Millington Municipal Schools

Guaranteed Energy Efficiency Improvements and Facility Upgrades

TRANE®

October 17, 2019

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October 17, 2019

Mr. James Griffin, Superintendent of Schools
Millington Municipal Schools Board of Education
5020 2nd Ave.
Millington, TN 38053

Subject: **Energy Conservation and Infrastructure Improvement Program**

Dear Superintendent Griffin:

Trane has completed the Preliminary Audit of the five (5) Millington Municipal Schools sites including the Board of Education building, as listed in the attached sections. The goal of this Preliminary Audit is to identify potential Energy Conservation Measures (ECMs) and infrastructure improvements that are needed due to aging infrastructure or outdated technology. The Preliminary Audit also allows of us to frame a potential self-funding program prior to commencing with the Investment Grade Audit (next step in the process).

In the following section, we have included an ECM Matrix, Executive Savings Summary and supporting documentation for your review. Within the ECM Matrix, the ECMs listed can be implemented at Millington Municipal Schools and leverage the energy savings to offset the capital expense.

For reference and discussion we have outlined specific areas where facility improvements will address aging infrastructure and outdated technology within the Millington Municipal School System and use Energy/Utility/Operational savings to fund the improvements, with the energy/utility use savings guaranteed by Trane. **This program will produce a calculated value of $1,474,273 in savings over the proposed 16-year term, which will offset Millington Municipal Schools' investment in real property improvements, ongoing measurement & verification, Certified Energy Manager (CEM) services and cost of debt service. These program savings represent a 10% reduction in the utility expenditures compared to the baseline for the five (5) facilities that were evaluated** (*see the Financial tab for details*)**.**

Going forward, we are asking Millington Municipal Schools to issue a Letter of Commitment (LOC) to Trane for the Investment Grade Audit (IGA). This is the first step in the process which requires a financial commitment. Trane will retain the services of an independent 3rd-party registered professional engineering firm to support the detailed audit. Having a separate engineering firm involved in the audit and engineering phases provides a check and balance that helps protect your interests. The IGA's fee is determined during the Preliminary Audit process based on the items which have been determined for deeper investigation. The IGA will be a full audit, of all energy conservation measures (ECMs) identified and the facilities determined by Millington Municipal Schools, whether they will ultimately cash flow or not and will serve as a useful tool for future budgeting and procurement.

The fee for the IGA is $93,425 (please see the sample Letter of Commitment – LOC – for details). The costs of the IGA are covered by the guaranteed program savings unless you ultimately decide not to proceed with the program. The results from the full IGA will be the basis for Trane's proposal and will serve your budgeting and procurement needs for years to come.

We truly appreciate the time and effort that the Millington Municipal Schools Maintenance Department has invested in assisting Trane in the development of this Audit and Executive Summary. With this investment of time, we have developed a Preliminary Performance Contracting Program with guaranteed energy/utility use savings that provide immediate and long-term benefits for all of the facilities analyzed.

Our proposed solution addresses the following business issues faced by the Millington Municipal School System:

- ***Updating Aging Infrastructure***

As the buildings in the Millington Municipal School System age, they require more maintenance and capital replacements. There are also new regulations, mandates and environmental guidelines that need to be met. To control long-term operating costs and protect your school system's assets, updating the aging infrastructure is critical.

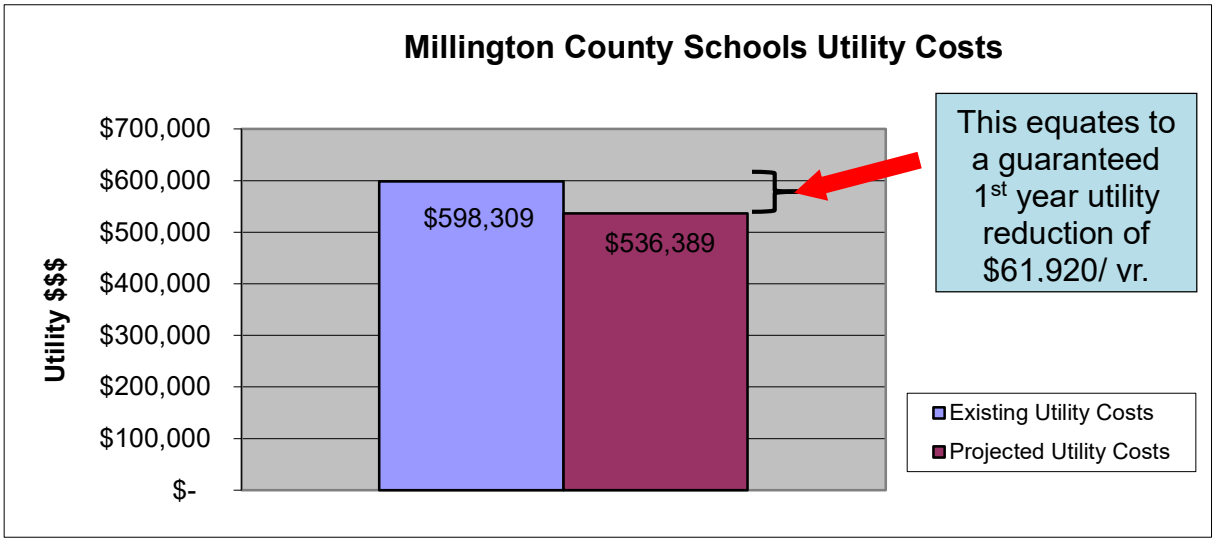
- ***Eliminating up-front Capital Expense***

We understand that with Millington Board of Mayor and Aldermen current needs, securing capital funds can be difficult and typically means long-term debt. Millington Municipal Schools Schools continually faces the need to undertake projects that update infrastructure, improve environmental conditions and implement new technology upgrades. The best way to accomplish this is to do so without a large up-front capital expenditure. **Our program accomplishes this goal by reinvesting the savings derived from infrastructure investments back into the facilities and guarantees the energy/utility use savings.**

- ***Reducing Operating Costs***

Given the ever-increasing utility rate increases and the budgeting pressures to reduce and control spending, this program is a beneficial solution for your public schools. Sustainable energy/utility savings fund the improvements and continue to provide positive cash flow throughout the project and after the financial term ends. ***The resulting energy reductions for Millington Municipal Schools are impressive -*** *See Savings Summary and Cash Flow Model for details*.

Millington Municipal Schools Projected Impact



- ***Carbon Footprint Reduction-***

This Program will also have a <u>significant favorable environmental impact by reducing:</u> CO_2 emissions, Sulfur Dioxide and Nitrous Oxide.

CO_2 emissions	**1,019,091**	**Lbs. / yr.**
Sulfur Dioxide	**5,903**	**Lbs. / yr.**
Nitrous Oxide	**1,743**	**Lbs. / yr.**

- ***Visibility and Public Perception***

Millington Municipal Schools can be a leader in Tennessee by proactively addressing high energy costs and aging infrastructure **without additional burden to the City of Millington taxpayers.**

This project includes energy efficient LED lighting platforms interior and exterior, , new and/or upgraded heating, ventilating and air-conditioning (HVAC) control and automation systems, new HVAC units and systems, building envelope and weatherization upgrades throughout the school sites with addional mechanical, building automation and window replacements at selected schools. *See ECM Matrix Summary for more details (next tab).*

All of these measures will upgrade the Learning Environment in Millington Municipal Schools, from improving light levels in classrooms, to maintaining the proper amount of outdoor air ventilation and temperature control for optimal indoor space conditions and energy savings. This is truly a great infrastructure improvement program, funded by the utility savings it produces!

We want to remind you again, that through this project, Millington Municipal Schools will be <u>redirecting a portion of the existing utility spend</u> toward infrastructure improvements that will generate energy- and non-energy-based savings to off-set the cost of the project from the existing budget.

With the School Board's approval and a funding commitment from the Millington Board of Mayor and Aldermen, Trane is prepared to mobilize immediately to perform the IGA. We thank you for this opportunity and look forward to working with you to make the Millington Municipal Schools program a success.

We appreciate your consideration. Please let us know if you have any questions.

Sincerely,

Jim Crone
Government & Business Relations
Trane U.S, Inc.

C: Stewart Shunk, Trane
Jeromy Cotten, Trane
Jason Land, PE, Trane

Millington City Schools - ECM Matrix

Facility Name	Interior LED Upgrades	Exterior Lighting Upgrades	BAS Controls	Internet Thermostat	HVAC Upgrades	New HVAC	Retro-Commissioning	Cooling Tower VFD	Building Envelope	Water Conservation
EA Elementary School							x (4)			
Millington Elementary School	x	x	x		x (1)				x	x
Millington Middle School	x	x	x		x (1)	x (5)			x	x
Millington High School	x	x	x		x (1)		x (2)	x (3)	x	x
Gym	x	x	x		x (1)					x
Vocational	x	x		x	x (1)					
Stadium	x	x		x	x (7)	x (6)				x
Field House	x			x	x (1)	x (8)				x
Miles Field House	x	x		x						

Notes:

1 Upgrade Roof Top Units that are end of life
2 Recommission the Annex section that is on the chiller boiler system
3 Install VFD on Cooling Tower Fan
4 If No Unit Replacement Retro-Commission Units to proper O.A.
5 Install units to provide one unit for each class room
6 Install weight room unit.
7 Replace (2) package units to gas pack and remove gas heaters
8 Install new roof top with duct sock on existing and new unit (demo split)

Millington Schools Preliminary - ECM Matrix		
Location(s)	**Cash Flow**	**Energy Conservation Measure/Scope Summary**
EA Harold Elementary		
Interior LED Lighting Upgrade		~*Some* fluorescent technology may remain, majority of the interior lighting will be LED
Exterior Site Lighting Upgrades		LED platform with programmable light levels and motion/dusk/dawn auto dimming feature(s)
Network BAS Controls		Recommending integrated Building Automation & Control System, including remote access
HVAC Retro-Commissioning	X	HVAC equipment "tune-up" and test & balance to restore operation as close to original design intent as is feasible given the age of the equipment
Millington Elementary		
Interior LED Lighting Upgrade	X	~*Some* fluorescent technology may remain, majority of the interior lighting will be LED
Exterior Site Lighting Upgrades	X	LED platform with programmable light levels and motion/dusk/dawn auto dimming feature(s)
Network BAS Controls	X	Recommending integrated Building Automation & Control System, including remote access
HVAC Replacement-RTU	X	Replace RTU all HVAC units that have reached ASRAE age limits (89)
Building Envelope	x	Door sweeps – Reuse existing fastening hardware if possible. Provide nylon brush type sweeps with matching aluminum/steel attachment plates. Weather-stripping – Reuse existing fastening hardware if possible. Use Class B door materials/channels and methods as required. Install replacement weather-stripping at or better than OEM level.
Water/Waste-Water Conservation	X	Low flow plumbing fixture retrofit; standardizing 0.5 GPM bubble stream aerators for lavs
Millington Middle School		
Interior LED Lighting Upgrade	X	~*Some* fluorescent technology may remain, majority of the interior lighting will be LED
Exterior Site Lighting Upgrades	X	LED platform with programmable light levels and motion/dusk/dawn auto dimming feature(s)
Network BAS Controls	X	Recommending integrated Building Automation & Control System, including remote access
HVAC Replacement-RTU	X	Replace RTU all HVAC units that have reached ASRAE age limits (20)
HVAC New	X	New VAV boxes rooms 101/102 and 110/111. New units for rooms 112/113, 106/107, 209/210 and 103/104/105
Building Envelope	x	Door sweeps – Reuse existing fastening hardware if possible. Provide nylon brush type sweeps with matching aluminum/steel attachment plates. Weather-stripping – Reuse existing fastening hardware if possible. Use Class B door materials/channels and methods as required. Install replacement weather-stripping at or better than OEM level.
Water/Waste-Water Conservation	X	Low flow plumbing fixture retrofit; standardizing 0.5 GPM bubble stream aerators for lavs
Millington High School		
Interior LED Lighting Upgrade	X	~*Some* fluorescent technology may remain, majority of the interior lighting will be LED
Exterior Site Lighting Upgrades	X	LED platform with programmable light levels and motion/dusk/dawn auto dimming feature(s)
Network BAS Controls	X	Recommending integrated Building Automation & Control System, including remote access
HVAC Retro-Commissioning	X	HVAC equipment "tune-up" and test & balance to restore operation as close to original design intent as is feasible given the age of the equipment
HVAC Replacement-RTU	X	Replace RTU all HVAC units that have reached ASRAE age limits (69)
Cooling Tower VFD	X	Install VFD on Cooling Tower Fan to both save energy and increase the life of the motor
Building Envelope	x	Door sweeps – Reuse existing fastening hardware if possible. Provide nylon brush type sweeps with matching aluminum/steel attachment plates. Weather-stripping – Reuse existing fastening hardware if possible. Use Class B door materials/channels and methods as required. Install replacement weather-stripping at or better than OEM level.
Water/Waste-Water Conservation	X	Low flow plumbing fixture retrofit; standardizing 0.5 GPM bubble stream aerators for lavs
High School Gym		
Interior LED Lighting Upgrade	X	~*Some* fluorescent technology may remain, majority of the interior lighting will be LED
Exterior Site Lighting Upgrades	X	LED platform with programmable light levels and motion/dusk/dawn auto dimming feature(s)
Network BAS Controls	X	Recommending integrated Building Automation & Control System, including remote access
HVAC Replacement-RTU	X	Replace RTU all HVAC units that have reached ASRAE age limits (1)
Water/Waste-Water Conservation	X	Low flow plumbing fixture retrofit; standardizing 0.5 GPM bubble stream aerators for lavs
High School Vocational		
Interior Lighting Upgrade	X	~*Some* fluorescent technology may remain, majority of the interior lighting will be LED
Exterior Site Lighting Upgrades	X	LED platform with programmable light levels and motion/dusk/dawn auto dimming feature(s)
Inter-net Programmable Thermostat	X	Programmable thermostats with override switch on greenhouse systems
HVAC Replacement-RTU	X	Replace RTU all HVAC units that have reached ASRAE age limits (2)
High School Stadium		
Interior LED Lighting Upgrade	X	~*Some* fluorescent technology may remain, majority of the interior lighting will be LED
Exterior Site Lighting Upgrades	X	LED platform with programmable light levels and motion/dusk/dawn auto dimming feature(s)
Inter-net Programmable Thermostat	X	Programmable thermostats with override switch on greenhouse systems
HVAC Replacement-RTU	X	Replace (2) package units to gas pack and remove gas heaters
HVAC New	X	Install new unit in weight room. Utilize existing duct work where applicable.
Water/Waste-Water Conservation	X	Low flow plumbing fixture retrofit; standardizing 0.5 GPM bubble stream aerators for lavs
High School Field House		
Interior LED Lighting Upgrade	X	~*Some* fluorescent technology may remain, majority of the interior lighting will be LED
Inter-net Programmable Thermostat	X	Programmable thermostats with override switch on greenhouse systems
HVAC Replacement-RTU	X	Replace RTU serving locker room and install sock duct
HVAC New	X	Install new unit RTU in locker room to replace split unit. Install sock duct
Water/Waste-Water Conservation	X	Low flow plumbing fixture retrofit; standardizing 0.5 GPM bubble stream aerators for lavs
Miles Field House		
Interior LED Lighting Upgrade	X	~*Some* fluorescent technology may remain, majority of the interior lighting will be LED
Exterior Site Lighting Upgrades	X	LED platform with programmable light levels and motion/dusk/dawn auto dimming feature(s)
Inter-net Programmable Thermostat	X	Programmable thermostats with override switch on greenhouse systems

Trane Partnership for Infrastructure Improvement & Operational Excellence

Program Cash Flow Analysis

Master 2019 PD

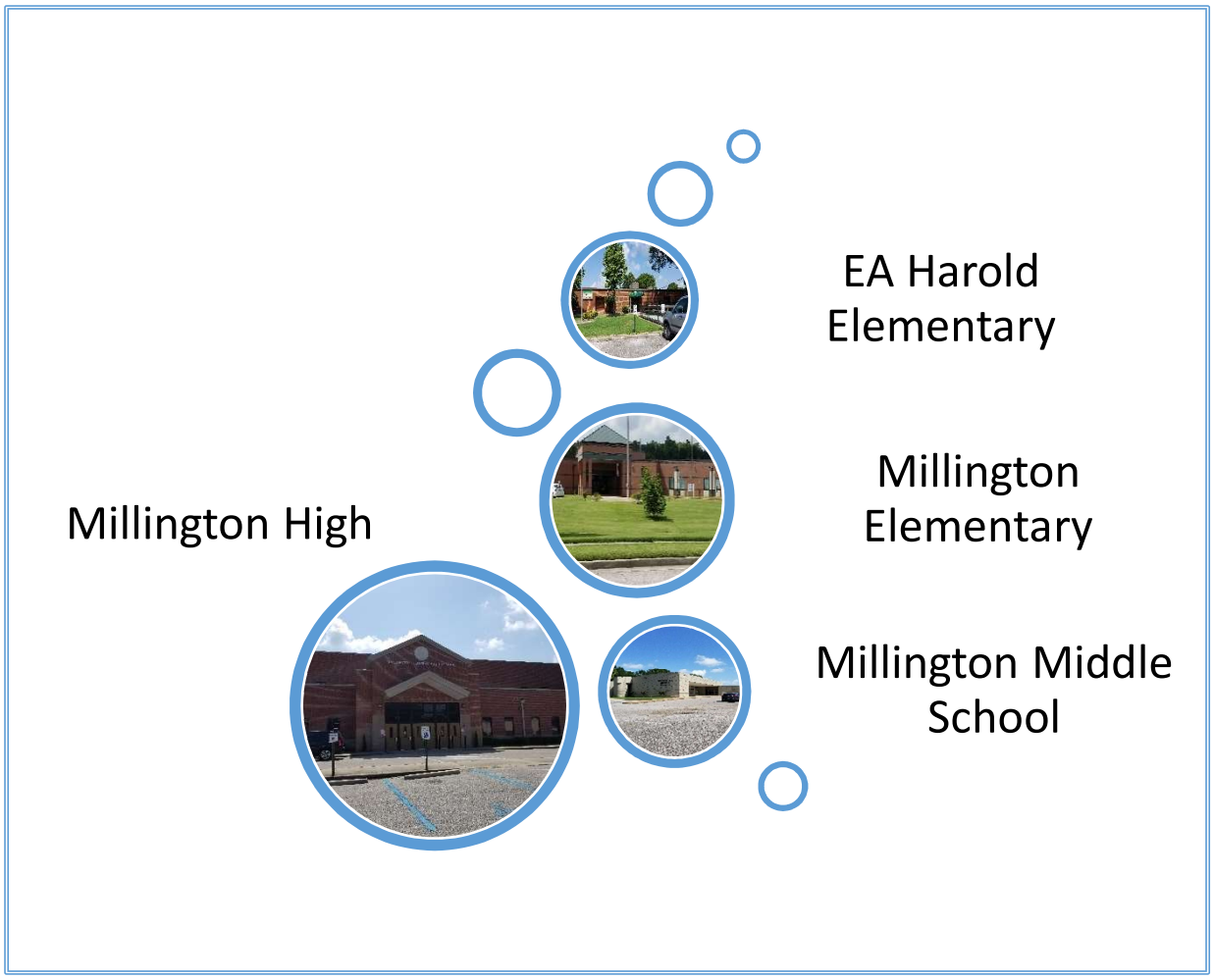
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total
Program Savings																					
Energy Savings	$ 61,920	$ 63,778	$ 65,691	$ 67,662	$ 69,692	$ 71,782	$ 73,936	$ 76,154	$ 78,438	$ 80,792	$ 83,215	$ 85,712	$ 88,283	$ 90,932	$ 93,660	$ 96,469	$ -	$ -	$ -	$ -	$ 1,248,114
Operational Savings	$ 8,916	$ 9,183	$ 9,459	$ 9,743	$ 10,035	$ 10,336	$ 10,646	$ 10,966	$ 11,295	$ 11,633	$ 11,982	$ 12,342	$ 12,712	$ 13,093	$ 13,486	$ 13,891	$ -	$ -	$ -	$ -	$ 179,719
Capital Cost Avoidance (annual cash contribution)	$ -																				$ -
Construction Period Savings **(9 Months)**	$ 46,440																				$ 46,440
Annual Program Savings	**$ 117,276**	**$ 72,961**	**$ 75,150**	**$ 77,404**	**$ 79,727**	**$ 82,118**	**$ 84,582**	**$ 87,119**	**$ 89,733**	**$ 92,425**	**$ 95,198**	**$ 98,054**	**$ 100,995**	**$ 104,025**	**$ 107,146**	**$ 110,360**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 1,474,273**
Program Cumulative Savings	$ 117,276	$ 190,237	$ 265,387	$ 342,791	$ 422,518	$ 504,636	$ 589,218	$ 676,338	$ 766,070	$ 858,495	$ 953,693	$ 1,051,747	$ 1,152,742	$ 1,256,767	$ 1,363,913	$ 1,474,273	$ 1,474,273	$ 1,474,273	$ 1,474,273	$ 1,474,273	
Program Costs																					
Principal & Interest	$ 474,061	$ 474,061	$ 474,061	$ 474,061	$ 474,061	$ 474,061	$ 474,061	$ 474,061	$ 474,061	$ 474,061	$ 474,061	$ 474,061	$ 474,061	$ 474,061	$ 474,061	$ 474,061	$ -	$ -	$ -	$ -	$ 7,584,980
Annual M&V/CEM Support	$ 22,687	$ 23,368	$ 24,069	$ 24,791	$ 25,534	$ 26,300	$ 27,089	$ 27,902	$ 28,739	$ 29,601	$ 30,489	$ 31,404	$ 32,346	$ 33,317	$ 34,316	$ 35,346	$ -	$ -	$ -	$ -	$ 457,299
Annual Service Support	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Program Costs	**$ 496,748**	**$ 497,429**	**$ 498,130**	**$ 498,852**	**$ 499,596**	**$ 500,362**	**$ 501,151**	**$ 501,963**	**$ 502,800**	**$ 503,663**	**$ 504,551**	**$ 505,465**	**$ 506,407**	**$ 507,378**	**$ 508,377**	**$ 509,407**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 8,042,279**
Program Cumulative Costs	$ 496,748	$ 994,177	$ 1,492,307	$ 1,991,159	$ 2,490,755	$ 2,991,116	$ 3,492,267	$ 3,994,230	$ 4,497,031	$ 5,000,694	$ 5,505,244	$ 6,010,710	$ 6,517,117	$ 7,024,495	$ 7,532,872	$ 8,042,279	$ 8,042,279	$ 8,042,279	$ 8,042,279	$ 8,042,279	
Cash Flow																					
Annual Net Cash Flow	**($379,472)**	**($424,468)**	**($422,980)**	**($421,448)**	**($419,869)**	**($418,243)**	**($416,569)**	**($414,844)**	**($413,068)**	**($411,238)**	**($409,353)**	**($407,412)**	**($405,412)**	**($403,353)**	**($401,232)**	**($399,047)**	**$0**	**$0**	**$0**	**$0**	**($6,568,006)**
Cumulative Net Cash Flow	$ (379,472)	$ (803,940)	$ (1,226,920)	$ (1,648,368)	$ (2,068,237)	$ (2,486,480)	$ (2,903,049)	$ (3,317,893)	$ (3,730,960)	$ (4,142,198)	$ (4,551,551)	$ (4,958,963)	$ (5,364,375)	$ (5,767,728)	$ (6,168,960)	$ (6,568,006)	$ (6,568,006)	$ (6,568,006)	$ (6,568,006)	$ (6,568,006)	

Program Financial Summary	
Program Construction Cost	$ 6,611,451
Estimated TVA Utility Rebates	$ -
Customer Down Payment	$ -
Loan/Lease Amount	$ 6,611,451
Year 1 - Program Savings	$ 70,836
Year 1 - Simple Payback (years)	93.3
Term - Program Costs	$ 8,042,279
Term - Program Savings	$ 1,474,273
Term - Cumulative Payback Ratio	5.46
Annual Interest Rate	1.75%
Loan/Lease Term (years)	16
Payments per Year	12
Construction Interest Considered (yes/no)	no
Total Interest Payments	$ 973,529
Annual Energy Cost Escalation Factor	3.0%
Annual Operational Cost Escalation Factor	3.0%
Annual Service Program Cost Escalation Factor	3.0%

Preliminary Energy Evaluation

For

Millington City Schools



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EA Harold Elementary School

Facility Observations

E.A. Harold Elementary school located at 4943 West Union, Millington, TN 38053 was originally constructed in 1948. The construction of the school is a block construction with a brick façade. The roof is generally a built up roof. The estimated size of the school is nearly 49,000 sq. ft. with approximately (6) portable buildings used for classrooms.

Windows

The north side of the school has well over 2,388 sq. ft. of the original single pane windows. Single-pane windows are made with a single layer of glass. They come in all of the same styles and materials that double-pane windows do, but they are not as efficient at keeping out noise or seasonal temperatures. Their initial cost is less, which makes them a good choice for those who need to stay within a strict budget, but over time, energy bills will be higher.

Single-pane glass treatments have no insulation value. When you have only one pane of glass, outside temperatures and noise will affect the inside of your facility more easily. Heating or cooling cost are impacted by the type of windows in a facility. Generally there is a long payback for changing out single pane windows to double pane windows but as energy cost continue to climb this will become more important. Additionally, there are other consideration such as solar and radiant energy effects for the occupants not to mention issues around sound.

Indoor Air Environment

The school appears to have an issue with moisture. Uncontrolled moisture indoors can cause major damage to the building structure, as well as to furnishings and to finish materials like floors, walls and ceilings. Uncontrolled moisture can trigger mold growth which not only damages the school facility, but can lead to health and performance problems for students and staff. Mold is usually not a problem indoors unless there is excess moisture.

It is extremely important to prevent uncontrolled moisture from entering the building envelope through window and door openings, seams, footings, roofs or other openings. In virtually all areas of the country, provide an exterior weather barrier to prevent moisture from entering construction cavities. Wet or damp construction cavities (e.g., spaces between interior and exterior walls), attics and plenums are major sources of mold and can contribute significantly to indoor air quality problems. In addition, moisture can damage the structure and degrade the performance of insulation, increasing energy and operating costs.

In hot, humid climates, even slight negative interior pressures can pull hot outdoor moisture into chilled wall cavities during cooling periods if the building envelope is not properly designed and constructed. Similarly, during heating periods, positive pressures can push warm, moist air from indoors into chilled

exterior walls. In either case, this uncontrolled moisture can lead to mold growth that impairs indoor air quality and damages building materials.

It appears that the school is under a negative pressure. This negative pressure is likely created by exhausting more air from the school than is being brought into the school in a controlled "conditioned" manner. The negative pressure is likely being created by the operations of the kitchen ventilation hood. The existing hood shown exhaust air but has no makeup air system integrated into the hood. Additionally, the kitchen doesn't have adequate cooling which leads to the running of the hood all day to bring cool air into the kitchen.

Lighting

Lighting consumes 15-30 percent of the electricity used in commercial buildings in the United States and impacts other systems through their electrical requirements and the heat that it produces. The lighting throughout the EA Harrold is mostly T-8 fluorescent lighting.

In 2015, the U.S. Department of Energy (DOE) issued new energy standards for general-service fluorescent lamps. These standards identify categories of lamps and impose minimum efficacies, expressed in lumens/W. Primarily impacting 4-ft. 32W T8 lamps and some reduced-wattage T8 lamps, the new standards are now set to take effect January 26, 2018. As such, many of the lights throughout the school are the 32 Watt lamps. Although these lamps may still be available the price to replace them will continue to increase as the Government attempts to end the production and stockpile of this lighting technology. Overtime this will cost the school system money to replace and upgrading is in order.

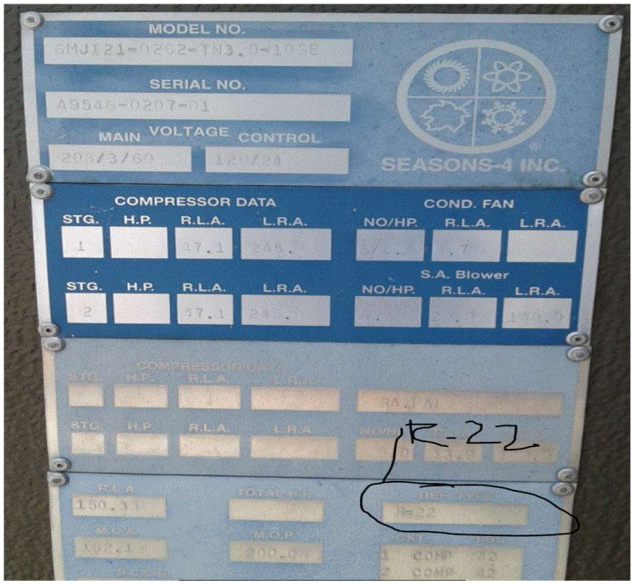
HVAC

EA Harrold has about 37 Roof Top type and Bard Type Units located on campus. It has been determined that 26 of the units need to be replaced due to the age of the unit. There are many issues around the age of the unit that suggest replacement.

The American Society of Heating, Refrigeration, and Air Conditioning Engineers has provided the industry with general life expectancy values for various types of HVAC systems. The useful life typically associated with the types of HVAC system on campus is about 15 years. It must be noted that this doesn't mean that the unit is useless at 15 years but it does mean the likely hood of major failures. These unplanned failures tend to drive up maintenance cost putting a burden on the school systems budget. Leveraging savings associated with and apply these savings to

upgrade investment at no cost or reduced cost could result in reduced maintenance savings that would offset any capital expense.

Many of the units are old enough that they use R-22 as the cooling medium. This creates a very costly issue for the school system. R-11 and R-12 are both considered CFC chemicals which stands for chloroflourocarbon. It is the first part of that name “chloro” which refers to the chlorine. R-22 is an HCFC or hydrocholorflourocarbon. It has chlorine in it, but the atmospheric life is much shorter than the CFCs, so it had less of an impact on the ozone layer.



To address the worldwide impact of these chemicals, the nations of the world signed on to the Montreal Protocol which set limits on ozone depletion for each country that signed on. In order for the U.S. to meet its Montreal Protocol commitments, phase out dates for CFCs and HCFCs were included in the Clean Air Act.

Equipment manufacturers were forced to find replacements for these refrigerants. CFCs were the most critical because they had the closest phase out dates. The replacement refrigerants used to meet this first round of phase out dates are shown here. You’ll note that initially HCFCs were not addressed because the phase out dates for that equipment didn’t begin until 2010.

Given limited options, manufacturers were forced to eliminate R-22 from new equipment as the year 2010 approached. By early 2010 the production and import of R22 became prohibited. However, servicing current, existing equipment is still acceptable if there is an available supply of R22. To confirm the public’s compliance with the new law, all sales of R22 must be purchased by a certified technician. The production and import of R22 will be continually reduced by law until 2020, when all production and import will be eliminated. Only recycled R22 refrigerant will be available to service existing air conditioners after 2020.

Older air conditioners could more frequently experience leaks and need repairs. Any air conditioners that are older than 2010 are more likely to use R22, which means there’s a lot more demand for it, and a reduced supply. Prices have only risen due to scarcity and are expected to reach as high as $2,000 to charge a five ton unit.

It must also be noted that many of the Roof Top Units inspected had pitting and/or holes in the gas heat exchangers. Cracks or holes in the heat exchanger on commercial equipment and in buildings where there are no living quarters gas heating equipment can be left running with cracks in the heat exchanger while waiting replacement as long as no CO is detected in the air.

If the equipment is leaking CO then the gas must be shut off immediately. A long-term repair for commercial heat exchangers is possible but not very practical. It would cost more than a new unit or heat exchanger would cost. The metal in the heat exchanger is usually too thin to weld and impossible to access with welding equipment even with removing the heat exchanger completely.

Heat exchangers will fail from age, hours of operation, and from operating conditions. A properly maintained system will last 20 years or more, but anything past 25 years is on borrowed time and should be inspected annually and tested for CO. Given the age of the system the units are on borrowed time

Building Automation System

Building heating and cooling control systems are independent systems that coordinate the building heating and cooling systems to create a pleasing, safe, and healthy environment for activities in the facility. Control systems come in various types and levels of sophistication; however, the desired result is a facility where the environment is comfortable, and that comfort is achieved at the lowest possible energy cost.

As modern facilities and available technology have evolved, control systems have grown in sophistication. Current systems coordinate comfort, manage energy use, report problem areas, and coordinate information to assist facilities managers in facilities operation.

EA Harrold has no central control system. As such, the energy savings and maintenance benefits of a controls system are not being realized at the campus.

Domestic Hot Water

One of the most common practices in school water heating system design is to serve multiple fixtures from a central location through the use of one or more hot water recirculation-loop systems.

In recirculation loops systems, two hot water lines are provided to the approximate vicinity of each fixture, one a supply line, the other a return line. A pump is used to circulate hot water to the fixtures, and then back to the central water heater through the return line, so that the lines are hot throughout the portion of the day when hot water is needed. This means hot water is available quickly to each fixture. Analysis and field study, done by ASHRAE, show that the heat loss and pumping energy in these types of systems usually is extremely high compared to the loads served, significantly increasing energy use beyond the energy used at the fixture.

Analytical work, performed by ASHRAE, verified by actual field test in schools and separate laboratory testing, has shown that school portable water heating systems energy use can be significantly reduced by altering practices at a minimum, given that schools water heating systems have NO water draw 80% of the time.

Energy Use

Electric, gas, and water for EA Harrold Elementary School are all provided by Memphis Light Gas and Water (MLGW) with the sewage treatment provided by the Millington Water Department.

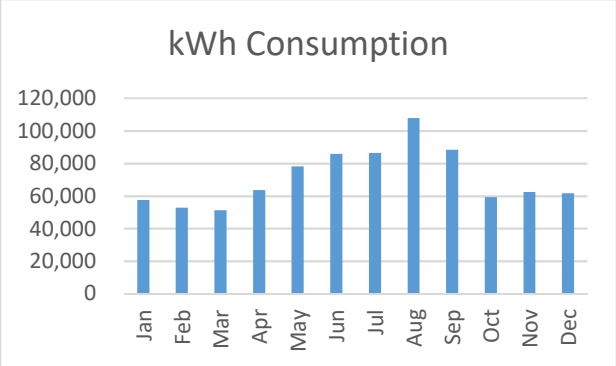
EA Harrold Elementary School Utilities	
Utility Type	**Utility Provider**
Electric	Memphis Light Gas and Water
Gas	Memphis Light Gas and Water
Water	Memphis Light Gas and Water
Sewer	Millington Water Department

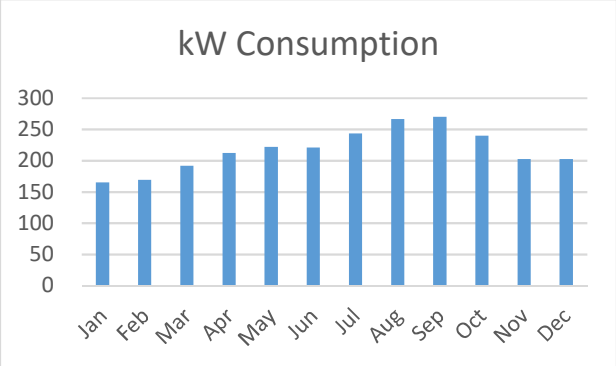
Utility bills spanning a 24 month period from November of 2016 to October of 2018 were recorded and analyzed for energy conservation opportunities. The following table shows the energy usage, the cost per unit used for energy savings analysis, and the total cost of all utilities for EA Harrold Elementary School.

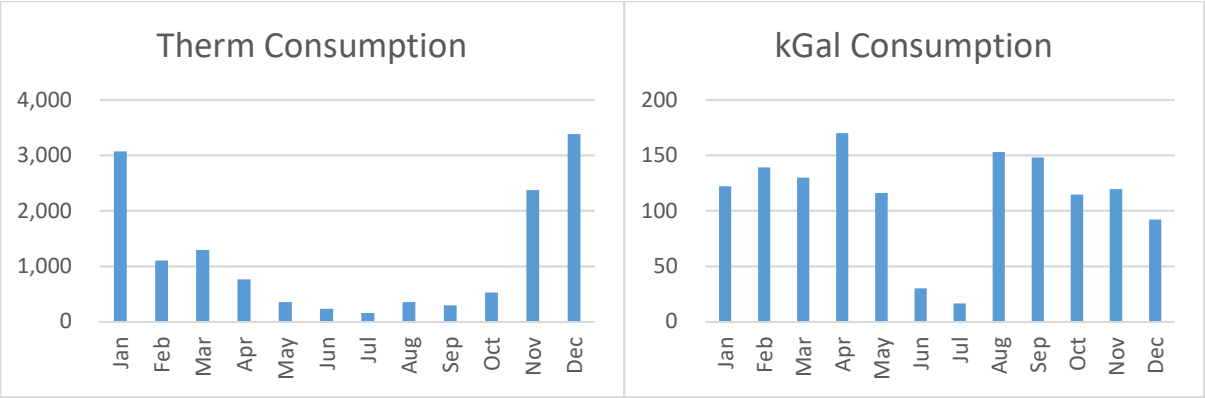
EA Harrold Elementary School Energy Usage		
Utility Type	**Utility Usage**	**$/Unit**
Electric (kWh)	854,489	$0.06013
Electric (kW)	2,608	$13.69
Gas (Therms)	12,789	$0.51
Water and Sewer (kGal)	1,365	$6.87
All Utilities ($)	$113,248*	

*Many of the rates are tiered, so rates used for analysis multiplied by total usage will not equal Total Utility $s.

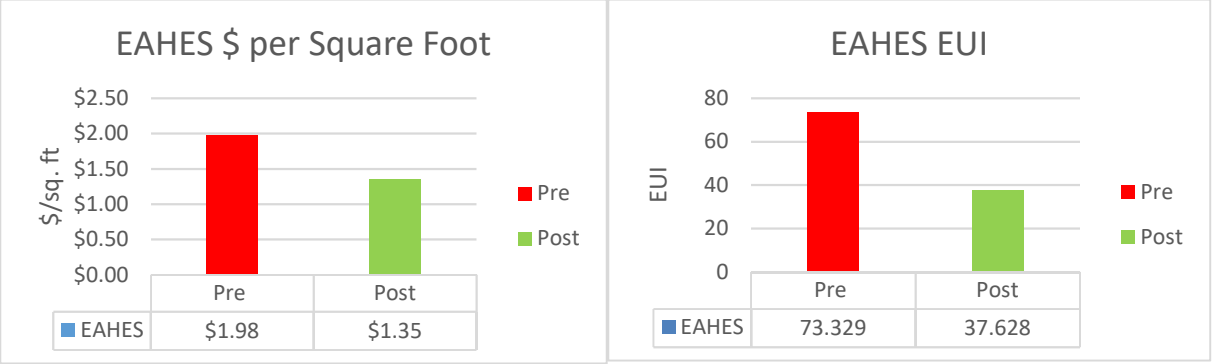
The following graphs show the average monthly kWh, KW, Therm and Kgal Consumption for EA Harrold Elementary School.







Based on a study done by the EPA, the average annual energy usage for education (K-12) facilities within the Ashrae Region 4 is 66 kBTU/sf (EUI). This number is closely reflected within our many case studies/performance contracts (PCs) across the state of TN. The pre-PC EUIs of over 20 school districts across the state of TN were found to have district wide EUIs ranging from 39.1 to 88.8 kBTU/sf with an average of 55.6 kBTU/sf. Millington Schools falls within the lower end of this range with a district average EUI of 42.9; however, EA Harrold Elementary School is currently running above the average with a current EUI of 73.3 kBTU/sf. Through the energy conservation measures presented within the this report, it is estimated that the school's utility usage can be reduced by approximately $36,243, resulting in an EUI of 37.6 kBTU/sf.



Energy Conservation Measures

Following is a Scope Summary for each Energy Conservation Measure (ECM) identified during the preliminary energy audit process for EA Harrold. The next step is for Trane to perform an investment grade audit (IGA). During the Investment Grade Audit (IGA), Trane's engineering and Development Teams will fully investigate these ECMs, as well as dive deeper into each facility and look for additional measures to significantly improve the buildings, utility expenditures, occupant comfort, and bottom line.

An Energy Conservation Measure or ECM for short, is a single initiative undertaken to reduce the energy consumption of a particular piece of equipment or a certain aspect of essential building services; energy conservation measures or ECMs are pluralistic and therefore imply a combination of several ECM initiatives to reduce energy consumption across an entire facility or building.

Energy is a term that broadly refers to either electricity, gas or water consumption; energy conservation and energy efficiency are often interchangeable terms as improved energy efficiency also means reduced energy consumption.

Interior Lighting Upgrade-LED's

Light emitting diodes (LED) are a solid-state lighting (SSL) technology that emits light when direct current passes through a semiconductor. This is in contrast to fluorescent and high intensity discharge (HID) bulbs such as metal halide or high-pressure sodium that generate light (and excess waste heat) by passing current through a metal vapor. Retrofitting of existing lighting system components--lamps, ballasts, etc.--along with de-lamping and fixture removal are all considerations. When required, replacement fixtures will be provided that utilize existing building wiring systems. Implementation of this ECM will reduce building energy use while maintaining lighting levels at or above Illuminating Engineering Society standards for these facility types.

The estimated savings for this ECM is: $13,289.96

Exterior Lighting Upgrade-LED's

Light emitting diodes (LED) are a solid-state lighting (SSL) technology that emits light when direct current passes through a semiconductor. This is in contrast to fluorescent and high intensity discharge (HID) bulbs such as metal halide or high-pressure sodium that generate light (and excess waste heat) by passing current through a metal vapor. LEDs are increasingly common in street lights, parking garage lighting, walkway and other outdoor area lighting.

The estimated savings for this ECM is: $289.79

Lighting Controls

Lighting control system help to gain the most efficiency from your lighting fixtures. The purpose of lighting controls is to minimize the electricity usage while maintaining the right amount of light when and where you need it.

Occupancy sensors are one of the first (and among the easiest) types of automated lighting controls that you can use to realize the greatest energy efficiency from your light fixtures. They are commonly seen in commercial buildings, since they are easy to install as part of an existing lighting system.

The estimated savings for this ECM is: $638.94

Building Weatherization

Air leakage, or infiltration, occurs when outside air enters a facility uncontrollably through cracks and openings. Properly sealing such cracks and openings can significantly reduce heating and cooling costs, improve building durability, and create a healthier indoor environment.

Door sweeps – Reuse existing fastening hardware if possible. Provide nylon brush type sweeps with matching aluminum/steel attachment plates. Weather-stripping – Reuse existing fastening hardware if possible. Use Class B door materials/channels and methods as required. Install replacement weather-stripping at or better than OEM level.

The estimated savings for this ECM is: $457.87

Window/Door Replacement

Energy efficient windows and doors are an important energy conservation measure. Heat gain and heat loss through windows can contribute to higher energy bills and uncomfortable employees. Replacement

of the windows and doors shall be in collaboration with the customer to insure proper color, hardware and function.

The estimated savings for this ECM is: $2,803.07

Kitchen Hood

The existing hood at the facility does not have the capability of making up air that is being exhausted. As such, this is creating a negative pressure in the facility leading to a potential for high humidity and potential mold issues. As such, it is recommended that a new hood be installed that has full makeup air capability. It is recommended that the hood be independent of any HVAC system in terms of makeup air so if either unit is off the stated goal of reducing negative air pressure is achieved.

The estimated savings for this ECM is: $212.27

HVAC Upgrades

The American Society of Heating, Refrigeration, and Air Conditioning Engineers has provided the industry with general life expectancy values for various types of HVAC systems. The ECM for replacement will focus on system where the HVAC unit has reached the end of its useful life. For the systems located at the EA Harold the useful life of the systems is 15 years. As such, it is recommended that 26 HVAC units be replaced.

The estimated savings for this ECM is: $6,356.56

Kitchen HVAC Unit

The kitchen doesn't appear to have adequate HVAC and therefore the employees are running the kitchen hood all the time creating a negative pressure on the school. As such, it is recommended that a HVAC unit be installed specifically for supply the correct amount of cooling and outside air for the occupants.

The estimated savings for this ECM is: -$1,378.88

Building Automation System (BAS)

The Building Automation System (BAS) core functionality is to keep building climate within a specified range, based on an occupancy schedule, monitor performance and device failures in all systems and provide malfunction alarms. Automation systems reduce building energy and maintenance costs compared to a non-controlled building.

The estimated savings for this ECM is: $10,686.06

Water Conservation

Bathroom fixtures offer good water saving opportunities because many of these fixtures can be retrofit to reduce the amount of water consumed per flush (toilets and urinals) or per minute of use (sinks and showers). Reducing sink and shower water usage also saves the thermal energy used to make hot water.

The estimated savings for this ECM is: $2,665.47

Retro-Commissioning

This ECM would apply to the existing HVAC equipment that is not being replaced. Retro-commissioning is a process to improve the efficiency of an existing building's equipment and systems. It can often resolve problems that occurred during design or construction, or address problems that have developed

throughout the building's life as equipment has aged, or as building usage has changed. Retro-commissioning involves a systemic evaluation of opportunities to improve energy-using systems.

The estimated savings for this ECM is: $212.27

Savings Potential and Cost Summary

The Energy Conservation Measures listed below are representative of the entire Preliminary Audit Results and do not reflect the items that can be carried in a self-funding program.

ECM Description	Savings	Budget
Interior Lighting Upgrade-LED's	$13,289.96	$80,473
Exterior Lighting Upgrade-LED's	$289.79	$2,537
Lighting Controls	$638.94	$27,522
Building Weatherization	$457.87	$5,085
Window/Door Replacement	$2,803.07	$314,219
Kitchen Hood	$212.27	$73,171
HVAC Upgrades	$6,356.56	$843,851
Kitchen HVAC Unit	$(1,378.88)	$95,496
Building Automation System (BAS)-Existing	$10,686.06	$200,860
Building Automation System (BAS)-New	$10,686.06	$158,069
Water Conservation	$2,665.47	$79,923
Retro-Commissioning	$221.48	$11,616

Millington Elementary School

Facility Observations

Millington Elementary school located at 6445 William Osteen Dr., Millington, TN 38053 was originally constructed in 2004. The construction of the school is a block construction with a brick façade. The roof is generally a built up roof. The windows are double pane. The estimated size of the school is nearly 116,000 sq. ft.

Lighting

Lighting consumes 15-30 percent of the electricity used in commercial buildings in the United States and impacts other systems through their electrical requirements and the heat that it produces. The lighting throughout the Millington Elementary is mostly T-8 fluorescent lighting.

In 2015, the U.S. Department of Energy (DOE) issued new energy standards for general-service fluorescent lamps. These standards identify categories of lamps and impose minimum efficacies, expressed in lumens/W. primarily impacting 4-ft. 32W T8 lamps and some reduced-wattage T8 lamps, the new standards are now set to take effect January 26, 2018. As such, many of the lights throughout the school are the 32 Watt lamps. Although these lamps may still be available the price to replace them will continue to increase as the Government attempts to end the production and stockpile of this lighting technology. Overtime this will cost the school system money to replace and upgrading is in order.

Building Automation System

Building heating and cooling control systems are independent systems that coordinate the building heating and cooling systems to create a pleasing, safe, and healthy environment for activities in the facility. Control systems come in various types and levels of sophistication; however, the desired result is a facility where the environment is comfortable, and that comfort is achieved at the lowest possible energy cost.

As modern facilities and available technology have evolved, control systems have grown in sophistication. Current systems coordinate comfort, manage energy use, report problem areas, and coordinate information to assist facilities managers in facilities operation.

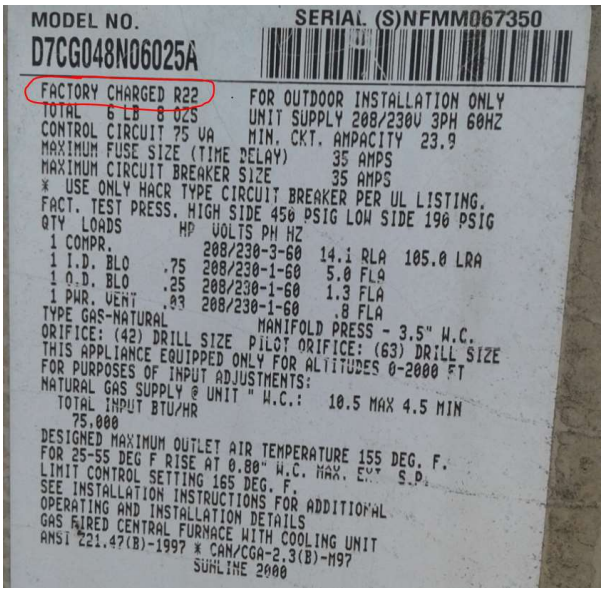
Millington Elementary School utilizes an Andover system which controls each package unit individually.

HVAC

Millington Elementary has about 89 Roof Top type units located on campus. It has been determined that ALL of the units need to be replaced due to the age of the unit. There are many issues around the age of the unit that suggest replacement.

The American Society of Heating, Refrigeration, and Air Conditioning Engineers has provided the industry with general life expectancy values for various types of HVAC systems. The useful life typically associated with the types of HVAC system on campus is about 15 years. It must be noted that this doesn't mean that the unit is useless at 15 years but it does mean the likely hood of major failures. These unplanned failures tend to drive up maintenance cost putting a burden on the school systems budget. Leveraging savings associated with and apply these savings to upgrade investment at no cost or reduced cost could result in reduced maintenance savings that would offset any capital expense.

Nearly all of the units are old enough that they use R-22 as the cooling medium. This creates a very costly issue for the school system. R-11 and R-12 are both considered CFC chemicals which stands for chloroflourocarbon. It is the first part of that name "chloro" which refers to the chlorine. R-22 is an HCFC or hydrocholorflourocarbon. It has chlorine in it, but the atmospheric life is much shorter than the CFCs, so it had less of an impact on the ozone layer.



To address the worldwide impact of these chemicals, the nations of the world signed on to the Montreal Protocol which set limits on ozone depletion for each country that signed on. In order for the U.S. to meet its Montreal Protocol commitments, phase out dates for CFCs and HCFCs were included in the Clean Air Act.

Equipment manufacturers were forced to find replacements for these refrigerants. CFCs were the most critical because they had the closest phase out dates. The replacement refrigerants used to meet this first round of phase out dates are shown here. You'll note that initially HCFCs were not addressed because the phase out dates for that equipment didn't begin until 2010.

Given limited options, manufacturers were forced to eliminate R-22 from new equipment as the year 2010 approached. By early 2010 the production and import of R22 became prohibited. However, servicing current, existing equipment is still acceptable if there is an available supply of R22. To confirm the public's compliance with the new law, all sales of R22 must be purchased by a certified technician. The production and import of R22 will be continually reduced by law until 2020, when all production and import will be eliminated. Only recycled R22 refrigerant will be available to service existing air conditioners after 2020.

Older air conditioners could more frequently experience leaks and need repairs. Any air conditioners that are older than 2010 are more likely to use R22, which means there's a lot more demand for it, and a reduced supply. Prices have only risen due to scarcity and are expected to reach as high as $2,000 to charge a five ton unit.

It must also be noted that many of the Roof Top Units inspected had pitting and/or holes in the gas heat exchangers. Cracks or holes in the heat exchanger on commercial equipment and in building where there are no living quarters gas heating equipment can be left running with cracks in the heat exchanger while waiting replacement as long as no CO is detected in the air.

If the equipment is leaking CO then the gas must be shut off immediately. A long-term repair for commercial heat exchangers is possible but not very practical. It would cost more than a new unit or heat exchanger would cost. The metal in the heat exchanger is usually too thin to weld and impossible to access with welding equipment even with removing the heat exchanger completely.

Heat exchangers will fail from age, hours of operation, and from operating conditions. A properly maintained system will last 20 years or more, but anything past 25 years is on borrowed time and should be inspected annually and tested for CO. Given the age of the system the units are on borrowed time.

Domestic Hot Water

One of the most common practices in school water heating system design is to serve multiple fixtures from a central location through the use of one or more hot water recirculation-loop systems.

In recirculation loops systems, two hot water lines are provided to the approximate vicinity of each fixture, one a supply line, the other a return line. A pump is used to circulate hot water to the fixtures, and then back to the central water heater through the return line, so that the lines are hot throughout the portion of the day when hot water is needed. This means hot water is available quickly to each fixture. Analysis and field study, done by ASHRAE, show that the heat loss and pumping energy in these types of systems usually is extremely high compared to the loads served, significantly increasing energy use beyond the energy used at the fixture.

Analytical work, performed by ASHRAE, verified by actual field test in schools and separate laboratory testing, has shown that school portable water heating systems energy use can be significantly reduced

by altering practices at a minimum, given that schools water heating systems have NO water draw 80% of the time.

Energy Use

Electric, gas, and water for Millington Elementary School are all provided by Memphis Light Gas and Water (MLGW) with the sewage treatment provided by the nearby Naval Base.

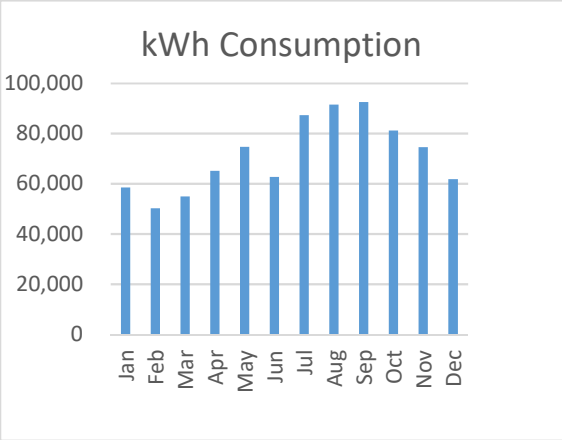
Millington Elementary School Utilities	
Utility Type	**Utility Provider**
Electric	Memphis Light Gas and Water
Gas	Memphis Light Gas and Water
Water	Memphis Light Gas and Water
Sewer	Tied in with the Naval Base

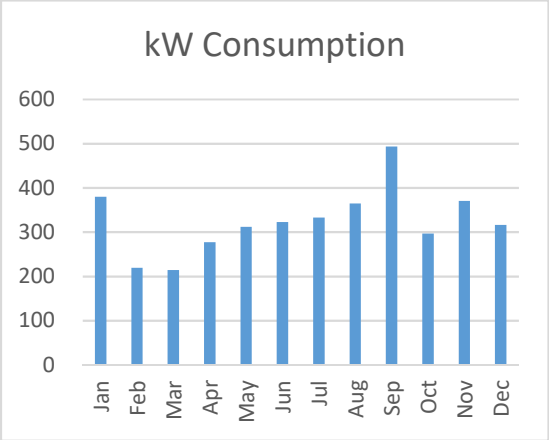
Utility bills spanning a 24 month period from November of 2016 to October of 2018 were recorded and analyzed for energy conservation opportunities. The following table shows the energy usage, the cost per unit used for energy savings analysis, and the total cost of all utilities for Millington Elementary School.

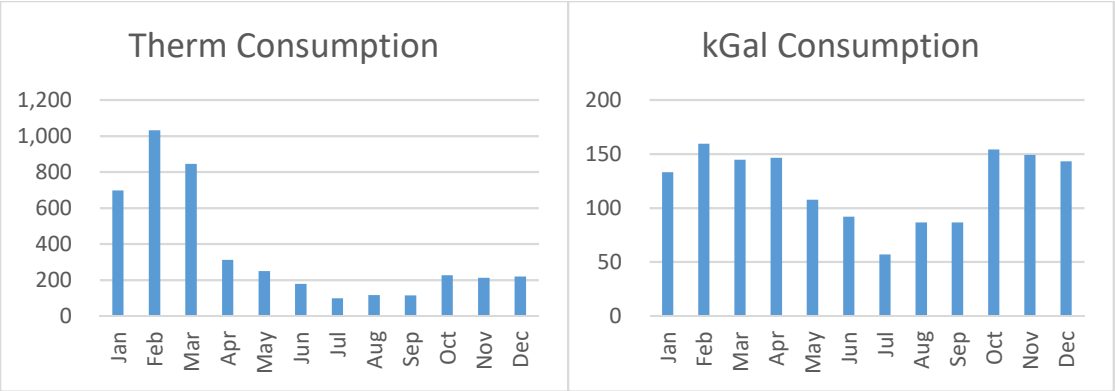
Millington Elementary School Energy Usage		
Utility Type	**Utility Usage**	**$/Unit**
Electric (kWh)	862,800	$0.06013
Electric (kW)	3,680	$13.69
Gas (Therms)	5,595.5	$0.51
Water and Sewer (kGal)	1459.5	$6.87
All Utilities ($)	$112,477*	

*Many of the rates are tiered, so rates used for analysis multiplied by total usage will not equal Total Utility $s.

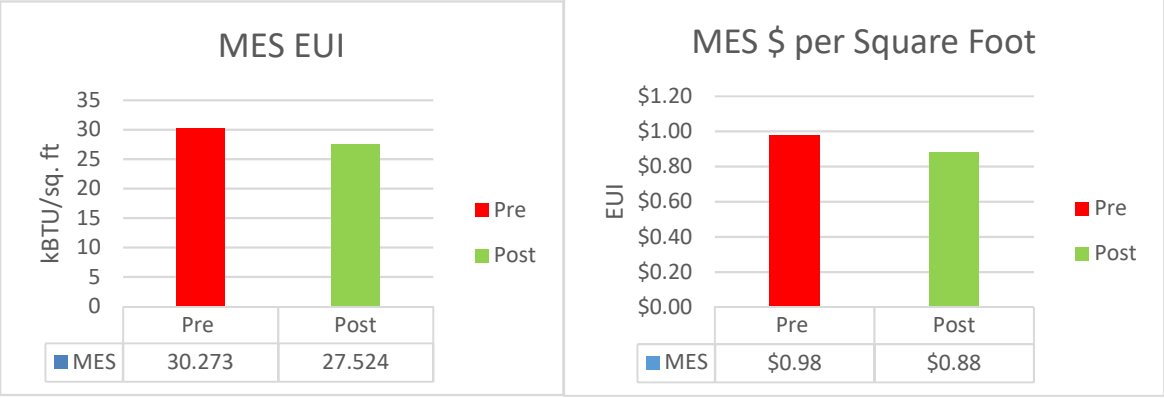
The following graphs show the average monthly kWh, KW, Therm and Kgal Consumption for Millington Elementary School.







Based on a study done by the EPA, the average annual energy usage for education (K-12) facilities within the Ashrae Region 4 is 66 kBTU/sf (EUI). This number is closely reflected within our many case studies/performance contracts (PCs) across the state of TN. The pre-PC EUIs of over 20 school districts across the state of TN were found to have district wide EUIs ranging from 39.1 to 88.8 kBTU/sf with an average of 55.6 kBTU/sf. Millington Schools falls within the lower end of this range with a district average EUI of 42.9, with Millington Elementary School currently running well below the average with a current EUI of 30.3 kBTU/sf. Through the energy conservation measures presented within this report, it is estimated that the school's utility usage can be reduced by approximately $10,923, resulting in an EUI of 27.5 kBTU/sf.



Energy Conservation Measures

Following is a Scope Summary for each Energy Conservation Measure (ECM) identified during the preliminary energy audit process for Millington Elementary School. The next step is for Trane to perform an investment grade audit (IGA). During the Investment Grade Audit (IGA), Trane's engineering and Development Teams will fully investigate these ECMs, as well as dive deeper into each facility and look for additional measures to significantly improve the buildings, utility expenditures, occupant comfort, and bottom line.

An Energy Conservation Measure or ECM for short, is a single initiative undertaken to reduce the energy consumption of a particular piece of equipment or a certain aspect of essential building services; energy conservation measures or ECMs are pluralistic and therefore imply a combination of several ECM initiatives to reduce energy consumption across an entire facility or building.

Energy is a term that broadly refers to either electricity, gas or water consumption; energy conservation and energy efficiency are often interchangeable terms as improved energy efficiency also means reduced energy consumption.

Interior Lighting Upgrade-LED's

Light emitting diodes (LED) are a solid-state lighting (SSL) technology that emits light when direct current passes through a semiconductor. This is in contrast to fluorescent and high intensity discharge (HID) bulbs such as metal halide or high-pressure sodium that generate light (and excess waste heat) by passing current through a metal vapor. Retrofitting of existing lighting system components--lamps, ballasts, etc.--along with de-lamping and fixture removal are all considerations. When required, replacement fixtures will be provided that utilize existing building wiring systems. Implementation of this ECM will reduce building energy use while maintaining lighting levels at or above Illuminating Engineering Society standards for these facility types.

The estimated savings for this ECM is: $10,063.29

Exterior Lighting Upgrade-LED's

Light emitting diodes (LED) are a solid-state lighting (SSL) technology that emits light when direct current passes through a semiconductor. This is in contrast to fluorescent and high intensity discharge (HID) bulbs such as metal halide or high-pressure sodium that generate light (and excess waste heat) by passing current through a metal vapor. LEDs are increasingly common in street lights, parking garage lighting, walkway and other outdoor area lighting.

The estimated savings for this ECM is: $870.83

Lighting Controls

Lighting control system help to gain the most efficiency from your lighting fixtures. The purpose of lighting controls is to minimize the electricity usage while maintaining the right amount of light when and where you need it.

Occupancy sensors are one of the first (and among the easiest) types of automated lighting controls that you can use to realize the greatest energy efficiency from your light fixtures. They are commonly seen in commercial buildings, since they are easy to install as part of an existing lighting system.

The estimated savings for this ECM is: $599.65

Building Weatherization

Air leakage, or infiltration, occurs when outside air enters a facility uncontrollably through cracks and openings. Properly sealing such cracks and openings can significantly reduce heating and cooling costs, improve building durability, and create a healthier indoor environment.

Door sweeps – Reuse existing fastening hardware if possible. Provide nylon brush type sweeps with matching aluminum/steel attachment plates. Weather-stripping – Reuse existing fastening hardware if possible. Use Class B door materials/channels and methods as required. Install replacement weather-stripping at or better than OEM level.

The estimated savings for this ECM is: $406.49

HVAC Upgrades

The American Society of Heating, Refrigeration, and Air Conditioning Engineers has provided the industry with general life expectancy values for various types of HVAC systems. The ECM for replacement will focus on system where the HVAC unit has reached the end of its useful life. For the systems located at Millington Middle School the useful life of the systems is 15 years. As such, it is recommended that 89 HVAC units be replaced.

The estimated savings for this ECM is: $1,779.83

Building Automation System (BAS)

The Building Automation System (BAS) core functionality is to keep building climate within a specified range, based on an occupancy schedule, monitor performance and device failures in all systems and provide malfunction alarms. Automation systems reduce building energy and maintenance costs compared to a non-controlled building.

The estimated savings for this ECM is: $756.17

Water Conservation

Bathroom fixtures offer good water saving opportunities because many of these fixtures can be retrofit to reduce the amount of water consumed per flush (toilets and urinals) or per minute of use (sinks and showers). Reducing sink and shower water usage also saves the thermal energy used to make hot water.

The estimated savings for this ECM is: $2,022.37

Savings Potential and Cost Summary

The Energy Conservation Measures listed below are representative of the entire Preliminary Audit Results and do not reflect the items that can be carried in a self-funding program.

ECM Description	Savings	Budget
Interior Lighting Upgrade-LED's	$10,063.29	$133,647
Exterior Lighting Upgrade-LED's	$870.83	$28,835
Lighting Controls	$599.65	$53,172
Building Weatherization	$406.49	$16,539
HVAC Upgrades	$1,779.83	$1,732,440
Building Automation System (BAS)-Existing	$756.17	$394,422
Building Automation System (BAS)-New	$756.17	$203,950
Water Conservation	$2,022.37	$2,410

Millington Middle School

Facility Observations

Millington Middle School located at 4964 Cuba-Millington, Millington, TN 38053 was originally constructed in 1973 with some updates made to the school in 1995. The construction of the school is a block construction with a brick façade. The roof is generally a built up roof. The school is mostly void of windows in the classroom. Majority of windows are in cafeteria and hall ways and are single pane windows.

Lighting

Lighting consumes 15-30 percent of the electricity used in commercial buildings in the United States and impacts other systems through their electrical requirements and the heat that it produces. The lighting throughout the Millington Middle School is mostly T-8 fluorescent lighting.

In 2015, the U.S. Department of Energy (DOE) issued new energy standards for general-service fluorescent lamps. These standards identify categories of lamps and impose minimum efficacies, expressed in lumens/W. primarily impacting 4-ft. 32W T8 lamps and some reduced-wattage T8 lamps, the new standards are now set to take effect January 26, 2018. As such, many of the lights throughout the school are the 32 Watt lamps. Although these lamps may still be available the price to replace them will continue to increase as the Government attempts to end the production and stockpile of this lighting technology. Overtime this will cost the school system money to replace and upgrading is in order.

Building Automation System

Building heating and cooling control systems are independent systems that coordinate the building heating and cooling systems to create a pleasing, safe, and healthy environment for activities in the facility. Control systems come in various types and levels of sophistication; however, the desired result is a facility where the environment is comfortable, and that comfort is achieved at the lowest possible energy cost.

As modern facilities and available technology have evolved, control systems have grown in sophistication. Current systems coordinate comfort, manage energy use, report problem areas, and coordinate information to assist facilities managers in facilities operation.

Millington Middle School utilizes an Andover system on the older units, which controls each package unit individually and a York Control System managing the new York Units.

HVAC

Millington Middle School has about 40 Roof Top type units located on campus. About half of the units have been upgraded to new York Roof Top units. It has been determined that 20 of the older units need to be replaced due to the age of the unit. There are many issues around the age of the unit that suggest replacement.

The American Society of Heating, Refrigeration, and Air Conditioning Engineers has provided the industry with general life expectancy values for various types of HVAC systems. The useful life typically associated with the types of HVAC system on campus is about 15 years. It must be noted that this doesn't mean that the unit is useless at 15 years but it does mean the likely hood of major failures. These unplanned failures tend to drive up maintenance cost putting a burden on the school systems budget. Leveraging savings associated with and apply these savings to upgrade investment at no cost or reduced cost could result in reduced maintenance savings that would offset any capital expense.

Nearly all of the units are old enough that they use R-22 as the cooling medium. This creates a very costly issue for the school system. R-11 and R-12 are both considered CFC chemicals which stands for chloroflourocarbon. It is the first part of that name "chloro" which refers to the chlorine. R-22 is an HCFC or hydrocholorflourocarbon. It has chlorine in it, but the atmospheric life is much shorter than the CFCs, so it had less of an impact on the ozone layer.

To address the worldwide impact of these chemicals, the nations of the world signed on to the Montreal Protocol which set limits on ozone depletion for each country that signed on. In order for the U.S. to meet its Montreal Protocol commitments, phase out dates for CFCs and HCFCs were included in the Clean Air Act.

Equipment manufacturers were forced to find replacements for these refrigerants. CFCs were the most critical because they had the closest phase out dates. The replacement refrigerants used to meet this first round of phase out dates are shown here. You'll note that initially HCFCs were not addressed because the phase out dates for that equipment didn't begin until 2010.

Given limited options, manufacturers were forced to eliminate R-22 from new equipment as the year 2010 approached. By early 2010 the production and import of R22 became prohibited. However, servicing current, existing equipment is still acceptable if there is an available supply of R22. To confirm the public's compliance with the new law, all sales of R22 must be purchased by a certified technician. The production and import of R22 will be continually reduced by law until 2020, when all production and import will be eliminated. Only recycled R22 refrigerant will be available to service existing air conditioners after 2020.

Older air conditioners could more frequently experience leaks and need repairs. Any air conditioners that are older than 2010 are more likely to use R22, which means there's a lot more demand for it, and a reduced supply. Prices have only risen due to scarcity and are expected to reach as high as $2,000 to charge a five ton unit.

It must also be noted that many of the Roof Top Units inspected had pitting and/or holes in the gas heat exchangers. Cracks or holes in the heat exchanger on commercial equipment and in building where there are no living quarters gas heating equipment can be left running with cracks in the heat exchanger while waiting replacement as long as no CO is detected in the air.

If the equipment is leaking CO then the gas must be shut off immediately. A long-term repair for commercial heat exchangers is possible but not very practical. It would cost more than a new unit or heat exchanger would cost. The metal in the heat exchanger is usually too thin to weld and impossible to access with welding equipment even with removing the heat exchanger completely.

Several class rooms share one HVAC unit creating issues around comfort and control. As such, it is recommended that each classroom have the ability to control their own space. Having a comfortable work environment helps facilitate learning.

Energy Use

Electric, gas, and water for Millington Middle School are all provided by Memphis Light Gas and Water (MLGW) with the sewage treatment provided by the Millington Water Department.

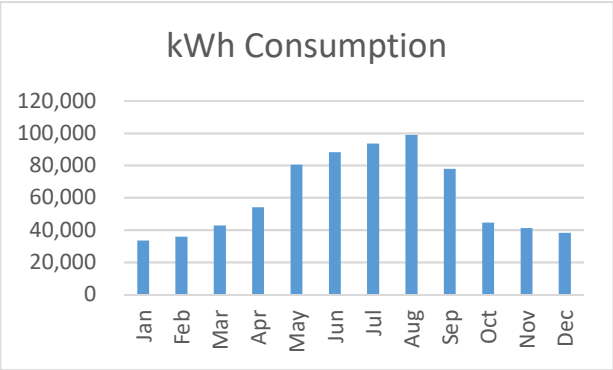
Millington Middle School Utilities	
Utility Type	**Utility Provider**
Electric	Memphis Light Gas and Water
Gas	Memphis Light Gas and Water
Water	Millington Water Department Public Works
Sewer	Millington Water Department

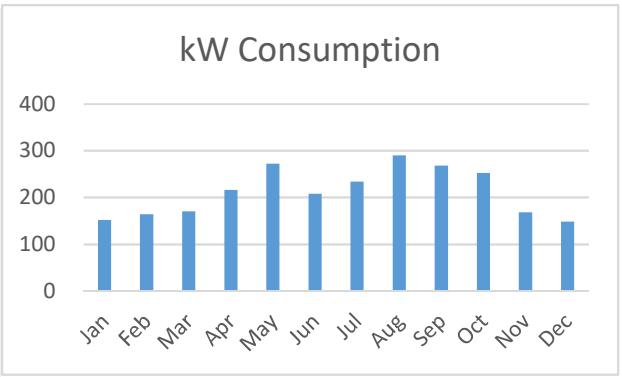
Utility bills spanning a 24 month period from November of 2016 to October of 2018 were recorded and analyzed for energy conservation opportunities. The following table shows the energy usage, the cost per unit used for energy savings analysis, and the total cost of all utilities for Millington Middle School.

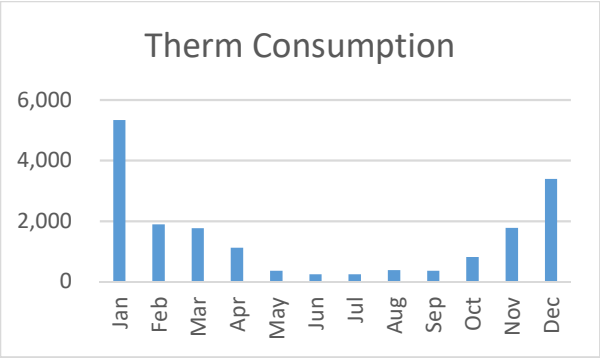
Millington Middle School Energy Usage		
Utility Type	**Utility Usage**	**$/Unit**
Electric (kWh)	723,400	$0.06013
Electric (kW)	2,536	$13.69
Gas (Therms)	17,310	$0.51
Water and Sewer (kGal)	Data Not Available	$8.59
All Utilities ($)	$93,629*	

*Many of the rates are tiered, so rates used for analysis multiplied by total usage will not equal Total Utility $s.

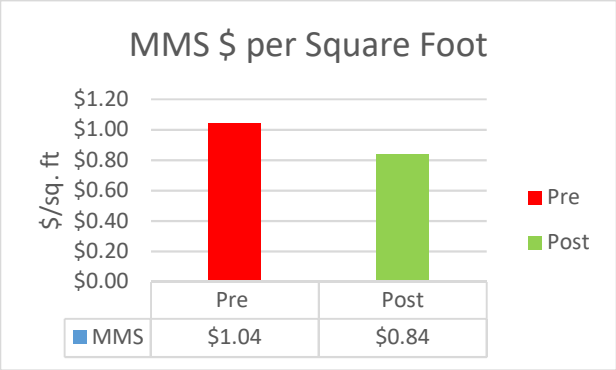
The following graphs show the average monthly kWh, KW, and Therm Consumption for Millington Middle School.

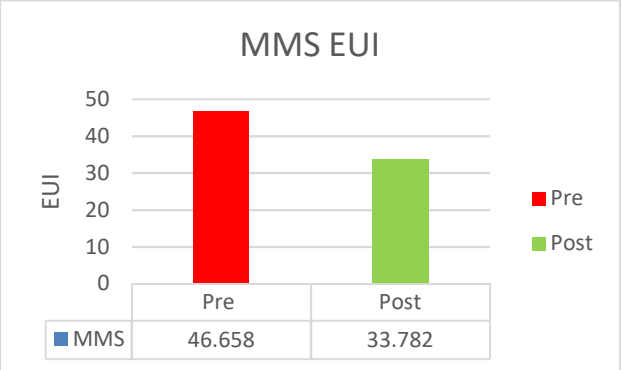






Based on a study done by the EPA, the average annual energy usage for education (K-12) facilities within the Ashrae Region 4 is 66 kBTU/sf (EUI). This number is closely reflected within our many case studies/performance contracts (PCs) across the state of TN. The pre-PC EUIs of over 20 school districts across the state of TN were found to have district wide EUIs ranging from 39.1 to 88.8 kBTU/sf with an average of 55.6 kBTU/sf. Millington Schools falls within the lower end of this range with a district average EUI of 42.9; however, Millington Middle School is currently running below the average with a current EUI of 46.7 kBTU/sf. Through the energy conservation measures presented within this report, it is estimated that the school's utility usage can be reduced by approximately $17,933, resulting in an EUI of 33.8 kBTU/sf.





Energy Conservation Measures

Following is a Scope Summary for each Energy Conservation Measure (ECM) identified during the preliminary energy audit process for Millington Middle School. The next step is for Trane to perform an investment grade audit (IGA). During the Investment Grade Audit (IGA), Trane's engineering and Development Teams will fully investigate these ECMs, as well as dive deeper into each facility and look for additional measures to significantly improve the buildings, utility expenditures, occupant comfort, and bottom line.

An Energy Conservation Measure or ECM for short, is a single initiative undertaken to reduce the energy consumption of a particular piece of equipment or a certain aspect of essential building services; energy conservation measures or ECMs are pluralistic and therefore imply a combination of several ECM initiatives to reduce energy consumption across an entire facility or building.

Energy is a term that broadly refers to either electricity, gas or water consumption; energy conservation and energy efficiency are often interchangeable terms as improved energy efficiency also means reduced energy consumption.

Interior Lighting Upgrade-LED's

Light emitting diodes (LED) are a solid-state lighting (SSL) technology that emits light when direct current passes through a semiconductor. This is in contrast to fluorescent and high intensity discharge (HID) bulbs such as metal halide or high-pressure sodium that generate light (and excess waste heat) by passing current through a metal vapor. Retrofitting of existing lighting system components--lamps, ballasts, etc.--along with de-lamping and fixture removal are all considerations. When required, replacement fixtures will be provided that utilize existing building wiring systems. Implementation of this ECM will reduce building energy use while maintaining lighting levels at or above Illuminating Engineering Society standards for these facility types.

The estimated savings for this ECM is: $5,692.90

Exterior Lighting Upgrade-LED's

Light emitting diodes (LED) are a solid-state lighting (SSL) technology that emits light when direct current passes through a semiconductor. This is in contrast to fluorescent and high intensity discharge (HID) bulbs such as metal halide or high-pressure sodium that generate light (and excess waste heat) by passing current through a metal vapor. LEDs are increasingly common in street lights, parking garage lighting, walkway and other outdoor area lighting.

The estimated savings for this ECM is: $336.27

Lighting Controls

Lighting control system help to gain the most efficiency from your lighting fixtures. The purpose of lighting controls is to minimize the electricity usage while maintaining the right amount of light when and where you need it.

Occupancy sensors are one of the first (and among the easiest) types of automated lighting controls that you can use to realize the greatest energy efficiency from your light fixtures. They are commonly seen in commercial buildings, since they are easy to install as part of an existing lighting system.

The estimated savings for this ECM is: $530.39

Building Weatherization

Air leakage, or infiltration, occurs when outside air enters a facility uncontrollably through cracks and openings. Properly sealing such cracks and openings can significantly reduce heating and cooling costs, improve building durability, and create a healthier indoor environment.

Door sweeps – Reuse existing fastening hardware if possible. Provide nylon brush type sweeps with matching aluminum/steel attachment plates. Weather-stripping – Reuse existing fastening hardware if possible. Use Class B door materials/channels and methods as required. Install replacement weather-stripping at or better than OEM level.

The estimated savings for this ECM is: $720.42

HVAC Upgrades

The American Society of Heating, Refrigeration, and Air Conditioning Engineers has provided the industry with general life expectancy values for various types of HVAC systems. The ECM for replacement will focus on system where the HVAC unit has reached the end of its useful life. For the

systems located at Millington Elementary School the useful life of the systems is 15 years. As such, it is recommended that 20 HVAC units be replaced.

The estimated savings for this ECM is: $3,901.70

New HVAC

It is also recommended that the rooms that are sharing HVAC units have their own units. As such, new VAV boxes and controls are recommended for rooms 101/102 and 110/111. These rooms have new York units and this is the most cost effective approach to provide individual classroom control. Room 112/113, 106/107, 209/210 and 103/104/105 will have their own dedicated units as each of the existing units are over 17 years old.

The estimated savings for this ECM is: $732.71

Building Automation System (BAS)

The Building Automation System (BAS) core functionality is to keep building climate within a specified range, based on an occupancy schedule, monitor performance and device failures in all systems and provide malfunction alarms. Automation systems reduce building energy and maintenance costs compared to a non-controlled building.

The estimated savings for this ECM is: $4,109.76

Water Conservation

Bathroom fixtures offer good water saving opportunities because many of these fixtures can be retrofit to reduce the amount of water consumed per flush (toilets and urinals) or per minute of use (sinks and showers). Reducing sink and shower water usage also saves the thermal energy used to make hot water.

The estimated savings for this ECM is: $1,570.54

Retro-Commissioning

This ECM would apply to the existing HVAC equipment that is not being replaced. Retro-commissioning is a process to improve the efficiency of an existing building's equipment and systems. It can often resolve problems that occurred during design or construction, or address problems that have developed throughout the building's life as equipment has aged, or as building usage has changed. Retro-commissioning involves a systemic evaluation of opportunities to improve energy-using systems.

The estimated savings for this ECM is: $338.24

Savings Potential and Cost Summary

The Energy Conservation Measures listed below are representative of the entire Preliminary Audit Results and do not reflect the items that can be carried in a self-funding program.

ECM Description	Savings	Budget
Interior Lighting Upgrade-LED's	$5,692.90	$76,362
Exterior Lighting Upgrade-LED's	$336.27	$10,466
Lighting Controls	$530.39	$30,067
Building Weatherization	$720.42	$11,506
HVAC Upgrades	$3,901.70	$570,689
New HVAC	$732.71	$183,286
Building Automation System (BAS)-Existing	$4,109.76	$221,926
Building Automation System (BAS)-New	$4,109.76	$193,120
Water Conservation	$1,570.54	$27,051
Retro-Commissioning	$338.24	$17,638

Millington High School

Facility Observations

Millington High School located at 8050 West Street, Millington, TN 38053 was originally constructed in 2004 with some updates made to the school in 2011 for the kitchen, library, cafeteria and science classes. The construction of the school is a block construction with a brick façade. The roof is generally a built up roof.

Lighting

Lighting consumes 15-30 percent of the electricity used in commercial buildings in the United States and impacts other systems through their electrical requirements and the heat that it produces. The lighting throughout the Millington High School is mostly T-8 fluorescent lighting.

In 2015, the U.S. Department of Energy (DOE) issued new energy standards for general-service fluorescent lamps. These standards identify categories of lamps and impose minimum efficacies, expressed in lumens/W. Primarily impacting 4-ft. 32W T8 lamps and some reduced-wattage T8 lamps, the new standards are now set to take effect January 26, 2018. As such, many of the lights throughout the school are the 32 Watt lamps. Although these lamps may still be available the price to replace them will continue to increase as the Government attempts to end the production and stockpile of this lighting technology. Overtime this will cost the school system money to replace and upgrading is in order.

Building Automation System

Building heating and cooling control systems are independent systems that coordinate the building heating and cooling systems to create a pleasing, safe, and healthy environment for activities in the facility. Control systems come in various types and levels of sophistication; however, the desired result is a facility where the environment is comfortable, and that comfort is achieved at the lowest possible energy cost.

As modern facilities and available technology have evolved, control systems have grown in sophistication. Current systems coordinate comfort, manage energy use, report problem areas, and coordinate information to assist facilities managers in facilities operation.

Millington High School utilizes an Andover system, which controls each package unit individually along with the air handlers and other equipment in Annex and new Cafeteria/Science building.

HVAC

Millington High School has about 86 Roof Top type units located on campus and a chiller boiler system that supplies chilled water and hot water to various main air handlers. The air handlers feed VAV boxes in the classrooms. It has been determined that 69 of the Roof Top units need to be replaced due to the age of the unit. There are many issues around the age of the unit that suggest replacement.

The American Society of Heating, Refrigeration, and Air Conditioning Engineers has provided the industry with general life expectancy values for various types of HVAC systems. The useful life typically associated with the types of HVAC system on campus is about 15 years. It must be noted that this doesn't mean that the unit is useless at 15 years but it does mean the likely hood of major failures. These unplanned failures tend to drive up maintenance cost putting a burden on the school systems budget. Leveraging savings associated with and apply these savings to upgrade investment at no cost or reduced cost could result in reduced maintenance savings that would offset any capital expense.

Nearly all of the units are old enough that they use R-22 as the cooling medium. This creates a very costly issue for the school system. R-11 and R-12 are both considered CFC chemicals which stands for chloroflourocarbon. It is the first part of that name "chloro" which refers to the chlorine. R-22 is an HCFC or hydrocholorflourocarbon. It has chlorine in it, but the atmospheric life is much shorter than the CFCs, so it had less of an impact on the ozone layer.

To address the worldwide impact of these chemicals, the nations of the world signed on to the Montreal Protocol which set limits on ozone depletion for each country that signed on. In order for the U.S. to meet its Montreal Protocol commitments, phase out dates for CFCs and HCFCs were included in the Clean Air Act.

Equipment manufacturers were forced to find replacements for these refrigerants. CFCs were the most critical because they had the closest phase out dates. The replacement refrigerants used to meet this first round of phase out dates are shown here. You'll note that initially HCFCs were not addressed because the phase out dates for that equipment didn't begin until 2010.

Given limited options, manufacturers were forced to eliminate R-22 from new equipment as the year 2010 approached. By early 2010 the production and import of R22 became prohibited. However, servicing current, existing equipment is still acceptable if there is an available supply of R22. To confirm the public's compliance with the new law, all sales of R22 must be purchased by a certified technician. The production and import of R22 will be continually reduced by law until 2020, when all production and import will be eliminated. Only recycled R22 refrigerant will be available to service existing air conditioners after 2020.

Older air conditioners could more frequently experience leaks and need repairs. Any air conditioners that are older than 2010 are more likely to use R22, which means there's a lot more demand for it, and a reduced supply. Prices have only risen due to scarcity and are expected to reach as high as $2,000 to charge a five ton unit.

It must also be noted that many of the Roof Top Units inspected had pitting and/or holes in the gas heat exchangers. Cracks or holes in the heat exchanger on commercial equipment and in building where there are no living quarters gas heating equipment can be left running with cracks in the heat exchanger while waiting replacement as long as no CO is detected in the air.

If the equipment is leaking CO then the gas must be shut off immediately. A long-term repair for commercial heat exchangers is possible but not very practical. It would cost more than a new unit or heat exchanger would cost. The metal in the heat

exchanger is usually too thin to weld and impossible to access with welding equipment even with removing the heat exchanger completely.

Heat exchangers will fail from age, hours of operation, and from operating conditions. A properly maintained system will last 20 years or more, but anything past 25 years is on borrowed time and should be inspected annually and tested for CO. Given the age of the system the units are on borrowed time.

It was also noted that the cooling tower doesn't have a VFD on the fan. A cooling tower VFD will help save energy and improve the operation of the motor over time.

Energy Use

Electric, gas, and water for Millington Central High School and all supporting facilities are all provided by Memphis Light Gas and Water (MLGW) with the sewage treatment provided by the Millington Water Department.

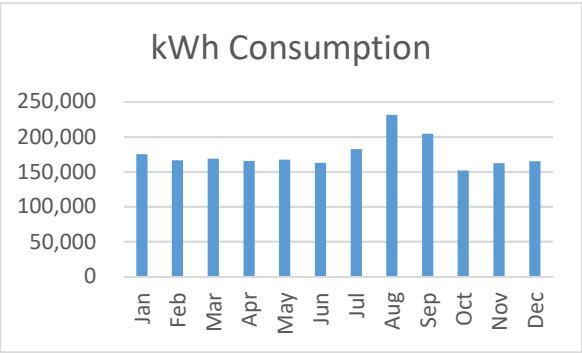
Millington Central High School Utilities	
Utility Type	**Utility Provider**
Electric	Memphis Light Gas and Water
Gas	Memphis Light Gas and Water
Water	Millington Water Department Public Works
Sewer	Millington Water Department

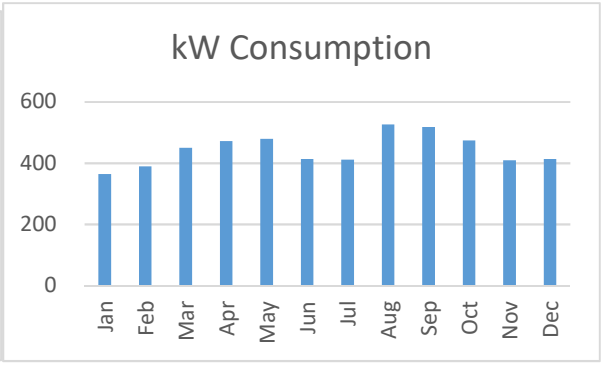
Utility bills spanning a 24 month period from November of 2016 to October of 2018 were recorded and analyzed for energy conservation opportunities. The following table shows the energy usage, the cost per unit used for energy savings analysis, and the total cost of all utilities for Millington Central High School.

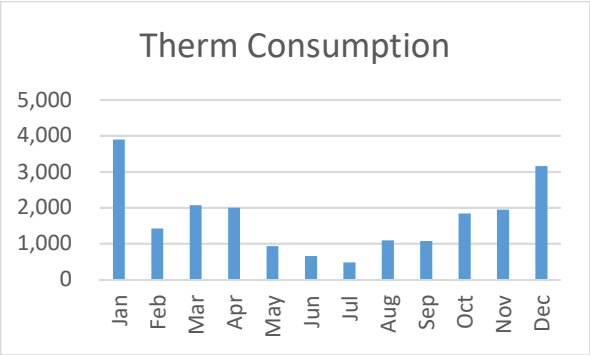
Millington Central High School Energy Usage		
Utility Type	**Utility Usage**	**$/Unit**
Electric (kWh)	2,055,292	$0.06013
Electric (kW)	5,051	$13.69
Gas (Therms)	32,022	$0.51
Water and Sewer (kGal)	Data Not Available	$8.59
All Utilities ($)	$264,094*	

*Many of the rates are tiered, so rates used for analysis multiplied by total usage will not equal Total Utility $s.

The following graphs show the average monthly kWh, KW, and Therm Consumption for Millington Central High School.







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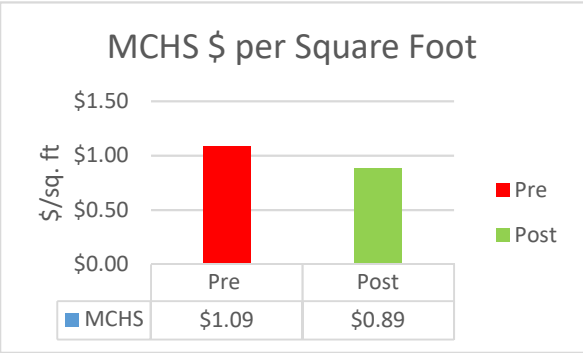

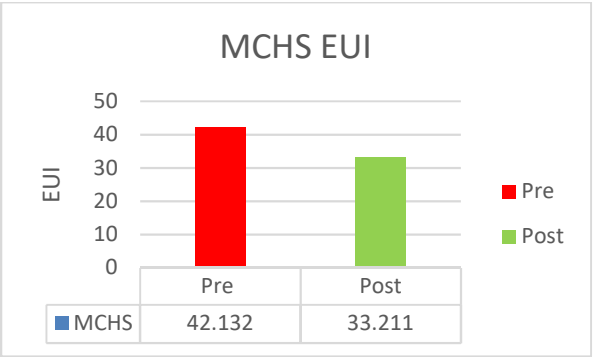

Energy Conservation Measures

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Energy is a term that broadly refers to either electricity, gas or water consumption; energy conservation and energy efficiency are often interchangeable terms as improved energy efficiency also means reduced energy consumption.

Interior Lighting Upgrade-LED's

Light emitting diodes (LED) are a solid-state lighting (SSL) technology that emits light when direct current passes through a semiconductor. This is in contrast to fluorescent and high intensity discharge (HID) bulbs such as metal halide or high-pressure sodium that generate light (and excess waste heat) by passing current through a metal vapor. Retrofitting of existing lighting system components--lamps, ballasts, etc.--along with de-lamping and fixture removal are all considerations. When required, replacement fixtures will be provided that utilize existing building wiring systems. Implementation of this ECM will reduce building energy use while maintaining lighting levels at or above Illuminating Engineering Society standards for these facility types.

The estimated savings for this ECM is: $18,790.01

Exterior Lighting Upgrade-LED's

Light emitting diodes (LED) are a solid-state lighting (SSL) technology that emits light when direct current passes through a semiconductor. This is in contrast to fluorescent and high intensity discharge (HID) bulbs such as metal halide or high-pressure sodium that generate light (and excess waste heat) by passing current through a metal vapor. LEDs are increasingly common in street lights, parking garage lighting, walkway and other outdoor area lighting.

The estimated savings for this ECM is: $943.45

Lighting Controls

Lighting control system help to gain the most efficiency from your lighting fixtures. The purpose of lighting controls is to minimize the electricity usage while maintaining the right amount of light when and where you need it.

Occupancy sensors are one of the first (and among the easiest) types of automated lighting controls that you can use to realize the greatest energy efficiency from your light fixtures. They are commonly seen in commercial buildings, since they are easy to install as part of an existing lighting system.

The estimated savings for this ECM is: $1,705.83

Building Weatherization

Air leakage, or infiltration, occurs when outside air enters a facility uncontrollably through cracks and openings. Properly sealing such cracks and openings can significantly reduce heating and cooling costs, improve building durability, and create a healthier indoor environment.

Door sweeps – Reuse existing fastening hardware if possible. Provide nylon brush type sweeps with matching aluminum/steel attachment plates. Weather-stripping – Reuse existing fastening hardware if possible. Use Class B door materials/channels and methods as required. Install replacement weather-stripping at or better than OEM level.

The estimated savings for this ECM is: $1,450.26

HVAC Upgrades

The American Society of Heating, Refrigeration, and Air Conditioning Engineers has provided the industry with general life expectancy values for various types of HVAC systems. The ECM for replacement will focus on system where the HVAC unit has reached the end of its useful life. For the

systems located at Millington High School the useful life of the systems is 15 years. As such, it is recommended that 75 HVAC units be replaced.

The estimated savings for this ECM is: $5,547.70

Cooling Tower VFD

Cooling Tower VFD allows the motor to vary its speed to match the need of the chiller instead of running at full speed all the time. The ECM will save on electric usage and will also prolong the motor since starts and stops are managed more "softly".

The estimated savings for this ECM is: $354.90

Building Automation System (BAS)

The Building Automation System (BAS) core functionality is to keep building climate within a specified range, based on an occupancy schedule, monitor performance and device failures in all systems and provide malfunction alarms. Automation systems reduce building energy and maintenance costs compared to a non-controlled building.

The estimated savings for this ECM is: $1,630.95

Water Conservation

Bathroom fixtures offer good water saving opportunities because many of these fixtures can be retrofit to reduce the amount of water consumed per flush (toilets and urinals) or per minute of use (sinks and showers). Reducing sink and shower water usage also saves the thermal energy used to make hot water.

The estimated savings for this ECM is: $2,873.86

Retro-Commissioning

This ECM would apply to the existing HVAC equipment that is not being replaced. Retro-commissioning is a process to improve the efficiency of an existing building's equipment and systems. It can often resolve problems that occurred during design or construction, or address problems that have developed throughout the building's life as equipment has aged, or as building usage has changed. Retro-commissioning involves a systemic evaluation of opportunities to improve energy-using systems.

The estimated savings for this ECM is: $438.46

Savings Potential and Cost Summary

The Energy Conservation Measures listed below are representative of the entire Preliminary Audit Results and do not reflect the items that can be carried in a self-funding program.

ECM Description	Savings	Budget
Interior Lighting Upgrade-LED's	$18,790.01	$166,258
Exterior Lighting Upgrade-LED's	$943.45	$25,431
Lighting Controls	$1,705.83	$66,652
Building Weatherization	$1,450.26	$19,612
HVAC Upgrades	$5,547.70	$1,651,443
Cooling Tower VFD	$354.90	$11,412
Building Automation System (BAS) –Existing	$1,630.95	$620,742
Building Automation System (BAS)-New	$1,630.95	$508,940
Water Conservation	$2,873.86	$8,263
Retro-Commissioning	$438.46	$30,643

Millington Vocational School

Energy Conservation Measures

Following is a Scope Summary for each Energy Conservation Measure (ECM) identified during the preliminary energy audit process for Millington High School. The next step is for Trane to perform an investment grade audit (IGA). During the Investment Grade Audit (IGA), Trane's engineering and Development Teams will fully investigate these ECMs, as well as dive deeper into each facility and look for additional measures to significantly improve the utility expenditures, occupant comfort, and bottom line.

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Energy is a term that broadly refers to either electricity, gas or water consumption; energy conservation and energy efficiency are often interchangeable terms as improved energy efficiency also means reduced energy consumption.

Interior Lighting Upgrade-LED's

Light emitting diodes (LED) are a solid-state lighting (SSL) technology that emits light when direct current passes through a semiconductor. This is in contrast to fluorescent and high intensity discharge (HID) bulbs such as metal halide or high-pressure sodium that generate light (and excess waste heat) by passing current through a metal vapor. Retrofitting of existing lighting system components--lamps, ballasts, etc.--along with de-lamping and fixture removal are all considerations. When required, replacement fixtures will be provided that utilize existing building wiring systems. Implementation of this ECM will reduce building energy use while maintaining lighting levels at or above Illuminating Engineering Society standards for these facility types.

The estimated savings for this ECM is: $2,707.08

Lighting Controls

Lighting control system help to gain the most efficiency from your lighting fixtures. The purpose of lighting controls is to minimize the electricity usage while maintaining the right amount of light when and where you need it.

Occupancy sensors are one of the first (and among the easiest) types of automated lighting controls that you can use to realize the greatest energy efficiency from your light fixtures. They are commonly seen in commercial buildings, since they are easy to install as part of an existing lighting system.

The estimated savings for this ECM is: $64.72

HVAC Upgrades

The American Society of Heating, Refrigeration, and Air Conditioning Engineers has provided the industry with general life expectancy values for various types of HVAC systems. The ECM for replacement will focus on system where the HVAC unit has reached the end of its useful life. For the systems located at the Vocational the useful life of the systems is 15 years. As such, it is recommended that 2 HVAC units be replaced.

The estimated savings for this ECM is: $321.91

Internet Programmable Thermostat

The latest generation of thermostats, Wi-Fi ones, have many benefits that previous thermostats lacked. A Wi-Fi thermostat can help reduce energy costs, stay comfortable, remember to maintain the heating and cooling systems and keep control of changing the temperature settings.

The project includes the replacement of all the existing thermostat with a new TRANE Pivot Thermostat which is a 7 day programmable touchscreen thermostat that is selectable for light commercial use. The thermostat will be accessible via cell phone or internet providing remote access. The customer will be required to insure the network connection and operability.

The estimated savings for this ECM is: $1,001.62

Downsize Hot Water Heater

The facility has a large hot water generating system that is over 600 gallons in capacity. It is recommended that the system be removed and a more appropriately sized unit be installed. Given the current operation of the Vocational facility so a large hot water use is not needed based on interviews with maintenance personnel.

The estimated savings for this ECM is: $124.95

Savings Potential and Cost Summary

The Energy Conservation Measures listed below are representative of the entire Preliminary Audit Results and do not reflect the items that can be carried in a self-funding program.

ECM Description	Savings	Budget
Interior Lighting Upgrade-LED's	$2,707.08	$35,199
Lighting Controls	$64.72	$3,061
HVAC Upgrades	$321.91	$43,108
Internet Thermostat	$1,001.62	$3,247
Downsize Hot Water Heater	$124.95	$16,954

Millington HS GYM

Energy Conservation Measures

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Energy is a term that broadly refers to either electricity, gas or water consumption; energy conservation and energy efficiency are often interchangeable terms as improved energy efficiency also means reduced energy consumption.

Interior Lighting Upgrade-LED's

Light emitting diodes (LED) are a solid-state lighting (SSL) technology that emits light when direct current passes through a semiconductor. This is in contrast to fluorescent and high intensity discharge (HID) bulbs such as metal halide or high-pressure sodium that generate light (and excess waste heat) by passing current through a metal vapor. Retrofitting of existing lighting system components--lamps, ballasts, etc.--along with de-lamping and fixture removal are all considerations. When required, replacement fixtures will be provided that utilize existing building wiring systems. Implementation of this ECM will reduce building energy use while maintaining lighting levels at or above Illuminating Engineering Society standards for these facility types.

The estimated savings for this ECM is: $1,833.34

Exterior Lighting Upgrade-LED's

Light emitting diodes (LED) are a solid-state lighting (SSL) technology that emits light when direct current passes through a semiconductor. This is in contrast to fluorescent and high intensity discharge (HID) bulbs such as metal halide or high-pressure sodium that generate light (and excess waste heat) by passing current through a metal vapor. LEDs are increasingly common in street lights, parking garage lighting, walkway and other outdoor area lighting.

The estimated savings for this ECM is: $224.15

Lighting Controls

Lighting control system help to gain the most efficiency from your lighting fixtures. The purpose of lighting controls is to minimize the electricity usage while maintaining the right amount of light when and where you need it.

Occupancy sensors are one of the first (and among the easiest) types of automated lighting controls that you can use to realize the greatest energy efficiency from your light fixtures. They are commonly seen in commercial buildings, since they are easy to install as part of an existing lighting system.

The estimated savings for this ECM is: $69.59

HVAC Upgrades

The American Society of Heating, Refrigeration, and Air Conditioning Engineers has provided the industry with general life expectancy values for various types of HVAC systems. The ECM for replacement will focus on system where the HVAC unit has reached the end of its useful life. For the systems located at the GYM the useful life of the systems is 15 years. As such, it is recommended that 1 HVAC units be replaced.

The estimated savings for this ECM is: $688.06

Building Automation System (BAS)

The Building Automation System (BAS) core functionality is to keep building climate within a specified range, based on an occupancy schedule, monitor performance and device failures in all systems and provide malfunction alarms. Automation systems reduce building energy and maintenance costs compared to a non-controlled building.

The estimated savings for this ECM is: $3,162.38

Water Conservation

Bathroom fixtures offer good water saving opportunities because many of these fixtures can be retrofit to reduce the amount of water consumed per flush (toilets and urinals) or per minute of use (sinks and showers). Reducing sink and shower water usage also saves the thermal energy used to make hot water.

The estimated savings for this ECM is: $657.09

Downsize Hot Water Heater

The facility has a large hot water generating system that is a similar capacity to the Vocation School. It is recommended that the system be removed and a more appropriately sized unit be installed. Given the current operation of the Field House facility such a large hot water use is not needed based on interviews with maintenance personnel.

The estimated savings for this ECM is: $12.04

Savings Potential and Cost Summary

The Energy Conservation Measures listed below are representative of the entire Preliminary Audit Results and do not reflect the items that can be carried in a self-funding program.

ECM Description	Savings	Budget
Interior Lighting Upgrade-LED's	$1,833.34	$55,547
Exterior Lighting Upgrade-LED's	$224.15	$5,822
Lighting Controls	$69.59	$3,418
HVAC Upgrades	$688.06	$44,178
BAS Controls	$3,162.38	$82,103
Downsize Hot Water	$12.04	$2,935
Water Conservation	$657.09	$48,551

Millington Stadium

Energy Conservation Measures

Following is a Scope Summary for each Energy Conservation Measure (ECM) identified during the preliminary energy audit process for Millington High School. The next step is for Trane to perform an investment grade audit (IGA). During the Investment Grade Audit (IGA), Trane's engineering and Development Teams will fully investigate these ECMs, as well as dive deeper into each facility and look for additional measures to significantly improve the utility expenditures, occupant comfort, and bottom line.

An Energy Conservation Measure or ECM for short, is a single initiative undertaken to reduce the energy consumption of a particular piece of equipment or a certain aspect of essential building services; energy conservation measures or ECMs are pluralistic and therefore imply a combination of several ECM initiatives to reduce energy consumption across an entire facility or building.

Energy is a term that broadly refers to either electricity, gas or water consumption; energy conservation and energy efficiency are often interchangeable terms as improved energy efficiency also means reduced energy consumption.

Interior Lighting Upgrade-LED's

Light emitting diodes (LED) are a solid-state lighting (SSL) technology that emits light when direct current passes through a semiconductor. This is in contrast to fluorescent and high intensity discharge (HID) bulbs such as metal halide or high-pressure sodium that generate light (and excess waste heat) by passing current through a metal vapor. Retrofitting of existing lighting system components--lamps, ballasts, etc.--along with de-lamping and fixture removal are all considerations. When required, replacement fixtures will be provided that utilize existing building wiring systems. Implementation of this ECM will reduce building energy use while maintaining lighting levels at or above Illuminating Engineering Society standards for these facility types.

The estimated savings for this ECM is: $607.66

Exterior Lighting Upgrade-LED's

Light emitting diodes (LED) are a solid-state lighting (SSL) technology that emits light when direct current passes through a semiconductor. This is in contrast to fluorescent and high intensity discharge (HID) bulbs such as metal halide or high-pressure sodium that generate light (and excess waste heat) by passing current through a metal vapor. LEDs are increasingly common in street lights, parking garage lighting, walkway and other outdoor area lighting.

The estimated savings for this ECM is: $475.51

HVAC Upgrades

The American Society of Heating, Refrigeration, and Air Conditioning Engineers has provided the industry with general life expectancy values for various types of HVAC systems. The ECM for replacement will focus on system where the HVAC unit has reached the end of its useful life. For the systems located at the Vocational the useful life of the systems is 15 years. As such, it is recommended that 2 HVAC units be replaced.

The estimated savings for this ECM is: $175.05

New HVAC

A new pad mounted Gas Pack unit is being specified for the stadium weight room. The unit will connect to the existing ductwork and all outdoor air louvers will be blocked.

The estimated savings for this ECM is: NO SAVINGS

The two gas fired forced air heaters in the bathrooms will be replaced with infrared heaters. Infrared heaters provide more efficient heating by heating the concrete floor which radiates heat up, keeping the occupants warmer. Forced air system heat the air and hot air rises to the ceiling resulting in longer run times to maintain adequate temperatures where the occupants are located.

The estimated savings for this ECM is:

Internet Programmable Thermostat

The latest generation of thermostats, Wi-Fi ones, have many benefits that previous thermostats lacked. A Wi-Fi thermostat can help reduce energy costs, stay comfortable, remember to maintain the heating and cooling systems and keep control of changing the temperature settings.

The project includes the replacement of all the existing thermostat with a new TRANE Pivot Thermostat which is a 7 day programmable touchscreen thermostat that is selectable for light commercial use. The thermostat will be accessible via cell phone or internet providing remote access. The customer will be required to insure the network connection and operability.

The estimated savings for this ECM is: $168.45

Water Conservation

Bathroom fixtures offer good water saving opportunities because many of these fixtures can be retrofit to reduce the amount of water consumed per flush (toilets and urinals) or per minute of use (sinks and showers). Reducing sink and shower water usage also saves the thermal energy used to make hot water.

The estimated savings for this ECM is: $67.21

Infrared Heat

This ECM will replace the existing forced air heaters in the concession stand bathroom and install infrared heaters. Forced air system tend to use much more energy since hot air rises the occupancy feel cold and therefore the units run longer. The infrared heater heats objects, such as the concrete floor, and the heat radiates up from the floor making occupancy feel warmer.

The estimated savings for this ECM is: $54.51

Savings Potential and Cost Summary

The Energy Conservation Measures listed below are representative of the entire Preliminary Audit Results and do not reflect the items that can be carried in a self-funding program.

ECM Description	Savings	Budget
Interior Lighting Upgrade-LED's	$607.66	$10,729
Exterior Lighting Upgrade-LED's	$475.51	$7,792
HVAC Upgrades	$175.05	$25,750
New HVAC	$(1,111.44)	$42,942
Internet Thermostat	$168.45	$3,247
Infrared Heat	$54.51	$11,235
Water Conservation	$67.21	$17,328

Millington Field House

Energy Conservation Measures

Following is a Scope Summary for each Energy Conservation Measure (ECM) identified during the preliminary energy audit process for Millington High School. The next step is for Trane to perform an investment grade audit (IGA). During the Investment Grade Audit (IGA), Trane's engineering and Development Teams will fully investigate these ECMs, as well as dive deeper into each facility and look for additional measures to significantly improve the utility expenditures, occupant comfort, and bottom line.

An Energy Conservation Measure or ECM for short, is a single initiative undertaken to reduce the energy consumption of a particular piece of equipment or a certain aspect of essential building services; energy conservation measures or ECMs are pluralistic and therefore imply a combination of several ECM initiatives to reduce energy consumption across an entire facility or building.

Energy is a term that broadly refers to either electricity, gas or water consumption; energy conservation and energy efficiency are often interchangeable terms as improved energy efficiency also means reduced energy consumption.

Interior Lighting Upgrade-LED's

Light emitting diodes (LED) are a solid-state lighting (SSL) technology that emits light when direct current passes through a semiconductor. This is in contrast to fluorescent and high intensity discharge (HID) bulbs such as metal halide or high-pressure sodium that generate light (and excess waste heat) by passing current through a metal vapor. Retrofitting of existing lighting system components--lamps, ballasts, etc.--along with de-lamping and fixture removal are all considerations. When required, replacement fixtures will be provided that utilize existing building wiring systems. Implementation of this ECM will reduce building energy use while maintaining lighting levels at or above Illuminating Engineering Society standards for these facility types.

The estimated savings for this ECM is: $590.48

Lighting Controls

Lighting control system help to gain the most efficiency from your lighting fixtures. The purpose of lighting controls is to minimize the electricity usage while maintaining the right amount of light when and where you need it.

Occupancy sensors are one of the first (and among the easiest) types of automated lighting controls that you can use to realize the greatest energy efficiency from your light fixtures. They are commonly seen in commercial buildings, since they are easy to install as part of an existing lighting system.

The estimated savings for this ECM is: $8.01

HVAC Upgrades

The American Society of Heating, Refrigeration, and Air Conditioning Engineers has provided the industry with general life expectancy values for various types of HVAC systems. The ECM for replacement will focus on system where the HVAC unit has reached the end of its useful life. For the systems located at the Vocational the useful life of the systems is 15 years. As such, it is recommended that 1 Roof Top HVAC units be replaced. The existing ductwork will be replaced with sock type duct. Also the split unit will be replaced with a roof top unit and a new sock type duct will be installed.

The estimated savings for this ECM is: $381.03

Internet Programmable Thermostat

The latest generation of thermostats, Wi-Fi ones, have many benefits that previous thermostats lacked. A Wi-Fi thermostat can help reduce energy costs, stay comfortable, remember to maintain the heating and cooling systems and keep control of changing the temperature settings.

The project includes the replacement of all the existing thermostat with a new TRANE Pivot Thermostat which is a 7 day programmable touchscreen thermostat that is selectable for light commercial use. The thermostat will be accessible via cell phone or internet providing remote access. The customer will be required to insure the network connection and operability.

The estimated savings for this ECM is: $900.27

Downsize Hot Water Heater

The facility has a large hot water generating system that is a similar capacity to the Vocation School. It is recommended that the system be removed and a more appropriately sized unit be installed. Given the current operation of the Field House facility such a large hot water use is not needed based on interviews with maintenance personnel.

The estimated savings for this ECM is: $42.39

Water Conservation

Bathroom fixtures offer good water saving opportunities because many of these fixtures can be retrofit to reduce the amount of water consumed per flush (toilets and urinals) or per minute of use (sinks and showers). Reducing sink and shower water usage also saves the thermal energy used to make hot water.

The estimated savings for this ECM is: $196.97

Savings Potential and Cost Summary

The Energy Conservation Measures listed below are representative of the entire Preliminary Audit Results and do not reflect the items that can be carried in a self-funding program.

ECM Description	Savings	Budget
Interior Lighting Upgrade-LED's	$590.48	$10,925
Lighting Controls	$8.01	$2,616
HVAC Upgrades	$381.03	$78,035
Internet Thermostat	$900.27	$2,165
Downsize Hot Water	$42.39	$18,473
Water Conservation	$196.97	$6,242

Miles Field House

Energy Conservation Measures

Following is a Scope Summary for each Energy Conservation Measure (ECM) identified during the preliminary energy audit process for Millington High School. The next step is for Trane to perform an investment grade audit (IGA). During the Investment Grade Audit (IGA), Trane's engineering and Development Teams will fully investigate these ECMs, as well as dive deeper into each facility and look for additional measures to significantly improve the utility expenditures, occupant comfort, and bottom line.

An Energy Conservation Measure or ECM for short, is a single initiative undertaken to reduce the energy consumption of a particular piece of equipment or a certain aspect of essential building services; energy conservation measures or ECMs are pluralistic and therefore imply a combination of several ECM initiatives to reduce energy consumption across an entire facility or building.

Energy is a term that broadly refers to either electricity, gas or water consumption; energy conservation and energy efficiency are often interchangeable terms as improved energy efficiency also means reduced energy consumption.

Interior Lighting Upgrade-LED's

Light emitting diodes (LED) are a solid-state lighting (SSL) technology that emits light when direct current passes through a semiconductor. This is in contrast to fluorescent and high intensity discharge (HID) bulbs such as metal halide or high-pressure sodium that generate light (and excess waste heat) by passing current through a metal vapor. Retrofitting of existing lighting system components--lamps, ballasts, etc.--along with de-lamping and fixture removal are all considerations. When required, replacement fixtures will be provided that utilize existing building wiring systems. Implementation of this ECM will reduce building energy use while maintaining lighting levels at or above Illuminating Engineering Society standards for these facility types.

The estimated savings for this ECM is: $292.96

Exterior Lighting Upgrade-LED's

Light emitting diodes (LED) are a solid-state lighting (SSL) technology that emits light when direct current passes through a semiconductor. This is in contrast to fluorescent and high intensity discharge (HID) bulbs such as metal halide or high-pressure sodium that generate light (and excess waste heat) by passing current through a metal vapor. LEDs are increasingly common in street lights, parking garage lighting, walkway and other outdoor area lighting.

The estimated savings for this ECM is: $113.75

Internet Programmable Thermostat

The latest generation of thermostats, Wi-Fi ones, have many benefits that previous thermostats lacked. A Wi-Fi thermostat can help reduce energy costs, stay comfortable, remember to maintain the heating and cooling systems and keep control of changing the temperature settings.

The project includes the replacement of all the existing thermostat with a new TRANE Pivot Thermostat which is a 7 day programmable touchscreen thermostat that is selectable for light commercial use. The thermostat will be accessible via cell phone or internet providing remote access. The customer will be required to insure the network connection and operability.

The estimated savings for this ECM is: $34.49

Savings Potential and Cost Summary

The Energy Conservation Measures listed below are representative of the entire Preliminary Audit Results and do not reflect the items that can be carried in a self-funding program.

ECM Description	Savings	Budget
Interior Lighting Upgrade-LED's	$292.96	$3,620
Exterior Lighting Upgrade-LED's	$113.75	$2,285
Internet Thermostat	$34.49	$835

Main Office

Energy Conservation Measures

Following is a Scope Summary for each Energy Conservation Measure (ECM) identified during the preliminary energy audit process for Millington High School. The next step is for Trane to perform an investment grade audit (IGA). During the Investment Grade Audit (IGA), Trane's engineering and Development Teams will fully investigate these ECMs, as well as dive deeper into each facility and look for additional measures to significantly improve the utility expenditures, occupant comfort, and bottom line.

An Energy Conservation Measure or ECM for short, is a single initiative undertaken to reduce the energy consumption of a particular piece of equipment or a certain aspect of essential building services; energy conservation measures or ECMs are pluralistic and therefore imply a combination of several ECM initiatives to reduce energy consumption across an entire facility or building.

Energy is a term that broadly refers to either electricity, gas or water consumption; energy conservation and energy efficiency are often interchangeable terms as improved energy efficiency also means reduced energy consumption.

Interior Lighting Upgrade-LED's

Light emitting diodes (LED) are a solid-state lighting (SSL) technology that emits light when direct current passes through a semiconductor. This is in contrast to fluorescent and high intensity discharge (HID) bulbs such as metal halide or high-pressure sodium that generate light (and excess waste heat) by passing current through a metal vapor. Retrofitting of existing lighting system components--lamps, ballasts, etc.--along with de-lamping and fixture removal are all considerations. When required, replacement fixtures will be provided that utilize existing building wiring systems. Implementation of this ECM will reduce building energy use while maintaining lighting levels at or above Illuminating Engineering Society standards for these facility types.

The estimated savings for this ECM is: $1,448.98

Exterior Lighting Upgrade-LED's

Light emitting diodes (LED) are a solid-state lighting (SSL) technology that emits light when direct current passes through a semiconductor. This is in contrast to fluorescent and high intensity discharge (HID) bulbs such as metal halide or high-pressure sodium that generate light (and excess waste heat) by passing current through a metal vapor. LEDs are increasingly common in street lights, parking garage lighting, walkway and other outdoor area lighting.

The estimated savings for this ECM is: $333.03

Lighting Controls

Lighting control system help to gain the most efficiency from your lighting fixtures. The purpose of lighting controls is to minimize the electricity usage while maintaining the right amount of light when and where you need it.

Occupancy sensors are one of the first (and among the easiest) types of automated lighting controls that you can use to realize the greatest energy efficiency from your light fixtures. They are commonly seen in commercial buildings, since they are easy to install as part of an existing lighting system.

The estimated savings for this ECM is: $200.39

Building Automation System (BAS)

The Building Automation System (BAS) core functionality is to keep building climate within a specified range, based on an occupancy schedule, monitor performance and device failures in all systems and provide malfunction alarms. Automation systems reduce building energy and maintenance costs compared to a non-controlled building.

The estimated savings for this ECM is: $184.36

Building Weatherization

Air leakage, or infiltration, occurs when outside air enters a facility uncontrollably through cracks and openings. Properly sealing such cracks and openings can significantly reduce heating and cooling costs, improve building durability, and create a healthier indoor environment.

Door sweeps – Reuse existing fastening hardware if possible. Provide nylon brush type sweeps with matching aluminum/steel attachment plates. Weather-stripping – Reuse existing fastening hardware if possible. Use Class B door materials/channels and methods as required. Install replacement weather-stripping at or better than OEM level.

The estimated savings for this ECM is: $152.97

Water Conservation

Bathroom fixtures offer good water saving opportunities because many of these fixtures can be retrofit to reduce the amount of water consumed per flush (toilets and urinals) or per minute of use (sinks and showers). Reducing sink and shower water usage also saves the thermal energy used to make hot water.

The estimated savings for this ECM is: $66.15

Savings Potential and Cost Summary

The Energy Conservation Measures listed below are representative of the entire Preliminary Audit Results and do not reflect the items that can be carried in a self-funding program.

ECM Description	Savings	Budget
Interior Lighting Upgrade-LED's	$1,448.98	$12,937
Exterior Lighting Upgrade-LED's	$333.03	$2,390
Lighting Controls	$200.39	$8,210
BAS Control	$184.36	$19,630
Building Envelope	$152.97	$305
Water Conservation	$66.15	$212

Millington Municipal Schools

Guaranteed Energy Efficiency Improvements and Facility Upgrades

TRANE®

October 17, 2019

Improve Student Achievement by Upgrading the Classroom Learning Environment

The Facts Support Classroom Performance:

- According to an *ASHRAE Research Study*, **test scores show an overall increase** when the classroom is controlled within specific comfort ranges.

- Improvements to the classroom learning environment **increases attendance**.

  Source: *U.S. Department of Education*

- Asthma is one of the **leading causes of absenteeism in schools**. Asthma affects one out of every 13 school-aged children. IAQ problems in schools -- the presence of mold, dust mites, cockroaches, pet dander, and certain chemicals -- can trigger asthma attacks.

  Source: *U.S. Environmental Protection Agency (EPA)*

- **Student performance increases** when ventilation rates are set at the correct levels, which minimizes carbon dioxide levels in the classroom.

  Source: *Educational Facility Planner Report*

- "Appropriate light levels **improve test scores, reduce off-task behavior, and play a significant role in student achievement**."

  Source: *National Clearinghouse for Educational Facilities*

TRANE®

Goals of the Program

- ***Update & Improve the learning environment*** by leveraging "over-$pend" on your existing utilities as a means to help pay for the improvements.

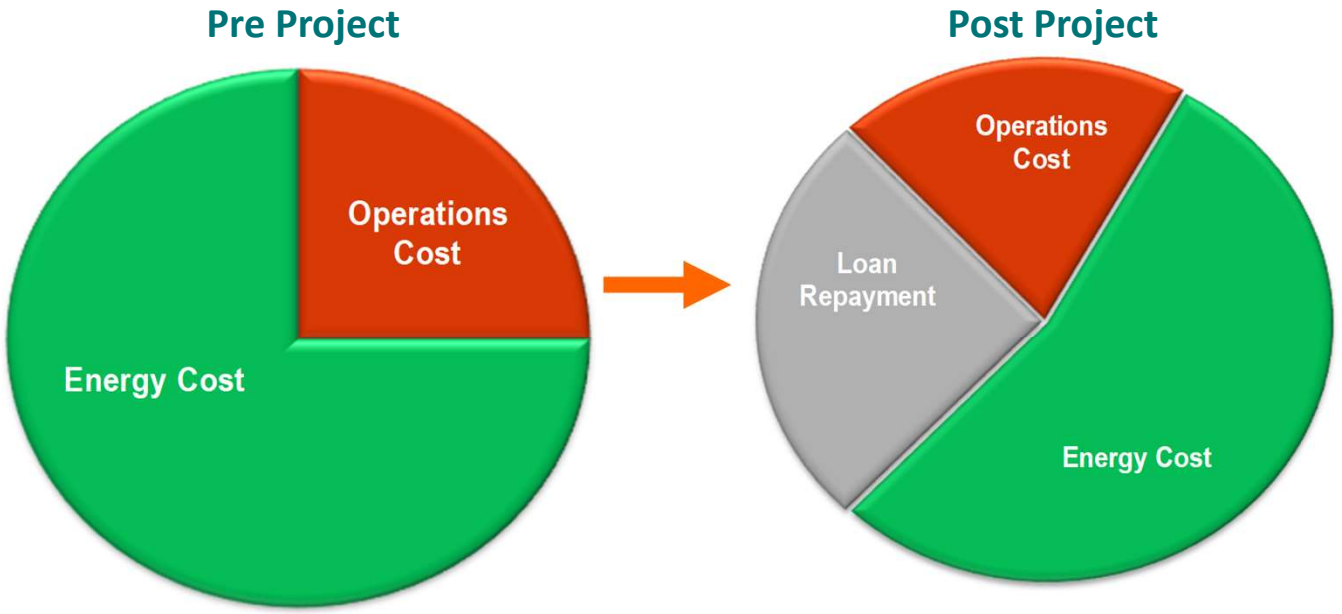
- ***Trane Guarantees the Savings, Results & Performance***

- ***100%*** of any excess annual utility savings goes to MMS

TRANE®

How Does This Work?

Trane guarantees that utility cost avoidance will meet or exceed the savings guarantee or Trane will pay the difference.



Note: The utility budget remains same, a portion of utility budget is re-allocated internally to pay debt service.

TRANE®

Our Goals

- Identify the energy/utility-based savings opportunities and facility improvement needs within your District.

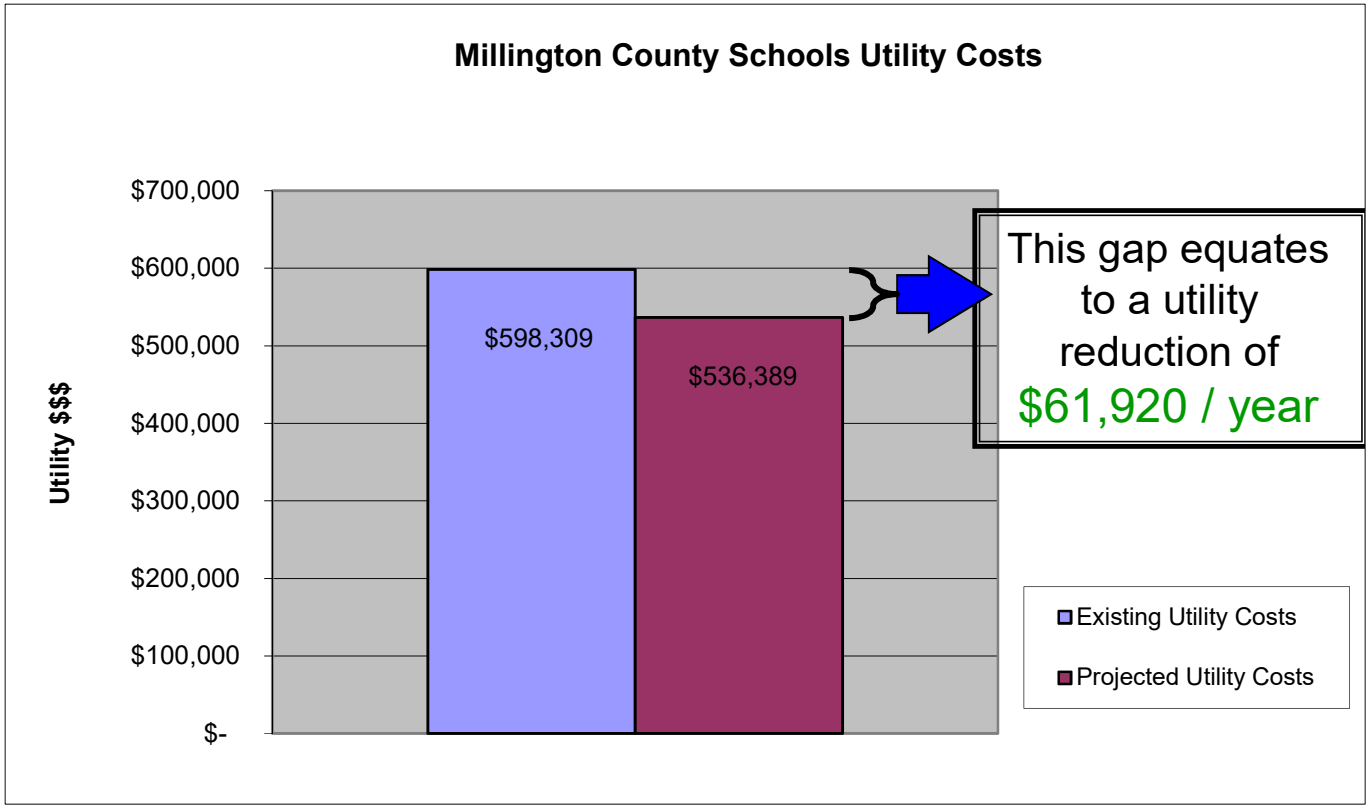
- Identify the facility needs that cannot be addressed through a self-funding energy conservation project, but can still be rectified and funded with guaranteed savings.

- Evaluate each “need” from a (life cycle) cost versus savings (utilities, maintenance, etc.) potential and prioritize the needs which are most pressing.

- Blend together a project that has a positive impact on ALL schools, funded through recovered waste savings over a 16 to 20-year term (average life expectancy of the recommended project measures) using EESI loan finds, that will be guaranteed by TRANE.

TRANE®

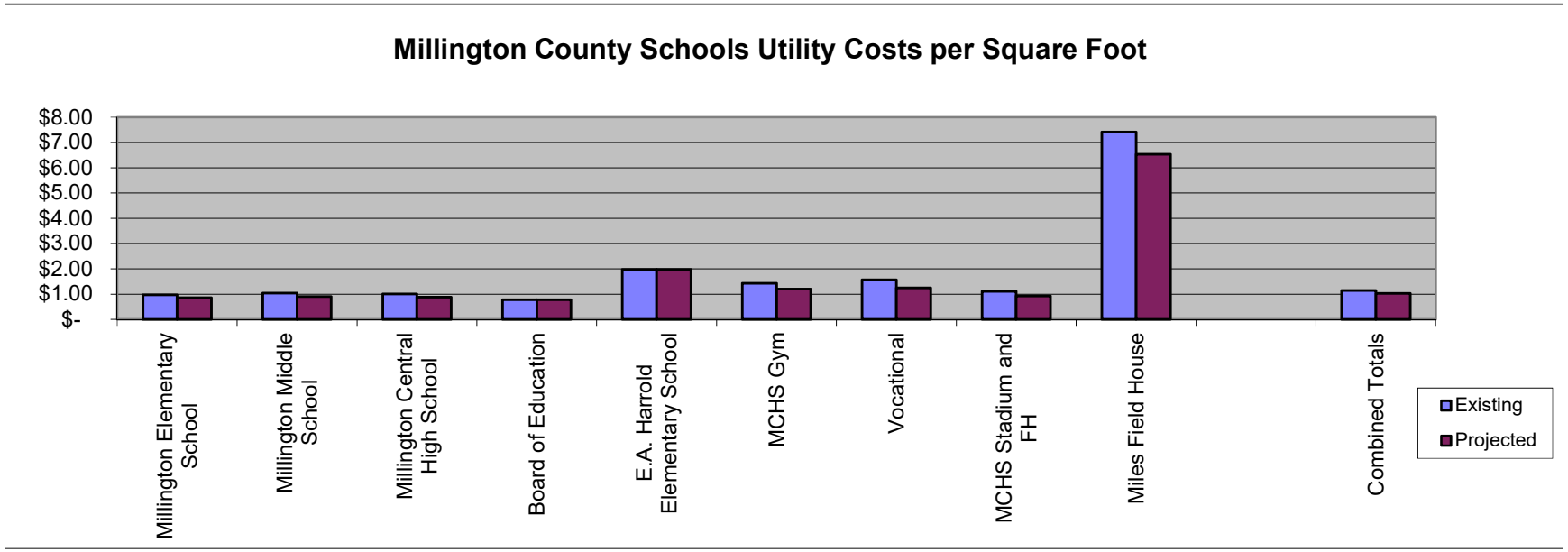
Preliminary Utility Audit Results



(523,864 square feet)

Preliminary Utility Audit Results

	Ft2	Existing Utility Costs Total, $	$/Ft2	Savings Calculated Savings, $	Guaranteed Savings, $	Projected Utility Costs Calculated Total, $	Guaranteed Total, $	Calculated $/ft2	Guaranteed $/ft2
Millington Elementary School	115,104	$ 112,477	$ 0.98	$ 17,378	$ 14,294	$ 95,099	$ 98,183	$ 0.83	$ 0.85
Millington Middle School	90,000	$ 93,629	$ 1.04	$ 16,659	$ 12,832	$ 76,970	$ 80,797	$ 0.86	$ 0.90
Millington Central High School	192,500	$ 192,583	$ 1.00	$ 29,362	$ 22,590	$ 163,221	$ 169,993	$ 0.85	$ 0.88
Board of Education	19,110	$ 14,862	$ 0.78	$ -	$ -	$ 14,862	$ 14,862	$ 0.78	$ 0.78
E.A. Harrold Elementary School	57,200	$ 113,248	$ 1.98	$ 261	$ 221	$ 112,987	$ 113,026	$ 1.98	$ 1.98
MCHS Gym	26,000	$ 37,026	$ 1.42	$ 7,026	$ 5,796	$ 30,001	$ 31,230	$ 1.15	$ 1.20
Vocational	10,400	$ 16,241	$ 1.56	$ 4,034	$ 3,294	$ 12,207	$ 12,947	$ 1.17	$ 1.24
MCHS Stadium and FH	13,050	$ 14,536	$ 1.11	$ 3,411	$ 2,451	$ 11,125	$ 12,085	$ 0.85	$ 0.93
Miles Field House	500	$ 3,708	$ 7.42	$ 500	$ 441	$ 3,208	$ 3,267	$ 6.42	$ 6.53
Combined Totals	**523,864**	**$ 598,309**	**$ 1.14**	**$ 78,631**	**$ 61,920**	**$ 519,678**	**$ 536,389**	**$ 0.99**	**$ 1.02**



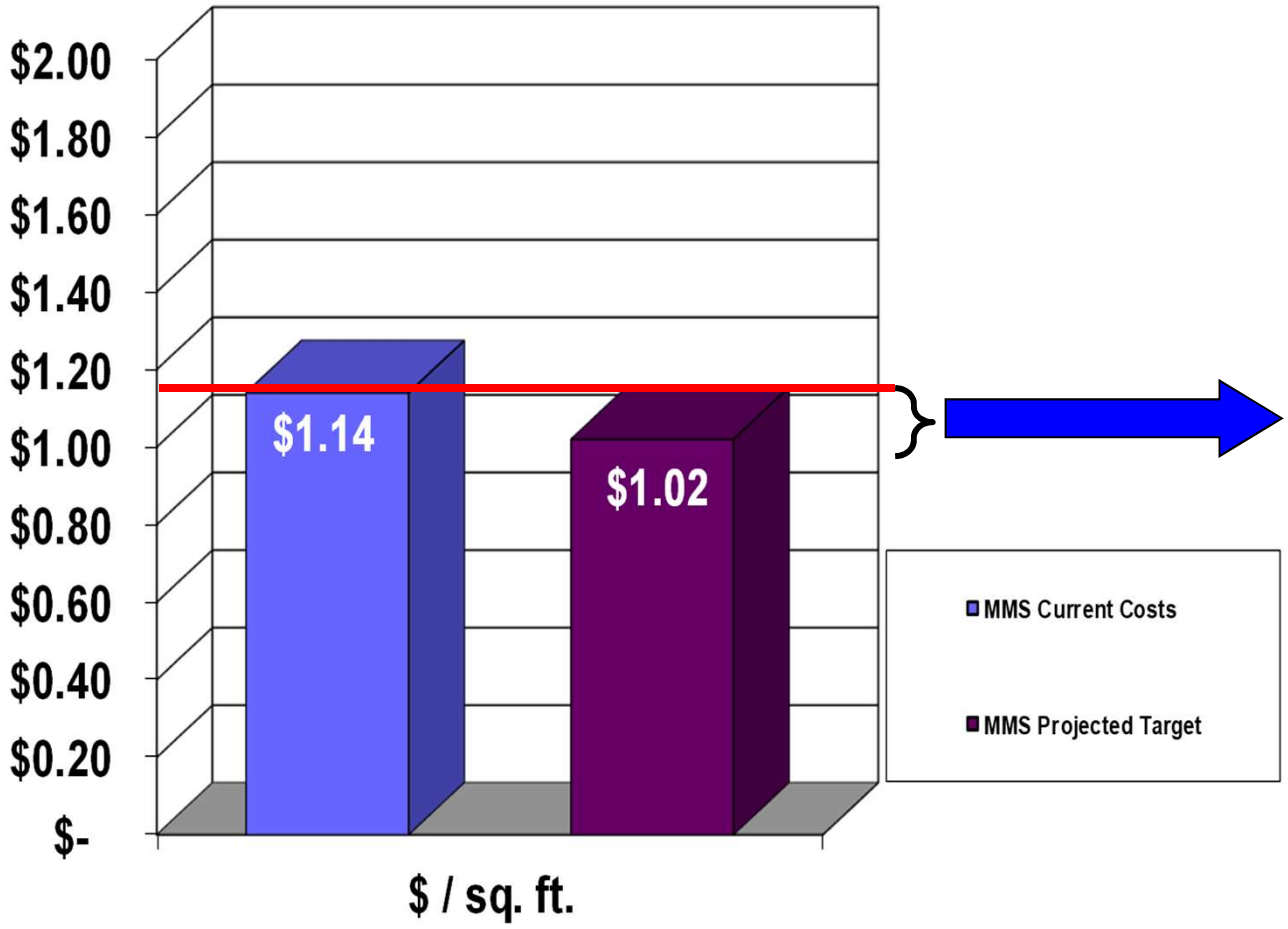
Results of the Energy Assessment

- TRANE audited 5 school owned facilities including the main office.
- Focus areas of improvements:
    1. **LED Lighting Upgrades Inside and Out**
    2. **Replacement of a majority of the Heating and Air Conditioning Units at (5) school campuses including the main office. (Units older than 7.5 years)**
    3. **Upgraded & Integrated Web-Based Temperature Control Systems by School Building**

•We identified an annual utility savings of $61,920 (total) which will help fund a minimum of $6,611,451 in facility upgrades, **reducing your schools operating costs by nearly $.12 cents per square foot.**

• Guaranteed savings from TRANE will be used for debt service repayment of the proposed EESI Loan over a possible 16 year term at 1.5% interest on the first $3M and 2% on the next $2M, for a total of $5M max.

Preliminary Cost/Sq. ft. Comparison



This gap equates to a utility reduction of $.12 per square foot or $61,920 / year

(523,864) square feet)

Proposed Project Improvements

Millington Elementary

1. LED Interior & Exterior Lighting Upgrades
2. Web-Based Building Automation
3. **Replace Roof Top HVAC Units (89)**
4. Building Envelope Weatherization
5. Water Conservation Measures

Millington Middle School

1. LED Interior & Exterior Lighting Upgrades
2. Web-Based Building Automation
3. **Replace Roof Top HVAC Units (20)**
4. **New Roof Top HVAC Units (7)**
5. Building Envelope Weatherization
6. Water Conservation Measures

Millington High School Facilities

1. LED Interior & Exterior Lighting Upgrades
2. Web-Based Building Automation
3. **Replace Roof Top HVAC Units (76)**
4. **New Roof Top HVAC Unit (1)**
5. **Retro-Commissioning (24)**
6. Building Envelope Weatherization
7. Water Conservation Measures

EA Harold Elementary

1. **Retro-Commissioning (29)**

Items in bold are priority needs that typically do not self-fund within 16 years

Preliminary Annual Utility Savings = $61,920

Estimated Project = $6,611,451

TRANE®

Financing Mechanisms

- TN Energy Efficient Schools Initiative (EESI) Loan
  - 16 year max term @ 1.5% interest rate on first $3M, then 2% on additional $2M for a $5M maximum loan amount.
- Bonds
  - Current model is 15 years @ 2.75% interest rate
- Cash
- Any combination of the above

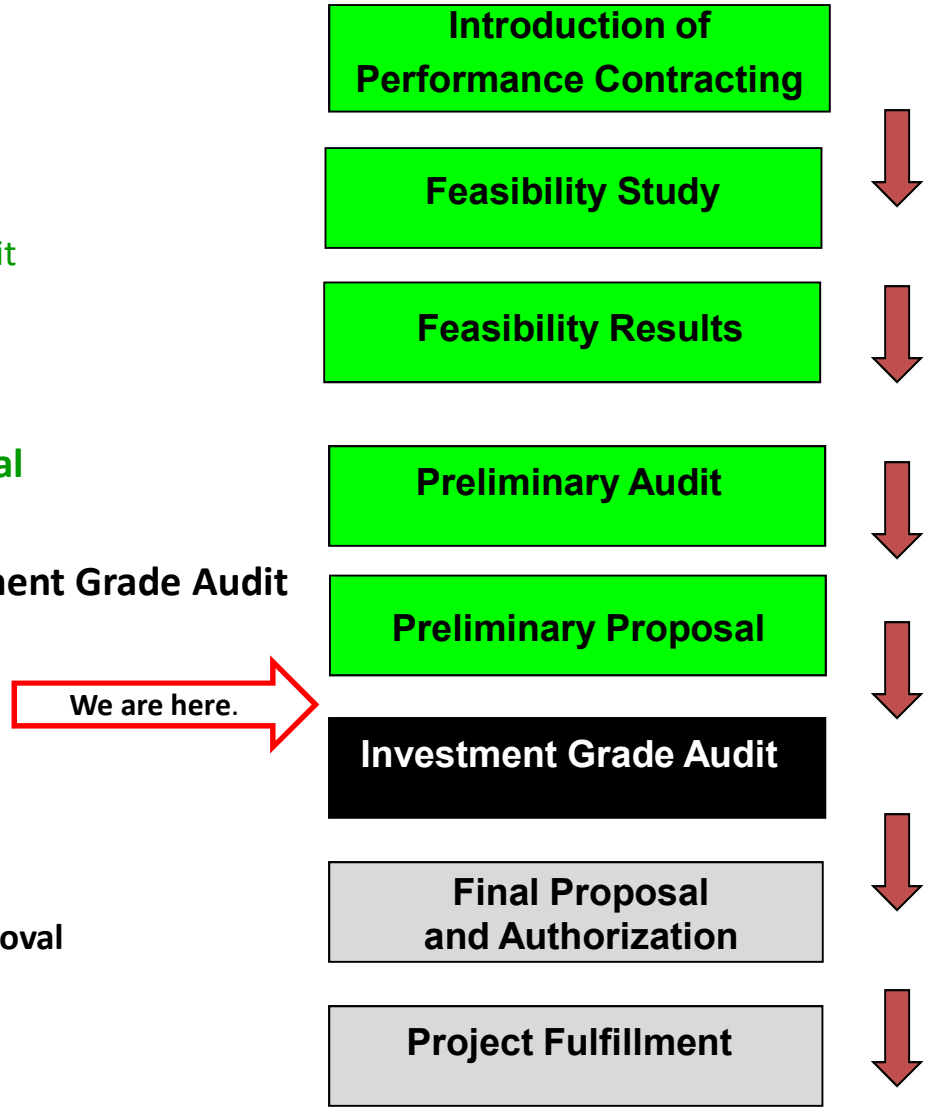
TRANE®

Progress to Date & Next Steps

- ✓ **Trane & Client execute Feasibility Study**
  - Utility Data collection
  - Comparative Analysis
- ✓ **Present results from Feasibility Study**
  - Letter to Proceed authorizing Preliminary Audit
  - Site visits
  - Identify Energy Conservation Measures
  - Identify Facility needs
- ✓ **Preliminary Audit Results & Initial Proposal**

- ➢ **Letter of Commitment authorizing Investment Grade Audit**
  - 1st financial commitment by client
  - Validate preliminary findings
  - Secure project financing
  - Finalize project scope, cost & contract terms

- **Final project authorization**
  - **Funding, Legal Reviews and Commission Approval**
- **Project Installation & Commissioning**
  - **Notice to Proceed, Mobilization**
- **Commence Maintenance & Verification Services Agreement**
- **Training & On-Going Technical Support Services**



Next Steps

- Present project to Millington Municipal Board of Education.
- Board of Education to approve the program authorizing Director Griffin to schedule a presentation to the Board of Education for a “Letter of Commitment”.
- Board approval of Letter of Commitment 11/5/19.
- Investment Grade Audit of Millington Municipal Schools (3-4 months max).

Trane Energy Efficiency Projects in TN

- Knox County & Knox County Schools (over $95M, multiple phases)
- Bethel University ($4.6M Project underway)
- Campbell County Schools (3 years)
- Claiborne County Schools (4 years)
- Coffee County Schools ($4.7M Project underway)
- Cumberland County Schools (3 years)
- Cumberland University (Just Completed, $2M)
- Haywood County Schools (Just completed, $4.6M)
- Maury County Schools (Year 1 savings complete)
- Robertson County Government (Year 1 savings underway)
- Robertson County Schools (In-Progress, $9M)
- Weakley County Schools (2 years complete, $5.2M project)
- Williamson County Schools (Phase 2 in-progress, $18M)

Investment Grade Audit

Two Deliverables:

1 - 3rd-party Investment Grade Audit (IGA) of the 3 schools.

The cost for the IGA will be 20 cents per sq./ft., or $93,425. This cost will only be incurred by MMS if a viable project is developed by TRANE, but not implemented by MMS. If a project is implemented, the cost of the IGA will be included in the project.

2 - Proposal for the Energy Conservation Measures selected by Millington Municipal Schools from the IGA to build the project you want for your schools.

Directly support the funding process that is in the best interest of the City of Millington and Millington Municipal Schools.

Extra Credit Points – *Student Engagement*

- The Trane BTU Crew - A completely researched, "baked-out" and prepared curriculum enrichment program that supports 4th, 5th & 6th Grade Teachers in meeting the required State of Tennessee Science Content Standard 14.0 for Energy.

- Light Switch Sticker Contest – Sponsorship of a Light Switch Sticker Contest for students to design light switch stickers to encourage occupants to turn lights off when areas are unoccupied.

- The Trane Energy Patrol - A Program for K-8 Students to assist their school in the further reduction of utility expense through behavior change. Featuring a contest between schools.

- HVAC and Energy Data Analytics labs, Internships, Guest Speakers, etc.

Trane wants more K-12 students pursuing the path for STEM careers. We have several initiatives to encourage and support students on this path.

Work Force and Technical Skill Development

TRANE HVAC Learning Lab

- Hands-on, real-time instruction
- Skill focused
- Career path builder
- Existing labs in Clarksville, TN & Elizabethton, TN

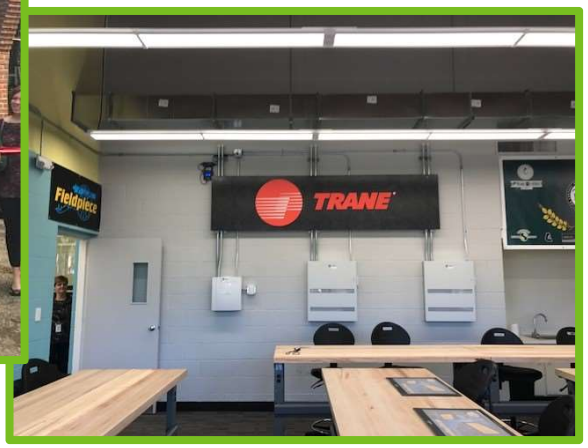
- Fully operational
- Built on-site or designated location
- Teaches energy and the environment

Work Force and Technical Skill Development

TRANE HVAC Learning Lab

Lake Erie College, Northeast, OH

Custom built for you



Community & Campus Engagement

Questions & Open Discussion

THANK YOU!

[NOTE: PRINT ON CLIENT's LETTERHEAD]

Millington Municipal Schools

(Date)

Trane U.S., Inc. – Memphis Office
1775 Pyramid Place, Suite 100
Memphis, TN 38132-1717

Attn: Jim Crone

Dear Jim:

Trane is authorized to proceed with a detailed Investment Grade Audit necessary to verify the data presented in the Prelinminary Audit Study dated November 5, 2019. The detailed Investment Grade Audit is estimated to require three (3) months to complete from the date of Trane's acceptance of this Letter of Commitment. Trane and Millington Municipal Schools, Millington Tennessee will enter into a PACT Agreement (performance contracting agreement) within sixty (60) days of the Final Proposal. In this event, the cost of the comprehensive study will be included as part of the overall project.

In order to enable Trane to perform the comprehensive study, we agree to provide Trane:

- Energy bills for the most recent 36 months and building information required to conduct the study; Historical records for maintenance costs; Access to the buildings and to facility and management personnel, and key decision makers to enable Trane to better understand the facility operations and organizational goals that will help Trane optimize the effectiveness of the proposed project, as required to conduct the study;

- Capital outlay plans for any of the sites in the study; and

- A time and location for a meeting for presentation of Trane's final proposal; all parties that will be involved in the decision-making process to proceed with a PACT Agreement will attend this meeting.

Trane agrees to deliver:

1. **The Investment Grade Audit (IGA)** will include energy use evaluation, utility consuming infrastructure evaluation, life cycle evaluation along with scope articulation and schematic drawings required to develop contract-grade cost estimates and resulting utility savings. The audit will not include construction documents. All energy conservation measures (ECMs) that are evaluated will be estimated whether they cash flow in a self-funded project or not.

2. **A Proposal** for a guaranteed savings performance contract (PACT agreement) with Trane that will include the items articulated in the IGA which will provide energy savings

to help fund the recommended improvement measures based on the utility and operational savings they produce.

Millington Municipal Schools will reimburse Trane the fee of $93,425.00 (plus applicable sales tax) for services and time invested if we do not enter into the Agreement within the sixty (60) day period. We will pay the fee (plus any applicable sales tax) to Trane within thirty (30) days of the date of Trane's invoice. Upon execution of an Agreement with Trane or payment for the Investment Grade Audit, whichever occurs first, Trane shall provide a copy of the IGA in its entirety to the Customer.

Sincerely,

Millington Municipal Schools

By: _____

James "Bo" Griffin
Director of Schools

Dated: _____

Acceptance by Trane

By: _____

Brian Durr
District VP & General Manager

Dated: _____

Attachment 1

List of Facilities Included in the Investmant Grade Audit

1. Millington Elementary School
2. Millington High School
3. Millington Middle School