within the semiconductor provide the environment necessary for an electrical current to move through a solar cell.

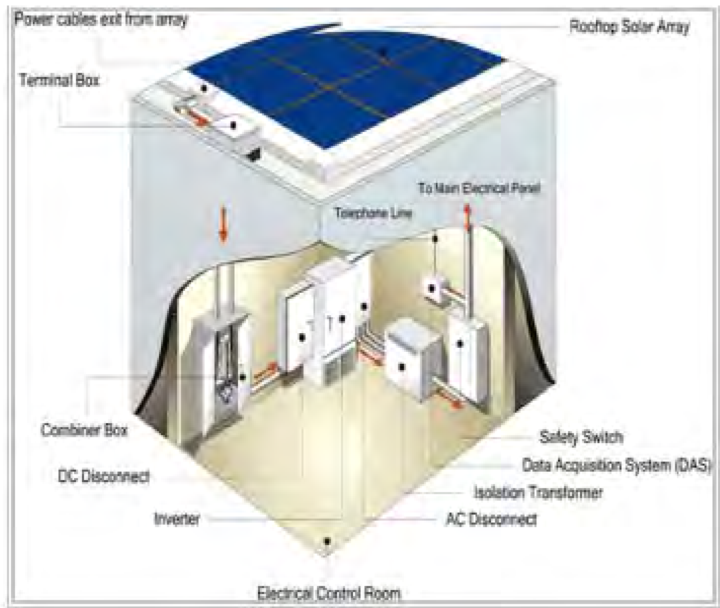
Sunlight Converted
At the atomic level, light is made of a stream of pure energy particles, called "photons." This pure energy flows from the sun and shines on the solar cell. The photons actually penetrate into the silicon and randomly strike silicon atoms. When a photon strikes a silicon atom, it ionizes the atom, giving all its energy to an outer electron and allowing the outer electron to break free of the atom. The photon disappears from the universe and all its energy is now in the form of electron movement energy. It is the movement of electrons with energy that we call "electric current."

Sunlight to Electricity
A typical solar cell consists of a glass cover to seal the cell, an anti-reflective layer to maximize incoming sunlight, a front and back contact or electrode, and the semiconductor layers where the electrons begin and complete their voyages. The electric current stimulated by sunlight is collected on the front electrode and travels through a circuit back to the solar cell via the back electrode.

PV System Architecture

Solar cells interconnected with other system components that ultimately serve a specific electrical demand, or 'load'. PV systems can either be stand-alone, or grid-connected. The main difference between these two basic types of systems is that in the latter case, the PV system produces power in parallel with the electrical utility, and can feed power back into the utility grid if the onsite load does not use all of the PV system's output. The 151 kW system proposed here is small enough where the school will consume all of the power generated by the cell.





Typical PV System

Electronic Information Kiosk

The electronic information kiosk brings the building to life for students, faculty, staff and parents. The kiosk terminals are user-driven via interactive touch screens, and can also be configured for tours and group presentations. The kiosk is a centralized source for information about the building, including:

- A tour of the building's earth-friendly construction materials.
- Continuous real-time display of the building's solar performance.
- An introduction to the unique day lighting design that maximizes the use of available sunlight.
- Building project overview and timeline.
- A solar quiz to test your knowledge.

Kiosk Screen

Energy production is of particular interest to building occupants and visitors.
The amount of energy the building produces is continuously monitored and displayed within the kiosk's real-time data display screen.
Current temperature and sunlight as well as monthly statistics are also available.
The kiosk's content will continue to expand to increase its value to students, faculty, staff and local community.

Scope of Work:
The following scope of work will be provided to achieve the projected savings:

Frankford Township School:

Photovoltaic System Specifications

- 560 SUNTECH SOLAR 270 W PV PANELS
- 10 SMA 56 INPUT PV COMBINERS
- 10 SMA DC DISCONNECT BREAKERS
- 10 SUNNY BOY 7000U INVERTERS

Miscellaneous Equipment and Services

- 24VDC WIRING-RHW (#8 AWG)
- CONDUIT-3" EMT
- CONDUIT-3/4" EMT
- 24VDC WIRING-RHW (300 MCM)
- CONDUIT-2" EMT
- 208V WIRING-THHN (#4 AWG)
- CONDUIT-2" EMT
- UTILITY METERING
- MANUFACTURER START UP SERVICES

Energy Savings Methodology and Results
Savings are based on energy conversion of the solar array and assume a 0.77 DC to AC conversion de-rate factor.

Changes in Infrastructure

The proposed solar array could reside on the building roof or be ground mounted.

Customer Support and Coordination with Utilities

Minor support will be required for the interruption of utilities for brief tie-in periods. Frankford Township School District and Honeywell will decide the exact location of solar system installation.

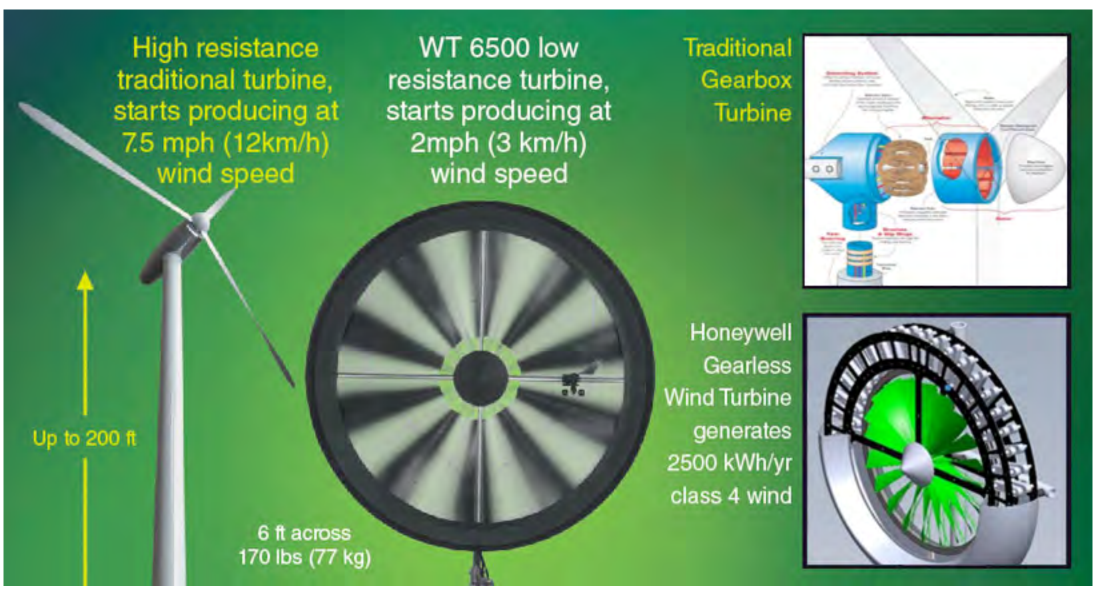
Environmental Issues

Resource Use	Renewable energy will be generated to supplement energy purchased from the electrical utility.
Waste Production	This measure will produce no waste byproducts.
Environmental Regulations	Aside from the environmental benefits from generating renewable energy no other environmental impact is expected.

ECM 7B
Wind Power

Existing Conditions:
Small wind electric systems could make a small contribution to the districts energy needs. The issue in the district is the amount of sustainable wind coupled with the wind velocity. The wind velocity is measured by NREL (DOE – National Renewable Energy Laboratory) at 12 mph for this location.

Proposed System:
Honeywell is recommending a small 6,500 Watt wind turbine at the school for educational purposes. The Honeywell Wind Turbine's Blade Tip Power System (BTPS) replaces the traditional gear box, shaft and generator of current wind turbine technology. The Honeywell Wind Turbine's gearless Blade Tip Power System creates a "free wheeling" turbine, generating energy from the blade tips (where the speed lies) rather than through a mechanical center gear. By practically eliminating mechanical resistance and drag, the Honeywell Wind Turbine creates significant energy (2,752 kWh/yr in class 4 winds at 33') operating in a greater range of wind speeds (2-42 mph/3-68 km/h) than traditional wind turbines. The highest output, lowest cost per kWh installed turbine ever made (in class and size).



Honeywell WT 6500 Specifications:

- Honeywell Gearless Wind Turbine
- Blade Tip Power System (BTPS)
- BTPS Permanent Magnet Electric Generator, Patents Pending
- ETL, UL, CSA, CE, EU Listed (Summer 2010)
- Installs on Pole, Roof Mount or Commercial Mount
- Lowest Cost kWh Installed Technology in Class
- Enclosed Blade Tip Power System
- Wide Wind Acceptance Angle

Honeywell WT 6500 Specifications:

- Acoustic Noise Emissions < 35dB
- Tip to Tip Blade Dimension 5.7' (170 cm)
- 170 lbs (77.2 kg)
- 120 AC 60 Hz
- 220 AC 50 Hz
    - KW Plate Power
- < 2 mph (3 km/h) Cut in Speed, Shut down 42 mph (67.5 km/h)
- Renewable Electric Generation 2752 kWh/yr - Class 4 Winds
- (D.O.E. average US household electric 11,000 kWh/yr)
- Smart Box Control System
- includes:
- Optimal Power Transfer Controller
- True Sine Wave Inverter
- Battery Power Management System
- Wind Direction and Speed Measurement Control System
- Standard RS485 Communication Port
- 5 Year Limited Warranty
- Annual CO2 Displacement 2.2 Tons
- Product Design Life 20 Years

Energy Savings Methodology and Results

Savings are based on energy conversion of the wind turbine array and assume a 0.77 DC to AC conversion de-rate factor.

Power = k Cp 1/2 ϱAV3
Where:
P = Power output, kilowatts
Cp = Max power coefficient, ranging from 0.25 to 0.45, dimension less (theoretical maximum = 59)
ϱ = Air density, lb/ft3
A = Rotor swept area, ft2 or
Π D2/4 (D is the rotor diameter in ft, π = 3.1416)
V = Wind speed, mph
k = 0.000133 a constant to yield power in kilowatts.

Changes in Infrastructure

The proposed wind turbine would reside on the building roof.

Customer Support and Coordination with Utilities

Minor support will be required for the interruption of utilities for brief tie-in periods. Frankford Township School District and Honeywell will decide the exact location of the wind turbine installation on the roof.

Environmental Issues

Resource Use	Renewable energy will be generated to supplement energy purchased from the electrical utility.
Waste Production	This measure will produce no waste byproducts.
Environmental Regulations	Aside from the environmental benefits from generating renewable energy no other environmental impact is expected.

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ECM 7C
Renewable Energy Education

Proposed Programs:
Honeywell is proposing a Renewable Energy Education program which includes solar and wind renewables as well as educational courses and renewable energy awareness programs to enhance the educational experience for the faculty staff and students.

Green Boot Camp
The Green Boot Camp is an intensive five-day, hands-on interactive educational experience to help educators become familiar with the latest methods of instruction to teach green and sustainable topics, methods, lessons and concepts to middle school students at their respective schools.

Educators will discover, examine and identify the roots of green technology, sustainable living and environmental consciousness by using the buildings of the District as a hands-on working laboratory. Teachers will discover new concepts by using interactive exploratory projects such as designing and building a solar house, a wind turbine and more. Plus, they will master exciting new teaching technologies to deliver instruction to their students.

Windows on the World™ (WOW)
For customers with GHG reduction goals, Honeywell offers a behavior-driven education and awareness program, resulting in cost savings and reduced eCO_2 footprint.

Training Education & Awareness Platform:
- Windows on the World™
- Interactive Exhibits
- Knowledge Based Offering
- Intuitive Web Based Platform
- Real Time Energy Meter Data
- Buildings Become a Teaching Tool
- Compelling Touch Screen Interfaces

How it Can Help:
- Achieve eCO_2 footprint reduction and associated cost savings without making large capital investments
- Drive "constituent" behavior change to become more sustainable
- Increase "stickiness" of sustainable programs through tracking and relevant reporting mechanisms

How WOW Works:

- WOW accesses resource usage data gathered by your building's meters
  - Electrical
  - Gas
  - Water
- Consolidates all onto one convenient platform
- Displays as Real-Time resource consumption
- Teaches how the "green" features of a building work
- Find out how conservation technologies lower resource consumption
- Track/compare renewable energy and conservation technologies
- Learn how sustainable technologies translate into tangible environmental benefits

Benefits to Frankford Township School:

- Identifies your organization as forward thinking and environmentally aware
- Demonstrates how your organization is a good corporate citizen
- Stimulates building occupants to be more efficient in their own use of resources
- Builds community support

Sustainable Education:
Your building can become a learning center for sustainability education. Building occupants and visitors can interact with colorful touch screen displays and see how the building is designed to conserve resources, preserve the natural environment and capture renewable energy.

Renewable Energy Systems

Wind Turbine Proposed System:
As stated in ECM 7B, Honeywell is recommending a small 6,500 Watt wind turbine at the Frankford Township School for educational purposes.

Honeywell WT 6500 Specifications:

- Honeywell Gearless Wind Turbine
- Blade Tip Power System (BTPS)
- BTPS Permanent Magnet Electric Generator, Patents Pending
- ETL, UL, CSA, CE, EU Listed (Summer 2010)
- Installs on Pole, Roof Mount or Commercial Mount
- Lowest Cost kWh Installed Technology in Class
- Enclosed Blade Tip Power System
- Wide Wind Acceptance Angle

- Acoustic Noise Emissions < 35dB
- Tip to Tip Blade Dimension 5.7' (170 cm)
- 170 lbs (77.2 kg)
- 120 AC 60 Hz
- 220 AC 50 Hz
    - KW Plate Power
- < 2 mph (3 km/h) Cut in Speed, Shut down 42 mph (67.5 km/h)
- Renewable Electric Generation 2,752 kWh/yr - Class 4 Winds
- (D.O.E. average US household electric 11,000 kWh/yr)
- Smart Box Control System
- includes:
- Optimal Power Transfer Controller
- True Sine Wave Inverter
- Battery Power Management System
- Wind Direction and Speed Measurement Control System
- Standard RS485 Communication Port
- 5 Year Limited Warranty
- Annual CO2 Displacement 2.2 Tons
- Product Design Life 20 Years

Energy Savings Methodology and Results

Savings are based on energy conversion of the wind turbine array and assume a 0.77 DC to AC conversion de-rate factor.

Changes in Infrastructure

The proposed solar array could reside on the building roof or be ground mounted.

Customer Support and Coordination with Utilities

Minor support will be required for the interruption of utilities for brief tie-in periods. The District and Honeywell will decide the exact location of solar system installation.

Honeywell recommends the installation of a Photovoltaic System for the Frankford Township School. This will generate electric power from solar energy. Although the returns are not ideal, this system will be appropriate to this site, and will assist in promoting the "Green Power" image of the District and will be a model for future duplication.

Solar Renewable Energy

Proposed System:

The proposed system is a nominal 10 kW-dc system with a DC/AC converter as is listed in the following table:

School ID	Panel Size (W)	Solar System Power (kW)
Frankford Township School	270	10

Scope of Work:
The following scope of work will be provided to achieve the projected savings:

Frankford Township School:

Photovoltaic System Specifications

- 37 SUNTECH SOLAR 270 W PV PANELS
- 1 SMA 56 INPUT PV COMBINERS
- 1 SMA DC DISCONNECT BREAKERS
- 1 SUNNY BOY 7000U INVERTERS

Miscellaneous Equipment and Services

- 24VDC WIRING-RHW (#8 AWG)
- CONDUIT-3" EMT
- CONDUIT-3/4" EMT
- 24VDC WIRING-RHW (300 MCM)
- CONDUIT-2" EMT
- 208V WIRING-THHN (#4 AWG)
- CONDUIT-2" EMT
- UTILITY METERING
- MANUFACTURER START UP SERVICES

Environmental Issues

Resource Use	Renewable energy will be generated to supplement energy purchased from the electrical utility.
Waste Production	This measure will produce no waste byproducts.
Environmental Regulations	Aside from the environmental benefits from generating renewable energy no other environmental impact is expected.

ECM 8A
Kitchen Hood Controllers

Existing Conditions

The kitchen in the Frankford Township School currently utilizes a constant volume kitchen exhaust hood system. This system operates at full load, even when there is no activity in the kitchen. It also requires operating the exhaust fan at full load. This not only wastes fan energy, but also the heating energy. When the hood is not utilized, an opportunity exists to reduce airflow, and consequently, conserve energy.

School ID	Kitchen Hood Exhaust	Total
Frankford Township School	1	1

Proposed System and Scope of Work

Honeywell recommends installing an automated DDC control system to control the hood exhaust fan, to ensure the optimal hood performance and to conserve energy. The control system will include the input/output processor, and keypad. Variable frequency drives will be mounted on the utility cabinet. The temperature sensor will be mounted in the exhaust duct and the optic sensor will be mounted inside the ends of the hood.

The generalized scope of work is as follows:

- Install a variable speed drive in a NEMA approved enclosure for the kitchen hood exhaust fan
- Reconfigure existing power wiring through the variable speed drive
- Provide a motion sensor and an optical sensor at the kitchen exhaust hood to determine use
- Provide variable speed drive control points for start/stop, speed and alarm
- Provide control logic and software to accomplish sequences and incorporate into DDC system
- Commission control components and sequences, and calibrate control loops

Energy Savings Methodology and Results

The savings approach is based upon reducing the amount of conditioned air that is being exhausted when there is no cooking taking place. The savings are generally calculated as:

Existing Heating BTU & Cost per BTU	= Metered Data from Existing meter readings
Cost of Existing Heating	= Average Site Data $/Therm
Reduction in Heating BTU	= Exhaust air cfm x 1.08 x Delta T x Hours the fan is off.
Cost of Proposed Heating	= BTU x Cost per BTU
Energy Savings $	= Existing Heating Costs – Proposed Heating Costs

The baseline adjustment calculations are included with the energy calculations.

Changes in Infrastructure

There will be improvements in HVAC equipment and controls for not operating fans continuously.

Customer Support and Coordination with Utilities

Minor support will be required for the interruption of utilities for brief tie-in periods.

Environmental Issues

Resource Use	Energy savings will result from reduced energy.
Waste Production	Any removed parts will be disposed of properly.
Environmental Regulations	No environmental impact is expected.

ECM 8B
Walk-In Freezer and Cooler Controllers

Existing Conditions

In many refrigeration walk-in freezers and coolers, the compressor is oversized and cycles on/off frequently. This compressor cycling results in higher energy consumption and may reduce the life of the compressor.

The quantity of freezers and coolers with locations are in the table below:

School ID	Walk-in Freezers	Walk-in Refrigerators	Total
Frankford Township School	2	1	3

Proposed Solution

Under this proposal, Honeywell will install a controller refrigeration sensor at above mentioned school as made by Intellidyne, to reduce the compressor cycles of the kitchen walk-in cooler and freezers. The installation of this ECM will have no negative impact on system operation and freezing of food products. By reducing the cycling, the sensor will improve operating efficiency and reduce the electric consumption by nearly 10% to 20%.

Generally, in the event of a compressor failure for the kitchen walk-in freezer; an audible alarm will sound from the panel located outside of the freezer. When this alarm occurs, a bypass switch on the controller located at the condensing unit on the roof should be toggled to place the compressor under normal operation. Once the failure has been corrected, the bypass switch should be toggled back to its original position to resume the controller operation.

This control enhancement will save energy through the reduced compressor cycling in the kitchen walk-in cooler and freezer and will extend the operating life of the compressor. Consequently, the compressor will not have to be replaced as often.

Intellidyne Features

- 15 Year full replacement warranty
- Automatic restart on power failure
- Surge protection incorporated into circuitry
- Fully compatible with all energy management systems
- UL Listed
- NYSERDA Tested
- Maintenance Free

Intellidyne Benefits

- Patented process reduces air conditioning electric consumption typically 10% to 20%
- UL listed, "Energy Management Equipment"
- Increased savings without replacing or upgrading costly system components
- "State-of-the-art" microcomputer controller – LED indicators show operating modes
- Protects compressor against momentary power outages and short cycling
- Simple 15-minute installation by qualified installer
- No programming or follow-up visits required
- Maximum year-round efficiency
- Reduces maintenance and extends compressor life
- Fail-safe operation
- Guaranteed to save energy
- 15-year replacement warranty for breakdowns or defects

Intellidyne's patented process determines the cooling demand and thermal characteristics of the entire air conditioning system by analyzing the compressor's cycle pattern, and dynamically modifies that cycle pattern to provide the required amount of cooling in the most efficient manner. This is accomplished in real-time by delaying the start of the next compressor "on" cycle, by an amount determined by the cooling demand analysis. These new patterns also result in less frequent and more efficient compressor cycles.

Changes in Infrastructure

None

Customer Support and Coordination with Utilities

Minor support will be required for the interruption of utilities for brief tie-in periods.

Environmental Issues

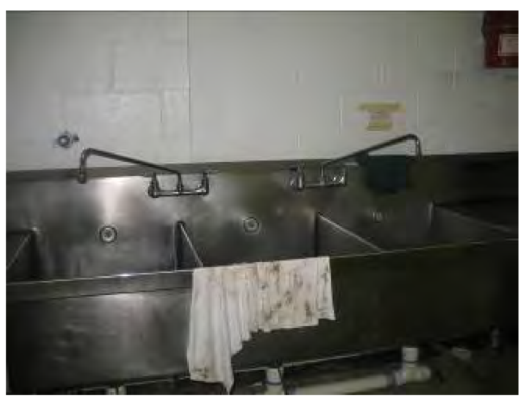
Resource Use	Energy savings will result from reduced energy.
Waste Production	Any removed parts will be disposed of properly.
Environmental Regulations	No environmental impact is expected.

ECM 8C
Kitchen Sink Pedal Valves

Existing Conditions
There are sinks in the Frankford Township School kitchen, where the kitchen staff cleans the pots and pans. Following is a count of the sinks at the Frankford Township School:

School	Total Faucets
Frankford Township School	2

Proposed Solution
Honeywell is proposing to install pedal valves on the sinks in the kitchen to reduce the water and energy consumption. The savings are derived from the fact that the sink will be running only when there is a person standing in front of the sink with his or her foot on the pedal valve. If that person walks away, water will no longer be running through the faucets and wasting water. With standard faucets, it's understandable that workers hands are, many times, just too busy to keep turning the water on and off. And frequently, faucets are left trickling or dripping. With pedal valves in place, water is no longer needlessly left running, trickling or dripping. However, when the sinks need to be filled, the latchable pedal, used on prep and pot sinks, provides continuous unattended flow.



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ECM 9A
Demand Response

Overview

Honeywell proposes to utilize a registered Demand Response Curtailment Service Provider (CSP) to provide energy response services to the Frankford Township and Branchville Schools. Through the CSP, the District will participate in the PJM Capacity Market Program and PJM Energy Efficiency Program. These programs are offered through the PJM Regional Transmission Organization (RTO), and Independent System Operator (ISO). The Capacity Market Program allows PJM customers the ability to respond to capacity emergencies when called upon by PJM, and the energy efficiency program pays PJM customers for implementing Energy Conservation measures (ECMs) that result in permanent load reductions during defined hours.

Proposed System

Honeywell proposes to work with a PJM Regional Transmission Organization (RTO), CSR to implement a Demand Response energy curtailment program which will generate revenue streams for the District. The PJM programs offer the District to the ability to respond to capacity emergencies when called upon by PJM, and benefit from permanent kW load reductions associated with implementing Energy Efficiency (EE) improvements. Honeywell's Demand Response agent acting as the CSP, will notify the district prior to potential events in order to advise and coordinate load curtailment participation in accordance with RTO program requirements, and will work with the District to benefit from EE Improvements. The PJM Markets are further described below.

PJM Capacity Market Program

Capacity represents the need to have adequate resources to ensure that the demand for electricity can be met. For PJM, that means that a utility or other electricity supplier, load serving entity, is required to have the resources to meet its consumers' demand plus a reserve amount. Electricity suppliers, load serving entities, can meet that requirement by owning and operating generation capacity, by purchasing capacity from others or by obtaining capacity through PJMs capacity market auctions. PJM operates a capacity market, called the Reliability Pricing Model (RPM). It is designed to ensure that adequate resources are available to meet the demand for electricity at all times. In the RPM, those resources include not only generating stations, but also demand response actions and energy efficiency measures by consumers to reduce their demand for electricity.

PJM must keep the electric grid operating in balance by ensuring there is adequate generation of electricity to satisfy the demand for electricity at every location in the region both now and in the future. PJM's markets for energy and ancillary services help maintain the balance now while the PJM market for capacity aims to keep the system in balance in the future. Resources, even if they operate infrequently, must receive enough revenue to cover their costs.

Payments for capacity provide a revenue stream to maintain and keep current resources operating and to develop new resources. Investors need sufficient long-term price signals to encourage the maintenance and development of generation, transmission and demand-side resources. The RPM, based on making capacity commitments in advance of the energy need, creates a long-term price signal to attract needed investments for reliability in the PJM region.

The PJM Energy Efficiency Program

Energy efficiency measures consist of installing more efficient devices or implementing more efficient processes/systems that exceed then-current building codes or other relevant standards. An energy efficiency resource must achieve a permanent, continuous reduction in demand for electricity. Energy efficiency measures are fully implemented throughout the delivery year without any requirement of notice, dispatch, or operator intervention. A demand response resource can reduce its demand for electricity when instructed; this means PJM considers it a "dispatchable resource". A demand response resource can participate in the RPM market for as long as its ability to reduce its demand continues. A demand response resource must be willing to reduce demand for electricity up to 10 times each year when called for a reduction. In a year without any reduction calls, the demand response resource is required to demonstrate the ability to reduce demand for electricity during a test of reduction capability. Data will be submitted by the demand response resource to prove compliance with reductions from actual calls or reductions from capability tests. An energy efficiency resource is one that reduced their demand for electricity through an energy efficiency measure that does not require any additional action by the consumer.

Energy Savings Methodology and Results

The energy savings for this ECM are realized due to savings in electric usage during scheduled load shedding periods.

Changes in Infrastructure

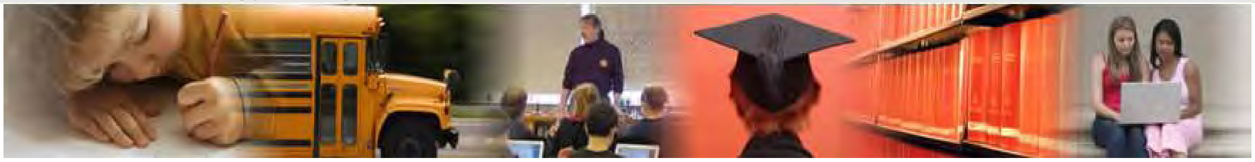
None

Customer Support and Coordination with Utilities

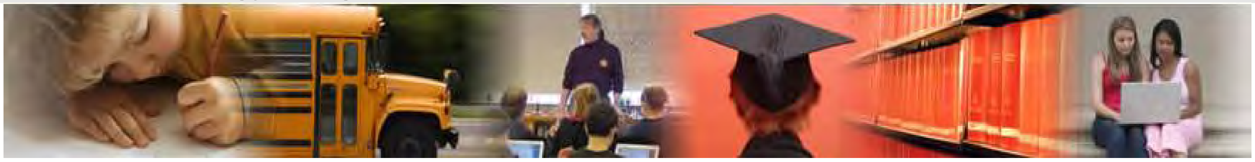
Minimal coordination efforts will be needed to reduce or limit impact to building occupants.

Environmental Issues

Resource Use	Energy savings will result from reduced Electric Usage during scheduled periods.
Waste Production	None.
Environmental Regulations	No environmental impact is expected.



Financial Analysis
Section C



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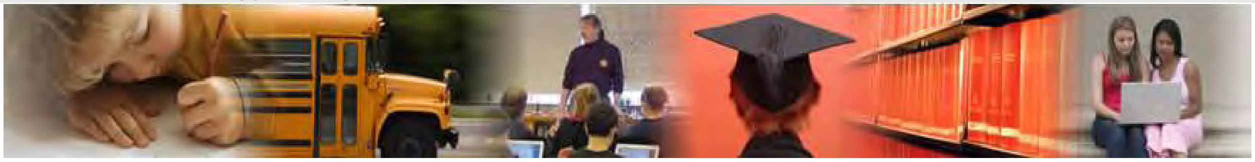


Overview

In the development of an Energy Savings Plan (ESP) in accordance with PL 2009, c.4, it is important to identify energy conservation measures (ECM's) that may be implemented now or at some point in the future. The law outlines the responsibility to identify the opportunities and then proceed forward based on the needs and requirements of the school district, while building a self funding comprehensive project. If an ECM is not identified as part of this ESP, it cannot be implemented as part of an Energy Savings Improvement Program (ESIP) without a board amended change to the ESP.

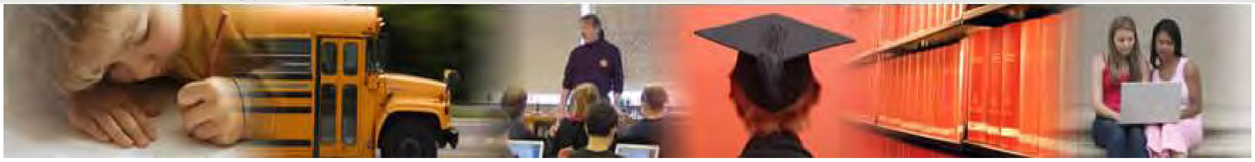
It is the intent of this financial analysis to identify ALL potential ECM's within the Frankford School District as part of a comprehensive ESP. It does not mean that all the ECM's need to be or can be implemented at this time if the requirements of the legislation are not met. However, so long as the ECM is part of this plan, it may be implemented at a later date as additional funding becomes available or technology changes in order to provide an improved financial return.

Should the Board of Education adopt this ESP, the next step is to develop a priority list of ECM's complete with a financial return that meets the requirement of the law and satisfy's the energy and operational goals of your district.

A collaborative project development agreement (PDA) between Honeywell and the Frankford School District will be developed to establish the minimum criteria for the project as well as outline a specific time line to implement the program.

The following spreadsheets are part of this financial overview.

- **Simple Payback - ALL** – This is an overview of the projects we identified by ECM with cost and savings identified per project. It is important to understand that economies can be achieved by combining projects; however for the purpose of clarity we have separated each.
- **Simple Payback – SAMPLE Recommended** – This is an overview of the projects we recommend that will meet the requirements of the law.
- **Financial Cash Flow** – **SAMPLE** - This is a 15 year cash flow with the costs, savings and financing for recommended projects identified in this plan. As ECM's are prioritized, selected and projects are combined, this cash flow will change. However, the law requires that all savings must pay for costs, including financing.



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Frankford School District
Simple Payback
All ECMs

All Energy Conservation Measures Considered								
		Total		PJM	Energy	Operational	Total	Simple
ECM	Description	Cost	SREC	Revenue	Savings	Savings	Savings	Payback
1A	Vending Misers	$1,698			$692	$2,379	$3,071	0.55
1B	Lighting Retrofit and Motion Sensors	$135,090			$11,404		$11,404	11.85
1C	Replace Refrigerators	$4,245			$888		$888	4.78
2A	Boiler Combustion Controls Savings	$26,885			$3,258		$3,258	8.25
2B	Boiler Replacement	$566,000			$10,469		$10,469	54.06
2C	Burner Replacement	$63,675			$5,037		$5,037	12.64
2D	DHW Heater Upgrade	$84,900			$2,527		$2,527	33.60
2E	AHU Unit Replacement	$29,715			$465		$465	63.96
3A	BMS System Upgrades	$424,500			$7,309	$28,300	$35,609	11.92
3B	Demand Control Ventilation	$2,830			$3,865		$3,865	0.73
4A	Building Envelope Improvements	$91,058			$8,406		$8,406	10.83
4B	Window Replacement	$340,591			$2,026		$2,026	168.10
4C	Roof Replacement	$149,000			$238		$238	625.12
5A	Computer Controllers	$6,509			$6,262		$6,262	1.04
6A	Energy Efficient Motors	$6,198			$105		$105	59.25
6B	VFDs on Motors	$8,500			$1,894		$1,894	4.49
7A	Install Photovoltaic System	$1,495,655	$76,454		$28,622		$105,076	14.23
7B	Wind Power	$10,613			$136		$136	77.93
7C	Renewable Energy Education	$109,663	$5,064		$2,062		$7,126	15.39
8A	Kitchen Hood Controllers	$10,896			$1,051		$1,051	10.37
8B	Walk-In Freezer Controllers	$8,490			$288		$288	29.53
8C	Kitchen Sink Pedal Valves	$3,000			$153		$153	19.62
9A	Demand Response	$0			$5,060		$5,060	0.00

Frankford School District
Simple Payback
Sample Project

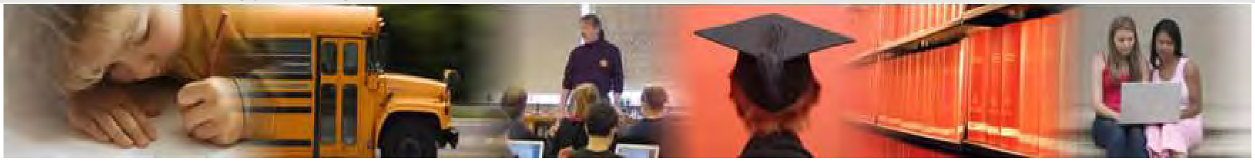
Honeywell

Energy Conservation Measures Recommended								
		Total		PJM	Energy	Operational	Total	Simple
ECM	Description	Cost	SREC	Revenue	Savings	Savings	Savings	Payback
1A	Vending Misers	$1,698			$692		$692	2.46
1B	Lighting Retrofit and Motion Sensors	$135,090			$11,404	$1,897	$13,301	10.16
1C	Replace Refrigerators	$4,245			$888		$888	4.78
2A	Boiler Combustion Controls Savings	$26,885			$3,258		$3,258	8.25
2C	Burner Replacement	$63,675			$5,037		$5,037	12.64
2D	DHW Heater Upgrade	$84,900			$2,527		$2,527	33.60
2E	AHU Unit Replacement	$29,715			$465		$465	63.96
3A	BMS System Upgrades	$424,500			$7,309	$28,300	$35,609	11.92
3B	Demand Control Ventilation	$2,830			$3,865		$3,865	0.73
4A	Building Envelope Improvements	$91,058			$8,406		$8,406	10.83
5A	Computer Controllers	$6,509			$6,262		$6,262	1.04
6A	Energy Efficient Motors	$6,198			$105		$105	59.25
6B	VFDs on Motors	$8,500			$1,894		$1,894	4.49
7C	Renewable Energy Education	$109,663	$5,064		$2,062		$7,126	15.39
8A	Kitchen Hood Controllers	$10,896			$1,051		$1,051	10.37
8C	Kitchen Sink Pedal Valves	$3,000			$153		$153	19.62
9A	Demand Response	$0		$5,060	$0		$5,060	0.00
	Sub Total Project	$1,009,361	$5,064	$5,060	$55,377	$30,197	$95,698	10.55
	Potential Rebates	$94,312						
	Total Project	$915,049	$5,064	$5,060	$55,377	$30,197	$95,698	9.56

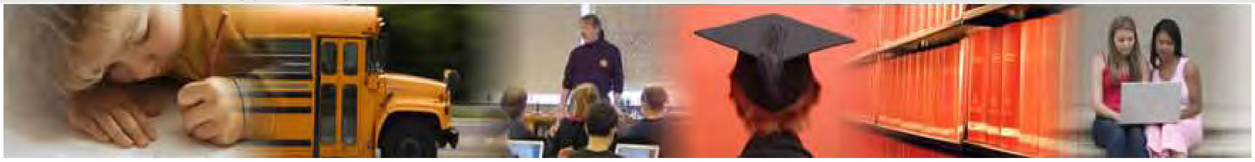
Frankford School District
Cash Flow Example
Sample Project

Capital Cost	$1,009,361
Interest Rate	4.00%
Term	15 years
Annual Energy Escalation	2.90%

Year Installation	Annual Energy Savings	Annual Operational Savings	Energy Rebate/PJM/ SREC Revenue	Total Annual Savings/Revenue	Annual Project Costs	Positive Annual Cash Flow
	$0	$0	$0	$0	$0	$0
1	$55,377	$30,197	$5,064	$90,638	$90,104.00	$534
2	$56,983	$30,197	$5,064	$92,244	$90,104.00	$2,140
3	$58,635	$31,073	$5,064	$94,772	$90,104.00	$4,668
4	$60,336	$31,974	$5,064	$97,374	$90,104.00	$7,270
5	$62,086	$32,901	$5,064	$100,051	$90,104.00	$9,947
6	$63,886	$33,855	$5,064	$102,805	$90,104.00	$12,701
7	$65,739	$34,837	$5,064	$105,640	$90,104.00	$15,536
8	$67,645	$35,847	$5,064	$108,556	$90,104.00	$18,452
9	$69,607	$36,887	$5,064	$111,558	$90,104.00	$21,454
10	$71,626	$37,957	$5,064	$114,646	$90,104.00	$24,542
11	$73,703	$39,057	$5,064	$117,824	$90,104.00	$27,720
12	$75,840	$40,190	$5,064	$121,094	$90,104.00	$30,990
13	$78,039	$41,355	$5,064	$124,459	$90,104.00	$34,355
14	$80,303	$42,555	$5,064	$127,921	$90,104.00	$37,817
15	$82,631	$43,789	$5,064	$131,484	$90,104.00	$41,380
Totals	$1,022,435	$542,671	$75,960	$1,641,066	$1,351,560.00	$289,506



Energy Calculations
Section D



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Frankford Township School District						
Green House Gas Savings Summary Table						
ECM No.	**ECM Description**	**Electric Savings kWh**	**Therm Savings**	**GHG Tons CO2**	**Equivalent Cars/yr**	**Equivalent Forested Acres/yr**
1A	Vending Misers	4,143	0	2	0.4	0.3
1B	Lighting Retrofit and Motion Sensors	71,371	(553)	39	6.8	4.1
1C	Replace Refrigerators	5,318	0	3	0.5	0.3
2A	Boiler Combustion Controls Savings	0	2,044	12	2.1	1.3
2B	Boiler Replacement	0	6,498	38	6.6	4.0
2C	Burner Replacement	0	3,160	18	3.2	1.9
2D	DHW Heater Upgrade	0	1,575	9	1.6	1.0
2E	AHU Unit Replacement	2,783	0	2	0.3	0.2
3A	BMS System Upgrades	0	4,555	27	4.7	2.8
3B	Demand Control Ventilation	0	2,424	14	2.5	1.5
4A	Building Envelope Improvements	0	5,267	31	5.4	3.2
4B	Window Replacement	0	1,271	7	1.3	0.8
4C	Roof Replacement	0	144	1	0.1	0.1
5A	Computer Controllers	37,200	0	22	3.8	2.3
6A	Energy Efficient Motors	627	0	0	0.1	0.0
6B	VFDs on Motors	11,347	0	7	1.2	0.7
7A	Install Photovoltaic System	171,487	0	102	17.7	10.7
7B	Wind Power	816	0	0	0.1	0.1
7C	Renewable Energy Education	12,141	0	7	1.3	0.8
8A	Kitchen Hood Controllers	1,771	474	4	0.7	0.4
8B	Walk-In Freezer Controllers	1,723	0	1	0.2	0.1
8C	Kitchen Sink Pedal Valves	0	96	1	0.1	0.1
9A	Demand Response	0	0	0	0.0	0.0
	TOTALS	**320,728**	**26,955**	**348**	**60.7**	**36.6**

Exhibit G5-1A.1
Frankford Township School District
ECM 1A - Vending Misers

		Frankford Township School					
C1	Energy Costs (per kwh)	0.16691					
C2	Current operating hours	168				24 Hours A Day x 7 Days A Week	
C3	Facility Occupied Hours per Week	85				6 AM to 11 PM; 17 Hours x 5 Days	
C4	Number of Cold Drink Vending Machines	3			**3**		
C5	Number of Uncooled Snack Machines	0			**0**		
C6	Power Req. of Cold Drink Machine (Watts)	400					
C7	Power Req. of Snack Machine (Watts)	80					
C8							
C9							
C10	Savings Analysis						
C11		Before					
C12	Cold Drink Machines	kWh					
C13		10,483				C2*52*C6*C4/1000	
C14							
C15		After	After				
C16		kWh	kWh				
C17		6,167				(C3*17.331+582.57)*C4	
C18							
C19		Before					
C20	Snack Machines	kWh					
C21		-					
C22							
C23		After					
C24		kWh					
C25		-					
C26	Electrical Rate ($/kWh)	$0.167					
C27							
C28	Project Summary						
C29							
C30	Kwh Savings	4,316			**4,316**	C13+C21-(C17+C25)	
C31	$$ Savings	$720			**$720**	C26*C30	
C32	De-Rate	4%					
C33	Savings Kwh	4,143			**4,143**	C30*(1-C32)	
C34	Savings $$	$692			**$692**	C31*(1-C32)	

Greenhouse Gas Emissions (GHGs)

Fuel	**Savings**	**Units**	**Carbon Emission Factor**	**Units**	**Emissions**		**Equivalent Cars/yr**	**Equivalent Forested Acres/yr**
Electricity	4143.4416	kwh/yr	0.0005919	Tons/kwh	2.452503083	Tons CO2/yr	0.428384818	0.258158219
Therms	0	mmbtu/yr	0.0585	Tons/mmBtu	0	Tons CO2/yr	0	0
Totals					2.452503083		0.428384818	0.258158219

Exhibit G5-1B.1
Frankford Township School District
ECM 1B - Lighting

				Sensor Savings Calculations								
				Saved	Blended	Estimated	O&M Savings	Total kWh	Total	Derate	Total kWh	Total
BUILDING	kW	kWh	Dollars	kWh	kWh Rate	Savings		Savings	$ Savings		Savings	$ Savings
Frankford Township School	15.1	26,798	$4,473	41,596	$0.167	$6,943	$0	68,394	$ 11,415.32	4%	65,658	$10,959
Branchville School	1.3	2,332	$542	3,619	$0.233	$842	$0	5,951	$ 1,384.33	4%	5,713	$1,329
Total Saved	**16.4**	**29,129.6**	**$5,015**	**45,215.1**		**$7,785**	**$0**	**74,344.8**	**$12,800**		**71,371.0**	**$12,288**

Greenhouse Gas Emissions (GHGs)

Fuel	Savings	Units	Carbon Emission Factor	Units	Emissions		Equivalent Cars/yr	Equivalent Forested Acres/yr
Electricity	71,371	kwh/yr	0.00059190	Tons/kwh	42.2	Tons CO2/yr	7.379	4.4
Therms	-	mmbtu/yr	0.05850000	Tons/mmBtu	0.0	Tons CO2/yr	-	0.0
Totals					**42.2**		**7.379**	**4.4**

Appendix A: Lighting Study

Location			Existing Fixture Information												Retrofit Information													Annual Savings		
Marker	Floor	Room Identification	Fixture Type	Ballast	Lamp Type	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Controls	Operational Hours per Day	Operational Days per Year	Ballast Wattage	Total Watts	Energy Use kWh/year	Category	Fixture Type	Lamp Type	Ballast	Controls	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Operational Hours per Day	Operational Days per Year	Ballast Watts	Total Watts	Energy Use kWh/year	Fixture Savings (kWh)	Controls Savings (kWh)	Total Savings (kWh)
1	1	Classroom (42)	Recessed	M	4'T12	12	4	34	S	9	184	24	1,920	3,180	T8	ecesse	4'T8	E	OS	12	4	32	7	184	13	1692	2101	378	700	1078
2	1	Classroom (43)	Recessed	M	4'T12	12	4	34	S	9	184	24	1,920	3,180	T8	ecesse	4'T8	E	OS	12	4	32	7	184	13	1692	2101	378	700	1078
3	1	Classroom (44)	Recessed	M	4'T12	12	4	34	S	9	184	24	1,920	3,180	T8	ecesse	4'T8	E	OS	12	4	32	7	184	13	1692	2101	378	700	1078
4	1	Classroom (45)	Recessed	M	4'T12	12	4	34	S	9	184	24	1,920	3,180	T8	ecesse	4'T8	E	OS	12	4	32	7	184	13	1692	2101	378	700	1078
5	1	Classroom (41)	Recessed	M	4'T12	12	4	34	S	9	184	24	1,920	3,180	T8	ecesse	4'T8	E	OS	12	4	32	7	184	13	1692	2101	378	700	1078
6	1	Classroom (46)	Recessed	M	4'T12	12	4	34	S	9	184	24	1,920	3,180	T8	ecesse	4'T8	E	OS	12	4	32	7	184	13	1692	2101	378	700	1078
7	1	Classroom (47)	Recessed	M	4'T12	12	4	34	S	9	184	24	1,920	3,180	T8	ecesse	4'T8	E	OS	12	4	32	7	184	13	1692	2101	378	700	1078
8	1	Classroom (40A)	Recessed	M	4'T12	4	2	34	S	9	184	15	332	550	T8	ecesse	4'T8	E	OS	4	2	32	7	184	6	280	348	86	116	202
9	1	Classroom (49)	Recessed	M	4'T12	12	4	34	S	9	184	24	1,920	3,180	T8	ecesse	4'T8	E	OS	12	4	32	7	184	13	1692	2101	378	700	1078
10	1	Classroom (50)	Recessed	M	4'T12	12	4	34	S	9	184	24	1,920	3,180	T8	ecesse	4'T8	E	OS	12	4	32	7	184	13	1692	2101	378	700	1078
11	1	Classroom (51)	Recessed	M	4'T12	12	4	34	S	9	184	24	1,920	3,180	T8	ecesse	4'T8	E	OS	12	4	32	7	184	13	1692	2101	378	700	1078
12	1	Classroom (53)	Recessed	M	4'T12	16	4	34	S	9	184	24	2,560	4,239	T8	ecesse	4'T8	E	OS	16	4	32	7	184	13	2256	2802	503	934	1437
13	1	Classroom (54)	eiling Suspende	M	4'T12	12	3	34	S	9	184	20	1,464	2,424	T8	g Susp	4'T8	E	OS	12	3	32	7	184	10	1272	1580	318	527	845
14	1	Classroom (55)	eiling Suspende	M	4'T12	15	4	34	S	9	184	24	2,400	3,974	T8	g Susp	4'T8	E	OS	15	4	32	7	184	13	2115	2627	472	876	1348
15	1	Classroom (56)	eiling Suspende	M	4'T12	16	3	34	S	9	184	20	1,952	3,233	T8	g Susp	4'T8	E	OS	16	3	32	7	184	10	1696	2106	424	702	1126
16	1	Storage Closet (560)	Ceiling Mounted	M	4'T12	3	2	34	S	2	184	20	264	97	T8	ng Mou	4'T8	E	S	3	2	32	2	184	6	210	77	20	0	20
17	1	office (56C)	Ceiling Mounted	M	4'T12	1	2	34	S	2	184	15	83	31	T8	ng Mou	4'T8	E	S	1	2	32	2	184	6	70	26	5	0	5
18	1	Office (56D)	Ceiling Mounted	M	4'T12	1	2	34	S	9	184	15	83	137	T8	ng Mou	4'T8	E	S	1	2	32	9	184	6	70	116	22	0	22
19	1	Classroom (57)	Recessed	M	4'T12	16	3	34	S	9	184	20	1,952	3,233	T8	ecesse	4'T8	E	OS	16	3	32	7	184	10	1696	2106	424	702	1126
20	1	Hallway	Recessed	E	2'T8	8	2	17	S	17	184	3	296	926	C	ecesse	2'T8	E	MS	8	2	17	13	184	3	296	694	0	231	231
21	1	Hallway	Recessed	N	LED	1	1	5	N	24	365	0	5	44	N/A	ecesse	LED	N	N	1	1	5	24	365	0	5	44	0	0	0
22	1	Hallway	Recessed	N	LED	1	1	5	N	24	365	0	5	44	N/A	ecesse	LED	N	N	1	1	5	24	365	0	5	44	0	0	0
23	1	Hallway	Recessed	E	2'T8	4	2	17	N	17	184	3	148	463	C	ecesse	2'T8	E	MS	4	2	17	13	184	3	148	347	0	116	116
24	1	Classroom (30)	Recessed	E	4'T8	10	2	32	S	9	184	6	700	1,159	C	ecesse	4'T8	E	OS	10	2	32	7	184	6	700	869	0	290	290
25	1	Cafeteria	eiling Suspende	N	MV	8	1	400	S	8	184	0	3,200	4,710	N/A	g Susp	CFL	N	OS	8	1	250	6	184	0	2000	2208	1766	736	2502
26	1	Gymnasium	eiling Suspende	N	MV	5	1	400	S	9	184	0	2,000	3,312	N/A	g Susp	CFL	N	OS	5	1	250	7	184	0	1250	1553	1242	518	1760
27	1	Gymnasium	Exit Sign	N	LED	2	1	5	N	9	365	1	12	39	N/A	xit Sig	LED	N	N	2	1	5	9	365	1	12	39	0	0	0
28	1	Gymnasium	eiling Suspende	M	4'T12	20	2	34	S	9	184	15	1,660	2,749	T8	g Susp	4'T8	E	OS	20	2	32	7	184	6	1400	1739	431	580	1010
29	1	Kitchen	eiling Suspende	M	4'T12	21	2	34	S	9	184	15	1,743	2,886	T8	g Susp	4'T8	E	OS	21	2	32	7	184	6	1470	1826	452	609	1061
30	1	Kitchen	eiling Suspende	M	4'T12	1	2	34	S	9	184	15	83	137	T8	g Susp	4'T8	E	S	1	2	32	9	184	6	70	116	22	0	22
31	1	Kitchen office	Recessed	M	4'T12	4	2	34	S	9	184	15	332	550	T8	ecesse	4'T8	E	OS	4	2	32	7	184	6	280	348	86	116	202
32	1	Kitchen closet	eiling Suspende	M	4'T12	3	2	34	S	9	184	15	249	412	T8	g Susp	4'T8	E	OS	3	2	32	7	184	6	210	261	65	87	152
33	1	Classroom (28)	eiling Suspende	M	4'T12	35	2	34	S	9	184	15	2,905	4,811	T8	g Susp	4'T8	E	OS	35	2	32	7	184	6	2450	3043	753	1014	1768
34	1	Office phys Ed	eiling Suspende	M	4'T12	6	2	34	S	9	184	15	498	825	T8	g Susp	4'T8	E	OS	6	2	32	7	184	6	420	522	129	174	303
35	1	Classroom (26)	eiling Suspende	M	4'T12	20	2	34	S	9	184	15	1,660	2,749	T8	g Susp	4'T8	E	OS	20	2	32	7	184	6	1400	1739	431	580	1010
36	1	Hallway	eiling Suspende	M	4'T12	12	2	34	S	17	184	15	996	3,115	T8	g Susp	4'T8	E	MS	12	2	32	13	184	6	840	1971	488	657	1145
37	1	Classroom (24)	eiling Suspende	M	4'T12	20	2	34	S	9	184	15	1,660	2,749	T8	g Susp	4'T8	E	OS	20	2	32	7	184	6	1400	1739	431	580	1010
38	1	Classroom (22)	eiling Suspende	M	4'T12	20	2	34	S	9	184	15	1,660	2,749	T8	g Susp	4'T8	E	OS	20	2	32	7	184	6	1400	1739	431	580	1010
39	1	Hallway	Recessed	M	4'T12	8	2	34	S	17	184	15	664	2,077	T8	ecesse	4'T8	E	MS	8	2	32	13	184	6	560	1314	325	438	763
40	1	Hallway	Exit Sign	N	LED	2	1	5	N	24	365	1	12	105	N/A	xit Sig	LED	N	N	2	1	5	24	365	1	12	105	0	0	0
41	1	Bathroom Women	Recessed	N	4'T8	2	3	32	OS	7	184	10	212	273	N/A	ecesse	4'T8	N	OS	2	3	32	7	184	10	212	273	0	0	0
42	1	Bathroom Women	Recessed	E	T8 U-Shape	1	2	32	OS	7	184	6	70	90	T8	ecesse	U-Sha	E	OS	1	2	32	7	184	6	70	90	0	0	0
43	1	Bathroom Men	Recessed	E	T8 U-Shape	1	2	32	OS	7	184	6	70	90	T8	ecesse	U-Sha	E	OS	1	2	32	7	184	6	70	90	0	0	0
44	1	Bathroom Men	Recessed	E	4'T8	2	3	32	OS	7	184	10	212	273	N/A	ecesse	4'T8	E	OS	2	3	32	7	184	10	212	273	0	0	0
45	1	Classroom (29)	eiling Suspende	M	4'T12	20	2	34	S	9	184	15	1,660	2,749	T8	g Susp	4'T8	E	OS	20	2	32	7	184	6	1400	1739	431	580	1010
46	1	Classroom (31)	eiling Suspende	M	4'T12	20	2	34	S	9	184	15	1,660	2,749	T8	g Susp	4'T8	E	OS	20	2	32	7	184	6	1400	1739	431	580	1010
47	1	Classroom (33)	eiling Suspende	M	4'T12	20	2	34	S	9	184	15	1,660	2,749	T8	g Susp	4'T8	E	OS	20	2	32	7	184	6	1400	1739	431	580	1010
48	1	Classroom (35)	eiling Suspende	M	4'T12	40	2	34	S	9	184	15	3,320	5,498	T8	g Susp	4'T8	E	OS	40	2	32	7	184	6	2800	3478	861	1159	2020
49	1	Office (35A)	eiling Suspende	M	4'T12	2	2	34	S	2	184	15	166	61	T8	g Susp	4'T8	E	S	2	2	32	2	184	6	140	52	10	0	10
50	1	Office (35B)	eiling Suspende	M	4'T12	2	2	34	S	2	184	15	166	61	T8	g Susp	4'T8	E	S	2	2	32	2	184	6	140	52	10	0	10
51	1	Display case	Recessed	N	CFL	3	1	42	S	2	184	0	126	46	N/A	ecesse	CFL	N	S	3	1	42	2	184	0	126	46	0	0	0
52	1	Classroom (37B)	Recessed	N	4'T12	4	4	34	S	9	184	24	640	1,060	T8	ecesse	4'T8	E	OS	4	4	32	7	184	13	564	700	126	233	359
53	1	Classroom (37A)	Recessed	N	4'T12	4	4	34	S	9	184	24	640	1,060	T8	ecesse	4'T8	E	OS	4	4	32	7	184	13	564	700	126	233	359
54	1	Conference room	Recessed	N	4'T12	2	4	34	S	9	184	24	320	530	T8	ecesse	4'T8	E	OS	2	4	32	7	184	13	282	350	63	117	180
55	1	MS Principal office	Recessed	N	4'T12	4	4	34	S	9	184	24	640	1,060	T8	ecesse	4'T8	E	OS	4	4	32	7	184	13	564	700	126	233	359
56	1	S Principal office hallw	Recessed	N	4'T12	1	4	34	S	9	184	24	160	265	T8	ecesse	4'T8	E	OS	1	4	32	7	184	13	141	175	31	58	90
57	1	Hallway	Recessed	M	4'T12	6	4	34	S	17	184	24	960	3,003	T8	ecesse	4'T8	E	MS	6	4	32	13	184	13	846	1985	357	662	1018

Location			Existing Fixture Information												Retrofit Information													Annual Savings		
Marker	Floor	Room Identification	Fixture Type	Ballast	Lamp Type	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Controls	Operational Hours per Day	Operational Days per Year	Ballast Wattage	Total Watts	Energy Use kWh/year	Category	Fixture Type	Lamp Type	Ballast	Controls	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Operational Hours per Day	Operational Days per Year	Ballast Watts	Total Watts	Energy Use kWh/year	Fixture Savings (kWh)	Controls Savings (kWh)	Total Savings (kWh)
58	1	Hallway	Recessed	E	2'T8	7	2	17	S	17	184	3	259	810	C	ecesse	2'T8	E	MS	7	2	17	13	184	3	259	608	0	203	203
59	1	Hallway display	Recessed	N	Halogen	2	1	35	S	17	184	0	70	219	N/A	ecess	aloge	N	S	2	1	35	17	184	0	70	219	0	0	0
60	1	Copy room	Recessed	E	4'T12	3	2	34	S	9	184	15	249	412	T8	ecesse	4'T8	E	OS	3	2	32	7	184	6	210	261	65	87	152
61	1	Bathroom Women	Recessed	E	4'T8	4	3	32	OS	7	184	10	424	546	N/A	ecesse	4'T8	E	OS	4	3	32	7	184	10	424	546	0	0	0
62	1	Bathroom Men	Recessed	E	4'T8	4	3	32	OS	7	184	10	424	546	N/A	ecesse	4'T8	E	OS	4	3	32	7	184	10	424	546	0	0	0
63	1	Bathroom Men	Recessed	E	T8 U-Shape	1	2	32	OS	7	184	6	70	90	T8	ecesse	U-Sha	E	OS	1	2	32	7	184	6	70	90	0	0	0
64	1	Bathroom Women	Recessed	E	T8 U-Shape	1	2	32	OS	7	184	6	70	90	T8	ecesse	U-Sha	E	OS	1	2	32	7	184	6	70	90	0	0	0
65	1	Hallway	Recessed	E	2'T8	16	2	17	S	17	184	3	592	1,852	C	ecesse	2'T8	E	MS	16	2	17	13	184	3	592	1389	0	463	463
66	1	Hallway	Recessed	E	2'T8	12	2	17	S	17	184	3	444	1,389	C	ecesse	2'T8	E	MS	12	2	17	13	184	3	444	1042	0	347	347
67	1	Classroom (20)	Ceiling Mounted	E	4'T12	18	2	34	S	9	184	15	1,494	2,474	T8	ng Mou	4'T8	E	OS	18	2	32	7	184	6	1260	1565	388	522	909
68	1	Classroom (25)	Ceiling Mounted	E	4'T12	18	2	34	S	9	184	15	1,494	2,474	T8	ng Mou	4'T8	E	OS	18	2	32	7	184	6	1260	1565	388	522	909
69	1	Faculty rm bathroom	Sconce	E	Inc	1	2	60	S	9	184	0	120	199	N/A	Sconce	CFL	N	OS	1	2	15	7	184	0	30	37	149	12	161
70	1	Faculty rm bathroom	Sconce	E	Inc	1	2	60	S	9	184	0	120	199	N/A	Sconce	CFL	N	OS	1	2	15	7	184	0	30	37	149	12	161
71	1	aculty rm phone boot	Ceiling Mounted	M	2'T12	1	2	17	S	9	184	3	37	61	T8	ng Mou	2'T8	E	OS	1	2	17	7	184	1	35	43	3	14	18
72	1	Classroom (18)	Ceiling Mounted	M	4'T12	18	2	34	S	9	184	15	1,494	2,474	T8	ng Mou	4'T8	E	OS	18	2	32	7	184	6	1260	1565	388	522	909
73	1	Classroom (23)	Ceiling Mounted	M	4'T12	18	2	34	S	9	184	15	1,494	2,474	T8	ng Mou	4'T8	E	OS	18	2	32	7	184	6	1260	1565	388	522	909
74	1	Classroom (16)	Ceiling Mounted	M	4'T12	18	2	34	S	9	184	15	1,494	2,474	T8	ng Mou	4'T8	E	OS	18	2	32	7	184	6	1260	1565	388	522	909
75	1	Classroom (14)	Ceiling Mounted	M	4'T12	18	2	34	S	9	184	15	1,494	2,474	T8	ng Mou	4'T8	E	OS	18	2	32	7	184	6	1260	1565	388	522	909
76	1	Bathroom Women	Recessed	E	4'T8	3	3	32	OS	7	184	10	318	410	T8	ecesse	4'T8	E	OS	3	3	32	7	184	10	318	410	0	0	0
77	1	Bathroom Men	Recessed	E	4'T8	3	3	32	OS	7	184	10	318	410	T8	ecesse	4'T8	E	OS	3	3	32	7	184	10	318	410	0	0	0
78	1	Bathroom Men	Recessed	E	T8 U-Shape	1	2	32	OS	7	184	6	70	90	T8	ecesse	U-Sha	E	OS	1	2	32	7	184	6	70	90	0	0	0
79	1	Bathroom Women	Recessed	E	T8 U-Shape	1	2	32	OS	7	184	6	70	90	T8	ecesse	U-Sha	E	OS	1	2	32	7	184	6	70	90	0	0	0
80	1	Office	Ceiling Mounted	M	4'T12	4	2	34	S	9	184	15	332	550	T8	ng Mou	4'T8	E	OS	4	2	32	7	184	6	280	348	86	116	202
81	1	Hallway	Recessed	E	2'T8	4	2	17	S	17	184	3	148	463	T8	ecesse	2'T8	E	MS	4	2	17	13	184	3	148	347	0	116	116
82	1	Classroom (15B)	Ceiling Mounted	E	4'T12	2	2	34	S	9	184	15	166	275	T8	ng Mou	4'T8	E	OS	2	2	32	7	184	6	140	174	43	58	101
83	1	Classroom (15A)	Ceiling Mounted	M	4'T12	4	2	34	S	9	184	15	332	550	T8	ng Mou	4'T8	E	OS	4	2	32	7	184	6	280	348	86	116	202
84	1	Classroom (12D)	Ceiling Mounted	M	4'T12	4	4	34	S	9	184	24	640	1,060	T8	ng Mou	4'T8	E	OS	4	4	32	7	184	13	564	700	126	233	359
85	1	Classroom (12C)	Ceiling Mounted	M	4'T12	4	4	34	S	9	184	24	640	1,060	T8	ng Mou	4'T8	E	OS	4	4	32	7	184	13	564	700	126	233	359
86	1	Classroom (12B)	Ceiling Mounted	M	4'T12	4	4	34	S	9	184	24	640	1,060	T8	ng Mou	4'T8	E	OS	4	4	32	7	184	13	564	700	126	233	359
87	1	Classroom (12A)	Ceiling Mounted	M	4'T12	4	4	34	S	9	184	24	640	1,060	T8	ng Mou	4'T8	E	OS	4	4	32	7	184	13	564	700	126	233	359
88	1	r Room With Work S	Ceiling Mounted	M	8'T12	2	2	80	S	4	184	24	368	271	T8	ng Mou	8'T8	E	OS	2	2	59	3	184	13	262	145	78	48	126
89	1	Classroom (21)	Recessed	M	4'T12	11	4	34	S	9	184	24	1,760	2,915	T8	ecesse	4'T8	E	OS	11	4	32	7	184	13	1551	1926	346	642	988
90	1	Classroom bath (21A	Recessed	M	4'T12	1	2	34	S	9	184	15	83	137	T8	ecesse	4'T8	E	OS	1	2	32	7	184	6	70	87	22	29	51
91	1	lassroom walkthroug	Recessed	M	4'T12	1	2	34	S	2	184	15	83	31	T8	ecesse	4'T8	E	S	1	2	32	2	184	6	70	26	5	0	5
92	1	Classroom (19)	Recessed	M	4'T12	6	4	34	S	9	184	24	960	1,590	T8	ecesse	4'T8	E	OS	6	4	32	7	184	13	846	1051	189	350	539
93	1	Library	Recessed	M	4'T12	19	4	34	S	9	184	24	3,040	5,034	T8	ecesse	4'T8	E	OS	19	4	32	7	184	13	2679	3327	598	1109	1707
94	1	Nurse's	Recessed	M	4'T12	2	4	34	S	9	184	24	320	530	T8	ecesse	4'T8	E	OS	2	4	32	7	184	13	282	350	63	117	180
95	1	Nurse's	Recessed	M	12 U-Shap	2	2	34	S	9	184	15	166	275	T8	ecesse	U-Sha	E	OS	2	2	32	7	184	6	140	174	43	58	101
96	1	Nurse's bath	Recessed	M	12 U-Shap	1	2	34	S	9	184	15	83	137	T8	ecesse	U-Sha	E	OS	1	2	32	7	184	3	67	83	26	28	54
97	1	Office Area	Recessed	M	4'T12	12	4	34	S	9	184	24	1,920	3,180	T8	ecesse	4'T8	E	OS	12	4	32	7	184	13	1692	2101	378	700	1078
98	1	Office	Recessed	M	4'T12	1	4	34	S	9	184	24	160	265	T8	ecesse	4'T8	E	OS	1	4	32	7	184	13	141	175	31	58	90
99	1	Office conference	Recessed	M	4'T12	4	4	34	S	9	184	24	640	1,060	T8	ecesse	4'T8	E	OS	4	4	32	7	184	13	564	700	126	233	359
100	1	Office conference	Recessed	M	12 U-Shap	2	2	34	S	9	184	15	166	275	T8	ecesse	U-Sha	E	OS	2	2	32	7	184	6	140	174	43	58	101
101	1	Office bath	Sconce	N	Inc	1	3	60	S	9	184	0	180	298	N/A	Sconce	CFL	N	OS	1	3	15	7	184	0	45	56	224	19	242
102	1	Office hallway	Ceiling Mounted	M	4'T12	1	2	34	S	9	184	15	83	137	T8	ng Mou	4'T8	E	OS	1	2	32	7	184	6	70	87	22	29	51
103	1	Office closet	Ceiling Mounted	E	4'T8	1	4	32	S	4	184	13	141	104	T8	ng Mou	4'T8	E	S	1	4	32	4	184	13	141	104	0	0	0
104	1	Entrance Hallway	Recessed	E	4'T12	13	4	34	S	17	184	24	2,080	6,506	T8	ecesse	4'T8	E	MS	13	4	32	13	184	13	1833	4300	773	1433	2206
105	1	Hallway	Recessed	M	4'T12	8	4	34	S	17	184	24	1,280	4,004	T8	ecesse	4'T8	E	MS	8	4	32	13	184	13	1128	2646	475	882	1358
106	1	Hallway	Exit Sign	N	LED	3	1	5	N	24	365	1	18	158	N/A	xit Sig	LED	N	N	3	1	5	24	365	1	18	158	0	0	0
107	1	Classroom (15)	Recessed	M	4'T12	12	3	34	S	9	184	20	1,464	2,424	T8	ecesse	4'T8	E	OS	12	3	32	7	184	10	1272	1580	318	527	845
108	1	Classroom office	Recessed	M	4'T12	1	2	34	S	4	184	15	83	61	T8	ecesse	4'T8	E	S	1	2	32	4	184	6	70	52	10	0	10
109	1	Office (13)	Recessed	M	12 U-Shap	1	2	34	S	9	184	15	83	137	T8	ecesse	U-Sha	E	OS	1	2	32	7	184	6	70	87	22	29	51
110	1	Office (13A)	Recessed	M	4'T12	1	4	34	S	9	184	24	160	265	T8	ecesse	4'T8	E	OS	1	4	32	7	184	13	141	175	31	58	90
111	1	Office (13B)	Recessed	M	4'T12	4	4	34	S	9	184	24	640	1,060	T8	ecesse	4'T8	E	OS	4	4	32	7	184	13	564	700	126	233	359
112	1	Office	Recessed	M	12 U-Shap	1	2	34	S	9	184	15	83	137	T8	ecesse	U-Sha	E	S	1	2	32	9	184	6	70	116	22	0	22
113	1	Office bath	Ceiling Mounted	M	4'T12	1	2	34	S	9	184	15	83	137	T8	ng Mou	4'T8	E	S	1	2	32	9	184	6	70	116	22	0	22
114	1	Office closet	Ceiling Mounted	M	4'T12	1	2	34	S	9	184	15	83	137	T8	ng Mou	4'T8	E	S	1	2	32	9	184	6	70	116	22	0	22
115	1	Janitor's Closet	Ceiling Mounted	M	4'T12	1	2	34	S	4	184	15	83	61	T8	ng Mou	4'T8	E	S	1	2	32	4	184	6	70	52	10	0	10
116	1	Bathroom Women	Recessed	E	4'T8	4	3	32	OS	7	184	10	424	546	T8	ecesse	4'T8	E	OS	4	3	32	7	184	10	424	546	0	0	0
117	1	Bathroom Men	Recessed	E	4'T8	4	3	32	OS	7	184	10	424	546	T8	ecesse	4'T8	E	OS	4	3	32	7	184	10	424	546	0	0	0
118	1	Bathroom Men	Recessed	E	T8 U-Shape	1	2	32	OS	7	184	6	70	90	T8	ecesse	U-Sha	E	OS	1	2	32	7	184	6	70	90	0	0	0

Location			Existing Fixture Information												Retrofit Information													Annual Savings		
Marker	Floor	Room Identification	Fixture Type	Ballast	Lamp Type	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Controls	Operational Hours per Day	Operational Days per Year	Ballast Wattage	Total Watts	Energy Use kWh/year	Category	Fixture Type	Lamp Type	Ballast	Controls	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Operational Hours per Day	Operational Days per Year	Ballast Watts	Total Watts	Energy Use kWh/year	Fixture Savings (kWh)	Controls Savings (kWh)	Total Savings (kWh)
119	1	Bathroom Women	Recessed	E	T8 U-Shap	1	2	32	OS	7	184	6	70	90	T8	ecesse	U-Sha	E	OS	1	2	32	7	184	6	70	90	0	0	0
120	1	Classroom 13	Recessed	M	4'T12	3	3	34	S	9	184	20	366	606	T8	ecesse	4'T8	E	OS	3	3	32	7	184	10	318	395	79	132	211
121	1	Classroom 13	Recessed	M	2'T12	2	3	20	S	9	184	24	168	278	T8	ecesse	2'T8	E	OS	2	3	17	7	184	4	110	137	96	46	142
122	1	Classroom 13 bath	Recessed	M	2'T12	1	2	20	S	9	184	16	56	93	T8	ecesse	2'T8	E	OS	1	2	17	7	184	3	37	46	31	15	47
123	1	Classroom (10)	Recessed	M	4'T12	9	4	34	S	9	184	24	1,440	2,385	T8	ecesse	4'T8	E	OS	9	4	32	7	184	13	1269	1576	283	525	809
124	1	Classroom (11)	Recessed	M	4'T12	8	4	34	S	9	184	24	1,280	2,120	T8	ecesse	4'T8	E	OS	8	4	32	7	184	13	1128	1401	252	467	719
125	1	Classroom bath	Recessed	M	4'T12	1	2	34	S	2	184	15	83	31	T8	ecesse	4'T8	E	S	1	2	32	2	184	6	70	26	5	0	5
126	1	Classroom (8)	Recessed	M	4'T12	8	3	34	S	9	184	20	976	1,616	T8	ecesse	4'T8	E	OS	8	3	32	7	184	10	848	1053	212	351	563
127	1	Classroom (9)	Recessed	E	4'T8	8	4	32	S	9	184	13	1,128	1,868	C	ecesse	4'T8	E	OS	8	4	32	7	184	13	1128	1401	0	467	467
128	1	Classroom (7)	Recessed	E	4'T8	9	4	32	S	9	184	13	1,269	2,101	C	ecesse	4'T8	E	OS	9	4	32	7	184	13	1269	1576	0	525	525
129	1	Classroom (5)	Recessed	E	4'T8	9	4	32	S	9	184	13	1,269	2,101	C	ecesse	4'T8	E	OS	9	4	32	7	184	13	1269	1576	0	525	525
130	1	Classroom (3)	Recessed	E	4'T8	9	4	32	S	9	184	13	1,269	2,101	C	ecesse	4'T8	E	OS	9	4	32	7	184	13	1269	1576	0	525	525
131	1	Classroom (2)	Recessed	E	4'T8	9	4	32	S	9	184	13	1,269	2,101	C	ecesse	4'T8	E	OS	9	4	32	7	184	13	1269	1576	0	525	525
132	1	Classroom (1)	Recessed	E	4'T8	9	4	32	S	9	184	13	1,269	2,101	C	ecesse	4'T8	E	OS	9	4	32	7	184	13	1269	1576	0	525	525
133	1	Hallway	Recessed	M	4'T8	5	2	32	S	17	184	6	350	1,095	C	ecesse	4'T8	E	OS	5	2	32	13	184	6	350	821	0	274	274
134	1	Hallway	Exit Sign	N	LED	2	1	5	N	24	365	1	12	105	N/A	xit Sig	LED	N	N	2	1	5	24	365	1	12	105	0	0	0
135	1	Hallway	Recessed	M	4'T8	12	2	32	N	17	184	6	840	2,628	C	ecesse	4'T8	E	OS	12	2	32	13	184	6	840	1971	0	657	657
136	1	Classroom (4)	Recessed	E	4'T8	8	4	32	S	9	184	13	1,128	1,868	C	ecesse	4'T8	E	OS	8	4	32	7	184	13	1128	1401	0	467	467
137	1	Classroom (6)	Recessed	E	4'T8	8	4	32	S	9	184	13	1,128	1,868	C	ecesse	4'T8	E	OS	8	4	32	7	184	13	1128	1401	0	467	467
138	1	Boiler Rm	Ceiling Mounted	M	4'T12	7	2	34	S	2	184	15	581	214	T8	ng Mou	4'T8	E	S	7	2	32	2	184	6	490	180	33	0	33
139	1	Janitor's Closet	Ceiling Mounted	M	4'T12	2	2	34	S	4	184	15	166	122	T8	ng Mou	4'T8	E	S	2	2	32	4	184	6	140	103	19	0	19
140	1	Boiler Rm	Ceiling Mounted	M	4'T12	9	2	34	S	24	184	15	747	3,299	T8	ng Mou	4'T8	E	S	9	2	32	24	184	6	630	2782	517	0	517
141	Ext	Exterior	Screw-in	N	MH	7	1	70	PC	12	365	18	616	2,698	PSMH	Screw-i	PSMH	N	PC	7	1	45	12	365	10	385	1686	1012	0	1012
142	Ext	Exterior	Screw-in	N	CFL	10	1	23	S	12	365	0	230	1,007	C	Screw-i	CFL	N	PC	10	1	23	9	365	0	230	756	0	252	252
143	Ext	Exterior	Screw-in	N	MH	1	1	400	PC	12	365	100	500	2,190	PSMH	Screw-i	PSMH	N	PC	1	1	275	12	365	59	334	1463	727	0	727
Totals:						**1,028**	**377**	**5,741**				**2,155**	**115,038**	**205,473**						**1,028**	**377**	**4,951**			**1,175**	**99,986**	**137,079**	**26,798**	**41,596**	**68,394**

Rows Highlighed Yellow Indicate an Energy Conservation Measure is recommended for that space

Proposed Lighting Summary Table			
Total Surface Area (SF)	90,000		
Average Power Cost ($/kWh)	0.1660		
Exterior Lighting	**Existing**	**Proposed**	**Savings**
Exterior Annual Consumption (kWh)	5,895	3,905	**1,991**
Exterior Power (watts)	1,346	949	**397**
Total Lighting	**Existing**	**Proposed**	**Savings**
Annual Consumption (kWh)	199,578	133,174	**68,394**
Lighting Power (watts)	113,692	99,037	**14,655**
Lighting Power Density (watts/SF)	1.26	1.10	**0.16**
Estimated Cost of Fixture Replacement ($)	159,761		
Estimated Cost of Controls Improvements ($)	22,000		
Total Consumption Cost Savings ($)	**18,493**		

Exhibit G5-1B.2
Frankford Township School District
ECM 1B - Lighting and Lighting Controls
Heating Penalty Calculations

		(A)		(B)	(C)	(D)						
	Total Savings from Lighting (kWh)	Heating season (Weeks)	% Heating Season	Fraction of Heat to be Made-up	Annual Equivalent of Lighting in Therms	Assume Seasonal Heating Efficiency conservatively at	Cost per Therm	Extra Heat Required =(AxBxC)/D	Heating Penalty	De-rate	Extra Heat Required	Heating Penalty
Frankford Township School	68,394	24	46%	40%	2,335	78%	1.59	553	$881	8%	508	$811
Branchville School	5,951	24	46%	40%	203	78%	1.65	48	$79	8%	44	$73
								601	$961		553	$884

Notes:

A = Heating Season = 1 – Fraction of the Year Representing the Cooling Season Liberal estimate of the heating season, as there are times during the year when the building is neither heated nor coole
B = Fraction of the Lighting Reduction that Has to Be Made Up by Heating A portion of the lighting heat is released at night plus interior zones will have limited heating loads. This is estimated at 50%.
C = Annual therm Equivalent of Lighting Saved Lighting reduction in kWh multiplied by 3,414 British Thermal Units (BTU)
D = Seasonal Heating Efficiency Estimate of basic efficiency of heating system. Heating system efficiency can vary from about 65-95%, depending on the type, use and technology

Extra Heat Required (Therms) = (A x B x C ÷ D)

Greenhouse Gas Emissions (GHGs)

Fuel	Savings	Units	Carbon Emission Factor	Units	Emissions		Equivalent Cars/yr	Equivalent Forested Acres/yr
Electricity		kwh/yr	0.0005919	Tons/kwh	0	Tons CO2/yr	-	-
Therms	(55)	mmbtu/yr	0.0585	Tons/mmBtu	(3.23)	Tons CO2/yr	(0.56)	(0.34)
Totals	(55)				(3.23)		(0.56)	(0.34)

Exhibit G5-1C.1

Frankford Township School District
ECM 1C - Replace Refrigerators

		Frankford Township School		Totals			
C1	Energy Costs (per kwh)	0.16691					
C2	Number of Refrigerators (18 cu ft)	4			**4**	Lounges & Home Economics	
C3	Power Consumption of Existing Refrigerators (kWh)	1700					
C4	Power Consumption of New Refrigerators (kWh)	315					
C5	Number of Refrigerators (42 cu ft)	0			**0**	Kitchen	
C6	Power Consumption of Existing Refrigerators (kWh)	5600					
C7	Power Consumption of New Refrigerators (kWh)	1470					
C8							
C9	Savings Analysis						
C10		Before					
C11		kWh					
C12		6,800				(C2*C3)+(C5*C6)	
C13							
C14		After	After				
C15		kWh	kWh				
C16		1,260				(C2*C4)+(C5*C7)	
C17							
C18	Electrical Rate ($/kWh)	$0.167					
C19							
C20	Project Summary						
C21							
C22	Kwh Savings	5,540			**5,540**	C12-C16	
C23	$$ Savings	$925			**$925**	C22*C18	
C24	De-Rate	4%					
C25	Savings Kwh	5,318			**5,318**	C22*(1-C24)	
C26	Savings $$	$888			**$888**	C23*(1-C24)	

Greenhouse Gas Emissions (GHGs)

Fuel	Savings	Units	Carbon Emission Factor	Units	Emissions		Equivalent Cars/yr	Equivalent Forested Acres/yr
Electricity	5318.4	kwh/yr	0.0005919	Tons/kwh	3.14796096	Tons CO2/yr	0.549862176	0.331364312
Therms	0	mmbtu/yr	0.0585	Tons/mmBtu	0	Tons CO2/yr	0	0
Totals					3.14796096		0.549862176	0.331364312

Exhibit G5-2.1
Frankford Township School District
Existing Boiler Efficiency

ESTIMATED OVERALL BOILER EFFICIENCY

ASSUMPTIONS / DATA

		Franklin Township School-Boiler B	Franklin Township School-Boiler C/D	Branchville School		
	BOILER TYPE	Hot Water	Hot Water	Hot Water		
C1	**COMBUSTION EFFICIENCY**	70	70	65		%
C2	**LOSSES DUE TO BLOWDOWN**	0	0	0		% OF MCR
C3	**LOSSES DUE TO RADIATION**	1	1	1		% OF MCR
C4	**% MAKEUP WATER**	0.1	0.1	0.1		%
C5	**MAKEUP T.D.S.**	80	80	80		PPM
C6	**BLOWDOWN T.D.S.**	3500	3500	3500		PPM
C7	**ENERGY INPUT TO BOILER(S)**	1,636	1,636	880		MMBTU/YR
C8	**FEEDWATER TEMPERATURE**	160	160	160		DEG F
C9	**MCR OF BOILER(s)**	2.403	3.33	0.463		MMBTU/HR
C10	**CONDENSATE RETURN TEMPERATURE**	160	160	160		DEG F
C11	**MAKEUP WATER TEMPERATURE**	60	60	60		DEG F
C12	**HOURS/YR BOILER OPERATION**	3099	3099	3099		HRS/YR
C13	**BLOWDOWN TEMPERATURE**	180	180	180		DEG F
C14	**HEAT REQUIRED TO RAISE A LB OF STEAM**	980	980	980		BTU/LB
C15	**BOILER LOAD FACTOR**	50	50	50	IF(((C7*(C1/100))/(C9*C12))*100<50,50 ,((C7*(C1/100))/(C9*C12))*100)	% LOAD FACTOR
C16	**LOSSES FROM BLOW DOWN**	0.0023	0.0023	0.0023	(C4*C5)/C6	LBS/LB STEAM
C17	**NET HEAT CONTENT IN BLOWDOWN**	120	120	120	C13-C11	BTU/LB
C18	**BLOWDOWN LOSS AS % OF MCR**	0.0196	0.0196	0.0182	(((((C9*10^6)*(C1/100))/C14)*C16*C17) /(C9*10^6))*100	%
C19	**LOSSES DUE TO BLOWDOWN AT AVERAGE LOAD**	0.0392	0.0392	0.0364	C18/(C15/100)	%
C20	**LOSSES DUE TO RADIATION**	3.5	3.5	3.5	(C3/(C15/100))+1.5	%
C21	**OVERALL BOILER EFFICIENCY**	66%	66%	61%	(C1-C19-C20)/100	

NOTES:

T.D.S. = TOTAL DISSOLVED SOLIDS; MCR = MAXIMUM CONTINUOUS RATING
HOURS/YR = See BMS Calc; 1 Dtherm = 1 MMBTU
Utility baseline reduced 10% in the "Energy Input to Boilers" to account for DHW
BOILER LOAD FACTOR
BOILER LOAD FACTOR = (TOTAL ENERGY TO BOILERS IN MMBTU/YR * BOILER COMBUSTION EFFICIENCY) /
LOSSES FROM BLOWDOWN
PRESENT BLOWDOWN RATE = (% OF MAKEUP WATER * MAKEUP WATER T.D.S.) / BLOWDOWN T.D.S.
NET HEAT CONTENT IN BLOWDOWN = HEAT CONTENT OF BLOWDOWN - HEAT CONTENT OF MAKEUP WATER

NET HEAT CONTENT OF BLOWDOWN = TEMPERATURE OF BLOWDOWN - TEMPERATURE OF MAKEUP WATER
BLOWDOWN LOSS AS % OF MCR = ((MCR OF BOILER IN MMBTU/HR * BOILER COMBUSTION EFFICIENCY) /
LOSSES DUE TO BLOWDOWN = BLOWDOWN LOSS AS % OF MCR / LOAD FACTOR
RADIATION LOSSES
LOSSES DUE TO RADIATION = (% RADIATION AT MCR / LOAD FACTOR) + 1.5%
OVERALL BOILER EFFICIENCY
OVERALL BOILER EFFICIENCY = COMBUSTION EFFICIENCY - % BLOWDOWN LOSSES - % RADIATION LOSSES

Exhibit G5-2.2
Frankford Township School District
Proposed Boiler Efficiency

ESTIMATED OVERALL BOILER EFFICIENCY

ASSUMPTIONS / DATA

		Frankford Township School-Boiler B	Frankford Township School-Boiler C/D	Branchville School		
	BOILER TYPE	Hot Water	Hot Water	Hot Water		
C1	**COMBUSTION EFFICIENCY**	86	86	85		%
C2	**LOSSES DUE TO BLOWDOWN**	0	0	0		% OF MCR
C3	**LOSSES DUE TO RADIATION**	1	1	1		% OF MCR
C4	**% MAKEUP WATER**	0.1	0.1	0.1		%
C5	**MAKEUP T.D.S.**	80	80	80		PPM
C6	**BLOWDOWN T.D.S.**	3500	3500	3500		PPM
C7	**ENERGY INPUT TO BOILER(S)**	1,636	1,636	880		MMBTU/YR
C8	**FEEDWATER TEMPERATURE**	140	140	140		DEG F
C9	**MCR OF BOILER(s)**	2.561	3.422	0.515		MMBTU/HR
C10	**CONDENSATE RETURN TEMPERATURE**	140	140	140		DEG F
C11	**MAKEUP WATER TEMPERATURE**	60	60	60		DEG F
C12	**HOURS/YR BOILER OPERATION**	3099	3099	3099		HRS/YR
C13	**BLOWDOWN TEMPERATURE**	160	160	160		DEG F
C14	**HEAT REQUIRED TO RAISE A LB OF STEAM**	980	980	980		BTU/LB
C15	**BOILER LOAD FACTOR**	50	50	50	IF(((C7*(C1/100))/(C9*C12))*100<50,50,((C7*(C1/100))/(C9*C12))*100)	% LOAD FACTOR
C16	**LOSSES FROM BLOW DOWN**	0.229%	0.229%	0.229%	(C4*C5)/C6	LBS/LB STEAM
C17	**NET HEAT CONTENT IN BLOWDOWN**	100	100	100	C13-C11	BTU/LB
C18	**BLOWDOWN LOSS AS % OF MCR**	0.02	0.02	0.02	(((((C9*10^6)*(C1/100))/C14)*C16*C17)/(C9*10^6))*100	%
C19	**LOSSES DUE TO BLOWDOWN AT AVERAGE LOAD**	0.04	0.04	0.04	C18/(C15/100)	%
C20	**LOSSES DUE TO RADIATION**	3.5	3.5	3.5	(C3/(C15/100))+1.5	%
C21	**OVERALL BOILER EFFICIENCY**	82%	82%	81%	(C1-C19-C20)/100	

NOTES:

T.D.S. = TOTAL DISSOLVED SOLIDS; MCR = MAXIMUM CONTINUOUS RATING
HOURS/YR = See BMS Calc; 1 Dtherm = 1 MMBTU
Utility baseline reduced 10% in the "Energy Input to Boilers" to account for DHW load.
BOILER LOAD FACTOR
BOILER LOAD FACTOR = (TOTAL ENERGY TO BOILERS IN MMBTU/YR * BOILER COMBUSTION EFFICIENCY) /
LOSSES FROM BLOWDOWN
PRESENT BLOWDOWN RATE = (% OF MAKEUP WATER * MAKEUP WATER T.D.S.) / BLOWDOWN T.D.S.
NET HEAT CONTENT IN BLOWDOWN = HEAT CONTENT OF BLOWDOWN - HEAT CONTENT OF MAKEUP WATER

NET HEAT CONTENT OF BLOWDOWN = TEMPERATURE OF BLOWDOWN - TEMPERATURE OF MAKEUP WATER
BLOWDOWN LOSS AS % OF MCR = ((MCR OF BOILER IN MMBTU/HR * BOILER COMBUSTION EFFICIENCY) /
LOSSES DUE TO BLOWDOWN = BLOWDOWN LOSS AS % OF MCR / LOAD FACTOR
RADIATION LOSSES
LOSSES DUE TO RADIATION = (% RADIATION AT MCR / LOAD FACTOR) + 1.5%
OVERALL BOILER EFFICIENCY
OVERALL BOILER EFFICIENCY = COMBUSTION EFFICIENCY - % BLOWDOWN LOSSES - % RADIATION LOSSES

Exhibit G5-2A.1
Frankford Township School District
ECM 2A Boiler Combustion Controls Savings Summary
Savings Summary

	Savings Calculation	**Frankford Township School**			**Total**	
C1	Number of Units	1			**1**	
C2	Current Boiler Efficiency	66%				Overall Thermal Efficiency
C3	Projected Burner/Boiler Efficiency Savings					
C4	Removal of Linkage Wear					
C5	Improved Combustion	2.00%				
C6	Increased Turndown					
C7	Total Efficiency Savings	2.00%				
C8	Annual Boiler Fuel Use	16,363				Therms/Yr
C9	Adjusted Boiler Usage	12,977				Interactive Summary (Therms)
C10	Annual Energy Savings for Combustion	379				((% Change in Boiler Efficiency) / (Old Overall Thermal Efficiency in % + % Change in Efficiency)) * Adjusted Boiler Fuel Use (C7/(C2+C7)*C9)
C11	Annual Energy Savings for Hot Water Reset	1,842				
C12	Total Annual Energy Savings	2,222			2,222	C10 + C11
C13	Boiler Fuel Cost	$1.59				$/Therm
C14	Annual Energy Savings	$3,542			$3,542	C13*C12
C15	De-Rate	8.00%				
C16	Annual Energy Savings	2,044			2,044	C12*(1-C15)
C17	Annual Energy Savings	$3,258			$3,258	C14*(1-C15)

Notes:
Upgrade of boiler controls will improve boiler efficiency by improving the air/fuel ratio over the entire firing range of the boiler.
Improving the air/fuel ratio will increase overall boiler combustion efficiency.
Experience and testing of this equipment indicates that this system will improve overall boiler efficiency by 2% to 8%.
Note that the boiler efficiency discussed here is the overall boiler thermal efficiency, not just its combustion efficiency. The value of this number will be much lower than for combustion efficiency alone as it includes losses from radiation, blowdown, and other related losses. The value for annual boiler fuel has been adjusted for the effect of other ECMs.

Greenhouse Gas Emissions (GHGs)

Fuel	**Savings**	**Units**	**Carbon Emission Factor**	**Units**	**Emissions**		**Equivalent Cars/yr**	**Equivalent Forested Acres/yr**
Electricity	0	kwh/yr	0.0005919	Tons/kwh	0	Tons CO2/yr	0	0
Therms	204	mmbtu/yr	0.0585	Tons/mmBtu	12.0	Tons CO2/yr	2.1	1.3
Totals					12.0		2.1	1.3

Exhibit G5-2B.1
Frankford Township School District
ECM 2C- Boiler Replacement

Savings Calculation

		Frankford Township School-Boiler B	Frankford Township School-Boiler C/D	Branchville School	Total			
C1	No. of Units	1	1	2	4			
C2	Current Boiler Efficiency	66%	66%	61%		%		Overall Thermal Efficiency
C3	Proposed Boiler Effiiciency	82%	82%	81%		%		Overall Thermal Efficiency
C4	Improvement in Boiler Efficiency	16%	16%	20%		%	C3-C2	New Boiler Efficiency
C5	Annual Boiler Fuel Use	16,363	16,363	8,800		Therms/Yr		
C6	Adjusted Boiler Usage	12,977	12,977	8,257	**34,212**	Therms/Yr	C5	Baseline therms less savings from other ECMs
C7	Boiler Fuel Cost	$1.594	$1.594	$1.653		$/Therm		
C8	Annual Energy Savings	2,518	2,518	2,027	**7,063**	Therms/Yr	(C4/(C2+C4)*C6)	((% Change in Boiler Efficiency) / (Old Overall Thermal Efficiency in % + % Change in Efficiency)) * Adjusted Boiler Fuel Use
C9	Annual Energy Savings $$	$4,014	$4,014	$3,351	**$11,379**		C8*C7	
C10	De-Rate	8%	8%	8%				
C11	Annual Energy Savings	2,316	2,316	1,865	**6,498**		C8*(1-C10)	
C12	Annual Energy Savings $$	$3,693	$3,693	$3,083	**$10,469**		C9*(1-C10)	

Notes:
Replacing the existing boiler with a new, high efficiency unit will reduce operating costs at this location.
Improving the air/fuel ratio will increase overall boiler combustion efficiency.
New Boiler will be No. 2 Fuel Oil
Note that the boiler efficiency discussed here is the overall boiler thermal efficiency, not just its combustion efficiency. The value of this number will be much lower than for combustion efficiency alone as it includes losses from radiation, blowdown, and other related losses. The value for annual boiler fuel has been adjusted for the effect of other ECMs.

Greenhouse Gas Emissions (GHGs)

Fuel	Savings	Units	Carbon Emission Factor	Units	Emissions		Equivalent Cars/yr	Equivalent Forested Acres/yr
Electricity		kwh/yr	0.0005919	Tons/kwh	-	Tons CO2/yr	-	-
Natural Gas	649.78	mmbtu/yr	0.0585000	Tons/mmBtu	38.01	Tons CO2/yr	6.64	4.00
#2 Fuel Oil		mmbtu/yr	0.0111900	Tons/gal	-	Tons CO2/yr	-	-
Totals					38.01		6.64	4.00

Exhibit G5-2C.1
Frankford Township School District
ECM 2C Boiler Burner Replacement Savings Summary
Savings Summary

Savings Calculation	**Frankford Township School**			**Total**	
Number of Units	3			3	
Current Boiler Efficiency	66%				Overall Thermal Efficiency
Projected Burner/Boiler Efficiency Savings					
Removal of Linkage Wear					
Total Efficiency Savings	5.00%				
Annual Boiler Fuel Use	49,088				Therms/Yr
Adjusted Boiler Usage	38,932				Interactive Summary (Therms)
Boiler Fuel Cost	$1.59				$/Therm
Annual Energy Savings	3,435			3,435	((% Change in Boiler Efficiency) / (Old Overall Thermal Efficiency in % + % Change in Efficiency)) * Adjusted Boiler Fuel Use
Annual Energy Savings	$5,476			$5,476	
De-Rate	8.00%				
Annual Energy Savings	3,160			3,160	
Annual Energy Savings	$5,037			$5,037	

Notes:
Upgrade of boiler controls will improve boiler efficiency by improving the air/fuel ratio over the entire firing range of the boiler.
Improving the air/fuel ratio will increase overall boiler combustion efficiency.
To achieve these savings, a new control system will be added to each boiler - the Control Links system.
Experience and testing of this equipment indicates that this system will improve overall boiler efficiency by 2% to 8%.
Note that the boiler efficiency discussed here is the overall boiler thermal efficiency, not just its combustion efficiency. The value of this number will be much lower than for combustion efficiency alone as it includes losses from radiation, blowdown, and other related losses. The value for annual boiler fuel has been adjusted for the effect of other ECMs.

Greenhouse Gas Emissions (GHGs)

Fuel	**Savings**	**Units**	**Carbon Emission Factor**	**Units**	**Emissions**		**Equivalent Cars/yr**	**Equivalent Forested Acres/yr**
Electricity	0	kwh/yr	0.0005919	Tons/kwh	0	Tons CO2/yr	0	0
Therms	316	mmbtu/yr	0.0585	Tons/mmBtu	18.5	Tons CO2/yr	3.2	1.9
Totals					18.5		3.2	1.9

Exhibit G5-2D.1
Frankford Township School District
ECM 2D - DHW Heater Upgrade

Savings Calculation

			Frankford Township School	Branchville School	Total		
C1	No. of Units		1	1	**2**		
C2	Current Boiler Efficiency		66%	61%		%	Overall Thermal Efficiency
C3	Proposed Boiler Efficiency		90%	90%		%	New Boiler Efficiency
C4	Improvement in Boiler Efficiency		24%	29%		%	C3-C2
C5	Annual Boiler Fuel Use		54,542	9,777		Therms/Yr	
C6	Boiler Fuel Use for DHW		5,454	978		Therms/Yr	Assumed 10%
C7	Adjusted Usage		5,358	978		Therms/Yr	Baseline therms less savings from other ECMs
C8	Fuel Cost		1.594	1.653		$/Therm	
C9	Annual Energy Savings		1,401	310	**1,711**	Therms/Yr	((% Change in Boiler Efficiency) / (Old Overall Thermal Efficiency in % + % Change in Efficiency)) * Adjusted Boiler Fuel Use (C4 / (C2+C4) * C7)
C10	Annual Energy Savings $$		$2,234	$513	**$2,747**		C8*C9
C11	De-Rate		8%	8%			
C12	Annual Energy Savings		1,289	285	**1,575**		C9*(1-C11)
C13	Annual Energy Savings $$		$2,055	$472	**$2,527**		C10*(1-C11)

Notes:
Replacing the existing boiler with a new, high efficiency unit will reduce operating costs at this location.
Improving the air/fuel ratio will increase overall boiler combustion efficiency.
New DHW Heater will be Propane/Oil
Note that the boiler efficiency discussed here is the overall boiler thermal efficiency, not just its combustion efficiency. The value of this number will be much lower than for combustion efficiency alone as it includes losses from radiation, blowdown, and other related losses. The value for annual boiler fuel has been adjusted for the effect of other ECMs.

Greenhouse Gas Emissions (GHGs)

Fuel	Savings	Units	Carbon Emission Factor	Units	Emissions		Equivalent Cars/yr	Equivalent Forested Acres/yr
Electricity		kwh/yr	0.0005919	Tons/kwh	-	Tons CO2/yr	-	-
Therms	157	mmbtu/yr	0.0585000	Tons/mmBtu	9.21	Tons CO2/yr	1.61	0.97
Totals					9.21		1.61	0.97

Exhibit G5-2E.1
Frankford Township School District
ECM 2E - AHU Replacements

Summary Table

	Frankford Township School		Total
Savings kWh	2,899		**2,899**
Savings kWh $$	$ 484		**$ 484**
Savings Therms	0		**0**
Savings Therms $$	$ -		**$ -**
De-Rate Therms	8%		
De-Rate Electric	4%		
Savings kWh	2,783		**2,783**
Savings kWh $$	$ 465		**$ 465**
Savings Therms	0		**0**
Therms	$ -		**$ -**

Greenhouse Gas Emissions (GHGs)

Fuel	Savings	Units	Carbon Emission Factor	Units	Emissions		Equivalent Cars/yr	Equivalent Forested Acres/yr
Electricity	2,783	kwh/yr	0.00059190	Tons/kwh	1.6	Tons CO2/yr	0.288	0.2
Therms	-	mmbtu/yr	0.05850000	Tons/mmBtu	0.0	Tons CO2/yr	-	0.0
Totals					**1.6**		**0.288**	**0.2**

O.A. Temp. Range deg F	Avg. Temp. deg F	Tons (Note 2)	Hrs/yr (Note 1)	Ton-Hrs/yr (Note 3)	Existing EER	Proposed EER	Existing RTU kwh	New RTU kwh	Energy savings KWH svg. (Note 6)	Cost Savings
110-114	112	6	0	0	9.0	11.5	0	0	0	$ -
105-109	107	6	0	0	9.0	11.5	0	0	0	$ -
100-104	102	6	0	0	9.0	11.5	0	0	0	$ -
95-99	97	6	6	36	9.0	11.5	48	38	10	$ 2
90-94	92	6	40	240	9.0	11.5	320	250	70	$ 12
85-89	87	5	122	633	9.0	11.5	844	661	184	$ 31
80-84	82	4	500	2,189	9.0	11.5	2,919	2,284	635	$ 106
75-79	77	4	620	2,212	9.0	11.5	2,949	2,308	641	$ 107
70-74	72	3	847	2,335	9.0	11.5	3,113	2,436	677	$ 113
65-69	67	2	671	1,306	9.0	11.5	1,741	1,363	378	$ 63
60-64	62	1	927	1,052	9.0	11.5	1,403	1,098	305	$ 51
55-59	57	0	0	0	9.0	11.5	0	0	0	$ -
			3,733	**10,003**			**13,338**	**10,438**	**2,899**	**$ 484**

NOTES
1. Weather bin data with temperatures and hours/year is for New Jersey
2. Peak at 92 degrees and zero at 55 degrees
3. Cooling ton-hours = Tons x Hours/year for each temperature bin.
4. New RTU energy consumption= ton-hrs/year x 12 / Proposed EER
6. KWH saved = KWH used by existing RTU- KWH used by the new RTU
7. Cooling KWH are caculated by subtracting the monthly base electric load from monthly total KWH.
Monthly base electric load is estimated as the average KWH for the winter months of December through March.

Exhibit G5-3A.1
Frankford Township School District
ECM 3A - Building Management System Upgrades
Unoccupied Set Back Controls

Thermal Savings

	Current	Proposed
Occupied Space Temperature	72.0	70.0
Unoccup. Space Temperature	68.0	55.0

NIGHT SETBACK SAVINGS CALCULATIONS:

	Description	Current Boiler Usage	Adjusted Baseline (includes interactive ECM affects)	Adjusted Boiler Load for Space Heating	Existing heating deg-hrs	Proposed heating deg-hrs	Energy Savings	Energy Savings	Energy Rate	Energy Savings	De-Rate	Energy Savings	Energy Savings
		Therms/yr	Therms/yr	Therms/yr	F	F	%	Therms/yr	$/Therm	$		Therms/yr	$
1.0	Frankford Township School	54,542.2	38,932.2	38,932.2	91,660.4	72,424.6	10%	4,085.2	1.594	6,512.6	8%	3,758.3	5,991.6
2.0	Branchville School	9,777.3	8,257.4	8,257.4	91,660.4	72,424.6	10%	866.5	1.653	1,432.4	8%	797.1	1,317.8
	TOTAL	64,319.5	47,189.7	47,189.7				4,951.6		7,945.0		4,555.5	7,309.4

Savings Calculation for Night Setback Control sequence
ASHRAE TMY-2 Weather Data

Current Operating Schedule

Amb. Temp Bin deg. F	Ave Temp deg. F	M.C.W.B deg. F	M.C. Enthalpy Btu/lbma	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Prorated Bin Hours	Occup.Bin Hours	Unocc. Bin Hours	Occup. Indoor temp	Unocc. Indoor temp	Occup. heating Deg-hours	Unocc. heating Deg-hours	Total heating Deg-hours
Heating								61.6%							
55 to 60	57.5	50.2	20.3	217.0	191.0	192.0	600.0	369.9	225.2	144.7	72.0	68.0	3,264.7	1,519.4	4,784.2
50 to 55	52.5	46.3	18.3	218.0	223.0	289.0	730.0	450.0	282.4	167.6	72.0	68.0	5,506.9	2,597.7	8,104.6
45 to 50	47.5	41.5	15.9	243.0	196.0	195.0	634.0	390.8	233.4	157.4	72.0	68.0	5,718.3	3,227.2	8,945.4
40 to 45	42.5	38.0	14.3	193.0	171.0	149.0	513.0	316.2	192.6	123.7	72.0	68.0	5,680.5	3,153.7	8,834.2
35 to 40	37.5	33.9	12.5	357.0	311.0	355.0	1,023.0	630.6	383.5	247.1	72.0	68.0	13,230.8	7,537.0	20,767.8
30 to 35	32.5	29.3	10.7	277.0	221.0	236.0	734.0	452.5	269.8	182.6	72.0	68.0	10,658.9	6,483.0	17,141.9
25 to 30	27.5	24.6	8.8	159.0	98.0	134.0	391.0	241.0	136.5	104.5	72.0	68.0	6,076.1	4,231.7	10,307.8
20 to 25	22.5	19.4	6.9	89.0	48.0	58.0	195.0	120.2	65.7	54.6	72.0	68.0	3,249.7	2,482.2	5,732.0
15 to 20	17.5	15.4	5.5	74.0	20.0	31.0	125.0	77.1	35.7	41.4	72.0	68.0	1,944.4	2,089.6	4,034.0
10 to 15	12.5	9.8	3.7	35.0	7.0	5.0	47.0	29.0	11.6	17.3	72.0	68.0	692.3	962.2	1,654.5
5 to 10	7.5	4.1	2.0	17.0	9.0	8.0	34.0	21.0	11.3	9.7	72.0	68.0	725.6	587.4	1,313.0
0 to 5	2.5	1.3	1.2	1.0	0.0	0.0	1.0	0.6	0.2	0.5	72.0	68.0	10.7	30.3	41.0
-5 to 0	(2.5)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	72.0	68.0	0.0	0.0	0.0
-10 to -5	(7.5)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	72.0	68.0	0.0	0.0	0.0
Total				1,880.0	1,495.0	1,652.0	5,027.0	3,098.8	1,847.8	1,251.1			56,758.9	34,901.4	91,660.4

Proposed Operating Schedule

Amb. Temp Bin deg. F	Occup.Bin Hours	Unocc. Bin Hours	Occup. Indoor temp	Unocc. Indoor temp	Occup. heating Deg-hours	Unocc. heating Deg-hours	Total heating Deg-hours
Heating							
55 to 60	225.2	144.7	70.0	55.0	2,814.4	361.8	3,176.2
50 to 55	282.4	167.6	70.0	55.0	4,942.1	419.0	5,361.1
45 to 50	233.4	157.4	70.0	55.0	5,251.5	1,180.7	6,432.1
40 to 45	192.6	123.7	70.0	55.0	5,295.4	1,545.9	6,841.3
35 to 40	383.5	247.1	70.0	55.0	12,463.8	4,324.5	16,788.3
30 to 35	269.8	182.6	70.0	55.0	10,119.2	4,108.9	14,228.2
25 to 30	136.5	104.5	70.0	55.0	5,803.0	2,873.4	8,676.4
20 to 25	65.7	54.6	70.0	55.0	3,118.4	1,773.0	4,891.4
15 to 20	35.7	41.4	70.0	55.0	1,873.0	1,551.7	3,424.7
10 to 15	11.6	17.3	70.0	55.0	669.0	736.8	1,405.9
5 to 10	11.3	9.7	70.0	55.0	703.1	461.2	1,164.3
0 to 5	0.2	0.5	70.0	55.0	10.4	24.3	34.7
-5 to 0	0.0	0.0	70.0	55.0	0.0	0.0	0.0
-10 to -5	0.0	0.0	70.0	55.0	0.0	0.0	0.0
Total	1,847.8	1,251.1	980.0	770.0	53,063.4	19,361.2	72,424.6

NOTES: 3,098.8

Night Setback Savings Formulas:
Energy Savings(%) = (Current Heating deg-hrs-Proposed Heating Deg-Hrs)/Current Heating Deg-hrs x 100 x recovery factor
Total Energy Savings = Energy Savings During Setback(%) x Current heating fuel consumption(Therms/yr) x Heating Fuel Cost($/therm)
Please see interactive savings table for break-down of adjusted baseline.
Current heating Therms/yr was derived from fuel utility bills.
The new heating fuel consumption is derived by deducting savings from all other ECMs from the baseline consumption

Greenhouse Gas Emissions (GHGs)								
Fuel	Savings	Units	Carbon Emission Factor	Units	Emissions		Equivalent Cars/yr	Equivalent Forested Acres/yr
Electricity		kwh/yr	0.0	Tons/kwh	0.0	Tons CO2/yr	0.0	0.0
Therms	455.5	mmbtu/yr	0.1	Tons/mmBtu	26.6	Tons CO2/yr	4.7	2.8
		mmbtu/yr	0.0	Tons/gal	0.0	Tons CO2/yr	0.0	0.0
Totals					26.6		4.7	2.8

Exhibit G5-3B.1
Frankford Township School District
ECM 3B - Install CO2 Sensors in Air Handling Units
Savings Summary

School ID	Savings kWh	$/kWh	kWh $$	Calculated Savings Therms	$/therms	Therms $$	De-Rate Electric	kWh	kWh $$	De-Rate Therms	Therms	Therms $$
Frankford Township School	-	$ 0.167	$0	2,635	$ 1.594	$4,201	4%	-	$0	8%	2,424	$3,865
Total	**-**		**$0**	**2,635**		**$4,201**		**-**	**$0**		**2,424**	**$3,865**

Greenhouse Gas Emissions (GHGs)

Fuel	Savings	Units	Carbon Emission Factor	Units	Emissions		Equivalent Cars/yr	Equivalent Forested Acres/yr
Electricity	-	kwh/yr	0.000592	Tons/kwh	0.0	Tons CO2/yr	-	0.0
Therms	242	mmbtu/yr	0.058500	Tons/mmBtu	14.2	Tons CO2/yr	2.5	1.5
Totals					**14.2**		**2.5**	**1.5**

General Information	
Building	**Frankford Township School**
System(s)	
Total CFM	14,000
OA CFM, Baseline Minimum	4,620
OA CFM, Proposed Minimum	3,696
Area Served	5,775
Space Temp	72
Space RH	55%
Space Enthalpy	27.4

64.58706119 Grains

Cooling/Heating System Info	
Cooling Equip Type	N/A
Cooling Full Load KW/Ton	0.00
Cooling IPLV	0.00
Heating System:	Hot Water
Heating Efficiency	66%
OAT for Cooling	60
OAT for Heating	55

Occupancy Profiles (% Max Occupancy)			
Time Period	**Hrs**	**Typical Day** **Occupied**	**UnOcc.**
5 AM - 7 AM	2	0%	100%
7 AM - 9 AM	2	20%	80%
9 AM - 11 AM	2	90%	10%
11 AM - 2 PM	3	100%	0%
2 PM - 5 PM	3	90%	10%
5 PM - 9 PM	4	50%	50%
9 PM - 11 PM	2	20%	80%
11 PM - 5 AM	6	0%	100%
	24		
		Weekday	**Off Peak**
Blended Average		46%	50%
Peak Day		85%	85%

Calculation Formulas	
Ventilation Loac	CFM of OA * 4.5 * (Enthalpy of OA - Enthalpy at Room Condition) / 12000
Ventilation Loac	CFM of OA * 1.1 * (Temp of OA - Room Temp) / 1000
Max Kw:	Cool Tons * Full Load kW/ton
Peak & Off Peal	Cool Tons * IPLV * Hours
MMBTU:	Heating MBH * Hours / 1000 / Efficiency

Operating Hour Profile (Academic) — Dry Bulb Temperature Bins (Hrs/Yr) OAT	Enthalpy	Annual Occupied	Annual Unoccupied	Baseline Energy Estimate — ntilation Quantity (% FL OA CF — Annual Occupied	Unoccupied	Ventilation Load (Tons or MBH) — Annual Occupied	Unoccupied	Annual Energy — Max kW	kWh	Therms	Proposed Energy Estimate — ntilation Quantity (% FL OA CF — Annual Occupied	Unoccupied	Ventilation Load (Tons/MBH) — Annual Occupied	Unoccupied	Annual Energy — Max kW	kWh	Therms
93	40.9	17	4	100%	100%	23	23	-	-	-	80%	80%	19	19	-	-	-
91	40.6	25	6	100%	100%	23	23	-	-	-	85%	80%	19	18	-	-	-
89	39.7	38	9	100%	100%	21	21	-	-	-	80%	80%	17	17	-	-	-
87	37.6	56	14	100%	100%	18	18	-	-	-	80%	80%	14	14	-	-	-
85	37.3	70	20	100%	100%	17	17	-	-	-	80%	80%	14	14	-	-	-
83	35	89	29	100%	100%	13	13	-	-	-	80%	80%	11	11	-	-	-
81	35	106	41	100%	100%	13	13	-	-	-	80%	80%	11	11	-	-	-
79	34	104	50	100%	100%	11	11	-	-	-	80%	80%	9	9	-	-	-
77	31.8	116	67	100%	100%	8	8	-	-	-	80%	80%	6	6	-	-	-
75	31.7	127	99	100%	100%	8	8	-	-	-	80%	80%	6	6	-	-	-
73	30.7	135	137	100%	100%	6	6	-	-	-	80%	80%	5	5	-	-	-
71	30.9	136	151	100%	100%	6	6	-	-	-	80%	80%	5	5	-	-	-
69	29.4	124	159	100%	100%	4	4	-	-	-	80%	80%	3	3	-	-	-
67	27.8	122	176	100%	100%	1	1	-	-	-	80%	80%	1	1	-	-	-
65	26.9	115	180	100%	100%	(1)	(1)	-	-	-	80%	80%	(1)	(1)	-	-	-
63	26.1	124	187	100%	100%	(2)	(2)	-	-	-	80%	80%	(2)	(2)	-	-	-
61	24.5	118	175	100%	100%	(5)	(5)	-	-	-	80%	80%	(4)	(4)	-	-	-
59	23.3	111	171	100%	100%	-	-	-	-	-	80%	80%	-	-	-	-	-
57	22.8	113	175	100%	100%	-	-	-	-	-	80%	80%	-	-	-	-	-
55	21.3	112	173	100%	100%	-	-	-	-	-	80%	80%	-	-	-	-	-
53	20.4	110	161	100%	100%	97	97	-	-	394	80%	80%	77	77	-	-	315
51	19.6	111	169	100%	100%	107	107	-	-	450	80%	80%	85	85	-	-	360
49	18.8	107	152	100%	100%	117	117	-	-	455	80%	80%	94	94	-	-	364
47	18.5	110	160	100%	100%	127	127	-	-	517	80%	80%	102	102	-	-	414
45	17.4	113	161	100%	100%	137	137	-	-	565	80%	80%	110	110	-	-	452
43	15.7	111	166	100%	100%	147	147	-	-	613	80%	80%	118	118	-	-	490
41	15.6	119	175	100%	100%	158	158	-	-	697	80%	80%	126	126	-	-	557
39	14.1	124	169	100%	100%	168	168	-	-	739	80%	80%	134	134	-	-	591
37	13.8	126	186	100%	100%	178	178	-	-	837	80%	80%	142	142	-	-	669
35		118	190	100%	100%	188	188	-	-	872	80%	80%	150	150	-	-	697
33		110	195	100%	100%	198	198	-	-	911	80%	80%	159	159	-	-	729
31		99	169	100%	100%	208	208	-	-	839	80%	80%	167	167	-	-	671
29		78	142	100%	100%	219	219	-	-	723	80%	80%	175	175	-	-	578
27		66	123	100%	100%	229	229	-	-	649	80%	80%	183	183	-	-	519
25		60	114	100%	100%	239	239	-	-	626	80%	80%	191	191	-	-	501
23		50	91	100%	100%	249	249	-	-	528	80%	80%	199	199	-	-	423
21		44	81	100%	100%	259	259	-	-	484	80%	80%	207	207	-	-	387
19		34	71	100%	100%	269	269	-	-	426	80%	80%	215	215	-	-	340
17		28	62	100%	100%	280	280	-	-	378	80%	80%	224	224	-	-	302
15		20	51	100%	100%	290	290	-	-	309	80%	80%	232	232	-	-	247
13		16	45	100%	100%	300	300	-	-	276	80%	80%	240	240	-	-	221
11		13	38	100%	100%	310	310	-	-	237	80%	80%	248	248	-	-	190
9		8	28	100%	100%	320	320	-	-	174	80%	80%	256	256	-	-	140
7		6	23	100%	100%	330	330	-	-	143	80%	80%	264	264	-	-	114
5		4	18	100%	100%	340	340	-	-	109	80%	80%	272	272	-	-	87
3		2	13	100%	100%	351	351	-	-	77	80%	80%	281	281	-	-	62
1		1	10	100%	100%	361	361	-	-	62	80%	80%	289	289	-	-	50
-1		1	6	100%	100%	371	371	-	-	34	80%	80%	297	297	-	-	27
-3		0	5	100%	100%	381	381	-	-	31	80%	80%	305	305	-	-	25
-5		0	4	100%	100%	391	391	-	-	22	80%	80%	313	313	-	-	17
-7		0	2														
Total	**8,744**	**3,743**	**5,001**						**-**	**13,175**						**-**	**10,540**

Savings Summary						
Electrical Savings Energy Summer (kWh/yr)	Demand (kW) Summer Peak	Summer Average	Therms/yr	Fuel Oil Savings (gal/yr)	Coal Savings (tons/yr)	Steam Savings (MMBtu/yr)
-	-	-	2,635			

	Qty	Est CFM each
Small Gym	0	6000
Large Gym/Cafeteria	2	7000
Total	2	14000
Estimated HP	6	From Dwgs
Fan Load Factor	0.8	
Boiler Efficiency	66%	

Exhibit G5.4A.1
Frankford Township School District
Building Envelope
Savings Summary

		Frankford Township School	Branchville School	Totals	
C1	Flow Factor	20	20		
C2	(AP)^n	5	5		
C3	Area	33.95	0.85		
C4	Air Leakage (CFM)	3,395	85		C1*C2*C3
C5	Heating Degree Days	5,800	5,800		
C6	Heating Efficiency Factor	28,900	28,900		
C7	Fuel Cost	$ 1.59	$ 1.65		
C8	$/kWh	$ 0.17	$ 0.23		
C9	Therms	6,813	171	**6,984**	C4*C5/C6*10
C10	Savings Therm $$	$10,862	$282	**$11,144**	C9*C7
C11	kWh				
C12	Savings Electric				
C13	Derate Therms	25%	8%		
C14	Derate Eletric	4%	4%		
C15	Therms	5,110	157	**5,267**	
C16	Therm $$	$8,147	$259	**$8,406**	
C17	kWh				
C18	Savings Elctric				

Greenhouse Gas Emissions (GHGs)

Fuel	Savings	Units	Carbon Emission Factor	Units	Emissions		Equivalent Cars/yr	Equivalent Forested Acres/yr
Electricity	-	kwh/yr	0.000592	Tons/kwh	0.0	Tons CO2/yr	-	0.0
Natural Gas	527	mmbtu/yr	0.058500	Tons/mmBtu	30.8	Tons CO2/yr	5.4	3.2
#2 Fuel Oil	-	mmbtu/yr	0.011190	Tons/gal	0.0	Tons CO2/yr	-	0.0
Totals					**30.8**		**5.4**	**3.2**

Exhibit G5-4B.1
Frankford Township School District
ECM 4B - Window Replacements

	Frankford Township School		Total	
Electrical Cost	$ 0.1669			
Fuel Cost	1.59			
Electical Savings	-		-	kWh
Electical Savings $$	$ -		$ -	
Therm Savings	1,381		**1,381**	Therms
Therm Savings $$	$ 2,202		**$ 2,202**	
De-Rate Electric	4%			
De-Rate Mechanical	8%			
Electical Savings	-		**-**	kWh
Electical Savings $$	$ -		**$ -**	
Therm Savings	1,271		**1,271**	Therms
Therm Savings $$	$ 2,026		**$ 2,026**	

								UAdT	UAdT						
Amb. Temp Bin deg. F	Ave Temp deg. F	M.C.W.B deg. F	01-08 Hours	09-16 Hours	17-24 Hours	Heating/ Cooling Season Weeks	Total Bin Hours	Window Square Feet	Heating Loss mmBtu's Existing	Heating Gain mmBtu's Proposed	Heating Gain Savings mmBtu's	heating therms saved	Chiller Eff - kw/ton, boiler efficiency	input kwh saved	Input therms saved
A	**B**	**C**	**D**	**E**	**F**		**G**	**H**	**I**	**J**	**K**	**L**	**M**	**N**	**O**
Cooling															
95-100	97.5	72.6	0.0	5.0	1.0	23	3	-	-	-	-	0	0.85	0.0	
90-95	92.5	74.1	0.0	33.0	7.0	23	18	-	-	-	-	0	0.85	0.0	
85-90	87.5	71.8	0.0	92.0	30.0	23	54	-	-	-	-	0	0.85	0.0	
80-85	82.5	69.4	8.0	330.0	162.0	23	220	-	-	-	-	0	0.85	0.0	
75-80	77.5	67.4	98.0	257.0	265.0	23	273	-	-	-	-	0	0.85	0.0	
70-75	72.5	64.6	325.0	236.0	286.0	23	373	-	-	-	-	0	0.85	0.0	
65-70	67.5	61.1	251.0	204.0	216.0	23	295	-	-	-	-	0	0.85	0.0	
60-65	62.5	56.5	358.0	268.0	301.0	23	408	-	-	-	-	0	0.85	0.0	
Heating															
55-60	57.5	50.2	217.0	191.0	192.0	27	310	2,407	9.21	4.12	5.09	51	66%		76.6
50-55	52.5	46.3	218.0	223.0	289.0	27	378	2,407	15.07	6.74	8.33	83	66%		125.3
45-50	47.5	41.5	243.0	196.0	195.0	27	328	2,407	16.44	7.35	9.09	91	66%		136.8
40-45	42.5	38.0	193.0	171.0	149.0	27	265	2,407	16.02	7.16	8.86	89	66%		133.3
35-40	37.5	33.9	357.0	311.0	355.0	27	529	2,407	37.35	16.70	20.65	207	66%		310.8
30-35	32.5	29.3	277.0	221.0	236.0	27	380	2,407	30.69	13.72	16.97	170	66%		255.3
25-30	27.5	24.6	159.0	98.0	134.0	27	202	2,407	18.42	8.23	10.18	102	66%		153.2
20-25	22.5	19.4	89.0	48.0	58.0	27	101	2,407	10.22	4.57	5.65	56	66%		85.0
15-20	17.5	15.4	74.0	20.0	31.0	27	65	2,407	7.21	3.22	3.99	40	66%		60.0
10-15	12.5	9.8	35.0	7.0	5.0	27	24	2,407	2.96	1.32	1.64	16	66%		24.6
5-10	5.5	4.1	17.0	9.0	8.0	27	18	2,407	2.39	1.07	1.32	13	66%		19.9
0-5	2.5	1.3	1.0	0.0	0.0	27	1	2,407	0.07	0.03	0.04	0	66%		0.6
-5-0	-2.5	0.0	0.0	0.0	0.0	27	0	2,407	-	-	-	0	66%		0.0
							4244							0	1,381

Col.	Notes				
A-F	Weather Data for Newark, NJ from Engineering Weather Data				
				Inputs	
G	Total Bin Hours	4244			
H	Window Square Footage from Audit	-	Cooling	Window Square Feet Audited	2,407 sq.ft
I	Cooling Gain and Heating Loss mmBtu's Existing			U of Existing Window	0.85 btu/sq,t/deg F
J	Cooling and Heating Gain mmBtu's Proposed			U of Proposed Window	0.38 btu/sq,t/deg F
K	Cooling and Heating Gain Savings mmBtu's			Winter Inside Set Point	70 Deg F
M	Cooling Ton-hrs or heating therms saved			Summer Inside Set Point	72 Deg F
N	Chiller/boiler efficiency			Heating cost	$1.59 $/therm
O	Input kwhsaved	0		Cooling cost	$0.17 $/kwh
P	Input therms saved	1381.4		Cost savings	$2,202

Greenhouse Gas Emissions (GHGs)

Fuel	Savings	Units	Carbon Emission Factor	Units	Emissions		Equivalent Cars/yr	Equivalent Forested Acres/yr
Electricity	-	kwh/yr	0.000592	Tons/kwh	0.0	Tons CO2/yr	-	0.0
Therms	127	mmbtu/yr	0.058500	Tons/mmBtu	7.4	Tons CO2/yr	1.3	0.8
Totals					**7.4**		**1.3**	**0.8**

Exhibit G5-4C.1
Frankford Township School District
ECM 4C- Roof Replacements

	Branchville School	Total	
Electrical Cost	$ 0.2326		
Fuel Cost	$1.65		
Electical Savings	-	-	kWh
Electical Savings $$	$ -	$ -	
Therm Savings	157	157	Therms
Therm Savings $$	$ 259	$ 259	
De-Rate Electric	4%		
De-Rate Therms	8%		
Electical Savings	-	-	kWh
Electical Savings $$	$ -	$ -	
Therm Savings	144	**144**	Therms
Therm Savings $$	$ 238	**$ 238**	

Greenhouse Gas Emissions (GHGs)

Fuel	Savings	Units	Carbon Emission Factor	Units	Emissions		Equivalent Cars/yr	Equivalent Forested Acres/yr
Electricity	-	kwh/yr	0.000592	Tons/kwh	0.0	Tons CO2/yr	-	0.0
Therms	14	mmbtu/yr	0.058500	Tons/mmBtu	0.8	Tons CO2/yr	0.1	0.1
Totals					**0.8**		**0.1**	**0.1**

		UAdT													
Amb. Temp Bin deg. F	Ave Temp deg. F	M.C.W.B deg. F	01-08 Hours	09-16 Hours	17-24 Hours	Heating/ Cooling Season Weeks	Total Bin Hours	Roof Square Feet	Heating Loss mmBtu's Existing	Heating Gain mmBtu's Proposed	Heating Gain Savings mmBtu's	heating therms saved	Chiller Eff - kw/ton, boiler efficiency	input kwh saved	Input therms saved
A	**B**	**C**	**D**	**E**	**F**		**G**	**H**	**I**	**J**	**K**	**L**	**M**	**N**	**O**
Cooling															
95-100	97.5	72.6	0.0	5.0	1.0	23	3		0	0	-	0	0.85	0.0	
90-95	92.5	74.1	0.0	33.0	7.0	23	18		0	0	-	0	0.85	0.0	
85-90	87.5	71.8	0.0	92.0	30.0	23	54		0	0	-	0	0.85	0.0	
80-85	82.5	69.4	8.0	330.0	162.0	23	220		0	0	-	0	0.85	0.0	
75-80	77.5	67.4	98.0	257.0	265.0	23	273		0	0	-	0	0.85	0.0	
70-75	72.5	64.6	325.0	236.0	286.0	23	373		0	0	-	0	0.85	0.0	
65-70	67.5	61.1	251.0	204.0	216.0	23	295								
60-65	62.5	56.5	358.0	268.0	301.0	23	408								
Heating															
55-60	57.5	50.2	217.0	191.0	192.0	27	310	7,800	2.57	2.08	0.49	5	61%		8.0
50-55	52.5	46.3	218.0	223.0	289.0	27	378	7,800	4.38	3.55	0.84	8	61%		13.6
45-50	47.5	41.5	243.0	196.0	195.0	27	328	7,800	4.89	3.96	0.94	9	61%		15.2
40-45	42.5	38.0	193.0	171.0	149.0	27	265	7,800	4.84	3.91	0.93	9	61%		15.1
35-40	37.5	33.9	357.0	311.0	355.0	27	529	7,800	11.41	9.23	2.18	22	61%		35.5
30-35	32.5	29.3	277.0	221.0	236.0	27	380	7,800	9.44	7.64	1.81	18	61%		29.4
25-30	27.5	24.6	159.0	98.0	134.0	27	202	7,800	5.70	4.61	1.09	11	61%		17.7
20-25	22.5	19.4	89.0	48.0	58.0	27	101	7,800	3.18	2.57	0.61	6	61%		9.9
15-20	17.5	15.4	74.0	20.0	31.0	27	65	7,800	2.25	1.82	0.43	4	61%		7.0
10-15	12.5	9.8	35.0	7.0	5.0	27	24	7,800	0.93	0.75	0.18	2	61%		2.9
5-10	5.5	4.1	17.0	9.0	8.0	27	18	7,800	0.75	0.61	0.14	1	61%		2.3
0-5	2.5	1.3	1.0	0.0	0.0	27	1	7,800	0.02	0.02	0.00	0	61%		0.1
-5-0	-2.5	0.0	0.0	0.0	0.0	27	0	7,800	0.00	0.00	0.00	0	61%		0.0
							4244							0	157

Col.	Notes			
A-F	Weather Data for Newark, NJ from Engineering Weather Data			
			Inputs	
G	Total Bin Hours	4244		
H	Roof Square Footage from Audit	7,800	Roof Square Feet Audited	7,800 sq.ft
I	Cooling Gain and Heating Loss mmBtu's Existing		C of Existing Roof (Winter)	0.0850 btu/sf hr deg F
			C of Existing Roof (Summer)	0.0863 btu/sf hr deg F
J	Cooling and Heating Gain mmBtu's Proposed		C of Proposed Roof (Winter)	0.0688 btu/sf hr deg F
			C of Proposed Roof (Summer)	0.0696 btu/sf hr deg F
K	Cooling and Heating Gain Savings mmBtu's		Winter Inside Set Point	70 Deg F
M	Cooling Ton-hrs or heating therms saved		Summer Inside Set Point	72 Deg F
N	Chiller/boiler efficiency		Heating cost	$1.65 $/therm
O	Input kwh saved	-	Cooling cost	$0.23 $/kwh
P	Input therms saved	157	Cost savings	$259.08

Exhibit G5-5A.1
Frankford Township School District
ECM 5A - Computer Controllers

	Total PCs	Blended Rate ($/kWh)	Total kWh	Total kWh$$	De-rate	kWh	kWh $$ Saved
Frankford Township School	225	$ 0.1669	37,908	$6,327	4%	36,392	$6,074
Branchville School	5	$ 0.2326	842	$196	4%	809	$188
Total	**230**		**38,750**	**$6,523**		**37,200**	**$6,262**

Greenhouse Gas Emissions (GHGs)

Fuel	Savings	Units	Carbon Emission Factor	Units	Emissions		Equivalent Cars/yr	Equivalent Forested Acres/yr
Electricity	37,200	kwh/yr	0.000592	Tons/kwh	22.0	Tons CO2/yr	3.8	2.3
Therms	-	mmbtu/yr	0.058500	Tons/mmBtu	0.0	Tons CO2/yr	-	0.0
Totals					**22.0**		**3.8**	**2.3**

	Total Number	Number Left "On" **	"Idle" Power Consumption (Watt)	"Sleep" Power Consumption (Watt)	Annual Hours of Power Management	Annual Energy Savings (kWh)		
Desktop PC's	225	81	84	6	6,000	37,908	Frankford Township School	
CRT Monitors	0	0	73	3	0	0		
LCD Monitors	0	0	28	2	0	0		
Laptops	35	0	20	1	0	0	Total	37,908
Desktop PC's	5	1.8	84	6	6,000	842	Branchville School	
CRT Monitors	0	0	73	3	#REF!	#REF!		
LCD Monitors	0	0	28	2	#REF!	#REF!		
Laptops	0	0	20	1	#REF!	#REF!	Total	#REF!

Notes:
Power Consumption numbers based on Lawrence Berkeley National Lab 2006 study
Laptop power includes screen. Desktop PC assumes non-energy star models- based on age of computers.
***Default of 36% as the percentage of computers turned off each night is based upon 2004 Lawrence Berkeley National Lab Report entitled "After-hours Power Status of Office Equipment and Inventory of Miscellaneous Plug-Load Equipment"*

Exhibit G5-6A.1
Frankford Township School District
ECM 6A-Energy Efficient Motors

	$/kWh	kWh Savings	kWh Savings $$	De-Rate	kWh Savings	kWh Savings $$
Frankford Township School	$0.1669	653	$109	4%	627	$105
Total		**653**	**$109**		**627**	**$105**

Greenhouse Gas Emissions (GHGs)

Fuel	Savings	Units	Carbon Emission Factor	Units	Emissions		Equivalent Cars/yr	Equivalent Forested Acres/yr
Electricity	627	kwh/yr	0.000592	Tons/kwh	0.4	Tons CO2/yr	0.1	0.0
Therms	-	mmbtu/yr	0.058500	Tons/mmBtu	0.0	Tons CO2/yr	-	0.0
Totals					**0.4**		**0.1**	**0.0**

Frankford Township School
Motor Savings

Item#	BLDG.	EQUIPMENT DESCRIPTION	MOTOR SIZE HP	MOTOR TYPE TEFC/ODP	OPERATING HOURS/YR	MOTOR LOAD *	STD EFF. FL-RPM	HI EFF. FL-RPM	RESHEAVE YES/NO	% > LOAD FROM RPM	STD EFF.	PREM. EFF.	SAVED KW	SAVED KWH	Total Savings	HP
A	B	D			F	G	H	I	J	K	L	M	N	O		
										if J= NO, 1 - (H/I)^3			hp x0.746 x G/M x (1+K)	=N x F	$$	
Zone																
						80%										
1	Frankford Township School	Bldg A HW Pump	7.5	ODP	1,549	80%	1,740	1,760	NO	3.4%	85.6%	92.2%	0.211	326	$54	7.5
2	Frankford Township School	Bldg A HW Pump	7.5	ODP	1,549	80%	1,740	1,760	NO	3.4%	85.6%	92.2%	0.211	326	$54	7.5
	TOTALS:		**15.00**										**0.42**	**653**	**$109**	**15.00**

Exhibit G5-6B.1
Frankford Township School District
ECM 6B - Install Variable Speed Drives on Pumps

Summary	Cost per kWh	kWh Savings	kWh Savings $$	De-Rate	kWh Savings	kWh Savings $$
Frankford Township School	$0.1669	11,820	$1,973	4%	11,347	$1,894
Totals		11,820	$1,973		11,347	$1,894

Greenhouse Gas Emissions (GHGs)

Fuel	Savings	Units	Factor	Units	Emissions		Cars/yr	Acres/yr
Electricity	11,347	kwh/yr	0.000592	Tons/kwh	6.7	Tons CO2/yr	1.2	0.7
Therms	-	mmbtu/yr	0.058500	Tons/mmBtu	0.0	Tons CO2/yr	-	0.0
Totals					**6.7**		**1.2**	**0.7**

			A	B		C	D	E	F	G	H	I
Item#	**BLDG.**	**DESCRIPTION**	**(Hp)**	**MOTOR SIZE (kW)**	**TEFC/ODP**	**HOURS/YR**	**MOTOR LOAD**	**EFFICIENCY**	**EXISTING kW**	**SPEED**	**NEW kW**	**SAVED kWh**
				A*.746					**B*D/E**		**F*G^3**	**(F-H)*C**
1	Frankford Township School	Boiler A HHW Pump 1	7.5	5.595	ODP	1,549	80%	92%	4.87	60%	1.05	5,910
2	Frankford Township School	Boiler A HHW Pump 2	7.5	5.595	ODP	1,549	80%	92%	4.87	60%	1.05	5,910
												11,820

Exhibit G5-7A.1
Frankford Township School District
ECM 7A - PV Photovoltaic Array

	Energy Value ($)	Size kW	Solar Radiation (kWh/m2/day)	AC Energy (kWh)	Energy Value ($)	De-Rate	AC Energy (kWh)	Energy Value ($)
Frankford Township School	0.1669	151.0	4.46	178,632	$29,815	4%	171,487	$28,622
Totals				**178,632**	**$29,815**		**171,487**	**$28,622**

Greenhouse Gas Emissions (GHGs)

Fuel	Savings	Units	Carbon Emission Factor	Units	Emissions		Equivalent Cars/yr	Equivalent Forested Acres/yr
Electricity	171,487	kwh/yr	0.000592	Tons/kwh	101.5	Tons CO2/yr	17.7	10.7
Therms	-	mmbtu/yr	0.058500	Tons/mmBtu	0.0	Tons CO2/yr	-	0.0
Totals					**101.5**		**17.7**	**10.7**

Frankford Township School

Station Identification	
City:	Newark
State:	New_Jersey
Latitude:	40.70° N
Longitude:	74.17° W
Elevation:	9 m
PV System Specifications	
DC Rating:	151
DC to AC Derate Factor:	0.77
AC Rating:	116.27
Array Type:	Fixed Tilt
Array Tilt:	40.7°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	0.1669

Results			
Month	Solar Radiation ($kWh/m^2/day$)	AC Energy (kWh)	Energy Value ($)
1	3.36	12,500	$2,086
2	4.05	13,497	$2,253
3	4.58	16,374	$2,733
4	4.84	16,002	$2,671
5	5.30	17,631	$2,943
6	5.33	16,629	$2,775
7	5.27	16,793	$2,803
8	5.25	16,618	$2,774
9	5.06	16,122	$2,691
10	4.46	15,183	$2,534
11	3.15	10,835	$1,808
12	2.87	10,448	$1,744
Year	4.46	178,632	$29,815

Exhibit G5-7B.1
Frankford Township School District
ECM 7B- Wind Power

		Frankford Township School	Total		
C1	Wind Velocity	12		MPH	MPH
C2	k = Conversion Factor to kW	0.0001330			
C3	Cp = Maximum power coefficient	0.45			Ranging from 0.25 to 0.45, Dimensionless Max =.59 (Note 1)
C4	ρ = Air density, lb/ft3	0.083			ρ = Air density, lb/ft3
C5	Rotor Diameter	5.7		FT	
C6	A = Rotor swept area, ft2	25.50			π C5^2/4
C7	Power = k Cp 1/2 ρAV^3	0.1093		kW	C2 x C3 x 1/2 x C4 x C6 x C1^3 (Note 1)
C8	Hours per Day	24			
C9	Days per Year	360			
C10	Number of Turbines	1	**1**		
C11	Total kWh DC per year Generated	944		kWh DC	C7 x C8 x C9 x C10
C12	Inverter Loss	10%			
C13	kWh Savings	850	**850**	kWh	C11 x (1 - C12)
C14	Cost per kWh	0.1669			
C15	kWh Savings $$	$142	**$142**	$$	C14 x C15
C16	De-Rate	4%			
C17	kWh Savings	816	**816**		
C18	kWh Savings $$	$136	**$136**		

Note 1 - Reference Small Wind Electric Systems a NJ Consumer Guide - US Department of Energy, Energy Efficiency and Renewable Energy Wind and Hydropower Technologies Program

Greenhouse Gas Emissions (GHGs)

Fuel	Savings	Units	Carbon Emission Factor	Units	Emissions		Equivalent Cars/yr	Equivalent Forested Acres/yr
Electricity	816	kwh/yr	0.000592	Tons/kwh	0.48	Tons CO2/yr	0.1	0.1
Natural Gas	-	mmbtu/yr	0.058500	Tons/mmBtu	0.00	Tons CO2/yr	-	0.0
Totals					**0.48**		**0.1**	**0.1**

Exhibit G5-7C.1
Frankford Township School District
ECM 7C - Renewable Energy Education

			Solar			Wind Power					
	Energy Value	Size	Solar Radiation	AC Energy	Size		Total	Energy Value	De-Rate	AC Energy	Energy Value
	($)	kW	(kWh/m2/day)	(kWh)	kW	kWh Savings	kWh Savings	($)		(kWh)	($)
Frankford Township School	0.166905259	10	4.46	11,831	6.5	816	12,647	$2,111	4.00%	12,141	$2,026
Totals		**10**		**11,831**	**6.5**	**816**	**12,647**	**$2,111**		**12,141**	**$2,026**

Greenhouse Gas Emissions (GHGs)

Fuel	Savings	Units	Carbon Emission F	Units	Emissions		Equivalent Cars/yr	Equivalent Forested Acres/yr
Electricity	12,141	kwh/yr	0.0005919	Tons/kwh	7.19	Tons CO2/yr	1.26	0.76
Therms	0	mmbtu/yr	0.0585	Tons/mmBtu	0.00	Tons CO2/yr	0.00	0.00
Totals					**7.19**		**1.26**	**0.76**

Solar Energy

Frankford Township School

Station Identification	
City:	Newark
State:	New_Jersey
Latitude:	40.70° N
Longitude:	74.17° W
Elevation:	9 m
PV System Specifications	
DC Rating:	10
DC to AC Derate Factor:	0.77
AC Rating:	7.7
Array Type:	Fixed Tilt
Array Tilt:	40.7°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	0.166905259

Results			
Month	Solar Radiation	AC Energy	Energy Value
	(kWh/m2/day)	(kWh)	($)
1	3.36	828	138
2	4.05	894	149
3	4.58	1084	181
4	4.84	1060	177
5	5.30	1168	195
6	5.33	1101	184
7	5.27	1112	186
8	5.25	1101	184
9	5.06	1068	178
10	4.46	1005	168
11	3.15	718	120
12	2.87	692	115
Year	4.46	11831	1975

Wind Energy

Frankford Township School

		Frankford Township School	**Total**		
C1	Wind Velocity	12		**MPH**	**MPH**
C2	k = Conversion Factor to kW	0.0001330			
C3	Cp = Maximum power coefficient	0.45			**Ranging from 0.25 to 0.45, Dimensionless Max =.59 (Note 1)**
C4	ρ = Air density, lb/ft3	0.083			**ρ = Air density, lb/ft3**
C5	Rotor Diameter	5.7		**FT**	
C6	A = Rotor swept area, ft2	25.50			**π C5^2/4**
C7	Power = k Cp 1/2 pAV^3	0.1093		**kW**	**C2 x C3 x 1/2 x C4 x C6 x C1^3 (Note 1)**
C8	Hours per Day	24			
C9	Days per Year	360			
C10	Number of Turbines	1	**1**		
C11	Total kWh DC per year Generate	944		**kWh DC**	**C7 x C8 x C9 x C10**
C12	Inverter Loss	10%			
C13	kWh Savings	850	**850**	**kWh**	**C11 x (1 - C12)**
C14	Cost per kWh	0.1669			
C15	kWh Savings $$	$142	**$142**	**$$**	**C14 x C15**
C16	De-Rate	4%			
C17	kWh Savings	816	**816**		
C18	kWh Savings $$	$136	**$136**		

Note 1 - Reference Small Wind Electric Systems a NJ Consumer Guide - US Department of Energy, Energy Efficiency and Renewable Energy Wind and Hydropower Technologies Program

Exhibit G5-8A
Frankford Township School District
ECM 8A - Kitchen Hood Controllers

		Frankford Township School		Totals		
C1	**Inputs**					
C2	Exhaust Flow	5000				
C3	Operating Hours per day	6				
C4	Operating Days per week	5				
C5	Operating Weeks per Year	36			Wks/ yr	180 days / 5 days per week
C6	Hp of Fan Motor	5				
C7	Load Factor of Fan	0.88				
C8	Cost per Killowatt Hour	0.1669				
C9	Cost per Therm	1.59421				
C10	**Motor Operating Savings**					
C11	Operating Hours per day	6			hrs/day	
C12	Operating Days per week	5			days/wk	
C13	Operating Weeks per Year	36			Wks/ yr	180 days / 5 days per week
C14	Hp of Fan Motor	5			HP	
C15	Load Factor of Fan	0.88				
C16	Cost per Killowatt Hour	0.167			$/Kwhr	
C17	Total Time	1,080			Hrs/Yr	C11*C12*C13
C18	Total KWhr per Hp per year	895			Kwh/Hp/yr	0.746/0.9*C17
C19	**Variable Exhaust Volume Analysis**					
C20	Total Kwh per Hp per year	475.9			Kwh/Hp/Yr	Sum of Column N
C21	Kwh Savings per year	1845			Kwh/yr	(C18-C20)*C14*C15
C22	**Heating Savings**					
C23	**Conditioned Make-up Air Heating**					
C24	Previous Net Exhaust Volume	5,000			cfm	
C25	New Net Exhaust Volume	3,666			cfm	Table 1
C26	Winter building Temperature	70			°F	
C27	Previous Net Heat Load	213,750			kBTU	outdoor air load calculator
C28	New Net Heat Load	156,721			kBTU	outdoor air load calculator
C29	Operating Hours per Day	6			Hrs/Day	
C30	Operating Days per Week	5			Days/Week	
C31	Btu per Fuel Unit	1000			kBtu/unit	
C32	System Efficiency	66%				
C33	Total KBtU	51,485			kBtu	(C27-C28)*0.6/C32
C34	Total Therms	515			Therms	C33*1000/100000
C35	**Cooling Savings**					
C36	Previous Net Exhaust Volume	5,000			cfm	
C37	New Net Exhaust Volume	3,666			cfm	C36*Table 1
C38	Previous Net Cooling Load	20,305			kBTU	outdoor air load calculator
C39	New Net Cooling Load	14,887			kBTU	outdoor air load calculator
C40	AC Correction Factor	-				
C41	COP	2.5				
C42	Savings	-			kWh	(C38 -C39) x 0.6 x C40 / (3.413 x C41)
C43	**Savings Therms**	515		**515**		C34
C44	**Savings Therms $$**	$821		**$821**		C43 * C9
C45	**Savings Electric**	1,845		**1,845**		C42 + C21
C46	**Savings Electric $$**	$308		**$308**		C45 * C8
C47	**De-Rate Therms**	8%				
C48	**De-Rate Electric**	4%				
C49	**Savings Therms**	474		**474**		C43 * (1 - C47)
C50	**Savings Therms $$**	$755		**$755**		C44 * (1-C47)
C51	**Savings Electric**	1,771		**1,771**		C45 * (1-C48)
C52	**Savings Electric $$**	$296		**$296**		C46 * (1-C48)

Greenhouse Gas Emissions (GHGs)

Fuel	Savings	Units	Carbon Emission Factor	Units	Emissions		Equivalent Cars/yr	Equivalent Forested Acres/yr
Electricity	1771.1	kwh/yr	0.000592	Tons/kwh	1.0	Tons CO2/yr	0.2	0.1
Therms	47.4	mmbtu/yr	0.058500	Tons/mmBtu	2.8	Tons CO2/yr	0.5	0.3
Totals					3.8		0.7	0.4

Exhibit G5-8B.1
Frankford Township School District
ECM 8B - Walk-In Controller
Savings Summary

Savings by Controller

	Frankford Township School		Total		
Existing Builidng kWh	598,160				
Existing Cooling Usage	2%				Assume @ 2%
Existing Cooling Usage	11,963			kWh	
Savings by Controller	5%				Assume @ 5%
Number of Controllers	3		3		
Savings by Controller	1,794			kWh	
Post Retrofit Usage	10,169			kWh	
Cost per kWh	$ 0.167				
$$ kWh	$ 300		**$ 300**		
kWh	1,794		**1,794**	kWh	
Derate	4%				
$$ kWh	$ 288		**$ 288**		
kWh	1,723		**1,723**	kWh	

Greenhouse Gas Emissions (GHGs)

Fuel	Savings	Units	Carbon Emission Factor	Units	Emissions		Equivalent Cars/yr	Equivalent Forested Acres/yr
Electricity	1,723	kwh/yr	0.000592	Tons/kwh	1.0	Tons CO2/yr	0.2	0.1
Therms	-	mmbtu/yr	0.058500	Tons/mmBtu	0.0	Tons CO2/yr	-	0.0
Totals					**1.0**		**0.2**	**0.1**

Exhibit G5-8C.1
Frankford Township School District
ECM 8C - Kitchen Pedal Valves
Savings Summary

	Location	Frankford Township School		Total	
C1	Number of Fixtures	2		2	
C2	Hours of Operation	8			
C3	Meals per Day	1000			
C4	Existing Sink Consumption Rate (Gal/meal)	2			Estimated Consumption rate as per ASHRAE Systems, Chapt 54 Table 1.
C5	Average Daily Load Gal/Day	2000			C4*C3
C6	Average Daily Load Gal/hr	250			C5/C2
C7	Occupant Days	180			
C8	Boiler Efficiency	66%			
C9	Total Consumption MBtus	260,698		260,698	(C5*C7/7.48*60*(120-60)/C8)/1000
C10	Proposed System				
C11	% Run Time Savings	20%			Estimated Run Time Savings
C12	Total Consumption MBtus	208,558		208,558	C9*(1-C11)
C13	Savings				
C14	Total Consumption Therms	104		104	C1*(C9-C12)/(1000)
C15	$/Therm	$1.59			
C16	Savings $$	$166		$166	C15*C14
C17	De-Rate	8%			
C18	Total Consumption Therms	96		96	C14*(1-C17)
C19	Savings $$	$153		$153	C16*(1-C17)

Greenhouse Gas Emissions (GHGs)

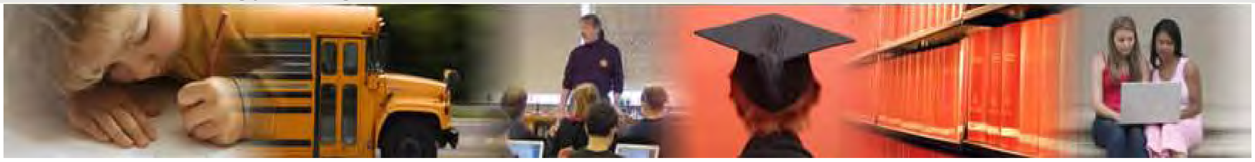
Fuel	Savings	Units		Carbon Emission Factor	Units	Emissions		Equivalent Cars/yr	Equivalent Forested Acres/yr
Electricity	-	kwh/yr		0.000592	Tons/kwh	0.0	Tons CO2/yr	-	0.0
Therms	10	mmbtu/yr		0.058500	Tons/mmBtu	0.6	Tons CO2/yr	0.1	0.1
Totals						**0.6**		**0.1**	**0.1**

Exhibit G5-9A.1
Frankford Township School District
ECM 9A - Demand Response
Savings Summary

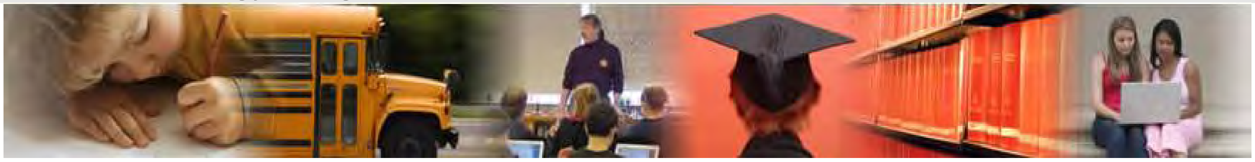
	KWh Savings	$/kWh	kWh Saving $$	De-Rate	KWh Savings	kWh Saving $$
Frankford Township School	28,712	$0.17	$4,792	4%	27,563	$4,600
Branchville School	2,060	$0.23	$479	4%	1,977	$460
	30,771		**$5,271**		**29,541**	**$5,060**

Greenhouse Gas Emissions (GHGs)

Fuel	Savings	Units	Carbon Emission Factor	Units	Emissions		Equivalent Cars/yr	Equivalent Forested Acres/yr
Electricity	29,541	kwh/yr	0.00059190	Tons/kwh	17.5	Tons CO2/yr	3.054	1.8
Therms	-	mmbtu/yr	0.05850000	Tons/mmBtu	0.0	Tons CO2/yr	-	0.0
Totals					**17.5**		**3.054**	**1.8**



Measurement, Verification and Guarantee of Energy Savings / Recommended Maintenance
Section E



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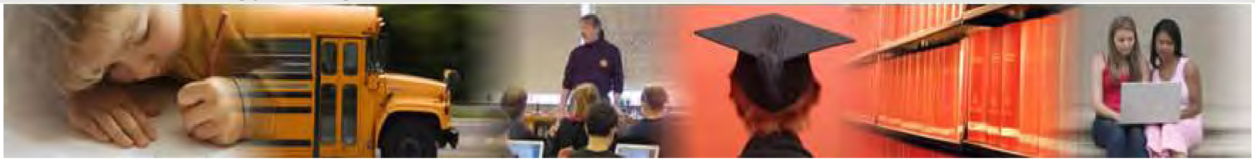


Honeywell has proven capabilities in applying measurement and verification methods appropriately to develop and verify energy baselines. Honeywell has also demonstrated abilities to conduct post-installation and regular interval verification inspections to confirm guaranteed energy savings.

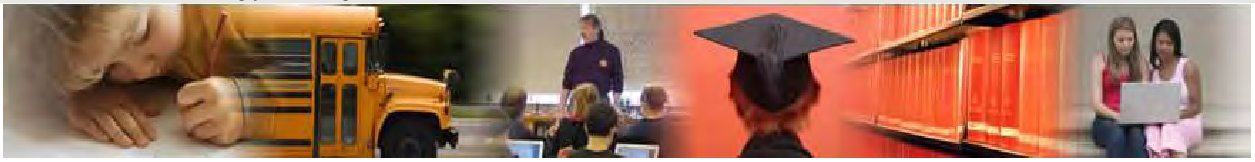
Honeywell will develop savings methodologies that follow current industry practice, such as outlined by the New Jersey Board of Public Utilities (NJBPU), Federal Energy Management Program's (FEMP) M&V Guidelines: Measurement and Verification for Federal Energy Projects. References to M&V protocols from the International Performance Measurement and Verification Protocol (IPMVP), ASHRAE Guideline 14 and the Air-Conditioning Refrigeration Institute (ARI) are used to further qualify the M&V plan.

Honeywell uses a variety of the M&V options as defined in the NJBPU Guidelines, as the basis for selecting methodologies to evaluate each Energy Conservation Measure (ECM) technology category identified and implemented through a performance contract.

In all performance contracting agreements, Honeywell discusses the M&V options available for savings verification with the District during the audit phase. The following tables are used as benchmarks for these discussions. In all cases, a mutual decision is reached on the M&V protocols that will be used for each ECM.

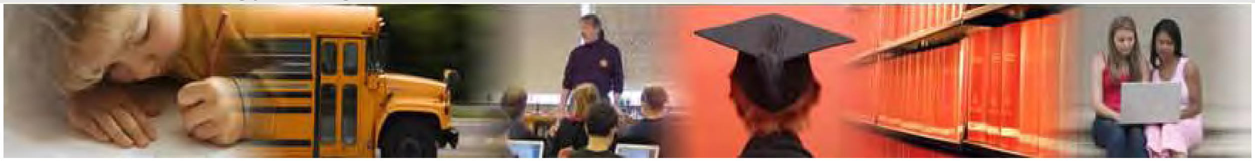
For each implemented ECM, energy savings are derived from a mutually agreed-upon, site-specific M&V plan. The M&V plan will provide an explanation of the objectives for M&V activities, which will comply with the steps outlined in the NJBPU Guidelines.

The plan will also define the parameters to be monitored, and a detailed description of the usage groups, population sizes and sample sizes that are proposed for each ECM. Definition of the baseline, post- installation, and regular interval parameters associated with each ECM are also defined in the M&V plan.



An M&V Specialist will work in close concert with the Performance Contracting Engineers (PCE's), the project installation team, and your District to ensure that accurate information is obtained.

M&V Options Summary			
FEMP Guidelines / Option	**Verification of Potential to Perform (and Generate Savings)**	**Verification of Performance (Savings)**	**Performance Verification Techniques**
Option A - Verifying that the opportunity has the potential to perform and to generate savings	Yes	Stipulated	Engineering calculations (possibly including spot measurements) with stipulated values
Option B - Verifying that the opportunity has the potential to perform and verifying actual performance by end use	Yes	Yes	Engineering calculations with metering and monitoring throughout term of contract
Option C - Verifying that the opportunity has the potential to perform and verifying actual performance (whole building analysis)	Yes	Yes	Utility meter billing analysis
Option D - Simulating that the opportunity has the potential to perform and simulating actual performance	Yes	Yes	Computer simulation



Honeywell Energy Auditing Process

The audit process begins with baseline development *before* ECMs are designed and the contract is signed. It continues throughout the term of the contract guarantee, and can continue as an ongoing service at the conclusion of the guarantee period.

Energy auditing is a *process,* but not so rigidly structured that it is devoid of independent decision making. It is a mistake to think that the energy auditing process is a series of tasks, performed sequentially the same way every time. Honeywell looks at energy auditing as a systematic means of analyzing and reporting results, and deciding which actions to take to meet the requirements of specific contracts. The following summarizes the energy auditing process. Energy audits can be provided on a quarterly, semi-annual or annual basis as determined by the District.

1. Data about a building's operation, utility costs, and usage is assembled to establish the baseline energy consumption model. If changes did occur, adjustment calculations will need to be done and the district will need to approve the adjustment.
2. Data is analyzed to determine base loads and to provide a check of savings figures. (i.e. are energy savings figures realistic?)
3. Requirements of the Honeywell scope & internal Risk Review Process are completed. All personnel involved in the Review Process approve the project, including the Honeywell Measurement & Verification Specialist Lead.
4. Industry standard energy engineering calculations and methods are utilized and are part of the contract documents. All calculations will be reviewed to satisfy the requirement that these must be a reasonable representation, or model, of facility energy consumption before and after the energy retrofit projects are completed.
5. The *Project Manager* will help ensure performance compliance, and will be responsible for proper installation, operation, and maintenance of the ECMs in accordance with design and contractual parameters. This includes ensuring that verification data is accurately collected and analyzed, and that measuring equipment is calibrated in accordance with prescribed standards.

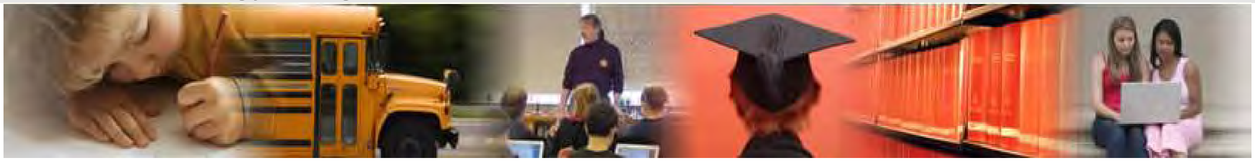
Measurement and Verification Options

Options A, B, C, and D are four options which contain measurement guidelines consistent with those defined in the September 2000 version of the FEMP M&V Guidelines. The four options were created to provide flexibility in the determination of savings.

This flexibility allows one to arrive at an optimum position regarding increased cost for decreased uncertainty in the determination the realized savings. The District's expectations and specific features of the campus facilities will dictate which particular option (A, B, C, or D) will be the most reasonable and cost-effective solution, providing accountable and verifiable results.

Option A – No Metering / Spot Metering

Requires verification that the ECM has the potential to perform and to generate savings. Verification of performance (savings) may be stipulated. Performance verification techniques for Option A include engineering calculations, spot measurements or stipulated (mutually agreed-upon) values. Field audits will be required in most cases with the application of Option A.



Spot metering will entail taking instantaneous measurement of volts, amperes, kVA, pF and kW. Measurements will be taken one time only. The type of data collection devices include: run-time loggers, kW/kWh transducers, occupancy data loggers, flow meters, and digital hygrometers. Measurement equipment will be calibrated in accordance with the manufacturer's specifications.

Option B – Regular Interval / Continuous Metering

Requires verification that the ECM has the potential to perform. It also requires verification of actual performance by end-use system or device. Verification of performance (savings) is required with this option. Performance verification techniques include engineering calculations, spot and short-term metering or continuous metering. Development of a sampling plan may be required when using Option B as measurement and verification option.

Short term metering will be conducted for a minimum period of three weeks. The data collected may be used to extrapolate after retrofit annual energy demand and consumption profiles.

Continuous data collection is done by totalization and trending consumption of energy consuming systems or end-use devices through an energy management system (EMS) or placement of an additional meter (sub-metering).

Option C – Utility Bill Analysis

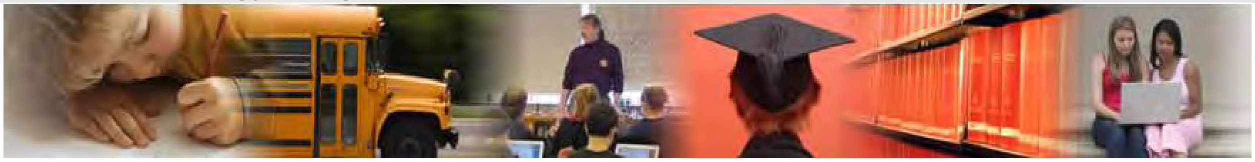
Requires verification that the opportunity has the potential to perform, as well as verification of actual performance via whole building analysis. Verification of potential to perform (generate savings) and verification of performance (savings) is required with this option. Performance verification techniques include utility meter billing analysis possibly with computer simulation.

Utility bill analysis consists of the review of two years of utility data to determine and establish the 365-day baseline. The baseline model is developed from utility bills and independent variables such as weather, operating schedules, and occupancy patterns.

Utility data is entered into a baseline-modeling program such as Metrix® that performs utility billing analysis using multivariate regression. Adjustments to the baseline that may be required are mutually agreed upon. The Metrix® utility accounting system is a third party software package designed by SRC Systems, Inc. in Berkley, California. The utility accounting system is used to track, budget, and verify utility operating costs and savings.

Option D – Computer Simulation

Requires verification that the opportunity has the potential to perform, as well as verification of actual performance by end-use systems or devices. Verification of potential to perform (generate savings) and verification of performance (savings) is required with this option. The performance verification technique is a computer simulation analysis. Option D provides a measurement and verification protocol for those ECMs which involve building envelope improvements, upgrades/expansions of existing energy management systems, ECMs which are variable load projects, or those ECMs which have interactive effects. Computer simulation will involve developing models by such building simulation programs as DOE 2.1e, Carrier HAP, or Trace 600.



Baseline Adjustments

Regular Adjustments

Every time an energy audit (determination of energy savings) is performed, the "regular" adjustments are calculated and applied to the baseline usage and cost data. These are adjustments for weather, billing period length and utility rates. These adjustments are usually performed through energy accounting software such as Metrix.

Periodic Adjustments

Periodic adjustments are performed separately from the energy accounting software. Often these adjustments involve the application of building energy simulation tools and techniques. Because the periodic adjustments are performed separately and cannot be developed automatically through the energy accounting software, these adjustments are recalculated only when it appears that conditions have changed enough to warrant a recalculation.

Combining and Applying Adjustments

Once developed, the regular usage adjustments and periodic usage adjustments are combined with an Excel spreadsheet to arrive at the total month by month usage adjustment, which accurately reflects what the baseline period usage would have been under current period conditions. The applicable utility rate changes are then applied to arrive at what the baseline period energy costs would have been under current period conditions and rates. This figure is then compared against the actual current period energy cost to determine the amount of energy cost savings which has occurred.

Audit Adjustment Methodologies

The Energy Analyst will determine actual annual energy savings by comparing the energy consumed during each guarantee year, with the base year, adjusted as described below. The purpose of base year adjustments is to ensure that the annual reconciliation is quantified on a comparison of energy consumption for each type of fuel.

Some typical adjustments are related to the following:

- Added mechanical or HVAC equipment
- Additional square footage
- Office equipment (computers, copiers, etc.)
- Changes in occupancy
- Equipment failures

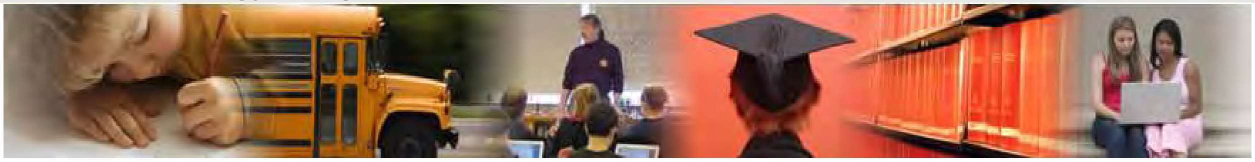
Specific adjustment methodologies are as follows:

Billing Period Adjustment

Adjustment to the monthly comparison periods will reflect same start date and equal number of days being compared.

Weather Adjustment

Adjustment to the base-year will reflect weather differences between the base-year or period and current year or period.



Square Footage Adjustment
Additions or permanent closures of floor space will be accounted for and factored into the comparison of the base-year and current period.

Utility Rate Adjustment
The energy audit methodology will use the rate schedules and charges documented in the contract as they apply to the current monthly bills.

Operational and Occupancy Hours Adjustment
Additions to or reductions in the sizes or types, as well as hours of operation of use for equipment will be accounted for and factored into the comparison of base-year and current period, based upon standard engineering calculations and data measured electronically for this purpose. Significant changes in conditioning set points will also be accounted for and adjusted.

Demand Charges Adjustment
Demand charges incurred as a result of equipment usage not controlled or operated for energy conservation under the project scope will be identified adjusted for in the annual savings reconciliation.

<u>Audit Adjustment Procedures</u>
If it is necessary to make baseline adjustments, the following adjustment procedures will be followed.

The Energy Analyst will estimate (using appropriate engineering calculations) how much energy was used due to the changed condition. The calculations will be based upon such factors as installed kW, BTU input, efficiency, runtime, etc.

For Example:
If the customer installed a new computer lab subsequent to the baseline year, and it has 30 PCs at 300 watts each and it runs 30 hours per week, the calculation would show:

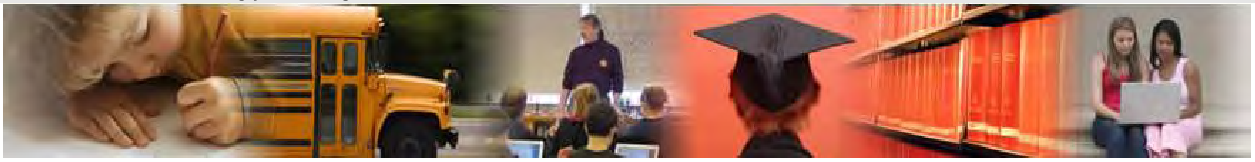
30 PCs X 300 Watts = 9 kW (Peak load increase)
9 kW X 30 hrs per week = 270 kWh per week
270 kWh X 4 weeks = 1080 kWh per four week period.

An increase usage of about 1,080 kWh per 4-week period, plus an additional peak load of 9 kW.

The Energy Analyst will document all changes in the audit:

- Equipment sizes
- Operating hours
- Energy calculation used
- Results

This information will be shown as adjustment documentation that is a permanent part of the audit file, and is used in preparing energy audits. It will be tracked throughout the term of the contract.



Without such adjustments, increased energy usage at the facility would reduce the value of the cost avoidance calculated by Metrix.

This is because cost avoidance is based on adjusted energy reduction-the difference between adjusted baseline energy consumption and current energy consumption. If the baseline is not adjusted upward to account for additional energy consumption (that Honeywell has no control over, and which was not present during the base year), the adjusted energy reduction will be less than the amount we had based our savings guarantee on.

The customer must agree to and understand all adjustments at the time of audit delivery (quarterly, semiannual, or annual). Their agreement and acceptance of the audit indicates their acceptance of the audit methodology, including all adjustments (due to changes in weather, changes in occupancy, addition of new equipment, etc.).

ECM-based Measurement and Verification (M&V) Audit Adjustments

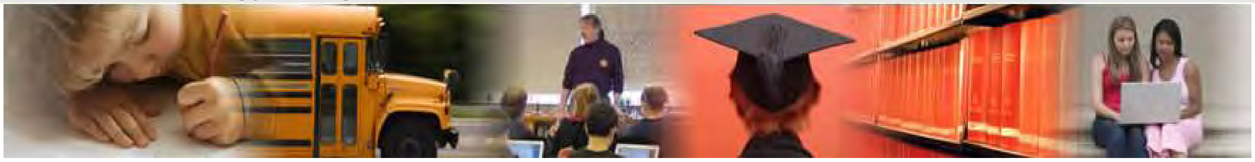
ECM-based Measurement and Verification (M&V), is another credible way to demonstrate energy savings. The technique has evolved considerably with the adoption of automated data collection tools (such as building automation systems with direct digital controllers, programmable meters and dataloggers) in facilities. ECM-based measurement and verification is the derivation of energy savings (and the associated value of those savings) from measured data collected before and after the implementation of the energy conservation measures (ECMs). It can also apply to demand savings, and the associated value of those savings. A form of this technique can be used for supply-side strategies that reduce the cost of the energy consumed (examples are cogeneration, thermal storage, and rate-switching or fuel-switching projects).

ECM Based M&V Audits are different from the utility bill auditing methods, which uses data obtained from the monthly bills. With the utility bill auditing method, it can be difficult to impossible to quantify the value of adjustments to baseline energy consumption, especially in a facility with few meters and many energy events that are not measured.

In ECM-Based Measurement and Verification, the ongoing energy savings are measured and calculated using the same calculation models and measurement methods that were used to determine the baseline energy savings. The Energy Analyst and the Engineer work closely together to ensure that the audit methodology matches the methodology used for the original energy savings estimates.

When ECM-based Measurement and Verification is used, the following five components are essential for demonstrating guaranteed energy savings:

1. Pre-retrofit energy use profile (baseline).
2. Post-retrofit time-of -use measurement.
3. Post-retrofit energy and/or demand measurement (directly measured or derived from other measured variables).
4. Post-retrofit value of energy and demand saved.
5. Acceptable sampling plan.



In Utility Bill Auditing, Honeywell uses energy consumption and demand information for the entire facility to develop the baseline energy use. In ECM-Based Measurement and Verification, Honeywell will model the energy use and demand associated with each individual ECM implemented.

Dollar Savings Calculations

Honeywell's policy to assigning a dollar value to savings is to first identify the consumption reduction of the particular utility. When the consumption reduction is identified, the corresponding cost of the utility unit is used to determine the value of the savings. The savings is based upon units of energy and the dollar value is associated with agreed upon based year per unit costs for oil, electric, gas, and water.

Maintenance Savings

For each improvement measure a list of potential maintenance savings or benefits will be developed. This list will be reviewed with Frankford School District to determine if any maintenance or material dollars can be applied to help justify specific investments identified in the audit.

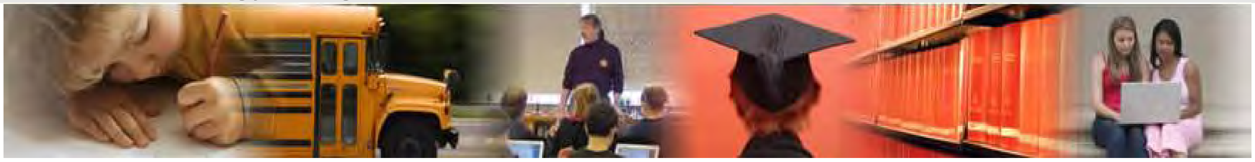
Guaranteed Savings

The approach that Honeywell utilizes in this asset management program includes two key components: a *performance guarantee* and *financial savings*. Honeywell guarantees the Customer that all installations and work performed are subject to final inspection and Customer's acceptance. This procedure ensures all work will be to the level of quality the Customer expects.

Honeywell also guarantees it will meet the objectives mutually defined with the Customer. Honeywell takes its commitment to partner with the Customer for the life of the contract seriously, and looks forward to a successful, long-term partnership.

Honeywell will provide a <u>cost avoidance</u> guarantee to the Customer. It will contain both energy and operational savings based on data from your utility bills, building operation, and budget information. The energy savings guarantee is structured to accommodate changes in utility rates, changes in building structures, changes in building occupancy patterns, and weather variances. In simple terms, this means that Honeywell guarantees a level of energy consumption based on conditions as they existed in the base year. Any changes or modifications to the buildings operating conditions need to be communicated on a regular basis. An example of this would be constructing an addition on a building. This addition would increase your energy baseline and would need to be documented. The energy guarantee is documented with any assumptions in our final contract and is shown in Attachments F & G, in our contract.

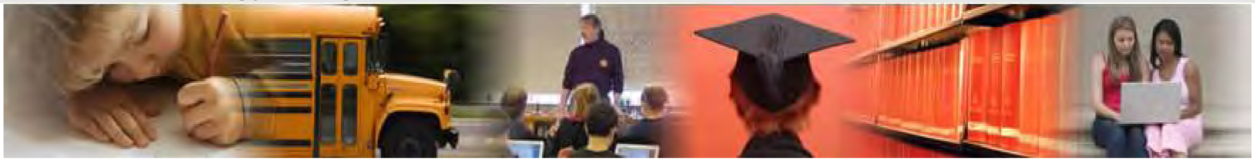
Honeywell considers the guarantee to be the cornerstone of our service to you. To be considered a *performance contract* an energy guarantee is a required component. The basis of an energy performance contract is that the majority of risk is shifted from the customer to the vendor. The strength of the Guarantee is only as good as the Company backing it and their financial solvency.



Honeywell has entered into over 4,300 energy performance contracts and has had over $1 Billion in energy guarantees. We have the strength and background to support the Customer for the long term.

It is important to make a distinction between Honeywell's guarantee and other possible savings assurance structures. Honeywell guarantees that the Customer will benefit from 100% of the cost savings, reductions, and cost avoidance realized. Alternate structures that may be proposed by other vendors include having the Customer share savings with the vendor, effectively reducing both the scope achievable under the savings captured by the Customer and limiting the overall financial benefits.

The guarantee is generally structured to cover the ongoing monitoring and auditing. Honeywell will work with the Customer to determine the scope of ongoing maintenance services required in order for the guarantee to remain in place and for the savings to be achieved.



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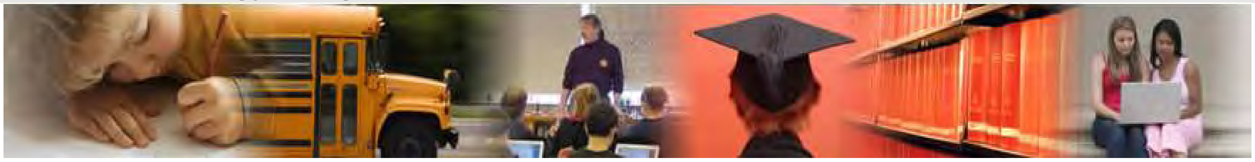


Recommended Preventive Maintenance Services

Service & Maintenance

A Comprehensive Portfolio, a Customized Approach.

Honeywell offers a uniquely comprehensive portfolio of services – one of the most extensive in the industry. As part of the Energy Savings Plan, we recommend the following services for consideration to ensure achievement of the Enrgy Savings outlined in this plam

According to the NJ ESIP program, all services are required to be bid by the school district for services as desired. Based on Honeywell's vast service organization, we are uniquely qualified to develop design specification for the public bidding according to NJ Law.

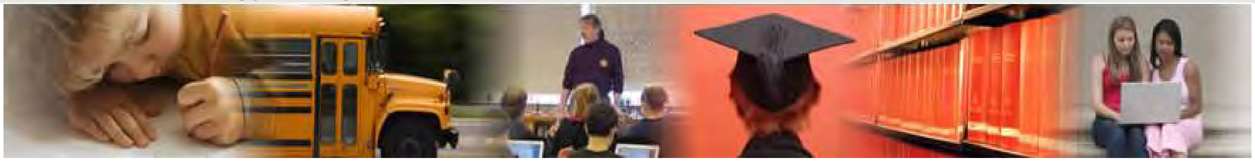
Honeywell strongly believes that the long-term success of any conservation program is equally dependent upon the appropriate application of energy savings technologies, as well as solid fundamental maintenance and support. One of the primary contributors to energy waste and premature physical plant deterioration is the lack of operations, personnel training and equipment maintenance.

Honeywell recommends routine maintenance on the following systems throughout the district for the duration of an energy guarantee of savings

Maintenance, Repair and Retrofit Services:

- Mechanical Systems
- Building Automation Systems
- Temperature Control Systems
- Air Filtration

Honeywell will work with the School District to evaluate current maintenance practices and procedures. This information will be the basis of a preventive maintenance and performance management plan designed to maximize building operating efficiencies, extend the useful life of your equipment and support the designed Energy Savings Plan.



At a minimum, we recommend the following tasks be performed on a quarterly basis with the district wide Building Management System.

System Support Services

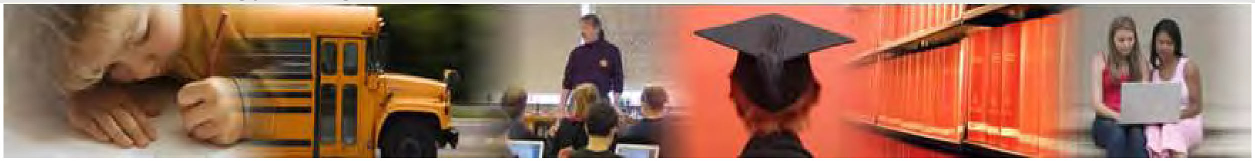
1. Review recent mechanical system operation and issues with customer primary contact, on a monthly basis.
2. Review online automation system operation and event history logs and provide summary status to the customer primary contact. Identify systemic or commonly re-occurring events.
3. Check with customer primary contact and logbook to verify that all software programs are operating correctly.
4. Identify issues and prioritize maintenance requests as required.
5. Provide technical support services for trouble shooting and problem solving as required during scheduled visits.
6. Provide ongoing system review and operations training support; including two semi-annual lunches and learn sessions.
7. Establish dedicated, site-specific emergency stock of spare parts to ensure prompt replacement of critical components. These will be stored in a secure location with controlled access.

Configuration Management

1. Update documentation and software archives with any minor changes to software made during maintenance work.
2. Verify and record operating systems and databases.
3. Record system software revisions and update levels.
4. Archive software in designated offsite Honeywell storage facility, on an annual basis.
5. Provide offline software imaging for disaster recovery procedures, updated on a regular basis.

Front End / PC Service

1. Verify operation of personal computer and software:
2. Check for PC errors on boot up
3. Check for Windows errors on boot up
4. Check for software operations and performance, responsiveness of system, speed of software
5. Routinely back up system files, on an annual basis:
6. Trend data, alarm information and operator activity data
7. Custom graphics and other information
8. Ensure disaster recovery procedures are updated with current files
9. Clean drives and PC housing, on an annual basis:
10. Open PC and remove dust and dirt from fans and surfaces
11. Open PC interface assemblies and remove dust and dirt
12. Clean and verify operation of monitors.
13. Verify printer operation, check ribbon or ink.
14. Initiate and check log printing functions.
15. Verify modem operation (if applicable).
16. Review IVR schedule for alarms and review (if applicable).



Temperature Control / Mechanical Services

TEMPERATURE CONTROLS

Services Performed

UNIT VENTS

Services Performed

Annual Inspection

1. Inspect motor and lubricate.
2. Lubricate fan bearings.
3. Inspect coil(s) for leaks.
4. Vacuum interior.
5. Test operation of unit controls.

PUMPS

Services Performed

Preseason Inspection

1. Tighten loose nuts and bolts.
2. Check motor mounts and vibration pads.
3. Inspect electrical connections and contactors.

Seasonal Start-up

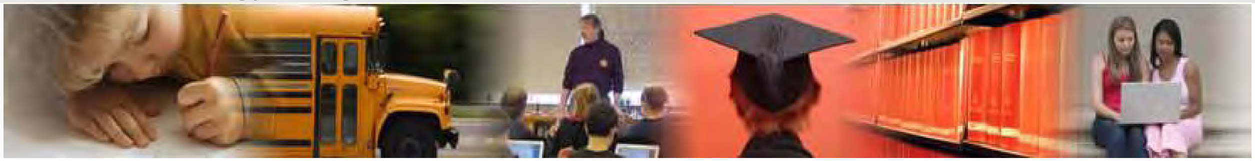
1. Lubricate pump and motor bearings per manufacturer's recommendations.
2. Visually check pump alignment and coupling.
3. Check motor operating conditions.
4. Inspect mechanical seals or pump packing.
5. Check hand valves.

Mid-season Inspection

1. Lubricate pump and motor bearings as required.
2. Inspect mechanical seals or pump packing.
3. Ascertain proper functioning.

Seasonal Shut-down

1. Switch off pump.
2. Verify position of hand valves.
3. Note repairs required during shut-down.



PACKAGED AIR-CONDITIONING SYSTEMS

Services Performed

Preseason Inspection

1. Energize crankcase heater.
2. Lubricate fan and motor bearings per manufacturer's recommendations.
3. Check belts and sheaves. Adjust as required.
4. Lubricate and adjust dampers and linkages.
5. Check condensate pan.

Seasonal Start-up

1. Check crankcase heater operation.
2. Check compressor oil level.
3. Inspect electrical connections, contactors, relays, operating and safety controls.
4. Start compressor and check operating conditions. Adjust as required.
5. Check refrigerant charge.
6. Check motor operating conditions.
7. Inspect and calibrate temperature, safety and operational controls, as required.
8. Secure unit panels.
9. Pressure wash all evaporator and condenser coils (if applicable)
10. Log all operating data.

Mid-season Inspection

1. Lubricate fan and motor bearings per manufacturer's recommendations.
2. Check belts and sheaves. Adjust as required.
3. Check condensate pan and drain.
4. Check operating conditions. Adjust as required.
5. Log all operating data.

Seasonal Shut-down *

1. Shut down per manufacturer's recommendations.

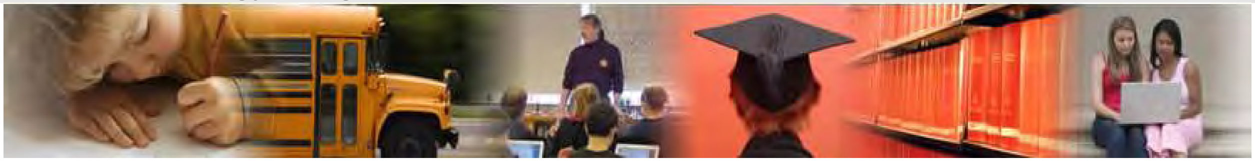
* If no Shut-down is required then (2) Mid-season Inspections are performed

BOILERS

Services Performed

Preseason Inspection

1. Inspect fireside of boiler and record condition.
2. Brush and vacuum soot and dirt from flues (not chimneys) and combustion chamber.
3. Inspect firebrick and refractory for defects.
4. Visually inspect boiler pressure vessel for possible leaks and record condition.



5. Disassemble, inspect and clean low-water cutoff.
6. Check hand valves and automatic feed equipment. Repack and adjust as required.
7. Inspect, clean and lubricate the burner and combustion control equipment.
8. Reassemble boiler.
9. Check burner sequence of operation and combustion air equipment.
10. Check fuel piping for leaks and proper support.
11. Review manufacturer's recommendations for boiler and burner start-up.
12. Check fuel supply.
13. Check auxiliary equipment operation.

Seasonal Start-up

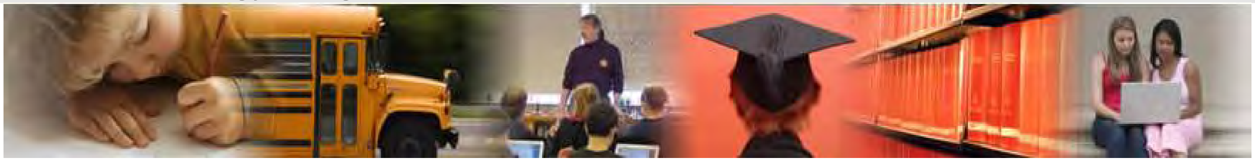
1. Inspect burner, boiler and controls prior to start-up.
2. Start burner and check operating controls.
3. Test safety controls and pressure relief valve.
4. Perform combustion analysis.
5. Make required control adjustments.
6. Log all operating conditions.
7. Review operating procedures and owner's log with boiler operator.

Mid-season Inspection

1. Review operator's log.
2. Check system operation.
3. Perform combustion analysis.
4. Make required control adjustments.
5. Log all operating conditions.
6. Review operating procedures and log with boiler operator.

Seasonal Shut-down

1. Review operator's log.
2. Note repairs required.



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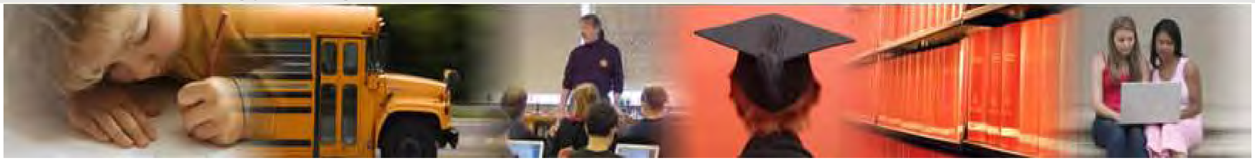
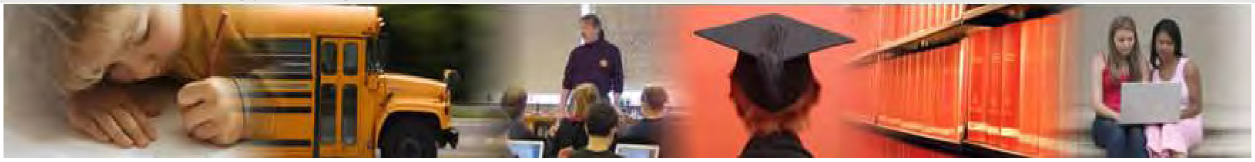


Design Approach
Section F



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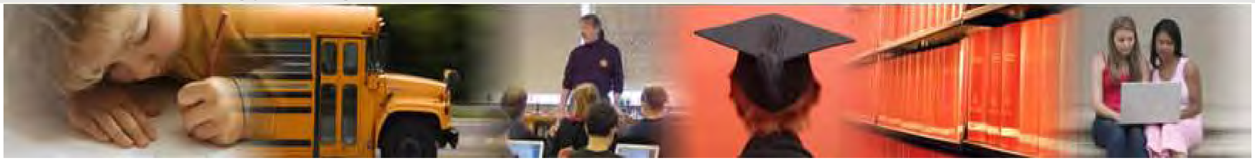


Design Approach

In accordance with the ESIP PL 2009, c.4 as part of the implementation process, an agreement between your school district and Honeywell will determine the energy conservation measures (ECM's) to be implemented. Honeywell is then required to secure the services of a New Jersey Licensed Engineering firm and/or Architectural firm in order to properly comply with local building codes, compliance issues and New Jersey Public contract law. Specifications will be designed and developed to exact standards as recommended by Honeywell in order to achieve all savings outlined in this Energy Savings Plan (ESP). Once specifications are completed, Honeywell will publicly solicit contractors capable of meeting the requirements of the specification for each trade. However, even before the completion of the bidding process, Honeywell will be providing construction and project management services in order to maintain a schedule in order to meet the School District's expectations. An overview of these activities and functions are detailed below.

Project Management – Construction Management Planning

A Honeywell Project Management Plan defines plans and controls the tasks that must be completed for your project. But more than task administration, our project management process oversees the efficient allocation of resources to complete those tasks.

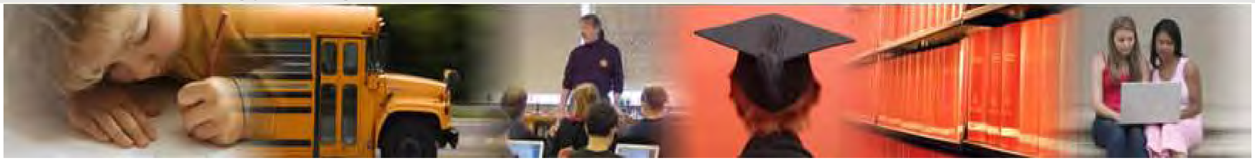
Each project and each customer's requirements are unique. At Honeywell we address customer needs through a formal communication process. This begins by designating one of our project managers to be responsible for keeping the customer abreast of the status of the project.

As the facilities improvements portion of the partnership begins, the Project Manager serves as a single focal point of responsibility for all aspects of the partnership. The Project Manager monitors labor, material, and project modifications related to the Frankford/Honeywell partnership and makes changes to ensure achievement of performance requirements in the facilities modernization component. The Project Manager regularly reviews the on-going process of the project with the customers.

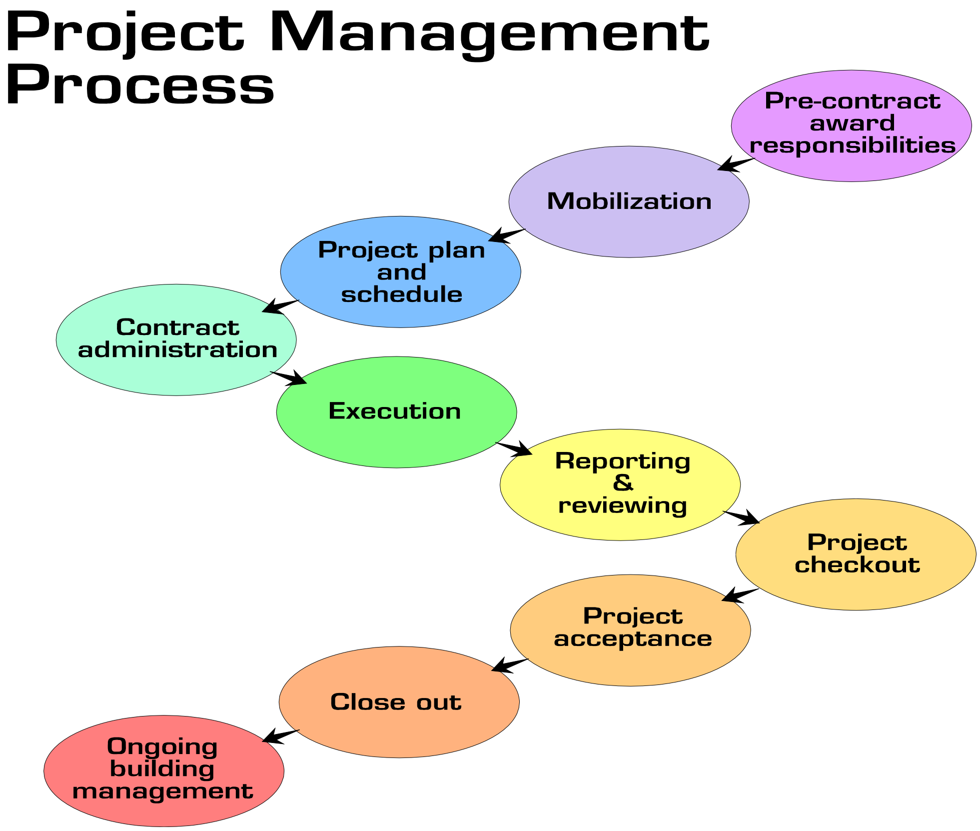
The Project Manager will develop and maintain effective on-going contact with the District and all other project participants to resolve issues and update project status.

There are several challenges in this position. The Project Manager must staff the project and create a work force capable of handling the technologies associated with the project and plan for and use these personnel to achieve optimum results focused on occupant comfort and guarantee requirements.

The project management process applies technical knowledge, people and communication skills, and management talent in an on-site, pro-active manner to ensure that our contract commitments are met on time, within budget, and at the quality you expect.



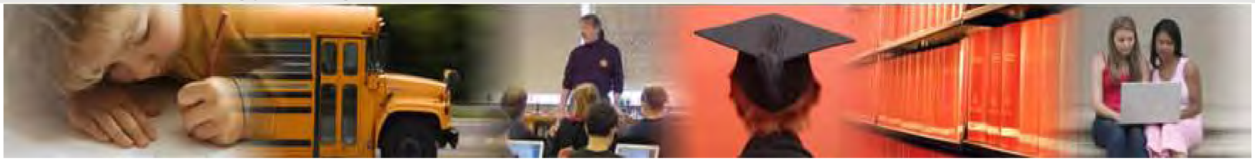
There are ten distinctive phases of the project management process:



Construction Management

Prior to any work in the buildings, our Project Manager, Jim Freeman will sit down with your administrative and building staff to outline the energy conservation upgrades that we will be installing in the buildings. We will discuss proper contractor protocol of checking in and out of the buildings on a daily basis, wearing identifiable shirts, and checking in with your facilities staff. We will coordinate certain projects for different times of the day so we do not interrupt the building and learning environments. Our staff will work a combination of first and second shifts to accomplish the pre-set implementation schedule.

Communication is the key success factor in any construction management plan, and our project manager will be the key focal point during the installation process. Our team will prevent schedule slippages by continuously tracking the location of all equipment and components required for the project. We make sure all equipment and components will be delivered on time prior to the scheduled date of delivery. Our thorough survey, evaluation and analysis of existing conditions, performed prior to the commencement of construction, will also prevent schedule slippages.



Subcontracting

As indicated above, Honeywell would develop detailed specifications with a NJ Licensed Engineering firm for each ECM project accepted by the School District. The contractor would need to be able to meet all requirements of New Jersey Public contracting laws regarding insurance, bonding, and performance requirements.

Typical areas that are subcontracted are as follows:

- ❖ Electrical Installation
- ❖ Water Conservation (Plumbing)
- ❖ HVAC Installation
- ❖ Renewable technologies
- ❖ Associated General Contracting specialty items to support the project etc., (ceilings, windows, concrete, structural steel, roofing, demolition and removal of equipment, painting and rigging)

Honeywell uses the following guidelines in hiring subcontractors to perform work on our projects.

- Firm's Qualifications and WBE/MBE Status
- Firm's Financial Stability
- Ability to perform the work within the project timeline
- Price
- Ability to provide service on the equipment or materials installed over a long period of time.

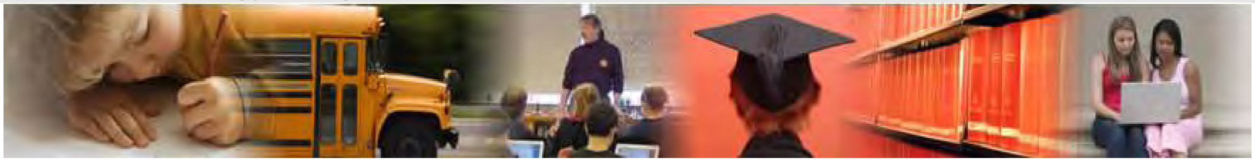
Approval of subcontractors that Honeywell proposes to use lies with the School District.

Installation Standards

When Honeywell designs a solution, we take into account current and future operations. For any upgrades we install, we follow building codes/standards, which dictate certain standards for energy or building improvements. Listed in tables following this section are standards for building design. During the life of the agreement, there is a partnership approach to maintaining these standards for reasons of comfort and reliability. For lighting our standard is generally to meet or exceed current light levels, achieving the relevant standards wherever possible.

In the case of lighting upgrades, we recommend that a group re-lamping of lamps be done around five years after the initial installation depending upon run times. Your building facility staff, on an as needed basis, can complete normal routine maintenance of lamps and ballasts. This maintains the quality of the lighting levels, and color rendering qualities of the lamps.

Space temperatures will be set by the energy management system and local building controls, and will be maintained on an annual basis. Flexibility will be maintained to regulate space temperatures as required to accommodate building occupant needs.



Your facility staff and building personnel will do the operation of the energy management system with ongoing training from Honeywell. Therefore, both the District and Honeywell will maintain the standards of comfort. The comfort standards will be maintained throughout the life of the agreement through sound maintenance planning and services recommended as part of this ESP.

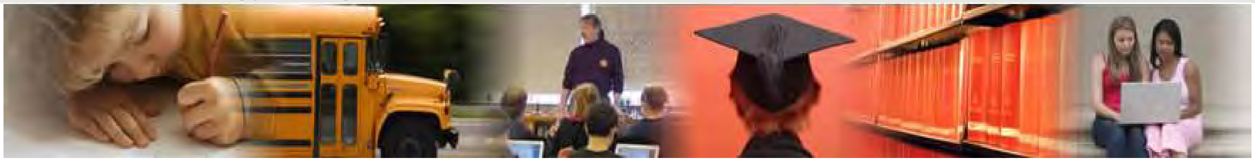
With regard to ventilation, Honeywell will upgrade ventilation to meet current standards in those areas where our scope of work involves upgrades to or replacement of systems providing building ventilation. We generally will not upgrade ventilation in those areas where our work doesn't involve the upgrade or replacement of systems or equipment providing ventilation to a building or facility.

Heating and Cooling Standards

Heating Temperatures	Cooling Temperatures	Unoccupied Temperatures
68-70° F	75° F	55-60° F

Lighting Standards:

Recommended Light Levels	
Task Area	**Foot-candles**
Corridors/Stairways/Restrooms	10-20
Storage Rooms	10-50
Conference Rooms	20-50
General Offices	50-100
Drafting/Accounting	100-200
Areas with VDTs	75
Classrooms	50-55
Cafeterias	50
Gymnasiums	30-50



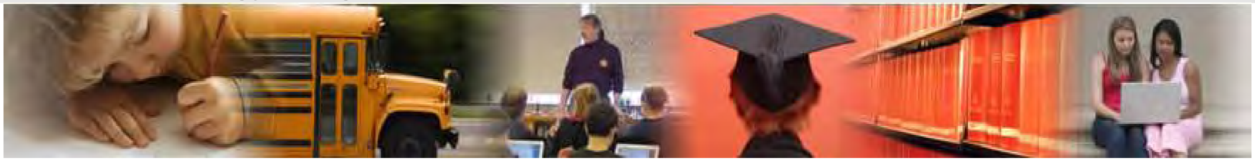
Honeywell uses a variety of in-house labor as well as subcontractors to install the energy conservation measures. We have on staff trained professionals in fire, security, energy management systems, all temperature control systems, and HVAC. However, according to the ESIP law, all trades will be publicly bid except for specific controls applications. Honeywell will also utilize the control system that is already in the facility so long as it can achieve the performance goals of the School District. Listed below is a sampling of some of the disciplines that would apply to the District, but is not all encompassing.

Improvements	Honeywell	Subcontractor
Engineering Design/Analysis	X	
Technical Audit	X	
Construction Administration/Management	X	
Installation of Energy Management System	X	X
Manufacturer of Energy Management Equipment	X	X
Installation of HVAC/Mechanical Equipment		X
Installation of Renewable Technology		X
Installation of Building Envelope		X
Energy Supply Management Analysis/Implementation	X	
Installation of Boilers		X
Maintenance of Energy Management Equipment	X	X
Manufacturer/Installation of Temperature Control s	X	X
Monitoring/Verification Guarantee	X	
Training of Owner Staff	X	
Financial Responsibility for Energy Guarantees	X	

Hazardous waste disposal or recycling

Honeywell disposes of all PCB ballasts or mercury containing materials removed as part of the project per EPA guidelines, and will fill out all the required paperwork for the District. Honeywell will work with the School District to review your hazardous material reports, and will identify the areas where work will be completed so that the District can contract to have any necessary material abatement completed.

Honeywell can help schedule or coordinate waste removal, but cannot contract for or assume responsibility for the abatement work. Honeywell also has the capabilities to assist the District in working with the EPA under compliance management issues. We also develop and manufacture automated systems to track and report a wide variety of environmental factors.



Commissioning

Honeywell provides full commissioning of energy conservation measures (ECM's) at the request of the customer. We will customize this process based on the complexity of Energy Conservation Measures and make our services available to the school district appointed commissioning agent as directed.

Upon project acceptance by the Frankford School District, the assigned Commissioning Agent (CA) will be responsible for start-up and commissioning of the new equipment and systems to be installed during the project. This will include verifying that the installed equipment meets specifications, is installed and started up in accordance with manufacturer's recommendations, and operates as intended. A commissioning plan will be prepared that describes the functional tests to be performed on the equipment and the acceptance criteria.

Prior to customer acceptance of the project, the CA submits the final commissioning report containing signed acceptance sheets for each ECM. Signed acceptance sheets are obtained upon demonstrating the functionality of each ECM to an agency-appointed representative.

Honeywell provides training for agency operators and personnel as needed when each ECM is completed and placed into service. All training is documented in the final commissioning report.

Financing the ESIP

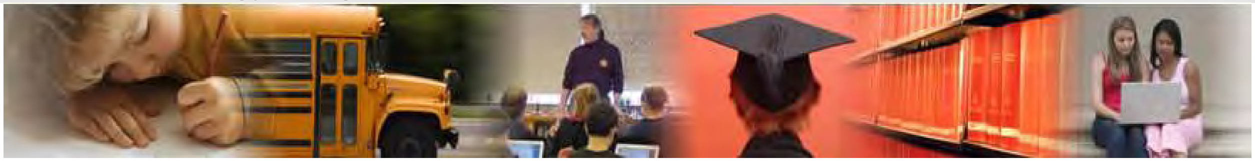
Upon adoption of this ESP, Honeywell will explore and obtain financing arrangements to fund the implementation phase of the process. Several options are available under the ESIP act PL 2009, c.4

An ESIP can be financed through energy savings obligations. The term refers to the two primary financing tools, debt and lease-purchase instruments. Each of these options is discussed below.

Financing an ESIP is based on the principle, that with certain exceptions (i.e., audit and verification costs), the cost of the improvements (including planning, design, engineering, construction, etc.) will be paid through the value of reduced energy costs. Using the BPU protocols for calculating savings, energy costs, and inflation as standards across all local units is a critical component of the ESIP.

Energy savings obligations shall not be used to finance maintenance, guarantees, or the required third party verification of energy conservation measures guarantees. Energy saving obligations, however, may include the costs of an energy audit and the cost of verification of energy savings as part of adopting an energy savings plan or upon commissioning. While the audit and verification costs may be financed, they are not counted in the energy savings plan as a cost to be offset with savings.

In all cases, the maturity schedules for energy savings obligations must not exceed the estimated useful life of the individual energy conservation measure.



An ESIP can also include installation of renewable energy facilities, such as solar panels. Under an energy savings plan, solar panels can be installed, and the reduced cost of energy reflected as savings.

The law also provides that the cost of energy saving obligations may be treated as an element of the local unit's utility budget, as it replaces energy costs.

Debt Issuance

The law specifically authorizes municipalities, school districts, counties, and fire districts to issue refunding bonds as a general obligation, backed with full faith and credit of the local unit to finance the ESIP. Because an ESIP does not effectively authorize new costs or taxpayer obligations, the refunding bond is appropriate and proper, as it does not affect debt limits, or in the case of a board of education, voter approval. The routine procedures for refunding bonds found in the Local Bond Law and Public School Bond Law would be followed for issuance of debt, along with any required Bond Anticipation Notes as authorized pursuant to law.

With regard to bonds for public schools, the Department of Education (DOE) has concluded that debt financed ESIP projects are not covered by State aid for debt service or a "Section 15 EFFCA Grant" as there is no new local debt being authorized.

Lease Purchase Financing

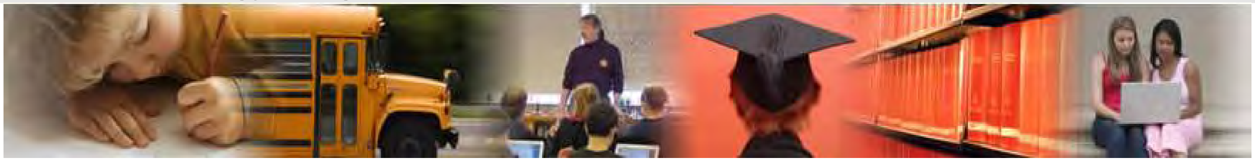
A local unit can enter into a lease-purchase agreement to implement an ESIP with a single investor lease or certificates of participation. The agreement can be entered into directly by the local unit, with ESCO, other private financing party, or through a county improvement authority or the New Jersey Economic Development Authority.

The following additional requirements affect ESIP leasing:

i. Ownership of the energy savings equipment or improvements shall remain with the third party financing entity until all lease payments have been made or other requirements of the financing documents for the satisfaction of the obligation are met. If improvements are made to facilities owned by the local unit, the local unit will have to enter into a ground lease of the facilities to be leased back to the local unit.

ii. The duration of a lease-purchase agreement shall not exceed 15 years, except that the duration of a lease purchase agreement for a combined heat and power (CHP) or cogeneration project shall not exceed 20 years. CHP and cogeneration facilities are specialized types of energy conservation measures. The law supersedes the existing 5 year limit on lease-purchase financing for these types of projects.

iii. Any lease purchase agreement may contain a clause making it subject to the availability of sufficient funds as may be required to meet the extended obligation; or a non-substitution clause maintaining that if the agreement is terminated for non-appropriation, the contracting unit may not replace the leased equipment. While normal for these types of leases, the optional nature in the law permits the transaction attorney to negotiate them as terms of a lease agreement.



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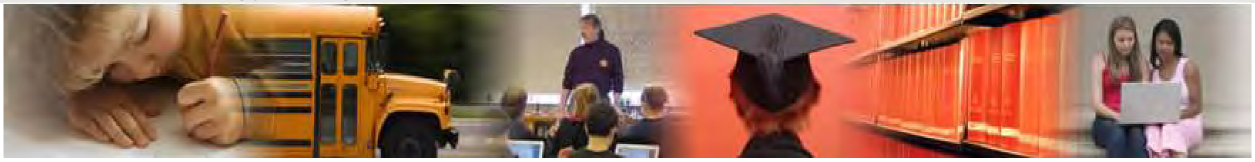
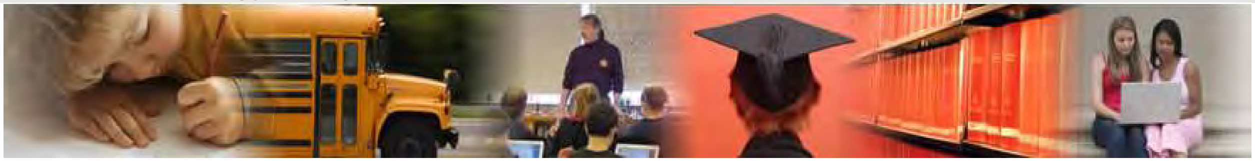


Section F
Design Approach
Sample Project Schedule



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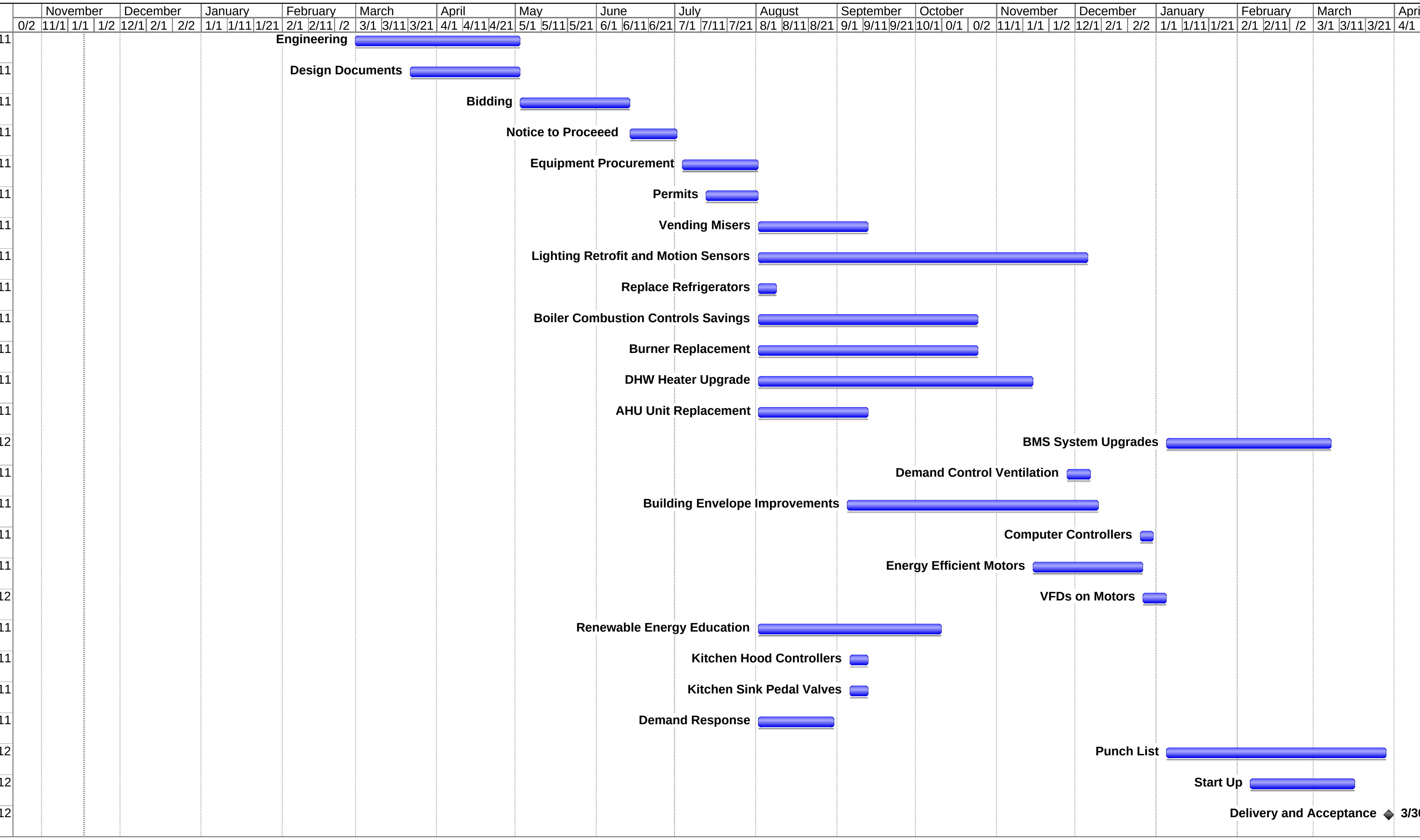
ID		Task Name	Duration	Start	Finish
1		Engineering	45 days	Tue 3/1/11	Mon 5/2/11
2		Design Documents	30 days	Tue 3/22/11	Mon 5/2/11
3		Bidding	30 days	Tue 5/3/11	Mon 6/13/11
4		Notice to Proceeed	14 days	Tue 6/14/11	Fri 7/1/11
5		Equipment Procurement	21 days	Mon 7/4/11	Mon 8/1/11
6		Permits	14 days	Wed 7/13/11	Mon 8/1/11
7		Vending Misers	30 days	Tue 8/2/11	Mon 9/12/11
8		Lighting Retrofit and Motion Sensors	90 days	Tue 8/2/11	Mon 12/5/11
9		Replace Refrigerators	5 days	Tue 8/2/11	Mon 8/8/11
10		Boiler Combustion Controls Savings	60 days	Tue 8/2/11	Mon 10/24/11
11		Burner Replacement	60 days	Tue 8/2/11	Mon 10/24/11
12		DHW Heater Upgrade	75 days	Tue 8/2/11	Mon 11/14/11
13		AHU Unit Replacement	30 days	Tue 8/2/11	Mon 9/12/11
14		BMS System Upgrades	45 days	Thu 1/5/12	Wed 3/7/12
15		Demand Control Ventilation	7 days	Mon 11/28/11	Tue 12/6/11
16		Building Envelope Improvements	70 days	Mon 9/5/11	Fri 12/9/11
17		Computer Controllers	5 days	Mon 12/26/11	Fri 12/30/11
18		Energy Efficient Motors	30 days	Tue 11/15/11	Mon 12/26/11
19		VFDs on Motors	7 days	Tue 12/27/11	Wed 1/4/12
20		Renewable Energy Education	50 days	Tue 8/2/11	Mon 10/10/11
21		Kitchen Hood Controllers	5 days	Tue 9/6/11	Mon 9/12/11
22		Kitchen Sink Pedal Valves	5 days	Tue 9/6/11	Mon 9/12/11
23		Demand Response	21 days	Tue 8/2/11	Tue 8/30/11
24		Punch List	60 days	Thu 1/5/12	Wed 3/28/12
25		Start Up	30 days	Mon 2/6/12	Fri 3/16/12
26		Delivery and Acceptance	0 days	Fri 3/30/12	Fri 3/30/12



Project: Frankford Township School Di
Date: Wed 11/17/10

Task	Progress	Summary	External Tasks	Deadline
Split	Milestone	Project Summary	External Milestone	