

# Investment Grade Audit – Klinger Middle School

## Overview

As part of the request for qualifications (RFQ) selection requirements by Centennial School District (CSD) seeking performance-based efficiency improvements, Reynolds Energy Services (RES) is submitting an investment grade audit (IGA) that outlines a project that will save energy, improve operational efficiency and promote energy awareness. The main focus of this IGA will be for a project associated at Klinger Middle School with minor work associated at Log College Middle School.

RES has conducted site surveys at Klinger Middle School and Log College Middle School, and has evaluated utility information provided. For the energy efficiency measures (EEMs) listed in this section, it is important to understand our approach to evaluating a project. The following components are essential in establishing baseline energy use and costs, and in evaluating EEMs:

### ➤ Energy Use Analysis

- Establish annual utility usage baseline
  - Helps identify initial project boundaries – cannot save more than minimum feasibly required to operate building
- Conduct benchmarking analysis
  - Use USDOE Commercial Building Energy Consumption Survey (CBECS) data to compare energy use intensity (EUI) to peer buildings
  - Helps identify energy savings potential
- Perform end-use analysis
  - **What?** - Electricity, Natural Gas, Water
  - **Where?** - Heating, Ventilation and A/C (HVAC), Lighting, Cooking, Domestic Hot Water, Plug Loads – Computers, Projectors, etc.
  - **Why?** - Off-hours operation, Malfunctioning Equipment, Automated controls issues
- Create baseline energy models
  - Create calibrated baseline energy models using simulation software or bin analysis

### ➤ Energy Cost and Savings Analysis

- Establish annual utility cost baseline
  - Make sure all utility accounts are provided – many Owners shop for electric generation and natural gas commodity annually.
  - Model utility tariffs to assure appropriate application of rates
- Conduct savings calculations based on EEMs
  - Run model scenarios reflecting implemented EEMs to determine energy use differential for each EEM.
  - Run selected EEMs together to account for interactive effects.
  - Non-weather related EEMs may be analyzed outside of model

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- Apply appropriate utility rates and tariffs to savings calculations
  - Run projected energy use profiles through tariff models to accurately predict utility bill savings.
  - Many times a blended rate (\$/kWh, or \$/MCF) is misapplied without considering fixed costs or tiered rate structures.

## Energy Use Analysis

Our approach to energy savings projects begins by providing Owners with a detailed look at the energy usage in their facilities. We then partner with them to select those EEMs that would have the largest impact on how they spend their utility dollars.

### Utility bill analysis

The table below shows the annual utility summary based on data from July, 2014 through July, 2015 for Klinger MS.

TABLE: Annual Utility Summary by Building

Building Name	Electric			Fuels		Water/Sewer		TOTAL	
	kWh	kW	\$	ccf	\$	kgal	\$	\$	\$/sf-yr
Klinger Middle School	871,600	360	\$ 85,777	58,127	\$ 41,799	990	\$ 14,262	\$ 141,839	\$ 1.21

Costs used in the analysis are indicative of utility information provided by CSD. PECO provides distribution services for both the natural gas and electricity. Two natural gas accounts, one larger service associated with the boiler plants and one smaller service, exist for Klinger MS. The electric and gas commodity charges are provided through Constellation Energy. Using the given bills, electric rates were derived to be \$0.067/kWh and \$8.33/kW. Based on the gas billing, a rate of \$0.69/CCF was used for both accounts. Water and sewer billing is provided through Southampton Township and their rates were found by contacting the authority. The water and sewer rates are \$6.31/kGal. and \$8.09/kGal. respectively. Refer to Schedules C and E of the GESA for more information on the baseline energy usage and rates used for calculations.

### Benchmarking

After the baseline usage is established, the next step is to determine the magnitude of the possible savings. Next, an in-depth analysis is provided to understand the specific areas of energy use and target where they can be reduced. Once this analysis has been completed, potential EEMs are targeted for further study and development.

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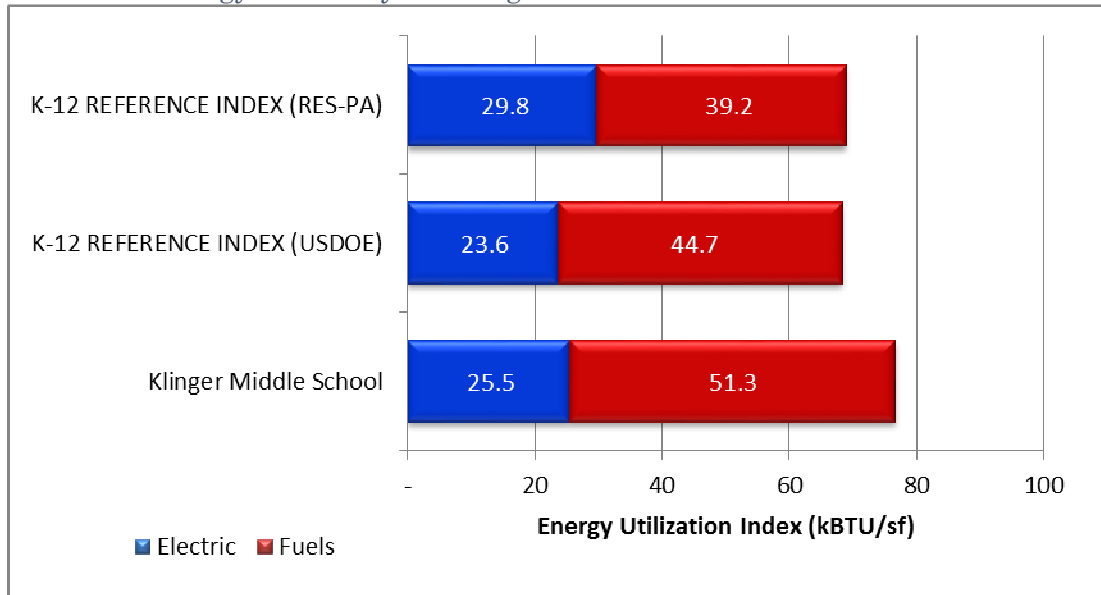
To benchmark the energy use of each building, the utility data provided are compared to energy use indices derived from the U.S. Department of Energy’s CBECS database, as well as from our own database of Pennsylvania schools gathered from previous projects. The benchmarking process compares like fuel use to that of peer buildings in this region on a square-foot basis. Ratings at or above average indicate that there is room for improvement. It is also useful to look at the intensity of each fuel use in comparison to the reference indices, as it can direct us when looking for specific areas to conserve energy. The following figures show the energy indices and benchmarking analysis for Klinger MS.

TABLE: Resource and Cost Indices By Building

Building Name	RESOURCES			COSTS		Water \$/sf-yr
	Electric kBTU/sf-yr	Fuels BTU/sf-y	Total Energy kBTU/sf-yr	Water kgal/sf-yr	Energy \$/sf-yr	
Klinger Middle School	25.5	51.3	76.7	8.5	\$ 1.09	\$ 0.12
<i>K-12 REFERENCE INDEX (USDOE)</i>	<i>23.6</i>	<i>44.7</i>	<i>68.3</i>	<i>na</i>	<i>na</i>	<i>na</i>
<i>K-12 REFERENCE INDEX (RES-PA)</i>	<i>29.8</i>	<i>39.2</i>	<i>69.0</i>	<i>na</i>	<i>na</i>	<i>na</i>
<b>ALL BUILDINGS</b>	<b>25.5</b>	<b>51.3</b>	<b>76.7</b>		<b>\$ 1.09</b>	<b>\$ 0.12</b>

As the figure below indicates, minimal savings potential for Klinger MS exists in both electrical usage and fuel usage. As part of the 2012 energy savings project with Siemens, many energy savings measures (new lighting, building automation scheduling, new boiler, etc.) were addressed and are reflected within the energy usage profile.

FIGURE: Energy Indices by Building



The next step is to develop a rate tariff model. We believe that using a rate tariff model is more accurate than using blended rates, which can lead to misleading results.

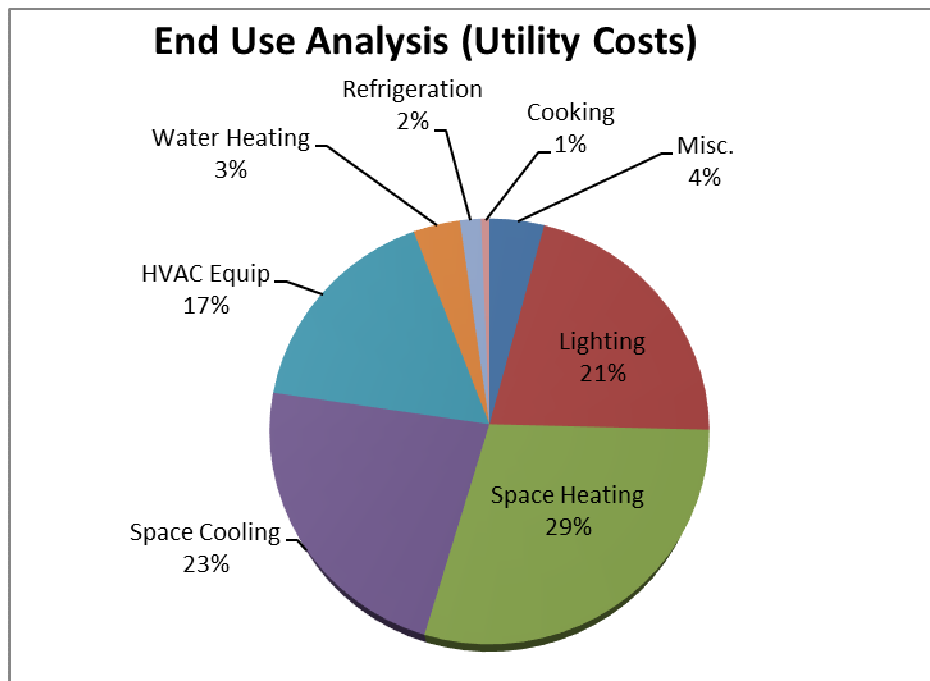
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The rate tariff model mimics the same calculation method used by the utility company to generate a monthly bill. For the IGA and GESA purposes, RES used the derived rates previously mentioned.

## End-Use Analysis

With the previous steps completed, we perform an end use analysis to investigate how and where the energy is being used in the building by using data from HVAC schedules, site observations, and hours provided during site visits. Typically RES aims for a modeled value within 5% accuracy of the given baseline data. The following page shows a modeled accuracy within 2% of annual values. The end use analysis is detailed in the following pages. The chart below summarizes the results of the end use analysis and provides a breakdown of where the combined electric and natural gas costs are being spent as a percentage of end use. Water usage is also identified within Schedule E of the GESA document.

## END USE UTILITY COST



**Centennial SD - Klinger MS**

Square Footage **116,770**

	Nameplate Values			Actual			%
	Ton	kW	HP	kW	HOURS	kWh	
Plug/Misc	0.3			35.0	2,400	84,074	9%
Lighting	1			116.8	2,400	280,248	32%
Cooling	1	300		300.0	1,000	300,000	34%
AHUs			57	47.8	2,800	133,777	15%
Uvs			1	0.8	2,800	2,347	0%
CUHs			5	4.2	3,000	12,573	1%
Pumps			20	16.8	4,000	67,056	8%
EFs			3	2.5	2,400	6,035	1%

Modeled Accuracy			
	kW	kWh	CCF
Summer	8%	-22%	
Winter	-3%	23%	
<b>Total</b>	<b>2%</b>	<b>-1%</b>	% Error Shown

Peak kW **419**      Total kWh **886,111**

Baseline			
	Peak kW	kWh	Mths.
Summer	360	420,000	Apr.-Sep.
Winter	356	451,600	Oct.-Mar.
<b>Total</b>		<b>871,600</b>	

Baseline	
CCF	58,127

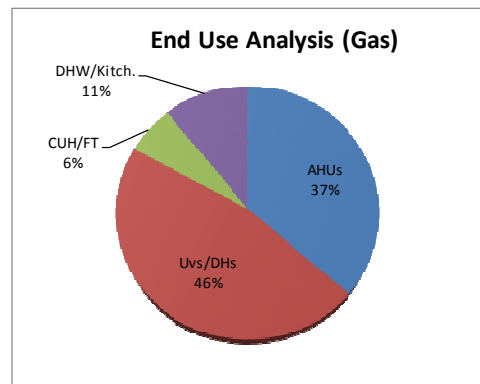
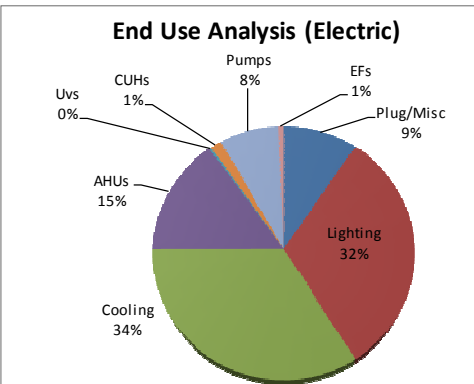
Modeled			
	Peak kW	Total - kWh	Mths.
Summer	393	329,143	Apr.-Sep.
Winter	344	556,968	Oct.-Mar.
<b>Total</b>		<b>886,111</b>	

Tag	MBH Total	Hours	CCF	
AHUs	1,200	1400	21,000	36%
Uvs/DHs	1,529	1400	26,754	46%
CUH/FT	267	1080	3,609	6%
DHW/Kitch.	500	1000	6,250	11%
Conv. Factor		100		
Boiler Eff.		80%		

Modeled Nat. Gas	
CCF Natural Gas	57,613

BASELINE ELECTRIC DATA			
	kWh	kW	\$
Jan	84,800	223	\$ 7,448
Feb	74,000	220	\$ 6,712
Mar	73,200	218	\$ 6,639
Apr	66,800	264	\$ 6,609
May	80,400	336	\$ 8,108
Jun	90,400	348	\$ 8,866
Jul	57,600	260	\$ 5,971
Aug	52,800	260	\$ 5,656
Sep	72,000	360	\$ 7,758
Oct	69,200	356	\$ 7,540
Nov	71,600	327	\$ 7,456
Dec	78,800	218	\$ 7,014
<b>Total</b>	<b>871,600</b>	<b>3,390</b>	<b>\$ 85,777</b>

BASELINE FUEL DATA			
	CCF	CCF	\$
Jan	10,800	721	\$ 8,173
Feb	10,050	636	\$ 7,584
Mar	8,500	2,116	\$ 7,570
Apr	4,500	2,440	\$ 4,979
May	1,460	1,098	\$ 1,897
Jun	-	718	\$ 595
Jul	-	404	\$ 361
Aug	-	377	\$ 341
Sep	10	545	\$ 458
Oct	70	736	\$ 622
Nov	4,020	919	\$ 3,527
Dec	7,500	507	\$ 5,692
<b>Total</b>	<b>46,910</b>	<b>11,217</b>	<b>\$ 41,799</b>



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Our strategy includes addressing all slices of the pie chart with the appropriate type of conservation program. Larger components represent larger savings potential; therefore these areas were addressed more aggressively than other areas. It should be noted that the larger end uses shown are associated with lighting and HVAC systems.

## Savings Estimates

RES uses a combination of proprietary tools and powerful modeling software to project energy savings. Existing energy use is carefully analyzed and modeled to establish baseline conditions. The proposed changes are then added to the model to calculate savings. Cost savings are then calculated by applying models of actual rate tariffs to achieve the most accurate results possible. In order to minimize the risk of missed energy savings, RES will employ Option C of the International Performance Measurement and Verification Protocol (IPMVP) for the fuels and an Option A approach for the water and sewer savings. Please refer to Schedule F, Measurement and Verification Analysis for more details.

RES has experience using different building simulation programs for detailed energy analysis. RES utilized statistical data from a program called eQUEST, which is a powerful DOE-2-based program that has been developed over several years and is recognized as one of the leading analysis programs in the industry. As with any software, the input data and parameters must be carefully analyzed in order to produce accurate results.

As part of the IGA and GESA, energy and water/sewer savings are determined by engineering calculations and End Use analysis. Building simulation results, lighting line by line calculations, water usage modeling, and achieved boiler savings results from similar EEMs were used to derive final savings estimates.

We believe in setting realistic goals for energy savings. While these goals are typically exceeded in actual execution, we start with achievable goals and then move to higher levels of achievement once we have succeeded in reaching the short-term goals. Rather than use a broad based approach of setting an overall energy reduction goal, the energy use is separated into specific categories and then measures are targeted within the categories and realistic savings estimates are applied to these measures. The overall savings target for the project is the aggregate of the individual building EEMs.

The final step is to take interactive effects into consideration. Once you have reduced energy consumption in a specific sector you must reduce the “base” energy use for that sector prior to applying the next efficiency measure so that cumulative savings are not overstated. In regards to operational cost savings estimates, RES continues to be realistic and conservative in developing a project. With any new system replacement, the newly installed systems will eventually require maintenance and repairs that will offset any initial savings. In some cases the installed equipment, such as new controls systems, are likely to require more maintenance than the previous systems.

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A more realistic approach would be to start with a reasonable savings in year one and decrease that number over the first five or six years to zero. With lighting, operational savings is legitimate for the first few years, replacement of the bulbs and ballast will be needed sooner or later. Once again, we would contend that a more realistic approach would be to show the savings in year one and slowly decrease that number over the succeeding years to a zero sum in year five.

The following pages describe the energy efficiency measures in detail.

## Energy Efficiency Measures

### EEM #1 – Mechanical System Upgrades

The remaining existing boiler at Klinger Middle School is 45 years old. The boiler is in fair to poor operating condition. Replacement of this boiler would provide an energy savings component associated with efficiency gains that come with newer, high efficiency boiler technology.

The central plant heating hot water and chilled water piping configuration needs to be modified to accommodate new heating and chilled water plant operational efficiencies that cannot be achieved with the current configuration. In addition, most piping specialties (manual valves, control valves, flexible connectors, air management components, etc.) are in very poor condition and should be replaced.

Combining new condensing boiler technology with an aggressive hot water reset strategy will allow the condensing boilers to operate in condensing mode (with hot water supply temperatures below 150 °F) for a large portion of the school operating year to maximize efficient boiler plant operation.

Klinger Middle School does not have a full building automation system installed. The building utilizes pneumatic controls that contain a master graphic control annunciation panel located in the boiler room. This panel provides hand-off-auto control of the heating/cooling zones in the building. Due to the age of the current control installation, RES believes this building would benefit from a modern digital control automation system.

HVAC equipment throughout the building, with the exception of two (2) air handling units, is old and has reached the end of its useful life and should be replaced.

Moderate demolition of existing piping and ductwork is required to accommodate updated installations. There will be minor asbestos abatement required primarily at existing to remain chilled and heating hot water elbows and on piping and in boilers in the mechanical/boiler room.

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## **Klinger Middle School Boiler Installation**

- Remove the remaining existing boiler, including gas and oil connections and stack connections.
- Install two, new 2.500 MBH high efficiency gas-fired condensing hot water boilers with factory equipped pre-piped and pre-wired gas train assembly.
- Basis of design: Patterson-Kelley MACH C-3000 or approved equal.
- Locate the new boilers on a new concrete pad in the location of the boiler to be demolished.
- Extend new insulated hot water piping from the existing hot water piping mains to connect to the new boiler.
- Provide and install all necessary drain and relief piping, safety devices, valves, fittings, and appurtenances as required for a fully operational system.
- Provide and install new double-wall factory built exhaust flue vent from the new boilers through the roof or side wall as per the manufacturer's instructions and code requirements.
- Install a condensate drain line from the base of the vent stack to the sanitary drain system.
- Extend new gas piping from the existing gas branch piping to connect to the new boilers gas train assemblies. Provide and install any relief gas piping as required to conform to Code regulations.
- Install and connect new electrical circuit to each new boiler.
- Provide testing and balancing on hot water loop.

## **Replace and/or upgrade the existing HVAC equipment as follows:**

- Replace indoor air handling units except the units that serve the Science classrooms and the Library. Provide VFDs for the existing fans in the air handling units serving the Science classrooms and the Library area.
- Replace existing hot water and chilled water pumps with new pumps having variable volume.
- Provide new energy recovery units to satisfy the current code requirements for outside air select locations.
- Provide air-cooled condensing units for air handling units serving the computer labs.
- Replace existing fan coil units.
- Replace existing individual room hot water duct coils.
- Replace existing outside air intakes with new units and motor operated dampers.
- Replace existing heating terminal units, one-for-one, with standalone electronic controls. (e.g. unit heaters, convectors, etc.)
- Provide new VAV boxes with electric heating in select locations.
- Replace existing gravity roof vents with motor operated dampers.
- Provide new grilles and diffusers to accommodate new or modified space layouts.
- Provide a new, fully automated, digital control system for the building. Control system will be either Siemens or an open protocol based alternative (BACnet or Lon-based).



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## **EEM #2 – Electrical System Upgrades**

### **Lighting Systems**

A detailed room by room interior and exterior lighting audit was conducted at Klinger MS. The audit showed that the lighting systems consists of energy efficient lamps (T-8, 25 watt fluorescent lamps and compact fluorescent technologies) as a result of the 2012 energy project. Exterior lighting was not addressed as part of the 2012 project, and furthermore, the high wattage (350 watts per fixture) stage lighting in the auditorium is being used for classroom applications. An additional item indicated by staff, was to implement occupancy sensors for corridor lighting control on the second floor in the classroom section of the main building.

### **Exterior Scope:**

- Retrofit existing parking lot lighting with new LED technology
- Retrofit existing pathway lights with new LED technology
- Replace high pressure sodium (HPS) wall packs on all surfaces of the building with new LED technology
- Replace HPS canopy surface mounted canopy lights in all entry ways with new LED technology
- Replace fixtures to illuminate 4 embedded stone sculptures on the 2nds Street Pike facing corners of the building (2 on SE corner and 2 on NE corner)

### **Interior Scope:**

- Add LED task lighting to Auditorium stage to reduce use of high wattage fixtures currently in place
- Add occupancy sensors for corridor lighting control on the second floor in the classroom section of the main building
- Replace all exit signs with new LED signs
- Retrofit (3) 8 foot wall washing fixtures located in the main offices w/ LED lamps
- Replace lamps for China hats in maintenance shop and office
- Replace lamps for recessed lighting cafeteria
- Replace ramp corridor lighting with new surface mounted fixtures w/ LED lamps
- Replace select stairwell lighting with similar fixtures and lamps installed in the connecting ramp area
- Replace lamps in the back of the house areas – storage, mechanical rooms, small restrooms – with LED equivalents
- Replace lighting fixtures in drywall ceilings being removed and replaced with new lay-in ceilings.

### **Power Systems**

- Replace the existing building service entrance switchgear.
- Replace select antiquated power panels throughout the building.
- Refeed ten (10) existing power panels with new feeders.
- Install new transformers to replace existing inefficient transformers.

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## Low Voltage Systems

- Replace existing clock system with new wireless clock system.
- Replace existing non-plenum rated data cabling with new plenum rated data cabling.
- Replace non-plenum rated speaker cabling with plenum rated cabling.
- Replace non-plenum rated security camera cabling with plenum rated cabling.
- Wire fire alarm devices installed to accommodate the HVAC system installation (primarily the wiring of duct mounted smoke detectors).

## Code Compliance Work

Many existing data and power circuiting cabling and flexible raceway are not properly supported. This existing to remain cabling will be correctly tied and supported to meet code requirements.

## **EEM #3 – Plumbing System Upgrades**

A small quantity of toilet room fixtures have sensor operated flush valves, however, most domestic water fixtures in the Klinger Middle School are old standard water flow models. Older toilets and urinals (manufactured before 1992) use approximately 3.5 gallons per flush (gpf) and 1.6-2.0 gpf, respectively. Most faucets have aerators with design flows of 2.0-2.5 gallons per minute.

### Scope:

- Replace toilets, which are not already low flow fixtures, and retrofit urinal flush valves to low flow. In addition, retrofit faucets with tamper resistant aerators to reduce flow and maintain pressure. These changes would minimize water use while maintaining equipment performance. Nominal energy savings could be achieved through reduction of hot water use at sinks.
- The gang toilet rooms will receive significant reworking of the chases between the toilet rooms to allow the water closets to be converted from floor mounted fixtures to wall mounted fixtures.
- Floor drains will be added to the second floor gang toilets only. There will be no floor drains added to the first floor (slab on grade) gang toilet rooms.
- Replace drinking fountains and replace existing water coolers with new ADA compliant bi-level water coolers except a few instances where the existing water cooler location will only accommodate a direct replacement.

## **EEM #4 – Architectural Upgrades**

The connecting corridor between the classroom wing and the Gym/Auditorium/Pool wing has a large expanse (approximately 1,200 SF) of southwest facing single pane glazing. This glazing at Klinger MS is non-safety glazing.

The existing brick façade installation has failed and requires replacement.

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## Scope:

- Demolition & abatement.
- Install new windows including the connecting corridor.
- Replace the building façade.
- Provide spray insulation & air barrier systems.
- Minor excavation, landscaping, paving patch and sidewalk replacement.
- Replace corridor doors and hardware.
- Update gang bathrooms for accessibility.
- Miscellaneous masonry modifications and finishes.
- Select suspended ceiling replacement.
- Select hard ceiling select replacement.
- Casework.
- Painting.
- Flooring.
- Window treatments.
- Roofing.

## **EEM #5 – Log College – Phase 1 Work**

Work during this phase at Log College consists of converting two (2) first floor classrooms and the storage room between the classrooms into STEM (Science-Technology-Engineering and Math) rooms and prep room.

## Scope:

- Installation of sinks in each STEM room and prep room.
- HVAC system modifications to accommodate the new STEM function.
- Casework modifications.
- Electrical system upgrades associated with new STEM function.

## **EEM and Project Costs**

Refer to the attached Schedules B and C for the projected energy and operating cost savings, avoided capital scope, and Reynolds' energy savings guarantee.

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## SCHEDULE B

<b>Centennial School District</b>					
Energy Project Financial Overview					
<b>EEM #</b>	<b>EEM Name</b>	<b>EEM Construction Cost</b>	<b>Annual Resource Savings</b>	<b>Annual Operational Savings (1)</b>	<b>Potential Act 129 Incentive</b>
<b>Klinger Middle School</b>					
1	Mechanical System Upgrades	\$ 4,533,219	\$ 4,670	\$ 1,300	\$ -
2	Electrical System Upgrades	\$ 1,013,012	\$ 3,430	\$ 800	\$ 2,000
3	Plumbing System Upgrades	\$ 896,995	\$ 6,336	\$ 400	\$ -
4	Architectural Upgrades	\$ 7,966,707	\$ 914	\$ 2,500	\$ -
5	Log College - Phase 1 Work	\$ 190,427	\$ -	\$ -	\$ -
6	* Code Compliance	\$ 150,698	\$ -	\$ -	\$ -
<b>PROJECT TOTALS</b>		<b>\$ 14,751,058</b>	<b>\$ 15,350</b>	<b>\$ 5,000</b>	<b>\$ 2,000</b>

\* Any unused amount of costs associated with the Code Compliance EEM will be credited back to Centennial School District

**SCHEDULE B  
Cash Flow Analysis**

**CENTENNIAL SCHOOL DISTRICT  
Guaranteed Energy Savings Contract**

**Financed Project Cost (1): \$ 14,751,058**  
 Finance Term (months): 240  
 Annualized Interest Rate: variable

**Est. Avoided Capital Costs (2): \$ 20,935,049**

**Estimated PECO Rebates (3): \$ (2,000)**

**Escalation Rates by Utility & Fuel**  
 Electric: 3.0%  
 Natural Gas: 3.0%  
 Fuel Oil: 3.0%  
 Water: 3.0%  
 Other: 3.0%  
 Operational: 3.0%  
 Escalation Rates for Annual Fees: 2.0%

Year	Electric Cost Savings	Natural Gas Cost Savings	Water Cost Savings	Operational Cost Savings	Total Cost Savings	Guaranteed Savings	Avoided Capital Contribution	Annual M&V Fees	Financing Payment (4)	Net Savings	Cumulative Savings
1	\$ 5,386	\$ 3,628	\$ 6,336	\$ 4,473	\$ 19,823	\$ 18,922	\$ 1,687,104		\$ (1,706,026)	\$ -	\$ -
2	\$ 5,548	\$ 3,736	\$ 6,526	\$ 4,580	\$ 20,390	\$ 19,461	\$ 1,015,499	\$ (2,035)	\$ (1,032,925)	\$ -	\$ -
3	\$ 5,714	\$ 3,848	\$ 6,722	\$ 4,713	\$ 20,998	\$ 20,041	\$ 1,014,609	\$ (2,076)	\$ (1,032,575)	\$ -	\$ -
4	\$ 5,886	\$ 3,964	\$ 6,924	\$ 4,728	\$ 21,501	\$ 20,516	\$ 1,015,976	\$ (2,117)	\$ (1,034,375)	\$ -	\$ -
5	\$ 6,062	\$ 4,083	\$ 7,131	\$ 4,866	\$ 22,142	\$ 21,128	\$ 1,016,407	\$ (2,160)	\$ (1,035,375)	\$ -	\$ -
6	\$ 6,244	\$ 4,205	\$ 7,345	\$ 4,437	\$ 22,231	\$ 21,186	\$ 1,014,066	\$ (2,203)	\$ (1,033,050)	\$ -	\$ -
7	\$ 6,431	\$ 4,331	\$ 7,566	\$ 4,569	\$ 22,897	\$ 21,821	\$ 1,012,601	\$ (2,247)	\$ (1,032,175)	\$ -	\$ -
8	\$ 6,624	\$ 4,461	\$ 7,792	\$ 4,705	\$ 23,584	\$ 22,475	\$ 1,014,742	\$ (2,292)	\$ (1,034,925)	\$ -	\$ -
9	\$ 6,823	\$ 4,595	\$ 8,026	\$ 4,846	\$ 24,290	\$ 23,149	\$ 1,010,489	\$ (2,338)	\$ (1,031,300)	\$ -	\$ -
10	\$ 7,028	\$ 4,733	\$ 8,267	\$ 4,990	\$ 25,018	\$ 23,842	\$ 1,014,717	\$ (2,384)	\$ (1,036,175)	\$ -	\$ -
11	\$ 7,239	\$ 4,875	\$ 8,515	\$ -	\$ 20,629	\$ 19,417	\$ 1,015,008	\$ -	\$ (1,034,425)	\$ -	\$ -
12	\$ 7,456	\$ 5,021	\$ 8,771	\$ -	\$ 21,248	\$ 20,000	\$ 1,016,050	\$ -	\$ (1,036,050)	\$ -	\$ -
13	\$ 7,679	\$ 5,172	\$ 9,034	\$ -	\$ 21,885	\$ 20,600	\$ 1,012,238	\$ -	\$ (1,032,838)	\$ -	\$ -
14	\$ 7,910	\$ 5,327	\$ 9,305	\$ -	\$ 22,542	\$ 21,218	\$ 1,013,657	\$ -	\$ (1,034,875)	\$ -	\$ -
15	\$ 8,147	\$ 5,487	\$ 9,584	\$ -	\$ 23,218	\$ 21,854	\$ 1,011,521	\$ -	\$ (1,033,375)	\$ -	\$ -
16	\$ 8,391	\$ 5,652	\$ 9,871	\$ -	\$ 23,914	\$ 22,510	\$ 1,010,615	\$ -	\$ (1,033,125)	\$ -	\$ -
17	\$ 8,643	\$ 5,821	\$ 10,167	\$ -	\$ 24,632	\$ 23,185	\$ 1,012,565	\$ -	\$ (1,035,750)	\$ -	\$ -
18	\$ 8,903	\$ 5,996	\$ 10,472	\$ -	\$ 25,371	\$ 23,881	\$ 1,007,369	\$ -	\$ (1,031,250)	\$ -	\$ -
19	\$ 9,170	\$ 6,176	\$ 10,787	\$ -	\$ 26,132	\$ 24,597	\$ 1,009,903	\$ -	\$ (1,034,500)	\$ -	\$ -
20	\$ 9,445	\$ 6,361	\$ 11,110	\$ -	\$ 26,916	\$ 25,335	\$ 1,009,915	\$ -	\$ (1,035,250)	\$ -	\$ -
<b>TOTAL</b>	<b>\$ 144,728</b>	<b>\$ 97,474</b>	<b>\$ 170,251</b>	<b>\$ 46,907</b>	<b>\$ 459,360</b>	<b>\$ 435,139</b>	<b>\$ 20,935,049</b>	<b>\$ (19,850)</b>	<b>\$ (21,350,338)</b>	<b>\$ -</b>	<b>\$ -</b>

- NOTES:**
1. Financed Project Cost reflects the guaranteed fixed price of the scope executed under the Guaranteed Energy Savings Agreement, including the first year of measurement and verification of savings.
  2. Avoided Capital Savings includes the amortized annual cost of capital equipment replacement or repairs that would be realized by the Owner within the lifetime of the Energy Project, but will instead be completed and financed through the Energy Project.. Savings include the total costs for all design, bidding, bonding, permitting, equipment and installation labor required to complete the work.
  3. Estimated payment from PECO/EPD 100kW-500kW Act 129 rebate programs based on information published by PECO/EPD 100kW-500kW and applied to this project.
  4. Year 1 financing payment includes annual payment plus construction interest.

# Investment Grade Audit – Klinger Middle School

## SCHEDULE C

Reynolds Energy Services (RES) guarantees that the Customer will achieve savings in Year 1 as listed in the following table. Escalation rates will be applied to future year savings according to the Cash Flow Analysis included in Schedule B.

**TABLE: Guaranteed Annual Energy Savings by Measure and Resource**

EEM	ELECTRIC				FUELS				WATER/SEWER			TOTAL	
	kWh	kW	Calculated	Guaranteed	ccf	Calculated	Guaranteed	kgal	Calculated	Guaranteed	Calculated	Guaranteed	
			\$	\$		\$	\$		\$	\$	\$		
1 Mechanical System Upgrades	14,920	45	\$ 1,372	\$ 1,235	4,691	\$ 3,298	\$ 2,968	-	\$ -	\$ -	\$ 4,670	\$ 4,203	
2 Electrical System Upgrades	40,000	90	\$ 3,430	\$ 3,087	-	\$ -	\$ -	-	\$ -	\$ -	\$ 3,430	\$ 3,087	
3 Plumbing System Upgrades	-	-	\$ -	\$ -	-	\$ -	\$ -	440	\$ 6,336	\$ 6,336	\$ 6,336	\$ 6,336	
4 Architectural Upgrades	8,716	-	\$ 584	\$ 526	469	\$ 330	\$ 297	-	\$ -	\$ -	\$ 914	\$ 822	
5 Log College - Phase 1 Work	-	-	\$ -	\$ -	-	\$ -	\$ -	-	\$ -	\$ -	\$ -	\$ -	
6 Code Compliance	-	-	\$ -	\$ -	-	\$ -	\$ -	-	\$ -	\$ -	\$ -	\$ -	
<b>TOTAL</b>	<b>63,636</b>	<b>135</b>	<b>\$ 5,386</b>	<b>\$ 4,848</b>	<b>5,160</b>	<b>\$ 3,628</b>	<b>\$ 3,265</b>	<b>440</b>	<b>\$ 6,336</b>	<b>\$ 6,336</b>	<b>\$ 15,350</b>	<b>\$ 14,448</b>	

The guaranteed savings shall be calculated as shown in Schedule F for the term of the Agreement. RES will pay the Customer the difference between the annual amount guaranteed and the amount of actual energy savings achieved in accordance with the provisions provided within the GESA as mutually agreed upon by RES and Customer. Payments for any savings shortfall will be paid to the Customer by RES in accordance with Section 4.2 of the GESA. Stipulated savings are savings that have been calculated and agreed upon by RES and Customer. Operational, maintenance and avoided capital savings are stipulated, and as such will not be tracked or measured. Rebates from utilities or any other source are not guaranteed by RES.

**TABLE: Projected Operational & Maintenance Cost Savings (Year 1)**

EEM	NATURE OF COSTS AVOIDED OR SAVINGS GENERATED	ANNUAL SAVINGS
		\$
1 Mechanical System Upgrades		\$ 1,300
2 Electrical System Upgrades		\$ 800
3 Plumbing System Upgrades	Equipment not replaced during warranty period; extended lamp life	\$ 400
4 Architectural Upgrades	Net maintenance impact of adding new equipment, replacing old equipment	\$ 2,500
5 Log College - Phase 1 Work	Net maintenance impact of adding new equipment, replacing old equipment	\$ -
6 Code Compliance		\$ -
<b>TOTAL</b>		<b>\$ 5,000</b>

Operational and maintenance (O&M) savings primarily include the maintenance costs avoided due to old or problematic equipment being replaced with new equipment or if equipment is altogether removed. Savings also include reduction in maintenance expense for materials during the new equipment warranty period.

# Investment Grade Audit – Klinger Middle School

## Centennial School District

TABLE: Avoided Capital Scope and Savings Breakdown

Scope Item	Total Cost (1)
Architectural/façade improvements	\$ 8,082,889
HVAC system replacements	\$ 4,520,938
Electrical system components	\$ 919,257
Lighting fixture replacements	\$ 89,049
Plumbing system components	\$ 890,488
<b>TOTAL:</b>	<b>\$ 14,502,620</b>

NOTES: (1) Includes all Bidding, Permitting, Bonding, Equipment, and Installation Labor costs required to complete individual projects.

**Monthly Payment Amount \$ 84,109**

**Annual Payment Amount \$ 1,009,312**

Annualized Interest Rate: 3.50%

Finance Term (months): 240

# Investment Grade Audit – Klinger Middle School

## Utility Rates

Guaranteed dollar amounts are calculated based on the base utility rates listed below, and escalated at the rates listed in Schedule B. If actual electric or gas rates are lower than those listed in this Schedule and escalated as described above, RES reserves the right to use the base utility rates for the guarantee period. If actual rates are higher than those listed in this Schedule and escalated as described above, RES reserves the right to use the actual rates for the guarantee period.

### Rate tariffs/avoided utility costs utilized in calculation of guaranteed energy savings:

The rates shown in the table below were derived from bills provided through September 2016.

#### Electric – PECO Charges:

Description	Unit	Cost/Unit
Customer Charge	Monthly	\$297.12
Distribution	kW	\$8.33
Total Generation Charge w/ tax	kWh	\$0.067

\*Generation charge was derived from the February 2017 bill and is included from Constellation New Energy

#### Natural Gas Charges:

Description	Unit	Cost/Unit
Customer Charge	Monthly	\$28.55
Distribution	Ccf	\$0.33
Commodity Charge (converted)*	Ccf	\$0.36

\*Commodity Charge was derived from the most recent year average.

#### Water/Sewer – Southampton Water Authority Charges:

Description	Unit	Cost/Unit
Water Charges (>1 kGal.)	kGal.	\$6.31
Sewer Charges (>135 kGal.)	kGal.	\$8.09

\*Charges were provided by the authority. Costs shown reflect values that are impacted beyond the base rates.

### Utility accounts that will be tracked for the guaranteed energy savings:

Customer Name:	Utility:	Account #:	Meter #:	Provider/Rate:
Klinger MS - Main	Electricity	83202-01207	017457141	PECO/EPD 100kW-500kW
Klinger MS - Boilers	Natural Gas (CCF)	46033-01003	044348580	GS Commercial - Distribution
Klinger MS - Other	Natural Gas (CCF)	64455-00809	027771908/027614095	GS Commercial
Klinger MS - Boilers	Natural Gas (DT)	RG-156792		Constellation Commodity



# Investment Grade Audit – Klinger Middle School

## Guaranteed Savings Reconciliation

The guarantee term will commence on the Commencement Date as defined in Section 3.1 and be referred to as the “savings guarantee commencement date”.

RES will monitor monthly utility usage for the guarantee period, within sixty (60) days of receiving pertinent utility bills. RES will provide Annual Savings Reports to the Customer, which shall include the initial calculation of the total dollar savings, the measurement and verification calculations and any other reasonable information requested by the Customer. Upon the submittal of the annual savings report, reconciliation (if necessary) will be in accordance with Section 4.2 of the GESA.

The Customer agrees to

1. Provide or cause its utility suppliers to provide periodic utility usage and cost in a timely manner. Preferably within two (2) weeks of the “Read Date” shown on the bill. RES will initiate data requests.
2. Execute all Customer responsibilities as set forth in the Agreement.
3. Provide RES full access to all pertinent facilities and information required for RES to perform its responsibilities. Access shall include but not be limited to the following:
  - a. All areas of all buildings included in the project
  - b. All utility meters included in the guarantee
  - c. All personnel responsible for operating and maintaining facilities
  - d. Remote access to building automation systems via credentials assigned to RES. Full access is required for commissioning and troubleshooting purposes. Access may be changed to read-only for monitoring at the conclusion of the commissioning process at the discretion of the Customer.
  - e. Actual monthly invoices for utilities
  - f. Inventories of material changes made within the facility as defined in Section 15 of the GESA.

# Investment Grade Audit – Klinger Middle School

## SUB-CONTRACTOR LIST

<b>Subcontractors</b>			
<b>Drywall and Ceiling Subcontractor</b>	<b>AD&amp;C</b> 475 Madison Ave. Suite2 York, PA 17404	<b>Austin Duchaine</b>	P: 717-324-1647 F: 800-627-5819 E: <a href="mailto:austin@adcllc.biz">austin@adcllc.biz</a>
<b>Door and Hardware Subcontractor</b>	<b>Capitol Door &amp; Hardware</b> 774 Corporate Circle New Cumberland, PA 17070	<b>John Ryerson Marc Ryerson</b>	P: 717-774-7440 F: 717-774-6992 E: <a href="mailto:jpr@capdoor.com">jpr@capdoor.com</a> E: <a href="mailto:marc@capdoor.com">marc@capdoor.com</a>
<b>Vinyl Floor Subcontractor</b>	<b>CB Flooring, LLC</b> 2311 Hummingbird Lane Harrisburg, PA 17112	<b>Tim Smith</b>	P: 717-545-2826 E: <a href="mailto:timsmith@cbflooring.com">timsmith@cbflooring.com</a>
<b>Excavation Site Subcontractor</b>	<b>Construction Masters Services, LLC</b> PO Box 1063 Reading PA 19607	<b>John Strick</b>	P: 610-777-1061 E: <a href="mailto:jstrick@constructionmastersservices.com">jstrick@constructionmastersservices.com</a>
<b>Resilient Flooring Subcontractor</b>	<b>Durex Coverings, Inc.</b> 53 Industrial Dr. PO Box 639 Brownstown, PA 17508	<b>Brooke Bucher</b>	P: 717-626-8566 F: 717-859-2158 E: <a href="mailto:brooke@durexcoverings.com">brooke@durexcoverings.com</a>
<b>Window Tinting Subcontractor</b>	<b>Doyle Window Tinting</b> 2820 Terwood Road Willow Grove, PA 19090	<b>Raymond Spada</b>	<b>P: 215-657-1000</b> E: <a href="mailto:ray@doylewindowtinting.com">ray@doylewindowtinting.com</a>
<b>Thermal Insulation Subcontractor</b>	<b>Gibble Construction, Inc.</b> 405 Hoffer Rd. Elizabethtown, PA 17022	<b>Nick Cicero</b>	<b>P:717-65-7858</b> E: <a href="mailto:nick@gibbleconstruciton.com">nick@gibbleconstruciton.com</a>
<b>Div. 10 Specialties Subcontractor</b>	<b>Hostetter Supply Co.</b> 97 Church St. PB Box 329 Seven Valleys, PA 17360	<b>William Davis</b>	<b>P:717-728-4909</b> E: <a href="mailto:bill@hostettersupply.com">bill@hostettersupply.com</a>
<b>Window Treatment Subcontractor</b>	<b>Jackson's Window Shop</b> 633 Lausch Ln. Lancaster, PA 17601	<b>Brian</b>	<b>P: 717-394-8673</b> E: <a href="mailto:brian@jwsmail.com">brian@jwsmail.com</a>
<b>Casework Subcontractor</b>	<b>Mastercraft Woodworking Company, Inc.</b> 681 Mohrsville Rd. Shoemakersville, PA 19555	<b>Eli</b>	<b>P: 610-926-1500</b> E: <a href="mailto:elimastercraft@gmail.com">elimastercraft@gmail.com</a>

# Investment Grade Audit – Klinger Middle School

<b>HVAC &amp; Plumbing Subcontractor</b>	<b>Myco Mechanical</b> 1 N. Washington St. Telford, PA 18969	<b>Mark</b>	<b>P: 267-382-0267</b> E: <a href="mailto:@mycomechanical.com">@mycomechanical.com</a>
<b>Fencing Subcontractor</b>	<b>National Fence</b>		
<b>Demolition Subcontractor</b>	<b>Power Component Systems</b> 801 Spangler Road Camp Hill, PA 17011	<b>Todd Quigley</b>	<b>P: 717-939-8226</b> F: 717-939-8227 E: <a href="mailto:tquigley@powercomponentsystems.com">tquigley@powercomponentsystems.com</a>
<b>Electrical Subcontractor</b>	<b>Philips Brothers Electrical Contractors, Inc.</b> 235 Sweet Springs Road Glenmoore, PA 19343	<b>Mark Philips</b>	<b>P: 610-458-8578</b> E: <a href="mailto:@philpsbrothers.com">@philpsbrothers.com</a>
<b>Aluminum Window Subcontractor</b>	<b>Pottsgrove Glass, Inc.</b> 480 Swamp Pike Schwenksville, PA 19473	<b>Bill McGonigal, Jr.</b>	<b>P: 610-587-8978</b> E: <a href="mailto:billjr@pottsgroveglass.com">billjr@pottsgroveglass.com</a>
<b>Aluminum Window Subcontractor</b>	<b>ProCom Roofing Corporation</b> 374 East Rd. Warrington, PA 18976	<b>Walter Murphy Bob Harrington</b>	<b>P: 215-491-4225</b> E: <a href="mailto:bob@procomroofing.com">bob@procomroofing.com</a>
<b>Final Cleaning Subcontractor</b>	<b>Sitebrite Cleaning Services</b> 6088 Winding Lane East Berlin, PA 17316	<b>Rick Shaffer</b>	<b>P: 717-577-9349</b> E: <a href="mailto:sitebriteservices@verizon.net">sitebriteservices@verizon.net</a>