City of Paterson

Energy Savings Plan

Presented to:

Katheleen Long
City Administrator
City of Paterson

Presented by:

Josh Smith
Regional Account Manager

ABM | Technical Solutions

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2024

ABM | Technical Solutions

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September 30, 2024

Kathleen Long
City Administrator
City of Paterson
155 Market Street
Paterson, NJ 07505

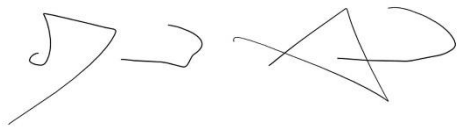
Dear Kathleen,

We understand the City of Paterson needs a comprehensive, performance-based energy savings program in a timely fashion to upgrade their facilities and optimize utility and operating budgets through an inclusive infrastructure renewal process. With our level of expertise in providing these types of programs to facilities and operations, ABM is confident that we will provide you with a quality program which lowers your operating costs and increases your energy and operational efficiency.

As we have with every past client, ABM will meet and exceed your expectations with our dedicated personnel, innovative processes and technology, and commitment to client satisfaction. Our entire organization stands behind this response and all the commitments made to the City of Paterson.

If there is any additional information I might provide, please do not hesitate to call, or write. We are ready to put our solutions to work for you.

Sincerely,



Josh Smith
Regional Account Manager

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Executive Summary

We Understand the Mission of the City of Paterson Environmental Commission Board

The Paterson Environmental Commission seeks to protect and improve the quality of our natural resources by addressing the City Council, the planning board, and the Mayor on actions and policies of sustainability. Through education and outreach, the Commission seeks to inspire and empower the community, both residential, commercial, and globally to incorporate environmentally responsible practices in their daily lives.

Our team has partnered with many local government facilities in the northeast region including the County of Passaic, greatly enhancing their infrastructure efficiency and redistributing funds to allow a more sustainable future. In providing services to the County of Passaic, we have become familiar with local and state regulations and have proven our ability to provide services to the City of Paterson The initial step in any project is to determine if it presents a good opportunity for investment.

Through our conversations with the City of Paterson, we understand the following items are of concern to the City of Paterson and many of these can be addressed by implementing an ESIP contract:

- Replace Fire Station AC and improve Indoor Air Quality (IAQ)
- Replacement of roofs at the Riverside Vets and Traffic Division buildings
- Rooftop Unit (RTU) replacement at Riverside Vets
- Board of Health HVAC controls replacement

Our team has assisted similar clients in the local government market, completing successful guaranteed energy savings projects in Passaic County.

- County of Passaic
- County of Ocean
- Town of Manalapan
- City of Wildwood
- City of Ventnor
- City of Atlantic City

How will this experience help the City of Paterson?

We help local government improve their financial position using a detailed analysis of current operational and financial philosophies. Our passion and core competency is optimizing existing budgets. We use all resources available to help improve the overall facility environment as well as the financial health of our customers. The improvements involved in this project will be specifically designed to reduce City of Paterson's overall operating costs, leverage and improve the quality of the systems – all by using existing budgets.

The City of Paterson Project Overview

As currently designed, our Energy Savings Improvement Plan (ESIP) energy conservation program will fund $5,550,335 in capital improvements modeled in a 20-year financing term at 4.65% interest rate.

This provides a combined positive cash flow of $3,930,250 over the full term and this money can be used now for additional capital improvement needs. Leveraging this money now for high priority items such as boiler upgrades, Building Automation System (BAS) upgrades, HVAC, and lighting upgrades, further renovations, etc. will be a huge benefit to the community. Throughout the process, ABM will work with you to fund the most important operational needs.

The following table highlights other project details:

ESIP Model Type:	ESCO
Engineer of Record:	Alaimo Group
Financial Advisor:	Heather Litzebauer, NW Financial Group, LLC
Bond Council:	John M. Cantalupo, Esq., Archer & Greiner, P.C.
Independant Third Party Auditor:	NV5

Public Finance Acumen and Financial Overview

The City of Paterson deserves a successful energy service partner who possesses the financial skills necessary to measure, identify, and produce the effort required to fund critical infrastructural needs. ABM's public finance acumen has proven to be one of our best assets. In many cases, it is the primary reason our clients select us for energy savings projects. Our primary position is that the technical solution is only as good as the financing structure allowed for implementation. The measurement of the worthiness of our program considers that we found technical issues you likely knew about, and that we have designed a program that creates the capital needed to fund the recommended outcome. ABM team members have achieved the highest standards in financial expertise in the industry. Brian Lavin will work with the City of Paterson on a financing strategy that aligns with the overall financial profile for the City. We have experience funding our solutions with traditional financing vehicles as well as off balance sheet and energy as a service arrangement.

Supporting the City of Paterson Strategic Direction

The ABM team has decades of experience delivering large capital improvement projects using creative financing strategies to stretch your budget, oftentimes creating a positive revenue stream that puts money back into the general fund.

ABM is a part of a statewide partnership with New Jersey Clean Cities Coalition working to advance air quality improvement, economic opportunity, and energy security through deployment of alternative fuel vehicles and infrastructure, education programs, and other petroleum reduction activities. Our work with New Jersey Clean Cities will benefit the City of Paterson with access to additional significant energy saving opportunities including transit, school bus, car electrification, and the funding opportunities to ensure cost effectiveness.

ABM is strongly committed to diversity within our employment ranks and the people and companies we do business with. We partner with Minority and Women-Owned Business Enterprises (M/WBE) and

Disadvantaged Business (M/WDBE) partners that attract world-class internal team members, suppliers, and subcontractors, in addition to helping customers achieve diversity participation goals.

Conclusion

We have a professional, personal, and overall real investment in the City of Paterson. Our business units have been supporting many large public entities, government clients, hospitals, and commercial facilities throughout the New Jersey for many years. We will create the best overall financial and facility strategy to exceed your expectations and create a true partnership between our organizations. ABM is excited to further support the facility and financial goals of the City of Paterson by demonstrating the full depth of our service offerings.

Your Dedicated ABM Team

Personnel

ABM provides a team of experienced and proven project leaders to each and every projects. Many team members have over 30 years of experience in their field. Key team members can have a combined total of over 180 years of experience in the performance contracting. We have been delivering energy retrofits since 1979. Our service technicians and project professionals have implemented Bundled Energy Services (BES), HVAC mechanical, and electrical projects in similar situations over the past 40 years.

ABM's energy professionals hold a wide range of certifications and accreditations that ensure they are meeting or exceeding client expectations on every project. Some of these include:

- **Professional Engineer (PE)** – Professional Engineers serve the public and keep them safe. They are required to demonstrate proficiency within a specific field of study and must pass an exam administered by the National Council of Examiners for Engineering and Surveying. PEs are licensed by state and must conform to continuing education requirements to keep their licenses.
- **LEED Accredited Professional (LEED-AP)** – LEED-Accredited Professionals demonstrate the ability to maximize energy efficiency while saving resources for future generations. They demonstrate experience and proficiency in green building analysis and design by passing an exam administered by the Green Building Certification Institute (GBCI).
- **Certified Energy Manager (CEM)** – Certified Energy Managers must pass an exam administered by the Association of Energy Engineers (AEE) that determines the knowledge of U.S. laws and guidelines surrounding the efficient use of resources and minimum operating requirements for buildings that serve the public.
- **Green Building Engineer (GBE)** – AEE's Certified Green Building Engineer (GBE) program awards special recognition to green building, design, and construction engineering professionals who demonstrate competence and ethical fitness for green building disciplines governing and affecting green building professionals.
- **Certified Indoor Air Quality Professional (CIAQP)** – CIAQP candidates must pass an exam on indoor environmental contaminants, mitigation strategies, and prevention techniques. CIAQP's are deemed competent and knowledgeable in air quality assessment, design, management, and problem mitigation.

- **High-Performance Building Design Professional (HBDP)** – Candidates who earn the HBDP certification demonstrate a well-rounded understanding of how HVAC&R design is integrated into high-performing buildings to achieve the overall goal of producing a sustainable HVAC&R design.
- **National Environmental Balancing Bureau (NEBB)** – NEBB is an International association certifying firms and qualifying supervisors and technicians in the following disciplines: Testing, Adjusting, and Balancing (TAB) of HVAC systems; Building Systems Commissioning (BSC); Sound and Vibration Measurement (S&V); Retro-commissioning (RCX); Fumehood Testing (FHT); and Cleanroom Performance Testing (CPT). NEBB also establishes and maintains industry standards, procedures, and work specifications for these disciplines.

Number of graduated, non-registered Architects/Engineers by discipline:

The following are numbers projected nationwide for ABM company-owned and franchise contractor network.

Structural Engineer > **10**
Mechanical Engineers > **50**
Electrical Engineers > **50**
Multi-Disciplinary Engineers > **20**
Systems Engineers > **20**
Professional Engineers > **25**
Mechanical Engineers > **50**
High-Performance Building Design Professional > **10**

LEED Accredited Professional > **75**
Certified Energy Manager > **50**
Green Building Engineer > **15**
Certified Green Indoor Air Quality Professional > **25**
Certified Energy Manager > **50**
Green Building Engineer > **15**
Certified Indoor Air Quality Professional > **25**

Building Energy Assessments and ECMs Descriptions

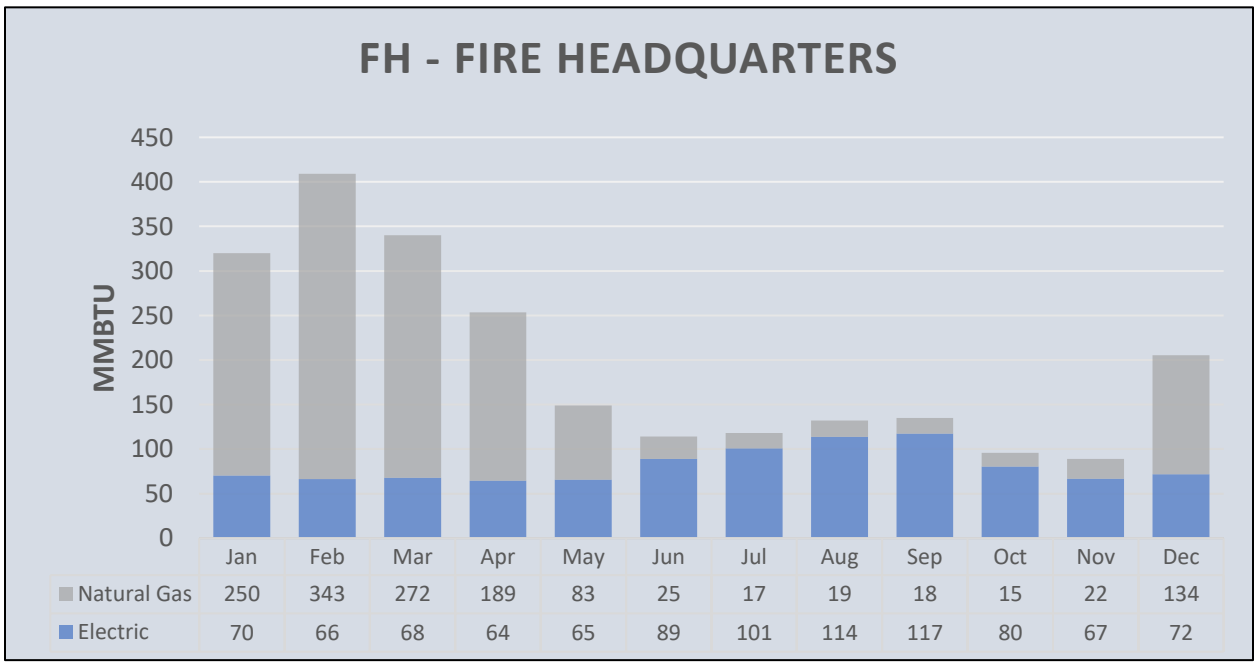
The following section includes a building-by-building assessment of the existing conditions, energy usage, and energy savings opportunities identified for completion in an ESIP. The City asked that ABM not review the buildings for water conservation upgrades or present opportunities for water conservation as water and sewer costs are not included in the City's utility cost.

ABM has also included below a summary of our review of the findings of the Local Government Energy Audit (LGEA).

1 - Fire Headquarters

The Fire Headquarters Building is a two (2) story masonry building, constructed in 2014. This is the newest building in the Paterson Municipal building group reviewed as part of the ESP. The building and its systems are generally in excellent condition. There have been no significant upgrades or system replacements since original construction.

As part of our ESP effort, ABM reviewed the LGEA report prepared by TRC in April of 2021. The LGEA reported a baseline energy cost of $50,579 and a Building Energy Use Index (EUI) of usage of 95.2 KBtu/sf for the year 2020. This compares well with the updated energy usage reviewed for the base year 2022 by ABM of 96.8 kBtu/sf (1.7% increase).



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Natural Gas	250	343	272	189	83	25	17	19	18	15	22	134
Electric	70	66	68	64	65	89	101	114	117	80	67	72

During the ESP development, ABM has completed numerous site visits focusing on the various systems in the building. This includes review of the heating and cooling systems and the associated controls, lighting, backup generation, energy metering and other major systems. ABM prepared an updated inventory of the major systems to account for any significant changes since the LGEA was prepared. The following ECMs are found to be cost effective for this facility, listed, in order of the technical category (TC) as defined by the Department of Energy (DOE).

ECMs recommended for installation under the plan are shown below:

Fire Headquarters	TC-5	Lighting Improvements - LED Upgrades
Fire Headquarters	TC-6	Building Envelope Modifications - Reduce Infiltration

Additional optional ECMs with higher capital costs include:

Fire Headquarters	TC-3	HVAC Controls - Install Truck Door Heating Lock-Out Controls
Fire Headquarters	TC-4	HVAC Improvements - Install Radiant Heating Systems
Fire Headquarters	TC-10	Distributed Generation - Install Cogeneration System

The following sections describe the proposed scopes of work.

TC – 5 Lighting Improvements – LED Upgrades

Lighting at the Fire Headquarters consists of mainly fluorescent fixtures, with LED fixtures used on the building exterior. Most of the interior fixtures are proposed to be upgraded to LED.

Of the fixtures to be upgraded, most will be retrofitted, and some will be replaced. The summary table below indicates the types of lighting upgrades being performed. The fixtures excluded from this scope are already energy efficient LED.

Contractor will furnish and install the following:

Proposed Lighting Description	Proposed QTY
EMERGENCY BALLAST LED	50
NEW 2X4 LED FLAT PANEL KIT	276
RELAMP 9 WATT LED A LAMP S/I	4
RETROFIT 4’ 2L LED TUBE /SELF BALLAST	31
RETROFIT 4’ 4L LED TUBE /SELF BALLAST	12

TC – 6 Building Envelope Modifications – Reduce Infiltration

Weatherization scope is to include:

- Weatherstrip seven (7) interior doors to compartmentalize conditioned space from garage
- Install seven (7) sweeps
- Install four (4) astragals
- Seal open penetrations in attic (75) linear feet

TC–3 HVAC Controls – Install Truck Door Heating Lock-Out Controls (Additional Optional ECM)

- Install overhead door sensors to determine when the door is open. Connect new door sensors to nearest heater unit. During the heating season, utilize door sensors to prevent the nearest heater units from operating until the door has been closed. Door sensors to be installed on 8 overhead doors (4 front + 4 back side).

TC – 4.1 HVAC Upgrades - Install Radiant Heating Systems (Additional Optional ECM)

Furnish and install new natural gas fired radiant tube heaters (Sunstar or equivalent) in the fire truck bay areas to replace the existing gas fired unit heaters.

Existing unit heaters to be replaced are listed on the next page:

Building	Unit	Manufacturer	Model No.	Size
Fire Headquarters	Truck Bay Unit Heater	Trane	GAND010	80,000 BTUh
Fire Headquarters	Truck Bay Unit Heater	Trane	GAND010	80,000 BTUh
Fire Headquarters	Truck Bay Unit Heater	Trane	GAND010	80,000 BTUh
Fire Headquarters	Truck Bay Unit Heater	Trane	GAND010	80,000 BTUh

New radiant heaters will include new thermostats, vent pipe, vent caps, end reflectors and gas line.

For the design effort will include new radiant heater selection, quantity, placement, and sizing and ensuring proper clearances are maintained between new radiant heaters and other existing equipment (electrical, trucks, truck exhaust systems, etc.).

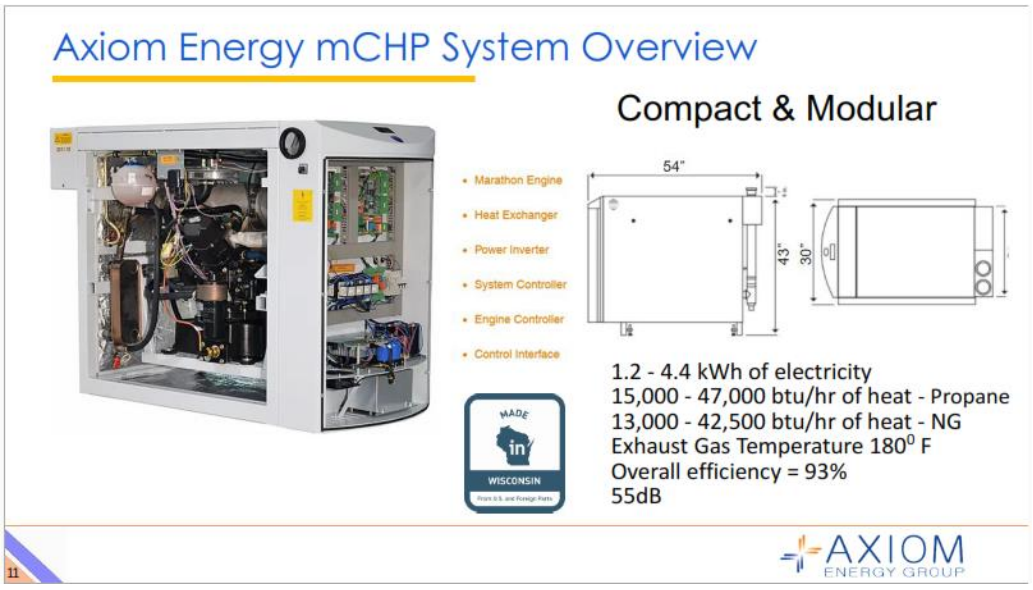
Remove and dispose of existing unit heaters in the following areas:

- Truck Bay – remove Trane gas-fired unit heaters, cap off or reuse / extend natural gas line for new radiant units, cap off or re-use vent stack for new radiant units, disconnect and reconnect electrical or provide new for each heater.

TC – 10 Distributed Generation - Install Cogeneration System (Additional Optional ECM)

Energy efficiency and cost savings can be generated by the installation of a micro combined heat and power (mCHP) system. The system to be installed shall be AXIOM mCHP – natural gas fired 4.4 kW cogeneration unit or equivalent. Also included will be a 120-gallon Domestic Hot Water (DHW) buffer tank.

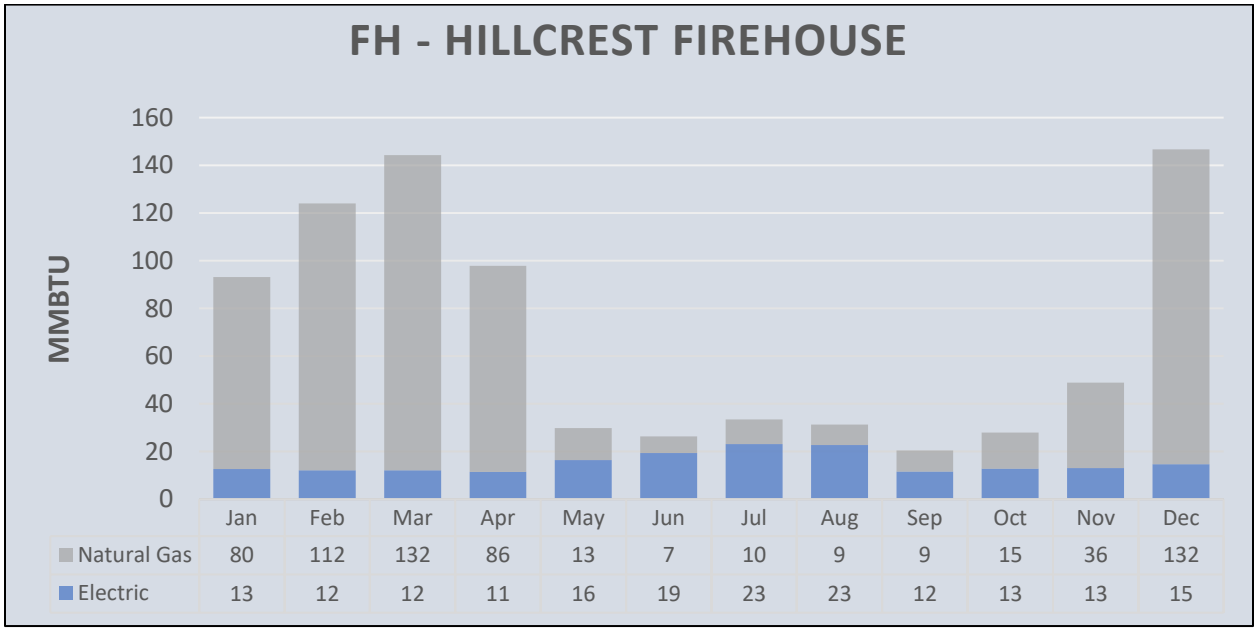
Complete installation shall include final design, utility interconnection coordination and all components for a fully functional cogeneration system.



2 - Hillcrest Firehouse

The Hillcrest Firehouse Building is a single-story masonry building, constructed in 1971. The building and its systems are in generally in good condition, the roof has reportedly recently been replaced. Other than a boiler replacement in 2018 with a new condensing boiler, there have been few HVAC upgrades or system replacements since original construction.

As part of our ESP effort, ABM reviewed the LGEA Report prepared by TRC in April of 2021. The LGEA reported a baseline energy cost of $13,263 and a Building Energy Use Index (EUI) of usage of 118.3 KBtu/sf for the year 2020. This falls in the expected range compared with the updated energy usage reviewed for the base year 2022 by ABM of 134.5 kBtu/sf (13.7% increase).



During the ESP development, ABM has completed numerous site visits focusing on the various systems in the building. This includes review of the heating and cooling systems and the associated controls, lighting, backup generation, energy metering and other major systems. ABM prepared an updated inventory of the major systems to account for any significant changes since the LGEA was prepared. The following ECMs were found to be cost effective for this facility, listed, in order of the TC as defined by the DOE.

ECMs recommended for installation under the plan are shown below:

Hillcrest Firehouse	TC-3	HVAC Controls - Install Truck Door Heating Lock-Out Controls
Hillcrest Firehouse	TC-5	Lighting Improvements - LED Upgrades
Hillcrest Firehouse	TC-6	Building Envelope Modifications - Reduce Infiltration Install Solar Film

Additional optional ECMs with higher capital costs include:

Hillcrest Firehouse	TC-4	HVAC Improvements - Replace Window AC Units with High Eff. HVAC
Hillcrest Firehouse	TC-4	HVAC Improvements - Install Radiant Heating Systems

The following sections describe the proposed scopes of work.

TC – 3 HVAC Controls – Install Truck Door Heating Lock-Out Controls

Install overhead door sensors to determine when the door is open. Connect new door sensors to nearest heater unit. During the heating season, utilize door sensors to prevent the nearest heater units from operating until the door has been closed. Door sensors to be installed on two (2) overhead doors.

TC – 5 Lighting Improvements – LED Upgrades

Lighting at the Hillcrest Firehouse consists of mainly fluorescent fixtures, with metal halide fixtures used on the building exterior. Most of these are proposed to be upgraded to LED.

Of the fixtures to be upgraded, most will be retrofitted, and some will be replaced. The summary table below indicates the types of lighting upgrades being performed. The fixtures excluded from this scope are already energy efficient LED.

Contractor will furnish and install the following:

Proposed Lighting Description	Proposed QTY
NEW 2X2 LED FLAT PANEL KIT	6
NEW 2X4 LED FLAT PANEL KIT	13
RELAMP 9 WATT LED A LAMP S/I	1
RETROFIT 3' 2L LED TUBE /SELF BALLAST	3
RETROFIT 4' 2L LED TUBE /SELF BALLAST	1
RETROFIT 4' 4L LED TUBE /SELF BALLAST	8

TC – 6 Building Envelope Modifications – Reduce Infiltration

Weatherization scope is to include:

- Provide door maintenance to nine (9) standard doors
- Weatherstrip nine (9) doors
- Install nine (9) sweeps
- Weatherstrip two (2) garage doors
- Seal the perimeter of the garage doors (100) linear feet
- Seal the roof/wall intersection from the exterior (560) linear feet
- Install window film to reduce solar heat gain on south side

TC – 4 HVAC Improvements – Replace window AC Units with High Efficiency HVAC (Additional Optional ECM)

Furnish and install new ductless split system heat pump(s) to replace the existing window AC units. Estimated total tonnage required is 12 tons served by (3) 4-ton condensing units with seven room units either ceiling or wall mounted. New heat pumps will serve the following areas:

- Weight room / gym - west side – 250 sf (est.)
- Kitchen / dining area - west side – 660 sf (est.)
- Sleeping quarters – east Side – 540 sf (est.)
- Lockers / bathroom – east Side - 540 sf (est.)

- Bedroom office – north side – 120 sf (est.)
- Bedroom office - north side - 140 sf (est.)
- Bedroom office - north side - 100 sf (est.)

Note that truck bay areas will **not** be served by new heat pumps.

Existing window AC units to be replaced are listed below:

Building	Unit	Manufacturer	Model No.	Size
Hillcrest Firehouse	Window / Wall AC Dining Rm. (W)	Friedrich		2-ton
Hillcrest Firehouse	Window / Wall AC Weight Rm. (W)	Friedrich	WS12C10C	1.5-ton
Hillcrest Firehouse	Window / Wall AC Sleeping Qtrs. (E)	Friedrich		2-ton
Hillcrest Firehouse	Heat Pump Bed Rm. (N)	Samsung	AQV12NSD	1-ton
Hillcrest Firehouse	Window / Wall AC Bed Rm. (N)			1.5-ton
Hillcrest Firehouse	Window / Wall AC Bed Rm. (N)	Friedrich	CP08G10B	8,000 BTUh
Hillcrest Firehouse	Window / Wall AC Bed Rm. (N)	Frigidaire	FAA055T7A	5,200 BTUh

New heat pumps will include new heat pump condenser units mounted on the roof (or other suitable area on rear patio possibly) as well as new ceiling and or wall mounted air handling units (AHU), thermostats, condensate lines, power, and other components as necessary for a complete and functional system.

Design effort will include new heat pump selection, sizing and ensuring code compliance and other permitting requirements. The scope of work includes, but is not limited to the following:

- Mechanical, and electrical engineering as required
- Installation of the new heat pump units to furnish a properly working system
- Furnish and install necessary electrical
- Furnish and install necessary controls
- Furnish start-up, check out and customer training
- Crane service as required
- Rigging of new equipment
- Removal of existing window AC units listed and sealing building opening from removed units
- AHUs shall include outside air capabilities and bipolar ionization units or other similar air purification systems.

Not included in this scope of work:

- Smoke detector replacement
- Test and balance
- Temporary cooling units
- Asbestos abatement

TC – 4.1 HVAC Upgrades - Install Radiant Heating Systems (Additional Optional ECM)

Furnish and install new natural gas fired radiant tube heaters (Sunstar or equivalent) in the fire truck bay areas to replace the existing ceiling mounted hot water fan coil units.

Existing fan coil units to be replaced are listed below:

Building	Unit	Size
Hillcrest Firehouse	Truck Bay Fan Coil Unit	30,000 BTUh (est.)
Hillcrest Firehouse	Truck Bay Fan Coil Unit	30,000 BTUh (est.)
Hillcrest Firehouse	Truck Bay Fan Coil Unit	30,000 BTUh (est.)

New radiant heaters will include new thermostats, vent pipe, vent caps, end reflectors and gas line.

Design effort will include new radiant heater selection, quantity, placement, and sizing and ensuring proper clearances are maintained between new radiant heaters and other existing equipment (electrical, trucks, truck exhaust systems, etc.).

Contractor will remove and dispose of existing fan coil units in the following areas.

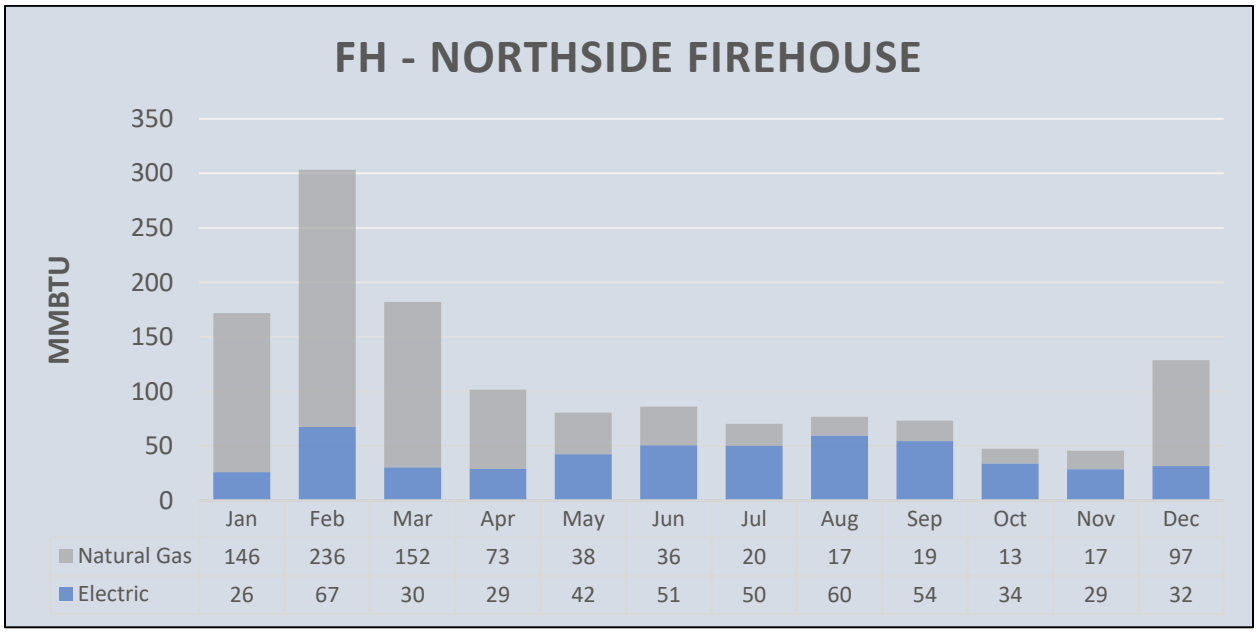
- Truck Bay – remove existing fan coil units and thermostat controls, extend electrical and natural gas line for new radiant units, install new vent stack for new radiant units. Install necessary valves to drain

existing hot water piping above ceiling. Drain existing hot water piping to prevent freezing above ceiling.

3 - Northside Firehouse

The Northside Firehouse building is a two (2) story masonry building, constructed in 1987. The building and its systems are generally in very good condition. Other than a boiler replacement in 2018 with a new condensing boiler, there have been few upgrades or system replacements since original construction.

As part of our ESP effort, ABM reviewed the LGEA Report prepared by TRC in April of 2021. The LGEA reported a baseline energy cost of $26,678 and a Building Energy Use Index (EUI) of usage of 82.5 KBtu/sf for the year 2020. This compares well with the updated energy usage reviewed for the base year 2022 by ABM of 79.8 kBtu/sf (3.2% decrease).



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Natural Gas	146	236	152	73	38	36	20	17	19	13	17	97
Electric	26	67	30	29	42	51	50	60	54	34	29	32

During the ESP development, ABM has completed numerous site visits focusing on the various systems in the building. This includes review of the heating and cooling systems and the associated controls, lighting, backup generation, energy metering and other major systems. ABM prepared an updated inventory of the major systems to account for any significant changes since the LGEA was prepared. The following ECMs were found to be cost effective for this facility, listed, in order of the TC as defined by the DOE.

ECMs recommended for installation under the plan are shown below:

Northside Firehouse	TC-5	Lighting Improvements - LED Upgrades
Northside Firehouse	TC-10	Distributed Generation - Install Cogeneration System

Additional optional ECMs with higher capital costs include:

Northside Firehouse	TC-3	HVAC Controls - Install Truck Door Heating Lock-Out Controls
Northside Firehouse	TC-4	HVAC Improvements - Install Radiant Heating Systems
Northside Firehouse	TC-6	Building Envelope Modifications - Reduce Infiltration

The following sections describe the proposed scopes of work.

TC – 5 Lighting Improvements – LED Upgrades

Lighting at the Northside Firehouse consists of mainly fluorescent fixtures, with metal halide fixtures used on the building exterior. Most of these are proposed to be upgraded to LED.

Of the fixtures to be upgraded, most will be retrofitted, and some will be replaced. The summary table below indicates the types of lighting upgrades being performed. The fixtures excluded from this scope are already energy efficient LED.

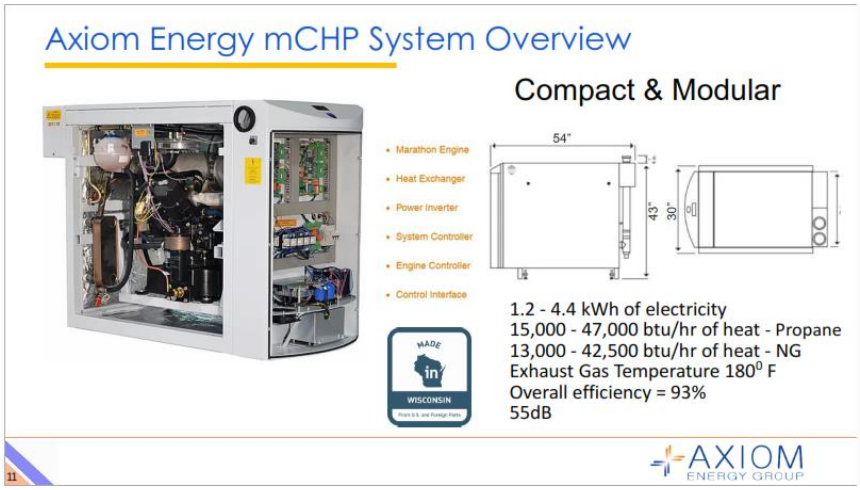
Contractor will furnish and install the following:

Proposed Lighting Description	Proposed QTY
NEW 2X4 LED FLAT PANEL KIT	44
RETROFIT 4’ 2L LED TUBE /SELF BALLAST	9

TC – 10 Distributed Generation - Install Cogeneration System

Energy efficiency and cost savings can be generated by the installation of a micro cogeneration system. The system to be installed shall be AXIOM mCHP – natural gas fired 4.4 kW cogeneration unit or equivalent. Also included will be a 120-gallon DHW buffer tank.

Complete installation shall include final design, utility interconnection coordination and all components for a fully functional cogeneration system.



TC–3 HVAC Controls – Install Truck Door Heating Lock-Out Controls (Additional Optional ECM)

Install overhead door sensors to determine when the door is open. Connect new door sensors to nearest heater unit. During the heating season, utilize door sensors to prevent the nearest heater units from operating until the door has been closed. Door sensors to be installed on three (3) overhead doors.

TC – 4.1 HVAC Upgrades - Install Radiant Heating Systems (Additional Optional ECM)

Furnish and install new natural gas fired radiant tube heaters (Sunstar or equivalent) in the fire truck bay areas to replace the existing ceiling mounted hot water fan coil units.

Existing fan coil units to be replaced are listed below:

Building	Unit	Size
Northside Firehouse	Truck Bay Fan Coil Unit	30,000 BTUh (est.)
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Northside Firehouse	Truck Bay Fan Coil Unit	30,000 BTUh (est.)

New radiant heaters will include new thermostats, vent pipe, vent caps, end reflectors and gas line.

Design effort will include new radiant heater selection, quantity, placement, and sizing and ensuring proper clearances are maintained between new radiant heaters and other existing equipment (electrical, trucks, truck exhaust systems, etc.).

Remove and dispose of existing fan coil units in the following areas.

- Truck Bay – remove existing fan coil units and thermostat controls, extend electrical and natural gas line for new radiant units, install new vent stack for new radiant units. Install necessary valves to drain existing hot water piping above ceiling. Drain existing hot water piping to prevent freezing above ceiling.

TC – 6 Building Envelope Modifications – Reduce Infiltration (Additional Optional ECM)

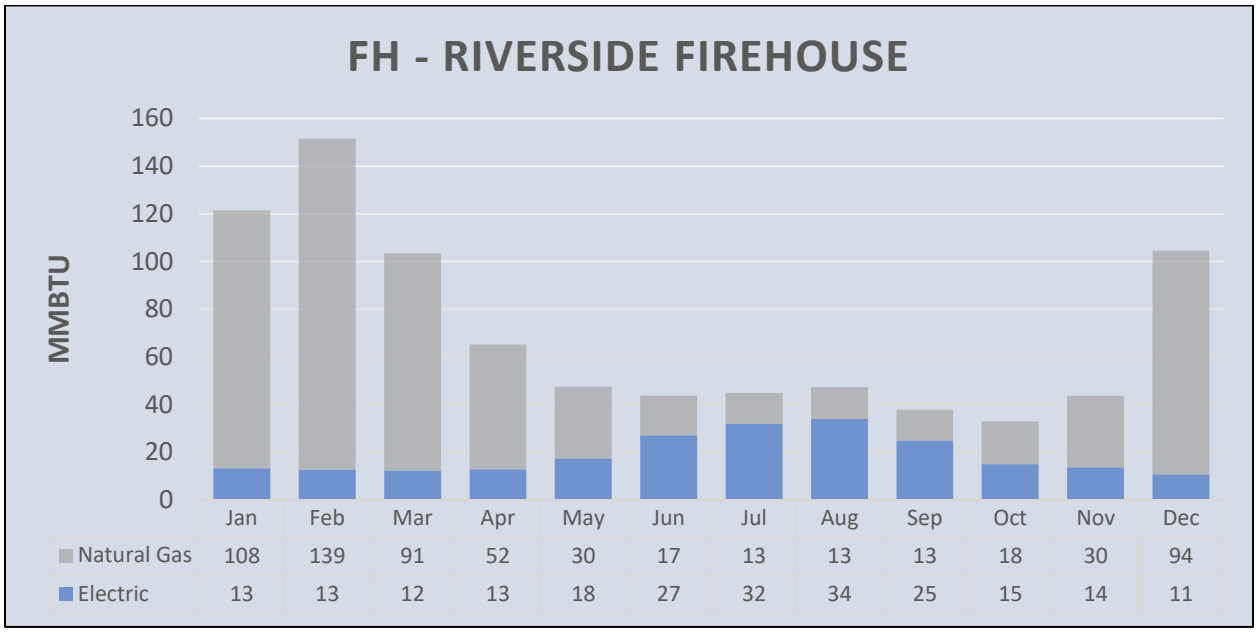
Weatherization scope is to include:

- Provide door maintenance to seven (7) standard doors
- Weatherstrip seven (7) doors
- Install seven (7) sweeps
- Weatherstrip three (3) garage door
- Seal the perimeter of the garage doors (132) linear feet

4 - Riverside Firehouse

The Riverside Firehouse Building is a two (2) story masonry building, constructed in 1962. The building and its systems are generally in fair to good condition. Other than radiant heating installed in the truck bays, there have been few upgrades or system replacements since original construction. Lighting was converted to LED under a recent energy project in 2018.

As part of our ESP effort, ABM reviewed the LGEA Report prepared by TRC in April of 2021. The LGEA reported a baseline energy cost of $11,376 and a Building Energy Use Index (EUI) of usage of 97.1 KBtu/sf for the year 2020. This falls in the expected range compared with the updated energy usage reviewed for the base year 2022 by ABM of 104.7 kBtu/sf (7.8% increase).



During the ESP development, ABM has completed numerous site visits focusing on the various systems in the building. This includes review of the heating and cooling systems and the associated controls, lighting, backup generation, energy metering and other major systems. ABM prepared an updated inventory of the major systems to account for any significant changes since the LGEA was prepared. The following ECMs were found to be cost effective for this facility, listed, in order of the TC as defined by the DOE.

ECMs recommended for installation under the plan are shown below:

Riverside Firehouse	TC-3	HVAC Controls - Install Truck Door Heating Lock-Out Controls

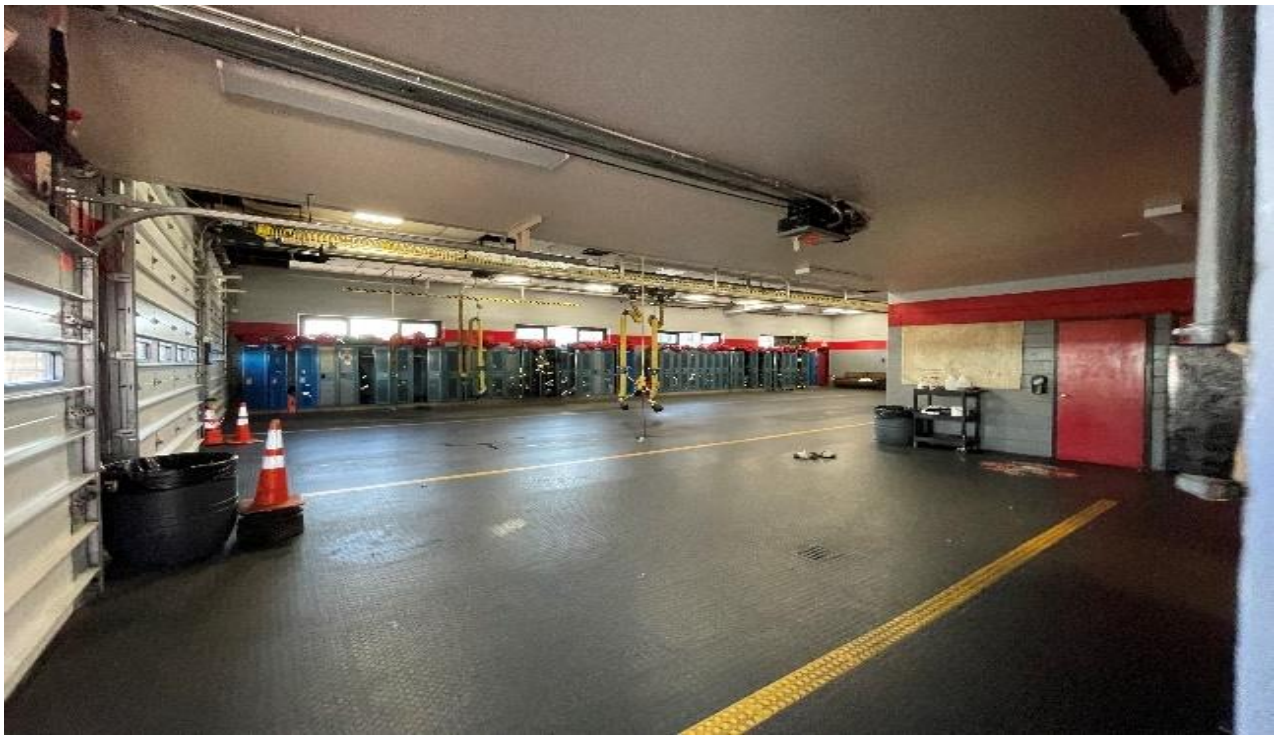
Additional optional ECMs with higher capital costs include:

Riverside Firehouse	TC-1	Boiler Improvements - Install High Eff. Boiler
Riverside Firehouse	TC-4	HVAC Improvements - Replace Window AC Units with High Eff. HVAC
Riverside Firehouse	TC-6	Building Envelope Modifications - Reduce Infiltration

The following sections describe the proposed scopes of work.

TC–3 HVAC Controls – Install Truck Door Heating Lock-Out Controls

Install overhead door sensors to determine when the door is open. Connect new door sensors to nearest heater unit. During the heating season, utilize door sensors to prevent the nearest heater units from operating until the door has been closed. Door sensors to be installed on three (3) overhead doors.



TC – 1 Boiler Upgrades – Replace Boilers (Additional Optional ECM)

Furnish and install a new natural gas fired condensing boiler (Lochinvar or equivalent) to replace the existing Weil McLain boiler in the boiler room. Existing A.O. Smith DHW heater is new and will remain in service.

Photos of the existing boiler is shown below:

Existing boiler to be replaced is listed below:

Building	Unit	Manufacturer	Serial No.	Size
Riverside Firehouse	Boiler	Weil McLain	CP3603662	300,000 BTUh (est)

Design effort will include new boiler selection, sizing and ensuring proper clearances are maintained between new boiler and other existing equipment. The scope of work includes, but is not limited to the following:

- Disconnect the electric and gas service, controls, flue piping and water piping from the existing boiler
- Removal and disposal of the existing boiler
- Installation of the new boiler to provide a properly working system
- New boiler will be of equal (output) capacity of existing boiler
- Necessary piping and piping accessories
- Pipe Insulation on new and other un-insulated piping in the boiler room
- New boiler will include new thermostats, vent pipe, and gas line to meet local code requirements .
- Reconnect electrical service and controls
- Cap existing boiler flue
- Initial water treatment chemicals will be added to the hot water system
- Existing circulating pumps will be reused

Not included in this scope of work:

- Asbestos abatement
- Removal of the existing flue
- Test and balance

TC – 4 HVAC Improvements – Replace window AC Units with High Efficiency HVAC (Additional Optional ECM)

Contractor will furnish and install new ductless split system heat pump(s) to replace the existing window AC units. Estimated total tonnage required is 8 tons served by (2) 4-ton condensing units with eight (8) room units either ceiling or wall mounted. New heat pumps will serve the following areas:

- Front bedroom ground floor – 144 sf (est.)
- Kitchen / dining / living room area – 500 sf (est.)
- Sleeping quarters second floor – 575 sf (est.)
- Office / bedroom second floor – 200 sf (est.)
- Bathroom second floor – 180 sf (est.)
- Office / bedroom first floor – 150 sf (est.)

Note that truck bay areas will not be served by new heat pumps.

Existing window AC units to be replaced are listed below:

Building	Unit	Manufacturer	Model No.	Size
Riverside Firehouse	Window / Wall AC Bed Rm. 1st Fl.	Friedrich		8,000 BTUh
Riverside Firehouse	Window / Wall AC Dining Rm. !st Fl	Firgidaire	FHWC183	18,000 BTUh
Riverside Firehouse	Window / Wall AC Living Rm. 1st Fl	Firgidaire		18,000 BTUh
Riverside Firehouse	Window / Wall AC 2nd Sleeping Qtrs.	Frigidaire	FRA256SV2	25,000 BTUh
Riverside Firehouse	Window / Wall AC 2nd Sleeping Qtrs.	Frigidaire	FFRE1533U1	15,000 BTUh
Riverside Firehouse	Portable AC bathroom. 2nd Fl	Friedrich		10,000 BTUh

Riverside Firehouse	Window / Wall AC 2nd flr Off./bedrm.	Frigidaire	FHWW063WB100	6,000 BTUh
Riverside Firehouse	Window / Wall AC 2nd flr Off./bedrm.	Frigidaire		6,000 BTUh
Riverside Firehouse	Window / Wall AC Bed Rm.	Friedrich		8,000 BTUh

New heat pumps will include new heat pump condenser unit mounted on the roof (or other suitable area on rear patio possibly) as well as new ceiling and or wall mounted AHUs, thermostats, condensate lines, power, and other components as necessary for a complete and functional system.

Final design effort will include new heat pump selection, sizing and ensuring code compliance and other permitting requirements. The scope of work includes, but is not limited to the following:

- Structural, mechanical, and electrical engineering as required
- Installation of the new heat pump units to furnish a properly working system
- Furnish and install necessary electrical
- Furnish and install necessary controls
- Furnish start-up, check out and customer training
- Crane service as required
- Rigging of new equipment
- Removal of existing window AC units listed and sealing building opening from removed units
- AHUs shall include outside air capabilities and bipolar ionization units or other similar air purification systems.

Not included in this scope of work:

- Smoke detector replacement
- Test and balance
- Temporary cooling units
- Asbestos abatement

TC – 6 Building Envelope Modifications – Reduce Infiltration (Additional Optional ECM)

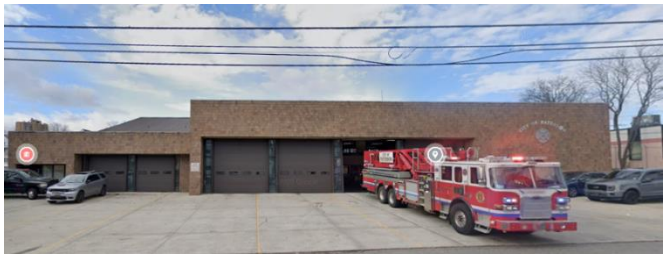
Weatherization scope is to include:

- Provide door maintenance to eight (8) standard doors
- Weatherstrip eight (8) doors

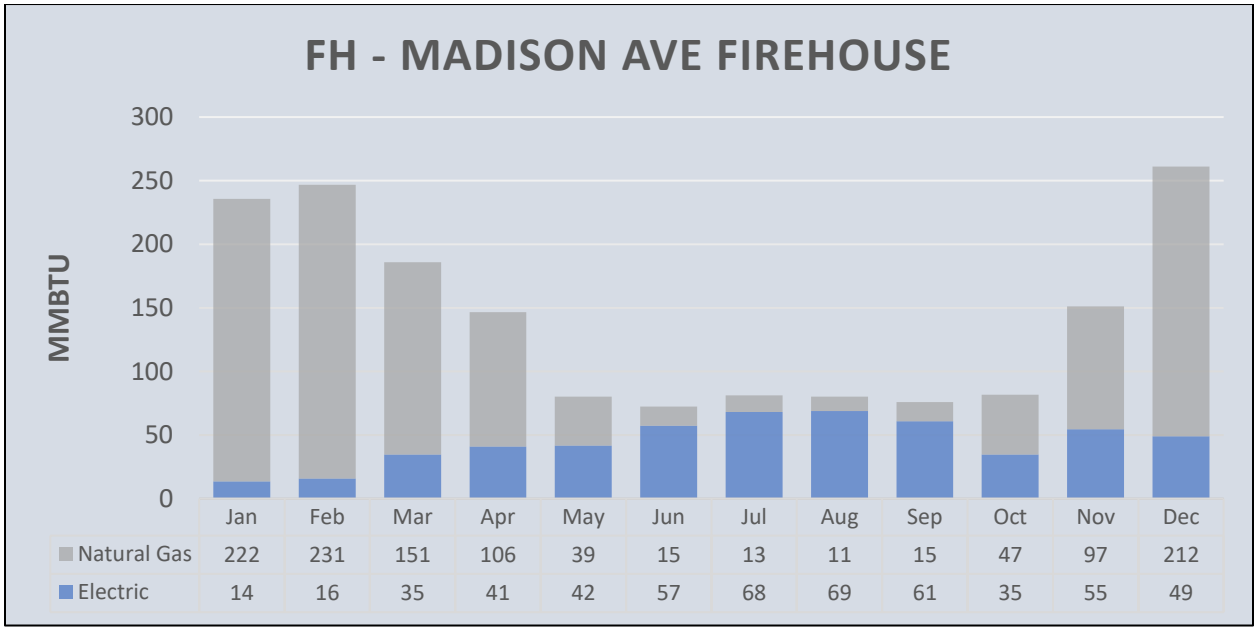
- Install eight (8) sweeps
- Weatherstrip six (6) garage door
- Seal the perimeter of the garage doors (130) linear feet.
- Seal the roof/wall intersection from the exterior (375) linear feet.
- Weatherize four (4) a/c units

5 – Madison Avenue Firehouse

The Madison Avenue Firehouse Building is a two (2) story masonry building, constructed in 1982. The building and its systems are generally in very good condition. Other than a boiler replacement in 2018 with two new condensing boilers, there have been few upgrades or system replacements since original construction.



As part of our ESP effort, ABM reviewed the LGEA Report prepared by TRC in April of 2021. The LGEA reported a baseline energy cost of $45,411 and a Building Energy Use Index (EUI) of usage of 142.4 KBtu/sf for the year 2020. This falls out of the expected range compared with the updated energy usage reviewed for the base year 2022 by ABM of 114.1 kBtu/sf (19.9% decrease).



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Natural Gas	222	231	151	106	39	15	13	11	15	47	97	212
Electric	14	16	35	41	42	57	68	69	61	35	55	49

During the ESP development, ABM has completed numerous site visits focusing on the various systems in the building. This includes review of the heating and cooling systems and the associated controls, lighting, backup generation, energy metering and other major systems. ABM prepared an updated inventory of the major systems to account for any significant changes since the LGEA was prepared. The following ECMs were found to be cost effective for this facility, listed, in order of the TC as defined by the DOE.

ECMs recommended for installation under the plan are shown below:

Madison Ave. Firehouse	TC-5	Lighting Improvements - LED Upgrades

Additional optional ECMs with higher capital costs include:

Madison Ave. Firehouse	TC-3	HVAC Controls - Install Truck Door Heating Lock-Out Controls
Madison Ave. Firehouse	TC-4	HVAC Improvements - Install Radiant Heating Systems
Madison Ave. Firehouse	TC-4	HVAC Improvements - Replace Window AC Units with High Eff. HVAC
Madison Ave. Firehouse	TC-6	Building Envelope Modifications - Reduce Infiltration

The following sections describe the proposed scopes of work.

TC – 5 Lighting Improvements – LED Upgrades

Lighting at the Madison Avenue Firehouse consists of mainly fluorescent fixtures, with metal halide fixtures used on the building exterior. Most of these are proposed to be upgraded to LED.

Of the fixtures to be upgraded, most will be retrofitted, and some will be replaced.

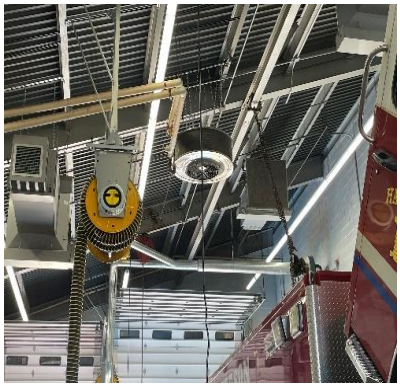
The summary table below indicates the types of lighting upgrades being performed. The fixtures excluded from this scope are already energy efficient LED.

Contractor will furnish and install the following:

Proposed Lighting Description	Proposed QTY
NEW 2X2 LED FLAT PANEL KIT	33
NEW 2X4 LED FLAT PANEL KIT	121
RELAMP 9 WATT LED A LAMP S/I	2
RETROFIT 4’ 2L LED TUBE /SELF BALLAST	15

TC–3 HVAC Controls – Install Truck Door Heating Lock-Out Controls (Additional Optional ECM)

Install overhead door sensors to determine when the door is open. Connect new door sensors to nearest heater unit. During the heating season, utilize door sensors to prevent the nearest heater units from operating until the door has been closed. Door sensors to be installed on eight (8) overhead doors (6 front + 2 back side).



TC – 4 HVAC Improvements – Replace window AC Units with High Efficiency HVAC (Additional Optional ECM)

Contractor will furnish and install new ductless split system heat pump(s) to replace the existing window AC units. Estimated total tonnage required is twelve tons served by (3) 4-ton condensing units with eight (8) room units either ceiling or wall mounted. New heat pumps will serve the following areas:

- Bedroom – 280 sf (est.)
- Bedroom – 280 sf (est.)
- Bedroom / office – 120 sf (est.)
- Office area – 350 sf (est.)
- Conference room/storage area – 200 sf (est.)
- Bedroom – 280 sf (est.)
- Office Area – 350 sf (est.)

Note that truck bay areas will not be served by new heat pumps.

Existing window AC units to be replaced are listed below:

Building	Unit	Manufacturer	Model No.	Size
Madison Ave. Firehouse	Window / Wall AC	Frigidaire	FAH105P1T1	10,000 BTUh
Madison Ave. Firehouse	Window / Wall AC Office	Friedrich		12,000 Btuh (est)
Madison Ave. Firehouse	Window / Wall AC Bedroom	Frigidaire	FAM156R1A	15,100 BTUh
Madison Ave. Firehouse	Window / Wall AC Bedroom	Frigidaire	FFRE1533S11	15,100 BTUh
Madison Ave. Firehouse	Window / Wall AC Bedroom	Frigidaire	FAA085P7A	8,000 BTUh
Madison Ave. Firehouse	Window / Wall AC Bedroom	Frigidaire		8,000 BTUh

New heat pumps will include new heat pump condenser unit mounted on the roof (or other suitable area on rear patio possibly) as well as new ceiling and or wall mounted AHUs, thermostats, condensate lines, power, and other components as necessary for a complete and functional system.

Final design will include new heat pump selection, sizing and ensuring code compliance and other permitting requirements. The scope of work includes, but is not limited to the following:

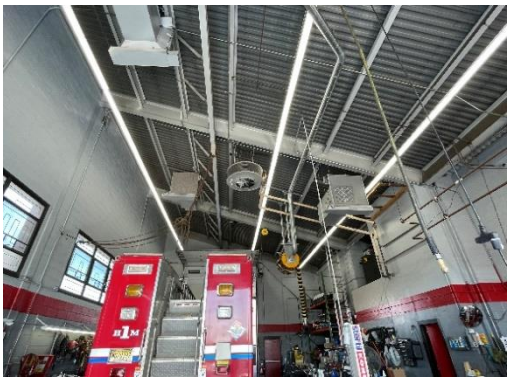
- Structural, mechanical, and electrical engineering as required
- Installation of the new heat pump units to furnish a properly working system
- Furnish and install necessary electrical
- Furnish and install necessary controls
- Furnish start-up, check out and customer training
- Crane service as required
- Rigging of new equipment
- Removal of existing window AC units listed and sealing building opening from removed units
- AHUs shall include bipolar ionization units or other similar air purification systems

Not included in this scope of work

- Smoke detector replacement
- Test and balance
- Temporary cooling units
- Asbestos abatement

TC – 4.1 HVAC Upgrades - Install Radiant Heating Systems (Additional Optional ECM)

Furnish and install new natural gas fired radiant tube heaters (Sunstar or equivalent) in the fire truck bay areas to replace the existing ceiling mounted hot water fan coil units.



Existing fan coil units to be replaced are listed below:

Building	Unit	Size
Madison Avenue Firehouse	Small Front Truck Bay Fan Coil Unit	45,000 BTUh (est.)
Madison Avenue Firehouse	Large Front Truck Bay Fan Coil Unit	20,000 BTUh (est.)
Madison Avenue Firehouse	Large Front Truck Bay Fan Coil Unit	20,000 BTUh (est.)
Madison Avenue Firehouse	Large Front Truck Bay Fan Coil Unit	30,000 BTUh (est.)
Madison Avenue Firehouse	Large Front Truck Bay Fan Coil Unit	30,000 BTUh (est.)
Madison Avenue Firehouse	Large Rear Service Bay	100,000 BTUh (est.)
Madison Avenue Firehouse	Large Rear Service Bay	40,000 BTUh (est.)

New radiant heaters will include new thermostats, vent pipe, vent caps, end reflectors and gas line.

Final design will include new radiant heater selection, quantity, placement, and sizing and ensuring proper clearances are maintained between new radiant heaters and other existing equipment (electrical, trucks, truck exhaust systems, etc.).

Contractor will remove and dispose of existing fan coil units in the following areas.

- Truck Bays – remove existing fan coil units and thermostat controls, extend electrical and natural gas line for new radiant units, install new vent stack for new radiant units. Install necessary valves to drain existing hot water piping above ceiling. Drain existing hot water piping to prevent freezing above ceiling.

TC – 6 Building Envelope Modifications – Reduce Infiltration (Additional Optional ECM)

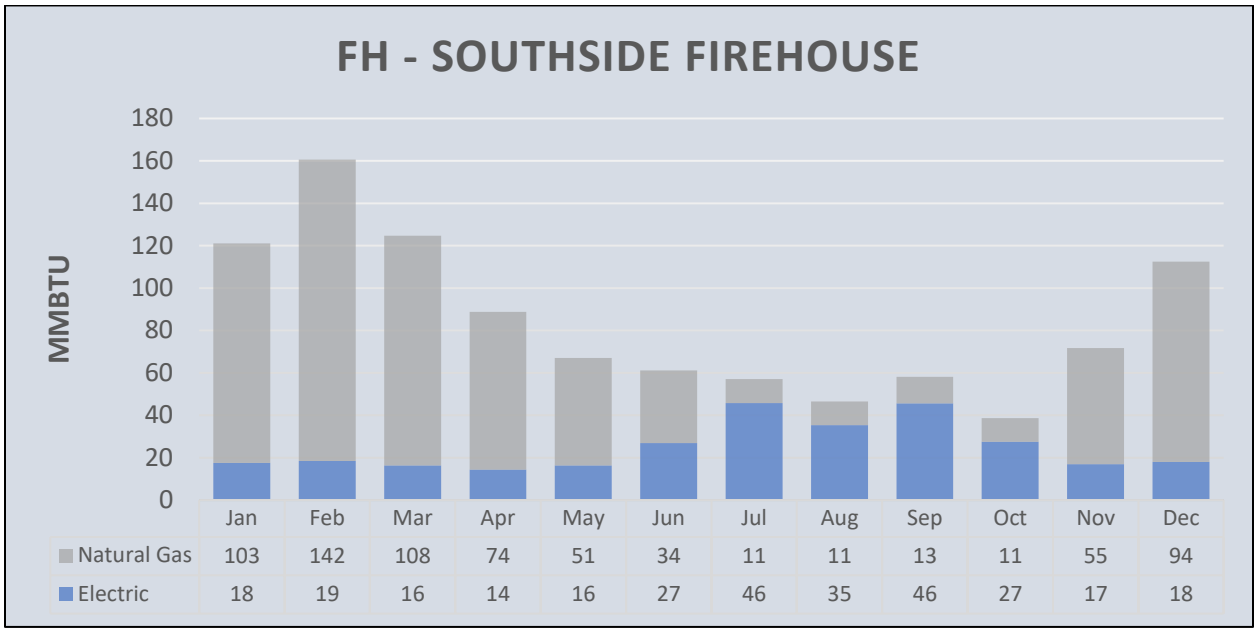
Weatherization scope is to include:

- Provide door maintenance to eleven standard doors
- Weatherstrip eleven doors
- Install eleven sweeps
- Weatherstrip eight garage doors
- Seal the perimeter of the garage doors (two hundred) linear feet

6 – Southside Firehouse

The Southside Firehouse Building is a two (2) story masonry building, constructed in 1964. The building and its systems are generally in fair to good condition. Other than a boiler replacement in 2018 with a non-condensing boiler, there have been few upgrades or system replacements since original construction. Lighting was converted to LED under a recent energy project in 2018.

As part of our ESP effort, ABM reviewed the LGEA Report prepared by TRC in April of 2021. The LGEA reported a baseline energy cost of $21,023 and a Building Energy Use Index (EUI) of usage of 99.0 KBtu/sf for the year 2020. This compares well with the updated energy usage reviewed for the base year 2022 by ABM of 93.3 kBtu/sf (5.7% decrease).



During the ESP development, ABM has completed numerous site visits focusing on the various systems in the building. This includes review of the heating and cooling systems and the associated controls, lighting, backup generation, energy metering and other major systems. ABM prepared an updated inventory of the major systems to account for any significant changes since the LGEA was prepared. The following ECMs were found to be cost effective for this facility, listed, in order of the TC as defined by the DOE.

ECMs recommended for installation under the plan are shown below:

Southside Firehouse	TC-1	Boiler Improvements - Install High Eff. Boiler
Southside Firehouse	TC-6	Building Envelope Modifications - Reduce Infiltration

Additional optional ECMs with higher capital costs include:

Southside Firehouse	TC-3	HVAC Controls - Install Truck Door Heating Lock-Out Controls
Southside Firehouse	TC-4	HVAC Improvements - Replace Window AC Units with High Eff. HVAC
Southside Firehouse	TC-4	HVAC Improvements - Install Radiant Heating Systems

The following sections describe the proposed scopes of work.

TC – 1 Boiler Upgrades – Replace Boilers

Furnish and install a new natural gas fired condensing boiler (Lochinvar or equivalent) to replace the existing Crown boiler in the boiler room. Existing Braford White DHW heater is new and will remain in service.

Existing boiler to be replaced is listed below:

Building	Unit	Manufacturer	Model No.	Size
Southside Firehouse	Boiler	Crown	16H 505	505,000 BTUh (est.)

Contractor is responsible for new boiler selection, sizing and ensuring proper clearances are maintained between new boiler and other existing equipment. The scope of work includes, but is not limited to the following:

- Disconnect the electric and gas service, controls, flue piping and water piping from the existing boiler
- Removal and disposal of the existing boiler
- Installation of the new boiler to provide a properly working system

- New boiler will be of equal (output) capacity of existing boiler
- Necessary piping and piping accessories
- Pipe Insulation on new and other un-insulated piping in the boiler room
- New boiler will include new thermostats, vent pipe, and gas line to meet local code requirements .
- Reconnect electrical service and controls
- Cap existing boiler flue
- Initial water treatment chemicals will be added to the hot water system
- Existing circulating pumps will be reused

Not included in this scope of work:

- Asbestos abatement
- Removal of the existing flue
- Test and balance

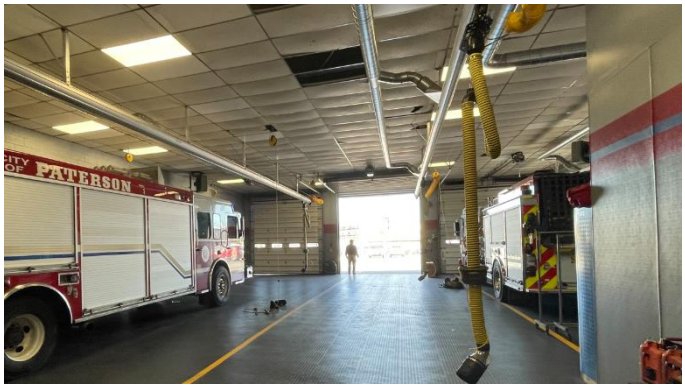
TC – 6 Building Envelope Modifications – Reduce Infiltration

Weatherization scope is to include:

- Provide door maintenance to three (3) standard doors
- Weatherstrip three (3) doors
- Install three (3) sweeps
- Weatherstrip three (3) garage doors
- Seal the perimeter of the garage doors (135) linear feet
- Seal the roof/wall intersection from the exterior (three hundred) linear feet

TC–3 HVAC Controls – Install Truck Door Heating Lock-Out Controls (Additional Optional ECM)

- Install overhead door sensors to determine when the door is open. Connect new door sensors to nearest heater unit. During the heating season, utilize door sensors to prevent the nearest heater units from operating until the door has been closed. Door sensors to be installed on three overhead doors.



TC – 4 HVAC Improvements - Replace window AC Units with High Efficiency HVAC (Additional Optional ECM)

Furnish and install new ductless split system heat pump(s) to replace the existing window AC units. Estimated total tonnage required is 10 tons served by (2) 5-ton condensing units with ten (10) room units either ceiling or wall mounted. New heat pumps will serve the following areas:

- Front office left side– 120 sf (est.)
- Front office right side- 120 sf (est.)
- Kitchen / dining area – 400 sf (est.)
- Living room / TV room – 320 sf (est.)
- Small bedroom upper floor– 120 sf (est.)
- Small bedroom upper floor – 120 sf (est.)
- Bedroom / office – 144 sf (est.)
- Bedroom / office – 144 sf (est.)
- Large bedroom upper floor – 400 sf (est.)

Note that truck bay areas will not be served by new heat pumps.

Existing window AC units to be replaced are listed below:

Building	Unit	Manufacturer	Model No.	Size
Southside Firehouse	Window / Wall AC Office	Friedrich		
Southside Firehouse	Window / Wall AC Office	GE	AKLK08AAG1	8,000 BTUh
Southside Firehouse	Window / Wall AC Office	Friedrich		12,000 BTUh (est)
Southside Firehouse	Window / Wall Living Rm.	Friedrich		18,000 BTUh
Southside Firehouse	Window / Wall Dining Rm.	Frigidaire		12,000 BTUh (est)
Southside Firehouse	Window / Wall BR office.	Frigidaire	FFRE0833S1	8,000 BTUh
Southside Firehouse	Window / Wall BR office.	Frigidaire	FHWW083WB1	8,000 BTUh
Southside Firehouse	Window / Wall BR office.	Frigidaire		8,000 BTUh (est)
Southside Firehouse	Window / Wall BR office.	Frigidaire		8,000 BTUh (est)
Southside Firehouse	Window / Wall Large Bedroom	Frigidaire	FRA256SV2	25,000 BTUh
Southside Firehouse	Window / Wall Large Bedroom	Frigidaire	FFRE1033U10	10,200 BTUh
Southside Firehouse	Window / Wall Large Bedroom	Friedrich		10,000 BTUh (est)

New heat pumps will include new heat pump condenser units mounted on the roof (or other suitable area on rear patio possibly) as well as new ceiling and or wall mounted AHUs, thermostats condensate lines, power, and other components as necessary for a complete and functional system.

Final design will include new heat pump selection, sizing and ensuring code compliance and other permitting requirements. The scope of work includes, but is not limited to the following:

- Structural, mechanical, and electrical engineering as required
- Installation of the new heat pump units to furnish a properly working system
- Furnish and install necessary electrical
- Furnish and install necessary controls
- Furnish start-up, check out and customer training
- Crane service as required
- Rigging of new equipment
- Removal of existing window AC units listed and sealing building opening from removed units
- AHUs shall include bipolar ionization units or other similar air purification systems.

Not included in this scope of work:

- Smoke detector replacement
- Test and balance
- Temporary cooling units
- Asbestos abatement

TC – 4.1 HVAC Upgrades - Install Radiant Heating Systems (Additional Optional ECM)

Furnish and install new natural gas fired radiant tube heaters (Sunstar or equivalent) in the fire truck bay areas to replace the existing ceiling mounted hot water fan coil units.

Existing fan coil units to be replaced are listed below:

Building	Unit	Size
Southside Firehouse	Truck Bay Fan Coil Unit	30,000 BTUh (est.)
Southside Firehouse	Truck Bay Fan Coil Unit	30,000 BTUh (est.)
Southside Firehouse	Truck Bay Fan Coil Unit	30,000 BTUh (est.)

New radiant heaters will include new thermostats, vent pipe, vent caps, end reflectors and gas line.

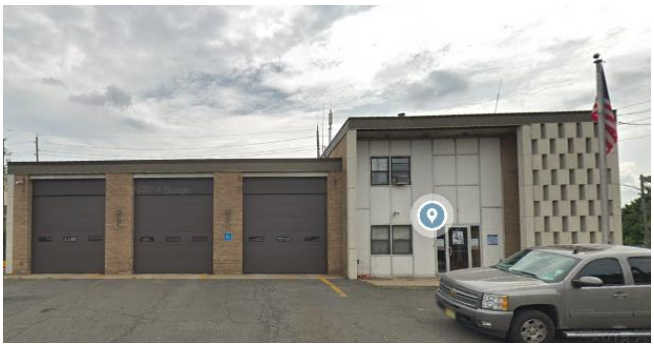
Final design to include new radiant heater selection, quantity, placement, and sizing and ensuring proper clearances are maintained between new radiant heaters and other existing equipment (electrical, trucks, truck exhaust systems, etc.).

Remove and dispose of existing fan coil units in the following areas.

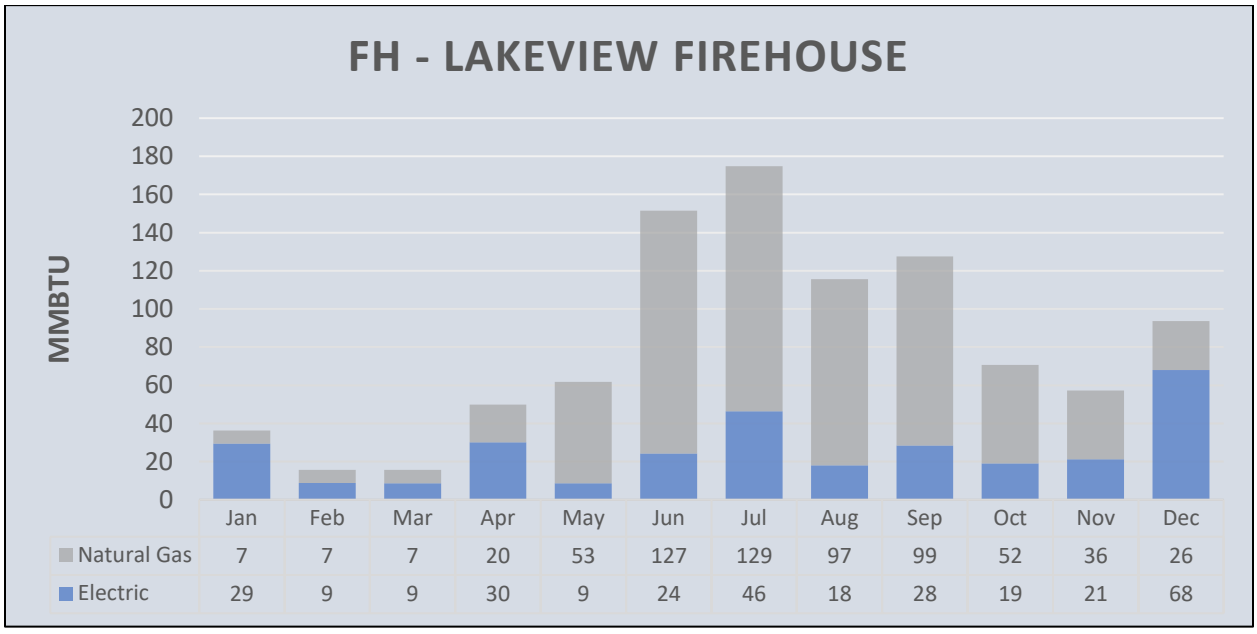
- Truck Bays – remove existing fan coil units and thermostat controls, extend electrical and natural gas line for new radiant units, install new vent stack for new radiant units. Install necessary valves to drain existing hot water piping above ceiling. Drain existing hot water piping to prevent freezing above ceiling.

7 – Lakeview Firehouse

The Lakeview Firehouse Building is a two (2) story masonry building, constructed in 1962. The building and its systems are generally in fair to good condition. Other than a boiler replacement in 2018 with a condensing boiler, there have been few upgrades or system replacements since original construction.



As part of our ESP effort, ABM reviewed the LGEA Report prepared by TRC in April of 2021. The LGEA reported a baseline energy cost of $18,502 and a Building Energy Use Index (EUI) of usage of 75.6 KBtu/sf for the year 2020 This falls out of the expected range compared with the updated energy usage reviewed for the base year 2022 by ABM of 117.1 kBtu/sf (54.9% increase).



During the ESP development, ABM has completed numerous site visits focusing on the various systems in the building. This includes review of the heating and cooling systems and the associated controls, lighting, backup generation, energy metering and other major systems. ABM prepared an updated inventory of the major systems to account for any significant changes since the LGEA was prepared. The following ECMs were found to be cost effective for this facility, listed, in order of the TC as defined by the DOE.

ECMs recommended for installation under the plan are shown below:

Lakeview Firehouse	TC-3	HVAC Controls - Install Truck Door Heating Lock-Out Controls
Lakeview Firehouse	TC-5	Lighting Improvements - LED Upgrades
Lakeview Firehouse	TC-6	Building Envelope Modifications - Reduce Infiltration

Additional optional ECMs with higher capital costs include:

Lakeview Firehouse	TC-4	HVAC Improvements - Install Radiant Heating Systems
Lakeview Firehouse	TC-4	HVAC Improvements - Replace Window AC Units with High Eff. HVAC

The following sections describe the proposed scopes of work.

TC–3 HVAC Controls – Install Truck Door Heating Lock-Out Controls

Install overhead door sensors to determine when the door is open. Connect new door sensors to nearest heater unit. During the heating season, utilize door sensors to prevent the nearest heater units from operating until the door has been closed. Door sensors to be installed on three (3) overhead doors.

TC – 5 Lighting Improvements – LED Upgrades

Lighting at the Lakeview Firehouse consists of mainly fluorescent fixtures, with metal halide fixtures used on the building exterior. Most of these are proposed to be upgraded to LED.

Of the fixtures to be upgraded, most will be retrofitted, and some will be replaced. The summary table below indicates the types of lighting upgrades being performed. The fixtures excluded from this scope are already energy efficient LED.

Contractor will furnish and install the following:

Proposed Lighting Description	Proposed QTY
NEW 1X4 LED FLAT PANEL KIT	15
RETROFIT 4' 2L LED TUBE /SELF BALLAST	1

TC – 6 Building Envelope Modifications – Reduce Infiltration

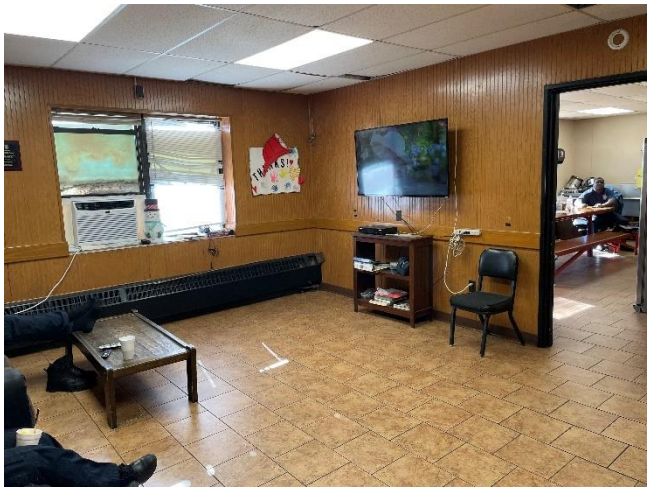
Weatherization scope is to include:

- Provide door maintenance to five (5) standard doors.
- Weatherstrip five (5) doors
- Install five (5) sweeps
- Weatherstrip six (6) garage doors
- Seal the perimeter of the garage doors (165) linear feet
- Seal the roof/wall intersection from the exterior (three hundred) linear feet
- Weatherize one (1) a/c unit

TC – 4 HVAC Improvements - Replace window AC Units with High Efficiency HVAC (Additional Optional ECM)

Furnish and install new ductless split system heat pump(s) to replace the existing window AC units. Estimated total tonnage required is10 tons served by (2) 5-ton condensing units with ten (10) room units either ceiling or wall mounted. New heat pumps will serve the following areas:

- Weight room – 450 sf (est.)
- Living room TV area – 300 sf (est.)
- Kitchen dining - 350 sf (est.)
- Corner bedroom – 120 sf (est.)
- Small office – 100 sf (est.)
- Large bedroom second floor– 750 sf (est.)
- Office – 150 sf (est.)
- Office – 120 sf (est.)
- Bedroom – 100 sf (est.)



Note that truck bay areas will not be served by new heat pumps.

Existing window AC units to be replaced are listed below:

Building	Unit	Manufacturer	Model No.	Size
Lakeview Firehouse	Window / Wall AC Living Rm.	Frigidaire	FFRE1533U___	15,000 BTUh
Lakeview Firehouse	Window / Wall AC Dining Rm .	Friedrich	(Not accessible)	18,000 BTUh (est)
Lakeview Firehouse	Window / Wall AC Bed Rm .	Frigidaire	FFRE0833S1	8,000 BTUh
Lakeview Firehouse	Window / Wall AC .	Friedrich	(Not accessible)	12,000 BTUh (est)
Lakeview Firehouse	Window / Wall AC Lg. Bed Rm 2nd Fl..	Frigidaire	FAS256T2A	25,000 BTUh
Lakeview Firehouse	Window / Wall AC Office.	Friedrich	(Not accessible)	8,000 BTUh (est)
Lakeview Firehouse	Window / Wall AC Office .	Frigidaire	FFRE0833S10	8,000 BTUh

New heat pumps will include new heat pump condenser units mounted on the roof (or other suitable area on rear patio possibly) as well as new ceiling and or wall mounted AHUs, thermostats condensate lines, power, and other components as necessary for a complete and functional system.

Final design will include new heat pump selection, sizing and ensuring code compliance and other permitting requirements. The scope of work includes, but is not limited to the following:

- Structural, mechanical, and electrical engineering as required
- Installation of the new heat pump units to furnish a properly working system
- Furnish and install necessary electrical
- Furnish and install necessary controls
- Furnish start-up, check out and customer training
- Crane service as required
- Rigging of new equipment
- Removal of existing window AC units listed and sealing building opening from removed units
- AHUs shall include outside air capabilities and bipolar ionization units or other similar air purification systems

Not included in this scope of work:

- Smoke detector replacement
- Test and balance
- Temporary cooling units
- Asbestos abatement

TC – 4.1 HVAC Upgrades - Install Radiant Heating Systems (Additional Optional ECM)

Furnish and install new natural gas fired radiant tube heaters (Sunstar or equivalent) in the fire truck bay areas to replace the existing ceiling mounted hot water fan coil units.

Existing fan coil units to be replaced are listed below:

Building	Unit	Size
Lakeview Firehouse	Truck Bay Fan Coil Unit	30,000 BTUh (est.)
Lakeview Firehouse	Truck Bay Fan Coil Unit	30,000 BTUh (est.)
Lakeview Firehouse	Truck Bay Fan Coil Unit	30,000 BTUh (est.)

New radiant heaters will include new thermostats, vent pipe, vent caps, end reflectors and gas line.

Final design will include new radiant heater selection, quantity, placement, and sizing and ensuring proper clearances are maintained between new radiant heaters and other existing equipment (electrical, trucks, truck exhaust systems, etc.).

Remove and dispose of existing fan coil units in the following areas.

- Truck Bays – remove existing fan coil units and thermostat controls, extend electrical and natural gas line for new radiant units, install new vent stack for new radiant units. Install necessary valves to drain existing hot water piping above ceiling. Drain existing hot water piping to prevent freezing above ceiling.

8 – City Hall

The City Hall Building is a three (3) story masonry building, constructed in 1895. The building and its systems are generally in fair to good condition. Other than a replacement steam boiler in 2023, there have been few heating system upgrades since original construction. Several HVAC systems have been installed during various renovations in specific areas. These include the Council Chambers, and IT areas. Most of the other areas are cooled by window units.

As part of our ESP effort, ABM reviewed the LGEA Report prepared by TRC in April of 2021. The LGEA reported a baseline energy cost of $89,067 and a Building Energy Use Index (EUI) of usage of 70.9 KBtu/sf for the year 2020. This compares well with the updated energy usage reviewed for the base year 2022 by ABM of 71.3 kBtu/sf (0.5% increase).

ECMs recommended for installation under the plan are shown below:

City Hall	TC-4	HVAC Improvements - Replace Steam Boiler - replaced in 2023 - Savings Claimed
City Hall	TC-3	HVAC Controls - Install Wi-Fi Thermostats and Boiler Lock-Out Controls
City Hall	TC-4	HVAC Improvements - Replace Council Chambers RTU - to be replaced summer of 2024 - Savings Claimed
City Hall	TC-5	Lighting Improvements - LED Upgrades
City Hall	TC-6	Building Envelope Modifications - Reduce Infiltration

Additional optional ECMs with higher capital costs include:

City Hall	TC-4	HVAC Improvements - Replace Temporary Computer Rm AC Units with High Eff. AC Units

The following sections describe the proposed scopes of work.

TC – 3 HVAC Controls – Install Wi-Fi Thermostats and Boiler Lockout Controls

There are four (4) independent HVAC systems serving the City Hall building, each with its own thermostat. There was no evidence of a comprehensive setback program in place to maintain building temperatures according to building / zone occupancy patterns. DPW staff cannot check status of the systems and setpoints remotely, making it difficult to operate the building efficiently.

ABM will replace the existing thermostats associated with the one (1) boiler, one (1) RTU for Council Chambers, one (1) RTU for the IT area, and one (1) Split System with new digital, BACnet IP enabled programmable, Wi-Fi capable thermostats. New thermostats will be Schneider Electric or equal. These new thermostats require building Wi-Fi (provided by City of Paterson) connectivity to communicate properly.

- Provide/Install/Connect four (4) Wi-Fi enabled BACnet IP thermostats using the City of Paterson Wi-Fi network to connect the devices
- Paterson DPW staff will be able to access the thermostats via their cell phone (City of Paterson IT approval will be needed). This will allow remote access and programming of schedules and setpoints.
- Include passive infrared (occupancy sensor) capability on each new thermostat, for after-hours usage.

Also included is an outside air temperature lock out control which will prevent the steam boiler from operating when outside temperatures rise above a pre-determined (and adjustable) setpoint. This will help to resolve the overheating that was observed during our site visits, where many windows were open, and several window AC units were running during the heating season.

TC – 4.2 HVAC Upgrades – Install New Rooftop Unit for Chamber Hall *(To be completed under emergency replacement in Summer of 2024)*

It is expected this unit will be replaced under an emergency replacement prior to the summer of 2024, therefore, no costs have been included for this ECM in the ESP. ABM has included the energy savings as permitted by the ESIP guidelines.

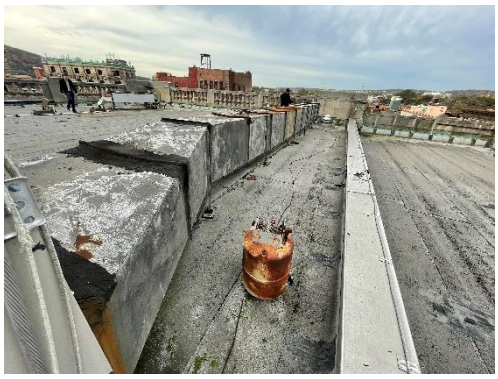
Contractor will replace old rooftop unit (currently cooling only) with a new Rooftop unit having both heating and cooling capability. Estimated total tonnage required is 25 tons. New RTU will serve the following areas:

- Council Chambers 3rd Floor

Existing rooftop unit to be replaced are listed below:

Building	Unit	Manufacturer	Model No.	Size
City Hall	Chambers Rooftop Unit	Lennox	DSSI-C300_00-176-3R	25-tons

A photo of the unit to be replaced is shown below:



New high efficiency heat pump rooftop unit will include new roof mounted ductwork (with weather protection) thermostats, condensate lines, power, and other components as necessary for a complete and functional system.

TC – 5 Lighting Improvements – LED Upgrades

Lighting at the City Hall consists of mainly fluorescent fixtures, with metal halide fixtures used on the building exterior. Most of these are proposed to be upgraded to LED.

Of the fixtures to be upgraded, most will be retrofitted, and some will be replaced. The summary table below indicates the types of lighting upgrades being performed. The fixtures excluded from this scope are already energy efficient LED.

Contractor will furnish and install the following:

Proposed Lighting Description	Proposed QTY
4' STRIP RETROFIT KIT	11
8' STRIP RETROFIT KIT	14
NEW 2X2 LED FLAT PANEL KIT	84
NEW 2X4 LED FLAT PANEL KIT	182
RELAMP 9 WATT LED A LAMP S/I	230

Proposed Lighting Description	Proposed QTY
RETROFIT 2' 2L LED TUBE /SELF BALLAST	1
RETROFIT 4' 2L LED TUBE /SELF BALLAST	33
RETROFIT 4' 4L LED TUBE /SELF BALLAST	91

TC – 6 Building Envelope Modifications – Reduce Infiltration

In addition to the standard weatherization strategies in this building, the elevator room should be de-coupled from the building. There are several openings that create a chimney or stack effect on the structure. These openings should be sealed on reduced in size to reduce heat loss.

Weatherization scope is to include:

- Provide door maintenance to seven (7) standard doors
- Weatherstrip six (6) doors
- Install six (6) sweeps.
- Weatherstrip one (1) interior door leading to elevator room to help de-couple floors
- Install one (1) sweep on interior doors
- Provide weatherization treatment to (50) a/c units.
- Seal openings in elevator room eight (8) square feet.

TC – 4 HVAC Improvements – Install High Efficiency AC Units (Additional Optional ECM)

Furnish and install new AC Unit(s) to replace the existing temporary cooling and other AC units listed below. Estimated total tonnage required is 15 tons served by (3) 5-ton condensing units with four (4) room units either ceiling or wall mounted. New heat pumps will serve the following areas:

- Main computer / copier area – 800 sf (est.)
- Server area – 400 sf (est.)
- Second floor temporary unit town clerk – 100 sf (est.)

Existing temporary AC units to be replaced are listed below:

Building	Unit	Manufacturer	Model No.	Size
City Hall	Main Computer / Copier Area	MOVINCOOL	OfficePro36	36,000 BTUh
City Hall	Main Computer / Copier Area	MOVINCOOL	OfficePro36	36,000 BTUh
City Hall	Server Area	Guardian	RFCX60CP20MP23E	60,000 BTUh (est.)
City Hall	2nd Floor Town Clerk Computer Room	MOVINCOOL	ClassicPlus 26	24,000 BTUh

New heat pumps will include new heat pump condenser unit mounted on the building exterior as well as new ceiling and or wall mounted AHUs, thermostats condensate lines, power, gas lines and other components as necessary for a complete and functional system.

Final design will include new heat pump selection, sizing and ensuring code compliance and other permitting requirements. The scope of work includes, but is not limited to the following:

- Structural, mechanical, and electrical engineering as required
- Installation of the new heat pumps, AC units to furnish a properly working system
- Furnish and install necessary electrical
- Furnish and install necessary controls
- Furnish start-up, check out and customer training
- Rigging of new equipment
- Removal of existing AC units listed above and sealing building openings from removed units
- AHUs shall include bipolar ionization units or other similar air purification systems.

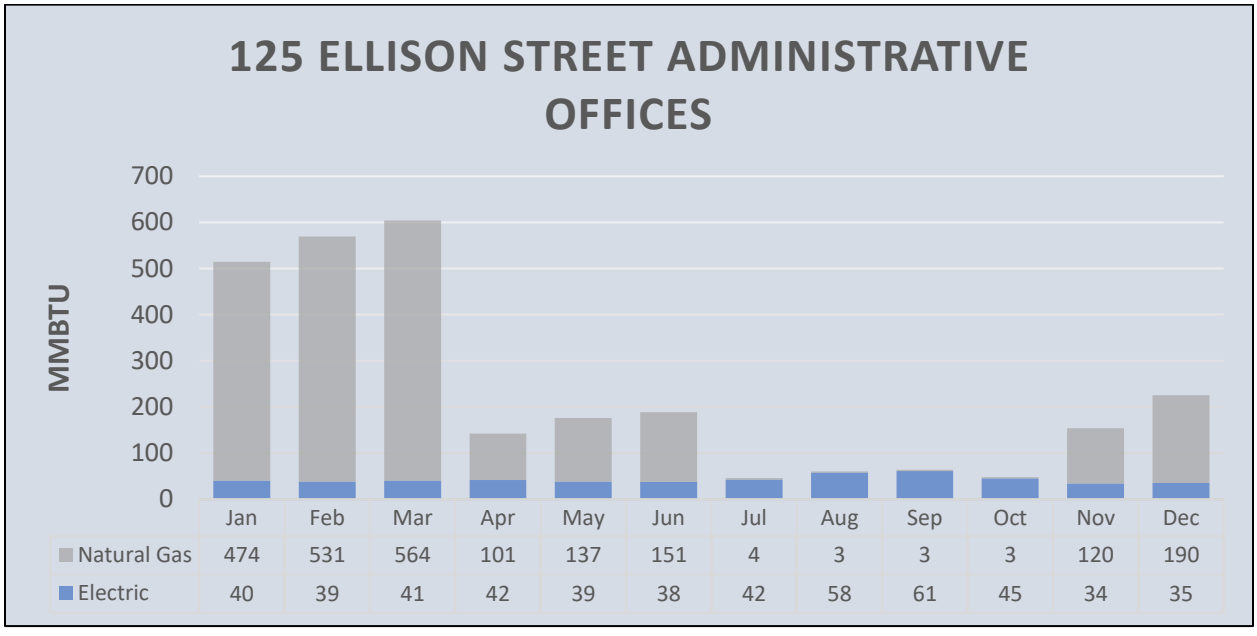
Not included in this scope of work:

- Smoke detector replacement
- Test and balance
- Temporary cooling units
- Asbestos abatement

9 – 125 Ellison Street

The 125 Ellison Street Building is a four (4) story masonry building, constructed in 1903. The building and its systems are generally in fair to good condition. There have been few heating system upgrades since original construction. The steam boiler is due for replacement. Several HVAC systems have been installed during various renovations in specific areas. A few of the older HVAC systems have been abandoned in place and these areas are now served by window AC units. Other areas are also cooled by window units.

As part of our ESP effort, ABM reviewed the LGEA Report prepared by TRC in April of 2021. The LGEA reported a baseline energy cost of $39,645 and a Building Energy Use Index (EUI) of usage of 62.9 KBtu/sf for the year 2020. This compares well with the updated energy usage reviewed for the base year 2022 by ABM of 66.5 kBtu/sf.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Natural Gas	474	531	564	101	137	151	4	3	3	3	120	190
Electric	40	39	41	42	39	38	42	58	61	45	34	35

During the ESP development, ABM has completed numerous site visits focusing on the various systems in the building. This includes review of the heating and cooling systems and the associated controls, lighting, energy metering and other major systems. ABM prepared an updated inventory of the major systems to account for any significant changes since the LGEA was prepared. The following ECMs were found to be cost effective for this facility, listed in order of the TC as defined by the DOE.

ECMs recommended for installation under the plan are shown below:

125 Ellison St. Administrative Offices	TC-3	HVAC Controls - Install WI-FI Thermostats and Boiler Lock-Out Control
125 Ellison St. Administrative Offices	TC-5	Lighting Improvements - LED Upgrades
125 Ellison St. Administrative Offices	TC-6	Building Envelope Modifications - Reduce Infiltration

Additional optional ECMs with higher capital costs include:

125 Ellison St. Administrative Offices	TC-1	Boiler Improvements - Install High Eff. Boiler
125 Ellison St. Administrative Offices	TC-4	HVAC Improvements - Replace Window AC Units with High Eff. HVAC

The following sections describe the proposed scopes of work.

TC – 3 HVAC Controls – Install Wi-Fi Thermostats and Boiler Lockout Controls

There are five (5) independent HVAC systems serving the 125 Ellison Street building, each with its own thermostat. There was no evidence of a comprehensive setback program in place to maintain building temperatures according to building / zone occupancy patterns. DPW staff cannot check status of the systems and setpoints remotely, making it difficult to operate the building efficiently.

ABM will replace the existing thermostats associated with the one (1) boiler and four (4) Carrier HVAC units serving the first floor with new digital, BACnet IP enabled programmable, Wi-Fi capable thermostats. New thermostats will be Schneider Electric or equal. These new thermostats require building Wi-Fi (provided by City of Paterson) connectivity to communicate properly.

- Provide/Install/Connect five (5) Wi-Fi enabled BACnet IP thermostats using the City of Paterson Wi-Fi network to connect the devices.

- Paterson DPW staff will be able to access the thermostats via their cell phone (City of Paterson IT approval will be needed). This will allow remote access and programming of schedules and setpoints.
- Include passive infrared (occupancy sensor) capability on each new thermostat, for after-hours usage.

Also included is an outside air temperature lock out control which will prevent the steam boiler from operating when outside temperatures rise above a pre-determined (and adjustable) setpoint. This will help to resolve the overheating that was observed during our site visits, where many windows were open and several window AC units were running during the heating season.

TC – 5 Lighting Improvements – LED Upgrades

Lighting at the 125 Ellison Street building consists of mainly fluorescent fixtures. Most of these are proposed to be upgraded to LED.

Of the fixtures to be upgraded, most will be retrofitted, and some will be replaced. The summary table below indicates the types of lighting upgrades being performed. The fixtures excluded from this scope are already energy efficient LED.

Contractor will furnish and install the following:

Proposed Lighting Description	Proposed QTY
8' STRIP RETROFIT KIT	1
NEW 1X4 LED FLAT PANEL KIT	44
NEW 2X2 LED FLAT PANEL KIT	33
NEW 2X4 LED FLAT PANEL KIT	196
RELAMP 9 WATT LED A LAMP S/I	36
RETROFIT 4’ 2L LED TUBE /SELF BALLAST	105

TC-6 Building Envelope Modifications – Reduce Infiltration

This is a beautiful old bank in which many of the original features still exists. It has high ceilings on some floors and an open stairwell from the first floor to the top floor. The windows were changed about 20 years ago but many of the seals are broken causing cloudy glass. Windows are not normally an energy item that meets the payback period. Additional funds from another source would be needed to include windows. Two exterior doors on the side of the building looked damaged and were chained together. There is a “pull down” ladder which leads to the attic. An energy lid and weatherstripping will be installed.

Weatherization scope:

- Provide door maintenance to five (5) standard doors.

- Weatherstrip five (5) single doors
- Install five (5) sweeps
- Provide weatherization treatment to thirteen (13) window AC units
- Install an energy lid and weatherstripping on “pull down” stairs to attic

TC – 1 Boiler Upgrades – Replace Boilers (Additional Optional ECM)

Furnish and install a new natural gas fired steam boiler (Rockmills or equivalent) to replace the existing old Rockmills boiler in the basement boiler room. Existing Braford White DHW heater is new and will remain in service.

Existing boiler to be replaced is listed below:

Building	Unit	Manufacturer	Model No.	Serial No.
125 Ellison Street Administrative Offices	Boiler	Rockmills	MP451	9538

Final design will include new boiler selection, sizing and ensuring proper clearances are maintained between new boiler and other existing equipment.

The scope of work includes, but is not limited to the following:

- Disconnect the electrical service, controls, flue piping and water piping from the existing boiler
- Removal and disposal of the existing boiler
- Installation of the new boiler to provide a properly working system
- New boiler will be of equal output capacity of existing boiler
- Necessary piping and piping accessories
- Installation of new flue as necessary to meet local code requirements
- Reconnect electrical service and controls
- Insulation of all new piping and existing un-insulated piping in boiler room

- Initial water treatment chemicals will be added to the steam system
- Supply and install new chemical treatment system for steam boiler system
- Disconnect and reconnect controls
- Provide proper training on new boiler and operation of new chemical treatment system
- Existing condensate tank will be reused
- Not included in this scope of work: Asbestos abatement Test and balance TC – 4 HVAC Improvements – Replace window AC Units with High Efficiency HVAC (Additional Optional ECM)

Furnish and install new ductless split system heat pump(s) to replace the existing window AC units. Estimated total tonnage required is 45 tons served by (9) 5-ton condensing units with thirty-three (33) room units either ceiling or wall mounted. New heat pumps will serve the following areas:

- 2nd floor office areas – 6,500 sf (est.)
- 3rd floor office areas – 6,500 sf (est.)
- 4th floor office areas – 6,500 sf (est.)

Existing window AC units to be replaced are listed below:

Building	Unit	Manufacturer	Size	Total Tons (Est)
125 Ellison Street	2nd Fl. Window AC Units - (11 units)	varies	15,100 Btuh (Ea.)	15 Tons
125 Ellison Street	3rd Fl. Window AC Units – (11 units)	varies	12,000 Btuh (Ea.)	12 Tons
125 Ellison Street	4th Fl. Window AC Units – (11 units)	varies	15,000 Btuh (Ea.)	15 Tons

New heat pumps will include 6 (six) new 8-ton heat pump condenser units mounted on the lower rear roof as well as new ceiling and or wall mounted AHUs, thermostats, condensate lines, power, and other components as necessary for a complete and functional system.

Final design will include new heat pump selection, sizing and ensuring code compliance and other permitting requirements. The scope of work includes, but is not limited to the following:

- Structural, mechanical, and electrical engineering as required
- Installation of the new heat pump units to furnish a properly working system
- Furnish and install necessary electrical

- Furnish and install necessary controls
- Furnish start-up, check out and customer training
- Crane service as required
- Rigging of new equipment
- Removal of existing window AC units listed and sealing building opening from removed units
- AHUs shall include bipolar ionization units or other similar air purification systems.

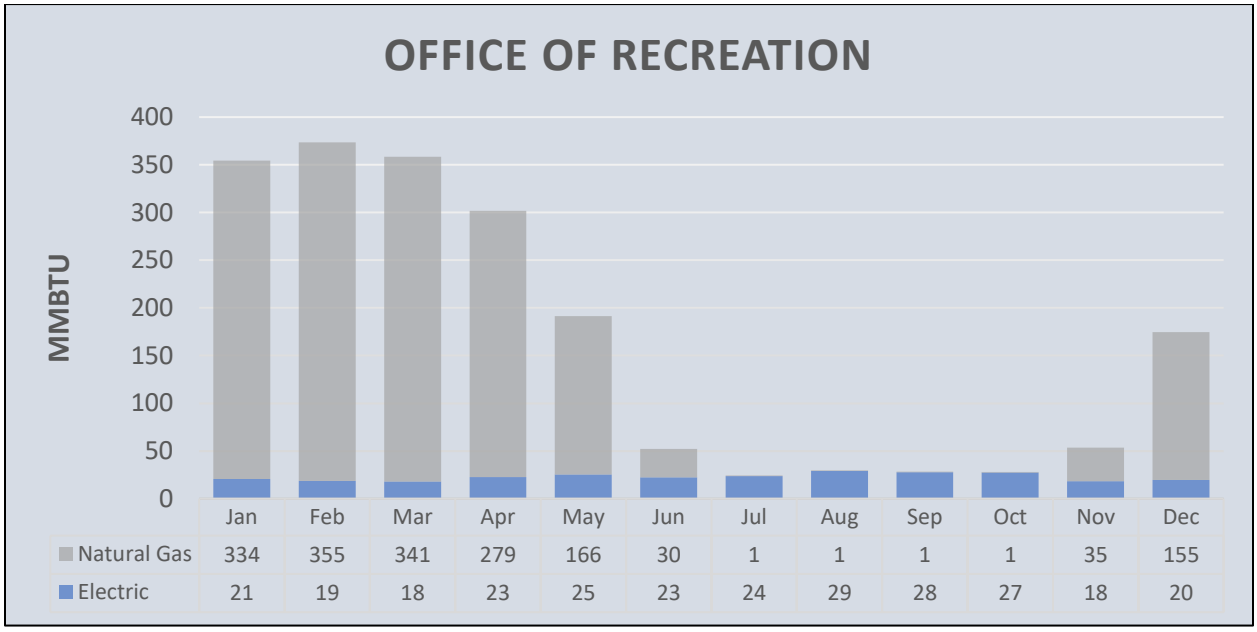
Not included in this scope of work:

- Smoke detector replacement
- Test and balance
- Temporary cooling units
- Asbestos abatement

10 – 133 Ellison Street

The 133 Ellison Street Building is a three (3) story masonry building, constructed in 1895. The building and its systems are generally in fair to good condition. There have been few heating system upgrades since original construction. Several HVAC systems have been installed during various renovations in specific areas. A few of the older HVAC systems have been abandoned in place and these areas are now served by window AC units. Other areas are also cooled by window units.

As part of our ESP effort, ABM reviewed the LGEA Report prepared by TRC in April of 2021. The LGEA reported a baseline energy cost of $24,102 and a Building Energy Use Index (EUI) of usage of 263.5 KBtu/sf for the year 2020. This compares well with the updated energy usage reviewed for the base year 2022 by ABM of 268.2 kBtu/sf (1.8% increase).



During the ESP development, ABM has completed numerous site visits focusing on the various systems in the building. This includes review of the heating and cooling systems and the associated controls, lighting, energy metering and other major systems. ABM prepared an updated inventory of the major systems to account for any significant changes since the LGEA was prepared. The following ECMs were found to be cost effective for this facility, listed in order of the TC as defined by the DOE.

ECMs recommended for installation under the plan are shown below:

Office of Recreation, 133 Ellison St.	TC-3	HVAC Controls - Install WI-FI Thermostats, Boiler Lock-Out
Office of Recreation, 133 Ellison St.	TC-5	Lighting Improvements - LED Upgrades
Office of Recreation, 133 Ellison St.	TC-6	Building Envelope Modifications - Reduce Infiltration

Additional optional ECMs with higher capital costs include:

Office of Recreation, 133 Ellison St.	TC-1	Boiler Improvements - Install High Eff. Boiler
Office of Recreation, 133 Ellison St.	TC-1	Boiler Improvements - Install High Eff. Burner on existing Boiler

The following sections describe the proposed scopes of work.

TC – 3 HVAC Controls – Install WI-FI Thermostats and Boiler Lockout Controls

There are four (4) independent HVAC systems serving the 133 Ellison Street building, each with its own thermostat. There was no evidence of a comprehensive setback program in place to maintain building temperatures according to building / zone occupancy patterns. DPW staff cannot check status of the systems and setpoints remotely, making it difficult to operate the building efficiently.

ABM will replace the existing thermostats associated with the one (1) boiler, three (3) Split Systems with new digital, BACnet IP enabled programmable, Wi-Fi capable thermostats. New thermostats will be Schneider Electric or equal. These new thermostats require building Wi-Fi (provided by City of Paterson) connectivity to communicate properly.

- Provide/Install/Connect four (4) Wi-Fi enabled BACnet IP thermostats using the City of Paterson Wi-Fi network to connect the devices.
- Paterson DPW staff will be able to access the thermostats via their phone (City of Paterson IT approval will be needed). This will allow remote access and programming of schedules and setpoints.
- Include passive infrared (occupancy sensor) capability on each new thermostat, for after-hours usage.
- One (1) thermostat in the rear of the first floor is to also be relocated from the hallway to the other side of the wall so that it senses the temperature inside the space.

Also included is an outside air temperature lock out control which will prevent the steam boiler from operating when outside temperatures rise above a pre-determined (and adjustable) setpoint. This will help to resolve the overheating that was observed during our site visits, where many windows were open and several window AC units were running during the heating season.

TC – 5 Lighting Improvements – LED Upgrades

Lighting at the 133 Ellison Street consists of mainly fluorescent fixtures, with metal halide fixtures used on the building exterior. Most of these are proposed to be upgraded to LED.

Of the fixtures to be upgraded, most will be retrofitted, and some will be replaced. The summary table below indicates the types of lighting upgrades being performed. The fixtures excluded from this scope are already energy efficient LED.

Contractor will furnish and install the following:

Proposed Lighting Description	Proposed QTY
NEW 2X4 LED FLAT PANEL KIT	74
RETROFIT 4’ 2L LED TUBE /SELF BALLAST	21

TC-6 Building Envelope Modifications – Reduce Infiltration

This structure has very little opportunity for Building Envelope upgrades. Much of the structure on the second floor is used as storage and is in disrepair. The third floor appears to be completely abandoned. The first floor has a few working office spaces, and they are sectioned off from the above detailed second and third floor. If the long-term plan is to keep the status quo, then consideration should be given to re-define the thermal boundary utilizing some interior surfaces to separate the unconditioned space from the conditioned office areas.

Weatherization scope:

- Provide door maintenance to four (4) standard doors.
- Weatherstrip four (4) single doors
- Install four (4) sweeps
- Provide weatherization treatment to two (2) window AC units
- Seal open soffit areas (360) square feet
- Provide blower door directed air sealing eight (8) hours

TC – 1 Boiler Improvements – Install High Eff. Boiler (Additional Optional ECM)

Furnish and install a new natural gas fired steam boiler (Smith or equivalent) to replace the existing old Smith boiler in the basement boiler room. Existing A. O. Smith DHW heater is relatively new and will remain in service.

Existing boiler to be replaced is listed below:

Building	Unit	Manufacturer	Model No.	Serial No.	Size
133 Ellison Street Office of Recreation	Boiler	Smith	28A-S/W-07		2,163 MBTUh

Final design will include new boiler selection, sizing and ensuring proper clearances are maintained between new boiler and other existing equipment.

The scope of work includes, but is not limited to the following:

- Disconnect the electrical service, controls, flue piping and water piping from the existing boiler
- Removal and disposal of the existing boiler
- Installation of the new boiler to provide a properly working system
- New boiler will be of equal capacity of existing boilers
- Necessary piping and piping accessories
- Installation of new flue as necessary to meet local code requirements
- Reconnect electrical service and controls
- Insulation of all new piping and existing un-insulated piping in boiler room
- Initial water treatment chemicals will be added to the steam system

- Supply and install new chemical treatment system for steam boiler system
- Disconnect and reconnect controls
- Provide proper training on new boiler and operation of new chemical treatment system
- Existing condensate tank will be reused

Not included in this scope of work:

- Asbestos abatement
- Test and balance

TC – 1 Boiler Improvements – Install High Eff. Burner on Existing Boiler (Additional Optional ECM)

New burners offer energy savings through improved combustion efficiency. Additionally, cost savings will be achieved by avoiding future replacement costs and reducing maintenance requirements of the burners and boilers.

Scope to include:

- Assist with boiler shutdown and isolation
- Pipe, valves, and fittings for gas and oil work
- Miscellaneous wiring and connectors for electrical work
- Remove and replace existing burner, gas trains, control panels, and oil pumps
- Furnish all labor to install gas piping and oil piping
- Inspect work for leaks
- Furnish all labor to install electrical components for new burners and accessories
- Assist manufacturer technician with commissioning of new burners and ensure
- Proper operation of components installed
- Project management and on-site support as required

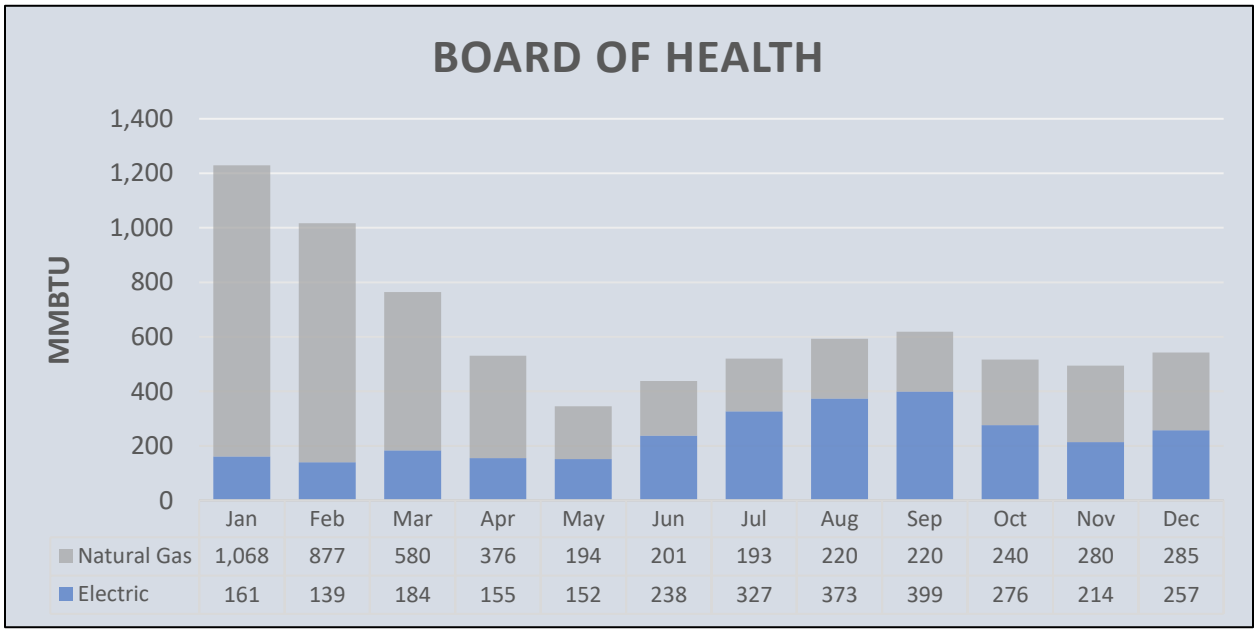
Standard Equipment and Trim

✓ Automatic fuel changeover	✓ Control circuit transformer with fuses
✓ Blower motor	✓ Siemens LMV-3 parallel positioning linkageless controls, AZL display
✓ Spark ignited gas pilot and pilot gas train	✓ Modbus interface
✓ Main gas train – Siemens vent-less type-factory pre-piped and wired	✓ Terminal strip, control switch, alarm buzzer and silencing switch
✓ Main & leak test cocks, high & low gas pressure switches, main gas pressure regulator-integral	✓ Color coded wiring, control circuit fuse
✓ Motorized main and auxiliary gas valves	✓ Siemens RWF-50 load control with sensor
✓ Remote mount oil pump	✓ Boiler water sensor and well for warm up
✓ Dual oil SSO valves and nozzle assembly	✓ Bottom gas inlet
✓ Oil strainer, pressure and compound gauges snubbers and petcocks.	✓ Relays for break glass, gas detection, comb air damper/fan, remote enable
✓ Remote pedestal mounted control panel	✓ Power flame ladder wiring diagrams
✓ Main disconnect switch, motor starters with circuit breakers for blower, oil pump	✓ DC-4 sequence draft control, actuator and linkage
✓ Burner mounting plate with refractory-field welding required	

11 – Board of Health Building

The Board of Health Building is a two (2) story masonry building, constructed in 1980. The building and its systems are generally in fair to good condition. The original boilers were replaced with a modular boiler system in 2010. The air conditioning system on the roof is failing and in need of replacement. It is estimated that only two (2) of the eight (8) refrigeration compressor units are operating, and other compressors have failed. Other areas are cooled by rooftop AC units and a few window units in selected areas.

As part of our ESP effort, ABM reviewed the LGEA Report prepared by TRC in April of 2021. The LGEA reported a baseline energy cost of $154,683 and a Building Energy Use Index (EUI) of usage of 208.5 KBtu/sf for the year 2020. This EUI is much higher than other buildings and is likely due to the building HVAC control systems are not operational. Heating control valves on the many constant volume boxes appear to be stuck open, resulting in overheating in many areas on the second floor. Other areas on the first floor are typically cold. This falls in the expected range compared with the updated energy usage reviewed for the base year 2022 by ABM of 195.1 kBtu/sf (6.4% decrease).



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Natural Gas	1,068	877	580	376	194	201	193	220	220	240	280	285
Electric	161	139	184	155	152	238	327	373	399	276	214	257

During the ESP development, ABM has completed numerous site visits focusing on the various systems in the building. This includes review of the heating and cooling systems and the associated controls, lighting, energy metering and other major systems. ABM prepared an updated inventory of the major

systems to account for any significant changes since the LGEA was prepared. The ECMs were found to be cost effective for this facility, listed in order of the TC as defined by the DOE.

ECMs recommended for installation under the plan are shown below:

Board of Health	TC-3	HVAC Controls - Install New DDC Control System
Board of Health	TC-4	HVAC Improvements - Replace Rooftop DX Units
Board of Health	TC-5	Lighting Improvements - LED Upgrades
Board of Health	TC-6	Building Envelope Modifications - Reduce Infiltration

Additional optional ECMs with higher capital costs include:

Board of Health	TC-4	HVAC Improvements - Convert Constant Volume System to VAV
Board of Health	TC-10	Distributed Generation - Install Cogeneration System

The following sections describe the proposed scopes of work.

TC-3 - HVAC Controls – Install New DDC Control System:

The existing control system is reported to be not operational, and the building overheats regularly on the second floors. First floor areas are reported as typically being too cold in the winter. Hot water valves in reheat boxes were observed to be in the open position due to failed valve actuators. Outside air dampers on the AHUs were observed to be closed, leading to a negative air pressure in the building, and poor indoor air quality. Ductwork has several holes above the ceilings from previous work that need to be patched. Access doors on air boxes are missing in many cases leading to additional air leaks above the ceiling.

The following scope is proposed:

- Baseline test and balance air and water system to document existing conditions
- 64 hours labor (two men, four days) to find and patch failed ductwork and missing access doors throughout building
- Replace other HW valve actuators at AHUs and other locations
- Install new fully functional BAS
  - All new thermostats
  - Implement OSA economizer controls
  - Implement demand control ventilation
  - Implement HW reset and boiler lock-out controls
  - Implement temperature setback / Optimal St/St
- Investigate Environmental Health area on first floor to address inadequate heating
  - Add 30’ of fin tube (clamp on) to radiation pipes along perimeter to address cold spots
- Post installation air and water systems test and balance

TC – 4.2 HVAC Upgrades – Install New Rooftop DX Units

Furnish and install two (2) new rooftop DX units to replace existing old Rooftop DX units. Estimated total tonnage required is 200 tons (2 DX units at 100-tons each). New DX units will serve the following equipment:

- AHU-1 –located on roof
- AHU-2 –located on roof

Existing DX unit to be replaced are listed below:

Building	Unit	Manufacturer	Model No.	Size
Board of Health	Rooftop DX	York	YCUL01000#C17XCADBTX…..	100-tons
Board of Health	Rooftop DX	York	YCUL0100EC17XCADBTX….	100-tons

A photo of the units to be replaced is shown in Figure 1.

Figure 1

New high efficiency Rooftop DX Units will include new refrigerant piping to AHUs, power, control interface, and other components as necessary for a complete and functional system.

Final design will include new DX Unit selection, sizing and ensuring code compliance and other permitting requirements.

The scope of work includes, but is not limited to the following:

- Structural, mechanical, and electrical engineering as required
- Disconnect electrical, controls, and other components
- Removal of existing Rooftop DX Units listed
- Disposal of removed Rooftop DX Units
- Installation of the new Rooftop DX Units to furnish a complete and properly working system
- Furnish and install curb adapter
- Furnish and install necessary electrical
- Furnish and install necessary controls
- Furnish start-up, check out and customer training
- Crane service as required
- Rigging of new equipment
- Coordination with roofing contractor to maintain warranty on roof

Not included in this scope of work:

- Smoke detector replacement
- Temporary cooling units
- Unforeseen conditions under the roof line
- Roofing service
- Asbestos abatement

TC – 5 Lighting Improvements – LED Upgrades

Lighting at the Board of Health building consists of mainly fluorescent fixtures, with metal halide fixtures used on the building exterior. Most of these are proposed to be upgraded to LED.

Of the fixtures to be upgraded, most will be retrofitted, and some will be replaced. The summary table below indicates the types of lighting upgrades being performed. The fixtures excluded from this scope are already energy efficient LED.

Contractor will furnish and install the following:

Proposed Lighting Description	Proposed QTY
4' STRIP RETROFIT KIT	44
8' STRIP RETROFIT KIT	1
NEW 2X2 LED FLAT PANEL KIT	64
NEW 2X4 LED FLAT PANEL KIT	275
NEW LED FLOOD 50 WATT	5
NEW LED SHOEBOX LOT 70 WATT ARM	6
RELAMP 9 WATT LED A LAMP S/I	14
RETROFIT 2’ 2L LED TUBE /SELF BALLAST	14
RETROFIT 3’ 2L LED TUBE /SELF BALLAST	2
RETROFIT 4’ 2L LED TUBE /SELF BALLAST	90
RETROFIT 4’ 4L LED TUBE /SELF BALLAST	2

TC-6 Building Envelope Modifications – Reduce Infiltration

This structure is a newer building with a flat metal panning roof, the roof/wall intersection appears to be sprayed however much of the spray is missing and therefore not considered sealed at the roof/wall intersection. The windows are in poor condition, soffits appear to be open to the interior the temperature increases the higher you travel inside the building, De-coupling the floors by weatherization techniques sealing the soffits would greatly reduce energy costs and increase comfort.

The photo to the right is an interior photo of the open side of the soffit. The wind, stack and mechanical pressures placed on this structure affect the comfort in all parts of the building, the combination of an air leaky roof/wall intersection and these large openings at the soffits are major issues with air exchange in the structure, This affects temperature, insect and moisture migration as well as run time on heating and cooling equipment.

Weatherization scope:

- Provide door maintenance to (15) standard doors
- Weatherstrip three (3) single doors
- Install three (3) sweeps
- Install sweeps on twelve (12) interior doors
- Weatherstrip one (1) garage door
- Provide weatherization treatment to eight (8) window AC units
- Seal open soffit areas (360) square feet
- Provide blower door directed air sealing (4) hours

TC – 4 HVAC Improvements – Convert Constant Volume to VAV (Additional Optional ECM)

Energy efficiency, improved occupant comfort and cost savings can be achieved by converting the constant volume reheat boxes in the building to variable air volume (VAV) boxes. This will include new hot water coils and control valves at the boxes to provide adequate shut off. Existing hot water valves are reported to be unable to close properly, leading to overheating of the building in many areas.

Also included will be variable speed drives (VSDs) to control the supply and return fans, and associated duct static pressure controls.

TC – 10 Distributed Generation - Install Cogeneration System (Additional Optional ECM)

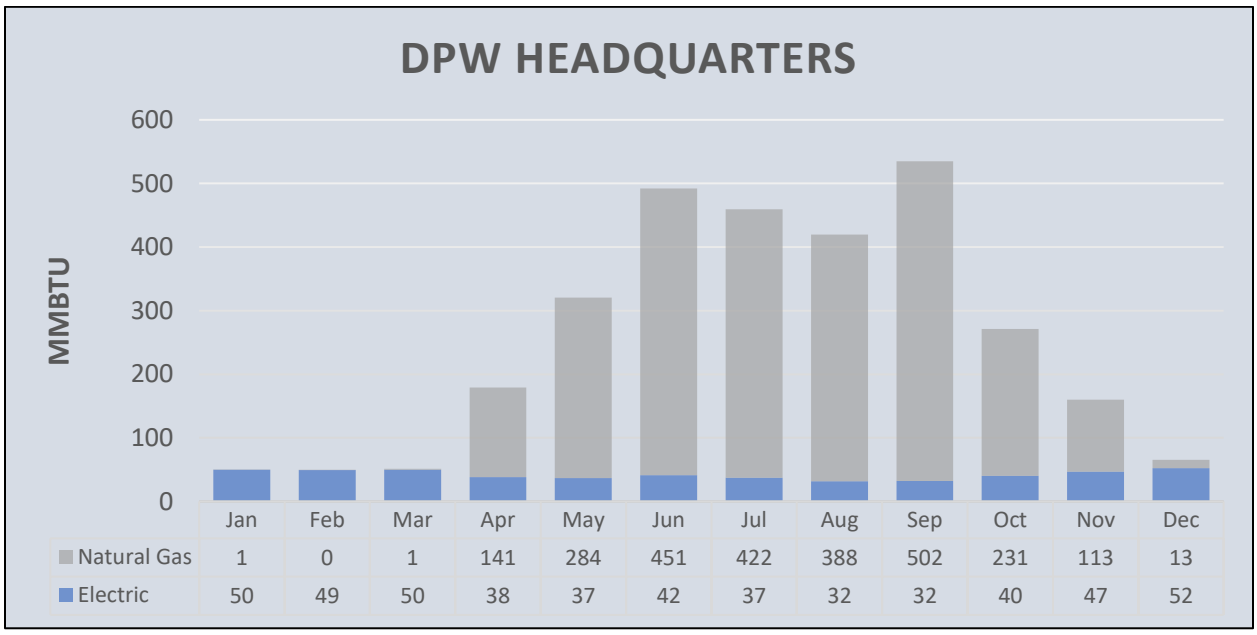
Energy efficiency and cost savings can be generated by the installation of two micro cogeneration system. The systems to be installed shall be AXIOM mCHP – natural gas fired 4.4 kW cogeneration unit or equivalent. Also included will be two 120-gallon DHW buffer tanks.

Complete installation shall include final design, utility interconnection coordination and all components for a fully functional cogeneration system.

12 – DPW Headquarters

The DPW Headquarters Building is a single-story masonry building, constructed in 1988. The building and its systems are generally in good condition. The building garage areas are heated using gas fired unit heaters, with a small boiler for the office areas. office areas are cooled by split system AC units and a few window units in selected areas.

As part of our ESP effort, ABM reviewed the LGEA Report prepared by TRC in April of 2021. The LGEA reported a baseline energy cost of $43,910 and a Building Energy Use Index (EUI) of usage of 147.4 KBtu/sf for the year 2020. This usage compares well with the updated energy usage reviewed for the base year 2022 by ABM of 152.7 kBtu/sf (3.6% increase).



During the ESP development, ABM has completed numerous site visits focusing on the various systems in the building. This includes review of the heating and cooling systems and the associated controls, lighting, energy metering and other major systems. ABM prepared an updated inventory of the major systems to account for any significant changes since the LGEA was prepared. The following ECMs were found to be cost effective for this facility, listed in order of the TC as defined by the DOE.

ECMs recommended for installation under the plan are shown below:

DPW Headquarters	TC-1	Boiler Improvements - Install High Eff. Boiler
DPW Headquarters	TC-3	HVAC Controls - Install WI-FI Thermostats
DPW Headquarters	TC-5	Lighting Improvements - LED Upgrades
DPW Headquarters	TC-6	Building Envelope Modifications - Reduce Infiltration

Additional optional ECMs with higher capital costs include:

DPW Headquarters	TC-4	HVAC Improvements - Install Radiant Heating Systems

The following sections describe the proposed scopes of work.

TC – 1 Boiler Upgrades – Replace Boiler

Furnish and install a new natural gas fired condensing boiler (Lochinvar or equivalent) to replace the existing Crown boiler in the boiler room.

Existing boiler to be replaced is listed below:

Building	Unit	Manufacturer	Model No.	Serial No.	Size
DPW Headquarters	Boiler	Crown	BWF061ENST2PSU	B000616388	51,000 BTUh

Contractor is responsible for new boiler selection, sizing and ensuring proper clearances are maintained between new boiler and other existing equipment. The scope of work includes, but is not limited to the following:

- Disconnect the electrical service, controls, flue piping and water piping from the existing boiler
- Removal and disposal of the existing boiler

- Installation of the new boilers to provide a properly working system
- New boiler will be of equal output capacity of existing boiler
- Necessary piping and piping accessories
- Installation of new flue as necessary to meet local code requirements
- Reconnect electrical service and controls
- Insulation of all new piping and existing un-insulated piping in boiler room
- Initial water treatment chemicals will be added to the hot water system
- Disconnect and reconnect controls

Not included in this scope of work:

- Asbestos abatement
- Removal of the existing flue
- Existing circulating pumps will be reused
- Test and balance

TC – 3 HVAC Controls – Install WI-FI Thermostats

There are three (3) independent HVAC systems serving the DPW Headquarters building, each with its own thermostat. There was no evidence of a comprehensive setback program in place to maintain building temperatures according to building / zone occupancy patterns. DPW staff cannot check status of the systems and setpoints remotely, making it difficult to operate the building efficiently.

ABM will replace the existing thermostats associated with the one (1) boiler, two (2) split systems with new digital, BACnet IP enabled programmable, Wi-Fi capable thermostats. New thermostats will be Schneider Electric or equal. These new thermostats require building Wi-Fi (provided by City of Paterson) connectivity to communicate properly.

- Provide/Install/Connect three (3) Wi-Fi enabled BACnet IP thermostats using the City of Paterson Wi-Fi network to connect the devices.
- Paterson DPW staff will be able to access the thermostats via their phone (City of Paterson IT approval will be needed). This will allow remote access and programming of schedules and setpoints.
- Include passive infrared (occupancy sensor) capability on each new thermostat, for after-hours usage.

TC – 5 Lighting Improvements – LED Upgrades

Lighting at the DPW Headquarters consists of mainly fluorescent fixtures, with LED fixtures used on the building exterior. Most of the interior lights are proposed to be upgraded to LED. Exterior lights were

observed to be operational during the day. Also included will be repairs to the photocells to correct this excess energy usage.

Of the fixtures to be upgraded, most will be retrofitted, and some will be replaced. The summary table below indicates the types of lighting upgrades being performed. The fixtures excluded from this scope are already energy efficient LED.

Contractor will furnish and install the following:

Proposed Lighting Description	Proposed QTY
8' STRIP RETROFIT KIT	2
NEW 2X2 LED FLAT PANEL KIT	3
NEW 2X4 LED FLAT PANEL KIT	2
NEW LED FLOOD LOT 140 W ADJ KNUCKLE	1
RETROFIT 4’ 2L LED TUBE /SELF BALLAST	6

TC-6 Building Envelope Modifications – Reduce Infiltration

This structure has many energy saving opportunities, doors need to be weather-stripped and the roof/wall intersection needs to be sealed.

Weatherization scope:

- Provide door maintenance to three (3) standard doors
- Weatherstrip three (3) single doors
- Install three (3) sweeps.
- Weatherstrip seven (7) large garage doors
- Weatherstrip three (3) small garage doors
- Seal the roof/wall intersection (600) linear feet

TC–3 HVAC Controls – Install Truck Door Heating Lock-Out Controls (Additional Optional ECM)

- Install overhead door sensors to determine when the door is open. Connect new door sensors to nearest heater unit. During the heating season, utilize door sensors to prevent the nearest heater units from operating until the door has been closed. Door sensors to be installed on ten (10) overhead doors (seven on side, three on back side).

TC – 4.1 HVAC Upgrades - Install Radiant Heating Systems (Additional Optional ECM)

Furnish and install new natural gas fired radiant tube heaters (Sunstar or equivalent) in the truck bay areas to replace the existing gas fired unit heaters.

Existing unit heaters to be replaced are listed below:

Building	Unit	Manufacturer	Size
DPW Headquarters	Front 2 Bays Unit Heater above mezzanine		275,000 BTUh (est.)
DPW Headquarters	Front 2 Bays Unit Heater	Reznor	250,000 BTUh (est.)
DPW Headquarters	Second 2 Bays Unit Heater	Reznor	250,000 BTUh (est.)
DPW Headquarters	Third triple Bay Unit Heater	Reznor	175,000 BTUh (est.)
DPW Headquarters	Third triple Bay Unit Heater	Reznor	250,000 BTUh (est.)
DPW Headquarters	Rear Bay Unit Heater Parts area		120,000 BTUh (est.)
DPW Headquarters	Rear Bay Unit Heater above mezzanine		75,000 BTUh (est.)

New radiant heaters will include new vent pipe, vent caps, end reflectors and gas line.

Final design will include new radiant heater selection, quantity, placement, and sizing and ensuring proper clearances are maintained between new radiant heaters and other existing equipment (electrical, trucks, truck exhaust systems, etc.).

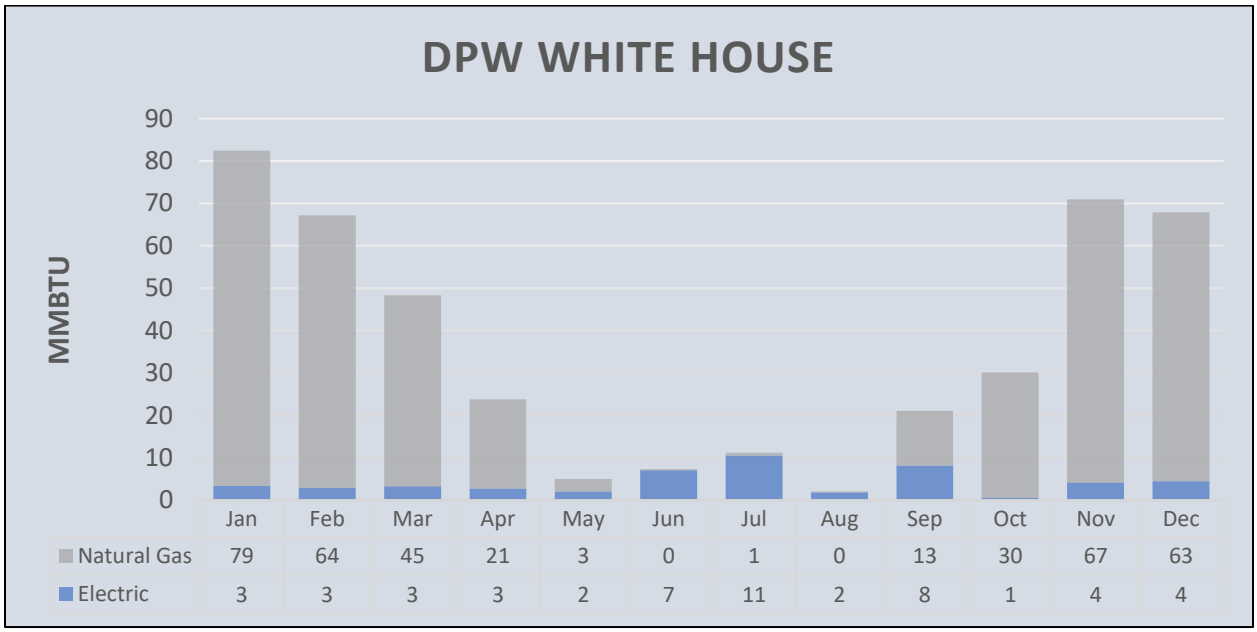
Contractor will remove and dispose of existing unit heaters in the following areas:

- Truck Bays and greenhouse area – remove gas-fired unit heaters, cap off or reuse / extend electrical and natural gas line for new radiant units, cap off or re-use vent stack for new radiant units, disconnect and reconnect electrical or provide new for each heater.

13 – DPW White House

The DPW White House Building is a two (2) story wood frame building. Built originally as a residence, the building was constructed in the 1800s. The building and its systems are generally in fair to good condition. The building is heated using a small boiler located in the basement. office areas are cooled by window units in selected areas.

As part of our ESP effort, ABM reviewed the LGEA Report prepared by TRC in April of 2021. The LGEA reported a baseline energy cost of $5,869 and a Building Energy Use Index (EUI) of usage of 87.4 KBtu/sf for the year 2020. This falls out of the expected range compared with the updated energy usage reviewed for the base year 2022 by ABM of 103.4 kBtu (18.4% increase).



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Natural Gas	79	64	45	21	3	0	1	0	13	30	67	63
Electric	3	3	3	3	2	7	11	2	8	1	4	4

During the ESP development, ABM has completed numerous site visits focusing on the various systems in the building. This includes review of the heating and cooling systems and the associated controls, lighting, energy metering and other major systems. ABM prepared an updated inventory of the major systems to account for any significant changes since the LGEA was prepared. The following ECMs were found to be cost effective for this facility, listed in order of the TC as defined by the DOE.

ECMs recommended for installation under the plan are shown below:

DPW White House	TC-3	HVAC Controls - Install WI-FI Thermostats
DPW White House	TC-5	Lighting Improvements - LED Upgrades
DPW White House	TC-6	Building Envelope Modifications - Reduce Infiltration

Additional optional ECMs with higher capital costs include:

DPW White House	TC-1	Boiler Improvements - Install High Eff. Boiler

The following sections describe the proposed scopes of work.

TC – 3 HVAC Controls – Install Wi-Fi Thermostats

There is one (1) boiler serving the DPW White House building, with one (1) thermostat. There was no evidence of a comprehensive setback program in place to maintain building temperatures according to building / zone occupancy patterns. DPW staff cannot check status of the systems and setpoints remotely, making it difficult to operate the building efficiently.

ABM will replace the existing thermostat associated with the one (1) boiler with new digital, BACnet IP enabled programmable, Wi-Fi capable thermostat. New thermostat will be Schneider Electric or equal. This new thermostat will require building Wi-Fi (provided by City of Paterson) connectivity to communicate properly.

- Provide/Install/Connect one (1) Wi-Fi enabled BACnet IP thermostats using the City of Paterson Wi-Fi network to connect the devices.
- Paterson DPW staff will be able to access the thermostats via their phone (City of Paterson IT approval will be needed). This will allow remote access and programming of schedules and setpoints.
- Include passive infrared (occupancy sensor) capability on each new thermostat, for after-hours usage.

TC – 5 Lighting Improvements – LED Upgrades

Lighting at the DPW White House consists of mainly fluorescent fixtures. Most of these are proposed to be upgraded to LED.

Of the fixtures to be upgraded, most will be retrofitted, and some will be replaced. The summary table below indicates the types of lighting upgrades being performed. The fixtures excluded from this scope are already energy efficient LED.

Contractor will furnish and install the following:

Proposed Lighting Description	Proposed QTY
RELAMP 2 WATT CANDLE S/I	30
RETROFIT 4’ 2L LED TUBE /SELF BALLAST	12

TC-6 Building Envelope Modifications – Reduce Infiltration

This structure is a historical residence not far from the above DPW Headquarters. This structure can benefit by the use of blower door directed air sealing.

Weatherization scope:

- Provide door maintenance to three (3) standard doors
- Weatherstrip three (3) single doors
- Install three (3) sweeps
- Provide weatherization treatment to three (3) window AC units
- Install one (1) attic hatch and weatherstrip
- Blower door directed air sealing (6) hours

TC – 3.1 Boiler Upgrades – Replace Boilers (additional Optional ECM)

Contractor will furnish and install a new natural gas fired condensing boiler (Lochinvar or equivalent) to replace the existing Slant Fin boiler in the basement.

Existing boiler to be replaced is listed below:

Building	Unit	Manufacturer	Model No.	Serial No.	Size
DPW Whitehouse	Boiler	Slant Fin	S-150 DP	S0062668	125,000 BTUhp

Contractor is responsible for new boiler selection, sizing and ensuring proper clearances are maintained between new boiler and other existing equipment. The scope of work includes, but is not limited to the following:

- Disconnect the electrical service, controls, flue piping and water piping from the existing boiler
- Removal and disposal of the existing boiler
- Installation of the new boilers to provide a properly working system
- New boiler will be of equal output capacity of existing boiler
- Necessary piping and piping accessories
- Installation of new flue as necessary to meet local code requirements
- Reconnect electrical service and controls
- Cap existing flue
- Insulation of new piping and existing un-insulated piping in basement area
- Initial water treatment chemicals will be added to the hot water system

- Disconnect and reconnect controls
- Existing circulating pumps will be reused

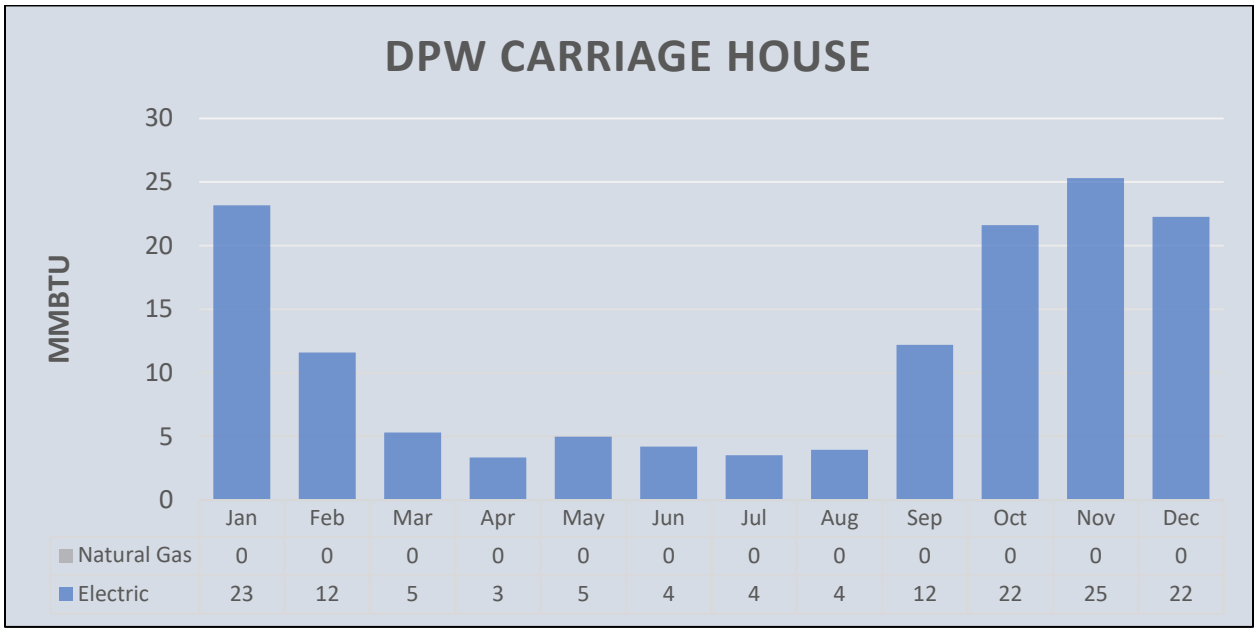
Not included in this scope of work:

- Asbestos abatement
- Removal of the existing flue
- Test and balance

14 – DPW Carriage House

The DPW Carriage House Building is a single-story wood frame building, with a partial stone facade. Built originally as a carriage house, the building was constructed in approximately 1905. The building is currently used as the office areas for the DPW facilities staff, and its systems are generally in good condition. The building is heated using electric unit heaters located in the ceiling of the conference room. Conference areas and office areas are cooled by window units.

As part of our ESP effort, ABM reviewed the LGEA Report prepared by TRC in April of 2021. The LGEA reported a baseline energy cost of $6,028 and a Building Energy Use Index (EUI) of usage of 76.0 KBtu/sf for the year 2020. This usage compares well with the updated energy usage reviewed for the base year 2022 by ABM of 73.7 kBtu/sf (3.0% decrease).



During the ESP development, ABM has completed numerous site visits focusing on the various systems in the building. This includes review of the heating and cooling systems and the associated controls, lighting, energy metering and other major systems. ABM prepared an updated inventory of the major systems to account for any significant changes since the LGEA was prepared. The following ECMs were found to be cost effective for this facility, listed in order of the TC as defined by the DOE.

ECMs recommended for installation under the plan are shown below:

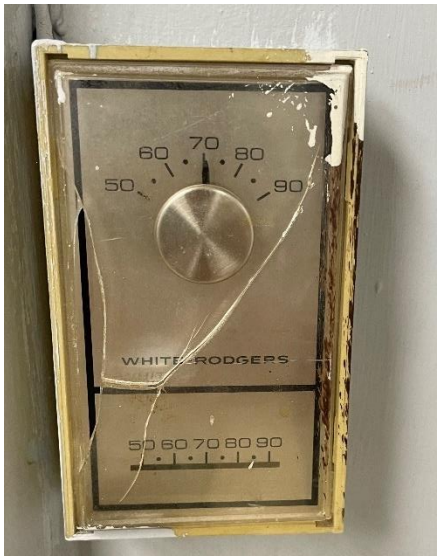
DPW Carriage House	TC-3	HVAC Controls - Install Wi-Fi Thermostats
DPW Carriage House	TC-5	Lighting Improvements - LED Upgrades
DPW Carriage House	TC-6	Building Envelope Modifications - Reduce Infiltration

Additional optional ECMs with higher capital costs include:

DPW Carriage House	TC-4	HVAC Improvements - Install Heat pumps

The following sections describe the proposed scopes of work.

TC – 3 HVAC Controls – Install Wi-Fi Thermostats



There are two electric unit heaters serving the DPW Carriage House building, with one (1) thermostat. There was no evidence of a comprehensive setback program in place to maintain building temperatures according to building / zone occupancy patterns. DPW staff cannot check status of the systems and setpoints remotely, making it difficult to operate the building efficiently.

ABM will replace the existing thermostat associated with the unit heaters with new digital, BACnet IP enabled programmable, Wi-Fi capable thermostat. New thermostat will be Schneider Electric or equal. This new thermostat will require building Wi-Fi (provided by City of Paterson) connectivity to communicate properly.

- Provide/Install/Connect one (1) Wi-Fi enabled BACnet IP thermostats using the City of Paterson Wi-Fi network to connect the devices.
- Paterson DPW staff will be able to access the thermostats via their phone (City of Paterson IT approval will be needed). This will allow remote access and programming of schedules and setpoints.
- Include passive infrared (occupancy sensor) capability on each new thermostat, for after-hours usage.

TC – 5 Lighting Improvements – LED Upgrades

Lighting at the DPW Carriage House consists of mainly fluorescent fixtures. Most of these are proposed to be upgraded to LED.

Of the fixtures to be upgraded, most will be retrofitted, and some will be replaced. The summary table below indicates the types of lighting upgrades being performed. The fixtures excluded from this scope are already energy efficient LED.

Contractor will furnish and install the following:

Proposed Lighting Description	Proposed QTY
RETROFIT 2’ 2L LED TUBE /SELF BALLAST/REFL	1
RETROFIT 4’ 2L LED TUBE /SELF BALLAST	8
RETROFIT 4’ 4L LED TUBE /SELF BALLAST	5

TC-6 Building Envelope Modifications – Reduce Infiltration

This structure can benefit by weatherstripping, and the use of blower door directed air sealing.

Weatherization scope:

- Provide door maintenance to three (3) standard doors
- Weatherstrip three (3) single doors
- Install three (3) sweeps
- Provide weatherization treatment to one (1) window AC units
- Install (1) attic hatch and weatherstrip
- Blower door directed air sealing three hours

TC – 4 HVAC Improvements - Replace window AC Units with High Efficiency HVAC (Additional Optional ECM)

Furnish and install new ductless split system heat pump(s) to replace the existing window AC units. Estimated total tonnage required is 3 tons served by (1) 3-ton condensing unit with three (3) room units either ceiling or wall mounted. New heat pumps will serve the following areas:

- Main room conference table – 400 sf (est.)
- Rear office area – 100 sf (est.)
- Rear office area – 100 sf (est.)

Existing window AC units and electric unit heaters to be replaced are listed below:

Building	Unit	Manufacturer	Size
DPW Carriage House	Electric Unit Heaters (2)	Qmark	4 kW (est.)
DPW Carriage House	Electric Unit Heater (1)	Dayton	4 kW (est.)
DPW Carriage House	Main Room Window AC Unit	Frigidaire	12,000 Btu (est.)

New heat pumps will include new heat pump condenser unit mounted on the building exterior as well as new ceiling and or wall mounted AHUs, thermostats condensate lines, power, gas lines and other components as necessary for a complete and functional system.

Final design will include new heat pump selection, sizing and ensuring code compliance and other permitting requirements. The scope of work includes, but is not limited to the following:

- Structural, mechanical, and electrical engineering as required
- Installation of the new gas fired heat pump units to furnish a properly working system

- Furnish and install necessary electrical
- Furnish and install necessary controls
- Furnish start-up, check out and customer training
- Rigging of new equipment
- Removal of existing window AC units and electric unit heaters listed and sealing building opening from removed units
- AHUs shall include bipolar ionization units or other similar air purification systems

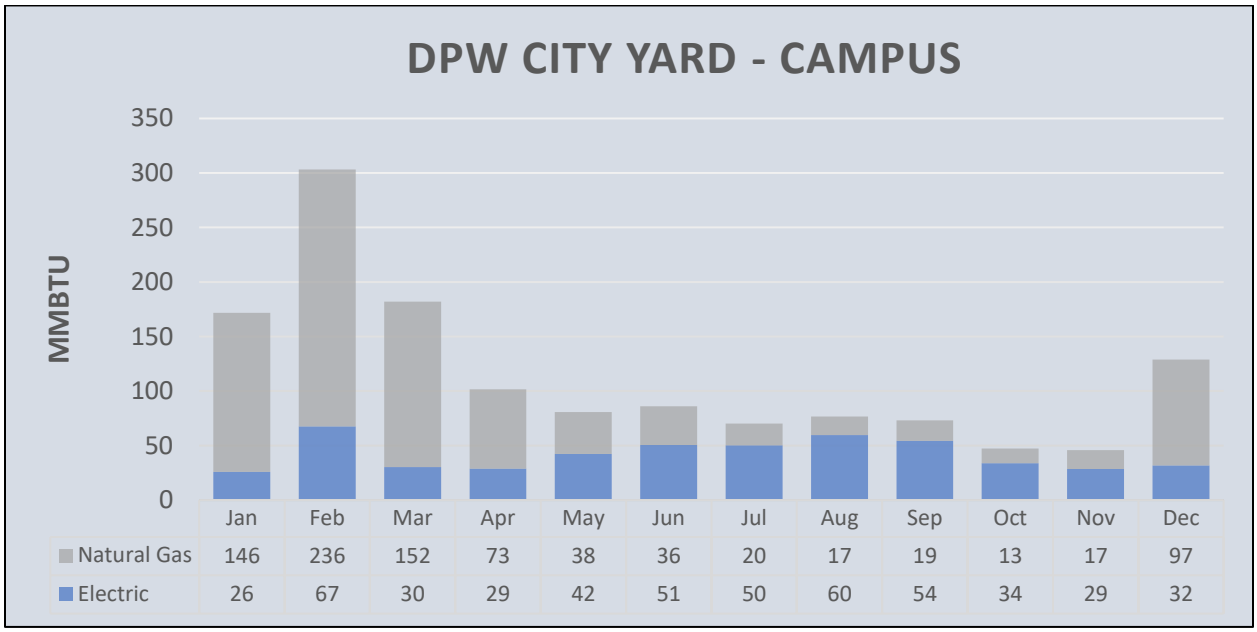
Not included in this scope of work:

- Smoke detector replacement
- Test and balance
- Temporary cooling units
- Asbestos abatement

15 – DPW City Yard

The DPW City Yard facility has three (3) singe-story masonry frame buildings, with a small second floor area on two (2) of the buildings. The buildings vary in age, with the two (2) older buildings built in the early 1900s, and the newest building built in 1989. The buildings and its systems are generally in fair to good condition. The buildings are heated using gas-fired unit heaters, with some gas-fired radiant heaters in the newer building truck bay areas. Small office areas are cooled by window units.

As part of our ESP effort, ABM reviewed the LGEA Report prepared by TRC in April of 2021. The LGEA reported a baseline energy cost of $24,992 and a Building Energy Use Index (EUI) of usage of 75.2 KBtu/sf for the year 2020. This falls out of the expected range compared with the updated energy usage reviewed for the base year 2022 by ABM of 98.4 kBtu/sf (30.8% increase).



During the ESP development, ABM has completed numerous site visits focusing on the various systems in the building. This includes review of the heating and cooling systems and the associated controls, lighting, energy metering and other major systems. ABM prepared an updated inventory of the major systems to account for any significant changes since the LGEA was prepared. The following ECMs were found to be cost effective for this facility, listed in order of the TC as defined by the DOE.

From the review of historical bills during the utility analysis it was revealed there are three (3) natural gas meters serving the main offices, old garage, and new garage, respectively. The gas meter serving the old garage (account #: 695833370 and meter #: 5088392) is on an expensive Large Volume Service (LVG) rate structure – but has no gas usage. If the City of Paterson were to decommission this meter, they could realize an annual savings of $2,022 at the current rate. It is recommended to reach out to PSE&G and shut off the account.

ECMs recommended for installation under the plan are shown below:

DPW City Yard	TC-3	HVAC Controls - Install Wi-Fi Thermostats
DPW City Yard	TC-5	Lighting Improvements - LED Upgrades
DPW City Yard	TC-6	Building Envelope Modifications - Reduce Infiltration

No additional ECMs were found feasible.

The following sections describe the proposed scopes of work.

TC – 3 HVAC Controls – Install Wi-Fi Thermostats

There are several independent heating units serving the DPW City Yard building, each with its own thermostat. There was no evidence of a comprehensive setback program in place to maintain building temperatures according to building / zone occupancy patterns. DPW staff cannot check status of the systems and setpoints remotely, making it difficult to operate the building efficiently.

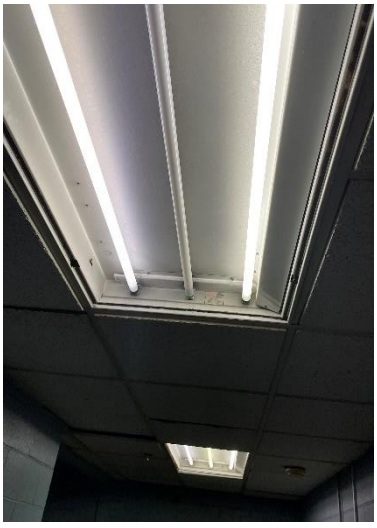
ABM will replace the existing thermostats associated with the unit heater systems with new digital, BACnet IP enabled programmable, Wi-Fi capable thermostats. New thermostats will be Schneider Electric or equal. These new thermostats require building Wi-Fi (provided by City of Paterson) connectivity to communicate properly.

- Provide/Install/Connect two (2) Wi-Fi enabled BACnet IP thermostats using the City of Paterson Wi-Fi network to connect the devices.
- Paterson DPW staff will be able to access the thermostats via their phone (City of Paterson IT approval will be needed). This will allow remote access and programming of schedules and setpoints.
- Include passive infrared (occupancy sensor) capability on each new thermostat, for after-hours usage.

TC – 5 Lighting Improvements – LED Upgrades

Lighting at the DPW Yard consists of mainly fluorescent fixtures, with metal halide fixtures used on the building exterior. Most of these are proposed to be upgraded to LED.

Of the fixtures to be upgraded, most will be retrofitted, and some will be replaced. The summary table below indicates the types of lighting upgrades being performed. The fixtures excluded from this scope are already energy efficient LED.



Contractor will furnish and install the following:

Proposed Lighting Description	Proposed QTY
8' STRIP RETROFIT KIT	15
NEW LED WALL PACK 55 WATT	2
NEW 2X4 LED FLAT PANEL KIT	15
NEW LED FLOOD 30 WATT	15
NEW LED FLOOD LOT 140 W ADJ KNUCKLE	5
NEW LED HIGH BAY 105 WATT	12
RELAMP 9 WATT LED A LAMP S/I	12
RETROFIT 4’ 2L LED TUBE /SELF BALLAST	1

TC-6 Building Envelope Modifications – Reduce Infiltration

This main building structure can benefit by weatherstripping.

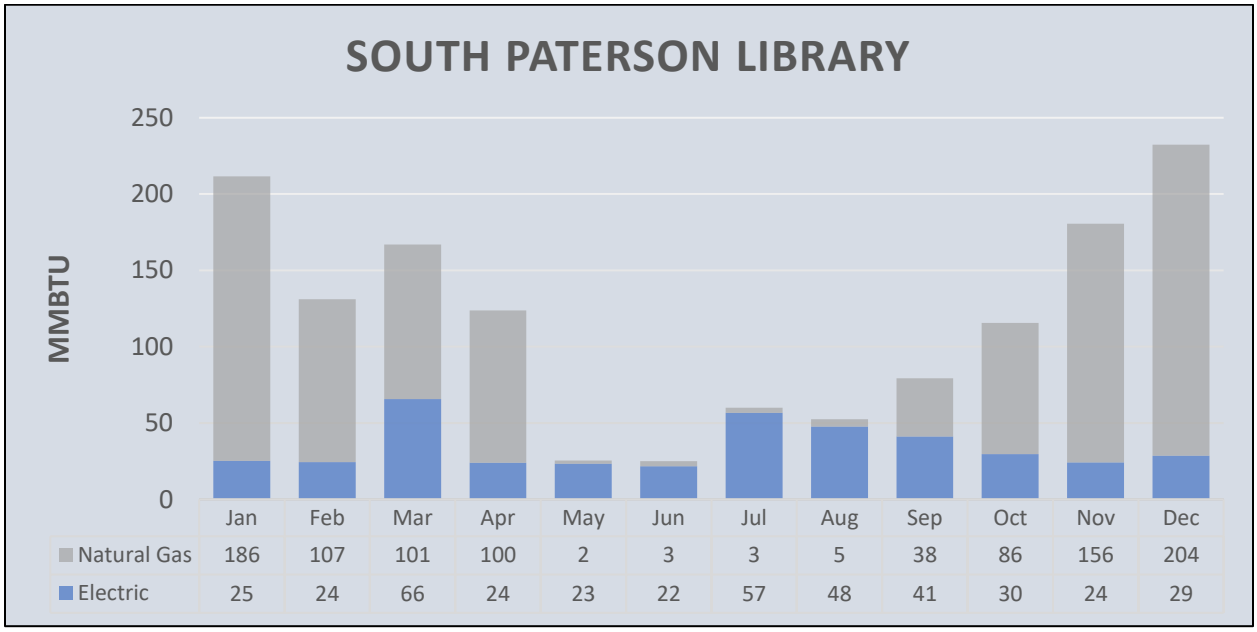
Weatherization scope:

- Provide door maintenance to three (3) standard doors.
- Weatherstrip three (3) single doors
- Install three (3) sweeps
- Weatherstrip two (2) garage doors
- Provide weatherization treatment to four (4) window AC units

16 – South Paterson Library

The South Paterson Library is a two (2) story masonry building, constructed in 1970. The building and its systems are generally in fair to good condition. The building is heated and cooled using gas-fired rooftop units, located on the roof (serving the second floor) and slab on grade areas in the rear of the building, serving the first floor.

As part of our ESP effort, ABM reviewed the LGEA Report prepared by TRC in April of 2021. The LGEA reported a baseline energy cost of $23,294 and a Building Energy Use Index (EUI) of usage of 104.4 KBtu/sf for the year 2020. This falls out of the expected range compared with the updated energy usage reviewed for the base year 2022 by ABM of 138.3 kBtu/sf (32.5% increase).



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Natural Gas	186	107	101	100	2	3	3	5	38	86	156	204
Electric	25	24	66	24	23	22	57	48	41	30	24	29

During the ESP development, ABM has completed numerous site visits focusing on the various systems in the building. This includes review of the heating and cooling systems and the associated controls, lighting, energy metering and other major systems. ABM prepared an updated inventory of the major systems to account for any significant changes since the LGEA was prepared. The following ECMs were found to be cost effective for this facility, listed in order of the TC as defined by the DOE.

ECMs recommended for installation under the plan are shown below:

South Paterson Library	TC-3	HVAC Controls - Install Wi-Fi Thermostats
South Paterson Library	TC-5	Lighting Improvements - LED Upgrades
South Paterson Library	TC-6	Building Envelope Modifications - Reduce Infiltration

Additional optional ECMs with higher capital costs include:

South Paterson Library	TC-4	HVAC Improvements - Replace Rooftop Units

The following sections describe the proposed scopes of work.

TC – 3 HVAC Controls – Install Wi-Fi Thermostats

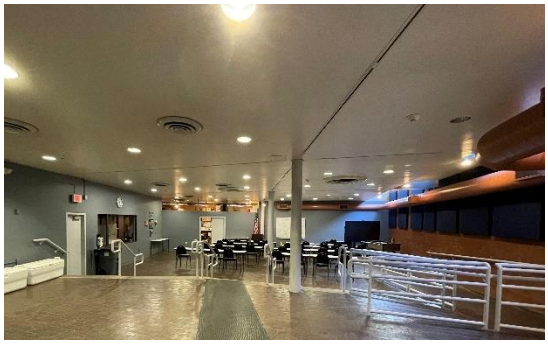
There are two (2) independent HVAC systems serving the South Paterson library building, each with its own thermostat. There was no evidence of a comprehensive setback program in place to maintain building temperatures according to building / zone occupancy patterns. DPW staff cannot check status of the systems and setpoints remotely, making it difficult to operate the building efficiently.

ABM will replace the existing thermostats associated with the two (2) rooftop unit systems with new digital, BACnet IP enabled programmable, Wi-Fi capable thermostats. New thermostats will be Schneider Electric or equal. These new thermostats require building Wi-Fi (provided by City of Paterson) connectivity to communicate properly.

- Provide/Install/Connect two (2) Wi-Fi enabled BACnet IP thermostats using the City of Paterson Wi-Fi network to connect the devices.
- Paterson DPW staff will be able to access the thermostats via their phone (City of Paterson IT approval will be needed). This will allow remote access and programming of schedules and setpoints.
- Include passive infrared (occupancy sensor) capability on each new thermostat, for after-hours usage.

TC – 5 Lighting Improvements – LED Upgrades

Lighting at the South Paterson library consists of mainly fluorescent fixtures, with metal halide fixtures used on the building exterior. Most of these are proposed to be upgraded to LED.



Of the fixtures to be upgraded, most will be retrofitted, and some will be replaced. The summary table below indicates the types of lighting upgrades being performed. The fixtures excluded from this scope are already energy efficient LED.

Contractor will furnish and install the following:

Proposed Lighting Description	Proposed QTY
4' STRIP RETROFIT KIT	20
NEW LED WALL PACK 37 W PHOTO CELL	8
RELAMP 9 WATT LED A LAMP S/I	158
RETROFIT 4’ 2L LED TUBE /SELF BALLAST	79
RETROFIT 4’ 4L LED TUBE /SELF BALLAST	1

TC – 6 Building Envelope Modifications – Reduce Infiltration

Weatherization scope is to include:

- Provide door maintenance to three (3) standard doors
- Weatherstrip three (3) doors
- Install three (3) sweeps
- Weatherstrip one (1) garage door
- Seal soffit areas (200) linear feet
- Seal the roof/wall (410) linear feet
- Install three (3) access hatches in soffit areas
- Blower door directed air sealing four (4) hours

TC – 4.2 HVAC Upgrades – Install New Rooftop Units (Additional Optional ECM)

Contractor will replace 1 old rooftop unit with new rooftop unit. Estimated total tonnage required is 26 tons. New RTUs will serve the following areas:

- Upper floor – 5,000 sf (est.)

Existing Rooftop units to be replaced are listed below:

Building	Unit	Manufacturer	Model No.	Size
South Paterson Library	Roof Mounted RTU	Jackson & Church	KGM-50-263-MZ3-MBR	26 Tons

A photo of the unit to be replaced is shown to the right:

New high efficiency rooftop unit will include new thermostats, condensate lines, power, gas lines and other components as necessary for a complete and functional system.

Final design will include new rooftop unit selection, sizing and ensuring code compliance and other permitting requirements. The scope of work includes, but is not limited to the following:

- Structural, mechanical, and electrical engineering as required
- Test and balance existing system prior to removal and document existing conditions
- Disconnect electrical, controls, ductwork, and other components
- Removal of existing rooftop units listed and sealing roof opening from removed units
- Disposal of removed rooftop units
- Installation of the new Rooftop Units to furnish a complete and properly working system
- Furnish and install curb adapters
- Furnish and install necessary gas piping
- Furnish and install necessary electrical
- Furnish and install necessary controls
- Furnish and install necessary ductwork and transitions
- Furnish start-up, check out and customer training
- Crane service as required

- Rigging of new equipment
- Test and balance new system and document conditions
- New rooftop unit shall include bipolar ionization units or other similar air purification systems.
- Coordination with roofing contractor to maintain warranty on roof

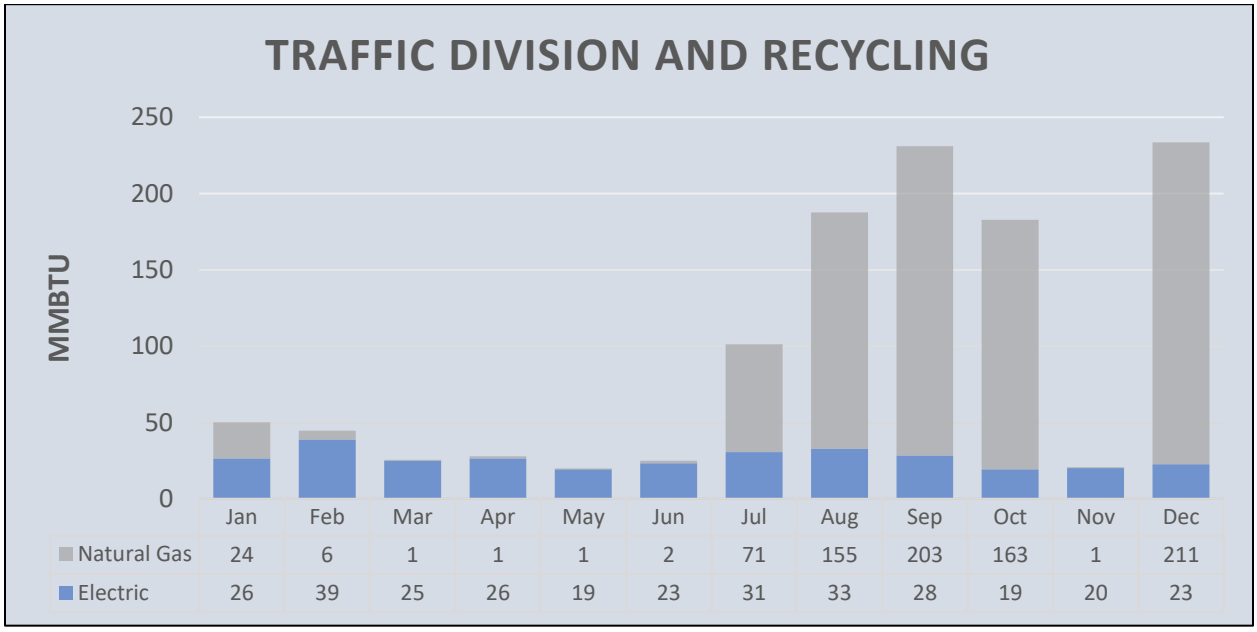
Not included in this scope of work:

- Smoke detector replacement
- Temporary cooling units
- Unforeseen conditions under the roof line
- Roofing service
- Asbestos abatement

17 – Traffic Division and Recycling

The Traffic Division and Recycling facility is a single-story masonry building, constructed in 1984. The building and its systems are generally in good condition. The building office areas are heated and cooled using gas-fired rooftop units. Shop and garage areas are heated using gas-fired unit heaters, with window AC units in selected areas.

As part of our ESP effort, ABM reviewed the LGEA Report prepared by TRC in April of 2021. The LGEA reported a baseline energy cost of $29,170 and a Building Energy Use Index (EUI) of usage of 166.0 KBtu/sf for the year 2020. This falls out of the expected range compared with the updated energy usage reviewed for the base year 2022 by ABM of 112.7 kBtu/sf (32.1% decrease).



During the ESP development, ABM has completed numerous site visits focusing on the various systems in the building. This includes review of the heating and cooling systems and the associated controls, lighting, energy metering and other major systems. ABM prepared an updated inventory of the major systems to account for any significant changes since the LGEA was prepared. The following ECMs were found to be cost effective for this facility, listed in order of the TC as defined by the DOE.

ECMs recommended for installation under the plan are shown below:

Traffic Division and Recycling	TC-3	HVAC Controls - Install WI-FI Thermostats

Traffic Division and Recycling	TC-5	Lighting Improvements - LED Upgrades
Traffic Division and Recycling	TC-6	Building Envelope Modifications - Reduce Infiltration
Traffic Division and Recycling	TC-20	Roof Repairs

Additional optional ECMs with higher capital costs include:

Traffic Division and Recycling	TC-3	HVAC Controls - Install Truck Door Heating Lock-Out Controls

The following sections describe the proposed scopes of work.

TC – 3 HVAC Controls – Install Wi-Fi Thermostats

There are five (5) independent HVAC systems serving the Traffic Division and Recycling building, each with its own thermostat. There was no evidence of a comprehensive setback program in place to maintain building temperatures according to building / zone occupancy patterns. DPW staff cannot check status of the systems and setpoints remotely, making it difficult to operate the building efficiently.

ABM will replace the existing thermostats associated with the five (5) rooftop unit and split systems with new digital, BACnet IP enabled programmable, Wi-Fi capable thermostats. New thermostats will be Schneider Electric or equal. These new thermostats require building Wi-Fi (provided by City of Paterson) connectivity to communicate properly.

- Provide/Install/Connect five (5) Wi-Fi enabled BACnet IP thermostats using the City of Paterson Wi-Fi network to connect the devices.
- Paterson DPW staff will be able to access the thermostats via their phone (City of Paterson IT approval will be needed). This will allow remote access and programming of schedules and setpoints.
- Include passive infrared (occupancy sensor) capability on each new thermostat, for after-hours usage.

TC – 5 Lighting Improvements – LED Upgrades

Lighting at the Traffic Division and Recycling building consists of mainly fluorescent fixtures, with metal halide fixtures used on the building exterior. Most of these are proposed to be upgraded to LED.

Of the fixtures to be upgraded, most will be retrofitted, and some will be replaced. The summary table below indicates the types of lighting upgrades being performed. The fixtures excluded from this scope are already energy efficient LED.

Contractor will furnish and install the following:

Proposed Lighting Description	Proposed QTY
4' STRIP RETROFIT KIT	8
8' STRIP RETROFIT KIT	27
NEW 2X2 LED FLAT PANEL KIT	2
NEW 2X4 LED FLAT PANEL KIT	16
RETROFIT 2' 2L LED TUBE /SELF BALLAST	2
RETROFIT 4' 2L LED TUBE /SELF BALLAST	3

TC-6 Building Envelope Modifications – Reduce Infiltration

This is a masonry building with a metal-panning roof. There is a curved section of glass blocks which created a very cold (in winter) and hot (in summer) office area.

Weatherization scope:

- Provide door maintenance to three (3) standard doors
- Weatherstrip three (3) single doors
- Install three (3) sweeps
- Weatherstrip one (1) roof hatch
- Provide weatherization treatment to two (2) window AC units
- Install an energy wall at soffit areas (300) square feet
- Seal the roof wall intersection (800) linear feet
- Weatherstrip three (3) garage doors

- Provide blower door directed air sealing eight (8) hours

TC – 20 Roofing Improvements – Replace Lower Front Section of Roof

The scope of work for this roof includes:

- Remove roof system to the structural deck
- Thoroughly inspect the decking and repair as necessary
- Attached R-30 minimum, 1/4" tapered insulation to the structural decking according to wind uplift requirements
- Adhere a 1/2" gypsum coverboard
- Replace internal drain bowls with new cast iron assemblies
- Install a 2-ply mineral-surfaced modified roof system in cold adhesive
- Install 2-ply flashings
- Install new aluminum coping, flashless metal edge, and trim
- Provide 25 year No Dollar Limit (NDL) warranty

TC–3 HVAC Controls – Install Truck Door Heating Lock-Out Controls (Additional Optional ECM)

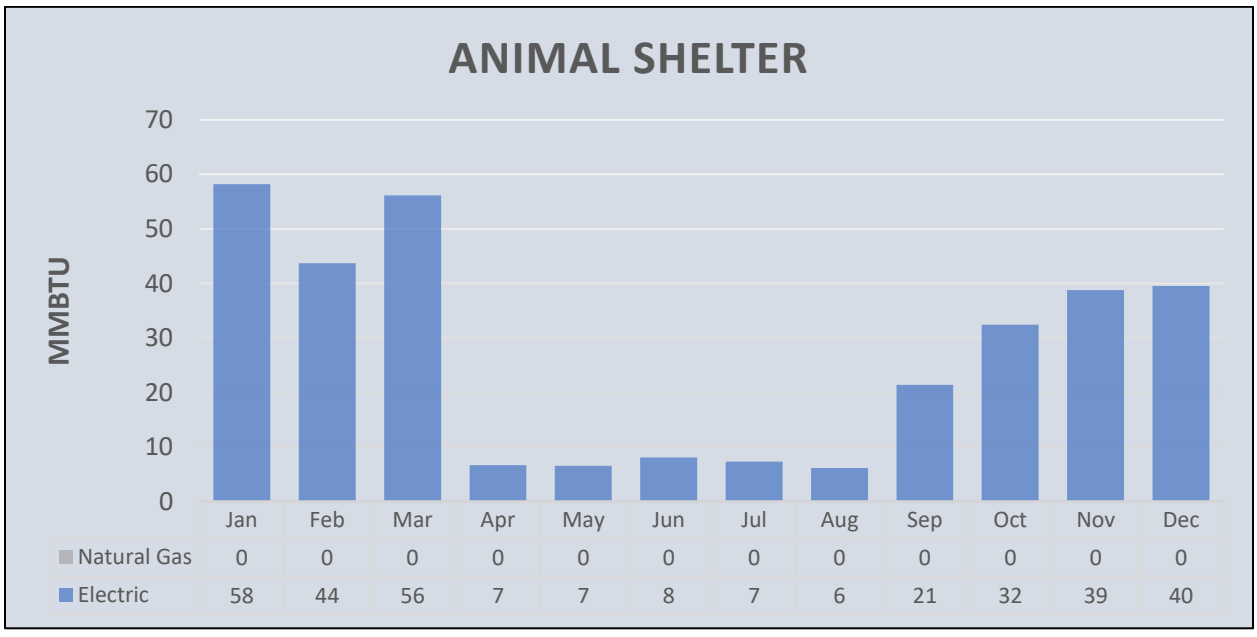
Install overhead door sensors to determine when the door is open. Connect new door sensors to nearest heater unit. During the heating season, utilize door sensors to prevent the nearest heater units from operating until the door has been closed. Door sensors to be installed on three (3) overhead doors.

At the time this photo was taken, the gas unit heater was running in the garage space.

18 – Animal Shelter

The animal shelter facility is a single-story masonry building, constructed in 1976. The building and its systems are generally in good condition. The building office areas are heated using electric baseboard units and cooled using window AC units. Animal areas are heated using an oil-fired furnace and electric unit heaters.

As part of our ESP effort, ABM reviewed the LGEA Report prepared by TRC in April of 2021. The LGEA reported a baseline energy cost of $10,024 and a Building Energy Use Index (EUI) of usage of 38.6 KBtu/sf for the year 2020. This falls out of the expected range compared with the updated energy usage reviewed for the base year 2022 by ABM of 61.9 kBtu/sf (60.6% increase).



During the ESP development, ABM has completed numerous site visits focusing on the various systems in the building. This includes review of the heating and cooling systems and the associated controls, lighting, energy metering and other major systems. ABM prepared an updated inventory of the major systems to account for any significant changes since the LGEA was prepared. The following ECMs were found to be cost effective for this facility, listed in order of the TC as defined by the DOE.

ECMs recommended for installation under the plan are shown below:

Animal Shelter	TC-5	Lighting Improvements - LED Upgrades
Animal Shelter	TC-6	Building Envelope Modifications - Reduce Infiltration

No additional ECMs were found feasible:

The following sections describe the proposed scopes of work.

TC – 5 Lighting Improvements – LED Upgrades

Lighting at the animal shelter building consists of mainly fluorescent fixtures, with metal halide fixtures used on the building exterior. Most of these are proposed to be upgraded to LED.

Of the fixtures to be upgraded, most will be retrofitted, and some will be replaced. The summary table below indicates the types of lighting upgrades being performed. The fixtures excluded from this scope are already energy efficient LED.

Contractor will furnish and install the following:

Proposed Lighting Description	Proposed QTY
8' STRIP RETROFIT KIT	18
NEW 2X4 LED FLAT PANEL KIT	15
NEW LED FLOOD 50 WATT	2
RELAMP 9 WATT LED A LAMP S/I	2

TC-6 Building Envelope Modifications – Reduce Infiltration

This is a small masonry building with a metal panning roof. It is separated into offices and kennels for stray dogs and cats. There are openings at each kennel which leads to an open fenced area. Typically, in winter this area is wrapped in a tarp to reduce the wind effect on the kennel area.

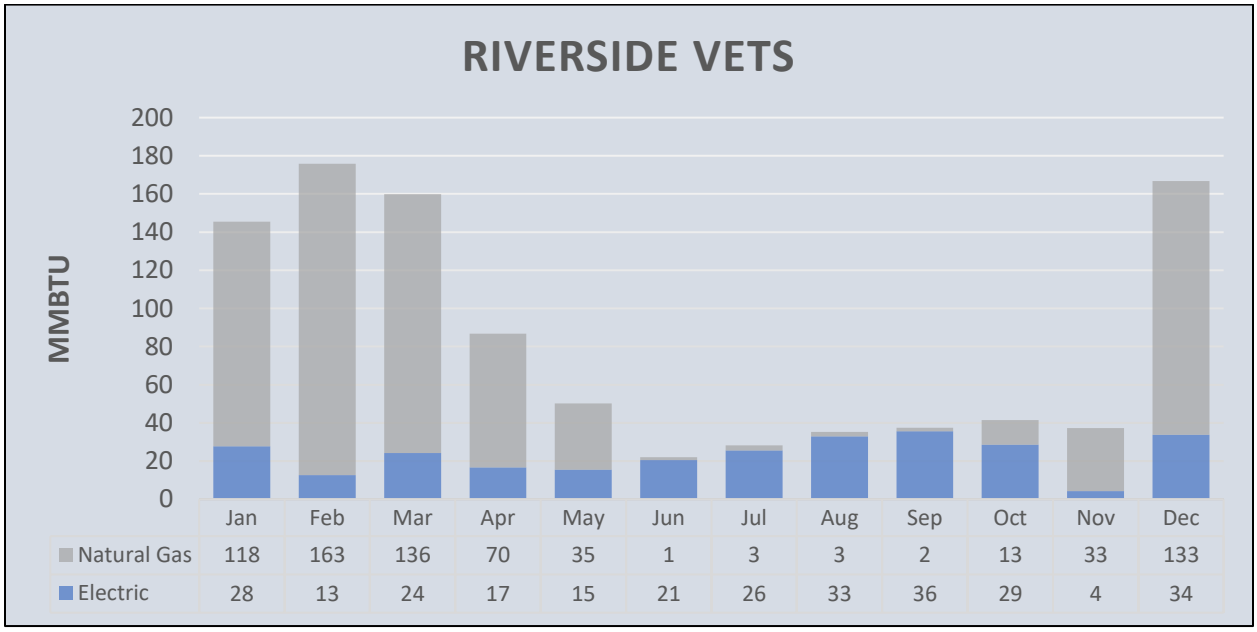
Weatherization scope:

- Provide door maintenance to three (3) standard doors.
- Weatherstrip three (3) single doors
- Install three (3) sweeps.
- Seal the roof/wall intersection (275) linear feet.
- Provide weatherization treatment to two (2) window AC units
- Provide blower door directed air sealing in office areas (four) hours

19 – Riverside Vets

The Riverside Vets facility is a two (2) story wood frame building, constructed in approximately 1950. The building and its systems are generally in fair to good condition. The building is heated and cooled using gas fired rooftop units with three small gas-fired furnaces located in the basement. Window AC units are also used in selected areas.

As part of our ESP effort, ABM reviewed the LGEA Report prepared by TRC in April of 2021. The LGEA reported a baseline energy cost of $25,770 and a Building Energy Use Index (EUI) of usage of 83.9 KBtu/sf for the year 2020. This falls out of the expected range compared with the updated energy usage reviewed for the base year 2022 by ABM of 67.8 kBtu/sf (19.2% decrease).



During the ESP development, ABM has completed numerous site visits focusing on the various systems in the building. This includes review of the heating and cooling systems and the associated controls, lighting, energy metering and other major systems. ABM prepared an updated inventory of the major systems to account for any significant changes since the LGEA was prepared. The following ECMs were found to be cost effective for this facility, listed in order of the TC as defined by the DOE.

ECMs recommended for installation under the plan are shown below:

Riverside Vets	TC-3	HVAC Controls - Install WI-FI Thermostats
Riverside Vets	TC-4	HVAC Improvements - Replace Rooftop Units
Riverside Vets	TC-5	Lighting Improvements - LED Upgrades
Riverside Vets	TC-6	Building Envelope Modifications - Reduce Infiltration
Riverside Vets	TC-20	Roof Repairs

No additional ECMs were found feasible:

The following sections describe the proposed scopes of work.

TC – 3 HVAC Controls – Install Wi-Fi Thermostats

There are five (5) independent HVAC systems serving the Riverside Vets building, each with its own thermostat. There was no evidence of a comprehensive setback program in place to maintain building temperatures according to building / zone occupancy patterns. DPW staff cannot check status of the systems and setpoints remotely, making it difficult to operate the building efficiently.

ABM will replace the existing thermostats associated with the five (5) rooftop unit systems with new digital, BACnet IP enabled programmable, Wi-Fi capable thermostats. New thermostats will be Schneider Electric or equal. These new thermostats require building Wi-Fi (provided by City of Paterson) connectivity to communicate properly.

- Provide/Install/Connect five (5) Wi-Fi enabled BACnet IP thermostats using the City of Paterson Wi-Fi network to connect the devices.
- Paterson DPW staff will be able to access the thermostats via their phone (City of Paterson IT approval will be needed). This will allow remote access and programming of schedules and setpoints.
- Include passive infrared (occupancy sensor) capability on each new thermostat, for after-hours usage.

TC – 4.2 HVAC Upgrades – Install New Rooftop Units for Dining Hall

Replace two (2) old rooftop (cooling only) units with two (2) new rooftop units having both heating and cooling capability. Estimated total tonnage required is 25 tons. (two units at 12.5-tons) New RTUs will serve the following areas:

- Main dining area – 4,300 sf (est.)

Existing Rooftop units to be replaced are listed below:

Building	Unit	Manufacturer	Model No.	Size
Riverside Vets	RTU rear lower oof	Not readable	Not readable	12.5 tons (Est)
Riverside Vets	RTU rear lower roof	Not readable	Not readable	12.5 tons (Est)

Photos of the units to be replaced are shown below:

New high efficiency Rooftop Units will include new thermostats, condensate lines, power, gas lines and other components as necessary for a complete and functional system.

Final design will include new rooftop unit selection, sizing and ensuring code compliance and other permitting requirements. The scope of work includes, but is not limited to the following:

- Structural, mechanical, and electrical engineering as required
- Test and balance existing system prior to removal and document existing conditions
- Disconnect electrical, controls, ductwork, and other components
- Removal of existing rooftop units listed and sealing roof opening from removed units
- Disposal of removed rooftop units
- Installation of the new rooftop units to furnish a complete and properly working system
- Furnish and install curb adapters
- Furnish and install necessary gas piping

- Furnish and install necessary electrical
- Furnish and install necessary controls
- Furnish and install necessary ductwork and transitions
- Furnish start-up, check out and customer training
- Crane service as required
- Rigging of new equipment
- Test and balance new system and document conditions
- New rooftop unit shall include bipolar ionization units or other similar air purification systems.
- Coordination with roofing contractor to maintain warranty on roof

Not included in this scope of work:

- Smoke detector replacement
- Temporary cooling units
- Unforeseen conditions under the roof line
- Roofing service
- Asbestos abatement

TC – 5 Lighting Improvements – LED Upgrades

Lighting at the Riverside Vets building consists of mainly fluorescent fixtures, with metal halide fixtures used on the building exterior. Most of these are proposed to be upgraded to LED.

Of the fixtures to be upgraded, most will be retrofitted, and some will be replaced. The summary table below indicates the types of lighting upgrades being performed. The fixtures excluded from this scope are already energy efficient LED.

Contractor will furnish and install the following:

Proposed Lighting Description	Proposed QTY
8' STRIP RETROFIT KIT	2
NEW 2X2 LED FLAT PANEL KIT	38
NEW 2X4 LED FLAT PANEL KIT	117
NEW LED FLOOD LOT 140 W ADJ KNUCKLE	2
RELAMP 9 WATT LED A LAMP S/I	16
RELAMP LED 6W PL E26 BASE	16
RETROFIT 4' 2L LED TUBE /SELF BALLAST	26
RETROFIT 4' 4L LED TUBE /SELF BALLAST	4

TC-6 Building Envelope Modifications – Reduce Infiltration

This structure is an old, renovated building. Much of the work completed was superficial and does little for comfort or energy conservation. The stairs leading to the attic need to be insulated as well as the door including weatherstripping, the basement is not conditioned and there is no insulation in the floor system. Blower door directed air sealing is recommended for this structure.

Weatherization scope:

- Provide door maintenance to three (3) standard doors.
- Weatherstrip three(3) single doors
- Install three (3) sweeps
- Weatherstrip one (1) door to attic
- Provide blower door directed air sealing six (6) hours

TC – 20 Roof Improvements – Replace Rear Hall Deck Roof

The scope of work for this roof includes:

- Remove roof system to the structural deck
- Thoroughly inspect the decking and repair as necessary
- Attached R-30 minimum, 1/4" tapered insulation to the structural decking according to wind uplift requirements
- Adhere a 1/2" gypsum coverboard
- Replace internal drain bowls with new cast iron assemblies
- Install a 2-ply mineral-surfaced modified roof system in cold adhesive
- Install 2-ply flashings
- Install new aluminum coping, flashless metal edge, and trim
- Provide 25 year No Dollar Limit (NDL) warranty

Technical & Financial Summary

Form I – Recommended ESIP Project

FORM I

ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP):
GENERAL INFORMATION: CONTRACTOR
CITY OF PATERSON
ENERGY SAVING IMPROVEMENT PROGRAM

1. Name of firm:	ABM Industries
2. Address:	90 Woodbridge Center Drive Woodbridge, NJ 07095
3. Contact person for this project (name & title):	Joshua Smith, Regional Account Manager
4. Telephone number of contact person:	973-313-4392
5. Email Address of contact person:	Joshua.Smith3@ABM.com

6. Lead personnel for this project (persons who will have supervisory or other responsibility for the work to be performed). Please list all personnel below:

Name	Title
Joshua Smith	Regional Account Manager
Daniel Madden	General Manager, Northeast Region
John Isherwood	Director of Sales, ABM Infrastructure Solutions
Robert Breslin	Direct of Construction Services
Tim McCoy	Project Manager
Chris Hart	Project Developer
Abraham Thick Gontijo	Energy Engineer
Tyler Rishell	Energy Engineer
Amit Batra	Director of Technology, Energy Solutions
Stephen Niez	Vice President, Technical Development East

Form II - Recommended Project – ECMs Summary Form

FORM II

ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP):
ENERGY CONSERVATION MEASURES (ECMs) SUMMARY FORM
CITY OF PATERSON
ENERGY SAVINGS IMPROVEMENT PROGRAM

ESCO Name: ABM Industries

Proposed Preliminary Energy Savings Plan: ECMs (Base Project)	Estimated Installed Hard Costs[1] $	Estimated Annual Savings $	Estimated Simple Payback (Years)
Boiler Improvements	$467,090	$5,387	86.7
HVAC Controls Upgrades	$733,663	$54,899	13.4
HVAC Improvements	$1,912,073	$48,063	39.8
Lighting Improvements - LED Upgrades	$1,074,862	$70,401	15.3
Building Envelope Modifications - Reduce Infiltration	$408,420	$10,741	38.0
Distributed Generation - Install Cogeneration System	$105,237	-$326	-
Roof Repairs	$849,990	$588	1445.6
*Add additional lines as needed**	**$5,551,335**	**$189,753**	**29.3**

Optional ECMs Considered, but not included with base project at this time	Estimated Installed Hard Costs[1] $	Estimated Annual Savings $	Estimated Simple Payback (years)
Boiler Replacement	$1,154,044	$4,077	283.1
HVAC Controls Upgrades	$271,997	$1,877	144.9
HVAC Improvements	$9,622,700	$66,423	144.9
Building Envelope Modifications - Reduce Infiltration	$139,388	$1,323	105.4
Distributed Generation - Install Cogeneration System	$841,895	-$1,373	-
			-
			-
			-
*Add additional lines as needed**	**$12,030,024**	**$72,327**	**166.3**

(1) The total value of Hard Costs is defined in accordance with standard AIA definitions that include: Labor Costs, Subcontractor Costs, Cost of Materials and Equipment, Temporary Facilities and Related Items, and Miscellaneous Costs such as Permits, Bonds, Taxes, Insurance, Mark-ups, Overhead, Profit, etc.

Form III – Recommended Project – Projected Annual Energy Savings Data Form (Units / $)

FORM III

ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP):
PROJECTED ANNUAL ENERGY SAVINGS DATA FORM
CITY OF PATERSON
ENERGY SAVING IMPROVEMENT PROGRAM

ESCO Name: ABM Industries

The projected annual savings for each fuel type MUST be completed using the following format. Data should be given in the form of fuel units that appear in the utility bills.

Energy/Water	ESCO Developed Baseline (Units) [2]	ESCO Developed Baseline (Costs $) [2]	Proposed Annual Savings (Units) [3]	Proposed Annual Savings (Costs $) [3]
Annual Electric Demand KW	9,137	$77,802	3,996	$34,031
Electric Energy KWH	1,658,781	$141,499	813,491	$69,393
Natural Gas (MMBtu)	16,362	$212,911	3,838	$49,942
Fuel Oil (Gallons)	0	$0	0	$0
Solar PPA (kWh)	0	$0	0	$0
Water (Gallons)	0	$0	0	$0
Other (Specify) (Units)				
Other (Specify) (Units)				

AVOIDED EMMISSIONS [1]	Provide in Pounds (Lbs)
NOX	1,126
SO_2	1,798
CO_2	1,718,029

1,718,029

(1) ESCOs are to use the rates provided as part of this RFP to calculate Avoided Emissions. Calculation for all project energy savings and greenhouse gas reductions will be conducted in accordance with adopted NJBPU protocols.

(2) "ESCOs Developed Baseline": City of Paterson current annual usages and costs as determined by the proposing ESCO; based off City of Paterson utility information as provided to proposing ESCO.

(3) "Proposed Annual Savings": ESCOs proposed annual savings resulting from the City of Paterson implementation of the proposed ESP, as based upon "ESCO's Developed Baseline".

Form IV - Recommended Project – Projected Annual Energy Savings Data Form (BTUs)

FORM IV

ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP):
PROJECTED ANNUAL ENERGY SAVINGS DATA FORM IN MMBTUs
CITY OF PATERSON
ENERGY SAVING IMPROVEMENT PROGRAM

ESCO Name: ABM Industries

The projected annual savings for each fuel type MUST be completed using the following format. Data should be given in equivalent MMBTUs.

Energy	ESCO Developed Baseline	ESCO Proposed Savings Annual	Comments
Electric Energy (MMBTUs)	5,660	2,776	
Natural Gas (MMBTUs)	16,362	3,838	
Fuel Oil (MMBTUs)	0	0	
Steam (MMBTUs)	0	0	
Other (Specify) (MMBTUs)			
Other (Specify) (MMBTUs)			

NOTE: MMBTU Defined: A standard unit of measurement used to denote both the amount of heat energy in fuels and the ability of appliances and air conditioning systems to produce heating or cooling.

FORM V

ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP):
ESCOs PROPOSED FINAL PROJECT COST FORM FOR BASE CASE PROJECT
CITY OF PATERSON
ENERGY SAVING IMPROVEMENT PROGRAM

ESCO Name: ABM Industries

PROPOSED CONSTRUCTION FEES

Fee Category	Fees [1] Dollar ($) Value	Percentage of Hard Costs
Estimated Value of Hard Costs [2]:	$3,638,597	N/A
Project Service Fees		
Investment Grade Energy Audit	$291,088	8.0%
Design Engineering Fees	$181,930	5.0%
Construction Management & Project Administration	$291,088	8.0%
System Commissioning	$98,242	2.7%
Equipment Initial Training Fees	$36,386	1.0%
Warrantee	$72,146	2.0%
Bonds, Ins, and Builders Risk	$109,158	3.0%
Project Service Fees Sub Total	$1,080,037	29.7%
ESCO Overhead	$555,134	10.0%
ESCO Profit	$277,567	5.0%
TOTAL PROJECT COSTS:	$5,551,335	44.70%
CASH / GRANTS APPLIED	$3,150,000	
TOTAL FINANCED PROJECT COSTS:	$2,401,335	

PROPOSED ANNUAL SERVICE FEES

First Year Annual Service Fees	Fees [1] Dollar ($) Value	Percentage of Hard Costs
SAVINGS GUARANTEE *(OPTION)*	$0	0.00%
Measurement & Verification *(Associated w/ Savings Guarantee Option)*	$36,300	Flat Fee
ENERGY STAR Services *(optional)*	$0	0.00%
Post Construction Services *(if applicable)*	$1,000	Flat Fee
Performance Monitoring	N/A	0.00%
On-going Training Services	N/A	0.00%
Verification Reports	w/ M&V	0.00%
TOTAL FIRST YEAR ANNUAL SERVICES *[sum lines A) through G)]*	$37,300	1.03%

NOTES:

(1) **Fees should include all mark-ups, overhead, and profit. Figures stated as a range will NOT be accepted.**

(2) **The total value of Hard Costs is defined in accordance with standard AIA definitions that include: Labor Costs, Subcontractor Costs, Cost of Materials and Equipment, Temporary Facilities and Related Items, and Miscellaneous Costs such as Permits, Bonds Taxes, etc.**

ESCO's proposed interest rate at the time of submission: 4.65% .

Form VI – Recommended Project – City of Paterson Annual Cash Flow Analysis Form

FORM VI

ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP):
ESCO's PRELIMINARY ANNUAL CASH FLOW ANALYSIS FORM
CITY OF PATERSON - ENERGY SAVING IMPROVEMENT PROGRAM

ESCO Name: ABM Industries

Note: Respondents must use the following assumptions in all financial calculations:
(a) The cost of all types of energy should be assumed to inflate at **2.4%** for gas and 2.2% electric per year; and
1. Term of Agreement: 20 years (240 Months)
2. Construction Period [2] (months): 12 Months
3. Cash Flow Analysis Format:

Project Cost[1]: **$5,551,335**
Direct Install Incentive Payment: **$0**
Cash / Other: **$3,150,000**
Total Financed Project Cost: **$2,401,335**

Interest Rate to be Used for Proposal Purposes: **4.65%**

Year	Annual Energy Savings	Annual Operational Savings	Energy Rebates / Incentives	Total Annual Savings	Annual Project Costs	City Of Paterson Costs	Annual Service Costs[3]	Net Cash-Flow to Client	Cumulative Cash Flow
Installation	$ 32,061			$ 32,061					$ -
1	$ 153,372	$ 6,935	$ 96,018	$ 256,325	$ (217,500)	$ (1,000)	$ (36,300)	$ 1,525	$ 1,525
2	$ 156,900	$ 7,095		$ 163,994	$ (162,500)	$ (1,000)		$ 494	$ 2,019
3	$ 160,508	$ 7,258		$ 167,766	$ (165,000)	$ (1,000)		$ 1,766	$ 3,785
4	$ 164,200	$ 7,425		$ 171,625	$ (167,250)	$ (1,000)		$ 3,375	$ 7,160
5	$ 167,977	$ 7,595		$ 175,572	$ (174,250)	$ (1,000)		$ 322	$ 7,481
6	$ 171,840			$ 171,840	$ (165,750)	$ (1,000)		$ 5,090	$ 12,571
7	$ 175,792			$ 175,792	$ (172,500)	$ (1,000)		$ 2,292	$ 14,864
8	$ 179,836			$ 179,836	$ (173,750)	$ (1,000)		$ 5,086	$ 19,949
9	$ 183,972			$ 183,972	$ (179,750)	$ (1,000)		$ 3,222	$ 23,171
10	$ 188,203			$ 188,203	$ (185,250)	$ (1,000)		$ 1,953	$ 25,124
11	$ 192,532			$ 192,532	$ (190,250)	$ (1,000)		$ 1,282	$ 26,406
12	$ 196,960			$ 196,960	$ (194,750)	$ (1,000)		$ 1,210	$ 27,616
13	$ 201,490			$ 201,490	$ (198,750)	$ (1,000)		$ 1,740	$ 29,356
14	$ 206,124			$ 206,124	$ (202,250)	$ (1,000)		$ 2,874	$ 32,230
15	$ 210,865			$ 210,865	$ (205,250)	$ (1,000)		$ 4,615	$ 36,846
16	$ 215,715			$ 215,715	$ (212,750)	$ (1,000)		$ 1,965	$ 38,811
17	$ 220,677			$ 220,677	$ (214,500)	$ (1,000)		$ 5,177	$ 43,987
18	$ 225,752			$ 225,752	$ (220,750)	$ (1,000)		$ 4,002	$ 47,989
19	$ 230,944			$ 230,944	$ (226,250)	$ (1,000)		$ 3,694	$ 51,684
20	$ 236,256			$ 236,256	$ (231,000)	$ (1,000)		$ 4,256	$ 55,940
Cost of Issuance						$ (228,564)			
Totals	$ 3,871,976	$ 36,307	$ 96,018	$ 4,004,301	$ (3,860,000)	$ (20,000)	$ (36,300)	$ 55,940	

NOTES:
(1) Includes: Hard costs and project service fees defined in ESCO's PROPOSED "FORM V"
(2) No payments are made by City of Paterson during the construction period.
(3) This figure should equal the vlaue indicted on the ESCO's PROPOSED "FORM V". DO NOT include in the Financed Project Cost

Estimate of Greenhouse Gas Reductions Resulting from Energy Savings

From the buildings evaluated in the development process, the City of Paterson will realize a ***21.1% ($153,372) reduction in annual utility spend*** and reduce greenhouse gas emissions by an impressive ***1,718,029 Pounds (lbs.) of CO^2*** the first year. The annual savings for electric and natural gas are as follows:

813,491 kWh savings

3,838 MMBtu savings

Additional environmental impact equivalencies include the following annual reductions to help you meet your sustainability goals:

87,688 gallons of gasoline consumed per year

102 homes' energy use for one year

154 residential homes' electricity use for one year

51,445,816 smartphones charged per year

270 tons of waste recycled instead of landfilled

12,886 tree seedlings grown for ten years

185 gasoline powered passenger vehicles in one year

910 acres of U.S. forests preserved in one year

https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

Identification of all Design and Compliance Issues and Identification of who will Provide these Services

After award of the ESIP contract, ABM will begin the design stage to finalize equipment sizing, selection and interconnections for the mechanical ECM scopes. Additional site details will be obtained during design to confirm interconnection points and other installation specifications. Other design and compliance issues to be confirmed include code compliance in relation to outside air requirements, as well as other requirements. Drawings will be prepared for selected ECMs as required to solicit competitive bids if work is to be performed outside of the COOP purchasing vehicles. The design and review of the compliance issues will be performed by Alaimo Engineering, under the direction of ABM.

A summary of the common design and compliance issues and responsible party is shown below.

Design and Compliance Issue	Responsible Party (Primary / Secondary)
Identification of material lay-down area(s)	City of Paterson / ABM
New equipment sizing and selection	ABM / Alaimo Engineering
New equipment interconnection tie-in details	ABM / Alaimo Engineering
Coordination with Paterson IT Department	ABM / Contractor
Compliance with codes	ABM / Alaimo Engineering
Lighting levels	ABM / Contractor
Crane and lift plan and clearances	ABM / Contractor
Service clearances for new equipment	ABM / Alaimo Engineering

ABM and the Alaimo Engineering team will generate design and construction documents to clearly define the complete requirements of the project to include applicable codes and criteria detailing the following:

- Site investigation and measurements
- Asbestos / lead-based paint abatement survey and plan
- Description of the work required
- Manufacturer's installation procedures
- Catalog cuts and equipment specifications
- Work schedule and phasing plan
- Detailed materials take-off

Material and equipment used shall include standard products from a regularly engaged manufacturer and shall essentially duplicate items that have been in use. The work plan shall address the means of access and egress in the areas involved during the renovation periods for staff and visitors. The engineering and project development teams will investigate the requirements for permitting of air quality, local construction for disruptions of vehicular traffic, and base utility systems permit requirements. Our design documents include a list of required permits for performing work, such as dig permits, and welding permits.

The following disciplines are typical of many of ABM's projects and serve as an example of the depth and detail of our engineering design processes. We will address all *applicable* disciplines as required within the work plan in accordance with the ECM and design requirements.

Site Work 	Site clearing, demolition and removal, grading, soil treatment, horizontal and vertical control, flexible and rigid pavement, parking, access controls, storm drainage, bollards, sidewalks, concrete curb and gutters, utility services, valves and meters, miscellaneous site features and final site stabilization. All site work shall comply with current codes, regulations, laws, and standards requirements.
Architectural 	Interior and exterior finishes, wall systems, doors, roofs, floor systems, passive life safety systems, vapor barriers, glazing and frames, louvers, screen walls, interior and exterior signage, insulation, casework, fire and extinguisher cabinets, miscellaneous accessories, and furnishing/equipment as required by the scope of work. All architectural work shall comply with current codes, regulations, laws, and standards.
Interior Design 	Floor, wall, ceiling systems; finishes involving repair and new installation work as identified in the scope of work and shall comply with current codes, regulations, laws, and standards.
Structural 	Foundations, walls, floor framing, roofing framing, lateral load stability, framing and connection of any architectural features, support of mechanical and electrical equipment, and repairs to existing buildings. All work, both repair and construction, shall comply with applicable current code, regulations, laws, and standards.
Heating, Ventilating and Air Conditioning (HVAC) 	Repair or installation of variable volume air handling systems, constant air volume systems, multi-zone air handling systems, condensing units, chiller, boilers, air handlers, fans, dampers, pumps, unit heaters, fan coil units, compressed air systems, ductwork and appurtenances, controls systems, and any other cooling/heating plant accessories and/or appurtenances. Systems shall be designed to meet industry standards, codes, Government regulations, and the requirements of the project scope of work and contract. Repair and installation work shall be quality and technically accurate. All work shall be coordinated with other disciplines, ensuring the compatibility of all building systems. Where applicable, the layout of rooms and equipment shall consider proper maintenance clearance, including coil pull space, dedicated electrical space required by the NEC, and separation of conditioned and unconditioned areas. Load calculation shall be in accordance with the current edition of American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals. Energy use shall be designed to achieve energy consumption levels at or below ASHRAE 90.1 and applicable codes if lifecycle is cost-effective. Materials, R-values, equipment and motor efficiency, temperature control systems, lighting, and lighting controls shall be used to the extent possible to provide an energy-efficient facility that beats the target energy budget. Required incidental design shall include testing, balancing, and adjusting by a firm certified by NEBB or AABC to provide Air and Hydronic TAB services. All TAB testing reports shall be submitted for approval.
Plumbing 	Repair or installation of domestic water heaters, plumbing fixtures, pumps, valves, piping and appurtenances, reverse osmosis systems, water filtration systems, water storage tanks and systems, automatic controls, low-flow faucet aerators, low-flow toilets, cooling tower modifications, boiler modifications, and all other items required for a complete and functional plumbing system. All

	design, materials, equipment, and work shall be in accordance with applicable codes, regulations, standards, and laws to include UFC 4-510-01 and NPC. Repair and installation work shall be as determined by the requirements of the individual scope of work.
Fire Suppression System 	Kitchen or fume hood suppression systems, standpipes, sprinklers, pipe and appurtenances, valves, inspectors test stations, control panels, and interlocks with other systems. System types may include but are not limited to wet pipe, dry pipe, pre-action, carbon dioxide, water mist, and other approved systems and shall be as specified in the project scope of work. All work shall be in accordance with all involved codes, regulations, and laws to include UFC 3-600-01, NFPA 13, NFPA 14, and other applicable NFPA standards.
Electrical System 	Repair or construction of an Electrical Systems as required by the scope of work shall be in accordance with NFPA 70, NFPA99, and NFPA 110. Essential equipment transfer switches, distribution equipment, and batteries shall not be located in the same room as normal service equipment. Seismic protection shall be provided in seismic zones in accordance with applicable local codes.
Exterior Electrical System 	May include, but not limited to repair or new construction power distribution system to include transformers, main protection devices and feeders, conductors, duct banks, etc. The primary electrical distribution system shall meet the requirements of the National Electrical Code (NEC) unless more stringent specifications elsewhere in the contract documents. The main distribution systems shall not be located under any buildings and manholes shall be used where needed. Voltage drop requirements shall be in accordance with TM 5-811-1, Chapters 5-4, and figure 5-1. 3-530-01AN and Illuminating Engineering Society of North America (IESNA) guidelines.
Exterior Lighting System 	Repair and/or construction of parking lot, walkway, and entrance lighting, or special lighting for exterior signage or similar items as identified in the project scope of work. The design of exterior lighting and associated lighting levels shall be in accordance with Illuminating Engineering Society (IES) guidelines.
Interior Electrical System 	Repair or installation shall include, but not limited to work on panelboards, circuits, service entrance equipment, surge protection, disconnect switches, isolated power systems, ground, circuit breakers, motor control centers, relays, wiring, conduit, receptacles, ground fault interrupters, and other items as required. All repair and/or installation UFC 3-520-01, UFC 4-510-01, NFPA 70, NFPA 99, NFPA 110 and other national standards as applicable to the involved systems. The work on the lighting systems required by the individual project scope of work shall meet all requirements of ASHRAE 90.1 and IES guidelines. Short circuit analysis and arc flash hazard analysis may be required for electrical distribution systems to include a fault-impedance diagram, a load flow analysis or study, a short-circuit analysis or study and power system coordination study. Personal protection equipment (PPE) labels for all electrical shall be provided. Emergency Lighting shall be in accordance with NFPA 70 NFPA 99, NFPA 101, and UFC 4-510-01 with battery back-up lighting in accordance with UFC 4-510-01.

Electrical Design Calculations 	Calculations shall be provided as required to include interior lighting, exterior lighting, load analysis, fault analysis, and voltage drop.
Environmental Consideration 	ABM shall obtain all required permits in the performance of individual projects and copies of all environmental correspondence to include request for permits shall be provided to the Client.

Assessment of Risks Involved in the Successful Implementation of the Plan

ABM has been helping our clients improve their facility infrastructure while saving energy for over 40 years with guaranteed energy savings projects. We have performed nearly one billion dollars' worth of energy retrofit projects, completing over two hundred projects within the past ten years. These projects vary from K-12 school districts, public and private colleges, and universities; to local, state, and federal government agencies. Programs range in size from $100,000 to $50 million. This experience will serve the City of Paterson well as we identify and mitigate risks during the final design phase

Several of the Paterson buildings are older and are suspected as containing hazardous materials, including possibly lead paint and asbestos. During development, we discussed these risks with Paterson DPW staff and was informed that the City of Paterson has an industrial Hygienist company under retainer. This Industrial Hygienist company is available to come to the site as necessary in a timely manner to obtain samples and perform testing to confirm the presence of lead or asbestos.

If ABM suspects that any of these or other hazardous materials are at risk of being disturbed by the ECM work, ABM will notify DPW who will in turn contact their Industrial Hygienist to confirm.

If it is confirmed that hazardous materials are present, The City of Paterson also has an abatement company that they use for removal and or encapsulation. Our construction schedule assumes that any required testing and removal will be done in a timely manner so as not to delay the construction schedule. ABM has not included any hazardous material testing or removal costs under this ESP.

A summary of other common risk issues and responsible party is shown below.

Risk Issue	Responsible Party (Primary / Secondary)
Life Safety System Coordination	City of Paterson / ABM
Schedule development and management	ABM
Future modifications to energy control sequences and setpoints – potential impact to savings	City of Paterson
Access to buildings for design, pre-construction walkthroughs and construction activities	City of Paterson
Cogeneration system utility interconnection approval	ABM / Contractor
Hazardous material – identification of potential for existence / interference	ABM / Contractor
Hazardous material –confirmation of existence	City of Paterson / City's Industrial Hygienist
Hazardous material – Removal / abatement / encapsulation	City of Paterson / City's Abatement contractor
Interest Rate Risk	City of Paterson
Energy Price Risk	City of Paterson
Energy Savings Risk	Varies if Performance guarantee is purchased
Construction Delay Risk	Delays by ABM – ABM Delays by Paterson – City of Paterson
Major Changes to Facility	City of Paterson
Operating Hours	City of Paterson
Load	City of Paterson
Weather	City of Paterson
Equipment Performance	Varies if Performance guarantee is purchased
Operations	City of Paterson
Maintenance	City of Paterson
Repair / Replacement	City of Paterson

Our Safety-first Mentality

We take care of people.

ABM fosters a safe environment for every team member, every day. Our **safety-first** culture proactively mitigates, detects, and corrects safety and risk issues using a comprehensive safety management system. **Our *ThinkSafe* philosophy promotes the idea that we can prevent all workplace accidents if we focus on safety** and make it an integral part of everything we do. We continuously reinforce this mindset through daily safety messaging, relevant training, and unique programs and materials.

Health and Safety Policy

Our risk management team works jointly with operations to ensure the safety and well-being of our team members and your facilities. They work tirelessly to maintain a safe workplace with appropriate procedures to protect our team members, our partners, the public, and the environment.

To accomplish this, we train team members on:

- Completing tasks safely and identifying hazards
- Deploying emergency response procedures and addressing challenges
- Reporting accidents and using established procedures to mitigate loss

Regional and Corporate Support

Our dedicated safety professionals are highly trained in their respective fields and consult with branch operations to keep our safety culture forefront. To ensure common goals, safety managers collaborate closely with frontline leaders, which allows better alignment of safety activities with their desired results.

Site-specific Training

Our safety training complies with OSHA and other regulatory bodies and uses best practices from organizations like the National Safety Council (NSC). On our client sites, we customize training to incorporate the client's safety requirements and oversee the safety activities of subcontractors. New team members are trained within thirty days of hire. If we take over from another vendor, we evaluate all incumbent staff members during transition, and based on any skill gaps identified, design training to address those gaps. We ensure training does not interfere with daily work schedules; however, we do require ongoing training throughout the careers of our team members. We incorporate a daily *Moment for Safety*, and conduct required *Monthly Safety Talks*.

Operator Empowerment

Safe Work Observation Program (SWOP)

Our frontline leaders expertly identify workplace hazards and make changes to prevent incidents.

Injury & Illness Prevention Program (IIPP)

Every team member, operations manager, supervisor, and site lead completes safety training and inspections designed to:

- ✓ Keep the team safe
- ✓ Identify deficiencies
- ✓ Provide necessary care to injured team members to expedite their recovery
- ✓ Investigate thoroughly and enact preventive measures

Hazard Identification

Our safety program helps leaders identify hazards and make changes to prevent accident or injury. We developed a job hazard analysis protocol that applies to all ABM on-site service team members. It highlights the responsibilities of frontline managers, branch managers, team members, and safety personnel to identify and report hazards and implement critical actions to mitigate them.

Along with the hazard protocol, ABM maintains a PPE hazard assessment process, a safety inspection process, and a safe work observation process. Our *Team Member Safety Handbook* requires reporting all unsafe acts or conditions to supervisors. Team members can report work-related concerns via our toll-free safety hotline (866.208.2114) and have authority to cease work if unsafe working conditions exist.

Top Focus Sites Program

The strong partnership between our risk & safety team and operations teams resulted in strategic reviews of our top frequency sites, leading to our Top Focus sites initiative. We analyze safety outliers and develop site-specific intervention and engagement plans for frontline team members and operational leadership.

Program components include:

- Initial site assessments
- Site-specific safety improvement plan
- Biweekly progress calls
- Team member engagement through safe work observations
- Regular site visits / audits by safety team
- Monthly progress review meetings

We have had outstanding results with our Top Focus process, with year-over-year improvements as great as 100%.

Moreover, the meaningful safety dialogue at all levels—operational leaders, frontline team members and safety teams—led us to the evolution of the program. To mitigate potential problem sites, we created a tiered action plan that lets us course correct quickly and effectively.

- **Tier 1: Site & Branch** – Continue existing focus program for high claim frequency locations
- **Tier 2: Targeted Purpose** – Target accounts for specific reasons outside of high claims activity, such as high or frequent OSHA activity, high client demand for improved safety practices, or high hazard work sites
- **Tier 3: Recognize & Anticipate** – Target accounts based on anticipated need and recognize outstanding performance

Managing Risk through Safety Programs

Safety is the cornerstone of ABM's operations. As part of the ABM *Way*, our documented processes ensure success for our customers, team members, and company. We are committed to fostering a safe working environment for every team member at all locations we service, every day. It is our responsibility to embrace the ABM *ThinkSafe* culture and proactively prevent, detect, and correct any safety or risk concern that may arise. *ThinkSafe* is an ABM program that promotes the idea that almost all workplace accidents are preventable – if you make focusing on safety an integral part of your day. At ABM, we strive to create a world-class culture in all we do, and safety is a vital part of that objective.

At ABM, risk management consists of both safety and claims management, working jointly with operations, to ensure the safety and well-being of our employees, our customers, and their staff and visitors.

ThinkSafe™
People. Materials. Environment.

Our policy:

- Maintains a safe workplace for our team members
- Uses methods and processes to protect our employees and the public and to prevent damage to property and the environment
- Maintains and enforces a program to fulfill our responsibilities

To ensure common goals and objectives, both safety and claims managers report to the Vice President of Risk and Safety. Our team of dedicated safety professionals liaise with branch operations to ensure the ABM safety culture is forefront in our team members' minds – every day. Each industry group is supported by dedicated safety professionals who are familiar with their work.

ThinkSafe Program

Because the ABM workforce represents a diversity of cultures and languages, our programs, training content and communication materials are frequently translated into one or more of 30+ languages represented by ABM Team Members. To reach approximately 100,000 employees, we developed the following programs that are cornerstones of ABM's *ThinkSafe* Program:

- **Moment for Safety**– Every day at ABM, our managers share a Moment for Safety with their teams. It promotes employees' safety awareness off the topic of the day and sets their minds to carry out their tasks safely.
- **Leadership and Engagement Tours** – These tours foster senior management engagement and ownership in safety and risk.
- **Empowerment of Field Locations** – Every operations manager, supervisor, and site lead, together with all employees, is a crucial part of ABM's Injury and Illness Prevention Program.

These programs have been embedded into ABM's culture and provide opportunities to minimize injuries and property damage. When incidents do occur our risk management programs become essential to get employees back to good health and back to work as quickly as possible. Our safety and risk management teams have developed powerful tools to identify and mitigate hazards and other risk-related issues.

Risk Management Resources and Programs

As an ABM client you'll have resources to depend on, including specialists in safety, training, prevention, workers' compensation, liability, claims, and insurance management. To manage the safety of your site and stay ahead of the latest safety procedures, ABM's safety committee meets monthly to:

- Report on training, inspections, and incidents
- Revisit safety objectives and loss prevention goals
- Provide recommendations for the prevention of future incidents
- Review monthly branch safety reports

Below are a few of the primary tools we use to teach safety awareness and manage performance:

- COVID-19 Exposure Control Plan
- ABM Safety and Health Manual
- Safety communications
- OSHA injury and illness recordkeeping
- Loss control
- Motor Vehicle Record (MVR) check and driver's alert Programs
- Safety hotline
- Telematics
- Stay-at-Work program
- Safe Work Observation Process (SWOP)
- Safety training videos
- Medical evaluation (in US only)
- National clinic program (in US only)
- Telephone Nurse Case Management (TCM) (in US only)

Identify the Eligibility for, and Costs and Revenues Associated with the PJM Independent System Operator for Demand Response and Curtailable Service Activities

Demand Response

Demand Response is a voluntary PJM program that compensates end-use (retail) customers for reducing their electricity use (load), when requested by PJM, during periods of high-power prices or when the reliability of the grid is threatened. These customers receive payments from PJM members called Curtailment Service Providers.

A weblink to the PJM Demand Response Program is listed below:

PJM - Demand Response

https://www.pjm.com/markets-and-operations/demand-response.aspx

During the development of this ESP, ABM obtained information for the emergency generators used at the firehouses and DPW headquarters. After discussion with PJM Demand Response service providers, it was determined that these generators are registered as “emergency use” and therefore cannot be used for Demand Response (DR) due to emissions restrictions.

Many of the ECMs proposed in the ESP will however generate reductions in electric demand (kW) and electric usage (kWh). ABM will work with the PJM Service Providers to confirm eligibility and if eligible, obtain the appropriate revenue from PJM.

Information about the PJM Demand Response Program is shown on the following pages.

Demand Response

Demand response – the means by which retail consumers can respond to wholesale electricity prices or to reliability needs of the system – is integrated into PJM Interconnection's wholesale electricity markets. By participating in demand response, retail customers can transact in PJM's energy, capacity and ancillary services markets in order to receive payments for reducing demand.

How Demand Response Works in PJM

At PJM, there are two broad categories for customers to participate in PJM markets as demand response, or DR, with the ability to participate as both:

- Load management (Pre-Emergency and Emergency DR) providers make a commitment in the capacity market to reduce load when required by the system or receive a financial penalty.
- Economic DR providers participate in the energy and ancillary services markets when it is economic for them. If the Economic DR offer price is less than the marginal price, they will be deployed similar to a generator.

The choice to participate in DR programs is voluntary. Participants must meet certain requirements in order to qualify for payments for reducing their demand for electricity. DR does not include reductions in electricity use that follow normal operating patterns or behavior.

Qualified PJM Market Participants who act as agents, called Curtailment Service Providers (CSPs), help eligible customers identify opportunities and determine the equipment and systems required to benefit financially from DR participation in PJM markets.

Key Points

- When electricity customers participate in demand response programs, they commit to reduce electricity usage in exchange for compensation derived from PJM markets.
- During times of peak stress on the grid, electricity reduction offers can help support grid reliability.
- Curtailment Service Providers act as brokers for eligible electricity consumers. They aggregate customer bids and offer them into PJM wholesale electricity markets.
- To increase access to PJM markets and promote grid efficiency, PJM is working to broaden opportunities for more electricity customers to participate in DR programs.

CSPs aggregate customers' curtailment capability, register that capability with PJM, offer it in the appropriate market, submit load data to verify the reductions and receive payment from PJM. Subsequent allocation of PJM payment between the CSP and the retail customer is a matter of private agreement.

Demand Response in the Capacity Market

Most demand response activity in PJM takes place in the capacity market, called the Reliability Pricing Model. Both DR resources and Energy Efficiency (EE) Resources participate in PJM's capacity market. These resources can receive payments for committing to reduce electricity demand or for implementing energy-efficiency measures, such as more efficient lighting, heating and other building systems, up to three years in the future.

The ability to dispatch DR gives PJM greater flexibility to manage the grid during summer heat waves and other challenging conditions. In the capacity market, DR participants must reduce load when requested by PJM or receive a significant financial penalty.

(866) 400-8980 | (610) 666-8980

Demand Response

Economic Demand Response in PJM's Energy and Ancillary Services Markets

Customers may participate as Economic Demand Response in the energy and ancillary services markets through a Curtailment Service Provider. Curtailment Service Providers will offer the load-reduction capability into the PJM Day-Ahead or Real-Time energy markets. They may also offer into the ancillary services markets for shorter periods of curtailment flexibility – such as minutes or seconds.

Economic DR participants in the Energy Market will only be compensated for load reductions that are not part of normal operations. In other words, if the customer already manages their electricity usage to help lower their retail electricity bill, these reductions would not be eligible for compensation through PJM's energy markets.

PJM clears the energy and ancillary services markets on a least-cost basis based on the resources that are available. If a DR resource is competitive, it will clear in the market in the same way as a generator. Ancillary services participation includes Synchronized Reserve, Regulation and Secondary Reserves markets.

March 18, 2024

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Maintenance Requirements Necessary to Ensure Continued Energy Savings, and Describe how they will be Provided

Ongoing and Preventive Maintenance

Preventive and corrective maintenance will continue to be provided by The City of Paterson and/or its contractors. While maintenance services are not included in this ESIP proposal, ABM did note during our surveys that there were several systems found to be in need of proper preventive maintenance. This included dirty filters and coils, air dampers not operational, and other issues. ABM would be happy to review the opportunity to provide improved maintenance to the City of Paterson outside of the ESIP.

The following sections describe the maintenance capabilities of ABM, and also Equipment Specific Maintenance Guidelines.

Maintenance is a core business of ABM. We firmly believe that performance contracting should be the beginning of a continuous improvement process rather than an isolated project that has a starting and ending point. Our service division plays a key role in starting up new systems and providing the customized preventive maintenance programs that many of our clients use to maintain peak operating efficiency of their new equipment. We understand that quality maintenance plays a significant role in maintaining the lifespan of your equipment. This is why our service team members, such as the service manager and lead technicians, are an integral part of the planning, development, and engineering processes.

A proactive operations and maintenance program is vital in minimizing energy consumption and costs associated with the City of Paterson's mechanical and electrical systems. Preventive maintenance work should be performed on a fixed schedule and should reflect the unique characteristics of your buildings, while accommodating future changes to a facility. As primary mechanical and electrical components presently serving the City of Paterson are replaced under this guaranteed energy savings performance contract, the maintenance staff can direct their attention toward performing any necessary preventive maintenance.

Developing your Maintenance Plan

A Performance Contracting Program is incomplete without planning the services necessary to maintain your facility. This planning should be an integral part of the development and engineering processes, rather than starting after new upgrades are installed.

Nationwide, we have over 100,000+ team members serving 20,000 clients since 1909. We service approximately four billion square feet of facilities and maintain over 500,000 HVAC systems annually. With full HVAC service, HVAC installation, building automation, electrical installation, electrical testing,

electrical service, plumbing, and energy services departments, we have unparalleled technical expertise throughout the nation.

Our facility engineers have been designing facility improvement measures for decades, and for the last 40+ years we have been using this expertise to build financially viable, sustainable solutions for our clients through our guaranteed energy savings contracting process. This alignment of in-house expertise means ABM can provide superior returns for our clients, while providing greater quality control because we sub-contract fewer services than anyone else in the industry.

Preventive Maintenance Program

ABM's Preventive Maintenance Program is the cornerstone of the maintenance program at ABM. We develop the preventive maintenance program using the steps described below. The resulting program database includes detailed task and service frequencies for each piece of equipment in the program and can be downloaded to most maintenance management information systems.

Our Corporate Support Services' staff uses its Alliance® CMMS software to develop preventive maintenance programs tailored to meet the needs of each client's site. Our staff has access to a library of standard preventive maintenance procedures for over two hundred different items of engineered equipment. These standard inspections are supported by over 4,000 tasks providing an ability to customize each preventive maintenance program. This library grows continually as new pieces of equipment, and procedures are added.

Each procedure contains detailed tasking plus labor allowances for each task based on our collective historical data. Procedures are selected for each item of equipment on a site, then customized to reflect the configuration of the equipment, its condition and duty cycle. The preventive maintenance programs are then scheduled to best complement the anticipated reactive workload, and to recognize seasonal constraints. The resulting job specific program is reviewed with site personnel, then issued automatically through the CMMS as the procedures come up on the schedule.

The ability to summarize and report on a periodic and regular basis is critical to the general building HVAC and mechanical services for the City of Paterson. This approach has proven to be highly successful in ABM's vast facility operations and has taken the form of capturing and carefully recording information at an extremely detailed level and summarizing into reports tailored to client's specific requirements. Data is recorded daily with reports being produced weekly, monthly, quarterly, and annually, depending on the City of Paterson's desired requirements. These reports are focused on the goals and policies established by the City of Paterson.

Program Offerings

ABM offers preventive maintenance and repairs for the City of Paterson's heating, air conditioning, and electrical power needs. Our program has the following offerings and benefits:

- Emergency 24/7 service and repairs included in guaranteed plans
- Fully customized plans for your facility and your business
- Transparent reporting and responsive communications through multi-platform apps
- Refrigerant management and expert training ensure compliance and workplace safety
- Indoor air quality testing helps maintain healthy, productive environments for your people

- Monitoring and recording maintenance tasks
- A firm dedicated cost for maintenance

The benefits of preventive maintenance include:

Saves Money

- Prevents costly repairs
- Saves in utility costs
- Reduces operating costs

Conserves Energy & Improves Performance

- Maximizes efficiency
- Improves system reliability
- Reduces energy use & expenses

Keeps Occupants Happy & Comfortable

- Supports healthy, productive, and safe environments
- Helps avoid costly work disruptions
- Addresses issues before they become urgent

More Maintenance & Less Replacements

- Prevents costly repairs
- Saves in utility costs
- Reduces operating costs

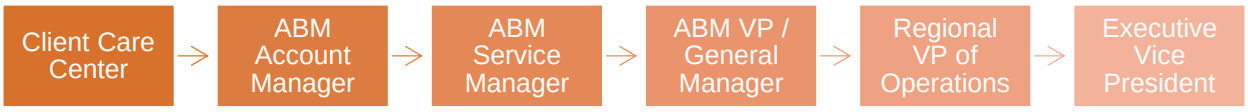
Maintenanc

Although a maintenance contract is not required for performance contracting projects, we strongly encourage a strong and reliable preventive maintenance program that will expand the lifecycle of your new or recently updated equipment.

Emergency Escalation Procedure

ABM's escalation process is maintained within our work order system. When we receive your work orders, the system automatically assigns the work order to the appropriate ABM staff member and sends that staff member an immediate email. For emergencies, the system also sends a copy of the work order to the ABM Account Manager and ABM local management.

ABM's Client Care Center provides "warm hand-off" for emergency work orders 24/7. To be specific, the Client Care Center will phone the appropriate ABM staff member to alert the staff member to the emergency work order. If the Client Care Center cannot reach the primary ABM staff member, the Client Care Center will move up the system-maintained escalation list until a person is reached in real-time. At ABM, we provide a single contact point to our clients and leverage our Client Care Center to handle the escalation 24/7.



Trouble Calls

ABM's dispatch procedure ensures the seamless and timely flow of information from tenants to workforce and back again. ABM manages the dispatch process for all trouble calls through the work order control module of its Alliance CMMS. This module allows quick entry of work requests as received. The system is configured to allow fast response to those requests. Under ABM's operating strategy, accountability is a key element. ABM's goal is 100% accountability for site labor. Scheduled work, such as projects, predictive and preventive maintenance, and unscheduled work, such as breakdown repair, are tracked through the system. Meticulous and timely work order administration, combined with periodic internal reviews and audits, ensure the records are both accurate and up to date. The database can then be used effectively to report activity and backlog to management, assisting them with workflow control and with the proper charging of the cost for work performed against appropriate cost centers.

All request for services via a phone call or email from the City of Paterson go directly to the Customer Care Center. As calls/emails are received, a work order is opened in Alliance, which is time and date stamped. The Customer Care Center dispatches the appropriate technician to the client site and upon receipt of a verified ETA (estimated time of arrival), the Customer Care Center communicates the ETA to the client and reconfirms the technician is on-site within the ETA that was established. Upon completion of the work, the Customer Care Center contacts the client to confirm the work was completed to the client's satisfaction. After completion of the work, the Customer Care Advocate completes an internal audit.

C.A.R.E. Program

The Customer Assurance, Review, and Evaluation (C.A.R.E.) Program is designed to measure and improve the City of Paterson's experience with the services provided by ABM. We understand that client satisfaction plays a large part in an organization's success. In our C.A.R.E. program, we routinely contact our clients to see how we are performing and if there is anything we can do to assist in running their facilities.

Establishing and measuring our impact on achieving expectations are integral parts of our C.A.R.E. quality control program. The implementation process includes commissioning of all systems and equipment to ensure installed systems are working within design parameters. The system settings and flow measurements are documented and included in the operation and maintenance manuals. Maintenance staff can run system diagnostics throughout the term of the agreement.

At a predetermined frequency, contact with each customer assures the quality and value of services. With each request, the customer will evaluate those services and communicate their comments. The transactional and relationship surveys are delivered electronically, by telephone, or by in-person review.

This multi-step process includes a start-up/orientation meeting, monthly in-house C.A.R.E. Meeting, C.A.R.E. interview, action plans, Net Promoter Score (NPS), and a C.A.R.E. value report.

All concerns are handled through an action plan that is documented and reviewed with a closed-loop process to confirm that both sides are committed to resolving any issues and progress is sustained.

Although handled at the closest point with the customer, all concerns are transparent and accountable at all levels. Our Key Performance Indicators (KPIs) measure accountability to the customer through C.A.R.E. interviews, C.A.R.E. value reports, response levels, outcomes, and NPS scores received.

Our CARE Program will:

- Enhance dialogue, between your representatives and ours, about the services provided and additional capabilities we can offer.
- Demonstrate how we have gone above and beyond the contract.
- Verify that your goals have been met or exceeded.
- Reinforce the decision to partner with ABM.
- Solidify the value of our offerings, such as improved efficiency, responsiveness and quality.
- Review your current needs and operating methods.
- Determine if there are additional services that can benefit you or modifications that need to be made to existing services.

Listen360

Listen360 is an additional benefit of the C.A.R.E. program. It is a two-question survey directly focused on the satisfaction of our clients. It provides an efficient way to manage feedback, use your direct and honest comments to improve business operations, correct shortcomings, and deliver outstanding customer service.

Most ECMs involve a replacement of equipment that has reached th
similar but more efficient equipment. Routine preventative maintenance will be necessary to keep the new

equipment operating efficiently. This includes air filter changes, cleaning of coils, and other similar maintenance tasks. In some cases, the new LED lighting upgrades for example - will result in a reduction in maintenance cost due to longer life components than are currently in use.

The cogeneration equipment proposed for the Northside Firehouse will require annual maintenance for oil and filter changes and similar maintenance procedures. The City of Paterson will likely choose to contract this maintenance to a contractor familiar with this equipment.

Team Disciplines

Site Supervisor

Provide technical support, jobsite leadership and management to assure a competent, highly qualified work force redeems client commitments in a professional, high-quality and timely manner. Provide hands-on job site installation as required.

Service Manager

Redeem operating unit gross profit objectives through leadership and management of staff while meeting contractual commitments to clients in a timely, high-quality manner.

Project Manager

Plan, coordinate, direct and supervise personnel, subcontractors and vendors ensuring they complete work on time and within budget, for multiple small to multi-million-dollar projects with safety, quality, integrity, and client satisfaction. Provide hands-on job site installation as required.

General Manager

Meet planned growth, profit, maintenance base and client retention goals through leadership and management of staff. Implement the Linc System® while redeeming client obligations in a timely, cost-effective, high-quality manner.

Lead Technician

Troubleshoot, repair, maintain, and install HVAC and related equipment as assigned. Assume day to day coordination of specific agreements or projects as assigned to assure contractual commitments are met in a timely, cost-effective manner.

Service Technician

Troubleshoot, repair, maintain, and install HVAC and related equipment as assigned. Assume day to day coordination of specific agreements or projects as assigned to assure contractual commitments are met in a timely, cost-effective manner.

Installer

Install, retrofit, and replace HVAC and related equipment as assigned in a timely, high-quality manner.

Equipment Specific Maintenance Guidelines

Air Compressors

Scheduled preventive maintenance inspections include:

- Check in with customer to discuss any operating issues or deficiencies.
- Check unit for proper operation, interlocks, tagging and excessive noise or vibration. Perform PM and fill out maintenance report; note any problems.
- Check condition of and lubricate motors and/or shaft bearings if applicable.
- Check belts for condition, proper tensions and alignment; adjust and/or replace as needed per contract terms.
- Inspect electrical wiring, components and connections for signs of wear or overheating and correct/tighten if necessary.
- Remove any loose debris or old parts around equipment; notify customer if excessive.
- Check oil level and pressure in loaded and unloaded modes if applicable.
- Verify proper loading and unloading operation and adjust if needed; note any deficiencies.
- Check all operating controls, limits, safeties, interlocks, gauges and thermometers; note any deficiencies.
- Take oil sample, change oil, filters and elements, clean strainer; dispose of old oil per contract terms.
- Check inlet air filters and replace same when needed.
- Blow down tank manually, check operation of auto blow down device; note any deficiencies.
- Monitor cycles and run time. Run time should not exceed 1/3 of off cycle. Note any deficiencies.
- Check operation of pressure reducing and relief valves and note any deficiencies.
- Inspect for signs of oil or air leakage and note any deficiencies.

Air Handlers

Scheduled preventive maintenance inspections include:

- Check in with customer to discuss any operating issues or deficiencies.
- Check unit for proper operation, interlocks, tagging and excessive noise or vibration. Perform preventive maintenance and fill out maintenance report; note any problems.
- Visually inspect coils for damage, obstructions and cleanliness. Brush, if needed, or schedule chemical cleaning per contract terms.
- Pressure wash coils and fans with biodegradable coil cleaning solution, when needed per contract terms.
- Check condition of and lubricate motors and/or shaft bearings, if applicable.
- Inspect fans and blowers for bent blades, imbalance, trash, dirt, proper rotation and airflow.
- Check belts for condition, proper tensions, and alignment; adjust and/or replace as needed per contract terms.

- Inspect electrical wiring, components and connections for signs of wear or overheating and correct/tighten if necessary.
- Remove any loose debris or old parts around equipment; notify customer if excessive.
- Check unit controls, thermostat, economizer, valves, dampers, louvers, linkage and shutters; lubricate pivot points, if applicable.
- Clean evaporator drain-pan and condensate drain piping as necessary. Install pan tablets and perform preventive maintenance on condensate pump, if applicable.
- Replace air filters and/or media as needed per contract terms; clean reusable filters.
- Check operation of freeze protection devices, if subject to freezing, note any deficiencies, if applicable.

Electric Heat

- Check operation and condition of electric heat elements, controls, interlocks and safeties, if applicable.

Gas Heat

- Visually inspect combustion chamber, heat exchanger, and flue; note any deficiencies, if applicable.

Oil Heat

- Check operation of oil burner, blower, controls and safeties; note any deficiencies, if applicable.
- Inspect fuel lines for leakage; replace oil filter element as needed, if applicable.

Steam Heat

- Check condition and operation of steam coil, trap, valves and accessories, if applicable.
- Inspect steam piping valves and accessories for leakage; check condition of pipe insulation, if applicable.

Boilers

(Electric, Gas, Oil & Steam)

Scheduled preventive maintenance inspections include

- Check in with customer; discuss any operating issues or deficiencies.
- Check unit for proper operation, interlocks, tagging and excessive noise or vibration. Perform preventive maintenance and fill out maintenance report; note any problems.
- Inspect electrical wiring, components and connections for signs of wear or overheating and correct/tighten if necessary.
- Remove any loose debris or old parts around equipment; notify customer if excessive.
- Inspect hot water piping and valves at boiler for leakage; check condition of pipe insulation, if applicable.
- Check condition, operation and proper liquid/air levels in expansion tank.
- Check water feed system, low water cut off and relief valve. Blow down boiler, if applicable.

- Check condition of thermometers, gauges, sight glasses and compare with operating controls.
- Check operation of remote controls, devices and interlocks. i.e.: time clocks, outdoor reset, E.M.S., etc.

Electric Heat

- Check condition and operation of all high temperature and operating controls.
- Amp out all stages of heat, check flow, high temperature and low water safeties and interlocks; note any deficiencies.
- Perform seasonal startup or shutdown, warm up boiler slowly, inspect for waterside leaks in tubes and jacket; note any deficiencies.

Gas Heat

- Check operation of gas burner, gas train, combustion blowers, controls and safeties; note any deficiencies found.
- Visually inspect combustion chamber, heat exchanger and flue; note any deficiencies.
- Inspect and check operation of all safeties and controls, cycle burner and check all flame safeguards.
- Inspect and lubricate burner blower, clean blower wheel if needed.

Oil Heat

- Check operation of oil burner, blower, controls and safeties; note any deficiencies.
- Pull and inspect burner gun assembly, clean nozzles and electrodes as needed.
- Inspect fuel lines for leakage, replace oil filter element as needed.
- Check condition and operation of barometric damper or other draft devices if applicable.
- Inspect and lubricate burner blower, clean blower wheel if needed.

Steam Heat

- Check condition and operation of steam coil, trap, valves and accessories.
- Inspect steam piping valves and accessories for leakage, check condition of pipe insulation.
- Check condensate return system, make up system, pumps and controls.

Boilers - Domestic Water

(Gas, Oil, & Electric)

Scheduled preventive maintenance inspections include:

- Check in with customer and discuss any operating issues or deficiencies.
- Check unit for proper operation, interlocks, tagging and excessive noise or vibration. Perform preventive maintenance and fill out maintenance report. Note any problems.
- Inspect electrical wiring, components and connections for signs of wear or overheating and correct/tighten if necessary.
- Remove any loose debris or old parts around equipment, notify customer if excessive.
- Check water feed system, low water cut off, and relief valve.
- Check condition of thermometers, gauges, sight glasses and compare with operating controls.
- Check operation of remote controls, devices and interlocks. i.e.: time clocks, outdoor reset, E.M.S., etc.
- Drain and flush water vessel, refill and check total operation.

Electric Heat

- Amp out all stages of heat, check flow, high temperature and low water safeties and interlocks; note any deficiencies.
- Check condition and operation of all high temperature, high pressure and operating controls.

Gas Fired

- Check operation of gas burner, gas train, combustion blowers, controls and safeties; note any deficiencies found.
- Visually inspect combustion chamber, heat exchanger and flue; note any deficiencies.
- Check condition, operation and proper liquid/air levels in expansion tank. Should have positive pressure; if applicable.
- Inspect and check operation of all safeties and controls, cycle burner and check all flame safeguards.
- Check condition and operation of barometric damper or other draft devices if applicable.
- Inspect and lubricate burner blower, clean blower wheel if needed.

Oil Fired

- Visually inspect combustion chamber, heat exchanger and flue; note any deficiencies.
- Check operation of oil burner, blower, controls and safeties; note any deficiencies.
- Pull and inspect burner gun assembly, clean nozzles and electrodes as needed.
- Inspect fuel lines for leakage; replace oil filter element as needed.
- Check condition, operation and proper liquid/air levels in expansion tank. Should have positive pressure, if applicable.
- Inspect and check operation of all safeties and controls, cycle burner and check all flame safeguards.

- Check water feed system, low water cut off and relief valve. Blow down boiler, if applicable.
- Inspect and lubricate burner blower, clean blower wheel, if needed.

Chillers - Centrifugal

(Air Cooled, Water Cooled and Glycol Cooled)

Scheduled preventive maintenance inspections include:

- Check in with customer to discuss any operating issues or deficiencies.
- Check unit for proper operation, interlocks, tagging and excessive noise or vibration. Perform preventive maintenance and fill out maintenance report; note any problems.
- Inspect electrical wiring, components and connections for signs of wear or overheating correct/tighten; if necessary.
- Remove any loose debris or old parts around equipment; notify customer if excessive.
- Inspect chilled water piping and valves for leakage: check condition of unit and pipe insulation.
- Check operation of remote controls, devices and interlocks. i.e.: time clocks, outdoor reset, E.M.S. etc.
- Check refrigerant charge/level and pressures, check evaporator and condenser approach temps; note any deficiencies.
- Check oil level and pressures, check operation of oil pumps. Check for proper oil return; note any deficiencies.
- Check oil temps, verify proper oil heater, oil cooler and control operation; note any deficiencies.
- Check all operating controls, limits, safeties, interlocks, gauges, and thermometers; note any deficiencies.
- Check operation and condition of vanes, actuators, linkage and controls, verify proper limit and overload settings.
- Inspect machine for any signs of oil or refrigerant leaks, inspect condition of rupture disk, vent pipe, or relief system.
- Check condition and operation of purge system, drain any water if present; note any deficiencies.
- Check operation of aux. Environmental equipment installed on machine if present; note any deficiencies.
- Check chilled/condenser water flow rates and temp. Check flow safeties, and interlocks; note any deficiencies.
- Pull condenser heads, brush clean and inspect tubes, clean strainer; note any deficiencies, per contract terms.
- Take oil sample, change oil, filters and elements, clean strainer, dispose of old oil, per contract terms.
- Test motor windings and oil pump, inspect and clean starters and contacts, check dash pot oil level if applicable; note any deficiencies.
- P/M purge system, i.e., replace driers, change oil, flush separator, clean drum and float valve, per manufacturer specifications.

- Inspect motor coupling assembly and alignment if applicable as per contract terms.
- Check operation of transition timer and resistors, clean resistors if needed.
- Check operation of air-cooled condenser (see P/M procedures for same).

Chillers - Oil Free Centrifugal

(Water Cooled)

Scheduled preventive maintenance inspections will be performed during normal working hours (times) times per year on the following schedule:

It will include the equipment listed in Section 3 and will include the following preventive maintenance procedures:

- Check in with customer to discuss any operating issues or deficiencies.
- Check unit for proper operation, excessive noise or vibration. Perform preventive maintenance and fill out maintenance report; note any problems.
- Inspect electrical wiring, components and connections for signs of wear or overheating correct/tighten; if necessary.
- Inspect chilled water piping and valves for leakage: check condition of unit and pipe insulation.
- Check operation of controls, devices and interlocks.
- Check refrigerant charge/level and pressures, check evaporator and condenser approach temps; note any deficiencies.
- Check all operating controls, limits, safeties, interlocks, gauges, and thermometers; note any deficiencies.
- Check operation and condition of compressor and controls, verify proper operation.
- Inspect machine for any signs of refrigerant leaks.
- Check chilled/condenser water temperatures. Note any deficiencies.
- Pull condenser heads, brush clean and inspect tubes, clean strainer; note any deficiencies, per contract terms (Every 2 years).

Chillers - Reciprocating

(Water Cooled, Glycol Cooled & Air Cooled)

Scheduled preventive maintenance inspections will be performed during normal working hours (times) times per year on the following schedule: (Quarterly, Annually, etc.)

It will include the equipment listed in Section 3 and will include the following preventive maintenance procedures:

- Check in with customer to discuss any operating issues or deficiencies.
- Check unit for proper operation, interlocks, tagging and excessive noise or vibration. Perform PM and fill out maintenance report; note any problems.
- Visually inspect units, piping and accessories for any signs of oil or refrigerant leakage. Note any found and schedule necessary repairs.
- Inspect electrical wiring, components and connections for signs of wear or overheating and correct/tighten if necessary.
- Remove any loose debris or old parts around equipment; notify customer if excessive.
- Inspect chilled water piping and valves at chiller for leakage, check condition of unit and pipe insulation.
- Check operation of freeze protection devices; note any deficiencies.
- Check operation of refrigeration cycle, pump down cycle, controls, refrigerant charge and oil level (if applicable); note any deficiencies.
- Check operation of compressor (see compressor PM procedures); note any deficiencies.
- Perform seasonal startup or shutdown; check operation of low ambient options installed; note any deficiencies.
- Check for proper water/glycol flow and heat exchange; note any deficiencies.
- Check operation of water/glycol regulating valves, flow safeties, changeover controls and pumps if applicable.
- Check condition of water/glycol piping, valves, hoses, supports, gauges, thermometers, etc.; note any deficiencies.
- Check operation of microprocessor, thermostats and/or controls in all modes; verify proper setpoints; note deficiencies. Replace any bad indicator lamps.
- Check operation of remote controls, devices and interlocks. i.e. time clocks, outdoor reset, E.M.S., etc.
- Check for proper chilled water flow and temperature, split, check flow interlocks.
- Check evaporator shell heater sand controls if applicable.
- Check condition and operation of contactors, time delays and compressor windings; note any deficiencies.
- Check operation of drycooler and pump if applicable (see drycooler PM procedures).
- Check operation of air-cooled condenser (see PM procedures for same).

Cooling Towers

(Open Tower, Closed Circuit & Injection)

Scheduled preventive maintenance inspections include:

- Check in with customer to discuss any operating issues or deficiencies.
- Check unit for proper operation, interlocks, tagging and excessive noise or vibration. Perform PM and fill out maintenance report; note any problems.
- Check condition of and lubricate motors and/or shaft bearings if applicable.
- Inspect fans or blowers for bent blades, imbalance, trash, dirt, proper rotation and airflow.
- Check belts for condition, proper tensions and alignment; adjust and/or replace as needed per contract terms.
- Check operation and settings of fan cycling, fan speed and temperature controls if applicable.
- Inspect electrical wiring, components and connections for signs of wear or overheating and correct/tighten if necessary.
- Remove any loose debris or old parts around equipment; notify customer if excessive.
- Check unit controls, thermostat, economizer, valves, dampers, louvers, linkage and shutters; lubricate pivot points if applicable.
- Perform seasonal startup or shutdown; check operation of low ambient options installed; note any deficiencies.
- Check operation of spray pump(s), spray header system(s), clean nozzles and strainer(s) (as needed).
- Check operation of capacity control devices, i.e.: dampers, bypass valves, fan speed reduction equipment, etc.; note any deficiencies.
- Check operation of water makeup devices, i.e.: float, electronic controls, solenoid valve; adjust and repair as needed; note any deficiencies.
- Check operation and oil level of gearbox; change oil per manufacturer's specifications. Inspect tower and piping for leakage; check condition of insulation; note any deficiencies.
- Check operation and condition of freeze protection, i.e.: sump heaters and controls, heat tape, auxiliary heat if applicable; note any deficiencies.
- Inspect cleanliness of tower; note any deficiencies.
- Clean tower, sump, hot and cold water basins, nozzles, eliminators and strainer; inspect condition; note any deficiencies; schedule any corrective actions (per contract terms).
- Check for proper water/glycol flow and heat exchange; note any deficiencies.
- Check glycol concentration and level; note any problems and schedule corrective actions to prevent freezing or other related problems.
- Check condition, operation and proper liquid/air levels in expansion tank. Should have positive pressure, if applicable.

- Inspect condition of tube bundle(s)/coil(s); note deficiencies; schedule cleaning if needed (per contract terms).

Drycoolers

Scheduled preventive maintenance inspections include:

- Check in with customer to discuss any operating issues or deficiencies.
- Check unit for proper operation, interlocks, tagging and excessive noise or vibration. Perform PM and fill out maintenance report; note any problems.
- Visually inspect coils for damage, obstructions and cleanliness. Brush if needed or schedule chemical cleaning.
- Pressure wash coils and fans with biodegradable coil cleaning solution, when needed per contract terms.
- Check condition of and lubricate motors and/or shaft bearings if applicable.
- Inspect fans or blowers for bent blades, imbalance, trash, dirt, proper rotation and air flow.
- Check belts for condition, proper tensions and alignment; adjust and/or replace as needed per contract terms.
- Check operation and settings of fan cycling, fan speed and temperature controls, if applicable.
- Inspect electrical wiring, components and connections for signs of wear or overheating and correct/tighten if necessary.
- Remove any loose debris or old parts around equipment and notify customer if excessive.
- Check unit controls, thermostat, economizer, valves, dampers, louvers, linkage and shutters; lubricate pivot points if applicable.
- Check for proper water/glycol flow and heat exchange; note any deficiencies.
- Check operation of water/glycol regulating valves, flow safeties, changeover controls and pumps if applicable.
- Check condition of water/glycol piping, valves, hoses, supports, gauges thermometers, etc.; note any deficiencies.
- Check glycol concentration and level; note any problems and schedule corrective actions to prevent freezing or other related problems.
- Check condition, operation and proper liquid/air levels in expansion tank. Should have positive pressure, if applicable.

Environmental Units

(Air-Cooled, Glycol Cooled, Water Cooled, Electric Heat, Heat Pump)

Scheduled preventive maintenance inspections include:

- Check in with customer; discuss any operating issues or deficiencies.
- Check unit for proper operation, interlocks, tagging and excessive noise or vibration. Perform preventive maintenance and fill out maintenance report; note any problems.
- Visually inspect units, piping and accessories for any signs of oil or refrigerant leakage. Note any found and schedule necessary repairs.
- Visually inspect coils for damage, obstructions and cleanliness. Brush, if needed, or schedule chemical cleaning.
- Pressure wash coils and fans with biodegradable coil cleaning solution when needed per contract terms.
- Check condition of and lubricate motors and/or shaft bearings, if applicable.
- Inspect fans or blowers for bent blades, imbalance, trash, dirt, proper rotation and airflow.
- Check belts for condition, proper tensions and alignment; adjust and/or replace as needed per contract terms.
- Check operation and settings of fan cycling, fan speed and temperature controls, if applicable.
- Inspect electrical wiring, components and connections for signs of wear or overheating and correct/tighten if necessary.
- Remove any loose debris or old parts around equipment and notify customer if excessive.
- Check operation of refrigeration cycle, pump down cycle, controls, refrigerant charge and oil level (if applicable); note any deficiencies.
- Check operation of compressor; note any deficiencies.
- Perform seasonal startup or shutdown; check operation of low ambient options installed; note any deficiencies.

Electric Heat

- Check operation and condition of electric heat elements, controls, interlocks and safeties, if applicable.

Glycol Cooled, Water Cooled

- Check for proper water/glycol flow and heat exchange; note any deficiencies.
- Check operation of water/glycol regulating valves, flow safeties, changeover controls and pumps, if applicable.
- Check condition of water/glycol piping, valves, hoses, supports, gauges, thermometers, etc.; note any deficiencies.
- Check glycol concentration and level; note any problems and schedule corrective actions to prevent freezing or other related problems.

- Check operation of drycooler and pump if applicable (see drycooler PM procedures).
- Check for proper water/glycol flow and heat exchange; note any deficiencies.
- Pull and clean strainers in water lines, back flush condenser as needed (per contract terms).

Environmental Units - Ceiling Mounted

(Air Cooled, Glycol Cooled, Water Cooled, Chilled Water)

Scheduled preventive maintenance inspections include:

- Check in with customer and discuss any operating issues or deficiencies.
- Check unit for proper operation, interlocks, tagging, and excessive noise or vibration. Perform preventive maintenance and fill out maintenance report; note any problems.
- Visually inspect unit, piping and accessories for any signs of oil or refrigerant leakage. Note any found and schedule necessary repairs.
- Visually inspect coils for damage, obstructions and cleanliness. Brush, if needed, or schedule chemical cleaning.
- Check condition of and lubricate motors and/or shaft bearings, if applicable.
- Inspect fans or blowers for bent blades, imbalance, trash, dirt, proper rotation and air flow.
- Check belts for condition, proper tensions and alignment; adjust and/or replace as needed per contract terms.
- Check operation and settings of fan cycling, fan speed and temperature controls; if applicable.
- Inspect electrical wiring, components and connections for signs of wear or overheating and correct/tighten if necessary.
- Remove any loose debris or old parts around equipment, notify customer if excessive.
- Clean evaporator drain pan and condensate drain piping as necessary. Install pan tablets and preventive maintenance condensate pump if applicable.
- Replace air filters and/or media as needed per contract terms; clean reusable filters.
- Check operation of refrigeration cycle, pumpdown cycle, controls, refrigerant charge and oil level (if applicable); note any deficiencies.
- Check operation of compressor; note any deficiencies.
- Check operation of microprocessor, thermostats and/or controls in all modes; verify proper set points; note deficiencies. Replace any bad indicator lamps.
- Check operation of reheat.
- Check operation of humidifier, clean and flush same, check or replace defective lamps, probes, valves, element, canister, pads, filters and tanks as applicable.
- Check operation of condenser fan section or condensing unit, if applicable.

Glycol Cooler, Water Cooled & Chilled Water

- Check for proper water/glycol flow and heat exchange; note any deficiencies.

- Check operation of water/glycol regulating valves, flow safeties, changeover controls and pumps, if applicable.
- Check condition of water/glycol piping, valves, hoses, supports, gauges, thermometers, etc.; note any deficiencies.
- Check glycol concentration and level; note any problems and schedule corrective actions to prevent freezing or other related problems.
- Check operation of drycooler and pump. If applicable, perform PM.
- Pull and clean strainers in water lines, back flush condenser as needed (pr contract terms).
- Inspect chilled water piping and valves at chiller for leakage. Check condition of unit and pipe insulation.

Fans

(Exhaust, Return & Supply)

Scheduled preventive maintenance inspections include:

- Check in with customer to discuss any operating issues or deficiencies.
- Check unit for proper operation, interlocks, tagging and excessive noise or vibration. Perform PM and fill out maintenance report; note any problems.
- Check condition of and lubricate motors and/or shaft bearings if applicable.
- Inspect fans or blowers for bent blades, imbalance, trash, dirt, proper rotation and airflow.
- Check belts for condition, proper tensions and alignment; adjust and/or replace as needed per contract terms.
- Check operation and settings of fan speed and temperature controls if applicable.
- Inspect electrical wiring, components and connections for signs of wear or overheating and correct/tighten if necessary.
- Remove any loose debris or old parts around equipment; notify customer if excessive.
- Check controls, thermostat, dampers, louvers, linkage and shutters; lubricate pivot points if applicable.
- Replace air filters and/or media as needed per contract terms, clean reusable filters.
- Check operation of freeze protection devices if subject to freezing; note any deficiencies.
- Fill out maintenance checklist and report any deficiencies.

Fan Coil Units

Scheduled preventive maintenance inspections include:

- Check in with customer to discuss any operating issues or deficiencies.
- Check unit for proper operation, interlocks, tagging and excessive noise or vibration. Perform PM and fill out maintenance report; note any problems.
- Visually inspect coils for damage, obstructions and cleanliness. Brush, if needed, or schedule chemical cleaning.

- Pressure wash coils and fans with biodegradable coil cleaning solution when needed per contract terms.
- Check condition of and lubricate motors and/or shaft bearings, if applicable.
- Inspect fans or blowers for bent blades, imbalance, trash, dirt, proper rotation and airflow.
- Check operation and settings of fan cycling fan speed and temperature controls, if applicable.
- Inspect electrical wiring, components and connections for signs of wear or overheating and correct/tighten if necessary.
- Check operation and condition of chilled/hot water controls, valves, piping and coils if applicable.
- Clean evaporator drain pan and condensate drain piping as necessary.

Frequency Drives

Scheduled preventive maintenance inspections include:

- Check in with customer to discuss any operating issues or deficiencies.
- Check unit for proper operation, interlocks, tagging and excessive noise or vibration. Perform PM and fill out maintenance report; note any problems.
- Remove any loose debris or old parts around equipment; notify customer if excessive.
- Visually inspect drive for signs of overheating and loose connections; perform tighten up annually or as needed.
- Check operation, setpoints, programming, display, interlocks and amp draws, compare drive readings with actual.
- Visually inspect enclosure and cover damage or tampering; note any deficiencies.

Heat Exchangers

Scheduled preventive maintenance inspections include:

- Check in with customer to discuss any operating issues or deficiencies.
- Check unit for proper operation
- Check for proper water/glycol flow and heat exchange; note any deficiencies.
- Check condition of water/glycol flow and heat exchange; note any deficiencies.
- Check pressure differential across unit and strainer, pull and clean when needed, per contract terms.
- Chemically clean in place with proper solutions if fouled, per contract terms.
- Check for proper water treatment. Notify office if problem exists.
- Drain, open, clean and inspect heat exchanger and close and fill when completed. Notify customer and office of any issues per contract terms.

Incremental Units

(Air Cooled & Water Cooled)

Scheduled preventive maintenance inspections include:

- Check in with customer to discuss any operating issues or deficiencies.

- Check unit for proper operation, interlocks, tagging and excessive noise or vibration. Perform PM and fill out maintenance report; note any problems.
- Visually inspect units, piping and accessories for any signs of oil or refrigerant leakage; note any found and schedule necessary repairs.
- Visually inspect coils for damage, obstructions and cleanliness.
- Check condition of and lubricate motors and/or shaft bearings if applicable.
- Remove any loose debris or old parts around equipment; notify customer if excessive.
- Replace air filters and/or media as needed per contract terms; clean reusable filters.
- Fill out maintenance checklist and report any deficiencies.
- Check operation of refrigeration cycle and operation controls.
- Check operation and condition of electric heat elements, controls, interlocks and safeties if applicable.

Heat Pumps

- Check in both heating and cooling modes; list any deficiencies.

Make-up Air Units

Scheduled preventive maintenance inspections include:

- Check in with customer to discuss any operating issues or deficiencies.
- Check unit for proper operation, interlocks, tagging and excessive noise or vibration. Perform PM and fill out maintenance report; note any problems.
- Visually inspect units, piping and accessories for any signs of oil or refrigerant leakage; note any found and schedule necessary repairs.
- Visually inspect coils for damage, obstructions and cleanliness. Brush, if needed, or schedule chemical cleaning.
- Pressure wash coils and fans with biodegradable coil cleaning solution when needed per contract terms.
- Check condition of and lubricate motors and/or shaft bearings if applicable.
- Inspect fans or blowers for bent blades, imbalance, trash, dirt, proper rotation and airflow.
- Check belts for condition, proper tensions and alignment; adjust and/or replace as needed per contract terms.
- Inspect electrical wiring, components and connections for signs of wear or overheating and correct/tighten if necessary.
- Remove any loose debris or old parts around equipment; notify customer if excessive.
- Check unit controls, thermostat, economizer, valves, dampers, louvers, linkage and shutters; lubricate pivot points if applicable.
- Clean evaporator drain pan and condensate drain piping as necessary; install pan tablets and PM condensate pump if applicable.
- Replace air filters and/or media as needed per contract terms; clean reusable filters.

- Check operation of freeze protection devices, if subject to freezing; note any deficiencies.
- Check operation and condition of electric heat elements, controls, interlocks and safeties if applicable.
- Check operation of refrigeration cycle, pump down cycle, controls, refrigerant charge and oil level if applicable; note any deficiencies.
- Check operation and condition of chilled/hot water controls, piping and coils if applicable.

Package Rooftop Units

(A/C, Electric Heat, Gas Heat, Oil Heat, Steam Heat, Hot Water Heat & Heat Pump)

Scheduled preventive maintenance inspections include:

- Check in with customer to discuss any operating issues or deficiencies.
- Check unit for proper operation, interlocks, tagging and excessive noise or vibration. Perform PM and fill out maintenance report; note any problems.
- Visually inspect units, piping and accessories for any signs of oil or refrigerant leakage; note any found and schedule necessary repairs.
- Visually inspect coils for damage, obstructions and cleanliness. Brush if needed, or schedule chemical cleaning.
- Pressure wash condenser coils and fans with biodegradable coil cleaning solution when needed, per contract terms.
- Check condition of and lubricate motors and/or shaft bearings, if applicable.
- Inspect fans or blowers for bent blades, imbalance, trash, dirt, proper rotation and airflow.
- Check belts for condition, proper tensions and alignment; adjust and/or replace as needed per contract terms.
- Check operation and settings of fan cycling, fan speed and temperature controls if applicable.
- Check operation and condition of head pressure dampers and/or bypass valve, if applicable.
- Inspect electrical wiring, components and connections for signs of wear or overheating and correct/tighten if necessary.
- Remove any loose debris or old parts around equipment; notify customer if excessive.
- Check unit controls thermostat, economizer, valves dampers, louvers, linkage and shutters; lubricate pivot points if applicable.
- Clean evaporator drain pan and condensate drain piping as necessary; install pan tablets.
- Replace air filters and/or media as needed per contract terms; clean reusable filters.
- Check operation of refrigeration cycle, pump down cycle, controls, refrigerant charge and oil level if applicable; note any deficiencies.
- Check operation of compressor; note any deficiencies.
- Perform seasonal startup or while performing preventive maintenance inspection; check operation of low ambient options installed; note any deficiencies.

Heat Pumps

- Check operation of refrigeration cycle, controls, refrigerant charge and oil level (if applicable) in both heating and cooling modes; note any deficiencies.

Electric Heat

- Check operation and condition of electric heat elements, controls, interlock and safeties, if applicable.

Gas Heat

- Check operation of gas burner, gas train, combustion blowers, controls and safeties; note any deficiencies.
- Visually inspect combustion chamber, heat exchanger and flue; note any deficiencies.

Oil Heat

- Check operation of oil burner, blower, controls and safeties; note any deficiencies.
- Pull and inspect burner gun assembly, clean nozzles and electrodes as needed.

Steam Heat

- Check condition and operation of steam coil, trap, valves and accessories.
- Inspect steam piping valves and accessories for leakage; check condition of pipe insulation.

Hot Water Heat

- Inspect hot water piping and valves for leakage; check condition of pipe insulation if applicable.
- Check operation of freeze protection devices if subject to freezing; note any deficiencies.

Pumps

Scheduled preventive maintenance inspections include:

- Check in with customer to discuss any operating issues or deficiencies.
- Check unit for proper operation, interlocks, tagging and excessive noise or vibration. Perform PM and fill out maintenance report; note any problems.
- Inspect electrical wiring, components and connections for signs of wear or overheating and correct/tighten if necessary.
- Remove any loose debris or old parts around equipment; notify customer if excessive.
- Check and lubricate pump and motor per manufacturer's specifications, do not grease sealed bearings.
- Check pump and system pressures, note deficiencies, i.e.: cavitations, hi/low pressures, etc.
- Check condition of pump seals and seal flush lines if applicable; note any deficiencies.
- Check condition and operation of gauges and thermometers; note any deficiencies.
- Check pressure differential across unit and strainer, pull and clean when needed, per contract terms.
- Check motor amp draw and surface temperature; note any deficiencies.
- Check condition and alignment of coupling assembly and inserts if applicable; note any deficiencies.

- Verify proper check valve operation; check balancing valve and shut off valve positions if applicable; note any deficiencies.
- Check operation of pump controls and interlocks, rotate lead/lag if applicable; note any deficiencies.
- Check condition and operation of back up pump and controls; note any deficiencies.

Space Heaters

(Electric Heat & Gas Heat)

Scheduled preventive maintenance inspections include:

- Check in with customer to discuss any operating issues or deficiencies.
- Check unit for proper operation, interlocks, tagging and excessive noise or vibration. Perform P/M and fill out maintenance report; note any problems.
- Check condition of and lubricate motors and/or shaft bearings, if applicable.
- Inspect fans or blowers for bent blades, imbalance, trash, dirt, proper rotation and air flow.
- Inspect electrical wiring, components and connections for signs of wear or overheating correct/tighten; if necessary.
- Remove any loose debris or old parts around equipment; notify customer if excessive.

Electric Heat

- Check operation and condition of electric heat elements, controls, interlocks and safeties; if applicable.
- Check for proper airflow and airflow safety switches; note and deficiencies.

Gas Heat

- Check operation of gas burner, gas train, combustion blower, controls and safeties; note any deficiencies found.
- Visually inspect combustion chamber, heat exchanger, and flue; note any deficiencies.
- Clean combustion chamber and burner section; as needed (per contract terms).

Split Systems

(A/C Only, Heat Pump, Gas Heat, Hot Water Heat)

Scheduled preventive maintenance inspections include:

- Check in with customer; discuss any operating issues or deficiencies.
- Check unit for proper operation, interlocks, tagging and excessive noise or vibration. Perform preventive maintenance and fill out maintenance report, note any problems.
- Visually inspect units, piping and accessories for any signs of oil or refrigerant leakage. Note any found and schedule necessary repairs.
- Visually inspect coils for damage, obstructions and cleanliness. Brush, if needed, or schedule chemical cleaning.
- Pressure wash coils and fans with biodegradable coil cleaning solution, when needed per contract terms.

- Check condition of and lubricate motors and/or shaft bearings, if applicable.
- Inspect fans or blowers for bent blades, imbalance, trash, dirt, proper rotation and airflow.
- Check belts for condition, proper tensions, and alignment; adjust and/or replace as needed per contract terms.
- Check operation and settings of fan cycling, fan speed and temperature controls, if applicable.
- Check operation and condition of head pressure dampers and/or bypass valve, if applicable.
- Inspect electrical wiring, components and connections for signs of wear or overheating and correct/tighten if necessary.
- Remove any loose debris or old parts around equipment; notify customer if excessive.
- Check operation of refrigeration cycle, pump down cycle, controls, refrigerant charge and oil level (if applicable); note any deficiencies.
- Check operation of compressor; note any deficiencies.
- Perform seasonal startup or shutdown. Check operation of low ambient options installed; note any deficiencies.
- Check unit controls, thermostat, economizer, valves, dampers, louvers, linkage and shutters; lubricate pivot points, if applicable.
- Clean evaporator drain pan and condensate drain piping as necessary. Install pan tablets and perform preventive maintenance on condensate pump, if applicable.
- Replace air filters and/or media as needed per contract terms, clean reusable filters.
- Check operation of freeze protection devices, if subject to freezing; note any deficiencies.

Electric Heat

- Check operation and condition of electric heat elements, controls, interlocks and safeties, if applicable.

Gas Heat

- Check operation of gas burner, gas train, combustion blowers, controls and safeties; note any deficiencies found.

Transfer Switches

Scheduled preventive maintenance inspections include:

- Check in with customer to discuss any operating issues or deficiencies.
- Fill out maintenance checklist and report any deficiencies.
- Notify proper customer personnel prior to testing, transferring and shutting down of any electrical equipment.
- Visually inspect all electrical components and enclosures for debris and cleanliness and clean as necessary.
- Inspect all components for proper settings and calibrations and adjust as necessary.

- Visually inspect all wiring and cabinet safety ground, conductors and fastenings.
- Check all access panels for proper closure.
- Check to be certain that there are not exposed high voltage terminals within normal access of operating personnel.

Variable Air Volume Boxes

Scheduled preventive maintenance inspections include:

- Check in with customer to discuss any operating issues or deficiencies.
- Check unit for proper operation, interlocks, tagging and excessive noise or vibration. Perform P/M and fill out maintenance report; note any problems.
- Inspect electrical wiring, components and connections for signs of wear or overheating correct/tighten; if necessary.
- Check operation and condition of electric heat elements, controls, interlocks and safeties; if applicable.
- Check operation and condition of hot water or steam heat, valves and controls, if applicable.
- Verify min/max air flow settings and proper thermostat control, and actuator operation.
- Check operation of controls, valve, dampers and linkage; lubricate pivot points if applicable.
- Check condition of and lubricate motors and/or shaft bearings; if applicable.
- Inspect fans or blowers for bent blades, imbalance, trash, dirt, proper rotation and air flow.
- Check operation and settings of fan cycling, fan speed and temperature controls; if applicable.
- Replace air filters and/or media as needed per contract terms, clean reusable filters.

Water Source Heat Pumps

Scheduled preventive maintenance inspections include:

- Check in with customer to discuss any operating issues or deficiencies.
- Check unit for proper operation, interlocks, tagging and excessive noise or vibration. Perform PM and fill out maintenance report; note any problems.
- Visually inspect units, piping and accessories for any signs of oil or refrigerant leakage; note any found and schedule necessary repairs.
- Visually inspect coils for damage, obstructions and cleanliness. Brush, if needed, or schedule chemical cleaning (at additional cost).
- Check condition of and lubricate motors and/or shaft bearings if applicable.
- Inspect electrical wiring, components and connections for signs of wear or overheating and correct/tighten if necessary.
- Remove any loose debris or old parts around equipment; notify customer if excessive.
- Clean evaporator drain pan and condensate drain piping as necessary; Clean condensate pump and check operation, if applicable.

- Replace air filters and/or media as needed per contract terms; clean reusable filters.
- Fill out maintenance checklist and report any deficiencies.
- Check operation of refrigeration cycle and operation controls.
- Check operation and condition of electric heat elements, controls, interlocks and safeties if applicable.
- Pull and clean strainers in water lines, if necessary.
- Chemically clean and flush water/glycol side of condenser when needed (at additional cost.
- When checking operation of refrigeration cycle, back flush condenser coils, if necessary.

Micro-Cogeneration Units

Scheduled preventive maintenance inspections include:

- Check in with customer to discuss any operating issues or deficiencies.
- Every 4000 operating hours perform the following maintenance
  - Change oil, oil filter, air filter, spark plug, and spark plug cable.
  - Perform other electrical maintenance as indicated above including tightening of lugs, checking for heat related issues, etc. .
  - Re-start and check for proper operation, reviewing the initial start-up checklists and commissioning procedures

Description of, and Cost Estimates of a Proposed Energy Savings Guarantee

Energy Incentives and Rebates

ABM is expecting to utilize $96,018 of rebates towards this project. ABM has calculated these estimated rebates through the NJ Clean Energy Program with PSE&G being the utility provider. We used the prescriptive lighting rebate calculations as a base line.

Savings Calculations

ABM has conducted an on-site survey of the City of Paterson's lighting; heating, ventilating, and air conditioning (HVAC) equipment; water usage; building envelope; and facility operations. In the survey, we evaluate the energy and utility consumption and costs (fuel oil, natural gas, electric, water, and sewer), as well as the existing building control strategies. We also review the operation schedules for each facility and miscellaneous "plug load" equipment (copiers, computers, and vending machines). the City of Paterson will receive a description of the savings potential from the measures evaluated in our investment grade audit (IGA) and will be shown additional project funding that can be generated by leveraging these savings.

Baseline Calculation Methodology

Establishing Baseline

Baseline energy use, developed during the IGA, is the monthly and annual energy output from current equipment, occupancy, and operational methodology.

In determining a baseline, we:

- Analyze energy usage records for the past three years, taking into account any changes in facility equipment and operations that would alter the usage during that three-year period.
- Obtain a thorough understanding of the programmatic activities conducted in each building, as well as an understanding of the electrical and mechanical equipment operating patterns.
- Develop an energy and water usage computer simulation model for the facility and calibrate using actual data. This calibrated model is used as a tool for evaluating energy savings for specific ECMs and accounting for energy consumption interactions between ECMs.

Once we have an annual baseline, we review prior years to determine if anything significant has changed. If the pattern is consistent, we have good reason to believe that the building is operating as its equipment and controls system will currently allow.

Total Monthly Energy Use by Building

After completing mechanical drawings, data logging, and a survey, we performed an in-depth end-use analysis. This gives the City of Paterson and ABM a better understanding of building energy use based on the load profile, occupancy patterns, and overall system efficiencies.

Baseline Maintenance

A dynamic facility can show energy savings that appear to decrease over time. Adjustments to the baseline may be appropriate if the true savings derived from the ECMs are to be accounted for when the client modifies a facility for reasons outside the scope of the performance contract.

Typical changes to facilities include:

- Occupancy schedule changes
- HVAC schedule changes
- Additional miscellaneous equipment
- New HVAC equipment (cooling)
- Additions to buildings
- Remodeled buildings

If excess time is required to calculate the effect of large-scale changes, we may ask the client to pay for the time involved or agree to another form of savings' calculations for the areas affected.

ABM obtained data associated with changes at the facility and furnished questionnaires to assist the City of Paterson's designated personnel in providing required information. We model the questionnaire after ones we found effective in similar programs and customize it to accommodate your record-keeping methods.

As the City of Paterson informs us of any changes that may impact energy use, we measure the effects on the overall energy use of the facility. The additional calculated monthly usage will be presented to the City of Paterson for review and approval and added to the baseline(s) for use in the savings calculations.

Restoration of Energy Using Equipment

Restoring non-operable equipment will cause an increase in the amount of energy used, particularly electricity. ABM's proprietary in-house comprehensive energy analysis software program can compute the anticipated annual utility consumption for these devices with an accuracy of +/-3%. It can also account for degradation of efficiency in rebuilt equipment.

We recommend adding the annual energy use from restored equipment to the initial baseline for the appropriate facility. We subtract the actual energy use after the implementation of the program from the adjusted baseline.

Calculation Methodology

ABM determines energy savings on a monthly basis by using the baseline energy usage and the actual billed energy consumption of the facility. The steps in determining savings are shown arithmetically:

BASELINE / ADJUSTED BASELINE **–** **ACTUAL USAGE** **=** **ENERGY SAVINGS**

ABM's Monitoring Department performs M&V of energy savings, ensuring compliance with International Performance Measurement and Verification Protocol (IPMVP) protocol and can use electric meters calibrated for accuracy and registered with the National Institute for Standards and Tests (NIST).

ABM's monitoring personnel detect and facilitate the return of tens of thousands of dollars in excess utility charges to affected systems.

Methodology to Assign Dollar Value to Savings

Dollar savings are calculated by multiplying the energy incremental rate (i.e., $/kWh, $/MMBTU) by the energy units saved. ABM makes adjustments to the incremental rate each year to account for increasing utility rates. Two common methods to accomplish this are the Consumer Price Index and the actual increase/decrease in the utility rate structure. The use of a pre-arranged inflation index or flat utility rate structure establishes a floor and ceiling for utility energy costs. the City of Paterson will approve the adjustment method used.

The procedures for assigning dollar values to energy, water, and O&M savings are described in the following paragraphs.

Preliminary Evaluation

To accurately report savings from the installed ECMs, complete baselines, and utility rates are developed and analyzed. We evaluate water and energy consumption data provided by the City of Paterson. The savings potential at the specified facility is established based on energy and water conserving retrofit scenarios and their associated costs.

Data Sources

Accurate information on fuel consumption, building occupancy, equipment down time, and/or renovation schedules is used to provide an assessment of savings. Information is obtained on a number of variables, including utility rates, local weather profile, facility square footage changes, environmental conditions, schedules, and an inventory of equipment in the facility. We obtain weather data from the National Weather Service, National Oceanic and Atmospheric Administration (NOAA), or Accuweather to establish the Comprehensive Energy Analysis baselines. Year-to-year utility usage trends and overall average use date-adjusted values are compared and adjusted to reflect the electric and natural gas usage within each calendar month. This eliminates variation and prepares the data for use in calibrating simulation programs.

Utility Rates

Rate structures and actual utility bills are analyzed to determine the current rates being charged to the City of Paterson's facilities. The resulting cost per unit is used for savings calculations.

Utility Bill Analysis

Electric, gas and water data is collected and analyzed for the City of Paterson's facilities. This data will establish an existing usage pattern and aid in the calculation of predicted savings from the various energy efficiency measures.

Master Meters

For mastered metered buildings, we find the IGA baseline energy consumption by analyzing up to 36 months of data per meter. We enter the data onto a spreadsheet and normalize to calendar months. The data is used to calibrate the building models developed, estimate savings, and create weather-adjusted equations. For electric and gas data, a weather regression analysis is performed by charting the available usage versus the monthly degree-days. A linear equation is applied to winter and summer data and the

correlation of the data is analyzed. Data outside of the norm may be removed until achieving a correlation of 0.8 or greater, or the best possible correlation allowed with the available data.

Utilization of non-utility savings is strictly up to the city. Some of ABM's clients choose to utilize non-utility savings to maximize project potential, while others choose to utilize utility savings only. ABM's clients that have chosen to utilize non-utility savings have typically utilized all of the savings' categories listed above, with the exception of manpower and administrative costs, as these "productivity enhancing" categories often times do not result in actual cost reductions to the client.

For buildings that contain electric meters, we calculate savings by subtracting the post-implementation billed usage from the baseline usage.

The specific equations for calculating the unit savings are as follows:

Unit Savings = Baseline Usage – Billed Usage

- Billed Usage = Total Units (kWh or Centum Cubic Feet (CCF)) from the current post implementation
- Utility bill, for all meters of that type for that facility.

Baseline Usage = M x DD + B

Where:

- M = slope of the equation
- DD = the degree days in the billing period (cooling or heating, depending on the equation used)
- B = they intercept of the equation

The regression equation to be used depends on the fuel type and the number of Heating Degree Days (HDD) and Cooling Degree Days (CDD) in the billing period. The equation will be decided by the follow rules:

For Electric Accounts:

- If CDD = > HDD then use Summer/CDD equation
- If HDD > CDD then use Winter/HDD equation

For Natural Gas Accounts:

- If HDD = 0 then use Summer/CDD equation
- If HDD <> 0 then use Winter/HDD equation

The dollars saved will be calculated by multiplying the units saved by the applicable unit rate.

Dollars Saved = Unit Savings * Contractual Utility Rate

Some sites may not have any correlation to weather. For these sites, non-weather adjusted baseline usage will be determined and used for savings verification. The equations used for the calculation of savings are as follows:

Unit Savings	Baseline Usage – Billed Usage
Billed Usage	Total Units (kWh or ccf) from the current post implementation utility bill, for all meters of that type for that facility
Baseline Usage	Total Units derived from pre-implementation utility bills, representing the usage profile of the facility, usually an average over multi-year consumption

Procedure for Calculating Energy and Cost Savings

To establish a baseline, ABM deploys extensive data logging and verifies equipment runtimes, CO2 levels, indoor temperatures, and humidity levels, and more. The following paragraphs summarize the typical procedures and formulas ABM uses to measure and calculate energy savings.

Energy Savings Calculation Methodology

Actual demand and energy rates were determined from 2022-2023 PSE&G electric bills provided by Paterson.TC-1 - Boiler Upgrades – Replace Boilers

Gas Savings	$(\text{existing gas usage}) \times \left(1 - \frac{\text{(old eff.)}}{\text{(new eff.)}}\right)$
Cost Savings	(gas savings) x (gas rate)

1. Nameplate boiler efficiencies derated based on the boiler condition and age are used for the savings calculations.
2. New boiler efficiency from cutsheet is used in calculating the energy savings.
3. Boiler cycling losses were assumed based on the purge cycle timing.
4. Boiler load is assumed to vary linearly with OAT below the building BP.

TC-3 - HVAC Controls Upgrades (Equipment Scheduling)

- Install Truck Door Heating Lock-Out Controls
- Install Wi-Fi Thermostats and Boiler Lock-Out Controls
- Install Wi-Fi Thermostats
- Install New DDC Control System

The existing heating and cooling equipment usage is calculated on a bin-hour/temperature basis through a calculation of the net heating and cooling energy required to maintain comfortable environmental conditions. This technique varies for each type of HVAC system, such as single zone constant volume with reheat; single zone variable air volume with reheat; multi-deck constant volume; dual duct multi-zone constant volume; or single zone DX cooling with baseboard independent heating. Each of these systems requires different equations to evaluate energy use during occupied and unoccupied hours. ABM can

develop customized spreadsheets to calculate energy requirements for each zone and system type in a building.

The formula developed considers the following:

- Zone loads based on occupied/unoccupied periods at various outdoor air temperatures and interior heat loads.
- HVAC system operating parameters that provide the necessary heating, cooling, and ventilation rates needed to meet zone loads through a combination of air quantity, discharge air temperature, and outdoor air Cubic Feet per Minute (CFM).
- Sum the annual heating, cooling, and fan energy for each temperature bin for each zone.
- Sum all zones and compare with annual HVAC energy consumption based on utility bills, after subtracting lighting, equipment, and other electrical and thermal loads unrelated to the HVAC systems.

Calculation Methodology

1. HOBO Motor on/off, temp/RH loggers, along with Outdoor Air Temps (OAT) are used to determine the runtime and setpoints of the equipment.
2. The equipment load is assumed to vary linearly with OAT with Balance Point (BP) being the temp when the building is in equilibrium with no heating or cooling need.
3. Energy Efficiency Rating (EER)/COP for the equipment used in the calculation is obtained from the cutsheet (where name plate data is available) and derated for equipment in poor condition.
4. Building schedule is obtained from city system and is specific to each building. Difference between the existing equipment schedule and actual (or proposed) schedule results in these savings.
5. Cooling Setpoint of 80-85°F and Heating Setpoint of 55-60°F will be maintained during Unoccupied Hours. Extra equipment runtime to maintain these temps during night/weekend is taken into account while calculating savings.

Shutdown Period	$\left(old \frac{hrs}{wk}\right) - \left(new \frac{hrs}{wk}\right)$
Cooling Savings	$\left(shutdown\ period\right) \times \left(cooling\ period\right) \times \left(\frac{temp\ limit}{diversity\ factor}\right) \times \left(\frac{(avg.\ tons) \times 12}{EER}\right)$
Heating Savings	$existing\ gas\ usage \times 1 - \frac{new\ temp.\ difference}{old\ temp.\ difference} \times \frac{setback\ period}{168}$

Outdoor Air Adjustment

- The amount of outdoor air ‘required’ was calculated based on the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) 62 code.
- Control trending data was used to monitor the return duct CO2 levels, outdoor air (OA) CFM and position of OA damper to calculate the average actual OA brought into the building through AHUs.
- The difference between the actual OA and the required OA was the savings. Cooling Savings were calculated using the ‘Ventilation Preconditioning Bins’ from BinMaker Pro software. Ton-hr./Standard Cubic Feet Per Minute (SCFM) of cooling or MBTU/SCFM of heating energy was calculated the energy required to bring in a SCFM of OA to indoor cooling and heating setpoints.

Calculation Methodology

- Average winter outdoor temperature (below balance point temperature) = AWO
- Annual hours below BP temperature (from bin or hourly data) = AHB
- Average space setpoint temperature = ASST
- Pre-retrofit CFM = Excess OA CFM to AHUs
- Post-retrofit CFM = 0 Excess OA
- Savings (CFM) = (Pre-retrofit CFM – Post-retrofit CFM)
- Total annual BTUs saved = CFM savings x 1.08 x (ASST – AWO) x AHB

Total annual gas saved = annual BTUs saved / (100,000 x heating deficiency)

Cooling Savings	$\frac{(\text{vent air decrease}) \times 4.5 \times (\text{enthalpy diff.}) \times (\text{cooling period}) \times (\text{chiller factor})}{12{,}000}$
Heating Savings	$\frac{(\text{vent air decrease}) \times 1.08 \times (\text{temp. difference}) \times (\text{heating period})}{1{,}000{,}000 \times (\text{boiler eff.})}$

Economizer Mode Savings

1. Economizer Mode Savings were calculated only for the Occupied Period when the OA Enthalpy is lower than the return / mixed air enthalpy.
2. TMY3 Bin Data was used for OA enthalpy.
3. Nameplate Efficiencies (or new equipment efficiencies) were used to calculate the energy savings.

Cooling Savings	$\frac{CFM \times 1.08 \times (\text{temp. difference}) \times (\text{chiller factor}) \times (\text{economizer period})}{12{,}000}$
Heating Savings	(cooling savings) x (electrical cost)

TC-4 – HVAC Improvements

- Replace Window AC Units with High-Efficiency HVAC
- Replace Council Chambers RTU (savings only)
- Replace Rooftop Units

HVAC Improvements demand savings were achieved strictly on the efficiency improvements of upgraded mechanical equipment. Demand savings were claimed for summer months only.

1. HOBO Motor on/off, Temp/RH loggers, along with OAT are used to determine the runtime and setpoints of the equipment.
2. The equipment load is assumed to vary linearly with OAT with BP being the temp when the building is in equilibrium with no heating or cooling need.
3. Pre and post EER is obtained from the nameplate data of the existing equipment and cutsheet for proposed new equipment.
4. Equipment upgrade savings are only taken for the occupied period.

Cooling Savings	$\left[\text{demand savings}\right] \times \left[\text{operating period}\right]$
Demand Savings	$\left[\text{load factor}\right] \times \text{tons} \times 12 \times \left[\frac{1}{\text{exist EER}}\right] - \left[\frac{1}{\text{new EER}}\right]$
Load Factor	$\frac{\text{present cooling energy}}{\left[\text{tons} \times \frac{12}{\text{exist EER}} \times \left[\text{operating period}\right]\right]}$

TC-5 - Lighting Improvements – LED Upgrades

Lighting demand savings use appropriate coincidence factors applied to demand (kW) savings. Demand savings were claimed for all 12 months.

The existing lighting kW baseline is calculated by counting and recording each individual fixture on a room-by-room basis and noting individual wattage. The existing fixture wattages are multiplied by the number of fixtures and tabulated to determine the kW connected load. Annual run hours (diversity factor) are applied to each individual fixture to calculate annual kWh consumption. This will serve as the existing baseline for lighting connected load and lighting consumption. After determining a list of proposed ECMs, the same calculations are conducted for the proposed lighting. Each proposed upgrade is counted and recorded, and each individual retrofit type will be allocated the new wattage to determine the new KW. The annual run hours are applied to determine the new annual kWh consumption. HOBO Lighting, occupancy loggers, and personnel interviews are used to get the lighting runtime.

The total lighting system kW demand savings are calculated by subtracting the proposed system kW demand from the existing system kW demand. Similarly, the total kWh savings are calculated by subtracting the proposed kWh from the existing kWh. The calculation is represented by the following equations:

- Total kW Demand Savings = ∑ [Existing kW Demand – Proposed kW Demand]
- Total kWh Savings = ∑ [Existing kWh – Proposed kWh]
- The sum total of the lighting savings is the total kWh and kW demand dollar savings
- Total kW Demand Dollars Savings = ∑ [kW Demand Savings * kW Utility Rate * 12 Months]
- Total kWh Dollars Savings = ∑ [kWh Savings * kWh Utility Rate]

Lighting Heating Penalty and Cooling Savings are calculated to account for the HVAC/Lighting interaction. The appropriate cooling Coefficient of Performance (COPs) and heating efficiencies are used to account for the reduction in cooling load and heating penalty as shown below:

Cooling Savings	$\frac{(\text{lighting savings}) \times 3{,}413 \times (\text{cooling period}) \times (\text{chiller factor})}{12{,}000 \times (\text{lighting period})}$
Heating Penalty	$\frac{(\text{lighting savings}) \times 3{,}413 \times (\text{heating period})}{1{,}000{,}000 \times (\text{boiler eff.}) \times (\text{lighting period})}$

T6 - Building Envelope Modifications – Reduce Infiltrations

From the ASHRAE fundamentals handbook, the equation for heat transfer estimation is:

$$q = 1.08 \bullet Q \bullet \Delta T$$

Where:

- q = heat loss/gain, measured in BTU/hr
- 1.08 is a conversion factor accounting for the density of air (~ 0.075 lb/ft³ at sea level), the specific heat of air (0.24 BTU/lb/°F) and a conversion from minutes to hours (60)
- ΔT is the temperature difference between the outdoors and the building setpoint.
- Q is the rate of airflow rate

Airflow rate is calculated as:

$$Q = A \bullet \sqrt{(Cs\Delta T + Cw \bullet V^2)}$$

Where:

- Q is the airflow rate
- A is the gap area (as recorded in the survey)
- Cs is the stack coefficient
- Cw is the wind coefficient
- V is the average wind speed

The stack and wind coefficients are dependent on building height and are available as table lookups provided from ASHRAE. Average wind speed is obtained from NOAA comparative climactic data for locations throughout the U.S. Temperature bin data, obtained from a software package called BinMaker Pro which uses climactic design data obtained from ASHRAE. For each temperature bin, the heat loss/gain equation is applied and the summation of outputs from these equations provides an estimate of the heat transfer characteristics for a particular building.

TC-10 – Distributed Generation – Install Cogeneration System

The magnitude of demand savings was determined by the peak electrical output of the CHP. Demand savings were claimed for 11 out of 12 annual months to account for CHP planned and unplanned downtime.

Packaged micro cogeneration (CHP) energy offset is expressed through the following formulas (terms in the following formulas are annual quantities corresponding to the baseline period evaluated):

CHP Electric Offset = Existing Site Electric Load – CHP Electric Production

CHP Natural Gas Offset = NGexisting - NGThermal + NGCHP

Where:

NGexisting = Natural Gas-equivalent site thermal load that is capable of being offset by CHP-produced thermal energy (domestic hot water load)

NGThermal = Equivalent amount of site natural gas offset by the useful thermal output of the CHP.

NGCHP = Natural gas consumption of the CHP engine.

Determination of Existing Loads:

- Existing electric load is the annual baseline site consumption of electricity. For CHP evaluated in combination with other measures that reduce baseline electric consumption, savings from other measures are first subtracted out of the baseline. Determined using electric bills provided.
- Existing natural gas equivalent site thermal load, in this case, is the equivalent amount of natural gas used in firehouse domestic hot water heaters to supply the building's domestic hot water load.
  - Since there is no heating load in the summer months, summer natural gas bills are used to determine a natural gas baseload which is attributed to the production of domestic hot water.
  - This natural gas quantity is converted to an equivalent thermal load using equipment efficiency data recovered from equipment nameplates during ABM's site audits.

Determination of Useful CHP Output & CHP Natural Gas Consumption:

- CHP Electric Production is determined using the following formula:

CHP Electric Production = (Engine Nameplate Electric capacity minus parasitics * Average Part Load Operating %) * Annual Operating Hours

  - Engine nameplate electric capacity is from manufacturer data (CHP Parasitic electric load assumed to be 7% of nameplate capacity).
  - Annual operating hours account for an assumed 95% uptime of the CHP unit.
  - Average Part Load Operating %: CHP part load, expressed as a percentage of nameplate capacity, that is necessary to supply a site load that is the arithmetic mean of average annual electric load (Peak Load * Load Factor) and estimated minimum load (Peak Load * Load Factor2). Assumption used in the absence of hourly interval data.
- CHP Useful Thermal Output is the resultant, recoverable thermal energy produced to achieve the calculated CHP Electric Production. Engine heat balance is from manufacturer data. This energy quantity is converted to an equivalent amount of natural gas using equipment efficiency data recovered from equipment nameplates during ABM's site audits.

- CHP Natural Gas Consumption is the quantity of natural gas required to achieve the calculated CHP Electric Production. Engine heat rate information is from manufacturer data.

TC-20 – Roof Improvements / Repairs

The audit process for insulation is similar to that of air infiltration/exfiltration in that the auditor visually inspects areas of the building for existing insulation. Where insufficient or non-existent insulation is found, recommendations for upgrades are proposed. The calculation for heat gain/loss through insulation is:

$$q = A \cdot U \cdot \Delta T$$

Where:

- A is the area of insulation (in square feet)
- U is the heat transfer coefficient (inverse of R-value) of the insulation
- ΔT is the temperature difference between the outdoors and the building set point.

This equation is applied to the hourly bin temperature data for both the existing and proposed insulation amounts and the difference between the two indicates the estimated savings due to increased insulation.

Measurement & Verification

As with most certified ESCOs, ABM uses the International Performance Measurement and Verification Protocol (IPMVP). The National Association of Energy Service Companies (NAESCO), DOE, and other high-profile Energy Saving organizations recognize this protocol as the standard guideline for measuring savings resulting from energy conservation projects.

Electrical, Natural Gas and Water Savings

ABM measures electrical, natural gas, and water savings through the IPMVP process. We carefully measure each ECM for its specific interaction on the baseline and include the savings in our M&V report.

M&V Overview

The M&V team works closely with our customers throughout the three major life cycle components of a project: Plan, Install, and Maintain. Customer participation throughout these components results in clear expectations and a solid understanding of technical M&V tasks, calculations, and deliverables.

Step 1 – Plan

The first component of planning includes a thorough review of baseline utility usage, cost patterns, and utility rate analysis. Understanding rate structures allows the development team ECMs that provide the biggest return on investment for the client. In addition, proper application of rates ensures that savings are not overstated or understated.

ABM suggests an onsite M&V workshop be conducted when final baseline data analysis is completed and a preliminary list of ECMs is identified. During this workshop, we will present and discuss a preliminary M&V approach in addition to providing any clarification needed. The goal of following a collaborative M&V selection process is to create an M&V plan that optimizes the balance of costs versus the confidence level of reported savings. M&V best practices have evolved over the past few decades, and ABM's M&V and engineering teams have extensive knowledge regarding the proper application of M&V options.

After the workshop, ABM will finalize the M&V plan, tasking, and cost estimating for inclusion in the contract. In addition, the M&V team will work with the Project Manager and Engineer to ensure proper metering, equipment selection, and trend point. The sequence of operation programming expenses is accounted for in our scope.

Overview:

- Identify ECMs
- Document baseline energy
- Plan and coordinate M&V activities
- Design ECMs

Step 2 – Install

During the implementation phase of the project, the M&V team works closely with the Project Manager to ensure any remaining pre-retrofit measurements, logging, or other tasking are completed prior to demolition or changes to existing equipment and programming. In addition, regular meetings are conducted to review progress and obtain any pre/post data on ECMs as they are completed. Site visits are conducted to physically inspect each ECM.

Finally, the M&V team works with the client and the Project Manager to provide confirmation that each ECM has the potential to perform before final acceptance occurs. This establishes agreement that each ECM has been installed in alignment with the Basis of Design and has been properly commissioned. Typically, within 90 days after final project acceptance, a Post-Install Report (PIR) is provided. This documents the overall project's potential to perform, along with calculated Install Period savings and a projection of year one savings.

Overview:

- Install ECMs
- Commission
- Verify operations

Step 3 – Maintain

After final project acceptance, the M&V plan will be executed throughout the reporting period. ABM personnel will gather data accordingly and may conduct site visits to determine if ECMs are still in place and operating per design. These site visits will be coordinated with the client.

We recommend regular communication throughout the performance period. If any issues or changes occur within the buildings, providing that information to ABM allows us to determine possible energy impact and provide suggestions on resolution. This results in timely resolution and maximizes the client's ability to achieve desired savings. Conversely, if the M&V plan includes regular site visits, remote BAS inspection, or trend data analysis, interim feedback will be provided if any concerns are uncovered in the data or while on site.

Overview:

- Gather data
- Verify savings
- Report
- Document project feedback
- Assure persistence

The cost for the energy savings guarantee per the RFP response is $36,300

Overview of IPMVP M&V Options

The IPMVP defines four broad options for M&V of energy savings. More than one option may be applicable to any one specific situation. The option that provides acceptable confidence with the lowest cost to the client is typically selected. M&V options are determined by where you place the boundary of the analysis. The first approach is the Retrofit Isolation Method (RIM), where performance is evaluated at the specific equipment or system level. The second approach is the whole building method, where performance is evaluated at the building or utility meter level.

Measurement and Verification Details

This section specifically details the options available for verifying the energy savings after we implement the selected ECMs. The key to successfully achieving the predicted savings of this project is the accuracy of the energy baselines and the M&V of savings.

The IPMVP defines four broad options for M&V of energy savings. Each option is applicable to specific situations and having more than one option for any single situation is possible. The broad categories of the IPMVP lay out as follows:

Option A	• Retrofit Isolation – Key Parameter Measurement • Measurement of key parameter(s), some agreed-upon parameters
Option B	• Retrofit Isolation – All Parameter Measurement • Measurement of all key parameters
Option C	• Whole Building – Utility Bill Comparison • Baseline utility data is normalized for weather, then compared to current data
Option D	• Whole Building – Calibrated Simulation • ECM savings are generated through a computer modeled building simulation

Often overlooked is the necessity of identifying the M&V plan concurrently with the project development. In some cases, it is necessary to drop or ignore a portion of savings associated with a specific measure because a portion is immeasurable or unreasonably expensive to measure.

Implementation of a verification plan for the diverse types of ECMs typically involved in a performance contract usually requires a combination of methods to successfully measure savings. For any given ECM, we may cross verification categories by combining a stipulated and an end-use measurement component into the savings calculation.

Factors that guide the selection of an M&V method for each ECM include:

- Cost of measurement vs. savings
- Complexity of ECMs to be installed
- Likelihood of sustainable savings
- Probability of future construction or ECMs
- Timing of measure installation
- Level of interaction between ECMs
- Dynamics of the facility's energy baseline
- Degree of sub-metering in the facility

Due to the variables and dynamics unique to each performance contract and often to each facility, ABM must develop an individual M&V plan for each situation. While the specifics may vary, the general method employed will always follow one of the methods outlined in the IPMVP.

The following paragraphs detail the potential M&V methods and where we typically use them on ABM projects, followed by a sample chart from a Reference Project listing the M&V protocols used for each ECM Measure.

Option A

- Retrofit Isolation – Key Parameter Measurement
- Measurement of key parameter(s), some agreed-upon parameters

This option allows us to calculate energy savings using a sampling of field measurements combined with stipulated parameters. Once calculated, we stipulate the savings for the life of the project. Ongoing actual measurements may or may not be used in this verification technique depending on whether predicted savings and/or the volatility of the measures implemented warrant the expenditure on additional field measurements.

A typical application for using this option is for lighting efficiency and water efficiency improvements where performance may be relatively stable and not interdependent with other measures. We quantify the savings for the lighting upgrade by measuring before and after power consumption for a representative sample of lighting circuits and by stipulating or agreeing to the hours of operation of each circuit.

Option B

- Retrofit Isolation – All Parameter Measurement
- Measurement of all key parameters

We measure and verify energy savings performance of ECMs at the end-use site. Option B techniques are designed for projects where long-term continuous measurement of performance is desired and warranted. Under Option B, we continuously monitor individual loads to determine performance. To determine savings, we compare this measured performance with a baseline.

A possible application for Option B measurement is chiller efficiency improvements in a setting of continuous change at a facility. We quantify the savings for the chiller upgrade by measuring the existing chiller's performance in kW/Ton at several points in load while maintaining steady condensing temperature. For other steady condensing temperatures, we develop the same chiller performance curve, resulting in a three-dimensional load curve for the existing chiller(s). After the retrofit, we measure a similar 3-D load curve and install instrumentation. This will sample the actual tonnage being delivered to the building cooling loads during the entire measurement period and measure the power reduction interpolated from the before and after performance curves.

Option C

- Whole Building – Utility Bill Comparison
- Baseline utility data is normalized for weather, then compared to current data

Option C verification techniques calculate savings by comparing the post-retrofit overall energy use in a building or facility with pre-retrofit energy baselines. Implicit in this measurement option is the necessity of identifying and accounting for the effects of changes to the facilities during the measurement period that are beyond the scope of the measures installed. The impact of building additions, changes in operating hours, and remodeling projects that the client implements during the measurement period must have their energy impact accounted for if the true savings from the ECMs is to be assessed. This process can be time-consuming and expensive in facilities that are very dynamic.

There are many benefits to an Option C measurement. When significant interactions between energy-consuming systems and ECMs are present, and when assessing savings for measures that we cannot easily measure directly, Option C may be the only viable method. Option C savings calculations also most closely emulate the bills from the utility company, and the calculations are easy to understand and explain.

Option D

- Whole Building – Calibrated Simulation
- ECM savings are generated through a computer modeled building simulation

Option D verification techniques calculate savings by using a carefully calibrated hourly building simulation model to examine building performance before and after the digital implementation of ECMs. A high degree of comfort in both the simulation and the operator is necessary for this method to work to the satisfaction of both parties.

Our Recommendation for the City of Paterson

Based on the information received from the City of Paterson, and our analysis of this information, our Project Development team recommends utilizing IPMVP Option A – Retrofit Isolation – Key Parameter Measurement and IPMVP Option B – Retrofit Isolation – All Parameters Measurement for this project.

Project-Specific Savings Measurement & Verification Plan

Measure	M&V Description
TC 1.1 Boiler Replacements	Baseline: Boiler efficiency, piping/system losses, return water temperature (for condensing boilers), design capacity, heating load, local historical weather data, heating set points, scheduling, sequence of operation were used to model baseline consumption.
M&V Approach: Option A	Post-Installation: A combustion efficiency test will be completed, and results will be used to calculate Verified Savings. All other system parameters will be held constant. Once the savings are calculated based on as-built conditions, savings will be agreed upon for the term of the guarantee and no further calculations will be completed.
Utilities: Natural Gas	Ongoing: Visual inspection (during Reporting Term) will be completed and feedback of equipment condition, maintenance, and operation will be provided.
TC 3.1: Building Automation Upgrades	Baseline: The existing HVAC control system schedules equipment setback temperatures during unoccupied hours and run hours were verified with data loggers, equipment data was gathered, and engineering design standards were used to determine existing operating conditions of systems.
M&V Approach: Option A	Post-Installation: Verify proper programming of schedules, set points, and other general energy-saving controls strategies. Post-installation energy use will be determined with engineering methods using measured set points and trending data, where available. Once the savings are calculated based on as-built conditions, savings will be agreed upon for the term of the guarantee and no further calculations will be completed.
Utilities: Electric Natural Gas	Ongoing: Annual controls inspection (during Reporting Term) and trending review if available to verify temperature setbacks, and unit operating schedules. Current conditions will be documented and provided as informational feedback only.
TC 4.1: HVAC Improvements	Baseline: Engineering methods were used to calculate savings for the annual operating hours. Annual Operating hours were determined from review of existing control system equipment, site observation, bin weather data, and input from site personnel. Existing name plate efficiency (EER/COP) was used for baseline conditions adjusted to reflected age of equipment.
M&V Approach: Option A	Post-Installation: New unit name plate efficiency (EER/COP) will be used. Operating hours will be verified through post installation control programming. The savings will be confirmed or updated based on any changes to the scope of work. The savings are agreed upon at the level determined post-installation.
Utilities: Electric Natural Gas	Ongoing: Annual visual inspection (during Reporting Term) of a sample of scope items. Current conditions will be documented and provided as informational feedback only.
ECM 5.1:	Baseline: Pre-Retrofit fixture power will be measured for lamp ballast combinations (LBC) representing a total of 75% of the connected load. Burn hours are agreed upon.

Lighting Improvements – LED Upgrades	Prior to retrofit, burn hours will be logged and lighting levels will be measured for a representative sample of space types.
M&V Approach: Option A	Post-Installation: Post-Retrofit fixture power will be measured for lamp ballast combinations (LBC) representing a total of 75% of the connected load. Any lamp ballast combination representing less than 5% of the total connected load will not be measured and original estimated savings will only be adjusted if the actual fixture type or quantity installed varies from original design. Burn hours remain the same as baseline.
Utilities: Electric	Ongoing: Annual visual inspection of a sample set of lighting fixtures in selected facilities to ensure the integrity of the fixtures and confirm the ECM still has the potential to perform as specified. Current conditions will be documented and provided as informational feedback only.
TC 6.1: Building Envelope Improvements	Baseline: Building Envelope was inspected during baseline activities and deficiencies were noted and measured. Data was then incorporated into engineering methods to determine the existing conditions and potential savings.
M&V Approach: Option A	Post-Installation: As-built documentation will be compared to the contractual scope of work and visually inspected for proper installation. The savings will be confirmed or updated based on any changes to the scope of work. The savings for this TC are agreed upon at the level determined post-installation.
Utilities: Electric Natural Gas	Ongoing: Annual visual inspection (during Reporting Term) of a sample of scope items. Current conditions will be documented and provided as informational feedback only.
TC 10.1: Distributed Generation - Install Cogeneration System	Baseline: Baseline consumption is sitewide electrical consumption, and natural gas consumption associated with the production of domestic hot water load. Baseline site hot water load was modeled using a combination of site observations, utility bill analysis, input from site personnel, and existing equipment nameplate information.
M&V Approach: Option A	Post-Installation: Installed system capacity will be compared to original design to verify the system's potential to perform, data acquisition capabilities will be verified, and initial kWh production data will be documented.
Utilities: Electric Natural Gas	Ongoing: kWh production will be determined from the control system, which measures total production. Contractor will weather normalize the production. Total savings will be the total kWh produced by the Cogeneration system and the domestic hot water output. The Savings reported in Year 1 of the Reporting Term will be agreed upon agreed upon for the remainder of the Guarantee Performance Term. Savings after Year 1 will be calculated by applying the annual escalation percentage(s), to the Savings for the previous Performance Year. Current conditions will be documented during a site inspection during the Reporting Period to verify the system is still in place and being properly maintained and will be provided as informational feedback only.
ECM 20.1	Baseline: Existing roofing dimensions and materials were surveyed. Building heating and cooling loads were modeled based on local weather patterns and roofing

Roof Repair or Replacement	specifications. Baseline model is agreed upon and no further calculations of baseline infiltration or heat gain will be completed.
M&V Approach: Option A	Post-Installation: Scope completion and on-site verification of proper installation will be completed. Savings will only be updated if the installed scope varies from original design. Once the savings are calculated based on as-built conditions, savings will be agreed upon agreed upon for the term of the guarantee and no further calculations will be completed.
Utilities: Electric Natural Gas	Ongoing: Annually, if access is possible, a visual inspection will be completed to verify materials are in place and remain in good condition. Current conditions will be documented and provided as informational feedback only.

Deemed Savings

While not directly defined as an IPMVP option, the protocol recognizes that there are instances when M&V of savings is not warranted. In cases where the cost of measurement is too high as compared to the savings, where the parameters preclude accurate measurements, or where the confidence of the savings projections is high, the client and ABM may agree to deem those projected savings satisfied for the term of the project based on proper installation, successful Functional Performance Test results, or equipment/ product specification documents without any measurement or recalculation of the savings. One example of this is window tinting. If the specified Solar Heat Gain Coefficient (SHGC) is confirmed in the product specification sheets, the savings would be deemed satisfied.

Client Benefits Associated with Savings Measurement

The following lists some of the main benefits associated with any M&V plan. All the benefits listed are included in an Option C plan.

Maximize the Energy Savings

Through careful investigation of building scheduling parameters, HVAC equipment performance, and occupancy patterns, the ABM Monitoring Department delivers the maximum amount of energy savings achievable using the equipment installed under the program.

Sustain the Energy Savings

Without M&V, energy savings tend to erode over time. This can be due to changes in HVAC control parameters, maintenance strategies, space use, building structure, and equipment replacement. While some of these items are unavoidable, it is vital to quantify the effects of those changes to see if the installed measures are still functioning correctly.

Defend the Performance Contracting Decision

The decision to enter into an Energy Savings Improvement Plan (ESIP) involving champions and detractors within a client's organization can be difficult. Signing an ESIP can require an understanding that the energy service company will honor the guarantee should a shortfall in savings result. ABM's Monitoring Department works hard to ensure that all the client's entities understand the results of the M&V activities. We accomplish this through periodic reporting, annual site visits, and council presentations. Should the energy savings fall short of the guaranteed level, ABM will make up the shortfall.

Identify Additional Opportunities

During the initial ECM installation, we encounter measures that are not fully evaluated. Other potential measures may come to light only after the completion of the initial installation. In these cases, the ABM Monitoring Department will continue to investigate for energy savings, from changes in the operation and maintenance of the facilities to projects that will increase comfort and reduce energy consumption.

Ongoing Training and a Consistent Knowledge Base

If facility personnel changes, ABM will train the client's new employees on issues specific to your facilities. With a staff of professionals who know systems, controls, and the details of your facilities, we have the ability to train new staff quickly and guide them through the learning process.

Forecast Changes in Energy Consumption and Making Energy-Smart Choices

As facilities equipment and usage change, so does energy usage. ABM's Monitoring Department can quantify that change, enabling the client to more accurately budget for the required energy upgrades. Also, we can help the client make decisions about the proposed changes at their facilities, giving you the tools to evaluate the long-term energy impact of different buying choices.

Identify Utility Billing Errors

As part of many performance contracts, we collect client utility bills on an ongoing basis to determine savings. During the process of examining and entering the data and comparing the usage to expected usage, we have detected utility-billing errors. ABM monitoring personnel facilitate the return of tens of thousands of dollars in over-bills.

Guarantee

Repayment of Missed Savings

The decision to enter into an ESIP involving champions and detractors within a client's organization can be difficult. ABM's Monitoring Department works hard to ensure that the City of Paterson understands the results of the M&V activities. We accomplish this through periodic reporting, annual site visits, and regular communication.

Should the energy savings fall short of the guaranteed level, ABM will make up the shortfall.

Our Bundled Energy Solutions Agreement states the following:

Savings Guarantee

Subject to changes in the Factors Affecting Energy Use, Contractor guarantees that the Customer will realize total Savings during the Guarantee Performance Term not less than the Guaranteed Savings set forth

Guarantee Shortfall Payment

Should the sum of Customer's Verified Savings for a given Performance Year be less than the Guaranteed Savings for that Performance Year, Contractor shall pay to the Customer, within 30 days of the acceptance of the annual Savings Report (Energy Cost Avoidance Report Report), the difference between the Guaranteed Savings for such year and the Verified Savings for that Performance Year, with such amount not to exceed the Guaranteed Savings amount set forth in Exhibit G-4 (the "Guarantee Payment"). Contractor will have the right to offset its Guarantee Payment obligations by any amounts due to Contractor from Customer under this or any other agreement. If in the judgment of the Customer, Customer would benefit from additional energy services or energy saving retrofits, Customer and Contractor may mutually agree upon such services or retrofits in lieu of the Guarantee Payment. For the purposes of this Contract, such services or retrofits actually delivered by Contractor will be considered a Guarantee Payment for that Performance Year. There shall be no carryover with respect to either Excess Savings or Savings Shortfall for any Performance Year into future Performance Years; provided, however, any Installation Period Savings shall be credited towards the Guarantee for the first Performance Year.

Operational Savings

Operational savings are not guaranteed as part of the energy savings performance contract; however, most of our clients realize a great deal of operational savings in addition to the guaranteed annual energy savings. Operational savings incurred by our clients, whether in conjunction with the energy savings or not, are simply additional dollars for our clients to utilize as they see fit. At times, projected and/or realized operational savings may meet or even exceed the guaranteed annual energy savings amount.

Client Responsibilities

ABM will base the guaranteed savings amounts upon the information received from the City of Paterson, including utility bills, budget figures and other factors that may assist us in calculating accurate projected savings. Our goal is to help the City of Paterson realize their savings potential, whether that be through energy savings, operational savings, or other types of savings. ABM will guarantee a precise annual energy savings amount. Any operational or other savings incurred by the City of Paterson that are in addition to or in excess of the guaranteed annual energy savings are considered additional dollars for the City of Paterson to utilize as they see fit.

General Responsibilities

Responsibilities of the City of Paterson can be broken down into two main categories:

- **'Participation** – The City of Paterson will also need to participate in training of any new systems or procedures that are to be implemented. ABM is fully capable and prepared to provide these training to the City of Paterson. You can review more detailed information in the Training section of this proposal.

- **Maintenance** – Finally, the City of Paterson will be responsible for regular routine maintenance of newly installed ECM's. the City of Paterson can perform that routine maintenance with in-house staff or contract out those regular preventative maintenance tasks. Routine maintenance is required to ensure optimal operation and efficiency. Non-maintained systems could impact the guarantee as system performance is calculated based on the original equipment manufacturer (OEM) equipment efficiency.

Monitoring Services

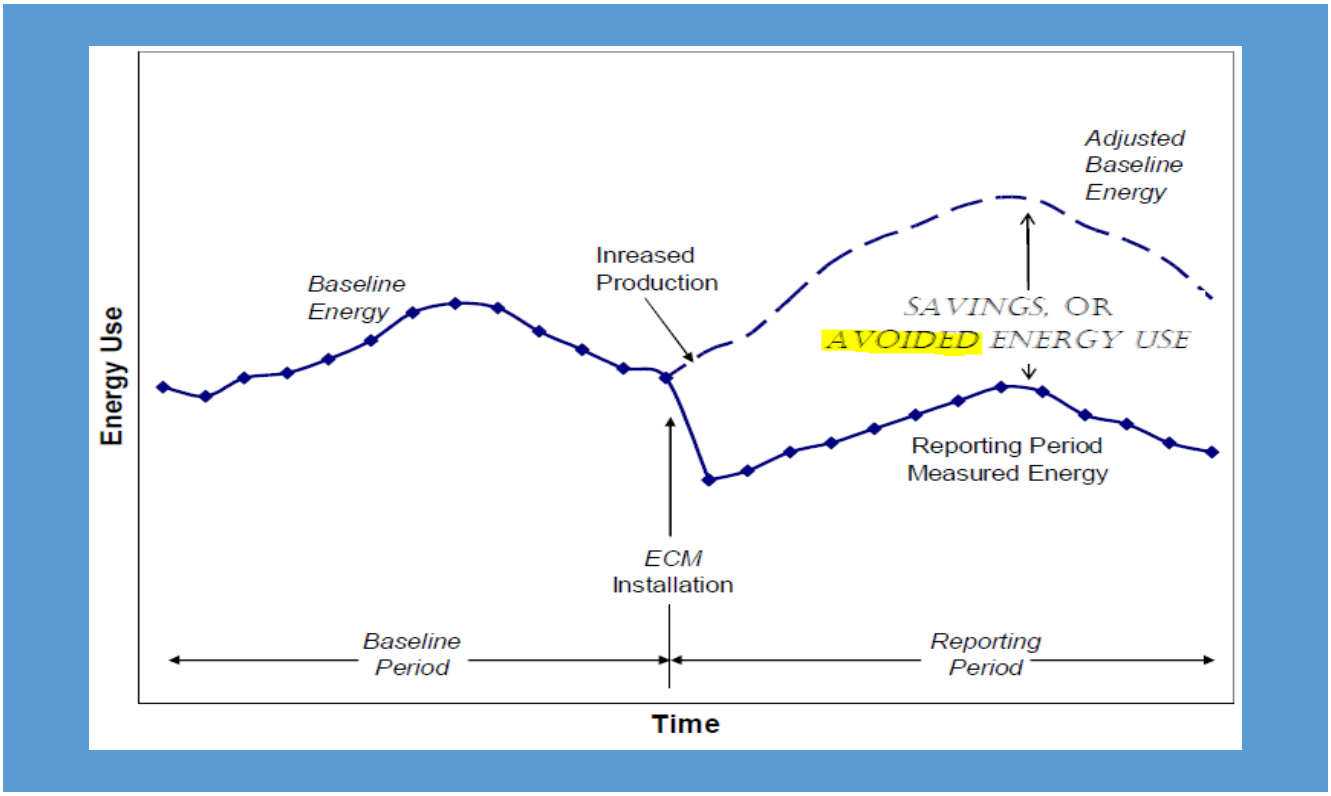
ABM offers a monitoring service as part of the guarantee that focuses on the measurement, verification, and the maintenance of the energy savings.

Entirely Stipulated Savings

While not directly defined as an IPMVP option, the protocol recognizes that there are instances when M&V of the savings is not warranted. In cases where the cost of measurement is too high as compared to the savings, where the parameters preclude accurate measurements, or where the confidence of the savings projections is high, the client and ABM may agree to stipulate those projected savings for the term of the project without any additional M&V of the savings.

What is "Avoidance"?

One important concept to remember is "Avoidance." To provide an accurate estimate of savings, the pre-retrofit baseline data must be normalized for factors like weather. The purpose of M&V is to estimate the absence of energy, which simply asks the following: What amount of energy would the old equipment and building have consumed under the current conditions? Savings are calculated by comparing current data to a baseline that has been adjusted to current conditions.



Proper Sampling

For some ECMs within the project scope, a sampling plan may be proposed. The purpose of monitoring a sample as an alternative to monitoring an entire population is to characterize specific attributes of a population from which a sample is drawn with adequate accuracy and reliability while reducing monitoring costs and effort.

Sampling is typically a two-stage process that can address one or both components of ECM savings, which are “performance” (efficiency, power draw, etc.) and use, also known as “operation” (run hours, space requirements, etc.) Performance is typically addressed by separating equipment by scale, such as lighting fixture model, motor rated horsepower size, etc.

Operation is typically addressed by separating the equipment by usage groups, which reduces the variation and therefore the sample size required.

Usage groups should be developed from certain criteria:

- Area type (for example, office, hallway, meeting room)
- Annual operating hours
- Similar function use
- Timing / usage patterns of the operating hours, load, or other variable
- Variability of operating hours, load, or other variables

Sampling Size Calculation

Measurement and verification guidelines suggest using sample sizes that meet a confidence level of at least 80% and a precision of 20%. Using a Cv of 0.5 will increase the initial sample size but reduce the risk of under-sampling.

Confidence refers to the probability that the estimate will fall in the range of precision:

- P – Precision. The value estimated by sampling cannot be expected to be the actual value, therefore it is useful to state an interval in which we have confidence the true value lies. Confidence interval is also often referred to as precision.
- Cv – Coefficient of Variation, defined as the standard deviation of the readings divided by the mean.
- Z – Z-Statistic (1.645 for 90% confidence, 1.282 for 80% confidence).

The sample size can be calculated using the following equation:

(where n = sampling size): $n = \frac{z^2(Cv)^2}{p^2}$

Sampling Plan Process

ABM will follow the following process for any suggested sample plan:

- Review the baseline data to determine the full population size.
- Arrange the data and clearly identify each item for future cross-referencing.
- Identify any equipment that heavily impacts the possible savings. For example, lighting fixtures that represent at least 75% of the lighting energy use or savings will be measured. Less impactful fixture types that are found in smaller populations will not be included in the sampling plan to control costs.

- Calculate the sampling size (n) using the equation above (80% confidence, 20% precision, Cv = 0.5).
- Randomly select equipment from the population to meet the sampling size.

Typical M&V Services

Monitoring Reports

The client will receive a monitoring report with the following calculation for each building.

HISTORICAL ENERGY BASELINE – **ACTUAL ENERGY CONSUMPTION** X **CONTRACTUAL ENERGY RATES**

Other savings calculation methodologies, as identified in the program, will also appear on these reports. They summarize the total savings for year-to-date and compare them against a prorated portion of the guarantee, so the progress of the program can be tracked.

At year-end, ABM will compile the savings and any adjustments and will issue a final year-end report for acceptance by the client. We use the savings as reported to fulfill the requirements under the guarantee. We will note any changes to the baseline or savings adjustments in the monitoring reports, which we can modified to meet the City of Paterson's needs, often without additional expense.

Monthly Activities

- Receiving and compiling energy bills or other data needed to M&V process
- Analyzing utility bills for errors or irregularities

Year-End Reports

- Final savings calculations and adjustments
- Overall analysis of facility energy performance
- Graphs comparing current usage to baseline usage

Energy Management Services Overview

Remote electronic monitoring of a client's Energy Management Services (EMS) is the only proactive mechanism available to detect and prevent increasing energy consumption.

Start-up Activity

- Software and hardware set-up
- Data logging report

Monthly Activity

- Review temperature trends
- Review digital inputs
- Review weekly schedules
- Review holidays and daylight savings time changes
- Phone calls

The overall purpose of the call-up is to help ensure the correct operation of the EMS. Our technicians look for changes to the program outside the current scope or areas that are not achieving the expected temperatures or setbacks, which may indicate EMS or HVAC equipment failure. When differences or difficulties are found, they will notify the client and work with them to make any necessary corrections.

Monitoring Variables

On a continuous basis we will monitor the assets on site to monitor the variables that are used for the energy savings s. All points that are provisioned into the open protocol BAS system can be mapped onto the platform to perform the services in consideration. Some parameters shall be stipulated based on product ratings and specifications

Deviation Management

Based on the schedules and policies mutually agreed during the base lining period, these will be programmed into the energy management platform to monitor any deviates from the same. Upon any breach of policy (e.g. overcooling or undercooling) or any schedule breach (e.g. cooling system in a switch ‘ON’ mode post operational hours) the platform shall generate an incident/alert.

A report of all deviations shall be generated on a periodic basis and will be submitted to the client. These reports will help in the determination of actual energy savings achieved or take corrective action or adjust the baselines as necessary. The client should inform ABM of any pre-planned changes in operational schedules so that the necessary adjustments can be made and incidents during that period disregarded.

Platform-Based Commissioning

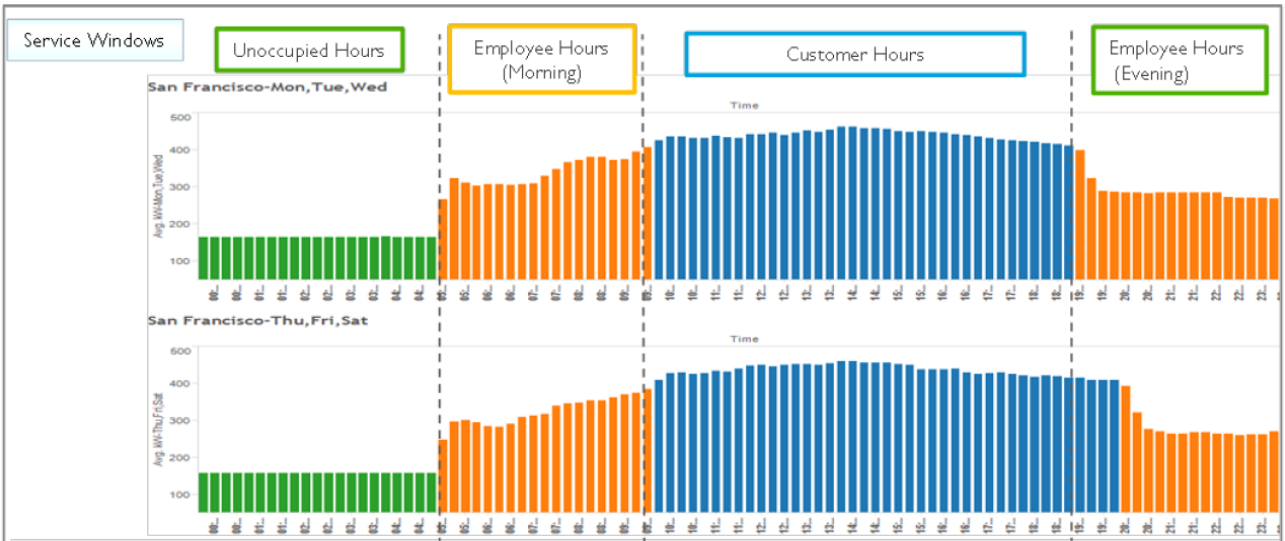
In addition to deviation management, we also collect data points against the weather RSS feeds. For instance, economizer operations are programed on the basis that the outside air temperature sensors can be faulty at times. However, having an RSS feed of external weather data will assist in providing validation to systems/sensors that are not working for one reason or another.

Sample Analytics Reports

As a part of the EMS services there are certain reports that are generated to assist in identifying energy leakages and in evaluating energy performance. The main goals of reporting are:

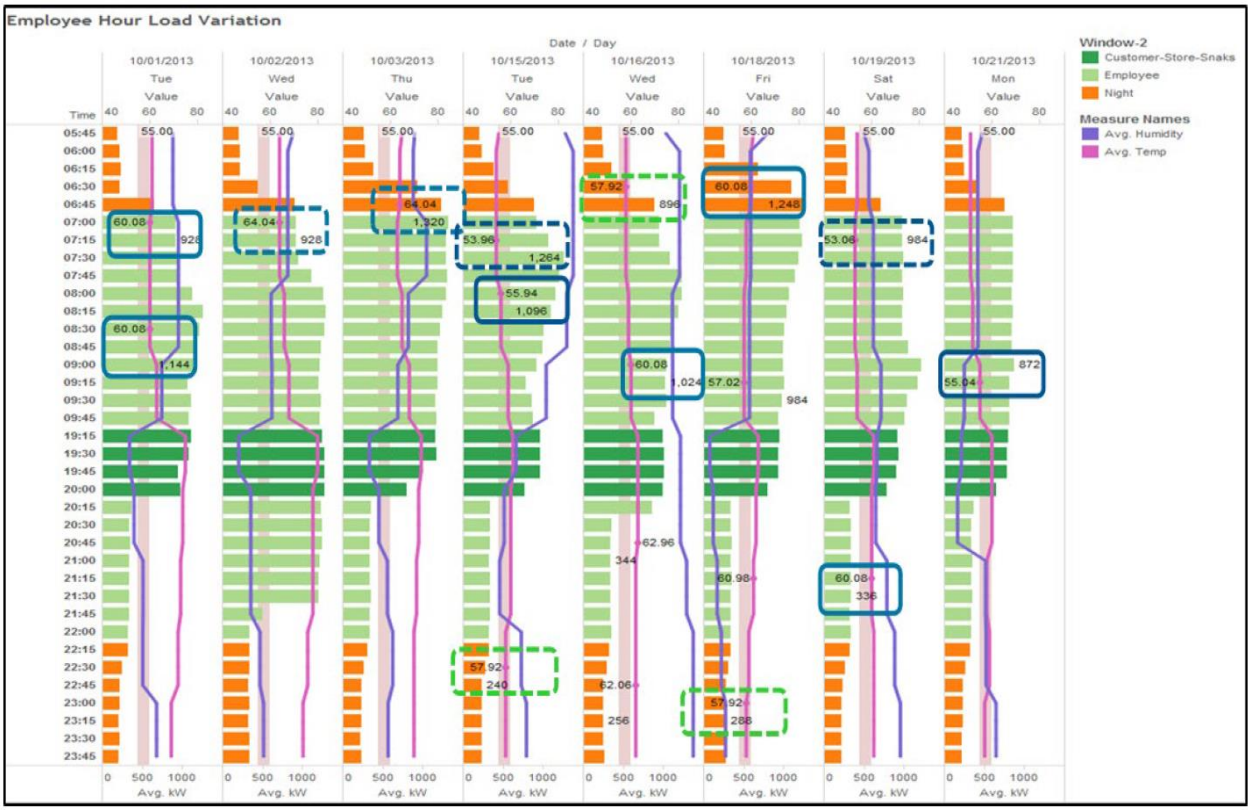
- Deliver access to and transparency of data
- Report against key performance indicators
- Facilitate decision making through advanced analytics

The sample report below specifies what we call ‘service windows’ which periods are of time with unique energy profiles during a site’s operations across any given day. These service windows are a result of the variation in business load, specific equipment utilization, set points, operating schedules etc. Below is an example of a service window for a retail store where varying energy behavior can be clearly visualized.

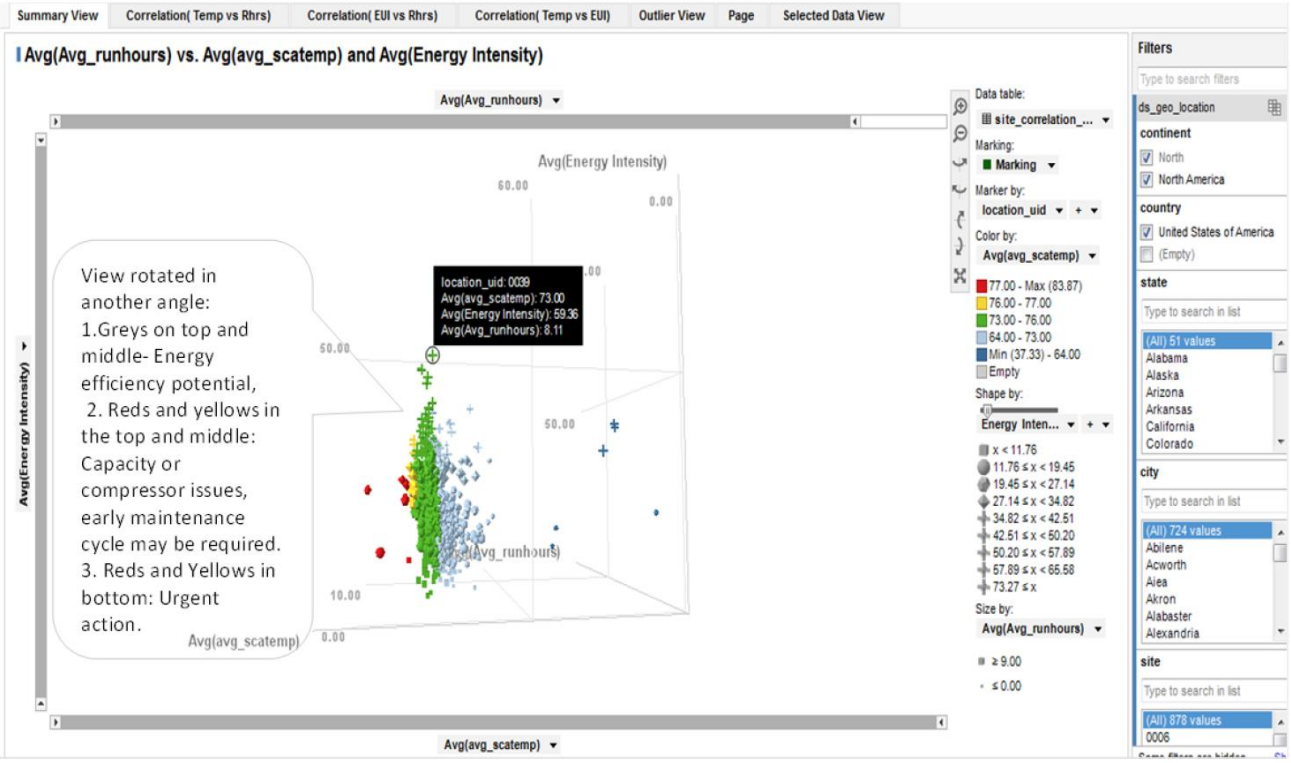


Consumption profile	Night Load Profile	Employee Only Profile	Business Hours Profiling	Employee Only Profile
Lighting Profile	20%	40-50%	100%	40-50%
Thermal Profile	78-80 degree F	75 degree F	73 degree F	75 degree F
HVAC Units in Demand Mode	Yes	Yes	No	Yes
Economizer Mode working		Climate Zone based control strategy (Calibration by Weather feed)		

Based on the service window's potential savings areas are ascertained. For instance, in the below graph, the service windows of HVAC operations have been isolated. We can see that for same temperature profile during the employee hours window, there is significant variation in consumption profile and vice-versa. Also, humidity has significant impact on energy consumption at lower temperatures which is probably, because of problem/error in Economizer operations percentage.



The graph below provides an insight into the advanced capabilities of the energy management services. Here, the average run hours are plotted against the average temperature profile of an SCA and the average energy intensity. Here, the color coding helps us in understanding of any leakages/operational optimization that may need to be implemented. For the red and yellow marked points (SCAs), an in-depth analysis would be conducted based on the processed data collected by the platform to improve energy performance of these areas within the building.



The following analysis reports maybe the standard reports provided based on the availability of data. They will be provided periodically as mutually discussed.

Energy Consumption (kWh)

- All Sites Total
- Site Wise Consumption
- Energy Intensity Report
- Cluster Reports (By Climate Zone and Equipment Type)

Consumption Profile by Service

- All Sites Average
- Site Wise

Consumption Profile by Service Window

- Site Wise
- League Report
- Working Hours Report (Occupied, Employee, Unoccupied hours)

Asset Run Hours Reports

- Assets Wise
- Asset System Wise

Site Trips

ABM's M&V Group will typically visit each job site at least once per year. This is our opportunity to interface with the administrative and maintenance staff to see how active the energy program is. It also gives us an opportunity to look for additional ECMs.

Some of the services performed on the site trip may include:

- Review project status with client
- Present to board/decision makers
- Inquire about past and future changes
- Inspect all ECMs
- Take quantitative measures
- Look for additional ECMs
- Review and inspect O&Ms

The Measurement and Verification team has a very precise and process-orientated system regarding what needs to be accomplished and what information is needed, requested, etc. Following is a sample of our "Auditing Checklist" used for every audit:

Auditing Checklist		
Item to Check	**Comments**	✓
Baseline bills provided?	All data accounted for, correct meter reads, etc.	
Verify all units for each utility meter	CCf, kWh, Therms, MCf, etc.	
Determine minimum cost-per-unit	Set meter to use average cost/consumption	
Utility companies	Names and contact numbers of providers	
Utility companies' rates/schedules	Is a lower rate available or a demand charge assessed?	
Identify distributors vs. commodity suppliers	Distributor = delivery (units), supplier = commodity (cost)	
Associate meters/accounts with buildings	Acct. # → meter # → building name → service address	
Device/Meter numbers	Cross-reference with utility company for accuracy	
Baseline period	Based upon construction start	
Weather data collection	To be done by Energy Engineer	
Square-footage of each building		
Letter of Authorization (LOA)	One for each utility company or blanket for all	
Tax ID # and/or pin #	Required for setting up some online accounts	

Online utility access	Tax ID # and/or pin #	
On-site contacts & ABM contacts	Accounting, facilities, audit recipient, etc.	
ECM list itemization		
Identify utilities impacted	Gas, water, electric, propane, fuel oil, diesel, coal	
Contract documents	Signed guarantee, scope of work, ECM calcs, contract	
Project cost	Available in contract	
Guarantee amount	Could be dollar savings or unit reductions	
Stipulated savings	Available in guarantee document	
Expected energy savings	From master ECM list	
Length of guarantee (# of audits)		
Construction start date	When Linc mobilizes	
Construction completion date	When project is signed off by customer as finished	
Remote access to controls & schedules?	Yes / No	
Audit period	Based upon construction completion	
Identify which meters are impacted	Collaboration between scope of work & project manager	
Buildings' operations	After-hour events, renting out space, programs, etc.	
Summer operation (shutdown)	Any period buildings are shutdown/cease operation	
Upload modeling data	Create MT1 & .pjy file in Metrix	
Model/tune meters	Verify accuracy of balance points	

Order of Operations		
Process	**To Do Before Being Checked Off**	✓
RFP / RFQ	Notify M&V team of project coming down pipeline	
Received Initial Bill Data	Provide utility bill data, logins, passwords, spreadsheets to M&V team	
Accounts Identified	Account numbers need to be associated to buildings	
Prelim. Created	Compile/organize data into Preliminary Assessment	
LOI Received	Letter of intent received	
Technical Scope Created	Tech. scope of existing controls/equip. determined from on-site analysis	

Association of Meters	Meter location needs to be identified during on-site analysis	
Scope of Work Created	Solution Development creates ECM list from assessments & prelim. Data	
Verification Meeting	Client determines desired scope or accepts scope presented	
Scope of Work Refined	If necessary, original list of ECMs refined to only those to be implemented	
ECMs Identified	Determine ECMs from master list to be implemented & added to contract	
Contract Drafted	Contract drafted	
ECM Calcs Reviewed	Review, question, and/or comment on ECM calculations & assumptions	
Scope of Work Reviewed	Review, question, and/or comment on scope of work	
Project Costs Reviewed	Review, question, and/or comment on costs, hours, purchases	
Contract Reviewed	May take several attempts before finalizing	
Contract Revised	If necessary, contract updated per comments, questions, concerns, etc.	
Contract Signed	Upload to the portal upon receiving signature	
LOA / Tax ID Received	Obtain LOA for each utility company on the client's letterhead	
Remote Access Obtained	Get all possible accounts online and all LOAs on file with utility companies	
Impacted Meters Identified	Refine list of meters to be monitored to include only those impacted	
Model / Tune Meters	Weather-normalize only impacted meters	
Modeling Reviewed	Review, question, and/or comment meter balance points, baseloads, etc.	
Construction Started	Notify M&V team of construction start	
Scope Revalidation	Determine if changes were made to scope that impact expected savings	
Guarantee Revalidation	If scope changes occurred, how did it impact guarantee?	
Construction Completion	Notify M&V team of construction completion	
Energy Audit Compilation	Run raw data report and compile audit	
Audit Approval	Send to Auditing Team for approval, comments, or questions	
Point-Person Delivery	Deliver to person that will deliver to the client	
Client Delivery	Follow up to confirm audit was delivered to the client	

Appendix

ECM Savings Calculations