PRELIMINARY REPORT

Performance Services

SHIAWASSEE COUNTY JAIL

Facility Study

January, 2018

SUBMITTED TO:

Shiawassee County Jail
201 E. McArthur St.
Corunna, MI 48817
City, State, Zip

SUBMITTED BY:

Michael Livendale
Business Development Manager

John Kinsora
Project Development Engineer

NASCO ACCREDITED

ENERGY STAR PARTNER

Performance Services, Inc.
28175 Haggerty Road | Novi, MI 48377
p: 248-497-1026 f: 317-713-1751
www.performanceservices.com

Table of Contents

Contents

I Executive Summary

Performance Services, Inc. (PSI) is pleased to have the opportunity to provide a Preliminary Energy Assessment study for the Shiawassee County Jail. PSI is uniquely qualified to provide this analysis due to our team's experience in identifying and designing solutions to renovate the Jail that optimizes the environment, increasing energy efficiency and cost effectively address aged or obsolete equipment and systems.

Through your team's input, and our site analysis, we have developed a detailed analysis of your buildings' infrastructure and systems. As part of this study we have developed solutions that will address your jail' aged equipment and environment issues while reducing your energy costs. Our team of Michael Livendale, John Kinsora look forward to continuing to work with your team in developing a mutually beneficial long term relationship.

The intent of this study is to access key facility issues related to the mechanical, electrical, plumbing and building envelope systems and offer proven, effective solutions. Facility study parameters are:

- ✓ Identify environment issues and provide solutions for improvements that meet national and local correctional institution Environment Standards as identified in this study
- ✓ Define and quantify energy savings opportunities that would work in conjunction with environmental improvements
- ✓ Provide an "Equipment Report Card" detailing the age, quantity and expected remaining life of major HVAC equipment per building.
- ✓ Offer preliminary cost estimates for improvements to your facilities' HVAC systems

Optimal Environment (OE)

Performance Services is focused on improving/optimizing the environment in buildings while also reducing energy costs. We have spent many years developing successful and practical environment criteria. Our team of senior engineers and field technicians has worked to develop our own standards for indoor air quality, lighting, background noise, air movement (draft) and filtration which are based on rigorous state and national criteria, i.e. ASHRAE, IEEE, etc.

In later project development we would recommend measuring these aspects of the environment before the project and measure and document them again after wards to verify that the Optimal Environment standards have been met.

Numerous studies have identified a quality environment as it relates to temperature, indoor air quality – including proper ventilation and humidity levels, noise, air movement and lighting as a key component in inmate satisfaction.

Our facility study of your buildings used the following environment standards as criteria in the evaluation.

Environment Standards

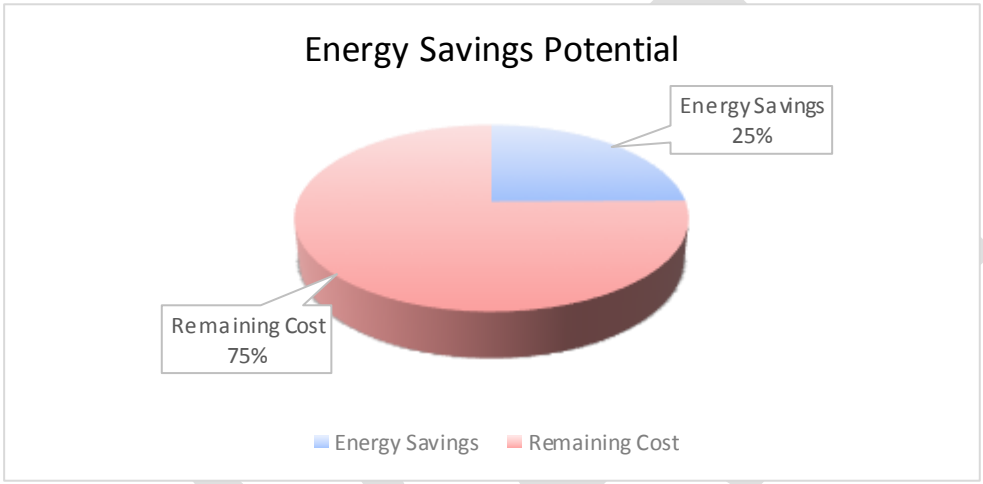
CATEGORY	CRITERIA	STANDARD
INDOOR AIR QUALITY	TEMPERATURE	Within 1° of set point
	RELATIVE HUMIDITY	Below 65% relative humidity (summer)
	OUTSIDE AIR	15 CFM/person of outside air (design)
	CO_2 LEVELS	Below 1000 ppm
LIGHTING	Correctional institution	50 foot candles
	Gyms	80 foot candles
	Cafeteria	50 foot candles
	Corridors/Stairs	35 foot candles
NOISE (MECHANICAL)	Background Sound Levels	Below 45db
AIR FILTRATION	Minimum Efficiency	MERV 6
AIR MOVEMENT (DRAFT)	Air Movement	Minimal noticeable air movement

This preliminary proposal provides improvements to reduce energy consumption and operational costs and reduce Shiawassee County Jail impact on the environment. The intent of the Preliminary Energy Assessment (PEA) was to evaluate the energy performance of the facilities and identify potential Energy Conservation Measures (ECMs). This report is the initial step in developing a comprehensive analysis of the site's opportunities to reduce operating costs, energy consumption and CO2 emissions. Based on our site visit, we believe that technically and financially viable projects exist with substantial benefit and savings. Honeywell looks forward to working with your team to co-develop projects that meet the Shiawassee County Jail conservation, sustainability and economic goals.

Energy Savings Opportunities

The Shiawassee County Jail facilities team has done a great job keeping energy costs under control especially given system designs and the age of equipment and controls in the buildings. There are numerous opportunities to reduce the energy cost of your jail HVAC systems. These include system design modifications, the installation of energy efficient equipment and control sequence modifications.

Implementing the energy conservation measures that we have identified in the Shiawassee County Jail will ensure a quality environment result in energy savings of over **$23,317 per year**, which would be a **27%** reduction in energy costs.



II Detailed Facility Survey

Utility Analysis

Electricity

Electricity is provided by Consumers Energy from (2) meters under the general service rate GSD which has a kW demand component. T

- Electric usage: 396,680 kwh
- Electric cost: $49,445
- Average $/kwh $.125/ kwh (including demand)

Natural Gas

Natural gas provided by Consumers Energy under the General Service Rate GS-2.

- Natural gas usage: 2256 MCF
- Natural gas cost: $13,661
- Average $/MCF $6.06

Water and sewer

Water and Sewer is provided by the City of Shiawassee. The billing is complicated and based on REU (residential equivalent units) and average 12 month usage. Before any water conservation project the water and sewer department will need to be contacted to recalculate a new rate.

- Water and sewer usage: 1,677 kilo gallons (kgal)
- Water and Sewer cost: $30,789
- Water and Sewer $/kgal $3.10/kgal for water, $3.650/kgal for sewer above minimum

Total Utility Cost: $93,895

$/sq.ft. $3.67/square foot

Energy Utilization Index

Energy Utilization Index (EUI) is a calculated value of the energy use (electric and natural gas) of one facility compared to another of a similar usage. EUI are based on the energy use (in kBtu) per square foot of the building.

Shiawassee County Jail EUI 141 kBtu/square foot

Median per Energy Star 93 kBtu/square foot for prison/incarceration properties

The energy usage is 52% more than the national average for prison/incarcerations facilities.

Existing Conditions

Building Envelope and Layout

The original building was built in 1962. With major additions and renovations in 1984. That increased the number of cells.

Over that period the size of the kitchen has remained relatively the same.

Most of the windows are double pane but do not seal well with complaints of drafts in the winter months.

The doors are in fair condition but some have excess rust that cannot be repaired and should be replaced.

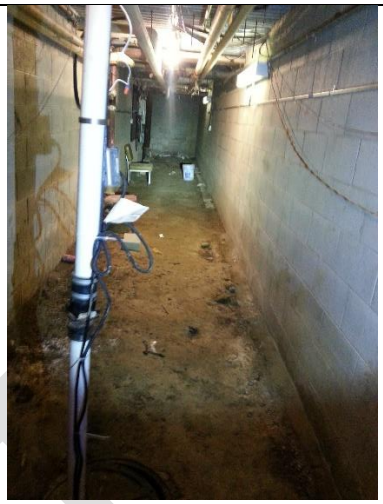
The front entrance vestibule is not adequately conditioned for the need of the space. This area has remained almost the same size as originally designed yet the inmate population has increased substantially. The front entrance/waiting area is not set up well for visitation when a large group of people show up at the same time.

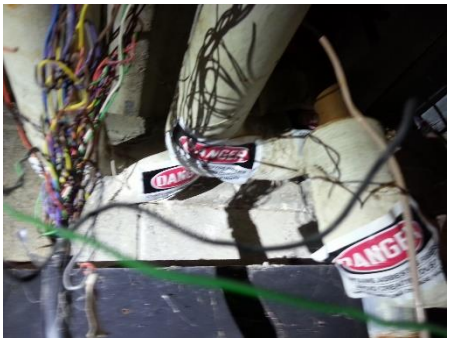
The piping tunnel is a dirt floor with signs of moisture from the ground and dripping moisture from above. The tunnel allows access to the mechanical and electrical room.

Roof

The roof is a ballasted (stones) membrane installed in the in the 1980's. The roof in spots is in poor condition with reports of leaks, areas where the ballast stones have been removed and not replaced, standing water, and algae growth on the roof. The Service Life of roof is 20 to 30 years. Several of the roof drains are clogged with leaves and twigs and there is a collection of lint on the roof below the dryer vent that discharges onto the roof. This should be inspected and cleared on an annual or semi-annual basis.

The roof structural is composed of concrete planks. The planks are difficult to work with for making





The top picture shows the access tunnel (domestic hot and cold water, gas, electrical) below portions of the jail. The space has a sand floor with signs of moisture on the walls.

The lower picture shows the deteriorating insulation, piping and wiring in the tunnel.

large modification (roof opening for fans, heating, air conditioning, etc.) which may explain why a skylight was replaced with a roof top unit. This is one of the areas that is leaking. In addition the planks in many areas are exposed (no dropped ceiling due to limited space) and all wiring and piping that has been added over the years is exposed. This includes the inmate areas.

Heating and Air Conditioning

The heating and air conditioning is from roof top units that run continuously. Many of the RTU's were replaced in 2016. The Expected Service Life of a RTU is 15 to 20 years.

Several of the roof top units are within 10 feet of the edge of the roof and do not meet code. A safety fence should be installed to prevent accidents.

Temperature Controls

The roof top unit (RTU) controls are digital and controls the heating and air conditioning staging but not the outside air dampers. The digital temperature controls are older but have been maintained and parts are still available. The controls communicate with a central computer but the jail does not have access to this system and must rely on Shiawassee maintenance for response to problems. Further investigation is required.

The temperature control of the building is poor with numerous complaints. This is primarily due to the poor zoning of the roof top units (heating and air conditioning) and is a common problem with many roof top units. The multiple zones served by a single roof top unit (east wall, west wall, interior, etc.) unit make temperature control difficult if not impossible. For example: on a winter day the interior cells may need cooling while the exterior zone need heating.

Water Heater

Some doors and frames are rusted making repair impossible and will need to be replaced.

Due to limited kitchen space the reach in coolers and freezer are located in the garage area away from the kitchen disrupting the work flow.

Roof top unit using a skylight opening for ductwork. This is one of the roof leaks.

The domestic hot water heater was installed within the last 5 years. The Service Life of a domestic water heater is 15 to 20 years.

Plumbing

The plumbing fixtures are original and in fair to good condition. The fixtures have a high flow (GPM) and most of them are mechanical push buttons. Several of the access closets have standing water in them due to leakage. The sewer system in the basement sometimes backs up. The cause of the problem could not be determined.

Electrical

Electrical and wiring has been added over the years for computers and system added to the buildings. Many of the electrical panels have been rewired to accommodate the ever increasing computers and other devices that require communication or power.

Power and communication wiring has greatly increased since the building was built in 1962. With a hard concrete ceiling in most of the building most of the wire is exposed. In some central areas (near the server room) the amount of wiring and cable is causing the drop in ceiling to crack.

Several roof top units are within 10 feet of the edge of the roof. Per code these units need a protective barrier to prevent accidents.

The roof is estimted to have been installed in the 1980's. it is a ballasted (rocks) membrane roof. Overall in poor condition with standing water, numerous areas where rocks have been removed and not replaced. Several roof drains need to be cleaned and the lint on the roof below the dryer vents should be regularly cleaned.

III Proposed Scope of Work

Scope of work Matrix

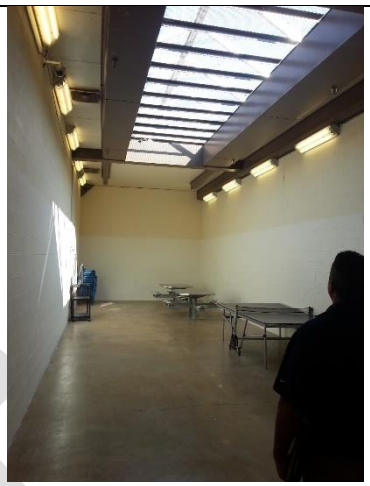
Shiawassee County Jail	Upgrade Lighting to LED and Occupancy Sensors	Plumbing Retrofit	Roof Replacement	Outside Duct Repair	Power Factor Correction	Temperature Controls Access	Dryer Vent Relocation	Roof Safety Barrier	Temperature Control Zoning	Electrical Panel Replacement	Closet Exhaust Addition
County Jail	E	E	EC	E	E	E	C	O	C	C	C

Key	
E	Energy project. Energy savings alone will fund the project within the payback period without Capital cost needed.
EC	Energy and Capital Project. Indicates the project has Energy Savings but will not provide a payback within 20 years. Generally applies to End Of Life Equipment that needs to be updated and replaced.
C	Capital. Indicates projects with no Energy Savings and may increase energy usage but needs to be done for code requirements or operational, maintenance improvements.
O	Operational, Maintenance. Items that are a known concern or problem and require attention in order to prevent future problems.

Retrofit existing light fixtures with LED and Occupancy Sensors

Description

- The majority of the lighting uses 32 watt T8 lamps and electronic ballasts.
- The media center has wall mounted 175 watt metal halide up light and 2 foot 40 watt compact fluorescent.
- The existing fixtures are in good shape and most of the lamps are operating.
- Limited use of occupancy sensors.



Most of the lighting is 32 watt T8 and electronic ballasts. As part of this Energy Conservation Measure all of the fluorescent fixtures will be replaced or the lamps will be replaced with LED saving energy. LED's will have a 5 to 7 year warranty.

Occupancy sensors will be added in applicable areas to meet the 2018 Michigan Energy Code.

Upgrade

- Remove existing lamps and ballasts in existing fixtures with T8 lamps (offices, hallways, day room, hallways, etc.). Existing fixture will be reused.
- Interior of fixtures and lenses of fixtures that are reused will be wiped clean.
- Install new LED and Driver. New LED lighting will be 5000k (almost white light).
- Broken or missing acrylic lenses will be replaced as required.
- Existing emergency lighting system replaced with internal fixture mounted battery powered LED lamps and drivers. Emergency lights will automatically light on a loss of power.
- Exit signs will be replaced with LED with battery back up.
- All new fixtures to be approved for correctional use with tamper proof screws.
- Occupancy Sensors
    - Occupancy sensors will be installed in all applicable areas. Occupancy sensors will not be installed in small janitor's closets, closets, cells, etc.
    - The existing lights switch will be replaced or a ceiling mounted occupancy sensor(s) will be installed.
    - Ceiling mounted occupancy sensors will be wireless allowing them to be easily moved to better match the configuration of the room.
    - Occupancy sensor will meet the 2018 Michigan Energy Code.

- Lamps to be disposed of per all federal, state and local requirements.
- All removed lamps, ballasts and fixtures will be disposed of. Correctional dumpsters will not be used for disposal.
- The lighting retrofit includes all equipment, labor, disposal, check-out, commissioning and warranty on all labor and equipment.
- Warranty
    - One year labor and Material Warranty
    - Exterior fixtures: Exterior:10 year material and labor
    - Interior lamps and fixtures :7 years material
    - Recessed (canned) fixtures with pin based lamps: 5 years
    - Occupancy Sensors: 2 years parts

Benefit

- Reduced energy consumption
- Longer lamp and ballast life with occupancy sensors
- Overall (7) year warranty on LED lamps and drivers

Roof Replacement

Description

- The roof was installed in the 1980's and is over 30 years old. The Service Life of a roof is 25 to 30 years.
- The roof is poor condition with reports of leaks, areas where stones have been moved to repair leaks and not returned, standing water and algae.

As described in the Existing Condition Section above the roof should be replaced. The above picture shows standing water on the bare roof where the ballasted stones have been removed, most likely to repair a leak.

Upgrade

- Move existing rock ballast. Ballast will be reused
- Remove existing membrane and dispose of.
- Replace wet or damaged insulation.
- Replace damaged roof drains.
- Install new membrane roof.
- Install ballast (rocks) and add rocks as required.

Benefit

- Reduced energy consumption
- Increased reliability
- Decreased maintenance
- Decreased leaks and damage from the leaks
- 25 year manufacturer warranty

Temperature Control Access

Description

- The existing controls are fairly sophisticated for roof top units and allow numerous adjustments and monitoring.
- The Jail personnel have limited access to the system and depend on the Shiawassee county maintenance personnel.

Upgrade

- Train and allow the Jail personnel limited access to the controls through a separate computer head end.

Benefit

- Increased comfort.
- Decreased maintenance calls
- Increased reliability

The existing control system is fairly extensive and in good condition. The County Jail Personnel have limited access to the system. This Energy Conservation Measure will give further access. Temperature control retrofits will help but not alleviate the problems with the lack of proper temperature control zoning in the building.

Power Factor Correction

Description

- The power factor for the building in some months is below the required power factor as required by Consumer Energy.
- The power factor is low on the Jail meter.
- Consumers Energy has a penalty charge for low power factor.

Upgrade

- Investigate the cause of the low power factor including further review of electrical power and possible monitoring.
- Install power factor correction capacitors to increase the power factor.

Benefit

- Reduced electric cost

The building has a low power factor and the utility company charges a penalty for not meeting the required power factor.

Plumbing Retrofit

Description

- Many of the existing cell plumbing fixtures are original high flow (gpm) fixtures
- Some of the plumbing chases are wet due to leaks.
- The existing mechanical fixtures have a pushbutton for the water closet and the sink with no limits on how often the button can be pressed.
- The correctional officers have no control over the water usage and cannot prevent water closets from being flushed (before a search or to prevent deliberate overflow of a fixture due to clogging.)

The top picture shows moisture in the piping chase between the fixtures. The constant presence of moisture due to a leak or high water table is a breeding ground for mold.

The lower picture shows a typical piping arrangement behind each cell water closet/sink combination. Much of the system is mechanical push button and inmates can press the buttons (flush and faucet) as often as they want.

Upgrade

- Remove the existing mechanical system.
- Install an electronic system that will save water through programmed flow.
- The existing fixtures will be reused.
- The electronic system will can be controlled for a computer by the correctional officers to limit the amount of flushes and shut off the water to the cells.

Benefit

- Reduced water and sewer costs.
- Increased control of water closets and sinks.
- This ECM proposes to install an electronic system with a water conserving feature that will reduce the amount of water used and also allow the correctional officers full control of flush interval and even shut down the water to the fixtures from a single location.

Outside Duct Repair

Description

- Some of the roof top unit (RTU) for heating and air conditioning have insulated ductwork on the roof expose.
- The insulation covering in places has split open allowing moisture to penetrate the insulation and ductwork. The moisture will eventually soak the insulation and rust the ductwork.

Upgrade

- Repair or replace insulation or ductwork as required.

Benefit

- Increased ductwork and insulation life

Some of the roof top units providing heating and air conditioning have ductwork on the roof. In several areas the insulation is cracked allowing moisture to penetrate. The insulation and duct should be repaired and sealed.

Temperature Control Zoning

Description

- The County Jail has many complaints of heating and air conditioning.
- Many of the problems are due to the zoning of the Roof Top Units (RTU) with a single unit providing heating and air conditioning to several different zones (interior and exterior)
- The addition of new roof top units for additional zoning will be difficult due to the need of the Jail and the concrete plank used in construction.

Upgrade

- Install electric duct heaters in several roof top units that provide heating and air conditioning to both interior and exterior zones.
- The reheats will be added to exterior areas.
- The RTU will be operated to condition the interior (or space with need for air conditioning) and the reheat will be operated to provide additional heat and prevent overcooling the space.
- The reheats could also be used in the summer for reheat.
- Connect reheats to temperature control system.

Benefit

- Increased comfort
- Decreased complaints

Note:

The electric cost will increases due to the use of additional electric heating.

Dryer Vent Relocation

Description

- The dryers vent directly onto the roof along a wall that does not receive adequate air circulation (cut off from the wind.)
- If the roof is not cleaned regularly the lint collects on the roof presenting a fire hazard.

The above shows a collection of lint from dryers behind the adjacent wall. The lint collects on the roof. We propose to raise the vents above the roof line for a better dispersion.

Upgrade

- Redirect the dryer vents up through the roof or out the existing opening and over the roof a sufficient distance to increase dispersion.
- Investigate improved lint collection system.

Benefit

- Decreased collection of lint on roof.

Roof Barriers

Description

- Per code all equipment should be 10 feet from the edge of a roof or a barrier needs to be erected.
- (2) Roof top units are within 10 feet of the edge of the roof presenting a fall hazard.

Upgrade

- Install a roofing barrier near the equipment per code.

Benefit

- Code Compliance
- Safety and security for County personnel and contractors.

The above roof top units are within 10 feet of the edge of the roof. A barrier need to be erected near the unit to prevent accidents.

the floor or grade below.

1012.5 Mechanical equipment. Guards shall be provided where appliances, equipment, fans or other components that require service are located within 10 feet (3048 mm) of a roof edge or open side of a walking surface and such edge or open side is located more than 30 inches (762 mm) above the floor, roof or grade below. The guard shall be constructed so as to prevent the passage of a 21-inch-diameter (533 mm) sphere.

SECTION 1013

Replace Electrical Panels

Description

- The main building was installed in 1962.
- Over time additional electrical equipment and computers have come into everyday use.
- The building was never designed for the equipment needed to operate a modern buildings.
- Electrical panels have been added and expanded on and are in need of replacement, rewiring and consolidation.

Over the years since 1962 additional electrical equipment and computers have been added to existing electrical panels or electrical panels have been added as required. Some of the panels have become overloaded and need to be replaced and rewired.

Upgrade

- Review electrical panels and loads on the panels.
- Install new panels and consolidate where possible

Benefit

- Code Compliance
- Safety and security.
- Improved equipment operation with a more equal and stable load.

Closet Exhaust Addition

Description

- Several of the storage closets do not have exhaust that provides some ventilation and air movement.
- Cleaning chemicals and other supplies are stored in several closets. .
- Without proper exhaust the closet will become musty and the odors in the closet will migrate to the adjacent rooms

Upgrade

- Add exhaust to closet that are used for equipment rooms, cleaning supply storage including those with janitor sinks.
- Due to the nature of the ceiling (concrete planks) the routing and access to the roof may be difficult.

Benefit

- Code Compliance
- Improved indoor air quality.

Additional Energy Conservation and Improvement Measures

The following ECM's were not specifically addressed in the ECM section but often provide good energy savings and fit well within the Energy Savings/Sustainability program. Further investigation will be required.

Additional ECM's
Replace old unit heaters in garage. Unit heaters are over 20 years old. The Service Life of a unit heater is 15 years.
Replace outside doors and frames. Several of the doors and frames are rusted (holes) and will need to be replaced.
Add outside air damper control to roof top unit controllers. Will allow better control for ventilation and occupant comfort
Install ceiling fans in day room to improve circulation.

IV Financial Summary

- Cost $958,927
- Utility Savings $23,317
- Operational Savings TBD. Lights savings due to life of LED,
- Utility Incentive TBD. Utility incentives available for Lights and occupancy sensors.

Shiawassee County Jail - Facilities Proforma - PRELIMINARY 15 Year Financial Cash Flow Model

Guaranteed Energy Savings Contract ***Restoring Facilities through Capital Infrastructure Improvements and Energy Conservation***

Proposed Project 15 Year Cash Flow Analysis

	Construction Period	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15
Annual Avoided Energy Costs	$7,695	$23,317	$24,016	$24,737	$25,479	$26,243	$27,031	$27,842	$28,677	$29,537	$30,423	$31,336	$32,276	$33,244	$34,242	$35,269
Annual Operations and Maintenance and Savings	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Capital Cost Avoidance	$0	$0	$0	$0	$0	$0										
Total Annual Savings / Cost Avoidance	$0	$23,317	$24,016	$24,737	$25,479	$26,243	$27,031	$27,842	$28,677	$29,537	$30,423	$31,336	$32,276	$33,244	$34,242	$35,269
Annual Amortization Schedule		$84,746	$84,746	$84,746	$84,746	$84,746	$84,746	$84,746	$84,746	$84,746	$84,746	$84,746	$84,746	$84,746	$84,746	$84,746
Annual Service and M&V Costs	$0		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Annual Costs	$0	$84,746	$84,746	$84,746	$84,746	$84,746	$84,746	$84,746	$84,746	$84,746	$84,746	$84,746	$84,746	$84,746	$84,746	$84,746
Annual Net Cash Flow	$7,695	-$53,735	-$114,464	-$174,473	-$233,740	-$292,243	-$349,959	-$406,863	-$462,932	-$518,141	-$572,464	-$625,874	-$678,344	-$729,846	-$780,350	-$829,827

Financial Summary

NET PROJECT CASH FLOW	-$829,827
Project Cash Flow	$958,927

Project Financial Assessment Criteria

Budgeted Capital Costs	
District Contribution	
Utility Incentives or Rebates	
Net Cost to Finance	$958,927

Financial Amortization Criteria

Financial Term in Years	15
Interest Rate	3.75%
Annual O&M Escalation	3.00%
Annual Utility Escalation	3.00%

Notes:

1) Capital Cost Avoidance includes future budgeted replacement expenditures for equipment beyond its useful life or does not meet minimum energy efficient regulations
2) Proportional Payments can be structured to achieve budget neutral on an annual basis
3) Financing Rates subject to credit approval and documentation review, subject to change prior to final contract
4) The savings in energy and water consumption costs, wastewater usage costs, and other operating costs, and increase in billable revenues due to the conservation measures are guaranteed to cover the costs of the payments for the measures
5) Payments are subject to annual appropriation by the fiscal body of the school corporation or political subdivision and do not constitute an indebtedness of Shiawassee County Jailwithin the meaning of a constitutional or statutory debt limitation.

VI Appendix

ASHRAE Equipment Life Expectancy chart

ASHRAE is the industry organization that sets the standards and guidelines for most all HVAC-R equipment. For additional info about ASHRAE the website is www.ashrae.org .

Equipment Item	Median Years
Air conditioners	
Window unit	10
Residential single or Split Package	15
Commercial through-the wall	15
Water-cooled package	15
Heat Pumps	
Residential air-to-air	15
Commercial air-to-air	15
Commercial water-to-air	19
Roof-top air conditioners	
Single-zone	15
Multi-zone	15
Boilers, hot water (steam)	
Steel water-tube	24 (30)
Steel fire-tube	25 (25)
Cast iron	35 (30)
Electric	15
Burners	21
Furnaces	
Gas- or oil-fired	18
Unit heaters	
Gas or electric	13
Hot water or steam	20
Radiant Heaters	
Electric	10
Hot water or steam	25

Equipment Item	Median Years
Air terminals	
Diffusers, grilles, and registers	27
Induction and fan coil units	20
VAV and double-duct boxes	20
Air washers	17
Ductwork	30
Dampers	20
Fans	
Centrifugal	25
Axial	20
Propeller	15
Ventilating roof-mounted	20
Coils	
DX, water, or steam	20
Electric	15
Heat Exchangers	
Shell-and-tube	24
Reciprocating compressors	20
Packaged chillers	
Reciprocating	20
Centrifugal	23
Absorption	23
Cooling towers	
Galvanized metal	20
Wood	20
Ceramic	34

Equipment Item	Median Years
Air-cooled condensers	20
Evaporative condensers	20
Insulation	
Molded	20
Blanket	24
Pumps	
Base-mounted	20
Pipe-mounted	10
Sump and well	10
Condensate 15	
Reciprocating engines	20
Steam turbines	30
Electric motors	18
Motor starters	17
Electric transformers	30
Controls	
Pneumatic	20
Electric	16
Electronic	15
Valve actuators	
Hydraulic	15
Pneumatic	20
Self-contained	10