Holmdel Board of Education

E.S.I.P

Final/Submitted ECM List

&

Project Value

January 23, 2018

SETTEMBRINO ARCHITECTS

25 Bridge Avenue, Suite 201

Red Bank, NJ 07701

(732) 741-4900

DLB ASSOCIATES

265 Industrial Way West

Eatontown, NJ 07724

(732) 774-2000

HOLMDEL TOWNSHIP BOARD OF EDUCATION - ENERGY SAVINGS IMPROVEMENT PROGRAM									
ECM SUMMARY FORM - Proposed Preliminary Energy Savings Plan: ECM Base Project									
ECM #	**School / Facility**	**ECM Description**	**Estimated Installed Hard Costs (w/ 10% Contingency)**	**Estimated Incentives From P4P**	**Estimated Incentives From SmartStart**	**Estimated Annual Energy Savings (Elec)**	**Estimated Annual Energy Savings (Gas)**	**Estimated Annual Energy Savings (Total)**	**Estimated Simple Payback (Years)**
ECM-2	Holmdel High School / Satz Middle School	Replace Existing Boilers with Condensing Boilers	$332,024		N/A	$5,523	$9,821	$15,344	
ECM-3	Holmdel High School / Satz Middle School	Convert Electric Dishwasher Booster Heater to Natural Gas	$18,524		N/A	$3,773	($1,441)	$2,332	
ECM-4	Holmdel High School / Satz Middle School	Lighting Replacement / Upgrades	$195,302		N/A	$36,763	$0	$36,763	
ECM-5	Holmdel High School / Satz Middle School	Exterior Lighting Replacements with LED lighting	$235,202		N/A	$19,164	$0	$19,164	
ECM-7	Indian Hill School	Lighting Replacement / Upgrades	$96,420	N/A	$18,915	$8,880	$0	$8,880	
ECM-8	Indian Hill School	Exterior Lighting Replacements with LED lighting	$36,982	N/A	$2,000	$2,133	$0	$2,133	
ECM-10	Village School	Lighting Replacement / Upgrades	$117,483	N/A	$21,990	$16,653	$0	$16,653	
ECM-11	Village School	Exterior Lighting Replacements with LED lighting	$132,836	N/A	$9,600	$6,775	$0	$6,775	
		Project Summary Totals:	$1,164,773	$173,232	$52,505	$99,663	$8,380	$108,043	9.2 (AVG)

HOLMDEL TOWNSHIP BOARD OF EDUCATION - ENERGY SAVINGS IMPROVEMENT PROGRAM		
PROPOSED CONSTRUCTION FEES		
Fee Category	**Fees Dollar ($) Value**	**Percentage of Hard Costs**
Estimated Value of Hard Costs (Pre-incentives)	$1,164,773	100.0%
Soft Costs (A/E fees, bond counsel, etc.)	$349,432	30%
Total Project Costs (Pre-Incentives)	**$1,514,205**	

Holmdel Board of Education

Approved Energy Savings Plan

May 25, 2017

SETTEMBRINO ARCHITECTS

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HOLMDEL TOWNSHIP BOARD OF EDUCATION - ESIP

ENERGY SAVINGS PLAN

May 25, 2017

Prepared by:
DLB Associates
(dlb # 11951)

Table of Contents

SECTION 1: EXECUTIVE SUMMARY

1.1 Report Disclaimer

Non-Disclosure Statement:

This ESP report includes data that is not to be disclosed outside of the Board of Education of the Township of Holmdel and shall not be duplicated, disclosed, used or disseminated without the permission of the Board.

Financial Exhibits:

The financial information contained in this ESP report is included for informational and planning purposes only. It is provided to aid in decision making, planning and development of budgets. The monetary values are estimated based upon past project experience and published cost data and are to be validated and confirmed by financial professionals prior to efforts such as securing funding for the project(s), etc.

1.2 Introduction

The New Jersey State Legislature approved a bill that allows certain local public entities such as a Board of Education to enter into contracts for up to 15 years for energy conservation at buildings owned by such entities. Furthermore, this allows the Board of Education to make these energy related improvements to their facilities and pay for the costs using the energy savings value that result.

The enacted Chapter 4 of the Laws of 2009, the "Energy Savings Improvement Program" (ESIP), provides all government agencies in New Jersey with a flexible tool to improve and reduce energy usage with minimal expenditure of new financial resources. Guidelines for implementation of this program have been provided through the Department of Community Affairs Local Finance Notices (LFN) 2009-11 and 2011-17, the Sustainable Jersey How-To Guide and subsequent protocols provided by the Board of Public Utilities for computing energy costs savings.

1.3 Facilities

The Holmdel Township Board of Education (HTBOE) is including the following facilities in their ESIP:

HOLMDEL TOWNSHIP BOARD OF EDUCATION - ESIP			
FACILITY	**Type**	**LOCATION**	**APPROXIMATE SIZE**
Holmdel High School / William R. Satz School	Holmdel - Grades 9 - 12 Satz - Grades 5 - 8	24 Crawford's Corner Road Holmdel, NJ 07733	Holmdel - 2-story @ 207,000SF Satz - 1-story @ 93,000SF
Indian Hill School	Grades 4 - 6	735 Holmdel Road Holmdel, NJ 07733	2-story @ 93,000SF
Village School	Pre-K - 3	67 McCampbell Road Holmdel, NJ 07733	1-story @ 131,000SF

The ESIP process begins with the completion of the Local Government Energy Audit (LGEA). This initial energy audit identifies the existing systems present in the facilities and suggests Energy Conservation Measures (ECMs) that should be investigated in further detail.

The LGEAs for the HTBOE facilities noted above were completed by the CHA consulting group in the spring of 2013 and are available upon request.

DLB Associates' first course of action was to review these reports and to physically survey the facilities. The results of the surveys were used to establish a baseline digital model of each facility. These models were based upon visual investigations and records of prior energy usage for a minimum of twelve months.

1.4 Investment Grade Audits

The survey and modeling of the facilities resulted in three separate Investment Grade Audit (IGA) reports, one for each facility noted above. These reports provided detailed descriptions of the building systems and energy usage and evaluated the efficacy of a number of proposed ECMs.

In order to evaluate each proposed ECM, a digital model was produced for the facility in question. These models are described in further detail in Section 9.2.

1.5 Energy Savings Plan

The next step, (after having completed a detailed IGA) to implementing an ESIP is the creation of an Energy Savings Plan (ESP). The plan is created to further develop what is outlined in the IGA reports to a more detailed scope of work with more refined cost estimates and energy savings to provide the owner with an estimate of projected cash flow over the life of the contract. This report constitutes the ESP for the HTBOE.

The ESP identifies, provides, and describes:

- Each recommended ECM;
- An estimate of greenhouse gas reductions from the resultant savings;
- Identification of all design and compliance issues;
- Maintenance requirements necessary to ensure continued savings;
- Identification of eligibility for PJM (a regional transmission organization (RTO) that coordinates the movement of wholesale electricity in all or parts of 13 states and the District of Columbia) demand response and curtailable service programs;
- An assessment of any risks associated with implementation of the plan.

The plan is used as a reference document to provide information to the local entity for the purposes of third party and Board of Public Utilities (BPU) reviews, soliciting proposals, and to secure funding and move into construction services.

The ESP is the core of the ESIP process. It describes HTBOE's preferred ECMs and the cost and savings calculations that self-fund the project via reduced operating costs. The ESP provides the HTBOE the necessary information to decide which proposed ECMs to implement as part of the ESIP construction project(s).

To ensure conformance with the requirements of Public Finance Notice LFN 2009-11, the ESP must address the following elements:

- The results of the energy audit; (Section 3, Appendix A)
- A description of the energy conservation measures that will comprise the program; (Section 3)
- An estimate of greenhouse gas reductions resulting from those energy savings; (Section 5)
- Identification of all design and compliance issues and identification of who will provide these services; (Section 6)
- An assessment of risks involved in the successful implementation of the plan; (Section 6)
- Identify the eligibility for, and costs and revenues associated with the PJM Independent System Operator for demand response and curtailable service activities; (Section 7)
- Schedules showing calculations of all costs of implementing the proposed ECMs and the projected energy savings; (Section 4)
- Maintenance requirements necessary to ensure continued energy savings, and describe how they will be provided; (Section 8)

In addition, and per LFN 2009-11, the ESP requires several other important elements:

- The calculations of energy savings must be made in accordance with protocols for their calculation adopted by the BPU. The calculation shall include all applicable State and Federal rebates and tax credits, but shall not include the cost of an energy audit and the cost of verifying energy savings. (Section 4)
- The plan must be verified by an independent third party to ensure that the calculations were made in accordance with the BPU standards and that all required elements of the ESP are covered. (Appendix C)
- After verification is completed, the governing body must formally adopt the plan. At that point, the plan must be submitted to the Board of Public Utilities where it will be posted on the BPU website. BPU approval is required. If the contracting unit maintains its own website, the plan must also be posted on that site.

HTBOE has chosen the "DIY" method for implementation of the ECMs identified in this plan. Under this method, there is no Energy Services Company (ESCO) involvement. HTBOE has selected Settembrino Architects as the architectural firm responsible for overseeing their ESIP process.

Retaining an Architect to assist with the ESIP authorizes the architectural firm to be responsible for procurement of services from different organizations to perform the various elements of an ESIP including the ESP preparation, development of construction plans, bids and specifications, recommendation regarding the award of construction contracts and construction management.

Local units (e.g. HTBOE) who choose to use the DIY method will also be responsible for obtaining the funding needed for the project.

1.6 Plan Assumptions

The following assumptions were made during the ESP analysis:

1. The energy models and spreadsheet evaluations to determine the savings from implementing ECMs utilized information from the LGEA reports from February 2013, as well as site surveys, interviews with operations

staff on scheduling, operating hours, and equipment control, existing drawing analysis, and equipment research by DLB Associates performed during the IGA portion of the project.

2. ECM calculations follow published NJ BPU Clean Energy Program Protocols to Measure Resource Savings, industry standard energy modeling practices utilizing information obtained from field visits, and drawing research and engineering assumptions where necessary.
3. Baseline energy model consumption calibration was performed using electric utility bills after the installation of solar panels on the roofs since net metering data and solar generation reports were available for the analyzed and modeled billing period.
4. Energy cost savings are calculated using an average cost per kWh or therm for electric utility, solar, and natural gas from the most recent bills available as provided by the HTBOE. The calculated average cost per kWh or therm includes the kW or HMAD (highest monthly average demand) demand charge respectively. Additionally, only those charges listed on the HTBOE's actual utility bills were used. These methodologies were confirmed with the BPU. The average rates obtained from the bills are in close agreement with published utility company tariff rates.
5. Incentives used in the calculation of total construction cost are based on current pricing of the 2017 NJ Clean Energy Program. Incentive availability and total amount received by the HTBOE may vary if the project begins after 2017.
6. Construction cost estimates were obtained using RS Means Cost Data, engineering estimates, industry pricing, prevailing wage data for New Jersey, prior project experience and contingencies as specified by the Architect. These cost estimates have been refined throughout the course of the project as new or different information was obtained and verified.
7. The maximum simple payback period for ECM acceptance was originally believed to be limited to (15) years. However, clarification received from the BPU indicates that it is the average simple payback of all ECM's included in the ESP that must be (15) years or less to qualify.
8. The Energy Savings Plan is not an Energy Savings Guarantee.

1.7 Summary

Eleven (11) total ECMs are part of the ESP, and include both mechanical and lighting energy reduction measures.

The recommended project has a gross project cost of ***$1,448,511*** and a net annual first year utility savings of ***$129,493.***

Incentives from the New Jersey Clean Energy Program's Pay-For-Performance and SmartStart Programs are anticipated to be ***$226,337***.

Costs and incentives for participating in the PJM Demand Response & Curtailable Service Program have not been included in the ESP.

SECTION 2: UTILITY CONSUMPTION AND COSTS

2.1 Summary

The facilities are currently delivered electricity from Jersey Central Power and Light (JCP&L) under the Annual General Service Secondary rate tariff for Indian Hill Elementary School and Village Elementary School and the Annual General Service Secondary Time-of-Day for the Holmdel High School / Satz Middle School complex. Each facility also utilizes roof-mounted solar panels under a power purchase agreement with Hudson Energy Solutions, a Just Energy Group Company, for electricity. Total consumption is the net kWh delivered by the utility plus the solar system's generated kWh.

Natural gas is provided by New Jersey Natural Gas (NJNG). The facilities also utilize a third party supplier, Compass Energy Gas Services, LLC, for natural gas commodity purchasing.

The utility data provided by the HTBOE and used in the calculated utility rate analysis represent the calendar year from July 2015 to June 2016 for utility, solar electric and natural gas. Additional utility data were provided to DLB Associates by the HTBOE in order to compare energy consumption prior to and after the solar installation and to analyze annual fluctuations in overall energy usage.

2.2 Calculated Utility Rates

Utility rates were calculated for each facility based on historical utility bills for natural gas, solar, and electric.

2.2.1 Electric kWh Consumption Rate

Since each school uses a combination of solar and net-metered utility power for electricity, with the billing periods not aligned (i.e. JCP&L billing period is middle-of-the-month to middle-of-the-month whereas solar billing period is from first-day-of-the-month to last-day-of-the-month), the following approach was utilized to calculate the average kWh rate for each school:

- Determine the average daily kWh In and kWh Out at the utility meter for each 15th day to 14th day utility billing month (e.g. August bill is from July 15th to August 14th, and September bill is from August 15th to September 14th).
- Add the calculated average daily kWh In from the utility meter's August (1st day to 14th day in August) and September (15th day to 31st day in August) bills to the total kWh generated listed on the August 1st to 31st bill from Hudson Energy Solutions.
- Subtract from that total the calculated daily kWh Out from the utility meter's August (1st day to 14th day in August) and September (15th day to 31st day in August) bills to arrive at an estimated total kWh consumed for the month.

The electric and solar bills used to calculate the electric utility rate for all schools were from July 2015 through June 2016.

Additionally, the Village Elementary School has two electric utility accounts, and for this school, the bill data for both JCP&L account numbers 100 009 804 921 and 100 100 334 901 were used in conjunction with the solar bill data as it is unknown exactly which areas of the building are supplied by each service and the proposed lighting ECM's occur throughout the building.

Conversely, while the Holmdel High School / Satz Middle School complex has three electric utility accounts, the separately metered Theater (100 009 449 156) and Sports Lighting (100 009 448 786) utility bill data were omitted as there are no ECM's for these unconnected spaces.

The calculated average kWh electric rates for each school are listed below, and include energy and demand components, taxes, and surcharges as listed on the actual utility bills.

CALCULATED UTILITY RATES - ELECTRIC			
School	Indian Hill Elementary	Village Elementary	Holmdel High / Satz Middle
Bill Period	July 2015 – June 2016	July 2015 – June 2016	July 2015 – June 2016
Total Electric Utility Consumption (kWh)	926,586	794,741	2,370,886
Maximum Electric Utility Demand (kW)	423	253	1,234
Total Solar Consumption (kWh)	463,665	527,193	617,406
Total Electric Utility Payments ($)	$79,719.00	$110,054.56	$303,398.78
Total Solar Payments ($)	$51,237.45	$58,321.51	$68,099.83
Calculated Electric Rate ($ / kWh)	$0.0884	$0.1385	$0.1280

2.2.2 Natural Gas

The average cost per therm of natural gas was calculated by dividing the total amount paid to the utility in a 12 month period by the total consumption. A few natural gas utility bills were missing for the sample bill period, and in these instances, a bill for the same month in the prior year was used to calculate an approximate consumption and amount paid total.

CALCULATED UTILITY RATES - GAS			
School	Indian Hill Elementary	Village Elementary	Satz Middle / Holmdel High
Bill Period	July 2015 – June 2016	July 2015 – June 2016	July 2015 – June 2016
Total Gas Consumption (therms)	40,220	42,525	98,017
Total Gas Utility Payments ($)	$46,616.16	$49,349.76	$112,284.94

CALCULATED UTILITY RATES - GAS			
School	Indian Hill Elementary	Village Elementary	Satz Middle / Holmdel High
Calculated Gas Rate ($ / therm)	$1.159	$1.160	$1.146

2.3 Total Energy & Cost

The baseline electricity and gas consumption values used to calibrate the energy models for the ECM analyses were based on historical utility data provided by the HTBOE.

The actual electric consumption data used to calibrate the Trace energy models was obtained from the JCP&L bills from July 2015 through June 2016.

The actual gas consumption data used to calibrate the energy models was obtained from the available NJNG bills from 2010 through 2012 for the Village Elementary School and 2015 through 2016 for Holmdel High School / Satz Middle School complex. The Indian Hill Elementary School gas usage was calibrated to the June 2013 through May 2014 utility bill data, as the energy model was in close agreement with the most recent set of data.

SECTION 3: ENERGY CONSERVATION MEASURES

3.1 Overview

A Local Government Energy Audit (LGEA) for each of the District's four (4) schools was performed by the CHA consulting group in February 2013. These reports were developed in agreement with the BPU's LGEA Program guidelines.

This set of LGEAs analyzed a variety of mechanical and lighting ECMs for each school, comprised of both low and high cost projects, including eight (8) ECMs for the Holmdel High School, eleven (11) for the Satz Middle School, thirteen (13) for the Indian Hill Elementary School, and twelve (12) for the Village Elementary School. Of these forty-four (44) ECMs reviewed by CHA, thirty (30) were recommended as being under a twenty (20) year payback period.

Using this foundation, DLB Associates performed Investment Grade Audits (IGAs) for each school and issued three (3) facility reports in 2015, with the Holmdel High School / Satz Middle School combined as one report. This was due to the fact that they are in a single building envelope and share systems.

DLB Associates surveyed each of the facilities and interviewed operations staff in October and November of 2014 to obtain updated information about the existing systems, equipment schedules, and any known issues.

The ECMs analyzed in this set of reports were obtained from the LGEA-recommended ECMs, with a few additional ECMs proposed based on site observations. Some of the LGEA-recommended ECMs appeared to have been previously addressed through necessary equipment replacement by HTBOE.

The ECM evaluation approach followed in the IGA reports included BPU-acceptable spreadsheet analyses and whole-building models using Trane Trace 700, Version 6.3.1.2. Trace is a full building energy simulation tool compliant with ASHRAE Standard 140. It has the ability to model and calculate the energy usage of the building's heating, cooling, and lighting systems, as well as any miscellaneous loads associated with plug loads, cooking equipment, water heating, etc. Trace models the interactions of these systems for every hour of a typical weather year. More information on the calculation approaches are in Section 9 of this report.

The energy savings determined through the spreadsheet analyses and the Trane Trace modeling effort were used with estimated construction costs and calculated utility rates to determine a simple payback period for each ECM. The IGAs proposed twenty-five (25) ECMs based on a fifteen (15) year simple payback period cutoff for each ECM individually.

The initial "draft" ESP submitted for 3rd Party Review advised pursuing seventeen (17) of the ECMs presented in the IGAs based on a more detailed analysis. The following changes to the IGA's recommended ECMs are as follows:

- Four (4) of the chiller-related ECMs at the Indian Hill Elementary School were removed from the final plan. This decision was based on the fact that the existing chiller appears to be oversized and is linked to an existing cooling tower currently under a separate study initiated by the HTBOE. Replacing this chiller in kind would not serve to address any of the current conditions being investigated. While two (2) of the ECMs regarding chilled water and condenser water pump variable frequency drives were considered viable at first, further considerations determined that any potential energy savings would be negated by less efficient existing chiller and cooling tower operation with the variable flow conditions.

This "final" ESP to be submitted to the BPU advises pursuing eleven (11) ECMs, and incorporates the following changes based upon additional analysis conducted following receipt of the 3rd Party Review comments:

- Consolidating and reducing the quantity of boilers at Indian Hill is not technically feasible as the remaining (3) Aerco boilers do not have sufficient capacity to meet the space heating loads. This ECM has been eliminated from this "final" ESP version.
- Replacing the motors and installing VFD's on the hot water distribution pumps would require the installation of modulating control valves at each terminal unit, along with the associated control wiring. The added construction cost makes these ECM's cost prohibitive when compared to the total source energy savings. The three ECM's for installing premium motors and VFD's have been eliminated from this "final" ESP version.
- An error was identified and corrected in the Indian Hill Trane Trace energy model regarding the Demand Control Ventilation ECM for the Gymnasium and Cafeteria. While initially excluded because of a simple payback period exceeding 15 years, the revised energy model indicated a simple payback period of roughly 10 years. This, along with the significant energy savings associated with this ECM make it a viable addition to this "final" ESP version.
- While initially excluded due to the Code requirement to add lighting controls whenever 50% or more of lighting fixtures are replaced, recent technology improvements and corresponding Energy Star and/or DLC product listings make LED Tube replacements for existing T8 and Compact Fluorescent lighting a viable alternative to full fixture replacement, and avoids the Code requirement to add lighting controls. This ECM has been added back into this "final" ESP version.
- Due to the design change to utilize LED Tube replacements only, the ECMs for installing Lighting Controls Only have been eliminated from this "final" ESP version.
- Due to the amount of time elapsed since the original analysis in 2015 that utilized electric, gas and solar bills from the August 2013 to July 2014 time frame, the program requirement for bills not to exceed 24 months old was no longer met. More recent bills were observed and revised utility rates were calculated. The revised rates impacted the cash flow analysis. The only viable approach was eliminating the interior HID replacements for each school.
- The energy model for the Holmdel High School and Satz Middle School has been revised based on additional information received from the school district. Because of such large disparities in gas usage between school years, additional utility bills were requested permitting DLB to analyze gas usage profiles and compare to monthly weather data. Ultimately, the model calibration process referenced the 2015-2016 electrical and gas utility bills, with their corresponding utility rates. Actual weather data analysis confirmed the changes in gas usage each year are directly linked to outside air temperatures.
- A brief meeting was also held with the school's facilities management team and a walkthrough followed. During this conversation and survey, clarifications were made on building occupancy, daily and weekly scheduling, heating type, boiler efficiency, controls / automation, kitchen equipment, and setpoints. This information helped to increase the accuracy of the model and calibrate to the 2015-2016 utility bills.

The four (4) LGEA reports are on file with the HTBOE and available on the internet at the NJ Clean Energy website. The three (3) IGA reports are included as an appendix to this "final" ESP report as both versions of the

Energy Savings Plan utilize information contained in the IGAs as a basis. The "draft" version of the ESP that was provided for review by the third party engineering firm is included in the appendix as well.

3.2 ECM Reporting Key

HOLMDEL HIGH SCHOOL / W.R. SATZ MIDDLE SCHOOL												
Energy Conservation Measure		LGEA's (02/2013)		IGA's (03/2015)			ESP (05/2015, Draft for 3rd Paty Review)			ERP (04/2017, For P4P Submission)		
Item	Description	Number	Proposed	Number	Proposed	Notes	Number	Proposed	Notes	Number	Proposed	Notes
1	Outside Air Duct Modifications	HS-ECM-1	No	N/A	**N/A**	Appeared To Already Be Complete	N/A	N/A		N/A	N/A	
2	Install VSD's & Premium Motors on HW Pumps	HS-ECM-2	Yes	ECM-HS2	Yes		ECM-1	Yes		N/A	**No**	Valve Installation Is Cost Prohibitive
3	DCV Controls (Auditorium, Cafeteria, & Old Gym)	HS-ECM-3	Yes	ECM-HS3	Yes		ECM-2	Yes		ECM-1	Yes	
4	Domestic Hot Water Heater Modifications	HS-ECM-4a	Yes	ECM-HS4a	**No**	Payback Period Exceeds Allowable	N/A	N/A		N/A	N/A	
5	Replace Electric Domestic Water Heaters	HS-ECM-4b	Yes	ECM-HS4b	**No**	Payback Period Exceeds Allowable	N/A	N/A		N/A	N/A	
6	Lighting Replacement / Upgrades	HS-ECM-5	No	ECM-HS5	**No**	Fixture Replacements Require New Controls	N/A	N/A		ECM-4	**Yes**	LED Tube Replacements Only
7	Install Lighting Controls (occupancy sensors)	HS-ECM-6	No	ECM-HS6	**Yes**	Based Upon Specific Interior Spaces As Noted	ECM-3	Yes	Based Upon Specific Interior Spaces As Noted	N/A	**No**	Poor Application Uniformity
8	Lighting Replacements with Lighting Controls (Occupancy Sensors)	HS-ECM-7	Yes	ECM-HS7	Yes	Based Upon Specific Interior Spaces As Noted	ECM-4	Yes	Based Upon Specific Interior Spaces As Noted	N/A	**No**	Eliminated To Restore Positive Cash Flow After Utility Rate Decreases
9	Exterior Lighting Replacements with LED lighting	HS-ECM-8	Yes	ECM-HS8	Yes		ECM-5	Yes		ECM-5	Yes	
10	RTU Replacement (replace ACU-1)	S-ECM-1a	Yes	ECM-MS1	**No**	Payback Period Exceeds Allowable	N/A	N/A		N/A	N/A	
11	RTU Replacement (replace ACU-2)	S-ECM-1b	Yes	ECM-MS1	**No**	Payback Period Exceeds Allowable	N/A	N/A		N/A	N/A	
12	RTU Replacement (replace ACU-3)	S-ECM-1c	Yes	ECM-MS1	**No**	Payback Period Exceeds Allowable	N/A	N/A		N/A	N/A	
13	Replace Existing Boilers w/ Condensing Boiler	S-ECM-2	Yes	ECM-MS2	Yes		ECM-6	Yes		ECM-2	Yes	
14	Install VSD's & Premium Motors on HW Pumps	S-ECM-3	Yes	ECM-MS3	Yes		ECM-1	Yes		N/A	**No**	Valve Installation Is Cost Prohibitive
15	Replace Domestic Water Heaters	S-ECM-4a	Yes	ECM-MS4a	**No**	Payback Period Exceeds Allowable	N/A	N/A		N/A	N/A	
16	Domestic Hot Water Heater Modifications	S-ECM-4b	Yes	ECM-MS4b	**No**	Payback Period Exceeds Allowable	N/A	N/A		N/A	N/A	
17	Convert Electric Dishwasher Booster Heater to Natural Gas	S-ECM-5	Yes	ECM-MS5	Yes		ECM-7	Yes		ECM-3	Yes	
18	Install Kitchen Hood VSD / Controller	S-ECM-6	No	ECM-MS6	No	Payback Period Exceeds Allowable	N/A	N/A		N/A	N/A	
19	Install Walk-in Cooler / Freezer Controls	S-ECM-7	Yes	ECM-MS7	**No**	Payback Period Exceeds Allowable	N/A	N/A		N/A	N/A	
20	Lighting Replacement / Upgrades	S-ECM-8	No	ECM-MS8	No	Fixture Replacements Require New Controls	N/A	N/A		ECM-4	**Yes**	LED Tube Replacements Only
21	Install Lighting Controls (occupancy sensors)	S-ECM-9	No	ECM-MS9	**Yes**	Based Upon Specific Interior Spaces As Noted	ECM-3	Yes	Based Upon Specific Interior Spaces As Noted	N/A	**No**	Poor Application Uniformity
22	Lighting Replacements with Lighting Controls (Occupancy Sensors)	S-ECM-10	Yes	ECM-MS10	Yes	Based Upon Specific Interior Spaces As Noted	ECM-4	Yes	Based Upon Specific Interior Spaces As Noted	N/A	**No**	Eliminated To Restore Positive Cash Flow After Utility Rate Decreases
23	Exterior Lighting Replacements with LED	S-ECM-11	Yes	ECM-MS11	Yes		ECM-5	Yes		ECM-5	Yes	

INDIAN HILL ELEMENTARY SCHOOL												
Energy Conservation Measure		LGEA's (02/2013)		IGA's (03/2015)			ESP (05/2015, Draft for 3rd Paty Review)			ESP (05/2017, Final for BPU Submission)		
Item	Description	Number	Proposed	Number	Proposed	Notes	Number	Proposed	Notes	Number	Proposed	Notes
1	Window Replacement & Reduced Glazing for Classrooms 1-20	ECM-1	Yes	ECM-1	**No**	Payback Period Exceeds Allowable	N/A	N/A		N/A	N/A	
2	Interlock HW Piping & Relocate Boilers to Boiler Room B	ECM-2	Yes	ECM-2	Yes		ECM-8	Yes		N/A	**No**	(3) Aerco Boilers Do Not Meet Heating Capacity
3	Install VSD's & Premium Motors on HW Pumps (in Boiler Room A)	ECM-3	Yes	ECM-3	Yes		ECM-9	Yes		N/A	**No**	Valve Installation Is Cost Prohibitive
4	Replace Chiller	ECM-4	Yes	ECM-4	Yes		N/A	**No**	Owner Pursuing Complete Chiller Plant Redesign	N/A	N/A	
5	DCV Controls (Gymnasium & Cafeteria)	ECM-5	Yes	ECM-5	**No**	Payback Period Exceeds Allowable	N/A	N/A		ECM-6	**Yes**	Modeling Error Corrected; ECM Becomes Viable
6	Replace Domestic Hot Water with Gas-Fired Tankless Heater	ECM-6	No	ECM-6	No		N/A	N/A		N/A	N/A	
7	Replace Existing Boiler for DHW w/ Condensing Boiler	ECM-7	No	ECM-7	No		N/A	N/A		N/A	N/A	
8	Install Kitchen Hood VSD / Controller	ECM-8	No	ECM-8	No		N/A	N/A		N/A	N/A	
9	Install Walk-in Cooler / Freezer Controls	ECM-9	Yes	ECM-9	**No**	Payback Period Exceeds Allowable	N/A	N/A		N/A	N/A	
10	Install VFDs and Premium Motors on Two Chilled Water Pumps	N/A	N/A	ECM-10	**Yes**	New Recommendation Not Noted In Lgea	N/A	**No**	Not Viable If Not Also Replacing Existing Chiller	N/A	N/A	
11	Install VFDs and Premium Motors on Two Condenser Water Pumps	N/A	N/A	ECM-11	**Yes**	New Recommendation Not Noted In Lgea	N/A	**No**	Not Viable If Not Also Replacing Existing Chiller	N/A	N/A	
12	Install VFDs and Premium Motors on Cooling Tower Fan	N/A	N/A	ECM-12	**Yes**	New Recommendation Not Noted In Lgea	N/A	**No**	Owner Pursuing Complete Chiller Plant Redesign	N/A	N/A	
13	Lighting Replacement / Upgrades	ECM-10	No	ECM-13	No	Fixture Replacements Require New Controls	N/A	N/A		ECM-7	**Yes**	LED Tube Replacements Only
14	Install Lighting Controls (occupancy sensors)	ECM-11	No	ECM-14	**Yes**	Based Upon Specific Interior Spaces As Noted	ECM-10	Yes	Based Upon Specific Interior Spaces As Noted	N/A	**No**	Poor Application Uniformity
15	Lighting Replacements with Lighting Controls (Occupancy Sensors)	ECM-12	Yes	ECM-15	Yes	Based Upon Specific Interior Spaces As Noted	ECM-11	Yes	Based Upon Specific Interior Spaces As Noted	N/A	**No**	Eliminated To Restore Positive Cash Flow After Utility Rate Decreases
16	Exterior Lighting Replacements with LED	ECM-13	Yes	ECM-16	Yes		ECM-12	Yes		ECM-8	Yes	

VILLAGE ELEMENTARY SCHOOL												
Energy Conservation Measure		LGEA's (02/2013)		IGA's (03/2015)			ESP (05/2015, Draft for 3rd Paty Review)			ESP (05/2017, Final for BPU Submission)		
Item	Description	Number	Proposed	Number	Proposed	Notes	Number	Proposed	Notes	Number	Proposed	Notes
1	Window Replacement in Atrium	ECM-1	Yes	ECM-1	**No**	Payback Period Exceeds Allowable	NA	NA		NA	NA	
2	Remove Slant Fin Boilers and Tie in Classrooms to Main Boiler Loop	ECM-2	Yes	ECM-2	**No**	Payback Period Exceeds Allowable	NA	NA		NA	NA	
3	Replace Art Room AC Unit	ECM-3	Yes	NA	**NA**	Appeared To Already Be Complete	NA	NA		NA	NA	
4	Replace Computer Room AC Unit	ECM-4	Yes	NA	**NA**	Appeared To Already Be Complete	NA	NA		NA	NA	
5	Install VFDs and Premium Motors on two HW Pumps (15HP each)	ECM-5	Yes	ECM-5a ECM-5b ECM-5c	**Yes (ECM 5c)**	ECM 5C: Combined ECM Of Premium Motors (5A) And VSD (5B)	ECM-13	Yes		N/A	**No**	Valve Installation Is Cost Prohibitive
6	DCV Controls for Multipurpose room and Old Gym	ECM-6	Yes	ECM-6	Yes		ECM-14	Yes		ECM-9	Yes	
7	Install Kitchen Hood / VFD Controller	ECM-7	Yes	ECM-7	**No**	Payback Period Exceeds Allowable	NA	NA		NA	NA	
8	Replace Air Pump Motors with Premium Efficiency Motors	ECM-8	Yes	NA	**NA**	Appeared To Already Be Complete	NA	NA		NA	NA	
9	Lighting Replacements / Upgrades	ECM-L1	No	ECM-8	No	Fixture Replacements Require New Controls	NA	NA		ECM-10	**Yes**	LED Tube Replacements Only
10	Install Lighting Controls (occupancy sensors)	ECM-L2	No	ECM-9	**Yes**	Based Upon Specific Interior Spaces As Noted	ECM-15	Yes	Based Upon Specific Interior Spaces As Noted	NA	**No**	Poor Application Uniformity
11	Lighting Replacements with Lighting Controls (Occupancy Sensors)	ECM-L3	Yes	ECM-10	Yes	Based Upon Specific Interior Spaces As Noted	ECM-16	Yes	Based Upon Specific Interior Spaces As Noted	N/A	**No**	Eliminated To Restore Positive Cash Flow After Utility Rate Decreases
12	Exterior Lighting Replacements with LED lighting	ECM-L4	Yes	ECM-11	Yes		ECM-17	Yes		ECM-11	Yes	

3.3 ECM Descriptions

Proposed ECMs are described in the sections below. Additional background, energy savings, and cost calculations can be found in the IGA reports in Appendix A of this report and "draft" ESP in the Third Party Review portion.

3.3.1 ECM-1 – High School / Satz School - DCV Controls for Multi-Purpose Rm., Cafeteria & Old Gym

The three (3) existing Air Handling Units (AHUs) that serve the Multi-Purpose Room, Cafeteria and Old Gym currently operate under a schedule based on the anticipated usage of the space. This is independent of the number of people using the space or even if the schedule happens to change for any reason. The AHUs provide the same amount of outside air regardless of the occupancy of the room. In many situations, excess ventilation air is heated, resulting in unnecessary energy usage.

A new Demand Control Ventilation (DCV) system will be implemented that varies the outside air dampers on the Air Handling Units (AHUs) to introduce only the required (minimal) amount of outside air to maintain a sufficient indoor air quality.

A Carbon Dioxide (CO2) sensor will be located in each space and will monitor the indoor air quality, controlling the operation of the damper in the respective AHU. When the space is unoccupied, the damper will be at a minimum position, reducing the heating load on the AHU's hot water coil and hence energy consumption.

Estimated Savings Calculation Protocol:

The savings of this retrofit have been estimated by comparing energy consumption of the air handlers in two operating modes: (a) using the existing construction, and (b) with the demand control ventilation controls installed. Savings were simulated over a full calendar year. The Trane Trace program was used for this analysis.

Maintenance:

The operation of the air handlers should be spot checked periodically to confirm that the demand control ventilation is still working as intended.

Recommendation:

This measure is recommended for implementation.

3.3.2 ECM-2 – High School / Satz School - Replace Existing Boilers with Condensing Boilers

Two (2) existing conventional gas boilers were installed in 1997 and remain in good condition. These boilers have typical thermal efficiencies of approximately 80%, losing significant heat to waste gases leaving the boiler. Installing two new condensing boilers increase the average thermal efficiency to approximately 92% by recapturing heat from condensed water that would otherwise be wasted in the form of moisture through the boiler stack. The new boilers will also include controls for outside air reset, which adjusts the hot water temperature based on outside air conditions.

This work will also include the installation of a new exhaust stack and controls for operation of the new boilers.

The overall increase in the efficiency of a new hot water condensing type boiler has been estimated to be approximately 15-percent (as an annualized average) relative to the current boilers. This efficiency gain is comprised of the following components:

- Reduction in standby losses due to improved insulation on newer boilers: two-percent
- Increase in burner combustion efficiency at variable load using outdoor air reset: 13-percent (the same increase in burner efficiency has been assumed at part load)
- Total: 15-percent efficiency gain

It is recommended that the construction be undertaken during the summer months. This will ensure that there is no need for hot water capacity as the school only needs cooling during that period. All domestic hot water production is achieved via a separate water heater.

It is also recommended that the existing zone valves be repaired or replaced entirely. The valve serving the original building has not been functioning as intended and would benefit from a new installation. The repaired / replaced valves would allow for the proper balancing and operation of the system.

Estimated Savings Calculation Protocol:

The savings of this retrofit have been estimated by comparing the operation of the existing boilers with that of a new installation using the higher efficiency and listed above. The Trane Trace program was used for this analysis.

Maintenance:

A maintenance contract should be considered with the boiler vendor to maintain and repair the boiler as needed. This should also include training for the school maintenance staff so they can become familiar with the operation of the condensing boiler in tandem with the existing cast iron boiler that is to remain as backup.

Recommendation:

This measure is recommended for implementation.

3.3.3 ECM-3 – High School / Satz School - Convert Electric Dishwasher Booster Heater To Gas

The main kitchen located near the cafeteria currently has a dedicated electric dishwasher booster heater with a capacity of 58.5 kW. This heater typically operates approximately 4 hours a day during the dishwashing cycle. Replacing the booster heater with an instantaneous gas-fired heater will reduce operating costs. Natural gas is less expensive to operate than electricity for a given heater size in this geographic location, despite having a higher thermal efficiency (100% for electric vs. 80% for natural gas).

Estimated Savings Calculation Protocol:

The savings of this retrofit have been estimated by an Excel spreadsheet. It is assumed that the same amount of heat is added to the water and the flow rate does not change. The fuel usage is annualized and multiplied by the calculated utility rates to determine annual cost.

Maintenance:

Check the operation of the water heaters to confirm that they are still working as intended.

Recommendation:

This measure is recommended for implementation.

3.3.4 ECM-4 - High School / Satz School – Lighting Replacements / Upgrades

The majority of the installed lighting throughout the facility is T8 or compact fluorescent lamps. While Light Emitting Diode (LED) lighting technology and efficiency have improved substantially in recent years, the costs associated with providing all new LED lighting fixtures is prohibitive based on the limited wattage reduction and corresponding limited utility bill savings.

Furthermore, current applicable Codes require the installation of lighting controls whenever 50% or more of the existing lighting is upgraded or replaced, thus adding additional costs to this ECM. Although additional savings would be realized by the installation of the required controls, those savings do not offset the material and installation costs associated with that effort in most spaces, and there would not be a consistent approach to the operation of the fixtures throughout the facility.

The middle ground for spaces that cannot meet a reasonable simple payback when considering new lighting fixtures and the associated Code-required controls is providing new LED tubes in the existing fluorescent lighting fixtures. This approach achieves energy savings, and since the existing fixture remains intact, does not trigger the Code requirement – and associated construction costs – for installing new lighting controls. In addition, the existing operation of the fixtures remains the same for users of the school.

Estimated Savings Calculation Protocol:

The estimated savings for this ECM was calculated as prescribed in the New Jersey Clean Energy Program's Protocols to Measure Resources Savings guide ("Guide"), dated March 2014. Operating hours (EFLH), coincidence factors (CF), and influence factors (IF) for each space were as defined in the Guide for nearly all spaces. Deviation from the Guide values are highlighted in the calculation tables and were made for the following reasons:

- Industry-standard lamping terminology and operating wattages were used in the calculations (not highlighted)
- There are no savings associated with the averaged 1960 EFLH since the corridor lighting is maintained on during school hours. Instead, the 1080 EFLH utilized in the calculations assumes the lighting is left on for six hours after student dismissal to provide illumination for cleaning.

Due to the good general maintenance program in place, only 20% (0.20 CF) of the corridors are assumed to be operating after hours.

- Stairwells have a CF of 1.00 (all lighting on during EFLH)
- EFLH reduced to 400 for storage rooms and other small, typically unoccupied spaces (based on survey, it is unreasonable to assume that lighting in these spaces is normally operated for the full EFLH listed in the Guide)

The calculations were performed in Microsoft Excel using custom-built tables.

Maintenance:

LED replacement tubes shall be spot checked periodically to confirm that they are still operating as intended.

Recommendation:

This measure is recommended for implementation in specific spaces as indicated in the calculation tables.

3.3.5 ECM-5 – High School / Satz School - Exterior Lighting Replacements with LED Lighting

The exterior lighting is HID technology, which as described in ECM-16 above, is recommended for replacement with LED technology.

Utilizing LED fixtures for the complete replacement of all parking lot and wall pack type lighting fixtures was evaluated. The new fixtures are proposed to be installed in a similar location as the existing. These installations fit well with the existing pole and wall pack layout and would provide uniform illumination across the parking lot area and at the building perimeter where currently illuminated. The actual measured footcandle values could be slightly lower than the current values, but the perceived illumination will be higher due to the nature of LED lighting.

The exterior lighting is presently controlled through time clocks. Due to the time that has elapsed since originally designed, current codes requirement the installation of control devices to comply with ASHRAE 90.1-2010.

The Lumenwave system by Echelon is a wireless mesh network with local photocells and optional occupancy sensors installed at each fixture. There is a software package that will replace the existing timeclock system(s).

This system will allow the reuse of the existing branch circuit power wiring to the fixtures, thus avoiding a large construction cost, while achieving compliance with applicable codes, and giving the HTBOE some flexibility in how they want the parking lot and building perimeter lighting to operate.

Estimated Savings Calculation Protocol:

The estimated savings for this ECM was calculated as prescribed in the New Jersey Clean Energy Program's Protocols to Measure Resources Savings guide ("Guide"), dated March 2014. Deviation from the Guide values are highlighted in the calculation tables and were made for the following reasons:

- Industry-standard lamping terminology and operating wattages were used in the calculations (not highlighted)
- Exterior lighting has a CF of 1.00 (all lighting on during EFLH), no IF (outside of the conditioned space), and EFLH increased to 4380 hours (assumed to operate for an average of 12 hours per day, 365 days per year for security purposes)
- Savings (SVG) associated with installing the Lumenwave controls was estimated to be 15% based on ASHRAE 90.1-2010 requirements to reduce light output by at least 30% between the hours of midnight and 6AM at minimum. These six hours daily represent half of the annual 4380 operating hours, so the code-mandated savings of 30% was corresponding reduced by half to 15%.

The calculations were performed in Microsoft Excel using custom-built tables.

Maintenance:

New LED fixtures and Lumenwave control devices should be spot checked periodically to confirm that they are still operating as intended. No routine maintenance is anticipated for the Lumenwave software.

3.3.6 ECM-6 – Indian Hill School - DCV Controls for Gymnasium & Cafeteria

The two (2) Rooftop Units (RTUs) that serve the Gymnasium and the Cafeteria currently operate under a schedule based on the anticipated usage of the space. This is independent of the number of people using the space or even if the schedule happens to change for any reason. The RTUs provide the same amount of outside air regardless of the occupancy of the room. In many situations, excess ventilation air is heated or cooled, resulting in unnecessary energy usage.

A new Demand Control Ventilation (DCV) system will be implemented that varies the outside air dampers on the Rooftop Units (RTUs) to introduce only the required (minimal) amount of outside air to maintain a sufficient indoor air quality.

A Carbon Dioxide (CO2) sensor will be located in each space and will monitor the indoor air quality, controlling the operation of the damper in the respective AHU. When the space is unoccupied, the damper will be at a minimum position, reducing the heating load on the AHU's hot water coil and hence energy consumption.

Estimated Savings Calculation Protocol:

The savings of this retrofit have been estimated by comparing energy consumption of the air handlers in two operating modes: (a) using the existing construction, and (b) with the demand control ventilation

controls installed. Savings were simulated over a full calendar year. The Trane Trace program was used for this analysis.

Maintenance:

The operation of the RTUs should be spot checked periodically to confirm that the demand control ventilation is still working as intended.

Recommendation:

This measure is recommended for implementation.

3.3.7 ECM-7 - Indian Hill School – Lighting Replacements / Upgrades

The majority of the installed lighting throughout the facility is T8 or compact fluorescent lamps. While Light Emitting Diode (LED) lighting technology and efficiency have improved substantially in recent years, the costs associated with providing all new LED lighting fixtures is prohibitive based on the limited wattage reduction and corresponding limited utility bill savings.

Furthermore, current applicable Codes require the installation of lighting controls whenever 50% or more of the existing lighting is upgraded or replaced, thus adding additional costs to this ECM. Although additional savings would be realized by the installation of the required controls, those savings do not offset the material and installation costs associated with that effort in most spaces, and there would not be a consistent approach to the operation of the fixtures throughout the facility.

The middle ground for spaces that cannot meet a reasonable simple payback when considering new lighting fixtures and the associated Code-required controls is providing new LED tubes in the existing fluorescent lighting fixtures. This approach achieves energy savings, and since the existing fixture remains intact, does not trigger the Code requirement – and associated construction costs – for installing new lighting controls. In addition, the existing operation of the fixtures remains the same for users of the school.

Estimated Savings Calculation Protocol:

The estimated savings for this ECM was calculated as prescribed in the New Jersey Clean Energy Program's Protocols to Measure Resources Savings guide ("Guide"), dated March 2014. Operating hours (EFLH), coincidence factors (CF), and influence factors (IF) for each space were as defined in the Guide for nearly all spaces. Deviation from the Guide values are highlighted in the calculation tables and were made for the following reasons:

- Industry-standard lamping terminology and operating wattages were used in the calculations (not highlighted)
- There are no savings associated with the averaged 1960 EFLH since the corridor lighting is maintained on during school hours. Instead, the 1080 EFLH utilized in the calculations assumes the lighting is left on for six hours after student dismissal to provide illumination for cleaning.

Due to the good general maintenance program in place, only 20% (0.20 CF) of the corridors are assumed to be operating after hours.

- Stairwells have a CF of 1.00 (all lighting on during EFLH)
- EFLH reduced to 400 for storage rooms and other small, typically unoccupied spaces (based on survey, it is unreasonable to assume that lighting in these spaces is normally operated for the full EFLH listed in the Guide)

The calculations were performed in Microsoft Excel using custom-built tables.

Maintenance:

LED replacement tubes shall be spot checked periodically to confirm that they are still operating as intended.

Recommendation:

This measure is recommended for implementation in specific spaces as indicated in the calculation tables.

3.3.8 ECM-8 – Indian Hill School - Exterior Lighting Replacements with LED Lighting

The exterior lighting is HID technology, which as described in ECM-11 above, is recommended for replacement with LED technology.

Utilizing LED fixtures for the complete replacement of all parking lot and wall pack type lighting fixtures was evaluated. The new fixtures are proposed to be installed in a similar location as the existing. These installations fit well with the existing pole and wall pack layout and would provide uniform illumination across the parking lot area and at the building perimeter where currently illuminated. The actual measured footcandle values could be slightly lower than the current values, but the perceived illumination will be higher due to the nature of LED lighting.

The exterior lighting is presently controlled through time clocks. Due to the time that has elapsed since originally designed, current codes requirement the installation of control devices to comply with ASHRAE 90.1-2010.

The Lumenwave system by Echelon is a wireless mesh network with local photocells and optional occupancy sensors installed at each fixture. There is a software package that will replace the existing timeclock system(s).

This system will allow the reuse of the existing branch circuit power wiring to the fixtures, thus avoiding a large construction cost, while achieving compliance with applicable codes, and giving the HTBOE some flexibility in how they want the parking lot and building perimeter lighting to operate.

Estimated Savings Calculation Protocol:

The estimated savings for this ECM was calculated as prescribed in the New Jersey Clean Energy Program's Protocols to Measure Resources Savings guide ("Guide"), dated March 2014. Deviation from the Guide values are highlighted in the calculation tables and were made for the following reasons:

- Industry-standard lamping terminology and operating wattages were used in the calculations (not highlighted)
- Exterior lighting has a CF of 1.00 (all lighting on during EFLH), no IF (outside of the conditioned space), and EFLH increased to 4380 hours (assumed to operate for an average of 12 hours per day, 365 days per year for security purposes)
- Savings (SVG) associated with installing the Lumenwave controls was estimated to be 15% based on ASHRAE 90.1-2010 requirements to reduce light output by at least 30% between the hours of midnight and 6AM at minimum. These six hours daily represent half of the annual 4380 operating hours, so the code-mandated savings of 30% was corresponding reduced by half to 15%.

The calculations were performed in Microsoft Excel using custom-built tables.

Maintenance:

New LED fixtures and Lumenwave control devices should be spot checked periodically to confirm that they are still operating as intended. No routine maintenance is anticipated for the Lumenwave software.

3.3.9 ECM-9 – Village School - DCV Controls for Multi-Purpose Room & Old Gym

The AHUs serving the Multi-purpose Room and Old Gymnasium provide the same amount of outside air regardless of the occupancy of the room. In many situations, excess ventilation air is heated, resulting in unnecessary energy usage.

The two (2) existing Air Handling Units (AHUs) that serve the Multi-Purpose Room and Old Gymnasium currently operate under a schedule based on the anticipated usage of the space. This is independent of the number of people using the space or even if the schedule happens to change for any reason. The AHUs provide the same amount of outside air regardless of the occupancy of the room. In many situations, excess ventilation air is heated, resulting in unnecessary energy usage.

A new Demand Control Ventilation (DCV) system will be implemented that varies the outside air dampers on the Air Handling Units (AHUs) to introduce only the required (minimal) amount of outside air to maintain a sufficient indoor air quality.

A Carbon Dioxide (CO2) sensor will be located in each space and will monitor the indoor air quality, controlling the operation of the damper in the respective AHU. When the space is unoccupied, the damper will be at a minimum position, reducing the heating load on the AHU's hot water coil and hence energy consumption.

Estimated Savings Calculation Protocol:

The savings of this retrofit have been estimated by comparing energy consumption of the air handlers in two operating modes: (a) using the existing construction, and (b) with the demand control ventilation controls installed. Savings were simulated over a full calendar year. The Trane Trace program was used for this analysis.

Maintenance:

The operation of the AHUs should be spot checked periodically to confirm that the demand control ventilation is still working as intended.

Recommendation:

This measure is recommended for implementation.

3.3.10 ECM-10 - Village School – Lighting Upgrades

The majority of the installed lighting throughout the facility is T8 or compact fluorescent lamps. While Light Emitting Diode (LED) lighting technology and efficiency have improved substantially in recent years, the costs associated with providing all new LED lighting fixtures is prohibitive based on the limited wattage reduction and corresponding limited utility bill savings.

Furthermore, current applicable Codes require the installation of lighting controls whenever 50% or more of the existing lighting is upgraded or replaced, thus adding additional costs to this ECM. Although additional savings would be realized by the installation of the required controls, those savings do not offset the material and installation costs associated with that effort in most spaces, and there would not be a consistent approach to the operation of the fixtures throughout the facility.

The middle ground for spaces that cannot meet a reasonable simple payback when considering new lighting fixtures and the associated Code-required controls is providing new LED tubes in the existing fluorescent lighting fixtures. This approach achieves energy savings, and since the existing fixture remains intact, does not trigger the Code requirement – and associated construction costs – for installing new lighting controls. In addition, the existing operation of the fixtures remains the same for users of the school.

Estimated Savings Calculation Protocol:

The estimated savings for this ECM was calculated as prescribed in the New Jersey Clean Energy Program's Protocols to Measure Resources Savings guide ("Guide"), dated March 2014. Operating hours (EFLH), coincidence factors (CF), and influence factors (IF) for each space were as defined in the Guide for nearly all spaces. Deviation from the Guide values are highlighted in the calculation tables and were made for the following reasons:

- Industry-standard lamping terminology and operating wattages were used in the calculations (not highlighted)

- There are no savings associated with the averaged 1960 EFLH since the corridor lighting is maintained on during school hours. Instead, the 1080 EFLH utilized in the calculations assumes the lighting is left on for six hours after student dismissal to provide illumination for cleaning. Due to the good general maintenance program in place, only 20% (0.20 CF) of the corridors are assumed to be operating after hours.

- Stairwells have a CF of 1.00 (all lighting on during EFLH)

- EFLH reduced to 400 for storage rooms and other small, typically unoccupied spaces (based on survey, it is unreasonable to assume that lighting in these spaces is normally operated for the full EFLH listed in the Guide)

The calculations were performed in Microsoft Excel using custom-built tables.

Maintenance:

LED replacement tubes shall be spot checked periodically to confirm that they are still operating as intended.

Recommendation:

This measure is recommended for implementation in specific spaces as indicated in the calculation tables.

3.3.11 ECM-11 – Village School - Exterior Lighting Replacements with LED Lighting

The exterior lighting is HID technology, which as described in ECM-16 above, is recommended for replacement with LED technology.

Utilizing LED fixtures for the complete replacement of all parking lot and wall pack type lighting fixtures was evaluated. The new fixtures are proposed to be installed in a similar location as the existing. These installations fit well with the existing pole and wall pack layout and would provide uniform illumination across the parking lot area and at the building perimeter where currently illuminated. The actual measured footcandle values could be slightly lower than the current values, but the perceived illumination will be higher due to the nature of LED lighting.

The exterior lighting is presently controlled through time clocks. Due to the time that has elapsed since originally designed, current codes requirement the installation of control devices to comply with ASHRAE 90.1-2010.

The Lumenwave system by Echelon is a wireless mesh network with local photocells and optional occupancy sensors installed at each fixture. There is a software package that will replace the existing timeclock system(s).

This system will allow the reuse of the existing branch circuit power wiring to the fixtures, thus avoiding a large construction cost, while achieving compliance with applicable codes, and giving the HTBOE some flexibility in how they want the parking lot and building perimeter lighting to operate.

Estimated Savings Calculation Protocol:

The estimated savings for this ECM was calculated as prescribed in the New Jersey Clean Energy Program's Protocols to Measure Resources Savings guide ("Guide"), dated March 2014. Deviation from the Guide values are highlighted in the calculation tables and were made for the following reasons:

- Industry-standard lamping terminology and operating wattages were used in the calculations (not highlighted)
- Exterior lighting has a CF of 1.00 (all lighting on during EFLH), no IF (outside of the conditioned space), and EFLH increased to 4380 hours (assumed to operate for an average of 12 hours per day, 365 days per year for security purposes)
- Savings (SVG) associated with installing the Lumenwave controls was estimated to be 15% based on ASHRAE 90.1-2010 requirements to reduce light output by at least 30% between the hours of midnight and 6AM at minimum. These six hours daily represent half of the annual 4380 operating hours, so the code-mandated savings of 30% was corresponding reduced by half to 15%.

The calculations were performed in Microsoft Excel using custom-built tables.

Maintenance:

New LED fixtures and Lumenwave control devices should be spot checked periodically to confirm that they are still operating as intended. No routine maintenance is anticipated for the Lumenwave software.

Recommendation:

This ECM is recommended for all exterior HID lighting.

3.4 ECM Costs and Savings

HOLMDEL TOWNSHIP BOARD OF EDUCATION - ENERGY SAVINGS IMPROVEMENT PROGRAM									
ECM SUMMARY FORM - Proposed Preliminary Energy Savings Plan: ECM Base Project									
ECM #	School / Facility	ECM Description	Estimated Installed Hard Costs (w/ 10% Contingency)	Estimated Incentives From P4P	Estimated Incentives From SmartStart	Estimated Annual Energy Savings (Elec)	Estimated Annual Energy Savings (Gas)	Estimated Annual Energy Savings (Total)	Estimated Simple Payback (Years)
ECM-1	Holmdel High School / Satz Middle School	Demand Control Ventilation (High School Auditorium, Cafeteria and Old Gym)	$15,840	Awarded At Project Level	N/A	($1,545)	$16,747	$15,202	1.0
ECM-2	Holmdel High School / Satz Middle School	Replace Existing Boilers with Condensing Boilers	$210,925		N/A	$0	$9,811	$9,811	21.5
ECM-3	Holmdel High School / Satz Middle School	Convert Electric Dishwasher Booster Heater to Natural Gas	$15,378		N/A	$3,773	($1,440)	$2,334	6.6
ECM-4	Holmdel High School / Satz Middle School	Lighting Replacement / Upgrades	$229,977		N/A	$41,445	$0	$41,445	5.5
ECM-5	Holmdel High School / Satz Middle School	Exterior Lighting Replacements with LED lighting	$235,202		N/A	$19,164	$0	$19,164	12.3
ECM-6	Indian Hill School	Demand Control Ventilation (Caf / Gym)	$13,860	N/A	$0	$53	$1,168	$1,221	11.4
ECM-7	Indian Hill School	Lighting Replacement / Upgrades	$96,420	N/A	$18,915	$8,880	$0	$8,880	10.9
ECM-8	Indian Hill School	Exterior Lighting Replacements with LED lighting	$36,982	N/A	$2,000	$2,133	$0	$2,133	17.3
ECM-9	Village School	Demand Control Ventilation (Multipurpose room and old gym)	$6,380	N/A	$0	$505	$4,926	$5,431	1.2
ECM-10	Village School	Lighting Replacement / Upgrades	$120,439	N/A	$22,590	$17,072	$0	$17,072	7.1
ECM-11	Village School	Exterior Lighting Replacements with LED lighting	$132,836	N/A	$9,600	$6,775	$0	$6,775	19.6
		Project Summary Totals:	$1,114,239	$173,206	$53,105	$98,254	$31,213	$129,467	7.3 (AVG)

SECTION 4: FINANCIAL ANALYSIS

4.1 Overview

A financial analysis of the proposed ESP was completed in order to determine which ECMs to include in the plan and the resultant cash flow. This financial investigation is based on the premise that the annual monetary savings from the implemented ECMs offset the costs of the work associated with the installation of new equipment and control scenarios.

According to the adopted law, an ESIP may be financed through a lease-purchase agreement or through the issuance of energy savings obligations. The cost of energy savings obligations can be included as part of the HTBOE's utility budget, as the implementation costs must offset the baseline energy costs. Additionally, projects funded under an ESIP program require the New Jersey Department of Education's "Other Capital" project approval.

The baseline financial analysis was performed in accordance with the protocols of the NJ BPU. This includes a financing period of fifteen (15) years and utility escalation of 2.2% for electric rate and 2.4% for natural gas rate. However, per conversations with the NJ BPU, the interest rate used for the fifteen (15) year loan is 4.00% as this is both a realistically achievable rate based on current market trends and the HTBOE credit rating, and is the highest rate the ESP can obtain while still being cash positive.

The interest rate and overall financial analysis will require revision after actual financing terms are in place in order to present an accurate projection of cash flow.

The analysis also was performed in agreement with the Pay for Performance (P4P) Program. The P4P Guidelines Version 4.1 state that ESPs are separate and distinct deliverables from those of the P4P Program.

Table 4.2.5 below is the cash flow summary for the proposed ESP.

4.2 Definition of Terms

4.2.1 Pay For Performance Program

The New Jersey Office of Clean Energy offers incentives that can be applied to all schools in this ESP. The greatest value in incentives can be achieved through the New Jersey Pay for Performance (P4P) Program. The P4P program is designed for qualified energy conservation projects applied to facilities whose demand in any of the preceding 12 months exceeds 200 kW.

Facilities that meet this criterion must also achieve a minimum performance target of 15-percent energy reduction by using the EPA Portfolio Manager benchmarking tool before and after implementation of the measures. If the participant is a customer of regulated New Jersey Utilities for both electric and gas, both electric and gas incentives will be available under the P4P Program.

Since all schools in the district utilize a portion of electric power from solar panels from a provider that is not an investor-owned electric New Jersey Utility as identified by the P4P Program, only gas measures were thought to be eligible for incentives during the IGA process. After further review all schools were determined to be eligible to receive P4P incentives for both electric and natural gas saving measures, provided that they meet the total energy savings criterion. This conclusion was based on the fact that the HTBOE pays Societal Benefits Charges to both JCP&L and NJNG.

The Holmdel High School / Satz Middle School facility is eligible for P4P incentives, as the proposed ECMs yield electric and natural gas consumption savings greater than 15-percent. The Indian Hill Elementary and Village Elementary Schools are below the 15-percent electric and natural gas consumption minimum savings for the program, and therefore are ineligible for P4P incentive programs. They are eligible however to pursue Smart Start incentives. P4P calculations for the schools can be found in Appendix B of this document.

Incentive #1: Energy Reduction Plan

This incentive is designed to offset the cost of services associated with the development of the Energy Reduction Plan.

- Incentive Amount: $0.05 per square foot
- Minimum Incentive: $2,500
- Maximum Incentive: $25,000 or 50-percent of Facility annual energy cost

The standard incentive pays $0.10 per square foot, up to a maximum of $50,000, not to exceed 50-percent of facility annual energy cost, paid after approval for application. For building audits funded by the New Jersey Board of Public Utilities Local Government Energy Audit, which receive an initial 75-percent incentive toward performance of the energy audit, facilities are only eligible for an additional $0.05 per square foot, up to a maximum of $25,000, rather than the standard incentive.

Incentive #2: Installation of Recommended Measures

This incentive is based on projected energy savings as determined in Incentive #1 (Minimum 15-percent savings must be achieved), and is paid upon successful installation of recommended measures.

Electric

- Base incentive based on 15-percent savings: $0.09 per projected kWh saved
- For each percentage point over 15-percent add: $0.005 per projected kWh saved
- Maximum incentive: $0.11 per projected kWh saved

Gas

- Base incentive based on 15-percent savings: $0.90 per projected therm saved
- For each percentage point over 15-percent add: $0.05 per projected therm saved
- Maximum incentive: $1.25 per projected therm saved

Incentive cap: 25-percent of total project cost

Incentive #3: Post-Construction Benchmarking Report

This incentive is paid after accepting of a report proving energy savings over one year utilizing the Environmental Protection Agency (EPA) Portfolio Manager benchmarking tool.

Electric

- Base incentive based on 15-percent savings: $0.09 per projected kWhr saved
- For each percentage point over 15-percent add: $0.005 per projected kWhr saved
- Maximum incentive: $0.11 per projected kWhr saved

Gas

- Base incentive based on 15-percent savings: $0.90 per projected therm saved
- For each percentage point over 15-percent add: $0.05 per projected therm saved
- Maximum incentive: $1.25 per projected therm saved

4.2.2 New Jersey Smart Start

For this program, specific incentives for energy conservation measures are calculated on an individual basis utilizing the New Jersey Smart Start incentive program. This program provides incentives dependent upon specific pieces of mechanical and electrical equipment.

If a facility qualifies and enters into the New Jersey P4P, all energy savings will be included in the total site energy reduction and savings will be applied towards the P4P incentive. A project is not applicable for both New Jersey incentive programs.

The Indian Hill Elementary School and the Village Elementary School are eligible for several lighting incentives available under New Jersey Smart Start programs:

- Interior LED linear replacement lamps (2' & 4' only): $5 per lamp
- Interior LED high bay fixture replacements: $150 per fixture
- Exterior LED wallpack fixture replacements: $100 per fixture
- Exterior LED pole-arm fixture replacements: $100 per fixture

4.2.3 Direct Install Program

The Direct Install program targets small to medium sized facilities where the peak electrical demand does not exceed 150kW in any of the previous 12 months. Buildings must be located in New Jersey and served by one of the state's public, regulated electric or natural gas utility companies. On a case-by-case basis, the program manager may accept a project for a customer that is within ten-percent of the 150kW peak demand threshold.

Direct Install is funded through New Jersey's Clean Energy Program and is designed to provide capital for building energy upgrade projects to fast track implementation. The program will pay up to 70-percent of the costs for lighting, HVAC, motors, natural gas, refrigeration and other equipment upgrades with higher efficiency alternatives. If a building is eligible for this funding, the Direct Install Program can significantly reduce the implementation cost of energy conservation projects.

The program pays 70-percent of each project cost up to $75,000 per electrical utility account. Total funding for each year is capped at $250,000 per customer. Installations must be completed by a Direct Install participating contractor, a list can be found on the New Jersey Clean Energy website at www.njcleanenergy.com. Contractors will coordinate with the applicant to arrange installation of recommended measures identified in a previous energy assessment, such as this document.

None of the schools are eligible to receive funding from the Direct Install Program due to the peak demand rising above the 150kW upper limit throughout.

4.2.4 Estimated Total Project Cost

The project cost is based upon a number of factors including but not limited to:

- Vendor equipment quotes
- Prior engineering project experience
- RS Means cost data
- Architect's direction (Soft Cost value)

The soft costs are intended to cover ECM A / E fees, an estimating contingency, public bidding costs, bond counsel, etc. These estimated costs should be verified during the design phase to ensure the accuracy of the ESP due to elapsed time and other exterior influences and conditions.

HOLMDEL TOWNSHIP BOARD OF EDUCATION - ENERGY SAVINGS IMPROVEMENT PROGRAM		
PROPOSED CONSTRUCTION FEES		
Fee Category	**Fees Dollar ($) Value**	**Percentage of Hard Costs**
Estimated Value of Hard Costs (Pre-incentives)	$1,114,239	100.0%
Soft Costs (A/E fees, bond counsel, etc.)	$334,272	30.0%
Total Project Costs (Pre-Incentives)	**$1,448,511**	

4.2.5 Estimated Cash Flow Summary

HOLMDEL TOWNSHIP BOARD OF EDUCATION - ENERGY SAVINGS IMPROVEMENT PROGRAM

PRELIMINARY ESTIMATE - ANNUAL CASH FLOW ANALYSIS FORM

Number of ECMs: 11

Total Project Costs: $1,448,511
Electric Savings: $98,254
Natural Gas Savings: $31,239
Net Utility Savings: $129,493
NJCEP Incentives (One Time): $226,337

Interest Rate: 4.00%
Electric Annual Escalation Rate: 2.20%
Natural Gas Annual Escalation Rate: 2.40%
Percent Financed: 100%
Discount Rate: 8.00%

Term Years	Additional Cash Outlay	Energy Savings (Elec. & Gas)	Maintenance Savings	NJCEP Incentive	Total Savings	Interest Expense	Loan Principal	Total Payments	Net Cash Flow	Cumulative Cash Flow
0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
1	$0	$129,493	$0	$226,337	$355,830	($57,940)	($72,340)	($130,281)	$225,549	$225,549
2	$0	$132,538	$0	$0	$132,538	($55,047)	($75,234)	($130,281)	$2,258	$227,807
3	$0	$135,655	$0	$0	$135,655	($52,037)	($78,243)	($130,281)	$5,375	$233,182
4	$0	$138,846	$0	$0	$138,846	($48,908)	($81,373)	($130,281)	$8,565	$241,747
5	$0	$142,111	$0	$0	$142,111	($45,653)	($84,628)	($130,281)	$11,831	$253,577
6	$0	$145,454	$0	$0	$145,454	($42,268)	($88,013)	($130,281)	$15,173	$268,751
7	$0	$148,875	$0	$0	$148,875	($38,747)	($91,533)	($130,281)	$18,594	$287,345
8	$0	$152,377	$0	$0	$152,377	($35,086)	($95,195)	($130,281)	$22,096	$309,441
9	$0	$155,961	$0	$0	$155,961	($31,278)	($99,003)	($130,281)	$25,681	$335,122
10	$0	$159,630	$0	$0	$159,630	($27,318)	($102,963)	($130,281)	$29,349	$364,471
11	$0	$163,385	$0	$0	$163,385	($23,199)	($107,081)	($130,281)	$33,104	$397,576
12	$0	$167,229	$0	$0	$167,229	($18,916)	($111,364)	($130,281)	$36,948	$434,523
13	$0	$171,163	$0	$0	$171,163	($14,462)	($115,819)	($130,281)	$40,882	$475,406
14	$0	$175,190	$0	$0	$175,190	($9,829)	($120,452)	($130,281)	$44,909	$520,314
15	$0	$179,311	$0	$0	$179,311	($5,011)	($125,270)	($130,281)	$49,031	$569,345
	$0	$2,297,218	$0	$226,337	$2,523,555	($505,699)	($1,448,511)	($1,954,210)	$569,345	Totals

4.2.6 Lease-Purchase Agreement

One option for financing an Energy Savings Improvement Program is through a lease-purchase agreement pursuant to BPU guidelines. A lease-purchase agreement is an agreement between a contracting unit, in this case, the HTBOE, and an energy services company (ESCO) or other public or private entity. Under the agreement, the ESCO or other entity owns the energy savings equipment or improved facilities until all lease payments have been made. The maximum term of a lease-purchase agreement is fifteen (15) years, except in the case of cogeneration equipment, in which the term can be up to twenty (20) years.

4.2.7 Energy Savings Obligations

Another option for financing an ESP is to issue refunding bonds as a general obligation, backed with the faith and credit of the Board of Education to finance the plan. Energy savings obligations may be funded through appropriations for utility services in the annual budget of the contracting unit and may be issued as refunding bonds pursuant to N.J.S.40A:2-52 et seq., including the issuance of bond anticipation notes as may be necessary, provided that all such bonds and notes mature within the periods authorized for such energy savings obligations. Energy savings obligations may be issued either through the contracting unit or another public agency authorized to undertake financing on behalf of the unit.

In either case of lease-purchase agreement or energy savings obligations, the vehicles to finance debt cannot be used to cover maintenance, guarantees, or verification of guarantees of ECMs.

Holmdel Board Of Education ESIP

FORM V

ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP):
ESCOs PROPOSED FINAL PROJECT COST FORM FOR BASE CASE PROJECT
Holmdel Board Of Education
ENERGY SAVING IMPROVEMENT PROGRAM

Engineer Name: DLB Associates

PROPOSED CONSTRUCTION FEES

Fee Category	Fees (1) Dollar ($) Value	Percentage of Hard Costs
Estimated Value of Hard Costs (2):	$ 1,114,239	
Project Service Fees		
Legal/bond/financial fees/3rd party verification	$ 22,284	2.0%
Investment Grade Energy Audit	$ 95,000	8.5%
Design Engineering Fees	$ 105,852	9.5%
Construction Management & Project Administration	$ 72,425	6.5%
System Commissioning (M&V)	$ 38,711	3.5%
ESCO Overhead	N/A	
ESCO Profit	N/A	
Project Service Fees Sub Total	$ 334,272	30.0%
TOTAL FINANCED PROJECT COSTS:	$ 1, 448,511	

PROPOSED ANNUAL SERVICE FEES

First Year Annual Service Fees	Fees (1) Dollar ($) Value	Percentage of Hard Costs
SAVINGS GUARANTEE (*OPTION*)	N/A	N/A
Measurement and Verification (*Associated w/ Savings Guarantee Option*)	N/A	N/A
ENERGY STAR™ Services (*optional*)	0	
Post Construction Services *(If applicable)*	0	
Performance Monitoring	w/ Cx	
On-going Training Services	w / Cx	
Verification Reports	w/ Cx	
TOTAL FIRST YEAR ANNUAL SERVICES	0	

NOTES:
(1) Fees should include all mark-ups, overhead, and profit. Figures stated as a range will NOT be accepted.
(2) The total value of Hard Costs is defined in accordance with standard AIA definitions that include: Labor Costs, Subcontractor Costs, Cost of Materials and Equipment, Temporary Facilities and Related Items, and Miscellaneous Costs such as Permits, Bonds Taxes, Insurance, Mark-ups, Overhead and Profit, etc.

ESCO's proposed interest rate at the time of submission: 5% TO BE USED BY ALL RESPONDING ESCOs FOR PROPOSAL PURPOSES

SECTION 5: GREENHOUSE GAS REDUCTIONS

5.1 Overview

To illustrate the environmental benefit of implementing the recommended ECMs, in addition to complying with the requirements of Public Finance Notice LFN 2009-11, greenhouse gas emission reductions were calculated for the HTBOE's review.

The carbon dioxide (CO_2) emissions product reduction was analyzed using the factors developed by the New Jersey Department of Environmental Protection and published in the March 2014 New Jersey Clean Energy Program's Protocols to Measure Resource Savings document for both electric and gas. The factors used for the analysis and the potential reductions are tabulated below.

The total amount of CO_2 produced after the recommended ECMs have been implemented is ***1,199,417*** pounds annually, which is a nearly ***18%*** reduction from the modeled baseline.

EMISSIONS PRODUCT REDUCTION FACTORS	
Energy Type	**Emission Factor**
Electricity	1,111.79 lbs. per MWh saved
Gas	11.7 lbs. per therm saved

EMISSIONS PRODUCT REDUCTIONS FOR ENERGY SAVINGS PLAN							
ECM Number	**Facility**	**Description**	**Electric Savings** (kWh)	**Electric Savings** (lbs.)	**Gas Savings** (Therms)	**Gas Savings** (lbs.)	**Total Savings** (lbs.)
ECM-1	Holmdel High School / Satz School	Demand Control Ventilation (High School Auditorium, Cafeteria and Old Gym)	(12,076)	(13,426)	14,634	171,218	157,792
ECM-2	Holmdel High School / Satz School	Replace Existing Boilers with Condensing Boilers	0	0	8,573	100,304	100,304
ECM-3	Holmdel High School / Satz School	Convert Electric Dishwasher Booster Heater to Natural Gas	29,484	32,780	(1,258)	(14,717)	18,063
ECM-4	Holmdel High School / Satz School	Lighting Replacement / Upgrades	323,791	359,988	0	0	359,988
ECM-5	Holmdel High School / Satz School	Exterior Lighting Replacements with LED lighting	149,715	166,452	0	0	166,452
ECM-6	Indian Hill School	Demand Control Ventilation (Caf / Gym)	1,232	1,370	1,008	11,794	13,163
ECM-7	Indian Hill School	Lighting Replacement / Upgrades	100,448	111,677	0	0	111,677
ECM-8	Indian Hill School	Exterior Lighting Replacements with LED lighting	24,129	26,827	0	0	26,827
ECM-9	Village School	Demand Control Ventilation (Multipurpose room and old gym)	3,647	4,055	4,245	49,667	53,721
ECM-10	Village School	Lighting Replacement / Upgrades	123,263	137,042	0	0	137,042
ECM-11	Village School	Exterior Lighting Replacements with LED lighting	48,919	54,388	0	0	54,388
Totals			792,552	881,152	27,202	318,265	**1,199,417**

SECTION 6: PROJECT RISKS

6.1 Design and Compliance

This ESP has been created under the direction of licensed professional engineers on staff at DLB Associates to enhance successful negotiation of any risks in enacting ECMs that modify existing mechanical, electrical, and plumbing systems. This approach helps to verify that the proposed ECMs comply with all applicable New Jersey state codes and laws, along with engineering design and energy efficiency best practices.

The proposed ECMs will be further tested during the design phase where the full impact of construction materials and methods at a given time will be evaluated.

All ECMs have been analyzed to ensure compliance with minimum and maximum heating and cooling set points, ventilation requirements, lighting level necessities, among other applicable design criteria. All materials to be removed will be disposed of in accordance with state regulations.

6.2 Maintenance Impacts

The HTBOE Facilities personnel will be required to perform preventative maintenance on all proposed equipment installations and upgrades to ensure correct operation and to reach expected equipment life. The ECMs contained within this "final" ESP version will have minimal impact upon the staff's current maintenance practices and most likely will help to reduce overall maintenance efforts.

Many of the proposed ECMs call to replace existing equipment that are nearing the end of their useful lives and would require emergency maintenance to repair or replace upon failure. Several lighting ECMs within the plan specify the installation of LED lamps, which have a much longer lifespan than fluorescent lamps and will require less frequent replacement over time.

The existing boilers at the Holmdel High / Satz Middle School complex are being proposed for replacement with condensing boilers, similar to the existing condensing boilers installed at the Village Elementary School. The new equipment will operate similarly to the existing, so limited additional training for maintenance staff will be required.

System control schemes across the four schools will be modified to gain the benefits of variable speed control on pumps and fans and variable ventilation airflow in spaces with older air handling units and large fluctuations in occupancy. These updates will introduce a maintenance learning curve to understand how to work with the revised operation of the components and controls. Overall, however, maintenance labor is expected to remain the same.

6.3 Project Risks

While all projects contain unforeseen elements, DLB Associates has assessed potential risks involved with the implementation of the proposed "final" ESP version and does not foresee any major or extraordinary issues with the scope of the recommended ECMs. The proposed project(s) scope will include the installation of new equipment to replace existing systems at the end of their useful lives, which will help the HTBOE to avoid replacing the equipment during a failure / emergency event. The future design and construction phases will be critical to the success of the overall project(s).

Calculations for each ECM were performed in accordance with the Board of Public Utilities protocols to ensure that the proposed energy savings are realized after installation. Existing temperature set points, ventilation airflow, and lighting levels at the facilities either will be maintained or improved. No adverse impacts are anticipated with the scope of work.

Risks to the financial performance include a potentially higher interest rate, failure to receive proposed incentives and unforeseen field conditions during the design and construction process.

SECTION 7: PJM DEMAND RESPONSE & CURTAILABLE SERVICE PROGRAMS

7.1 Overview

The Pennsylvania-New Jersey-Maryland Interconnection (PJM) is a regional transmission organization (RTO) that coordinates the movement of wholesale electricity in all or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and the District of Columbia, with a total area served of 243,417 square miles. Based on PJM's 2014 Annual Report, the generating capacity of the PJM territory is 183,604 megawatts (MW), while the peak demand of the areas served is noted as 165,492 MW.

PJM offers various, voluntary demand response programs to curtail load at times when demand is high and the cost of energy is high for retail electricity consumers on the grid. Demand response participation can be classified as either Economic or Emergency, and a consumer can participate in one or both, through a Curtailment Service Provider (CSP).

A CSP helps determine which demand response programs are available for the electricity customer and the needed equipment and systems to benefit from participation. A CSP also can outline the specific requirements of the number of load reduction events to participate in, the degree of the load reduction, and the response time of the load reduction of all available programs. A list of CSPs who participate in the demand response program are available on the PJM website.

Examples of load reduction strategies include increasing temperature set points during cooling season, implementing energy-efficiency measures, or utilizing backup generators during peak load to draw less electricity from the grid for building operations. Load reductions that are part of normal operations, for example, closing a school for a holiday, do not count toward demand response load reduction.

Revenue earned for a load reduction commitment during a specified emergency demand time or high wholesale price period is paid based on the relevant PJM Reliability Pricing Model (RPM) price and the load reduction commitment of the electricity consumer. Payments are negotiated between the CSP and the consumer. Overall, committing to demand response helps lower electricity bills, ensure grid reliability, and avoid disruption of electricity service for other electricity customers, while providing revenue for the consumer.

Demand Response works by helping power grid operators accommodate spikes in usage, such as those that occur on hot summer days. It involves curtailing the use of electricity instead of boosting generation. Simply put, customers offer to reduce their consumption of electricity--during certain times--in return for being paid the market value of the electricity they don't consume.

Schools may participate in PJM's demand response programs. Interval metering is required. If an interval meter is not already installed by the utility, the CSP may install their own interval meter at the facility provided it meets metering requirements set forth by PJM.

One example of a Demand Response resource can be found in our local schools. More of our schools have installed air conditioners, controlled by automated systems. These systems can be easily switched off for a period of 15 to 30 minutes during the summer peak season while schools are not in session. By enrolling in the Demand Response program and agreeing to reduce the air conditioning loads when the grid needs it - typically for 15 minutes, each facility can earn $5,000 per year or more depending on its size.

Payments from the grid operator can be as high as $100,000 per megawatt of load reduction per year and are paid whether or not an emergency event is called. These moneys could be earmarked for energy efficiency projects, which would create further savings and environmental benefits.

SECTION 8: MAINTENANCE PLAN & REQUIREMENTS

8.1 Overview

DLB Associates recommends performing routine maintenance on all existing and new systems at the school facilities to ensure proposed energy savings are realized through the installed ECMs. Otherwise, a lack of proper system operation, adequate personnel training, and equipment maintenance can contribute to energy waste and early equipment deterioration. Regular maintenance is suggested for all mechanical systems and control equipment.

The maintenance plan and requirements section below discusses suggested maintenance measures associated with the scope of each ECM.

8.2 Assumptions

The HTBOE Facilities Department is assumed to be responsible for providing ongoing maintenance through the measurement and verification term. The design and construction team designers, suppliers and installers will be required to review operational procedures, schedules, and manufacturers' requirements for new and modified equipment as necessary to provide guidance and training on maintenance practices. The HTBOE Facilities personnel currently perform all required existing maintenance to a very satisfactory level.

8.3 Maintenance Plan Recommendations

Outlined below are recommended maintenance procedures for equipment involved with the suggested ECMs. This list is not comprehensive, but outlines some basic suggested practices.

8.3.1 Boilers

8.3.1.1 Pre-season Inspection

a) Inspect fireside of boiler and record condition.
b) Brush and vacuum soot and dirt from flues and combustion chamber.
c) Inspect flue of condensing boilers to ensure no degradation.
d) Inspect refractory for defects.
e) Visually inspect boiler pressure vessel for possible leaks and record condition.
f) Disassemble, inspect, and clean low-water cutoff.
g) Check valves and automatic feed equipment. Repack and adjust as needed.
h) Inspect, clean, and lubricate the burner and combustion control equipment.
i) Reassemble boiler.
j) Check burner sequence of operation and combustion air equipment.
k) Check fuel piping for leaks and proper support.
l) Address any manufacturer recommendations prior to start-up.
m) Check auxiliary equipment operation.

8.3.1.2 Seasonal Start-up

a) Inspect burner, boiler, and controls prior to start-up.

b) Start burner and check operating controls.

c) Test safety controls and pressure relief valve.

d) Perform combustion analysis.

e) Make any required controls modifications and log operating conditions.

f) Review operating procedures and operation log with boiler operator.

8.3.1.3 Mid-season Inspection

a) Review operation log and check system operation.

b) Perform combustion analysis.

c) Make any required controls modifications and log operating conditions.

d) Review operating procedures and operation log with boiler operator.

8.3.1.4 Seasonal Shut-down

a) Shut down boilers and verify position of valves.

b) Review operation log and note any required repairs.

8.3.2 Air Handling Units

8.3.2.1 General Maintenance Guidelines

a) Verify proper operation of all dampers. Have operator send a control signal to open and close all dampers and visually confirm they are fully modulating. Repair any actuators or dampers that are not functioning correctly.

b) Check all heating and cooling valves for proper operation.

c) Check the condition of heating and cooling coils and air handling unit filters. Visually inspect the components and change out the filters and clean the coils if needed.

SECTION 9: MEASUREMENT & VERIFICATION

9.1 Introduction

The New Jersey legislation refers to the use of the International Performance Measurement and Verification Protocol (MVP):

"P.L.2012, CHAPTER 55, approved September 19, 2012

Assembly Committee Substitute for Assembly, Nos. 2313 and 2564

AN ACT concerning energy savings improvement programs, amending various parts of the statutory law, and supplementing Title 52 of the Revised Statutes.

BE IT ENACTED by the Senate and General Assembly of the State of New Jersey:

1. Section 1 of P.L.2009, c.4 (C.18A:18A-4.6) is amended to read as follows:

e. (1) (a) The calculation of energy savings for the purposes of determining that the energy savings resulting from the program will be sufficient to cover the cost of the program's energy conservation measures, as provided in subsection a. of this section, shall involve determination of the dollar amount saved through implementation of an energy savings improvement program using the guidelines of the International Performance Measurement and Verification Protocol or other protocols approved by the Board of Public Utilities and standards adopted by the Board of Public Utilities pursuant to this section. The calculation shall include all applicable State and federal rebates and tax credits, but shall not include the cost of an energy audit and the cost of verifying energy savings. The calculation shall state which party has made application for rebates and credits and how these applications translate into energy savings."

This ESP utilized the MVP *"Option D. Calibrated Simulation. Savings are determined through simulation of the energy use of components or the whole facility. Simulation routines must be demonstrated to adequately model actual energy performance measured in the facility. This option usually requires considerable skill in calibrated simulation."*

9.2 Modeling Software and Approach

DLB utilizes the energy modeling software Trane Trace 700, Version 6.3.1.2. Trace is a full building energy simulation tool compliant with ASHRAE Standard 140. It has the ability to model and calculate the energy usage of the building's heating, cooling, and lighting systems, as well as any miscellaneous loads associated with plug loads, cooking equipment, water heating, etc. Trace models the interactions of these systems for every hour of a typical weather year.

Prior to the calculations of the ECMs, a baseline model was developed for each of the schools. This model represents the existing building to the best of DLB's knowledge, incorporating information from field surveys, existing drawings, and utility bills. Scheduling has been set up as per conversations with the building operators, including school sessions, weekend activities, and summer programs that may affect energy use. For information unknown or not able to be recorded in the field, typical industry standard values are entered into the model, such as the average plug loads of a classroom.

The energy analysis utilizes an 8760 hour weather file derived from historical data of Newark, NJ. This represents the average temperature, humidity, and wind speed recorded over several years. The precise geographic location of the energy model was also provided. This dictates the solar azimuth, which determines the direction of sunlight falling on the building.

Thermal zones were programmed into the model based on existing mechanical drawings of the space. Essentially, each air handling unit was assigned a particular series of spaces in the model. In areas with similar heating / cooling loads, function, and scheduling, multiple rooms were combined into a single "space", such as three adjacent classrooms with the same window orientation. This simplified the model without affecting the accuracy of the simulation.

Based on the provided room names, the functions of each area were approximated. Depending on space usage, the energy requirements of a building can vary widely. DLB has a series of predefined templates based on industry standards and previous energy modeling experience. These were implemented into the model for every space, consisting of offices, corridors, restrooms, storage, lobbies, classrooms, auditoriums, and electrical / mechanical spaces, etc.

Each room was modeled with internal loads, consisting of people, lighting, and miscellaneous plug loads. Typical values for these were used based on COMNET and ASHRAE 90.1 resources. Ventilation rates were assigned to each space using ASHRAE 62.1-2010, which is the latest adopted reference standard for the state of New Jersey. The space envelope conditions were derived from existing documentation of each building and subsequent additions or alterations over the years.

At the plant level, boilers, chillers, and DX systems are assigned air handling units, including fan coils. Efficiencies and operating temperatures of each space were programmed based on field data and existing documentation. The software calculates pump energy based on the loading of all systems attached to the plant.

Once all of the aforementioned data has been entered into the Trace project, the model is calibrated using utility data. An iterative approach is used to modify the program parameters to match the calculated energy usage (electricity and natural gas) as close to the values in the provided utility data. Typical calibration approaches include raising or lowering misc. loads, revising schedules, and adjusting thermostat set points.

With a properly calibrated baseline model, several ECMs were calculated for each of the schools. The process includes copying the baseline project to a new "alternative", making the proposed changes to the design, and recalculating the model. The result is a report showing the monthly energy usage (electricity and natural gas) for the baseline and proposed buildings. This data was then exported into spreadsheet software for analysis. The exported tables can be found in the appendix.

Johnson & Urban Third Party Review Report

Johnson & Urban, LLC
Consulting Engineers

Independent Third Party Review of Energy Savings Plan (ESP)

Conducted For:

Holmdel Public Schools
Holmdel, NJ

Conducted By:

Johnson and Urban, LLC
Consulting Engineers
295 Route 34
Colts Neck, NJ 07722

November 6, 2015
J&U # 15-140

Table of Contents

1. Executive Summary

1.1 Overview

Johnson and Urban Consulting Engineers (J&U) has been retained by the Holmdel School District to perform an independent third party review of an Energy Savings Plan (ESP) developed in accordance with NJ statutes for financing of energy savings construction projects. The ESP is the core of the Energy Savings Improvement Plan (ESIP) process. The plan describes Holmdel Public School's preferred Energy Conservation Measures (ECMs) and the energy cost savings calculations that pay for the construction costs through reduced energy costs. This report will provide an independent third party review of the ESP, required by State statutes set forth in Chapter 4 of the Laws of 2009 "Energy Savings Improvement Plan", Public Law 2012, Chapter 55 and Local Finance Notice 2009-11 prior to the implementation of an ESIP plan.

The basis of this third party review is the ESP prepared by DLB Associates Consulting Engineers, dated May 13, 2015. The ESP report is based on the results of Investment Grade Audits (IGAs), dated March 2015, also prepared by DLB Associates. The IGA are presented in Appendix A of the ESP, one for each school with the High School and Satz School combined into one audit. The ESP also references Local Government Energy Audits (LGEAs), dated February 2013 and prepared by CHA. These audits were not included as part of the ESP, but were downloaded from the NJ SmartStart website and reviewed by J&U.

1.2 Energy Savings Plan Review

Per the applicable statute, the ESP must successfully address nine "plan components" in order to proceed with the ESIP process. The reviewed ESP includes the required components, however, in our opinion, further information and clarification is required to fully satisfy the requirements. Our comments of the required plan components are included in the body of this report.

1.3 Energy Savings Calculations Review

Energy savings calculations were prepared by DLB Associates using Trane Trace building simulation software, as well as calculation spreadsheets, all presented in Appendix A of the ESP. Our review of these calculations has revealed many areas in which further clarification and/or correction are needed. We have identified these areas of concern in the body of this report.

1.4 Conclusion

We believe the ESP as currently submitted is unlikely to be approved by the BPU as it stands, which is a prerequisite to proceeding with implementation of the ESIP. The issues raised in the review will require summary results to be recalculated and re-presented, and may alter

the program compliance of several ECMs. Additional information in several areas is required in order to demonstrate compliance to required calculation methodologies.

2. Energy Savings Review Disclaimer

2.1 Disclaimer

Johnson and Urban Consulting Engineers (J&U) has provided all reasonable due diligence in this review of the ESP prepared for Holmdel Schools. This review is not a guarantee that the costs and savings stated in the ESP are valid. J&U will not be held responsible for failure to achieve the predicted savings, nor the estimated construction costs. J&U has performed a visual walkthrough of the facilities included in this report, and has interviewed district maintenance personnel. As such, we have a familiarity with the buildings included in the ESP.

The calculations included in an ESP include a large number of variables and assumptions which can alter the energy savings predictions. It is impractical to review all inputs, software algorithms and assumptions in detail. J&U has reviewed bottom line figures and parameters presented for reasonableness and validity of results, has checked calculations and assumptions provided, and has identified areas where more information is required for assurance of compliance with ESIP statutes and sound engineering principles.

3. Energy Savings Plan Review

3.1 Energy Savings Plan Components

Per Public Law 2009, Chapter 55, to implement an energy savings improvement program, a board of education shall develop an energy savings plan that consists of one or more energy conservation measures. The plan shall:

(a) contain the results of an energy audit;
(b) describe the energy conservation measures that will comprise the program;
(c) estimate greenhouse gas reductions resulting from those energy savings;
(d) identify all design and compliance issues that require the professional services of an architect or engineer and identify who will provide these services;
(e) include an assessment of risks involved in the successful implementation of the plan;
(f) identify the eligibility for, and costs and revenues associated with the PJM Independent System Operator for demand response and curtailable service activities;
(g) include schedules showing calculations of all costs of implementing the proposed energy conservation measures and the projected energy savings;
(h) identify maintenance requirements necessary to ensure continued energy savings, and describe how they will be fulfilled; and
(i) if developed by an energy services company, a description of, and cost estimates of an energy savings guarantee.

The following table lists whether each of the 9 required plan components was addressed in the ESP, it's location within the ESP and Johnson and Urban's comments on each component.

Energy Savings Plan Components Review Summary			
Plan Component	**Addressed in Plan?**	**ESP Section**	**J&U Comments**
Energy Audit Results	Yes	Table 3.4	Section 3.4
ECM Descriptions	Yes	Section 3.3	Section 3.5
Green House Gas Reductions	Yes	Section 5	Section 3.11
Design and Compliance Issues	Yes	Section 6.1	Section 3.6
Risk Assessment	Yes	Section 6.3	Section 3.7
Eligibility for PJM ISO Demand Response and Curtailable Services	No	Section 7	Section 3.8
Implementation Cost Estimates	Yes	Section 3.4	Section 3.9
Identification of Maintenance Requirements	Yes	Section 8	Section 3.3
Energy Savings Guarantee	N/A	N/A	Section 3.10

The ECMs selected for implementation in the ESIP are as follows:

ECM Summary Table		
ECM #	**School**	**ECM Description**
ECM-1	High School/Satz School	Install VFDs and Premium Motors on Heating Hot Water Pumps
ECM-2	High School/Satz School	Demand Control Ventilation (Auditorium, Cafeteria and Old Gym)
ECM-3	High School/Satz School	Install Lighting Controls - Occupancy Sensors
ECM-4	High School/Satz School	Lighting Replacements with Lighting Controls (Occupancy Sensors)
ECM-5	High School/Satz School	Replace Exterior Lighting with LED Fixtures
ECM-6	High School/Satz School	Replace Existing Boilers with Condensing Boilers
ECM-7	High School/Satz School	Convert Electric Dishwasher Booster Heater with Natural Gas
ECM-8	Indian Hill School	Combining Boiler Plants
ECM-9	Indian Hill School	Install VFDs and Premium Motors on Heating Hot Water Pumps
ECM-10	Indian Hill School	Install Lighting Controls - Occupancy Sensors
ECM-11	Indian Hill School	Lighting Replacements with Lighting Controls (Occupancy Sensors)
ECM-12	Indian Hill School	Replace Exterior Lighting with LED Fixtures
ECM-13	Village School	Install VFDs and Premium Motors on Heating Hot Water Pumps
ECM-14	Village School	Demand Control Ventilation (Multipurpose Room and Old Gym)
ECM-15	Village School	Install Lighting Controls - Occupancy Sensors
ECM-16	Village School	Lighting Replacements with Lighting Controls (Occupancy Sensors)
ECM-17	Village School	Replace Exterior Lighting with LED Fixtures

3.2 Utility Consumption and Cost Comments

Section 2 of the ESP provides a discussion and calculations pertaining to the establishment of annual baseline utility costs. J&U has the following comments:

1. The calculated electric rates ($/kWh) for each school appear to be incorrect. Assuming the calculation is Total Electric Utility Payments ($) divided by Total Electric Utility Consumption (kWh) from the same table, we calculate blended utility rates of .149 $/kWh, .174 $/kWh and .133 $/kWh respectively. In addition, the figures presented in this summary table do not appear to match the utility usage figures given in Appendix A. Please check the figures or explain how they were derived.

2. Paragraph 2.3 indicates that different electrical utility data was used to establish the baseline Trace model. This data was taken from JCP&L bills from October 2011 to November 2012 (a similar situation occurs with the gas utility bills). It is unclear to this reviewer why different utility data was used for the Trace model versus the cost calculation. We are concerned that the use of old utility cost data will make it difficult to verify energy cost savings once the ECM's are implemented and operational as building changes have occurred in recent years.

3.3 Maintenance requirements

Section 8 of the ESP provides a comprehensive discussion of anticipated maintenance requirements. No further comments.

3.4 Energy Audit Results Comments

Table 3.4 – ECM Costs and Savings represents the summary of the financial performance of the selected ECMs. Most of the data contained therein seems to have been brought forward from the analysis and calculations performed as part of the IGA presented in Appendix A. Upon review of this summary and supporting calculations, J&U has the following comments:

1. The estimated construction costs in almost all cases do not match the figures presented in the IGA. No discussion was found within the body of the report indicating whether these changes were purposeful. Please review this column of the table and make corrections as necessary or clarify how the figures were determined.

2. Estimated incentives for High School/Satz – each ECM is estimated to receive an incentive of $20,530 through the NJ Pay For Performance Program (P4P). For the seven ECMs considered for this school, the total incentive amount is given as $143,710. However, the P4P calculations given in Appendix B indicate a total anticipated P4P incentive of $56,854. As the incentive amount will have a profound impact on the calculated payback periods for each ECM, please review and make the corrections necessary. We would also

recommend that the total incentive not be averaged over all ECMs, but rather weighted to indicate the relative value of each ECM to the receipt of the overall incentive.

3. The estimated incentives for Indian Hill and Village Schools appears to be based on rebates available through the NJ SmartStart Equipment Incentives program, however no corresponding calculations were given in the body of the report indicating how the figures were derived. As the incentive amount will have a profound impact on the calculated payback periods for each ECM, please provide SmartStart incentive calculations for review.

4. ECMs-9 and 13 are shown to qualify for an installation incentive. Note that the current SmartStart Equipment Incentives do not include rebates for VFDs or premium efficiency motors for heating hot water pumps. Please review and adjust as necessary.

5. ECM-6 calculated payback of 17.7 years will make this ECM ineligible for the ESIP program as it is beyond 15 years.

6. Comments on estimated energy cost savings are provided elsewhere in this report. Please update table 3.4 once all comments are addressed.

3.5 ECM and ECM Cost Calculation Comments

1. ECM-1 – High School and Satz School - Install VFD's and Premium Motors on (3) VFD Pumps: During our field survey in preparation for this third party review, maintenance personnel indicated that the hot water systems serve primarily unit ventilators with face and bypass damper control, and air handlers with three way valve control. The unit ventilator hot water control valves are 2 position, and will be fully open whenever the outdoor air temperature is below 60 degrees per a software setpoint. The air handler control valves will bypass hot water when there is no call for heat, making them constant flow from a pumping standpoint. As such, there is little opportunity to ramp down hot water flow during the heating season, likely making this ECM not viable. However, no detailed Trace input or output for the ECM was included in the report for a reviewer to check. Please review this ECM and provide detailed calculation methodology and program input/output data if this ECM is still considered viable. In addition, this ECM may react in a negative way with boiler the replacement ECM, we would recommend running both options simultaneously through the Trace analysis.

Re-balancing of existing systems is recommended, but cost for same is not included in the construction cost estimates.

2. ECM-3 High School/Satz School – Install Lighting Controls: paragraph 5 recommends push button timer lighting controls for the mechanical room. We recommend that this not be done for safety reasons.

   Construction, incentive, and energy savings costs and room by room payback periods are calculated in spreadsheets given in Section 8 of Appendix A. We take no exception to the use of a calculation spreadsheet for calculations pertaining to this ECM, but have the following comments on the calculations:

   - The calculated energy cost savings spreadsheet appears to take the kWh savings for each room and multiplies that figure by a calculated "blended" utility rate (historical demand and energy combined). We do not believe this methodology complies with the NJ BPU Protocols to Measure Energy Savings, which requires actual tariff rates to be used and does not allow the rates to be blended (ESIP Program BPU Rules #11). We believe the calculated payback periods may be improved once the protocol algorithms are used.

   - That payback period for individual rooms vary substantially in the calculation spreadsheets. We would recommend that the data be summarized so that only those spaces with a payback of less than 15 years are presented in a single sheet with project totals to check against ECM data recorded elsewhere. We would also recommend a key plan be developed to show the program participants which areas are planned for lighting upgrades.

   - The calculation spreadsheets seem to include SmartStart incentives in the payback calculation. Note that these incentives will not be available where P4P incentives are claimed.

3. ECM-4 High School/Satz School – Lighting Replacements with Controls (Occupancy Sensors): Construction, incentive, and energy savings costs and room by room payback periods are calculated in spreadsheets given in Section 8 of Appendix A. We take no exception to the use of a calculation spreadsheet for calculations pertaining to this ECM, but have the following comments on the calculations:

   - The calculated energy cost savings spreadsheet appears to take the kWh savings for each room and multiplies that figure by a calculated "blended" utility rate (historical demand and energy combined). We do not believe this

methodology complies with the NJ BPU Protocols to Measure Energy Savings, which requires

actual tariff rates to be used and does not allow the rates to be blended (ESIP Program BPU Rules #11). We believe the calculated payback periods may be improved once the protocol algorithms are used.

- That payback period for individual rooms vary substantially in the calculation spreadsheets. We would recommend that the data be summarized so that only those spaces with a payback of less than 15 years be presented in a single sheet with project totals to check against ECM data recorded elsewhere. We would also recommend a key plan be developed to show the program participants which areas are planned for lighting upgrades.

- The calculation spreadsheets seem to include SmartStart incentives in the payback calculation. Note that these incentives will not be available where P4P incentives are claimed.

- Since the writing of this report, several areas within the district have been upgraded to LED lighting. Please check with the district and remove areas from the calculations that no longer apply to this ECM.

4. ECM-6 High School/Satz School – Replace Existing Boilers with Condensing Boilers: No detailed Trace input or output for the ECM was included in the report for a reviewer to check. From the discussion, it seems as though a constant 15% combustion efficiency increase was taken across all firing conditions. A condensing boiler will not reach the stated 92% combustion efficiency stated until return water temperature falls below 120 degrees. We believe this will rarely if ever occur within the building with the current configuration of heating coils. Please revisit this ECM and provide detailed Trace input/output and methodology to verify predicted energy savings.

5. ECM-8 - High School/Satz School – Interlock Hot Water Piping and Relocate Boilers to Boiler Room B: No detailed Trace input or output for the ECM was included in the report for a reviewer to check. The energy savings associated with this ECM are primarily electrical ($9,755 per year for electrical). We do not see where these savings would come from. Please revisit this ECM and provide detailed Trace input/output and methodology to verify predicted energy savings. In addition, the resulting total firing rate of 6,000 MBH may not be adequate to heat the building in cold weather, especially considering the requirement for a redundant module. Please

also check the total heating load of the building under design conditions and budget for additional boilers as necessary.

6. ECM-9-Indian Hill School – Install VFDs and Premium Motors on Hot Water Pumps: Same comments as ECM-1, above.

7. ECM-10- Indian Hill School - Install Lighting Controls: Same comments as ECM-3 above.

8. ECM-11 – Indian Hill School – Lighting Replacements with Controls (Occupancy Sensors): Same comments as ECM-4 above.

9. ECM-13 Village School - Install VFD's and Premium Motors on (2) VFD Pumps: Same comments as ECM-1 above.

10. ECM-14- Village School – Demand Control Ventilation (Multipurpose Room and Old Gym):

11. ECM-15- Village School - Install Lighting Controls: Same comments as ECM-3 above.

12. ECM-16 – Village School – Lighting Replacements with Controls (Occupancy Sensors): Same comments as ECM-4 above.

3.6 Design and Compliance Issue Comments

Per P.L. 2009, Chapter 4, the ESP must identify all design and compliance issues that require the professional services of an architect or engineer and identify who will provide these services.

Although not specifically mentioned in the ESP, it is presumed that the district will employ the services of a licensed and insured A/E team to provide these services.

3.7 Risk Assessment Comments

Section 6.3 states that "DLB Associates has assessed potential risks involved with the implementation of the proposed ESP and does not foresee any issues with the outlined project". While we assume that the author has considered the standard risks associated with every construction project (market forces, labor and material availability, acts of God, etc.), and that the ESIP and competitive bidding processes are designed to mitigate these risks, we believe there may be additional risks to the successful implementation and financial performance of this project. For example:

- Potential for asbestos in affected project areas and additional cost to mitigate.

- Enhanced maintenance on some equipment and systems. Many of the systems to remain and be reused as part of this ESP (such as air handlers) are of an older vintage and may be approaching the end of their useful lives. Equipment failure within the 15 year life span of this study would negatively affect the expected savings and cash flow.
- The use of 3 year old utility bills may make verification of energy savings difficult.

We suggest that a list of risks to the financial performance of the ESP be added to section 6.3.

Section 6.2, paragraph 5 mentions VFDs for fans. Because this is not a planned ECM, this wording should be removed.

3.8 Eligibility, Costs and Revenues associated with PJM Independent Operator Comments

Section 7 of the ESP includes a clear explanation of the PJM demand curtailment programs, however there is no discussion as to the eligibility or desirability of Holmdel School District participating in the available programs. As this is a basic requirement of the ESP, we believe this item needs to be further expanded to include participation costs, potential savings and recommendations.

3.9 Implementation Cost Comments

Rough construction cost estimates are presented in Appendix A of the ESP for each ECM. As mentioned in Section 3.3 of this report, the calculated totals do not match figures presented in the ECM summary results. It should be noted that construction cost estimates vary substantially from figures derived in the LGEA, the author may want to review the estimates. In addition, we have the following further comments:

1. Implementation of the various ECMs will require commissioning at the conclusion of the construction process. No costs for commissioning have been included in the cost estimates.

2. In the ECM descriptions for hot water pumping systems, re-balancing of existing systems is recommended, but cost for same is not included in the construction cost estimates.

3.10 Energy Savings Guarantee Comments

Because the Holmdel School District has chosen the "DIY" method of ESIP implementation (as opposed to the use of an ESCO firm), this component does not apply.

3.11 Green House Gas Reductions Comments

Section 5 of the ESP gives a description and summary of the anticipated greenhouse gas reductions as a result of the implemented ECMs. We have the following comments:

1. Electric CO2 reduction for ECM-2 should be a positive number.

2. Table will have to be recalculated if ECM energy reductions are altered in response to this review.

4. Energy Savings Calculations Review

4.1 Calculation Methodology

Section 9 of the ESP provides a discussion of the calculation methodology use in derivation of anticipated ECM energy use and savings. The software simulation package used for several of the ECMs, Trane Trace Version 6.3, is in compliance with BPU protocols when properly applied. However, the lighting costs, savings and energy use appear to have been estimated using spreadsheet analysis. While this is acceptable if the calculations are in conformance with BPU algorithms, as mentioned in section 3.3 above, we feel that corrections and clarifications are needed.

In order to fully verify the analyses conducted with the Trace program, additional information regarding program input and output is required. Please provide Trace building engineering checks, library members, plant information, system checksums, and equipment energy consumption summary output sheets.

4.2 Financial Analysis Comments

Section 4 of the ESP gives an overview of available incentive programs, funding options, project costs and estimated cash flow summary. We have the following comments on this section:

1. This section explains the rationale of using the P4P rebates for High School/Satz School, and SmartStart equipment incentives for Indian Hill and Village Schools. As mentioned in section 3, we believe there may be an issue in the calculation of the P4P incentives. We would also recommend a chart showing how the SmartStart incentives were calculated, as this information is not included in the report. In addition, SmartStart incentive program was changed on June 1, 2015, possibly changing the incentives available to this project.

2. Incentive #1 of the P4P program uses $.10/sf as the available payment. If the building audit was funded through BPU programs, this incentive may be only $.05/sf. Please verify.

3. Section 4.2.6 summarizes estimated project hard and soft costs. As mentioned in section 3 of this report, we believe there are inconsistencies between the IGA audit costs and the costs shown in the ESP. Please review and make any necessary changes.

4. We would recommend further breakdown and discussion as to how soft cost figure was derived, beyond a flat 35%.

5. Section 4.2.7 of the ESP is a table summarizing the estimated cash flow throughout the 15 year project timespan. We note that the summary indicates a positive cash flow in every program year, which is a requirement of the ESIP program. We have several comments on the information presented:

    - As mentioned elsewhere in this report, we believe that the Total Project Costs, Incentives and Utility Savings figures need to be revisited. Please update this table if figures change.

    - Finance interest rate of 5% should be verified with the District Business Administrator. If a lower rate is available, cash flow results will be enhanced.

    - The table seems to use project costs net of incentives for the financed principal. We believe the financed amount should be the Total Project Costs before incentives, because all incentives will not be realized until a year or more from project completion, and will be paid to the District. Approved incentives may be added to the cash flow summary in subsequent years.

5. Investment Grade Audit (IGA) Review

Because the IGA appears to be the basis for results and conclusions of the ESP, we have reviewed the information provided and offer additional comments below. The IGA is presented as three separate reports in Appendix A of the ESP.

5.1 Holmdel High School/Satz School

1. Section 2 - it is unclear to this reviewer why the figures given in the table "Monthly Energy Consumption Comparison" do not match the figures in the electric and gas bill summaries.
2. Several ECMs recommended in the section 3.1 are not carried forward to the ESP. Is this due to payback periods beyond 15 years?
3. Comments on construction costs, energy savings and calculations are covered elsewhere in this report.

5.2 Indian Hill School

1. The last paragraph of section 1.6 Indicates that "exhaust fans were reported to operate continuously, regardless of building use and occupancy". Was addition of fan control considered as an ECM?

2. Section 2 - it is unclear to this reviewer why the figures given in the table "Monthly Energy Consumption Comparison" do not match the figures in the electric and gas bill summaries.

3. Several ECMs recommended in the section 3.1 are not carried forward to the ESP. Is this due to payback periods beyond 15 years?

4. Comments on construction costs, energy savings and calculations are covered elsewhere in this report.

5.3 Village School

1. Section 2 - it is unclear to this reviewer why the figures given in the table "Monthly Energy Consumption Comparison" do not match the figures in the electric and gas bill summaries.

2. Several ECMs recommended in the section 3.1 are not carried forward to the ESP. Is this due to payback periods beyond 15 years?

3. Comments on construction costs, energy savings and calculations are covered elsewhere in this report.

5.4 Appendix B – P4P Calculations

1. The total P4P incentive for the High School/Satz School is listed as $56,854, far less than the total figure given in table 3.4 of the ESP

End of Report

DLB Responses To Third Party Review Report

HOLMDEL ESIP - ENERGY SAVINGS PLAN (ESP) REVIEW

Third Party Review Comments

No.	Comment / Question	Page	Section	Response
	Section 2 of the ESP provides a discussion and calculations pertaining to the establishment of annual baseline utility costs. J&U has the following comments:			
1	The calculated electric rates ($/kWh) for each school appear to be incorrect. Assuming the calculation is Total Electric Utility Payments ($) divided by Total Electric Utility Consumption (kWh) from the same table, we calculate blended utility rates of .149 $/kWh, .174 $/kWh and .133 $/kWh respectively. In addition, the figures presented in this summary table do not appear to match the utility usage figures given in Appendix A. Please check the figures or explain how they were derived.	8	3.2	DLB reached out to the BPU for clarification regarding utility kWh rate calculation protocol. Rates were recalculated as described in the "final" ESP yielding $0.1286, $0.1313 and $0.1422 for the High School, Indian Hill School, and Village School respectively.
2	Paragraph 2.3 indicates that different electrical utility data was used to establish the baseline Trace model. This data was taken from JCP&L bills from October 2011 to November 2012 (a similar situation occurs with the gas utility bills). It is unclear to this reviewer why different utility data was used for the Trace model versus the cost calculation. We are concerned that the use of old utility cost data will make it difficult to verify energy cost savings once the ECM's are implemented and operational as building changes have occurred in recent years.	8	3.2	As stated in Section 2.3, an outlying weather pattern in 2013 / 2014 lead to significant changes in the gas usage of the facilities. It was determined that data from 2011 to 2012 provided the best reference to calibrate the model to. In addition, calibrating the gas usage to of a typical year would result in a more conservative analysis than if DLB used the most recent outlier year (2013 / 2014 heating season). The energy cost savings associated with each ECM would increase if the outlier year were to be used. Regarding utility rates, the most recent cost data received was used to determine the energy cost estimate. Since gas utility rates are essentially independent of weather, DLB concluded the latest set of utility bills should be used to determine the blended gas rate. The analyses included in the report use this rate.
	Table 3.4 – ECM Costs and Savings represents the summary of the financial performance of the selected ECMs. Most of the data contained therein seems to have been brought forward from the analysis and calculations performed as part of the IGA presented in Appendix A. Upon review of this summary and supporting calculations, J&U has the following comments:			
3	The estimated construction costs in almost all cases do not match the figures presented in the IGA. No discussion was found within the body of the report indicating whether these changes were purposeful. Please review this column of the table and make corrections as necessary or clarify how the figures were determined.	8	3.4	All estimated construction costs have been reviewed and revised where necessary. Please refer to the estimates located in the Third Party Review section. These costs supercede all previous values reported.
4	Estimated incentives for High School/Satz – each ECM is estimated to receive an incentive of $20,530 through the NJ Pay For Performance Program (P4P). For the seven ECMs considered for this school, the total incentive amount is given as $143,710. However, the P4P calculations given in Appendix B indicate a total anticipated P4P incentive of $56,854. As the incentive amount will have a profound impact on the calculated payback periods for each ECM, please review and make the corrections necessary. We would also recommend that the total incentive not be averaged over all ECMs, but rather weighted to indicate the relative value of each ECM to the receipt of the overall incentive.	8	3.4	P4P incentives for the High School have been changed to "awarded at project level" rather than "amortized across each ECM" since incentives are based on the overall project's Total Source Energy Savings and not each ECM's. The original total of $143,710 was accurate and consisted of the sum of Incentives 1, 2 & 3 as calculated in Appendix B of the "draft" ESP. However, based on revised ECM's as presented in this "final" ESP, the total P4P incentive anticipated for the High School has increased to $178,411.

HOLMDEL ESIP - ENERGY SAVINGS PLAN (ESP) REVIEW

Third Party Review Comments

No.	Comment / Question	Page	Section	Response
5	The estimated incentives for Indian Hill and Village Schools appears to be based on rebates available through the NJ SmartStart Equipment Incentives program, however no corresponding calculations were given in the body of the report indicating how the figures were derived. As the incentive amount will have a profound impact on the calculated payback periods for each ECM, please provide SmartStart incentive calculations for review.	9	3.4	Program rules for NJ Smart Start incentives were reviewed and it was identified there are no qualifying mechanical ECM's at Indian Hill or Village School. NJ Smart Start incentives for lighting ECM's are prescriptive (refer to program rules) and do not require calculations. They are applied to each qualifying space as captured in the lighting ECM tables. The 2015 program rates were used in the "final" ESP calculations.
6	ECMs-9 and 13 are shown to qualify for an installation incentive. Note that the current SmartStart Equipment Incentives do not include rebates for VFDs or premium efficiency motors for heating hot water pumps. Please review and adjust as necessary.	9	3.4	Program rules for NJ Smart Start incentives were reviewed and it was identified there are no qualifying mechanical ECM's.
7	ECM-6 calculated payback of 17.7 years will make this ECM ineligible for the ESIP program as it is beyond 15 years.	9	3.4	DLB reached out to the BPU for clarification regarding the simple payback period. The lease-purchase agreement shall not exceed 15 years, indicating full payback of construction costs associated with the ECMs must occur within this period. Including this ECM maintains the overall simple payback period at less than 15 years.
8	Comments on estimated energy cost savings are provided elsewhere in this report. Please update table 3.4 once all comments are addressed.	9	3.4	Table 3.4 has been updated in the "final" ESP.
9	ECM-1 – High School and Satz School - Install VFD's and Premium Motors on (3) VFD Pumps: During our field survey in preparation for this third party review, maintenance personnel indicated that the hot water systems serve primarily unit ventilators with face and bypass damper control, and air handlers with three way valve control. The unit ventilator hot water control valves are 2 position, and will be fully open whenever the outdoor air temperature is below 60 degrees per a software setpoint. The air handler control valves will bypass hot water when there is no call for heat, making them constant flow from a pumping standpoint. As such, there is little opportunity to ramp down hot water flow during the heating season, likely making this ECM not viable. However, no detailed Trace input or output for the ECM was included in the report for a reviewer to check. Please review this ECM and provide detailed calculation methodology and program input/output data if this ECM is still considered viable. In addition, this ECM may react in a negative way with boiler the replacement ECM, we would recommend running both options simultaneously through the Trace analysis. Re-balancing of existing systems is recommended, but cost for same is not included in the construction cost estimates.	9	3.5	DLB has re-evaluated the existing conditions at each of the schools. As stated in the comment, the vast majority of valves on the unit ventilators are 2-way, 2-position type. Most of the air handling units are 3-way, modulating type. In order to reduce the flow to the terminal equipment, every UV and air handler would need to be retrofitted with 2-way, modulating control valves. The added construction cost makes this ECM cost-prohibitive and is no longer recommended for implementation.
10	ECM-3 High School/Satz School – Install Lighting Controls: Paragraph 5 recommends push button timer lighting controls for the mechanical room. We recommend that this not be done for safety reasons.	10	3.5	Due to the design change to implement LED tube-style lamp replacements only, Code-required lighting controls are only recommended for spaces that currently utilize HID lighting fixtures that are to be replaced with new LED lighting fixtures.

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11	ECM-3 High School/Satz School – Install Lighting Controls: The calculated energy cost savings spreadsheet appears to take the kWh savings for each room and multiplies that figure by a calculated "blended" utility rate (historical demand and energy combined). We do not believe this methodology complies with the NJ BPU Protocols to Measure Energy Savings, which requires actual tariff rates to be used and does not allow the rates to be blended (ESIP Program BPU Rules #11). We believe the calculated payback periods may be improved once the protocol algorithms are used.	10	3.5	(same as #1 above)
12	ECM-3 High School/Satz School – Install Lighting Controls: That payback period for individual rooms vary substantially in the calculation spreadsheets. We would recommend that the data be summarized so that only those spaces with a payback of less than 15 years are presented in a single sheet with project totals to check against ECM data recorded elsewhere. We would also recommend a key plan be developed to show the program participants which areas are planned for lighting upgrades.	10	3.5	Tables list all spaces investigated for each ECM, with room identifiers as provided by Holmdel BOE (no better information was available). Those spaces meeting the 15-year payback are clearly indicated by highlighted cells (refer to legend). Key plan graphics are beyond the scope of DLB services (refer to room identifiers).
13	ECM-3 High School/Satz School – Install Lighting Controls: The calculation spreadsheets seem to include SmartStart incentives in the payback calculation. Note that these incentives will not be available where P4P incentives are claimed	10	3.5	The "draft" ESP incorrectly applied NJ Smart Start incentives to the High School that is using the NJ P4P incentive program. NJ Smart Start incentives have been removed from the High School lighting ECM's in the "final" ESP.
14	ECM-4 High School/Satz School – Lighting Replacements With Lighting Controls (Occupancy Sensors): The calculated energy cost savings spreadsheet appears to take the kWh savings for each room and multiplies that figure by a calculated "blended" utility rate (historical demand and energy combined). We do not believe this methodology complies with the NJ BPU Protocols to Measure Energy Savings, which requires actual tariff rates to be used and does not allow the rates to be blended (ESIP Program BPU Rules #11). We believe the calculated payback periods may be improved once the protocol algorithms are used.	10	3.5	(same as #1 above)
15	ECM-4 High School/Satz School – Lighting Replacements With Lighting Controls (Occupancy Sensors): That payback period for individual rooms vary substantially in the calculation spreadsheets. We would recommend that the data be summarized so that only those spaces with a payback of less than 15 years be presented in a single sheet with project totals to check against ECM data recorded elsewhere. We would also recommend a key plan be developed to show the program participants which areas are planned for lighting upgrades.	11	3.5	(same as #12 above)
16	ECM-4 High School/Satz School – Lighting Replacements With Lighting Controls (Occupancy Sensors): The calculation spreadsheets seem to include SmartStart incentives in the payback calculation. Note that these incentives will not be available where P4P incentives are claimed.	11	3.5	(same as #13 above)

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17	ECM-4 High School/Satz School – Lighting Replacements With Lighting Controls (Occupancy Sensors): Since the writing of this report, several areas within the district have been upgraded to LED lighting. Please check with the district and remove areas from the calculations that no longer apply to this ECM.	11	3.5	Due to the time required to go through this program, it is impractical to maintain a "living document". Each space was evaluated independently, and excluding particular spaces that have since been upgraded with LEDs will result in a smaller scope of work - but will not invalidate the conclusions. The EOR that prepares construction documents will need to verify the applicability of the ECM's in each space.
18	ECM-6 High School/Satz School – Replace Existing Boilers with Condensing Boilers: No detailed Trace input or output for the ECM was included in the report for a reviewer to check. From the discussion, it seems as though a constant 15% combustion efficiency increase was taken across all firing conditions. A condensing boiler will not reach the stated 92% combustion efficiency stated until return water temperature falls below 120 degrees. We believe this will rarely if ever occur within the building with the current configuration of heating coils. Please revisit this ECM and provide detailed Trace input/output and methodology to verify predicted energy savings.	11	3.5	DLB did not assume a flat rate efficiency improvement for the condensing boiler energy savings calculations. In the Trane Trace model, three alterations were made between the baseline and proposed design. These include: • Change nominal boiler efficiency from 80% to 92%. • Change boiler power consumption curve to a condensing boiler model. • Add an outside air reset curve. Trace input / output data has been included for reference.
19	ECM-8 -Indian Hill School – Interlock Hot Water Piping and Relocate Boilers to Boiler Room B: No detailed Trace input or output for the ECM was included in the report for a reviewer to check. The energy savings associated with this ECM are primarily electrical ($9,755 per year for electrical). We do not see where these savings would come from. Please revisit this ECM and provide detailed Trace input/output and methodology to verify predicted energy savings. In addition, the resulting total firing rate of 6,000 MBH may not be adequate to heat the building in cold weather, especially considering the requirement for a redundant module. Please also check the total heating load of the building under design conditions and budget for additional boilers as necessary.	11	3.5	Two boiler plants (Mechanical Room A and Mechanical Room B) were to be consolidated into a single plant. The existing (7) AO Smith boilers are to be removed and the existing (3) Aerco boilers are to be moved to other mechanical room. DLB re-evaluated the heating capacity of the remaining (3) Aerco boilers that were proposed to remain and identified they have insufficient capacity to meet the design load. DLB has omitted this ECM from the "final" ESP report.
20	ECM-9-Indian Hill School – Install VFDs and Premium Motors on Hot Water Pumps: Same comments as ECM-1, above.	12	3.5	(same as #9 above)
21	ECM-10- Indian Hill School - Install Lighting Controls: Same comments as ECM-3 above.	12	3.5	(same as #10, 11, 12 & 13 above)
22	ECM-11 – Indian Hill School – Lighting Replacements with Controls (Occupancy Sensors): Same comments as ECM-4 above.	12	3.5	(same as #14, 15, 16 & 17 above)
23	ECM-13 Village School - Install VFD's and Premium Motors on (2) VFD Pumps: Same comments as ECM-1 above.	12	3.5	(same as #9 above)
24	ECM-14- Village School – Demand Control Ventilation (Multipurpose Room and Old Gym):	12	3.5	There is nothing to address in this statement.
25	ECM-15- Village School - Install Lighting Controls: Same comments as ECM-3 above.	12	3.5	(same as #10, 11, 12 & 13 above)

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26	ECM-16 – Village School – Lighting Replacements with Controls (Occupancy Sensors): Same comments as ECM-4 above.	12	3.5	(same as #14, 15, 16 & 17 above)
27	Per P.L. 2009, Chapter 4, the ESP must identify all design and compliance issues that require the professional services of an architect or engineer and identify who will provide these services. Although not specifically mentioned in the ESP, it is presumed that the district will employ the services of a licensed and insured A/E team to provide these services.	12	3.6	The Holmdel Board of Education has selected the DIY method where they have taken the lead, and an Architect with and Engineer subconsultant has been retained. Retaining an Engineer to assist with the ESIP authorizes the engineering firm to be responsible for procurement of services from different organizations to perform the various elements of an ESIP including the ESP preparation, development of construction plans, bids and specifications, recommendation regarding the award of construction contracts and construction management. Language identifying this method of implementation has been added to the ESP.
28	We suggest that a list of risks to the financial performance of the ESP be added to section 6.3.	13	3.7	Risks to the financial performance include a potentially higher interest rate, failure to receive proposed incentives and unforeseen field conditions during the design and construction process. These risks have been identified in the ESP at the noted location.
29	Section 6.2, paragraph 5 mentions VFDs for fans. Because this is not a planned ECM, this wording should be removed.	13	3.7	DLB has removed the paragraph. There are no remaining references to VFDs on fans and pumps.
30	Section 7 of the ESP includes a clear explanation of the PJM demand curtailment programs, however there is no discussion as to the eligibility or desirability of Holmdel School District participating in the available programs. As this is a basic requirement of the ESP, we believe this item needs to be further expanded to include participation costs, potential savings and recommendations.	13	3.8	A high-level investigation of possible incentive money associated with implementing a demand response program for selected larger-capacity cooling equipment has been completed and included in the ESP.
31	Rough construction cost estimates are presented in Appendix A of the ESP for each ECM. As mentioned in Section 3.3 of this report, the calculated totals do not match figures presented in the ECM summary results. It should be noted that construction cost estimates vary substantially from figures derived in the LGEA, the author may want to review the estimates.	13	3.9	All estimated construction costs have been reviewed and revised where necessary. Please refer to the estimates located in the Third Party Review section. These costs supercede all previous values reported.
32	Implementation of the various ECMs will require commissioning at the conclusion of the construction process. No costs for commissioning have been included in the cost estimates.	13	3.9	Startup costs have been included in the cost estimates. Intensive commissioning efforts are not anticiapted as most ECM's are 1-for-1 replacements. Limited commissioning efforts can be absorbed in the 10% construction continency when needed.
33	In the ECM descriptions for hot water pumping systems, re-balancing of existing systems is recommended, but cost for same is not included in the construction cost estimates.	13	3.9	Balancing is not required as modulating valves, in conjunction with VFD pressure sensor, will establish the required flow rate under varying operating conditions.

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34	Section 5 of the ESP gives a description and summary of the anticipated greenhouse gas reductions as a result of the implemented ECMs. We have the following comments: 1. Electric CO2 reduction for ECM-2 should be a positive number.	14	3.11	The negative number for Electric CO2 reduction associated with ECM-2 is correct. Due to increased air recirculation caused by reduction of exhaust air in response to satisfactory CO2 levels, there is an increase in the associated air handler's compressor energy as this recirculated air now needs to be cooled rather than bringing in cooler, ourside air during shoulder seasons (the unit is not equipped with economizer function).
35	Table will have to be recalculated if ECM energy reductions are altered in response to this review.	14	3.11	The table has been updated based on changes made stemming from the third party review comments.
Section 9 of the ESP provides a discussion of the calculation methodology use in derivation of anticipated ECM energy use and savings. Upon review of this summary and supporting calculations, J&U has the following comments:				
36	However, the lighting costs, savings and energy use appear to have been estimated using spreadsheet analysis. While this is acceptable if the calculations are in conformance with BPU algorithms, as mentioned in section 3.4 above, we feel that corrections and clarifications are needed.	14	4.2	(same as #10, 11, 12 & 13 above)
37	The software simulation package used for several of the ECMs, Trane Trace Version 6.3, is in compliance with BPU protocols when properly applied. In order to fully verify the analyses conducted with the Trace program, additional information regarding program input and output is required. Please provide Trace building engineering checks, library members, plant information, system checksums, and equipment energy consumption summary output sheets.	14	4.1	Additional requested information has been provided in the Appendix.
Section 4 of the ESP gives an overview of available incentive programs, funding options, project costs and estimated cash flow summary. We have the following comments on this section:				
38	This section explains the rationale of using the P4P rebates for High School/Satz School, and SmartStart equipment incentives for Indian Hill and Village Schools. As mentioned in section 3, we believe there may be an issue in the calculation of the P4P incentives. We would also recommend a chart showing how the SmartStart incentives were calculated, as this information is not included in the report. In addition, SmartStart incentive program was changed on June 1, 2015, possibly changing the incentives available to this project.	14	4.2	(same as #4 & 5 above)
39	Incentive #1 of the P4P program uses $.10/sf as the available payment. If the building audit was funded through BPU programs, this incentive may be only $.05/sf. Please verify.	14	4.2	P4P Incentive #1 for the High School was reduced to $0.05 / SF as entity participated in LGEA.
40	Section 4.2.6 summarizes estimated project hard and soft costs. As mentioned in section 3 of this report, we believe there are inconsistencies between the IGA audit costs and the costs shown in the ESP. Please review and make any necessary changes.	14	4.2	All estimated construction costs have been reviewed and revised where necessary. Please refer to the estimates located in the Third Party Review section. These costs supercede all previous values reported.

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41	We would recommend further breakdown and discussion as to how soft cost figure was derived, beyond a flat 35%.	14	4.2	The soft costs were estimated by the architect at a flat 35% of construction costs in order to cover The soft costs are intended to cover ECM A / E fees, an estimating contingency, public bidding costs, bond counsel, etc. These estimated costs should be verified during the design phase to ensure the accuracy of the ESP due to elapsed time and other exterior influences and conditions. This content was added to the ESP.
Section 4.2.7 of the ESP is a table summarizing the estimated cash flow throughout the 15 year project timespan. We note that the summary indicates a positive cash flow in every program year, which is a requirement of the ESIP program. We have several comments on the information presented:				
42	As mentioned elsewhere in this report, we believe that the Total Project Costs, Incentives and Utility Savings figures need to be revisited. Please update this table if figures change.	15	4.2	As mentioned above, Total Project Costs, Incentives and Utility Savings have been updated. Please refer to the estimates located in the Third Party Review section. These costs supercede all previous values reported.
43	Finance interest rate of 5% should be verified with the District Business Administrator. If a lower rate is available, cash flow results will be enhanced.	15	4.2	Following conversations with the HTBOE financial advisor and the NJ BPU, a 4.00% loan interest rate has been utilized in the revised cash flow analysis.
44	The table seems to use project costs net of incentives for the financed principal. We believe the financed amount should be the Total Project Costs before incentives, because all incentives will not be realized until a year or more from project completion, and will be paid to the District. Approved incentives may be added to the cash flow summary in subsequent years.	15	4.2	This comment has been adressed by removing the incentives from the Cash Flow analysis.
Because the IGA appears to be the basis for results and conclusions of the ESP, we have reviewed the information provided and offer additional comments below. The IGA is presented as three separate reports in Appendix A of the ESP.				
45	Holmdel High School/Satz Middle School - Section 2: It is unclear to this reviewer why the figures given in the table “Monthly Energy Consumption Comparison” do not match the figures in the electric and gas bill summaries.	15	5.1	Electric consumption in IGA did not properly account for solar PV generation; this has been corrected in the "final" ESP. See response #2 above regarding natural gas consumption.
46	Holmdel High School/Satz Middle School: Several ECMs recommended in the section 3.1 are not carried forward to the ESP. Is this due to payback periods beyond 15 years?	15	5.1	The list of recommended ECM's was adjusted throughout the course of this project (LGEA, IGA, ESP) for a varity of reasons, and is summarized in the ECM Coordination List.
47	Indian Hill School: The last paragraph of section 1.6 Indicates that “exhaust fans were reported to operate continuously, regardless of building use and occupancy”. Was addition of fan control considered as an ECM?	15	5.2	No, fan control was not considered.
48	Indian Hill School - Section 2: It is unclear to this reviewer why the figures given in the table “Monthly Energy Consumption Comparison” do not match the figures in the electric and gas bill summaries.	15	5.2	Electric consumption in IGA did not properly account for solar PV generation; this has been corrected in the "final" ESP. See response #2 above regarding natural gas consumption.

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49	Indian Hill School: Several ECMs recommended in the section 3.1 are not carried forward to the ESP. Is this due to payback periods beyond 15 years?	16	5.2	The list of recommended ECM's was adjusted throughout the course of this project (LGEA, IGA, ESP) for a varity of reasons, and is summarized in the ECM Coordination List.
50	Village School - Section 2: It is unclear to this reviewer why the figures given in the table "Monthly Energy Consumption Comparison" do not match the figures in the electric and gas bill summaries.	16	5.3	Electric consumption in IGA did not properly account for solar PV generation; this has been corrected in the "final" ESP. See response #2 above regarding natural gas consumption.
51	Village School: Several ECMs recommended in the section 3.1 are not carried forward to the ESP. Is this due to payback periods beyond 15 years?	16	5.3	The list of recommended ECM's was adjusted throughout the course of this project (LGEA, IGA, ESP) for a varity of reasons, and is summarized in the ECM Coordination List.
52	The total P4P incentive for the High School/Satz School is listed as $56,854, far less than the total figure given in table 3.4 of the ESP.	16	5.4	(same as #4 above)