Resolution of the City of Jersey City, N.J.

File No. **Res. 21-507**
Agenda No. **10.34**
Approved: Jun 30 2021

RESOLUTION TO ACCEPT AND AUTHORIZE ADOPTION OF THE ENERGY SAVINGS PLAN SUBMITTED BY SCHNEIDER ELECTRIC BUILDINGS AMERICAS, INC.

COUNCIL offered and moved adoption of the following resolution:

Whereas, pursuant to P.L. 2009, c. 4, as amended by P.L. 2012, c. 55 (the "ESIP Law"), the City of Jersey City, in the County of Hudson, New Jersey (the "City") may implement an energy savings improvement program provided that the value of the energy savings resulting from the program will be sufficient to cover the costs of the improvements as set forth in the energy savings plan; and

Whereas, by Resolution No. 19-463 adopted on May 22, 2019, the City commissioned the preparation of an energy audit of various City facilities in accordance with the ESIP Law, which energy audit demonstrated that there is a potential for energy savings at such facilities; and

Whereas, following a competitive contracting process pursuant to an RFP with a return date of February 7, 2020, the City, by Resolution No. 20-402 adopted on June 10, 2020, awarded a two phase contract to Schneider Electric Buildings Americas, Inc. ("Schneider") to prepare an energy savings plan (Phase I) and, subject to City discretion, to implement an energy savings improvement program on behalf of the City (Phase II); and

Whereas, Schneider has developed, prepared and presented to the City, based upon a scope of projects, an Energy Savings Plan dated June 21, 2021 (the "ESP"); and

Whereas, the ESP recommends the implementation of an energy savings improvement program that including the acquisition, installation and construction of various energy conservation measures ("ECMs") and facilities alterations (collectively with ECMs, the "Energy Savings Improvements"), as well as the acquisition, installation and construction of certain energy-related capital improvements (the "Energy-Related Improvements"); and

Whereas, in accordance with the N.J.S.A. 40A:11-4.6 and related rules and regulations (the "ESP Law"), the City appointed Gabel Associates ("Gabel") to act as a "third party verifier" in order to verify the savings set forth in the ESP; and

Whereas, Gabel has verified the savings set forth in the ESP as set forth in its report dated June 22, 2021; and

Whereas, the City has determined that the energy savings generated from ESP will be sufficient to cover the cost of the program's ECM's set forth in the ESP; and

Whereas, the City has determined that the cost of facility alterations does not exceed 15% of the cost of the Energy Savings Improvements; and

Whereas, the ESP, as so verified, must be submitted to the New Jersey Board of Public Utilities ("BPU") for approval thereby; and

Whereas, after review and advice of outside counsel, and in order to move the ESP forward to consideration of implementation of Phase II, the City has determined it appropriate to approve the ESP for adoption for purposes of submission for necessary approvals by the BPU;

NOW, THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF JERSEY CITY AS FOLLOWS:

1. The Jersey City Municipal Council ("Council") hereby accepts the ESP, submitted by Schneider on June 21, 2021 and attached hereto, and authorizes the adoption of the same upon its review and approval by BPU.

Res. 21-507 **Approved: June 30 2021**

Resolution to Accept and Authorize Adoption of the Energy Savings Plan Submitted by Schneider Electric Buildings Americas, Inc.

APPROVED AS TO LEGAL FORM

Business Administrator

Corporation Counsel

☐ Certification Required

RECORD OF COUNCIL VOTE – Jun 30														8-0
	AYE	NAY	N.V.	Absent		AYE	NAY	N.V.	Absent		AYE	NAY	N.V.	Absent
RIDLEY	✓				SALEH	✓				LAVARRO	✓			
PRINZ-AREY	✓				SOLOMON	✓				RIVERA	✓			
BOGGIANO	✓				ROBINSON	✓				WATTERMAN, PRES				✓

N.V. – (Abstain)

Adopted at a meeting of the Municipal Council of the City of Jersey.

Joyce E. Watterman, President of Council

Sean J. Gallagher, City Clerk

Res. 21-507 **Approved: June 30 2021**

Resolution to Accept and Authorize Adoption of the Energy Savings Plan Submitted by Schneider Electric Buildings Americas, Inc.

RESOLUTION FACT SHEET -

This summary sheet is to be attached to the front of any resolution that is submitted for Council consideration. Incomplete or vague fact sheets will be returned with the resolution.

Project Manager

Katherine Lawrence, Senior Program Analyst	201-547-4632	KLawrence@jcnj.org
Division	Office of Sustainability	

Note: Project Manager must be available by phone during agenda meeting (Wednesday prior to council meeting @ 1:00 p.m.)

Purpose

To Resolve to Adopt the Energy Savings Plan prepared by Schneider Electric for purposes of submission to the Board of Public Utilities for Approval

ATTACHMENTS:

Jersey City ESP Rev3
JC-SE ESP-GA 3rd Party Review Complete Memo June 22 2021

Approved by	Status:
Katherine Lawrence, Senior Program Analyst	Approved - Jun 25 2021
John Mercer, Assistant Business Administrator	Approved - Jun 25 2021
Barkha Patel, Senior Planner	None
John McKinney, Attorney	None
Peter Baker, Corporation Counsel	None
Amy Forman, Attorney	None
Nick Strasser, Attorney	None
Norma Garcia, Attorney	None
Ray Reddington, Attorney	None
Jeremy Jacobsen, Attorney	Approved - Jun 25 2021
Sapana Shah, Attorney	None
Elizabeth Barna, Assistant Corporation Counsel	None
John Metro, Acting Business Administrator	Approved - Jun 25 2021

City of Jersey City

Energy Savings Plan

Rev 3: June 21, 2021

Table of Contents

1.0 Executive Summary

Overview of the Energy Savings Improvement Program

The Energy Savings Improvement Program, or ESIP, was created in 2009 by the NJ legislature to reduce energy & operational costs, reinvest in infrastructure, and support the individual goals of public entities across the state. The ESIP program is a design-build financing mechanism that is regulated by the NJ Board of Public Utilities (BPU). Jersey will implement a comprehensive ESIP that addresses infrastructure needs at 26 facilities throughout the City.

Commitment to Green Buildings

Jersey City has committed to meeting high performance building standards for new facilities, including the LEED-certified Municipal Services Complex shown here. The City's ESIP builds on this proactive sustainability leadership.

Jersey City's ECMs:

Jersey City's energy conservation measures (ECMs) were developed in partnership with the City's team to meet the following project goals:

1. Reduce energy & operational expenses
2. Expand Jersey City's position as a sustainability leader
3. Fund urgent, unavoidable capital needs
4. Make facilities more energy resilient
5. Improve indoor air quality and protect the health of employees and the community
6. Create local green jobs.

The ECMs in the Energy Savings Plan range from core savings opportunities with LED lighting at 24 sites to building and envelope insulation and water conservation at 23 sites. It provides Heating, Ventilation, & Air Conditioning (HVAC) improvements at 11 sites. This includes a comprehensive HVAC replacement at the Bethune Community Center, Jersey City's largest community center that provides extensive programming for a diverse community from children to adults and seniors. The Center also provides training space for the Police and Fire Departments and serves as an emergency shelter for heating and cooling. The project will ensure the Red Cross can always reliably operate at this critical community center during emergency situations.

The ECMs also include Building Automation System upgrades at several sites, as well a Combined Heat & Power System for the Pershing Pool Complex. This project will also include new boilers and domestic hot water system to maximize heating efficiency. This project has also identified but not included two important projects which are listed as Optional:

1. **Pershing Ice Rink:** The Pershing Ice Rink, used extensively by community members, faces a risk of failure and significant maintenance costs. The optional solution would provide a new ice chiller and boiler system to improve reliability for this community asset and to reduce maintenance costs.
2. **Courthouse HVAC Replacement:** During normal operations, the Jersey City Courthouse has nearly 1,000 people entering and exiting this facility every weekday. The optional HVAC renovation would address air quality and comfort concerns. The optional project would also include a new building automation system to improve the efficiency of the building.

The following chart provides an overview of the sites included in the Energy Savings Plan. Listed in green are included ECMs, and in blue are optional ECMs.

#	Facility	Address	HVAC / Controls	LED Lighting	Solar	Building Envelope	Water Conserv-ation
1	City Hall	280 Grove St		●			●
2	Firehouse	14 Orient Ave		●		●	●
3	Firehouse	152 Lincoln St		●		●	●
4	Firehouse	152 Linden Ave		●		●	●
5	Firehouse	160 Grand St		●		●	●
6	Firehouse	2 Bergen Ave		●		●	●
7	Firehouse	255 Kearney Ave	●	●	●	●	●
8	Firehouse	486 Ocean Ave		●		●	●
9	Firehouse	595 Palisade Ave	●	●		●	●
10	Firehouse	697 Bergen Ave	●	●		●	●
11	Firehouse and OEM	714 Summit	●	●	●	●	●
12	Firehouse Consolid.	349 Newark Ave	●	●		●	●
13	Connors Senior Center	28 Paterson	●	●		●	●
14	Lafayette Pool	395 Johnston Ave	●	●		●	●
15	Bethune Community Center	134 MLK Drive	●	●	●	●	●
16	Collier Senior Center	335 Bergen Ave	●	●		●	●
17	Courthouse	365 Summit Ave	● (blue)	●	●	●	●
18	Pavonia Pool	914 Pavonia Ave		●		●	●
19	Pershing Complex	201 Central Ave	● (blue)	●		●	●
20	E. Police Precinct	207 7th St		●		●	●
21	N. Police Precinct	282 Central Ave		●		●	●
22	S. Police Precinct	191 Bergen Ave	●	●		●	●
23	Municipal Services	13 Linden Ave		●		●	●
24	Records Warehouse	Linden Ave East	●	●	●	●	●

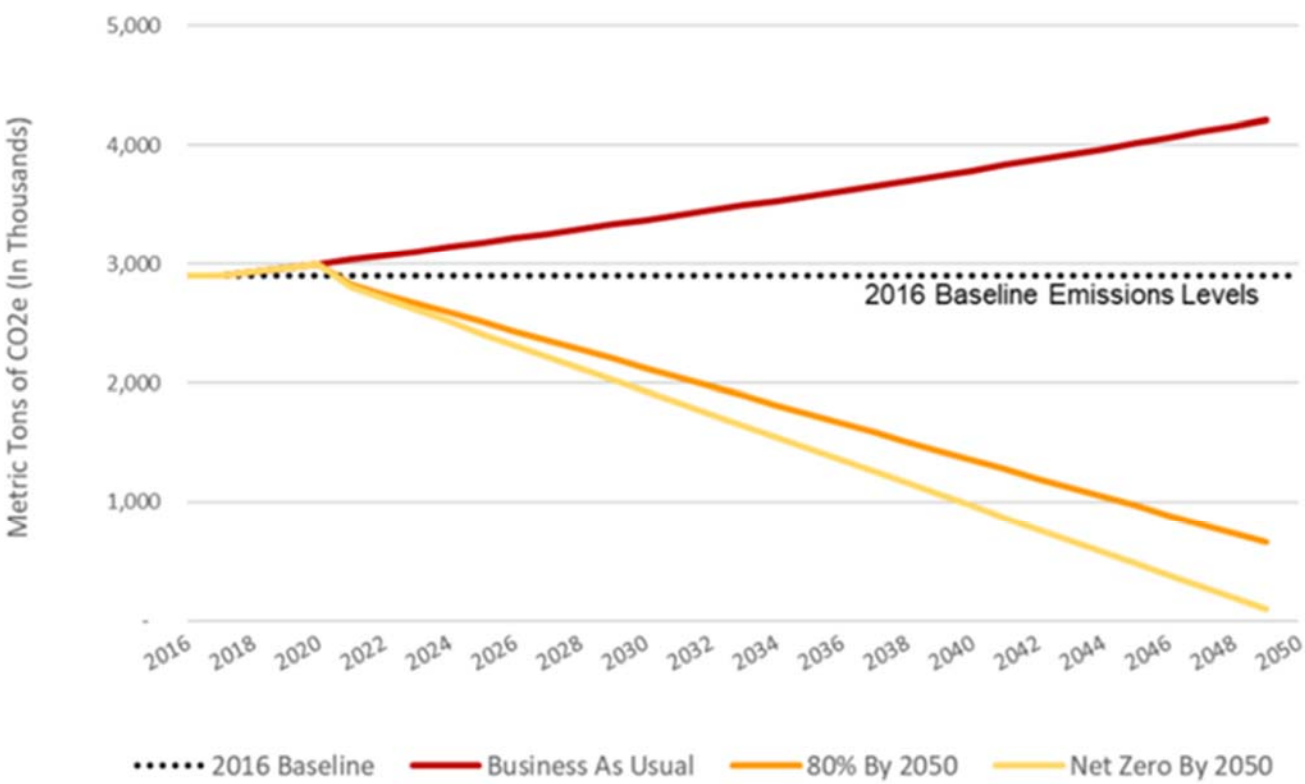
80% by 2050: Jersey City's Bold Commitment to Reducing Carbon Emissions

In order to achieve the City's goals of reducing carbon emissions 80 percent by 2050, it will be important for Jersey City to take decisive action through this Energy Savings Improvement Program. Upgrading end of life equipment will help ensure Jersey City can meet its climate action goals ahead of schedule.

> *"The City of Jersey City has already committed to an 80% reduction in greenhouse gas (GHG) emissions by 2050… To meet this goal, Jersey City will need to take bold actions."*
>
> JC Climate Action Planning Bulletin #4, August 2019

Jersey City's Greenhouse Gas Inventory Demonstrates Importance of ESIP for the Building Sector:

According to Jersey City's 2016 Greenhouse Gas Inventory, 67 percent of the City's GHG emissions result from "stationary energy" (commercial, residential and industrial energy). The GHG Inventory forecasts that **Jersey City's GHG emissions could increase 15 percent by 2030 and 30 percent by 2050 if no action is taken**.



Jersey City: Leading by Example to Enable Private Sector Action:

Jersey City can lead by example and achieve drastic GHG emission reductions for its municipal facilities through this Energy Savings Plan. This municipal leadership will enable the City to implement its Climate Action Plan and lead by example to implement change with its local residential and commercial buildings sector, thereby helping the City and the State of NJ to achieve its climate action goals.

2.0 Financial Analysis

2.1 Scope Summary

The intent of this project is to maximize savings for the City, fund critical capital improvements, and achieve the strategic goals of the City. We believe that the following energy conservation measures are the best solution to maximizing savings and meeting the City needs.

Number	ECM	Hard Costs	Annual Savings	Payback Period
	Health and Comfort			
1	Air Sealing Improvements	$ 174,442	$ 8,607	20
2	Building Automation System Upgrade	$ 902,793	$ 49,116	18
	Efficiency			
3	LED Lighting	$ 1,570,080	$ 108,630	14
4	Water Recommissioning	$ 236,625	$ 16,182	15
5	Pipe Insulation	$ 15,192	$ 836	18
6	High Efficiency Transformers	$ 64,668	$ 4,162	16
7	Energy Star Copier Operation	$ -	$ 718	0
	Infrastructure			
	Bethune			
8	HVAC System Replacement	$ 1,761,856	$ 9,602	183
	Pershing			
8	Pool Boilers, DHW	$ 734,752	$ 2,369	310
8	Combined Heat and Power (CHP)	$ 595,835	$ 27,952	21
9	Roofing Insulation	$ 154,682	$ 1,660	93
	Sustainability			
10	Solar PV System	$ 1,599,155	$ 70,688	23
	ESCO Project Summary:	$ 7,810,080	$ 300,522	26
	PSEG Energy Savers/NJ Direct Install	$ 580,103	$ 64,643	
	City Share of PSEG Energy Savers/NJ Direct Install	$ 166,938		

In order to achieve the above ECMs the following facility alteration is required to meet current code requirements. Specifically this facility alteration will allow the City to be able to install solar (ECM 10), and capture significant financial savings and incentives. Including this facility alteration within the ESP provides an economic advantage by making it possible for Jersey City to participate in the TREC program.

Number	Facility Alteration	Hard Costs
9	Roofing Replacement or Repair	$ 1,356,683

2.2 Financial Summary

The table below represents the total, turn-key cost of the ESIP based on the scope of work listed on the prior page and Form V from SE's RFP Response. This ESP program is a firm fixed-price contract. Schneider Electric will serve as the primary contractor, responsible for the execution of all scopes of work under the ESP program. However the Direct Install/Energy Savers scopes of work will be contracted directly and SE will provide consultation and coordination services with respect to this scope.

Energy Conservation Measures

Category	Cost	Percentage of Hard Costs
Estimated Value of Hard Costs:	$ 7,810,080	
Project Service Fees		
Investment Grade Energy Audit	$ 164,012	2.10%
Design Engineering Fees	$ 191,347	2.45%
Construction Management & Project Administration	$ 331,928	4.25%
System Commissioning	$ 93,721	1.20%
Equipment Initial Training Fees	$ 23,430	0.30%
ESCO Overhead	$ 480,320	6.15%
ESCO Profit	$ 429,554	5.50%
Project Service Fees Sub Total	$ 804,438	10.30%
TOTAL PROJECT COSTS:	$ 9,524,393	21.95%

Facility Alterations

Category	Project Cost	Percent of Hard Cost
Estimated Value of Hard Costs	$ 1,356,683	
Project Service Fees, ESCO Overhead and Profit	$ 297,792	21.95%
Total Project Costs	$ 1,654,474	21.95%

2.3 Cash Flow Analysis

ESCO Name: Schneider Electric

Note: This energy savings plan is based on the following assumptions in all financial calculations:
(a) The cost of all types of energy should be assumed to inflate at 2.4% for Natural Gas and Water, 2.2% for Electric.

1. Term of Agreement: 20 years
2. Construction Period (months): 18 months
3. Cash Flow Analysis Format:

Interest Rate to Be Used for Proposal Purposes: **2.25%**

ESP Financing

Facility Alterations	$	1,654,474
Turn-key ECMs w/ SE:	$	9,524,393
Cost of Issuance:	$	215,000
Total Cost:	$	11,393,867
ESIP Financing:	$	6,880,257
Funded by City:	$	4,513,610

PSEG Energy Savers

Program Value	$	523,121
City Share	$	156,936
PSEG Share	$	366,185

NJ OCE DI

Program Value	$	56,982
City Share	$	10,002
BPU Share	$	46,980

	Year	Annual Electric Savings	Annual Solar Savings	Annual Natural Gas Savings	Annual Water Savings	Annual O&M Savings	Energy Rebates/ Incentives	Total Annual Savings	ESIP Financing Costs	DI/PSEG Costs (On Bill Financed)	Annual Service Costs (CHP Maintenance)	Annual Service Costs (Solar O&M)	Net Cash-Flow to Client	Cumulative Cash Flow
6/30/2022	Installation	$ 50,605	$ 14,138	$ 5,436	$ 2,855	$ 27,712	$ 94,432	$ 195,177	$ 182,175	$ 10,002	$ -	$ -	$ 3,000	$ 3,000
6/30/2023	1	$ 253,023	$ 70,688	$ 27,180	$ 14,274	$ 55,423	$ 39,500	$ 460,088	$ 386,941	$ 52,312	$ 7,271	$ 10,564	$ 3,000	$ 6,000
6/30/2024	2	$ 258,589	$ 71,882	$ 27,832	$ 14,617	$ 55,423	$ 18,500	$ 446,843	$ 373,378	$ 52,312	$ 7,431	$ 10,722	$ 3,000	$ 9,000
6/30/2025	3	$ 264,278	$ 73,096	$ 28,500	$ 14,968	$ 55,423	$ 4,500	$ 440,765	$ 366,975	$ 52,312	$ 7,594	$ 10,883	$ 3,000	$ 12,000
6/30/2026	4	$ 270,092	$ 74,331	$ 29,184	$ 15,327	$ 55,423	$ 4,500	$ 448,857	$ 427,049		$ 7,761	$ 11,047	$ 3,000	$ 15,000
6/30/2027	5	$ 276,034	$ 75,586	$ 29,884	$ 15,695	$ 55,423		$ 452,623	$ 430,478		$ 7,932	$ 11,212	$ 3,000	$ 18,000
6/30/2028	6	$ 282,107	$ 76,863	$ 30,602	$ 16,071			$ 405,643	$ 383,156		$ 8,107	$ 11,380	$ 3,000	$ 21,000
6/30/2029	7	$ 288,314	$ 78,161	$ 31,336	$ 16,457			$ 414,267	$ 391,431		$ 8,285	$ 11,551	$ 3,000	$ 24,000
6/30/2030	8	$ 294,656	$ 79,481	$ 32,088	$ 16,852			$ 423,078	$ 399,886		$ 8,467	$ 11,724	$ 3,000	$ 27,000
6/30/2031	9	$ 301,139	$ 80,823	$ 32,858	$ 17,256			$ 432,077	$ 408,523		$ 8,653	$ 11,900	$ 3,000	$ 30,000
6/30/2032	10	$ 307,764	$ 82,189	$ 33,647	$ 17,671			$ 441,270	$ 417,347		$ 8,844	$ 12,079	$ 3,000	$ 33,000
6/30/2033	11	$ 314,535	$ 83,577	$ 34,454	$ 18,095			$ 450,660	$ 426,362		$ 9,038	$ 12,260	$ 3,000	$ 36,000
6/30/2034	12	$ 321,454	$ 84,988	$ 35,281	$ 18,529			$ 460,253	$ 435,572		$ 9,237	$ 12,444	$ 3,000	$ 39,000
6/30/2035	13	$ 328,526	$ 86,424	$ 36,128	$ 18,974			$ 470,052	$ 444,981		$ 9,440	$ 12,631	$ 3,000	$ 42,000
6/30/2036	14	$ 335,754	$ 87,884	$ 36,995	$ 19,429			$ 480,062	$ 454,594		$ 9,648	$ 12,820	$ 3,000	$ 45,000
6/30/2037	15	$ 343,141	$ 89,368	$ 37,883	$ 19,895			$ 490,287	$ 464,414		$ 9,860	$ 13,012	$ 3,000	$ 48,000
6/30/2038	16	$ 350,690	$ 90,877	$ 38,792	$ 20,373			$ 500,732	$ 474,447		$ 10,077	$ 13,207	$ 3,000	$ 51,000
6/30/2039	17	$ 358,405	$ 92,412	$ 39,723	$ 20,862			$ 511,402	$ 484,697		$ 10,299	$ 13,406	$ 3,000	$ 54,000
6/30/2040	18	$ 366,290	$ 93,973	$ 40,676	$ 21,362			$ 522,302	$ 495,170		$ 10,526	$ 13,607	$ 3,000	$ 57,000
6/30/2041	19	$ 374,348	$ 95,560	$ 41,653	$ 21,875			$ 533,436	$ 505,868		$ 10,757	$ 13,811	$ 3,000	$ 60,000
6/30/2042	20	$ 382,584	$ 97,174	$ 42,652	$ 22,400			$ 544,811	$ 516,799		$ 10,994	$ 14,018	$ 3,000	$ 63,000
	Totals	$ 6,322,329	$ 1,679,474	$ 692,784	$ 363,836	$ 304,828	$ 161,432	$ 9,524,683	$ 8,870,243	$ 166,938	$ 180,223	$ 244,278	$ 63,000	

2.4 Annual Service Costs

Implementing some of the ECMs will have additional service cost that is currently not incurred by the city. This cost is reflective in the 2.3 Cash Flow Anaylsis.

Year	CHP Maintenance	Solar Maintenance	Total
1	$7,271	$10,564	$17,835

2.5 Incentives, Rebates, and Curtailment Services

A variety of incentive and rebate programs were evaluated during the development of the Project. Based upon the scope of this project, the following rebates are currently included:

Year	PJM PDR	Smart Start	Combined Heat and Power	Total
Installation		$ 73,432	$ 21,000	$ 94,432
1	$ 4,500		$ 35,000	$ 39,500
2	$ 4,500		$ 14,000	$ 18,500
3	$ 4,500			$ 4,500
4	$ 4,500			$ 4,500
Total	$ 18,000	$ 73,432	$ 70,000	$ 161,432

All rebates and incentives are subject to program terms, conditions, approvals, and availability of funds.

NJ Clean Energy Program – Direct Install

The Direct Install program is applicable to small to mid-sized commercial and industrial facilities with an average peak electric demand that does not exceed an average of 200 kW in the preceding 12 months. The Direct Install program is funded up to 80% by the NJ Clean Energy program, and can address lighting, HVAC, refrigeration, motors, variable frequency drives, and more. For more information, please visit:

https://www.njcleanenergy.com/commercial-industrial/programs/direct-install

Scope of work documents have been completed by the Direct Install contractor and can be found in Appendix 7.3.

PSEG Energy Savers

The PSEG Energy Savers program is applicable to small to mid-sized commercial and industrial facilities with an average peak electric demand that does not exceed 200 kW in the preceding 12 months. The Energy Savers program is funded up to 70% by PSEG, and can address lighting, HVAC, refrigeration, motors, variable frequency drives, and more. For more information, please visit:

https://nj.pseg.com/businessandcontractorservices/saveenergyandmoneyforbusiness/directinstallprogram

Scope of work documents have been completed by the Direct Install contractor and can be found in Appendix 7.4.

NJ Clean Energy Program – Smart Start

The Smart Start Program provides prescriptive rebates for specific equipment changes, such as lighting upgrades or installation of variable frequency drives (VFDs). To learn more about the Smart Start Program, please visit:

http://www.njcleanenergy.com/ssb

The New Jersey Clean Energy Program requires that customer choose either the P4P or the Smart Start program. Based upon our analysis, all buildings that do not qualify for P4P will utilize the Smart Start program.

NJ Clean Energy Program – Combined Heat and Power

One of the goals of the State of New Jersey is to enhance energy efficiency through on-site power generation with recovery and productive use of waste heat, and to reduce existing and new demands to the electric power grid. The Board of Public Utilities seeks to accomplish this goal by providing generous financial incentives for Combined Heat & Power (CHP) installations. For more information, please visit:

https://www.njcleanenergy.com/commercial-industrial/programs/combined-heat-power/combined-heat-power

PJM Energy Efficiency Program (PJM EE)

The Energy Efficiency program is designed to provide financial benefit to the consumer for permanent reductions in electrical load. Examples of energy efficiency projects include upgrading to more efficient lighting, or replacing HVAC systems with more efficient ones, or other ECMs that reduce electrical load.

Jersey City will see permanent reductions in peak kW, primarily from lighting upgrades. After the installation of this Project, Schneider Electric will work to ensure that these incentives are secured on behalf of the City.

PJM Capacity Market Program (Demand Response)

The capacity market program stems from the need for utilities to balance electric supply with electric demand on the grid. Because there is a finite amount of generating capacity, demand response was created to allow consumers to shed demand when needed by PJM. Consumers must work with Curtailment Service Providers (CSPs) to shed electrical load when needed by PJM, in order to generate revenue. The load-shaving can be done through a variety of measures including energy efficiency, on-site generation, or manual shutdown.

Based upon the current conditions of the City’s building automation systems, it has been deemed that demand response may not be an immediate opportunity. However, following the ESIP project and the installation of more sophisticated building automation systems, Schneider Electric will evaluate demand response revenue opportunities under future programs.

3.0 Facility Descriptions and Energy Conservation Measures

3.1 Facility Descriptions

City Hall

City Hall is a 100,000 square foot facility that is mostly comprised of office spaces, small kitchens, and conference rooms. The building has four (4) floors including a basement. The building was originally built in 1896 and contains old and inefficient lighting and building envelope with excessive air infiltration.

As most parts of the building are office spaces with or without public access, the occupancy is within the standard office times and round the year. The basement of the building is used largely for storage purposes by the maintenance personnel, and hence might have some excess operations.

The building is constructed of concrete and structural steel with a stone façade. The building has a flat roof in the center, covered with black membrane and inclined roofs at the corners. The building has a combination of large single and double pane windows (cracked in some of the rooms), which leads to infiltration. Parts of the building, such as the Council of Chambers, have new stained-glass windows as they were redeveloped recently. The exterior doors are in good condition.

Firehouse 14 Orient Ave

The Firehouse is a single story 5,000 square foot facility comprised of apparatus floor (engine bay area), office space and a dormitory for the fire fighters. This single-story building constructed in 1960 also contains a commercial kitchen and mechanical rooms.

The apparatus floor and the dormitories, including the kitchen are functional and occupied year-round.

The building has a brick façade and the interior construction is wood and stucco. It has a flat roof with black rubber membrane. The building has no windows in the dormitory area but the doors leading to these spaces are tight and in fair condition. The apparatus floor has single pane windows at the backend of the space. These are old and show signs of air infiltration and energy loss through them during wintertime.

Firehouse 152 Lincoln Ave

The Firehouse located at 152 Lincoln Street is a 5,000 square foot, two-story building. Construction was completed in the early 1900's. The Firehouse is home to the Engine Company 11 of the Fire Department of Jersey City.

The building consists of offices, firetruck bays, a bunk room, a basement mechanical room, a locker room, and a kitchen room. As an emergency service facility, the Firehouse is open 24 hours a day, seven (7) days a week.

Interior lighting of the facility is provided by a combination of linear fluorescent T12 fixtures and incandescent lamps. Heating and cooling are provided by three (3) window air conditioning units and one gas fired Weil-McLain non-condensing hot water boiler.

The Fire House is an emergency facility operating 24 hours, seven (7) days a week.

Firehouse 152 Linden

The Firehouse is a 5,000 square foot three-story building comprised of various space types. The facility was constructed in the early 1900's. The building consists of office, engine bays area, bunk room, mechanical room, locker room, kitchen, and other space types. The Firehouse is an emergency facility operating 24 hours a day, seven (7) days a week.

The building foundations consists of masonry perimeter wall footings with masonry foundation walls. The foundation system includes masonry piers and column pads to support the upper floor and the roofs. The exterior walls are finished with brick accented with decorative stone.

The building has a flat roof covered with a metallic sheet surface that is in good condition. There is no equipment on the roof. The facility has aluminum-framed, double-pane window units.

Windows, shading devices, sills, related flashing. Overall, the windows are in fair condition with some units showing signs of uncontrolled moisture, air-leakage and other energy- comprising issues.

Firehouse 160 Grand St

The Firehouse at 160 Grand Street is a 1,800 square foot facility. The building was constructed in 1850. Interior space is comprised of an Apparatus floor (engine bay area), dormitories for the fire fighters, a commercial kitchen, and mechanical rooms in the basement. The apparatus floor and the dormitories, including the kitchen are functional and occupied all year round.

The building exterior is brick masonry and the interior construction is wood and Stucco. It has a flat roof and framed windows. The building is old and show signs of air infiltration. The apparatus floor has a garage door for the access of the fire engines.

Firehouse 2 Bergen Ave

The Firehouse is a 10,000 square foot facility comprised of office spaces, dormitories for the firefighters and an apparatus floor (garage where fire engines are parked). The building has two (2) floors with a commercial kitchen and mechanical rooms. The building is centrally heated and cooled. The building was constructed in 1900. The apparatus floor and the dormitories, including the kitchen are functional and occupied round the year.

The exterior of the building is brick masonry and the interior construction is wood and Stucco. It has a flat roof with black membrane. The rooftop is very small and has just about the right space to hold the air handling unit. The apparatus floor has two (2) garage doors for the access of the fire engines. The windows are double pane and show sign of little sign air infiltration.

Firehouse 255 Kearney Ave

The Firehouse is an 8,829 square foot facility comprised of office spaces, dormitories for the firefighters and two apparatus floors (firetruck bays). The building also contains a commercial kitchen and an office space. The apparatus floor and the dormitories, including the kitchen are functional and occupied all year round.

The building has a brick façade and the interior construction is wood and Stucco. It has a flat roof with black rubber membrane. The kitchen and the dorm areas are sandwiched between the apparatus floors on each side. The building does not have any windows and hence does not get enough sunlight to light spaces such as the apparatus floor and offices and kitchen. For this reason, the lights are on throughout the day, leading to greater expense for lighting than other typically sized buildings.

Firehouse 468 Ocean Ave

The Firehouse is a 5,000 square foot, three story building built in 1894. The Firehouse is home to Engine Company 22, Ladder 4 of the Fire Department of Jersey City.

The building consists of an office, firetruck bays, a bunk room, a boiler room, a kitchen and gymnasium room. As an emergency service facility, the Fire house is open 24 hours a day, seven (7) days a week.

The foundation consists of a concrete perimeter wall footings. The foundation systems include reinforced concrete column pads. The building's west wall has no insulation. The building is primarily constructed of brick masonry.

The primary roofs are flat and finished with a mineral surfaced over a single ply membrane

The windows are aluminum-framed, double-pane units. Windows, shading devices, sills, related flashing and caulking were inspected for signs of moisture, air leakage and other energy comprising issues. Overall, the windows were found to be in good condition with no signs of uncontrolled moisture, air-leakage and other energy-comprising issues.

Firehouse 595 Palisade Ave

The 595 Palisade Avenue Firehouse is a 20,000 square foot, single story building built in in the late 2000's. The firehouse is the Engine Company 14, Ladder 7 of the Fire Department of Jersey City. The building consists of offices, firetruck bays, a bunk room, a locker room, a kitchen and gymnasium room.

The Fire House is an emergency facility operating 24 hours, seven (7) days a week.

The foundation consists of a conventional reinforced concrete foundation. Exterior walls are finished with brick masonry. Exterior and interior wall surfaces were inspected during the field audit. They were found to be in overall good condition with no signs of uncontrolled moisture, air-leakage and other energy-compromising issues.

The garage has three (3) engine entrance doors on the North and South sides of the building. The building envelope appears to be in good condition with no evidence of damage or air infiltration.

The primary roof is flat and covered with a black rubber and appears to be in good condition. The primary roof is surrounded by sloped metallic roofs with no sign of excessive wear of damage.

Firehouse Bergen and Duncan

The Firehouse is a 5,000 square foot facility. It is comprised of two (2) floors and a basement. The building was originally constructed in the 1900 and recently renovated. The first floor has one fire truck bay and a fully equipped kitchen. The second floor has the Chief's office and the dormitory for the fire fighters. The building is a firehouse with lodging facility and is occupied 24 hours per day, seven (7) days a week throughout the year.

The building is made of brick and first floor is concrete. The building has a flat roof covered with a black rubber membrane. The roof appears to be in good condition as the building was recently renovated. The building has double pane windows throughout which are in good condition and show little sign of excessive air infiltration. The exterior door and the garage door appear to be in good condition, though there is energy loss through the garage door every time the door opens in the winter.

Firehouse and OEM

The Firehouse & OEM is an 18,000 square foot, one-story building built in 1997. The building consists of offices, engine bays, storage rooms, a locker room, kitchen, fire training school, and the office of emergency management. The Firehouse Engine 7 and Ladder 3 is located in the eastern portion of the building.

The western portion of the building houses Office of Emergency Management (OEM) and Homeland Security. The OEM focuses on enhancing the regional preparedness in major metropolitan areas. The OEM overseas the Jersey City/Newark Urban Area Initiative (UASI). Also, the fire training school is located in this portion of the building just after the OEM.

The fire house is an emergency service building operating 24 hours a day and seven (7) days a week. The fire station portion of the building has at any giving time about 15-20 firefighters working a given shift.

The building's foundation is made of reinforced concrete. The above-structure frame consists of structural steel beams and columns supporting open-web steel bar joists that in turn support the roof deck.

The primary roof is flat and finished with a black rubberized membrane that is in poor condition.

Exterior walls are finished with a combination of ground-face concrete masonry unit blocks.

The building's base and its perimeter were inspected for signs of uncontrolled moisture or water presence and other energy-compromising issues. Overall, the base was reported to be in good condition with no signs of uncontrolled moisture, air-leakage and/or other energy-compromising issues.

The garage has three (3) engine entrance doors on the North side and two (2) others on the South side of the building.

The building has aluminum-framed, fixed and side-hung casement double-glazed windows which are in good condition and show no signs of excessive infiltration. The exterior doors are constructed of aluminum and in fair condition. The door seals are worn, which increases the level of outside air infiltration.

Firehouse Consolidated

The Firehouse – Consolidated is a 14,762 square foot facility comprised of office spaces, dormitories for the firefighters and an apparatus floor (firetruck bay) with three (3) garage doors. The building was constructed in 1965. The building has two (2) floors with a commercial kitchen and mechanical rooms. The building is centrally heated and cooled. The building has energy inefficient lighting and no retrofits have been made in the recent past.

The apparatus floor and the dormitories, including the kitchen are functional and occupied all year round.

The building has a concrete facade with Stucco interior. It has a flat roof with black rubber membrane. The building has single pane windows and has blinds on the interior. The apparatus floor has three (3) garage doors. The windows are old and show sign of excessive air infiltration.

Joseph Connors Senior Center

The Division of Senior Affairs of the Jersey City Department of Health & Human Services operates two (2) senior citizen centers, the Joseph Connors Senior Center (located at 28 Paterson Street) and the Maureen Collier Senior Center (located at 335 Bergen Avenue). These centers provide information and assistance to seniors in order to help them obtain services they need. This includes housing, social services, New Jersey Transit senior discounts, recreational activities, and events.

Joseph Connors Senior Center is a 5,000 square foot facility that was constructed in 1950. The building has three (3) floors and includes an office, a reception area, a computer room, a play area, a storage room, an assembly room, and the basement mechanical space. The building is open Monday through Friday.

The building's foundation consists of concrete perimeter wall footings with masonry foundation walls. The foundation systems include reinforced column pads. Exterior walls are finished with brick masonry. We were not able to get access to the roof, as a result, we cannot describe its actual condition. The entrance door is fully glazed, aluminum framed and is in good condition. Windows are comprised of double-pane single hung and glass panel cut-up windows with wood frames. Windows, shading devices, sills, related flashing and caulking were inspected for signs of moisture, air-leakage and other energy comprising issues. Overall, the windows were found to be in poor condition with signs of uncontrolled moisture, air-leakage, and other energy-comprising issues.

Lafayette Pool

Lafayette Pool is a 7,450 square foot facility comprised of a front office (with rooms for registration, first aid and onsite police officer), pump rooms, restrooms and showers, locker rooms and a commercial kitchen space.

The facility was constructed in 2011. This is an open pool which is accessible to the public during the summer months. The facility predominantly consists of a front office (with rooms for registration, first aid and onsite police officer), pump rooms, restrooms and showers, locker rooms and a commercial kitchen space. The Lafayette pool is open for 20 weeks a year during the summer months. The water is drained, and the pool is closed during the winter. The facility is occupied by about 7-10 full time staff.

The building has (2) two swimming pools (kid's and an adult pool) both of which have concrete foundations. The office and kitchen have a brick façade and pitched roof. There are very few windows at the facility. The site is surrounded by a metal fence with entrance gates.

Bethune Community Center

Mary McLeod Bethune Community Center is a 26,350 square foot facility. The Community Center's key function is to provide Jersey City residents with a place to gather for group activities, social support, public information, boot camp, dance classes, and many other purposes. The building was constructed in 2002 and has two floors which are comprised of offices, classrooms, community rooms and mechanical spaces. Typically 75-100 people occupy the facility during normal operating hours. Special events occur frequently, which vary the hours of operation and occupancy greatly.

The foundation consists of a conventional, reinforced concrete. The building has structural steel columns supporting the upper floors and roof. The upper floor has concrete-topped metal decks that are supported by steel beams. Exterior walls are finished with brick masonry. Portions of the exterior wall are accented with concrete block. The primary roof is flat and finished with a single-ply membrane that is in good condition.

The windows are wood-framed double-pane glazed double-hung units. The main entrance doors are fully glazed, aluminum framed entry doors set in metal frames. The glazing is double paned. Windows, shading devices, sills, related flashing.

Interior lighting in the facility is provided by linear T8 fluorescent lamps and fixtures, and recessed ceiling mounted compact fluorescent lamp (CFL) fixtures. The lighting in the building is controlled predominantly by light switches located on the walls near entry doors to rooms. The facility's HVAC system consists of individual direct expansion constant volume gas-fired packaged roof top units (RTUs) and energy recovery units (ERUs). There is a total of three (3) Trane package RTUs, seven (7) ERUs, and two (2) Mitsubishi split system air conditioning serving the Telecom Room and the Computer Room. The seven (7) ERUs are noted to have a very high maintenance demand and are frequently being serviced by an outside mechanical contractor.

Maureen Collier Senior Center

Maureen Collier Senior Center is a 6,500 square foot facility comprised of a single floor. This building is used for public gatherings and other recreational purposes. It includes an office, kitchen, a large hall, and two entertainment rooms. The building was constructed in 1992. Since construction, the facility has not had any lighting upgrades and has mostly outdated and inefficient T12 fluorescent fixtures.

Building occupancy varies between 20-30 depending on events and activities. The entire facility is used year-round. The building is comprised of concrete masonry exterior walls with interior steel columns. The roof is steeply sloped and finished with asphalt paper shingles. The windows are aluminum-framed double-pane glazed units. No excessive air-infiltration or leakage was observed. The glass doors are aluminum framed and fully glazed. The doors and windows are in good condition.

Municipal Courthouse

The Jersey City Municipal Courthouse is a 60,000 square foot facility comprised of various space types. The Municipal Court is a statutory court that is responsible for hearing motor vehicle traffic violations and disorderly and petty disorderly criminal offenses within the jurisdiction of the municipality. Construction was completed in 2000. The building is three (3) floors (including the basement) and includes courtrooms, offices, conference rooms, police personnel rooms, holding cells, a garage, and a basement mechanical space. Typically, 100 to 400 people occupy the facility during normal operating hours. After-hours occupancy consists of approximately 50 people. The scheduled occupancy for the six courtrooms varies throughout the week.

The foundation consists of cast-in-place concrete perimeter wall footings with concrete foundation walls. The foundation systems include reinforced concrete column pads. Exterior walls are finished with brick masonry. The building has a flat roof covered with a multi-ply bituminous built-up membrane, which is in good condition.

The windows are glazed with insulated panes set in metal frames. The front-entry area windows are part of an aluminum-framed storefront system incorporating the entry doors. The entrance doors are fully glazed and aluminum framed doors set in the storefront framing system. Overall, the windows were found to be in good condition with no signs of uncontrolled moisture, air leakage, and other energy-compromising issues.

Interior lighting in the facility is provided mainly by linear T8 fluorescent lamps and fixtures. There are other small areas that are lit with compact fluorescent lamps and T5 fluorescent lamps. The lighting in the building is controlled predominantly by light switches located on the walls near entry doors to rooms. The facility's HVAC system consists of five (5) individual direct expansion constant volume Trane packaged roof top units and two (2) Lochinvar hot water boilers.

Pavonia Pool

The Jersey City Department of Recreation offers swim programs for all residents. Pavonia Pool is one of several recreational facilities managed by the Department of Recreation. It is an outdoor pool which is open for the summer months

Pavonia Pool is a 5,200 square foot facility. The facility was originally constructed in 1955 and has been renovated several times since construction. The building is one floor and includes a front desk reception area, an office, locker rooms, mechanical rooms, and storage rooms. The building's foundation consists of concrete perimeter wall footings with masonry foundation walls. Exterior walls are finished with concrete bricks. The building has a gable roof covered with metal standing seam. The facility has no regular window system and air registers throughout the building perimeter. The entrance doors are fully glazed, metal framed doors set in the storefront framing system. Pavonia Pool is an outdoor pool which is open for the summer months.

The building's foundation consists of concrete perimeter wall footings with masonry foundation walls. Exterior walls are finished with concrete bricks. The building has a gable roof covered with metal standing seam. The facility has no regular window system. Air registers throughout the building perimeter replaced the regular window system. The entrance doors are fully glazed, metal framed doors set in the storefront framing system. Overall, the building envelope was found to be in good condition.

Pershing Athletic Complex

Pershing Field Athletic Complex is a 38,108 square foot facility comprised of three (3) one-story buildings. The main office and the swimming pool areas have 16,988 square feet of conditioned space, and the covered ice rink area is 21,120 square feet. The facility is part of a larger recreational park that also includes a children's play area, a small field house, a running track, tennis and basketball courts and a garden area. The field house was not accessible during the audit.

Pershing Athletic Field is a recreational facility that operates year-round. The facility's peak electrical demand usually occurs on Saturday and sometimes Sunday with group pool lessons and scheduled events occurring at that time.

The three (3) buildings are slab on grade with perimeter beams or masonry foundations. The main office and ice rink building are constructed of brick masonry with a steel-framed flat roof. The pool enclosure is an exposed steel rigid frame with exterior masonry walls and roof panels of insulated fiberglass. Part of the roof is made of retractable fiberglass panels. The ice rink enclosure has a rigid steel frame with steel columns supporting four sloped roof structures. The facility buildings have few windows. The offices, the corridors, and the locker rooms have insulated windows. Pershing Field Athletic Complex has a 75-kW solar panel array installed on the ice rink's sloped roof.

Police Station East District

East District Police Precinct is a 15,500 square foot facility comprised of four (4) floors including the basement. The space types predominantly include the offices, locker rooms, and holding cells. The building was constructed in 1900. The entire facility is operational all year round and open 24 hours a day, although the number of people occupying the building vary throughout the day.

The East District Police Precinct is constructed of brick and steel and has a concrete facade. The building has a flat roof and its windows show signs of excessive air infiltration. However, the exterior doors are framed glass doors and in good condition. The building shares its walls on either side with other buildings and hence receives only minimal daylight or natural ventilation.

Police Station South District

The South District Police Precinct is a 6,000 square foot facility. The building was constructed in 1954. The building is single floor and includes offices, front desk (reception area), locker rooms, and the basement mechanical space. The Police Station is an emergency service building, as a result it is open 24 hours a day, seven (7) days a week.

The building's foundation consists of cast-in-place concrete perimeter wall footings with masonry foundation walls. The foundation system includes reinforced concrete column pads. We noticed moisture in the basement (locker room wall).

Exterior walls are finished with brick masonry. The windows are aluminum-framed, double-pane glazed, double-hung units. They are in good condition and show no signs of outside air infiltration. Exterior doors are constructed of metal and are in good condition. The building envelope was found to be in good condition.

Municipal Service Center

The MSC complex consists of (3) buildings for a total square footage of ~146,300. The building achieved LEED certification after installation. Some of the energy efficient measures installed as part of the LEED certification included flush-less urinals and a water source heating system. The buildings are approximately 6 years old.

Exterior walls are brick with windows being double pane glass. The large open work bays are heated with under slab radiant heat. Other HVAC systems include water source heat pumps, destratification fans, and unit heaters.

The facility is operated with typical office hours, with certain divisions starting earlier and others running later. The facility is critical to City operations.

Records Warehouse

The records building is a storage warehouse with a small office section. The square footage is ~64,000. The building was purchased by the city to be used for long term record storage. The building is two story brick building with gas fired rooftop units providing heating and cooling throughout. The roofing is scheduled to be replaced this fall outside of this energy savings plan. The building typically has two employees with a standard office schedule.

3.2 ECM Descriptions and Facility Alterations

Please see the following descriptions of ECMs currently included in the project. Scope of work indicated as "Optional" in red is currently not included in the project but is provided for the City's consideration.

1. Air Sealing Improvements

Overview

This ECM addresses the shell of the building and how well it is keeping conditioned air in and ambient air out. Our onsite testing and analysis of energy consumption indicate there is an opportunity to improve the indoor air quality, occupant comfort, and energy use by upgrading the existing air barrier systems. A tighter Building Envelope will provide the following advantages:

- Drafts will be reduced providing greater comfort for the building occupants. A tighter building envelope will lower the possibility of "hot" or "cold" spots brought on by unconditioned air infiltrating into conditioned spaces.
- Decreased Energy Consumption - Less conditioned air will be lost through the building envelope and the Heating and Cooling equipment will operate less to maintain the set point of the conditioned space. This will decrease the energy consumed and save on energy costs.
- Improved Air Quality – Decreasing infiltration of contaminated air promotes less humidity and greater air quality. This allows for the existing systems to run at peak performance and maintain the highest level of air quality for the occupants.
- Reduced Maintenance Costs – Reducing the "runtime" will increase the operating life of the heating and cooling equipment and increase the performance of new equipment.

Scope

The following is a breakout of the Building Envelope scope by facility:

Task	Bethune Community Center	Courthouse	Firehouse - Bergen	Firehouse - Bergen 2	Firehouse - Grand	Firehouse - Kearney	Firehouse - Lincoln	Firehouse - Ocean	Firehouse - Orient	Firehouse - Palisade	Firehouse & OEM	Firehouse Consolidated	Firehouse Linden
Building Envelope Improvement													
AC Unit Weatherization (Units)	8												
Buck Frame Air Sealing (LF)													
Caulking (LF)								18					
Door - Install Jamb Spacer (Units)													
Door Weather Striping - Doubles (Units)	4	5									1		
Door Weather Stripping - Singles (Units)	4	2	2	2	1	5	2	2	2	4	7	2	2
Double Hung Window Weatherization (Units)	125												
Hopper Window Weatherization (Units)												60	
Overhead Door Weather Stripping (Units)				1	1		1	1	1				1
Roll-Up Door Weather Stripping (Units)													
Roof-Wall Intersection Air Sealing (LF)		410							136	419	321		
Window Restoration (Units)													
Window Weatherization (Units)												60	
Building Envelope Alternate													
Attic Air Barrier Retrofit (SF)													
Install New Attic Hatch (Units)													
Retrofit Attic Hatch (Units)													

Task	Joseph Conners Senior Center	MSC - ESU	MSC - Vehicle	MSC - Warehouse	Pershing Field Athletic Complex	Police Precinct - East District	Police Precinct - South District	Records Warehouse
Building Envelope Improvement								
AC Unit Weatherization (Units)								
Buck Frame Air Sealing (LF)	6							
Caulking (LF)	32	37		17	360			63
Door - Install Jamb Spacer (Units)						1		
Door Weather Striping - Doubles (Units)		1	4	1	3			
Door Weather Stripping - Singles (Units)	5	3	11	3	16	3	3	2
Double Hung Window Weatherization (Units)					8			
Hopper Window Weatherization (Units)								
Overhead Door Weather Stripping (Units)								
Roll-Up Door Weather Stripping (Units)								2
Roof-Wall Intersection Air Sealing (LF)								
Window Restoration (Units)	2							
Window Weatherization (Units)								
Building Envelope Alternate								
Install New Attic Hatch (Units)								
Retrofit Attic Hatch (Units)								

2. Building Automation System (BAS) Upgrade

Overview

This solution combines two approaches to achieving energy savings by adjusting HVAC equipment setpoints and schedules. Some sites shall receive a new building automation system (BAS) or an upgrade of the current BAS to the latest platform. Other sites where it is cost prohibitive to implement a new BAS, shall receive new programmable thermostats. Each approach is outlined as follows:

New Building Automation System (BAS)

Updating a control system can greatly increase the efficiency of a building. A Building Automation System (BAS) allows building operators to control equipment from a central location. Individuals will have the ability to identify and diagnose equipment issues without ever having to leave the office. A centralized, building automation system installation will include a combination of the following:

- Installing new direct digital controls (DDC), where applicable,
- Incorporating existing DDC points, and
- Extending DDC to existing pneumatic controls.

With a microprocessor based direct digital control (DDC) system there are many opportunities to optimize building systems without sacrificing occupant comfort or safety. The BAS will allow energy managers to better control their energy use and consumption through the following control and reporting features including:

- Set point control and monitoring,
- Scheduling of equipment,
- Identification and verification of issues with equipment,
- Implementation of advanced control sequences, and
- Trending and reporting features.

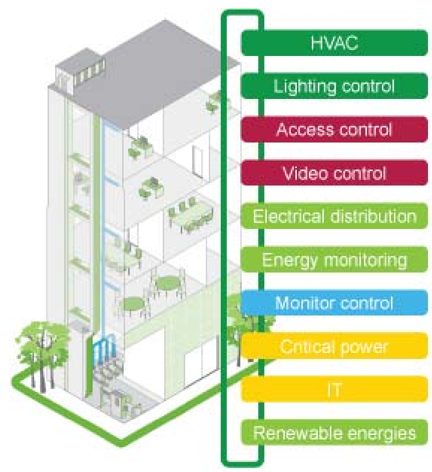


Figure 1. Building Automation System (BAS)

A BAS with new and integrated Direct Digital Controls and graphics equipped user interface workstations allows building personnel to better manage and control energy use.

All direct digital controls will be seamlessly integrated within the overarching BAS. The BAS will facilitate communications between the various systems and provide for a full featured graphical user interface accessible through a PC workstation or remotely via the internet. Through this interface, the facility staff will be able to view all spaces and systems for monitoring and troubleshooting purposes. Floor plan views for each facility will provide a live snapshot of conditions within each space including the current room temperatures, set points and effective occupancy. Detailed equipment graphics pages will display the status and configuration of mechanical equipment operated by DDC systems and all control points on the system will be accessible. Global and individual scheduling will be provided for all systems and all control points can be set up for instantaneous monitoring, trending, or alarming as required.

The following highlights the key benefits of this solution:

- **Reduce Energy Costs** – Control strategies use energy more effectively.
- **Improve Occupant Comfort** – New, calibrated system provide better temperature control.
- **Better Visibility** – Graphics, remote monitoring, and alarms help identify and prevent issues.
- **Enhance System Performance** – EMS will allow for new control strategies to be implemented.
- **Extends Equipment Life** – With reduced run times, equipment wear and tear will be lessened.

- **Reduce Maintenance Costs** – New, standardized control system will require less maintenance and replacement parts are more readily available.

New Programmable Thermostats

The microprocessor-based programmable thermostats have built-in keypad and display for programming and scheduling, and a 365-day time clock with two setback intervals per day. The thermostats have limited temporary set-point adjustment, definable in programming, and a local override button with remote override capability. This will allow occupants to adjust temperature settings for a temporary period without impacting night or unoccupied set points.

The ability to edit operating control parameters are password protected via a user-definable security access code. This ensures permanent set-points for unoccupied times are not comprised, thereby preserving future energy savings associated with unoccupied setbacks.

The following highlights the key benefits of this solution:

- **Reduce Energy Costs** – Scheduling and setback capabilities drive energy savings.
- **Straightforward** – The simplicity of the solution is easy to understand and implement.

Scope

The following section outlines the existing HVAC systems that will be incorporated into the new BAS. Any new HVAC equipment, meters, or other devices that will be incorporated into the new BAS are outlined in their associated ECM description. Existing HVAC systems that are designated as receiving new programmable thermostats shall be standalone from the new BAS.

Joseph Connors Senior Center

The following systems will receive new programmable thermostats standalone from the BAS:

- Six (6) air handling units

Lafayette

The following systems will receive new programmable thermostats standalone from the BAS:

- one (1) air handling unit

Bethune Community Center

The following systems will receive new DDC controls as part of the BAS upgrade:

- eleven (11) air handling units
  - o Provide DCV sequence for 8 of the air handling units
- twenty-two (22) VAV boxes

Maureen Collier Senior Center

The following systems will receive new programmable thermostats standalone from the BAS:

- six (6) air handling units

Courthouse

The following systems will receive new DDC controls as part of the BAS upgrade:

- hot water boiler plant
- five (5) air handling units will receive new controllers for enable/disable control and monitoring of the existing OEM controllers
- forty-seven (47) VAV boxes will receive new controllers.

Pershing Field Athletic Complex

The following systems will receive new DDC controls as part of the BAS upgrade:

- one (1) combined heat and power unit
- three (3) hot water boilers and associated hot water pumps
- three (3) fan coil units
- two (2) splits systems
- two (2) dehumidification units

Municipal Service Center

The existing Andover controls system will be updated to a new EcoStruxure Building Operation (EBO) controls system.

- six (6) existing supervisory controllers will be replaced with new supervisory controllers
- All existing equipment level controls will be integrated into the new BAS

Records

The following systems will receive new DDC controls as part of the BAS upgrade:

- five (5) rooftop units
- one (1) split system

3. LED Lighting Upgrades

Overview

Lighting systems are amongst the top energy users in most facilities. LED lighting technologies require about half of the power as conventional lighting systems to provide the same light output. Retrofitting or replacing lighting fixtures with LED provides multiple benefits including reduced energy consumption, modernized lighting technologies, improved light quality, and reduced maintenance costs. Further energy savings can be achieved through the control of operating hours using occupancy sensors for interior lighting and photocontrols (for dusk to dawn operation) or other technologies (such as time clocks) for exterior lighting.

A standardized lighting system will simplify maintenance and provide consistent lighting color and performance throughout Jersey City's facilities. The long life of LED tubes results in fewer burnouts, longer intervals between replacements and reduced maintenance costs.

Figure 2. High Efficiency LED Tube

Interior lighting improvements will incorporate retrofitting to new, energy efficient LED technology.

For a complete lighting scope of work, please visit the lighting line by line, PSE&G Energy Savers reports and the NJ OCE Direct Install reports in the Appendix.

In addition to the scope in the appendix, the following scope is included for the Pershing athletic fields.

- Remove 119 fixtures
- Install (55) new LED fixtures
- The following light levels are planned as part of this project:
    - Softball
        - Outfield of 20 foot candles
        - Infield of 39 foot candles
    - Baseball
        - Outfield of 23 foot candles
        - Infield of 40 foot candles

Figure 3. Pershing Athletic Fields

4. Water Recommissioning

Overview

The City has a variety of water fixtures. Many of these fixtures flush more water than what the fixture is designed to operate with. Schneider Electric proposes to reset all water fixtures to flush and operate the amount of water necessary to operate per the design.

Scope

The following water conservation scope will be installed:

Site Information			Quantities on Site									"Scope of Work"								
												Flushometer Fixtures						Tank Toilets	Sinks	Showers
Building or Meter	Recommended Scope of Work Option #	In Scope of Work	Lavatory Sinks	General Use Sinks	Multipurpose Lav Sinks	Tank Toilets	Pressure Assist Toilets	Flushometer Toilets	Urinals	Wall Showers	Handheld Showers	Valve Recommissioning	Valve Rebuilding	Valve Replacement	Spud & Flushtube Replacement	Control Stop Modify/Replace	Handle-Mount Hands-Free	Retrofit Upgrade	Vandal Resistant Flow Control	Wall Showerhead
Firehouse - Orient	2	x	-	1	2	2	-	-	1	2	-	-	1	-	-	-	-	2	2	2
Firehouse - Linden	2	x	-	1	2	3	-	-	-	3	-	-	-	-	-	-	-	3	3	3
Firehouse - Bergen	2	x	-	-	7	-	1	5	1	5	2	-	6	-	2	-	-	-	7	5
Firehouse - Kearny	2	x	-	1	6	4	3	-	2	-	3	-	2	-	1	-	-	4	6	-
Firehouse - Ocean	2	x	-	1	3	3	-	-	1	4	-	-	1	-	-	-	-	3	4	4
Bethune Community Center	3	x	17	2	-	-	-	18	5	-	-	-	-	23	17	10	-	-	19	-
Maureen Collier Senior Center	3	x	4	1	-	-	-	3	1	-	-	-	-	4	2	-	-	-	5	-
Police Precinct, South District	3	x	6	-	-	1	-	6	2	3	-	-	-	8	7	-	-	1	6	-
MSC - Vehicle	2	x	7	-	-	-	1	8	2	4	1	-	4	6	7	-	6	-	7	-
MSC - Shop	2	x	4	1	-	2	-	2	-	-	-	-	1	1	1	-	1	2	5	-
MSC - ESU	2	x	5	1	-	-	-	4	2	2	-	-	2	4	5	-	4	-	6	-
Records Warehouse	2	x	5	-	-	5	-	-	-	1	-	-	-	-	-	-	-	5	5	-
City Hall	3	x	17	2	-	1	-	19	7	-	-	-	-	26	24	-	-	1	19	-
Firehouse - Lincoln	2	x	-	1	3	2	-	-	-	3	-	-	-	-	-	-	-	2	3	3
Firehouse - Grand	2	x	-	1	3	1	-	2	1	2	-	-	3	-	1	-	-	1	3	2
Firehouse - Palisade	2	x	-	1	7	-	-	5	2	5	-	-	7	-	2	-	-	-	8	5
Firehouse1 - Bergen	2	x	-	1	4	-	-	3	1	1	1	-	4	-	1	-	-	-	4	1
Firehouse & OEM	2	x	6	2	12	-	-	13	6	10	1	-	14	5	9	-	-	-	20	10
Firehouse Consolidated	3	x	-	1	5	-	-	6	4	13	-	-	-	10	6	-	-	-	6	13
Joseph Connors Senior Center	3	x	8	1	-	4	-	4	1	-	-	-	-	5	5	-	-	4	6	-
Lafayette Pool	2	x	26	1	-	-	-	15	3	14	-	-	18	-	5	-	-	-	27	14
Courthouse	2	x	33	3	7	-	-	38	9	1	3	7	40	-	10	-	-	-	36	-
Pavonia Pool	2	x	9	1	-	-	-	13	3	24	-	16	-	-	-	-	-	-	10	24
Pershing Field Athletic Complex	2	x	12	2	-	-	-	13	2	6	-	2	5	8	9	-	-	-	14	6
Police Precinct, East District	3	x	2	-	-	-	1	1	1	1	-	-	-	2	2	-	-	-	2	-
MSC - HQ	2	x	18	4	-	-	-	16	2	-	-	-	6	12	14	-	12	-	22	-
Total		x	**179**	**30**	**61**	**28**	**6**	**194**	**59**	**104**	**11**	**25**	**114**	**114**	**130**	**10**	**23**	**28**	**255**	**92**

*Note: China replacement is not part of the scope unless called out. Please refer to appendices to see Fixture Line by Line.

5. Pipe Insulation

Solution Overview

Energy is lost in the hot water distribution systems through radiant heat from un-insulated pipes, piping assemblies, valves and fittings. With surface temperatures averaging 180 degrees F, the exposed pipes represent a safety hazard as well as a source of wasted energy. Un-insulated pipes can unnecessarily overheat conditioned spaces as well as unconditioned spaces, resulting in a loss of energy throughout.

Scope

A survey was performed during the investment grade audit. The below table shows the scope currently included.

Task	Fire Station - Palisade	Police Precinct - East District
Flange Insulation (Units)	26	3
Flex Fitting Insulation (UT)	2	
Gate Valve Insulation (Units)	5	1
Pipe Fitting Insulation (Units)	7	22
Pump Insulation (Units)	2	1
Straight Pipe Insulation (LF)	8	62
Strainer Insulation (Units)	2	
Tank Insulation (Units)	1	1
Triple Duty Valve Insulation (Units)	2	

6. High Efficiency Transformers

Overview

This measure replaces existing secondary transformers with new high efficiency transformers. With the age and condition of many of the electrical transformers, replacement with new equipment is recommended for efficiency improvement as well as reliability and safety. New transformers have lower losses across the transformer core.

Figure 4. High Efficiency Transformer

Secondary transformers reduce voltage from distribution level, to building level voltage (normally from 480V to 120/208V) to maintain power in the facility. These transformers operate continuously; therefore, utilizing new, high efficiency transformers results in long term, steady energy savings.

Scope

A transformer survey was performed during the investment grade audit and an inventory of existing equipment was compiled. Savings were calculated based on replacing this equipment with higher efficiency transformers.

kVA	Existing Qty	Replacement Qty
Pershing		
75	1	1
112.5	1	1
Courthouse		
225	1	1

7. Energy Star Copier Operation

Overview

With over 780 ESIP projects, Schneider Electric has spent a lot of time in public buildings. One common simple energy saving strategy is to ensure copy machines have their energy saver mode enabled. It is common to find copiers that have either been installed or manipulated to prevent the energy saver operation. Energy saver mode allows the machine to significantly reduce power draw during long periods of standby. Staff are often the culprits in disabling this feature as waiting for the warming process to warm the machine can take up to 2 minutes during the first set of copies made during the day.

Energy Conservation Opportunities

While the warming lamp normally only consumes around 100-150 watts of power, leaving it energized can become a serious energy waste when thinking about all the hours it could be on when no one is nearby. Schneider Electric will work with the IT department to implement a rule system that allows the warming lamp to stay operation up to 30-60 minutes after the last print job. This will allow staff to quickly make copies but not waste energy all night and weekend long.

Scope

The following building copiers will be put into energy saver mode.

Courthouse

- one (1) copier

Municipal Service Center

- one (1) copier/mass printer

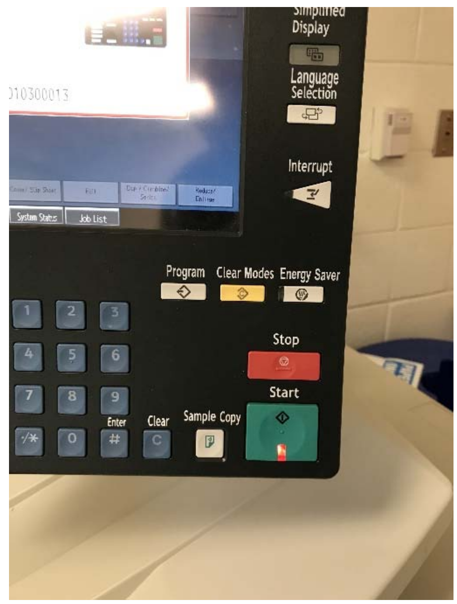


Figure 5. Copier Found without Energy Saver Mode Enabled

The copier will continue to draw more energy than a computer running all through the night.

8. HVAC Replacement

Overview

Many of the City's HVAC systems are dated and past the anticipated service life. Replacing this equipment will result in reduce maintenance, increased energy efficiency and increased up-time.

In addition to the HVAC systems, (1) 35kW combined heat and power unit will be installed at the Pershing athletic complex. The combined heat and power unit will provide heat for the pool and electricity for the building to use during normal operation. The CHP will operate in grid tied mode and will not be able to be active during a utility power outage. This CHP unit is approximately 88% efficient based on the ratio of input energy to used output energy. As a reference, electricity generated at power plants is typically less than 40% efficient.

Scope

Please refer to 7.6 Preliminary Mechanical Designs for more information. The following scope is currently included:

Bethune Community Center

- Replace eleven (11) existing rooftop units with eleven (11) new rooftop units.

Pershing – Pool Side

- Replace existing three (3) pool boilers with new condensing boilers.
- Remove existing heating boiler, connect heating zones to pool boiler plant.
- Install one (1) 35kW combined heat and power unit in location of existing heating boiler, connect CHP heating to boiler plant and electrical to building electrical.
- Replace one (1) H&V unit.
- Replace two (2) split systems.
- Replace three (3) exhaust fans.

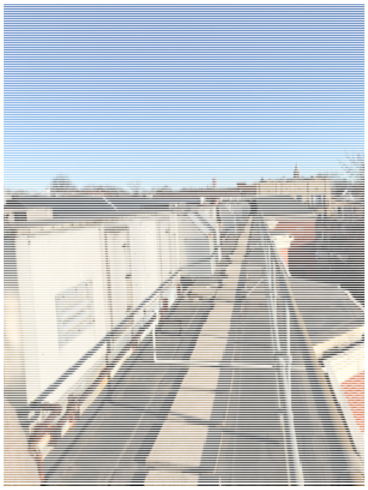


Figure 6. Bethune HVAC Equipment

The existing rooftop equipment is antiquated and requires frequent servicing.

Pershing - Ice Rink Side (Optional)

- Replace existing water-cooled ice chiller with new air-cooled chiller with remote air-cooled condenser.
- Replace ice pit boiler with new condensing boiler with buffer tank.
- Replace Zamboni domestic hot water heater.

Courthouse (Optional)

- Replace five (5) existing rooftop units with (5) new rooftop units.
- Replace two (2) hot water boilers with (2) new condensing boilers.
- Replace two (2) domestic hot water heaters with (2) new condensing domestic hot water heaters.

City Hall (Optional)

- Replace existing steam heating system with variable refrigerant flow system with dedicated outside air ventilation system.

9. Roof Repair, Replacement, & Warranty Extension

Overview

This measure addresses the roof of the building and how well it is protecting the rest of the building from outdoor elements, particularly rain, wind, snow, and ambient temperatures and humidity. Both roofs are also home to almost all of their buildings' heating, cooling, and ventilation equipment. Strong, weather-tight, properly draining, and dry roofs are critical to maintaining structurally sound, protective, and long-lasting buildings.

Roof repairs and upgrades fix roof leaks and water damage to the roof structure and roof insulation. Many roofs throughout Jersey City are out of warranty, so any repair costs fall directly on the City to remedy. As the roofs age, more and more leaks and issues arise, further driving up roof maintenance costs. When leaks are present, roof insulation becomes wet, and when this occurs, it never dries out. Wet insulation provides no thermal protection, which renders the insulation useless.

Roof core samples were taken at each building to indicate the current condition of each roof, including the condition and thickness of the roof insulation, the type of roof decking, and how many roofs are present. Repairing, retrofitting, or replacing a roof can:

- Eliminate roof leaks and areas of poor roof drainage.
- Replace all areas of wet insulation.
- Reduce the time and costs associated with future roof repairs – the new roofs will be under warranty.
- Improve the insulation performance of the roof, thus requiring less energy to maintain indoor temperature and humidity set points, and maintain acceptable occupant comfort.
- Allow for the installation of rooftop solar PV.

Scope

The following is a breakout of the buildings being considered for repair, retrofit, or replacement.

Building	Roof Area (sq. ft.)	Existing Roof Type	Warranty Status	Scope
Bethune Community Center	12,500	EPDM w/ tapered insulation; metal deck	Installed 2002, 15-year warranty	Roof replacement
Courthouse	27,300	Structurally sloped built-up roof w/ gravel flood coat in asphalt; metal deck	Installed 2001, 25-year bond	Roof retrofit

There is known wet roof insulation at Bethune, so a roof replacement is the most appropriate solution there. Bethune will receive a new EPDM roof with new insulation to meet the energy code. The Courthouse roof will be retrofitted with an EPDM roof over the existing roof.

10. Solar

Overview

This measure will involve the procurement and installation of solar PV panels at each of the buildings listed below. The PV system will allow the City to produce renewable energy on-site. The solar power generated onsite will be net metered, and will offset a significant amount of energy that would otherwise be purchased from the utility. These savings are realized for as long as the PV systems are producing power, which can often last 25 years or longer.

For example, the Courthouse is expected to consume 801,283 kWh in the first year after this ESIP project is implemented. The solar PV system is expected to produce 25.6% of that electric needed by the building. This means the City would only pay for 74.4% of the building's electric power in a year. The remainder of the power needed would be generated onsite, which would be owned and used by the City. Please reference the table below to see the savings impact.

In addition to these financial benefits, there are many positive societal and environmental impacts as well. Not only will the City's carbon footprint be drastically reduced so each building's impact on the environment is smaller, but the City will be a model, showcasing to other communities and the private sector how sustainability and energy efficiency objectives can be achieved in a fiscally responsible way.

Scope

Interconnection applications have already been submitted to PSE&G for these buildings. They have been approved by PSE&G for the PV systems at Firehouse Kearney, Courthouse, and Records Warehouse; the others are still being processed. This is an important step in the process and helps ensure that the utility provider accepts and approves of the plan to put PV systems at each location, and that existing electrical and utility-grid infrastructure are both able to handle the onsite power generation, without the need for expensive upgrades.

The following table summarizes the solar systems, which may be a combination of roof-mounted, ballasted rooftop, and carport structures. The system sizes (kW) were designed using Helioscope, and the PV production values (kWh) were calculated using NREL's PVWatts tool.

Building	PV System Size (kW-DC)	Post ESIP Baseline (kWh)	Expected PV Production (kWh)	PV% of Post ESIP Baseline	1st Year PV Savings
Firehouse Kearney	56.2	106,131	70,884	66.8%	$6,415
Firehouse & OEM	178.8	550,005	224,830	40.9%	$20,354
Bethune Comm. Ctr	43.9	357,114	55,559	15.6%	$7,304
Courthouse	160.7	801,283	205,192	25.6%	$26,490
Records Warehouse	88.6	124,064	111,890	90.2%	$10,125
Total	**528.2**	**1,938,597**	**668,355**	**34.5%**	**$70,688**

For solar panel layouts and calculations, please see the Appendix.

11. PSEG Energy Savers / NJ Direct Install

Most of the buildings included in the ESP qualified for PSEG Energy Savers or New Jersey Direct Install. Willdan is the selected vendor for both programs. Schneider Electric reviewed the proposals for each of the qualified buildings. As part of the ESIP, Schneider Electric re-calculated the electric rate impact as the New Jersey Direct Install and PSEG Energy Savers programs do not use actual utility rates. Detailed rates for each meter can be found in section 7.1.

Each of the buildings included in the scope is receiving LED lighting. The below is summary of the mechanical scope included in the project. Please refer to the PSEG Energy Savers and NJ Direct Install scope in the appendix for more information.

- Records – replace (1) HVAC unit and (2) heat pumps
- Firehouse Orient Ave – replace (1) HVAC unit
- Firehouse Consolidated – replace (1) HVAC unit and (1) boiler
- Firehouse OEM – replace (3) HVAC units
- Police North – replace (1) boiler
- Lafayette Pool – replace (1) HVAC unit and (1) boiler
- Firehouse Kearney – replace (1) HVAC unit and (1) boiler
- Firehouse Bergen and Duncan – replace (1) HVAC unit
- Firehouse Palisade – replace (1) boiler
- Maureen Collier Senior Center – replace (1) HVAC unit and (1) Boiler
- Municipal Service Center ESU – replace (1) HVAC unit

3.3 Optional ECMs

In addition to the areas noted above in red as optional, the following opportunities have been identified during the Investment Grade Audit but are not currently included in the Energy Savings Plan.

1. **City Hall HVAC system replacement** – The current HVAC system in City hall is aged and in need of replacement. A new system could involve electrification & decarbonization.
2. **Remote Net Metering solar** – After solar is installed as part of the ESIP, additional solar could be added to many of the sites under the municipal remote net metering program.
3. **Additional Solar PV** – During the IGEA, all sites were evaluated for solar PV systems, both rooftop and carport systems. Some of the buildings would require roofing improvements in order to install rooftop solar, some of the carport structures weren't a good fit for the site, or space available at the time wasn't advantageous to installing solar, so some sites were excluded from the final scope of work.
4. **Battery Storage** – The New Jersey Board of Public Utilities has not yet released a battery storage incentive. Each of the sites could be a good candidate based on price of electricity.
5. **Roofing upgrades** – Many of the sites included in the ESP have deteriorating roofs than can be upgraded to facility more energy savings and solar.
6. **Records Warehouse HVAC** – Several of the rooftop units are not being replaced as part of the current project. These rooftop units are near the end of their life and will need to be replaced in the future.
7. **BAS / Security Upgrades** – Some of the sites have security systems that can be integrated into the automation system for better monitoring and remote access.
8. **BAS Commissioning** – Some of the existing systems are dated and may benefit from point to point recommissioning exercise.

4.0 Energy Savings

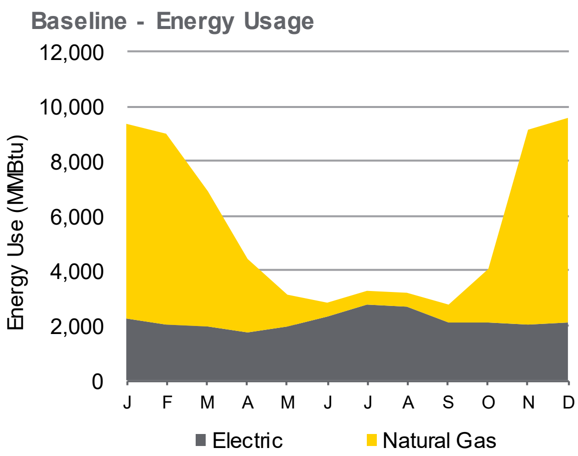
4.1 Baseline Energy Use

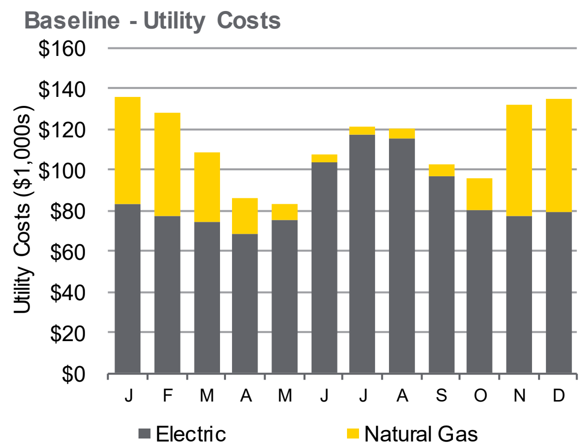
This baseline includes all facilities and was created by taking several years of utility data and utilizing the following:

- Prorating the usage into clean monthly bins
- Weather normalizing the baseline to represent a typical meteorological year

	Electricity			Natural Gas		Total	
Month *mmm*	Energy Use *kWh*	Energy Demand *kW*	Cost *$*	Energy Use *Therm*	Cost *$*	Energy Use *MMBtu*	Cost *$*
Jan	650,232	1,364	$82,925	71,111	$52,627	9,330	$135,552
Feb	589,958	1,400	$77,719	69,750	$50,289	8,988	$128,008
Mar	567,531	1,352	$73,969	49,594	$34,486	6,896	$108,455
Apr	522,246	1,301	$68,756	26,782	$17,199	4,461	$85,955
May	574,130	1,391	$75,100	11,392	$7,776	3,099	$82,876
Jun	692,418	1,606	$103,704	4,980	$4,284	2,861	$107,988
Jul	801,190	1,777	$116,858	5,491	$4,536	3,284	$121,395
Aug	785,750	1,843	$115,510	5,001	$4,279	3,182	$119,789
Sept	621,233	1,723	$97,242	6,639	$5,181	2,784	$102,424
Oct	623,984	1,615	$80,311	19,072	$15,521	4,037	$95,832
Nov	592,395	1,490	$77,061	71,537	$55,157	9,176	$132,218
Dec	619,712	1,358	$79,273	74,370	$55,563	9,552	$134,836
Year	**7,640,779**	**18,220**	**$1,048,429**	**415,718**	**$306,898**	**67,650**	**$1,355,327**

	Electricity			Natural Gas		Total	
Indices	**kBtu/sf**	**W/sf**	**$/sf**	**kBtu/sf**	**$/sf**	**kBtu/sf**	**$/sf**
	45.0	**3.2**	**$1.81**	**71.8**	**$0.53**	**116.8**	**$2.34**





Site ID	City Hall
Total sq ft	100,219

City of Jersey City ESIP - City Hall - Baseline

	Electricity			Natural Gas		Total	
Month	Energy Use	Energy Demand	Cost	Energy Use	Cost	Energy Use	Cost
mmm	*kWh*	*kW*	*$*	*Therm*	*$*	*MMBtu*	*$*
Year	682,517	2,181	$94,828	78,877	$57,077	10,217	$151,905
	Electricity			Natural Gas		Total	
Indices	kBtu/sf	W/sf	$/sf	kBtu/sf	$/sf	kBtu/sf	$/sf
	23.2	2.4	$0.95	78.7	$0.57	101.9	$1.52

Site ID	FH - Orient
Total sq ft	5,000

City of Jersey City ESIP - FH - Orient - Baseline

	Electricity			Natural Gas		Total	
Month	Energy Use	Energy Demand	Cost	Energy Use	Cost	Energy Use	Cost
mmm	*kWh*	*kW*	*$*	*Therm*	*$*	*MMBtu*	*$*
Year	74,664	240	$11,405	2,424	$2,300	497	$13,705
	Electricity			Natural Gas		Total	
Indices	kBtu/sf	W/sf	$/sf	kBtu/sf	$/sf	kBtu/sf	$/sf
	51.0	7.1	$2.28	48.5	$0.46	99.5	$2.74

Site ID	FH - Lincoln
Total sq ft	5,000

City of Jersey City ESIP - FH - Lincoln - Baseline

	Electricity			Natural Gas		Total	
Month	Energy Use	Energy Demand	Cost	Energy Use	Cost	Energy Use	Cost
mmm	*kWh*	*kW*	*$*	*Therm*	*$*	*MMBtu*	*$*
Year	38,504	127	$5,849	6,089	$4,932	740	$10,781
	Electricity			Natural Gas		Total	
Indices	kBtu/sf	W/sf	$/sf	kBtu/sf	$/sf	kBtu/sf	$/sf
	26.3	3.2	$1.17	121.8	$0.99	148.1	$2.16

Site ID	FH - Linden
Total sq ft	5,000

City of Jersey City ESIP - FH - Linden - Baseline

	Electricity			Natural Gas		Total	
Month	Energy Use	Energy Demand	Cost	Energy Use	Cost	Energy Use	Cost
mmm	*kWh*	*kW*	*$*	*Therm*	*$*	*MMBtu*	*$*
Year	42,814	137	$6,397	3,968	$3,223	543	$9,620
	Electricity			Natural Gas		Total	
Indices	kBtu/sf	W/sf	$/sf	kBtu/sf	$/sf	kBtu/sf	$/sf
	29.2	3.1	$1.28	79.4	$0.64	108.6	$1.92

Site ID	FH - Grand
Total sq ft	1,800

City of Jersey City ESIP - FH - Grand - Baseline

	Electricity			Natural Gas		Total	
Month	Energy Use	Energy Demand	Cost	Energy Use	Cost	Energy Use	Cost
mmm	*kWh*	*kW*	*$*	*Therm*	*$*	*MMBtu*	*$*
Year	48,031	169	$7,220	4,392	$3,617	603	$10,838
	Electricity			Natural Gas		Total	
Indices	kBtu/sf	W/sf	$/sf	kBtu/sf	$/sf	kBtu/sf	$/sf
	91.1	14.5	$4.01	244.0	$2.01	335.1	$6.02

Site ID	FH - Bergen
Total sq ft	10,000

City of Jersey City ESIP - FH - Bergen - Baseline

	Electricity			Natural Gas		Total	
Month	Energy Use	Energy Demand	Cost	Energy Use	Cost	Energy Use	Cost
mmm	*kWh*	*kW*	*$*	*Therm*	*$*	*MMBtu*	*$*
Year	146,266	354	$20,522	7,060	$5,585	1,205	$26,108
	Electricity			Natural Gas		Total	
Indices	kBtu/sf	W/sf	$/sf	kBtu/sf	$/sf	kBtu/sf	$/sf
	49.9	3.4	$2.05	70.6	$0.56	120.5	$2.61

Site ID	FH - Kearney
Total sq ft	8,829

City of Jersey City ESIP - FH - Kearney - Baseline

	Electricity			Natural Gas		Total	
Month	Energy Use	Energy Demand	Cost	Energy Use	Cost	Energy Use	Cost
mmm	*kWh*	*kW*	*$*	*Therm*	*$*	*MMBtu*	*$*
Year	120,339	417	$15,510	10,969	$8,872	1,508	$24,383
	Electricity			Natural Gas		Total	
Indices	kBtu/sf	W/sf	$/sf	kBtu/sf	$/sf	kBtu/sf	$/sf
	46.5	4.2	$1.76	124.2	$1.00	170.8	$2.76

Site ID	FH - Ocean
Total sq ft	5,000

City of Jersey City ESIP - FH - Ocean - Baseline

	Electricity			Natural Gas		Total	
Month	Energy Use	Energy Demand	Cost	Energy Use	Cost	Energy Use	Cost
mmm	*kWh*	*kW*	*$*	*Therm*	*$*	*MMBtu*	*$*
Year	62,561	172	$9,125	5,965	$4,772	810	$13,897
	Electricity			Natural Gas		Total	
Indices	kBtu/sf	W/sf	$/sf	kBtu/sf	$/sf	kBtu/sf	$/sf
	42.7	4.0	$1.82	119.3	$0.95	162.0	$2.78

Site ID	FH - Palisade
Total sq ft	20,000

City of Jersey City ESIP - FH - Palisade - Baseline

	Electricity			Natural Gas		Total	
Month	Energy Use	Energy Demand	Cost	Energy Use	Cost	Energy Use	Cost
mmm	*kWh*	*kW*	*$*	*Therm*	*$*	*MMBtu*	*$*
Year	209,175	449	$28,335	9,633	$7,714	1,677	$36,049
	Electricity			Natural Gas		Total	
Indices	kBtu/sf	W/sf	$/sf	kBtu/sf	$/sf	kBtu/sf	$/sf
	35.7	2.5	$1.42	48.2	$0.39	83.9	$1.80

Site ID	- Bergen Dunc
Total sq ft	5,000

City of Jersey City ESIP - FH - Bergen Duncan - Baseline

	Electricity			Natural Gas		Total	
Month	Energy Use	Energy Demand	Cost	Energy Use	Cost	Energy Use	Cost
mmm	*kWh*	*kW*	*$*	*Therm*	*$*	*MMBtu*	*$*
Year	73,091	199	$10,584	8,997	$7,199	1,149	$17,783
	Electricity			Natural Gas		Total	
Indices	kBtu/sf	W/sf	$/sf	kBtu/sf	$/sf	kBtu/sf	$/sf
	49.9	4.5	$2.12	179.9	$1.44	229.8	$3.56

Site ID	l - Summit + OE
Total sq ft	18,000

City of Jersey City ESIP - FH - Summit + OEM - Baseline

	Electricity			Natural Gas		Total	
Month	Energy Use	Energy Demand	Cost	Energy Use	Cost	Energy Use	Cost
mmm	*kWh*	*kW*	*$*	*Therm*	*$*	*MMBtu*	*$*
Year	586,120	1,178	$82,014	11,734	$8,895	3,174	$90,908
	Electricity			Natural Gas		Total	
Indices	kBtu/sf	W/sf	$/sf	kBtu/sf	$/sf	kBtu/sf	$/sf
	111.1	7.6	$4.56	65.2	$0.49	176.3	$5.05

Site ID	FH - Consolidated
Total sq ft	14,762

City of Jersey City ESIP - FH - Consolidated - Baseline

	Electricity			Natural Gas		Total	
Month	Energy Use	Energy Demand	Cost	Energy Use	Cost	Energy Use	Cost
mmm	*kWh*	*kW*	*$*	*Therm*	*$*	*MMBtu*	*$*
Year	199,853	493	$28,198	15,299	$12,212	2,212	$40,409
	Electricity			Natural Gas		Total	
Indices	kBtu/sf	W/sf	$/sf	kBtu/sf	$/sf	kBtu/sf	$/sf
	46.2	3.4	$1.91	103.6	$0.83	149.8	$2.74

Site ID	Joseph Connors SC
Total sq ft	5,000

City of Jersey City ESIP - Joseph Connors SC - Baseline

	Electricity			Natural Gas		Total	
Month	Energy Use	Energy Demand	Cost	Energy Use	Cost	Energy Use	Cost
mmm	*kWh*	*kW*	*$*	*Therm*	*$*	*MMBtu*	*$*
Year	31,656	293	$6,390	7,427	$5,977	851	$12,368
	Electricity			**Natural Gas**		**Total**	
Indices	**kBtu/sf**	**W/sf**	**$/sf**	**kBtu/sf**	**$/sf**	**kBtu/sf**	**$/sf**
	21.6	7.3	$1.28	148.5	$1.20	170.1	$2.47

Site ID	Lafayette Pool
Total sq ft	7,450

City of Jersey City ESIP - Lafayette Pool - Baseline

	Electricity			Natural Gas		Total	
Month	Energy Use	Energy Demand	Cost	Energy Use	Cost	Energy Use	Cost
mmm	*kWh*	*kW*	*$*	*Therm*	*$*	*MMBtu*	*$*
Year	71,697	83	$28,974	0	$0	245	$28,974
	Electricity			**Natural Gas**		**Total**	
Indices	**kBtu/sf**	**W/sf**	**$/sf**	**kBtu/sf**	**$/sf**	**kBtu/sf**	**$/sf**
	32.8	1.7	$3.89	0.0	$0.00	32.8	$3.89

Site ID	Bethune CC
Total sq ft	26,350

City of Jersey City ESIP - Bethune CC - Baseline

	Electricity			Natural Gas		Total	
Month	Energy Use	Energy Demand	Cost	Energy Use	Cost	Energy Use	Cost
mmm	*kWh*	*kW*	*$*	*Therm*	*$*	*MMBtu*	*$*
Year	576,491	1,444	$82,132	24,977	$21,094	4,465	$103,225
	Electricity			**Natural Gas**		**Total**	
Indices	**kBtu/sf**	**W/sf**	**$/sf**	**kBtu/sf**	**$/sf**	**kBtu/sf**	**$/sf**
	74.7	6.3	$3.12	94.8	$0.80	169.5	$3.92

Site ID	Maureen Collier SC
Total sq ft	6,500

City of Jersey City ESIP - Maureen Collier SC - Baseline

	Electricity			Natural Gas		Total	
Month	Energy Use	Energy Demand	Cost	Energy Use	Cost	Energy Use	Cost
mmm	*kWh*	*kW*	*$*	*Therm*	*$*	*MMBtu*	*$*
Year	55,467	277	$9,148	6,183	$4,960	808	$14,108
	Electricity			Natural Gas		Total	
Indices	kBtu/sf	W/sf	$/sf	kBtu/sf	$/sf	kBtu/sf	$/sf
	29.1	5.2	$1.41	95.1	$0.76	124.2	$2.17

Site ID	Pavonia Pool
Total sq ft	5,200

City of Jersey City ESIP - Pavonia Pool - Baseline

	Electricity			Natural Gas		Total	
Month	Energy Use	Energy Demand	Cost	Energy Use	Cost	Energy Use	Cost
mmm	*kWh*	*kW*	*$*	*Therm*	*$*	*MMBtu*	*$*
Year	61,684	148	$8,983	321	$423	243	$9,406
	Electricity			Natural Gas		Total	
Indices	kBtu/sf	W/sf	$/sf	kBtu/sf	$/sf	kBtu/sf	$/sf
	40.5	4.8	$1.73	6.2	$0.08	46.7	$1.81

Site ID	Pavonia Pool
Total sq ft	5,200

City of Jersey City ESIP - Pavonia Pool - Baseline

	Electricity			Natural Gas		Total	
Month	Energy Use	Energy Demand	Cost	Energy Use	Cost	Energy Use	Cost
mmm	*kWh*	*kW*	*$*	*Therm*	*$*	*MMBtu*	*$*
Year	61,684	148	$8,983	321	$423	243	$9,406
	Electricity			Natural Gas		Total	
Indices	kBtu/sf	W/sf	$/sf	kBtu/sf	$/sf	kBtu/sf	$/sf
	40.5	4.8	$1.73	6.2	$0.08	46.7	$1.81

Site ID	Pershing FAC
Total sq ft	38,108

City of Jersey City ESIP - Pershing FAC - Baseline

	Electricity			Natural Gas		Total	
Month	Energy Use	Energy Demand	Cost	Energy Use	Cost	Energy Use	Cost
mmm	*kWh*	*kW*	*$*	*Therm*	*$*	*MMBtu*	*$*
Year	846,061	1,840	$114,842	51,252	$31,899	8,013	$146,741
	Electricity			Natural Gas		Total	
Indices	kBtu/sf	W/sf	$/sf	kBtu/sf	$/sf	kBtu/sf	$/sf
	75.8	6.4	$3.01	134.5	$0.84	210.3	$3.85

Site ID	Police - East
Total sq ft	15,500

City of Jersey City ESIP - Police - East - Baseline

	Electricity			Natural Gas		Total	
Month	Energy Use	Energy Demand	Cost	Energy Use	Cost	Energy Use	Cost
mmm	*kWh*	*kW*	*$*	*Therm*	*$*	*MMBtu*	*$*
Year	157,697	321	$22,324	7,384	$5,940	1,277	$28,263
	Electricity			Natural Gas		Total	
Indices	kBtu/sf	W/sf	$/sf	kBtu/sf	$/sf	kBtu/sf	$/sf
	34.7	2.5	$1.44	47.6	$0.38	82.4	$1.82

Site ID	Police - South
Total sq ft	6,000

City of Jersey City ESIP - Police - South - Baseline

	Electricity			Natural Gas		Total	
Month	Energy Use	Energy Demand	Cost	Energy Use	Cost	Energy Use	Cost
mmm	*kWh*	*kW*	*$*	*Therm*	*$*	*MMBtu*	*$*
Year	101,784	201	$14,169	3,706	$3,056	718	$17,225
	Electricity			Natural Gas		Total	
Indices	kBtu/sf	W/sf	$/sf	kBtu/sf	$/sf	kBtu/sf	$/sf
	57.9	4.4	$2.36	61.8	$0.51	119.7	$2.87

Site ID	MSC Complex
Total sq ft	146,300

City of Jersey City ESIP - MSC Complex - Baseline

	Electricity			Natural Gas		Total	
Month	Energy Use	Energy Demand	Cost	Energy Use	Cost	Energy Use	Cost
mmm	*kWh*	*kW*	*$*	*Therm*	*$*	*MMBtu*	*$*
Year	1,944,444	3,610	$215,801	111,830	$78,947	17,819	$294,748
	Electricity			Natural Gas		Total	
Indices	kBtu/sf	W/sf	$/sf	kBtu/sf	$/sf	kBtu/sf	$/sf
	45.4	2.3	$1.48	76.4	$0.54	121.8	$2.01

Site ID	Records WH
Total sq ft	64,000

City of Jersey City ESIP - Records WH - Baseline

	Electricity			Natural Gas		Total	
Month	Energy Use	Energy Demand	Cost	Energy Use	Cost	Energy Use	Cost
mmm	*kWh*	*kW*	*$*	*Therm*	*$*	*MMBtu*	*$*
Year	192,080	946	$40,793	13,869	$11,055	2,043	$51,848
	Electricity			Natural Gas		Total	
Indices	kBtu/sf	W/sf	$/sf	kBtu/sf	$/sf	kBtu/sf	$/sf
	10.2	3.0	$0.64	21.7	$0.17	31.9	$0.81

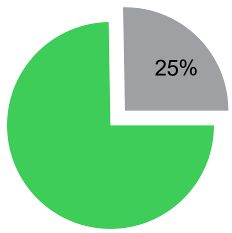
For a month to month baseline for each facility, please see Appendix 7.1.

4.2 Energy Savings

The following table highlights projected energy savings as a result of implementing the recommended ECMs.

City of Jersey City ESIP - Project Summary

Energy Cost Savings



Energy Indicies	Energy	Cost
	kBtu/sf	*$/sf*
Baseline	116.8	$2.34
Post Project	92.9	$1.75
% Savings	**20.5%**	**25.3%**

Project Summary			
Project	**Electricity Costs**	**Fossil Fuels Costs**	**Total Costs**
Phase	*$*	*$*	*$*
Baseline	**$1,048,429**	**$306,898**	**$1,355,327**
Post Project	**$730,925**	**$281,627**	**$1,012,551**
Savings, Units	**$317,504**	**$25,272**	**$342,776**
Percent Savings	**30.3%**	**8.2%**	**25.3%**

Notes:

1. Not all buildings are billed on demand. Demand is represented as a yearly month total
2. Table above excludes water savings of $14,274 and 1,069,663 Gallons
3. Table above excludes Pershing Ball Field Light Savings of $6,207 and 86,688 kWh

To estimate savings from the proposed project, Schneider Electric utilized engineering formulas and energy modeling software. Schneider Electric used Excel spreadsheets to accurately quantify savings for measures that have low interactivity. For measures that are significantly affected by interactions of different components, such as mechanical and BAS upgrades, Schneider Electric utilized energy simulation software called eQuest. eQuest was developed through funding by the United States Department of Energy (USDOE) and is the preferred tool for energy modeling in the energy performance contracting industry. Additionally, ELEMENT, a proprietary building modeling tool was used to develop baselines and savings for some builds. Using these modeling tool allows for the ability to model existing conditions and proposed retrofits to assess potential energy savings.

For detailed savings calculations for each ECM, please see the Appendix 7.1.

ECM Savings Summary by Site

ECM Detail		Total Energy Savings			Total Cost Savings			Detail Unit Savings			Detailed Cost Savings	
Site	ECM	Energy Savings	EUI Savings	Site % Savings	Cost Savings	ECI Savings	Site % Savings	Electric	Electric	Natural Gas	Electric	Natural Gas
Name	*Name*	*MMBtu*	*kBtu/sf*	*%*	*$*	*$/sf*	*%*	*kWh*	*kW*	*Therm*	*$*	*$*
City Hall	Energy Star Copier Operation	10	0.1	0.1%	$190	$0.00	0.1%	2,836	0	0	$190	$0
City Hall	Exterior LED	6	0.1	0.1%	$107	$0.00	0.1%	1,747	0	0	$107	$0
City Hall	LED Lighting	235	2.3	2.3%	$13,488	$0.13	8.9%	166,737	655	-3,337	$15,205	-$1,717
FH - Orient	LED Lighting	35	7.1	7.1%	$1,374	$0.27	10.0%	10,333	24	0	$1,374	$0
FH - Orient	Air Sealing Improvements	53	10.7	10.7%	$422	$0.08	3.1%	412	0	518	$50	$371
FH - Lincoln	LED Lighting	6	1.3	0.9%	$315	$0.06	2.9%	1,876	12	0	$315	$0
FH - Lincoln	Air Sealing Improvements	16	3.2	2.2%	$139	$0.03	1.3%	267	0	153	$33	$106
FH - Linden	LED Lighting	9	1.8	1.6%	$405	$0.08	4.2%	2,613	12	0	$405	$0
FH - Linden	Air Sealing Improvements	16	3.2	3.0%	$136	$0.03	1.4%	247	0	153	$30	$106
FH - Grand	LED Lighting	24	13.4	4.0%	$951	$0.53	8.8%	7,087	12	0	$951	$0
FH - Grand	Air Sealing Improvements	13	7.3	2.2%	$110	$0.06	1.0%	200	0	125	$24	$85
FH - Bergen	LED Lighting	72	7.2	6.0%	$3,099	$0.31	11.9%	21,147	72	0	$3,099	$0
FH - Bergen	Air Sealing Improvements	9	0.9	0.7%	$72	$0.01	0.3%	125	0	81	$15	$57
FH - Kearney	LED Lighting	47	5.3	3.1%	$1,538	$0.17	6.3%	13,748	36	0	$1,538	$0
FH - Kearney	Air Sealing Improvements	23	2.6	1.5%	$193	$0.02	0.8%	461	0	209	$43	$150
FH - Kearney	Direct Purchase Solar	242	27.4	16.0%	$6,415	$0.73	26.3%	70,885	81		$6,415	
FH - Kearney	PSEG Boiler Upgrade	34	3.8	2.2%	$239	$0.03	1.0%	0	0	337	$0	$239
FH - Kearney	PSEG HVAC Upgrade	10	1.1	0.6%	$324	$0.04	1.3%	2,841	6	0	$324	$0
FH - Ocean	LED Lighting	34	6.8	4.2%	$1,483	$0.30	10.7%	10,025	36	0	$1,483	$0
FH - Ocean	Air Sealing Improvements	22	4.3	2.7%	$186	$0.04	1.3%	354	0	205	$43	$143
FH - Palisade	Pipe Insulation Upgrade	58	2.9	3.4%	$456	$0.02	1.3%	0	0	576	$0	$456
FH - Palisade	LED Lighting	167	8.4	10.0%	$4,744	$0.24	13.2%	48,979	108	0	$4,744	$0
FH - Palisade	Air Sealing Improvements	92	4.6	5.5%	$727	$0.04	2.0%	702	0	899	$57	$670
FH - Palisade	PSEG Boiler Upgrade	140	7.0	8.3%	$1,105	$0.06	3.1%	0	0	1,397	$0	$1,105
FH - Bergen Duncan	LED Lighting	47	9.3	4.1%	$1,930	$0.39	10.9%	13,696	36	0	$1,930	$0
FH - Bergen Duncan	Air Sealing Improvements	19	3.8	1.7%	$161	$0.03	0.9%	280	0	182	$34	$127
FH - Bergen Duncan	PSEG HVAC Upgrade	71	14.1	6.1%	$2,441	$0.49	13.7%	17,920	18	94	$2,374	$67
FH - Summit + OEM	LED Lighting	122	6.8	3.8%	$3,861	$0.21	4.2%	35,697	96	0	$3,861	$0
FH - Summit + OEM	Air Sealing Improvements	59	3.3	1.9%	$350	$0.02	0.4%	418	0	581	$37	$313
FH - Summit + OEM	Direct Purchase Solar	767	42.6	24.2%	$20,354	$1.13	22.4%	224,832	259		$20,354	
FH - Summit + OEM	PSEG HVAC Upgrade	226	12.5	7.1%	$4,622	$0.26	5.1%	37,025	78	994	$4,099	$523
FH - Consolidated	LED Lighting	162	11.0	7.3%	$6,394	$0.43	15.8%	47,458	84	0	$6,394	$0
FH - Consolidated	Air Sealing Improvements	50	3.4	2.3%	$477	$0.03	1.2%	2,255	0	422	$275	$202
FH - Consolidated	PSEG Boiler Upgrade	369	25.0	16.7%	$2,025	$0.14	5.0%	0	0	3,685	$0	$2,025
FH - Consolidated	PSEG HVAC Upgrade	114	7.7	5.1%	$2,774	$0.19	6.9%	17,541	36	537	$2,518	$257
Joseph Connors SC	LED Lighting	57	11.5	6.7%	$2,827	$0.57	22.9%	16,784	108	0	$2,827	$0
Joseph Connors SC	Air Sealing Improvements	38	7.6	4.5%	$293	$0.06	2.4%	283	0	371	$34	$258
Joseph Connors SC	DDC Upgrade	63	12.6	7.4%	$576	$0.12	4.7%	841	0	601	$103	$473
Lafayette Pool	LED Lighting	69	9.3	28.3%	$1,862	$0.25	6.4%	20,284	42		$1,862	
Lafayette Pool	PSEG HVAC Upgrade	5	0.7	2.2%	$177	$0.02	0.6%	1,568	6		$177	
Lafayette Pool	DDC Upgrade	1	0.1	0.4%	$19	$0.00	0.1%	260	0		$19	
Bethune CC	Exterior LED	15	0.6	0.3%	$543	$0.02	0.5%	4,345	3	0	$543	$0
Bethune CC	LED Lighting	213	8.1	4.8%	$20,522	$0.78	19.9%	164,890	318	-3,502	$22,405	-$1,883
Bethune CC	Air Sealing Improvements	262	9.9	5.9%	$1,970	$0.07	1.9%	6,471	0	2,394	$789	$1,181
Bethune CC	Direct Purchase Solar	190	7.2	4.2%	$7,304	$0.28	7.1%	55,559	63		$7,304	
Bethune CC	DDC Upgrade	409	15.5	9.2%	$6,743	$0.26	6.5%	40,312	43	2,715	$5,296	$1,447
Bethune CC	BAS - DCV Only	35	1.3	0.8%	$1,267	$0.05	1.2%	10,262	3	0	$1,267	$0
Bethune CC	HVAC Upgrade	1,841	69.9	41.2%	$9,602	$0.36	9.3%	-9,753	107	18,743	-$929	$10,531
Bethune CC	Roof Replacement	10	0.4	0.2%	$416	$0.02	0.4%	2,850	10	0	$416	$0
Maureen Collier SC	LED Lighting	31	4.7	3.8%	$1,614	$0.25	11.4%	8,971	72	0	$1,614	$0
Maureen Collier SC	PSEG Boiler Upgrade	13	2.0	1.6%	$91	$0.01	0.6%	0	0	130	$0	$91
Maureen Collier SC	PSEG HVAC Upgrade	11	1.6	1.3%	$438	$0.07	3.1%	3,077	6	0	$438	$0
Maureen Collier SC	DDC Upgrade	109	16.7	13.5%	$1,123	$0.17	8.0%	3,264	0	975	$398	$725
Courthouse	Energy Star Copier Operation	10	0.2	0.1%	$341	$0.01	0.2%	2,836	0	0	$341	$0
Courthouse	Exterior LED	45	0.7	0.7%	$1,600	$0.03	0.8%	13,179	4	0	$1,600	$0
Courthouse	LED Lighting	633	10.5	9.3%	$45,862	$0.76	22.7%	364,967	753	-6,129	$49,125	-$3,264
Courthouse	Air Sealing Improvements	145	2.4	2.1%	$823	$0.01	0.4%	1,267	0	1,409	$152	$670
Courthouse	Direct Purchase Solar	700	11.7	10.2%	$26,490	$0.44	13.1%	205,193	232		$26,490	
Courthouse	DDC Upgrade	590	9.8	8.6%	$14,609	$0.24	7.2%	112,210	0	2,072	$13,500	$1,109
Courthouse	Roof Replacement	80	1.3	1.2%	$1,244	$0.02	0.6%	6,644	16	573	$928	$315
Courthouse	High Efficiency Transformers	52	0.9	0.8%	$1,960	$0.03	1.0%	15,115	21	0	$1,960	$0
Pavonia Pool	LED Lighting	16	3.0	6.5%	$733	$0.14	7.8%	4,592	24	0	$733	$0
Pavonia Pool	DDC Upgrade	11	2.2	4.7%	$430	$0.08	4.6%	3,368	4	0	$430	$0
Pershing FAC	Exterior LED	18	0.5	0.2%	$613	$0.02	0.4%	5,260	2	0	$613	$0
Pershing FAC	LED Lighting	71	1.9	0.9%	$7,470	$0.20	5.1%	60,731	159	-1,364	$8,284	-$814
Pershing FAC	Air Sealing Improvements	148	3.9	1.9%	$925	$0.02	0.6%	1,297	0	1,439	$152	$773
Pershing FAC	DDC Upgrade	342	9.0	4.3%	$3,618	$0.09	2.5%	17,135	0	2,837	$1,944	$1,674

Pershing FAC	Boiler Replacement	297	7.8	3.7%	$1,579	$0.04	1.1%	0	0	2,966	$0	$1,579
Pershing FAC	High Efficiency Transformers	60	1.6	0.7%	$2,202	$0.06	1.5%	17,480	24	0	$2,202	$0
Pershing FAC	Combined Heat and Power	230	6.0	2.9%	$27,952	$0.73	19.0%	233,221	322	-5,656	$30,747	-$2,795
Pershing FAC	DHW Replacement	149	3.9	1.9%	$790	$0.02	0.5%	0	0	1,493	$0	$790
Police - East	Pipe Insulation Upgrade	55	3.5	4.3%	$380	$0.02	1.3%	0	0	546	$0	$380
Police - East	LED Lighting	115	7.4	9.0%	$4,434	$0.29	15.7%	33,600	60	0	$4,434	$0
Police - East	Air Sealing Improvements	21	1.4	1.6%	$174	$0.01	0.6%	285	0	200	$34	$139
Police - South	LED Lighting	101	16.8	14.0%	$4,025	$0.67	23.4%	29,453	60	0	$4,025	$0
Police - South	Air Sealing Improvements	15	2.6	2.1%	$138	$0.02	0.8%	312	0	144	$38	$100
Police - South	Boiler Replacement	53	8.8	7.3%	$425	$0.07	2.5%	0	0	526	$0	$425
MSC Complex	Energy Star Copier Operation	10	0.1	0.1%	$187	$0.00	0.1%	2,836	0	0	$187	$0
MSC Complex	Exterior LED	26	0.2	0.1%	$469	$0.00	0.2%	7,504	8	0	$469	$0
MSC Complex	LED Lighting	293	2.0	1.6%	$11,749	$0.08	4.0%	172,729	335	-2,967	$13,355	-$1,606
MSC Complex	Air Sealing Improvements	178	1.2	1.0%	$1,063	$0.01	0.4%	3,508	0	1,658	$224	$838
MSC Complex	PSEG HVAC Upgrade	122	0.8	0.7%	$2,052	$0.01	0.7%	16,759	72	645	$1,592	$460
MSC Complex	DDC Upgrade	1,497	10.2	8.4%	$15,853	$0.11	5.4%	181,303	85	8,781	$11,173	$4,681
MSC Complex	LED Lighting - ESU Only	195	1.3	1.1%	$4,266	$0.03	1.4%	57,235	84		$4,266	
Records WH	LED Lighting	163	2.5	8.0%	$3,853	$0.06	7.4%	47,699	0	0	$3,853	$0
Records WH	Air Sealing Improvements	32	0.5	1.6%	$251	$0.00	0.5%	513	0	300	$41	$209
Records WH	Direct Purchase Solar	382	6.0	18.7%	$10,125	$0.16	19.5%	111,890	128		$10,125	
Records WH	DDC Upgrade	259	4.1	12.7%	$2,825	$0.04	5.4%	16,414	0	2,034	$1,327	$1,498
Records WH	DI HVAC Upgrade	12	0.2	0.6%	$274	$0.00	0.5%	3,390	0	0	$274	$0
Total Project Savings		**13,871**	**24.0**	**20.5%**	**$342,776**	**$0.59**	**25.3%**	**2,840,935**	**4,420**	**41746**	**$317,504**	**$25,272**
Total % Project Savings		*20.5%*	-	-	*25.3%*	-	-	*37.2%*	*20.5%*	*10.0%*	*30.3%*	*8.2%*
Total Baseline		**67,650**	**116.8**		**$1,355,327**	**$2.34**		**7,640,779**	**21,559**	**415,718**	**$1,048,429**	**$306,898**
Post Project		**53,779**	**92.9**		**$1,012,551**	**$1.75**		**4,799,844**	**17,139**	**373,972**	**$730,925**	**$281,627**

Notes:

- The above table does not include electric savings for the Pershing field lighting of $6,207 and 86,688kWh.
- The above table does not include water savings of 1,070kGal ($14,274) and $1,908 of natural gas heating savings.

In addition to the energy savings noted above, this Project will also provide O&M savings for the following scope items:

Scope Item	Annual O&M Savings
LED Lighting	$ 16,000
HVAC Replacement - DI/PSEG	$ 4,000
Pershing HVAC	$ 11,434
Water Recommissioning	$ 1,190
Bethune HVAC	$ 11,176
Roofing	$ 11,623
Total	**$ 62,853**

These O&M Savings are only factored into the first 5 years of the cash flow.

4.3 Environmental Impact

The following graphic shows the environmental impact of the project.

Project Emissions Impact

Emissions summary

City of Jersey City ESIP - Emissions Summary

Environmental Benefits	Scope 1	Scope 2	Total
Baseline Energy (MMBtu/yr)	41,572	26,078	67,650
Baseline Emissions (Tons CO2e/yr)	2,470	5,120	7,590
Savings (Tons CO2e/yr)	**244**	**1,902**	**2,145**
% Savings	**9.9%**	**37.1%**	**28.3%**

28.3%	2,145	461	277	85,815
% eTon Savings	eTons GHG	Cars Removed	Equivalent Houses	Equivalent Trees

**Emissions factors are derived from EPA eGrids database and represent the National average.*

> Scope 1 Emissions include ***direct*** emissions from on-site fossil fuel combustion.

> Scope 2 Emissions result from ***indirect*** emissions from purchased generation of electric, chw or steam.

The following table identifies the values used to determine environmental benefits:

AVOIDED EMISSIONS (1)	(lbs) Saved per MWh	(lbs) Saved per Therm	Pounds Saved Total (Lbs)
NOX	1.26	0.0786	3,573
SO2	0.98	0.0612	2,783
CO2	1,561	98	4,439106

5.0 Performance Assurance Support Services (PASS)

The purpose of Performance Assurance Support Services (PASS) is to measure, verify, and provide the necessary support services to sustain savings over time. Per NJ ESIP law, the PASS Agreement must be a separate contract from the ESIP Construction Contract. This section includes a description of the proposed measurement & verification plan.

5.1 Description of Services

The following is a description of services and terms that are used within this section.

Remote System Monitoring and Reporting

Activities include monitoring live conditions, reviewing and analyzing trends, recording deficiencies, as well as tuning, adjusting, and optimizing parameters. This also includes reporting operational performance of specific systems and equipment necessary to sustain energy savings, comfort, and safety. This helps manage and ensure key variables for energy measures are maintained to allow for sustained savings, performance, and comfort.

Remote Energy Management, Training & Technical Support

This involves live remote telephone and internet support used to provide instruction, assisted troubleshooting, and system training. This on-call service provides technical support for all installed systems and measures and helps reduce system downtime.

On-site Visits

On-site visits include a review and reporting of changes to operations (past present and future), usage, status, and conditions of building systems and equipment relative to their impact on energy performance. ECM and systems training can be provided upon request. Benefits include:

- Expert advice to aid in energy planning based on operational and future commitments
- Identifying excess energy targets and recommendations for improvement
- An increase in overall energy awareness

Resource Advisor

Resource Advisor is Schneider Electric's enterprise-level application providing secure access to data reports and summaries to drive the City's energy and sustainability programs. Resource Advisor combines quality assurance and data capture capabilities of utility information into one energy management solution.

Commission and Verify (C&V)

This process is used to qualify and validate the installation, function, operation and performance of ECMs. The protocol consists of a planned process with a deliberate combination of steps which systematically identify, test and challenge various key aspects used to verify the performance objectives of an installed ECM against an established design criterion. Benefits include an improved controls interface, reduced energy demand and consumption, and improve occupancy comfort.

"Option B" Measurement and Verification

The International Performance Measurement & Verification Protocol (IPMVP) was created to determine standards and best practices in the measurement & verification of energy efficiency investments. The IPMVP Option B, retrofit isolation involves localized measurements to isolate the impact of specific energy conservation measures. Specifically, for Jersey City's ESP, this will ensure performance of the solar system is proven without having to be concerned about any other energy consuming interaction behind the utility meter.

"Option C" Measurement and Verification

The IPMVP Option C, Whole Building Analysis, involves using utility meters and a weather normalized baseline to measure and verify savings. Option C is a good fit for buildings receiving comprehensive upgrades with a high degree of interactivity of the ECMs within this plan.

5.2 Measurement & Verification (M&V) Plan

The purpose of the Performance Assurance Support Services (PASS) program is to assist the City in sustaining savings over the long term. Based upon the scope of this project, we recommend a measurement & verification (M&V) program as described below. Green-colored boxes indicate what is included in the recommended M&V program.

	Location		Measurement & Verification (M&V)			Performance Assurance Support Services (PASS)				
	Type	Site Name	ECM Commission & Verify	Option B: Solar Production Guarantee	Option C: Whole-Meter Energy Efficiency Guarantee	Remote System Monitoring & Reporting	Resource Advisor	On-site Visits & Training (# per year)	Energy Star Benchmarking	PJM Demand Response & Frequency Program Support
1	City Operations	City Hall	■				■	2x	■	
2		Courthouse	■	■	■	■	■	4x	■	
3		Municipal Complex Services	■			■	■	4x	■	■
4		Records		■			■	2x	■	
5	City Services	Bethune Life Center		■	■	■	■	4x	■	
6		Joseph Connors Senior Center	■					1x		
7		Maureen Collier Senior Center	■					1x		
8	Recreation	Pershing Field Athletic Complex			■	■	■	4x	■	
9		Lafayette Pool	■					2x		
10		Pavonia Pool	■					2x		
11	Fire Department	14 Orient Ave	■					1x		
12		152 Lincoln St	■					1x		
13		152 Linden Ave	■					1x		
14		160 Grand St	■					1x		
15		2 Bergen Ave	■					1x		
16		255 Kearney Ave	■	■				1x		
17		486 Ocean Ave	■					1x		
18		595 Palisade Ave	■					1x		
19		697 Bergen Ave - Bergen & Duncan	■					1x		
20		Firehouse / OEM - 714 Summit	■	■				1x		
21		Firehouse Consolidated - 349 Newark	■					1x		
22	Police Department	East Precinct - 207 7th St	■					1x		
23		North Precinct	■					1x		
24		South Precinct - 191 Bergen Ave	■					1x		
25	Additional Solar PV Sites	West Precinct		■				2x		
26		City Hall Annex		■			■	2x	■	
27		City Offices & Parking - 4 Jackson Sq		■				2x		
28		Housing Preservation - 342 MLK		■				2x		
29		Purchasing & Parking - 392 Central	■	■			■	2x	■	
30	Additional DI Sites	Van Vorst Park	■							
31		Mary Benson Park	■							

The guarantee is based upon Option B/C methodology (as defined by IPMVP) for the energy efficiency measures at the sites above. Each year after the initial term, the services can be eliminated or negotiated between SE & Jersey City, to ensure the proper level of support and savings verification.

Services Included:	Install	Year 1	Year 2	Year 3
• Commissioning & Verify ECMs • Measurement & Verification of Savings • Financial guarantee • Quarterly Savings Reports • On-site Energy Auditing & Consulting • On-site Training • Resource Advisor • Building Automation System Reviews • Remote Energy Management & Technical Support	$100,417	$82,148	$80,954	$63,657

5.3 Ongoing Maintenance

Under the New Jersey ESIP legislation, all maintenance contracts are required to be procured separately from the ESIP. Schneider Electric will properly commission all equipment, provide training, review manufacturer maintenance requirements, and provide an owner's manual to ensure proper maintenance of the equipment.

ECM Category	O&M Impact
Lighting	Reduced O&M as lamps last much longer and ballasts are removed.
Water	Reduced O&M as internal diaphragm comes with 10-year material warranty.
Envelope	Routine, no different than current maintenance of building.
HVAC	No additional maintenance would be required outside of routine maintenance that is being done on existing equipment.
Building Automation System	Software upgrades as necessary.
CHP	Maintenance Contract is $0.86 per run hour of CHP ~$7,000 annually, which is accounted for in the project cashflow for ten years to be eligible for state incentives. O&M is provided by manufacturers. Includes the following: • 24/7/365 live monitoring • Scheduled and Unscheduled maintenance • Labor and parts, including engine and generator replacement
Solar	Maintenance Contract is $20/kW of solar size.

Additional information regarding service costs can be found in Section 2.4.

6.0 Implementation

6.1 Design & Compliance Issues

This project was developed using the proper Building Codes, Energy Codes, and Electrical Codes. Safety is of the utmost important to Schneider Electric, not only for our customers, but also for our employees and subcontractors. SE will comply with all the required safety codes and protocols to ensure a successful implementation.

6.2 Assessment of Risks

This assessment of risks is meant to provide the City with an idea of the potential risks that lie within the ESIP project. By no means is this an effort to eliminate responsibility of the ESCO to provide an Energy Savings Plan that meets industry standards of engineering, energy analysis, and expertise. This is included to allow the City to understand where potential failure points could be that would result in savings not being achieved or operational issues.

- If actual operation of the buildings deviates significantly from the parameters outlined in the Energy Savings Plan with respect to temperature set points and occupied times, energy savings associated with the building automation system and HVAC upgrades could be affected.
- Building Automation System sequences of operation must not be over-ridden or changed permanently. Overrides are permitted for maintenance or special occasions but must be reset to maintain energy savings.
- Water consuming fixtures must be maintained to maintain the water and energy savings. Replacement parts need to be of similar flow characteristics to maintain water and energy savings.
- Lighting systems will require maintenance as they age. Replacement parts need to be of similar energy efficiency to maintain savings.
- The new solar PV systems will require ongoing maintenance and monitoring to ensure expected savings and incentives are achieved and realized. As part of the Performance Assurance Support Services, Schneider Electric will be performing and aiding in these activities. An Operation and Maintenance contract with a qualified, reliable, and responsive 3rd party for all installed PV systems is very highly recommended. The cost for this solar O&M services has been included in the project cash flow, but it is ultimately the responsibility of Jersey City to authorize and pay for these services. Schneider Electric will gladly assist the City in finding a reputable and high-quality solar O&M service provider.
    - It is critical to maintain the solar system in a high-performing condition. Doing so will increase the solar production from the PV systems, and maximize its lifespan as well. The better the PV system performs, the more savings the City will see. A well-maintained PV system can last 25-30 years or longer.
    - The cost of a quality solar O&M service contract is small when compared to the long-term benefits that will be realized by having an optimized and high-performing PV system.
- Roofs shall be regularly inspected for leaks, curling/peeling, unusual wear, flashings, and expected performance. Making repairs when found will help increase the longevity of a roof system. Proper water drainage is important as well. Occasional preventive maintenance is recommended, especially for

flashings, joints, and transitions, to help ensure a waterproof roof system, and keeping the insulation underneath dry.

7.0 Appendices

7.1 Savings Calculations & Documentation

Below is a high-level summary of how savings were calculated for each measure included in this report. For further documentation of savings calculations, please see the Appendices Box folder.

Energy Analysis Methodology

Many tools and approaches exist for effectively analyzing energy conservation measures. Some ECMs are best analyzed in an individual spreadsheet calculation while other more comprehensive ECMs require higher levels of computer modeling to capture the entirety of their impact on energy consumption and demand. In general, the complexity of analysis tools escalates from spreadsheet calculations to, to more sophisticated computer software-based building simulation tools such as eQuest. Aspects such as total savings potential, influence on other ECMs, influence from weather, and overall complexity are all considered when selecting the analysis approach or tool for an ECM.

Below is a table displaying the ECMs and the analysis tool used for calculating the savings. Following the table are descriptions for each of the analysis tools and approaches used for calculating savings.

ECM Name	Analysis Tool
Air Sealing Improvements	Spreadsheet Calculations
Boiler Replacement	eQuest/ELEMENT
Combined Heat and Power	Spreadsheet Calculations
DDC Upgrade	eQuest/ELEMENT
Demand Control Ventilation	eQuest/ELEMENT
DHW Replacement	eQuest/ELEMENT
Direct Purchase Solar	Spreadsheet Calculations
Energy Star Copier Operation	Spreadsheet Calculations
Exterior LED	eQuest/ELEMENT
High Efficiency Transformers	Spreadsheet Calculations
HVAC Upgrade	eQuest/ELEMENT
Ice Rink Chiller Upgrade	Spreadsheet Calculations
LED Lighting	eQuest/ELEMENT
Pipe Insulation Upgrade	Spreadsheet Calculations
PSEG Boiler Upgrade	eQuest/ELEMENT
PSEG HVAC Upgrade	Spreadsheet Calculations
Roof Replacement	eQuest/ELEMENT

Savings Methods – Spreadsheet Calculations Non-Solar ECMs

Schneider Electric utilizes a mixture of spreadsheet calculations and basic formula calculation tools. eCalc is a proprietary Microsoft Excel based spreadsheet calculation tool used for calculating energy consumption and savings for an ECM, rather than a comprehensive building analysis approach. Often an approach using eCalcs or other spreadsheet calculations is the most accurate and reasonable way of approaching ECMs in which their operation, situation, or contribution to the baseline is limited.

What separates eCalcs from other spreadsheet-based tools is its integration of bin weather data into many of its standard calculations. Equipment or infiltration often has fluctuating savings opportunity as outside air reaches new high and low average temperatures through different seasons. By capturing the quantity of hours inside specific temperature ranges, these ECMs can better replicate the demand on the system, run hours, and heating and cooling loads. Below is an example of an eCalc spreadsheet for calculating envelope improvement savings.

eCalcs: Energy Calculation Suite — Life Is On | Schneider Electric

Jersey City ESIP - Bethune Community Center

Infiltration

Building Data

Building Name	Bethune Community Center
Weather City	NY, New York-JFK
Building Height, ft	25
Building Orientation, deg	40
Building L/W Ratio	0.3
Internal Draft Coefficient	0.7

Building Operating Conditions

Occupied Set Point Temp, oF	70.0
Cooling Setup Temp, oF	85.0
Percent of Building Cooled, %	70%
Cooling Seasonal Efficiency, %	300%
Heating Setback Temp, oF	55.0
Percent of Building Heated, %	100%
Heating Seasonal Efficiency, %	80%

Shelter Characteristics

Direction	Shelter Class	Terrain Category
See Reference Tables for Descriptions		
North	3	2
East	5	2
South	3	2
West	3	2

Building Crack Definitions

Penetration	Type	H	Qty	Length	Gap	% Open	Total Area	Wall Only
Name	*Select*	*ft*	*#*	*ft*	*inches*	*%*	*sqft*	*sqft*
AC Unit Weatherization	Wall	0.0	1	24	1/2	100%	1.0	1.0
or Weather Stripping - Dou	Door	-9.5	1	108	1/8	100%	1.1	1.1
or Weather Stripping - Sin	Door	-9.5	1	68	1/8	100%	0.7	0.7
Window - Double Hung	Wall	0.0	1	2,375	1/12	100%	16.5	16.5
Crack 5	Wall	0.0				100%	0.0	0.0
Crack 6	Wall	0.0				100%	0.0	0.0
Crack 7	Wall	0.0				100%	0.0	0.0
Crack 8	Wall	0.0				100%	0.0	0.0
Crack 9	Wall	0.0				100%	0.0	0.0
Crack 10	Wall	0.0				100%	0.0	0.0
Crack 11	Wall	0.0				100%	0.0	0.0
Crack 12	Wall	0.0				100%	0.0	0.0
Crack 13	Wall	0.0				100%	0.0	0.0
Effective H (Wall Only)		-0.9					19.3	19.3

Notes: H is the height difference between the crack and the neutral pressure level of the building.

Effective Building Coefficients

Shelter Coefficient	0.6
Wind Shear Exponent	0.22
Boundary Layer Thickness, ft	1200
Wall Pressure Coefficient	0.11
Roof Pressure Coefficient	-0.30

Site Parameters

Average Wind Speed, mph	11.0
Site Corrected Wind Speed, mph	7.5
Model Wind Coefficient	0.11
Draft Factor	0.13
Volume Factor, ft/min (in-wg)^0.5	2,603

Energy Engineering Calculations

	Temperature Bin Hours						Calculated Infiltration Rates				Energy Transfer		Energy Savings	
					Bethune Community Cente		Occupied Rates		Unoccupied Rates		Occupied	Unocc	Cooling	Heating
	Mid Pt Temp	MCWB	Density	Enthalpy	Occupied	Unocc	Wall	Roof	Wall	Roof	Load	Load	Savings	Savings
Ref	oF	oF	lb/ft3	Btu/lb	hrs/yr	hrs/yr	cfm	cfm	cfm	cfm	kBtu/yr	kBtu/yr	kBtu/yr	kBtu/yr
1	9	6.3	0.085	2.7	4	8	737	0	490	0	-337	-306	0	804
2	13	9.4	0.084	3.7	10	8	597	0	653	0	-649	-380	0	1,286
3	16	13.9	0.083	5.1	36	26	397	0	791	0	-1,439	-1,339	0	3,473
4	20	16.7	0.082	6.1	46	33	153	0	898	0	-670	-1,774	0	3,056
5	24	19.9	0.082	7.1	117	77	454	0	994	0	-4,733	-4,138	0	11,089
6	28	23.5	0.081	8.4	134	131	626	0	1,084	0	-6,892	-6,712	0	17,006
7	31	28.2	0.080	10.2	211	171	769	0	1,172	0	-11,826	-7,689	0	24,394
8	35	32.1	0.080	11.8	275	209	884	0	1,250	0	-15,741	-7,985	0	29,658
9	39	34.6	0.079	12.8	403	304	975	0	1,317	0	-23,276	-10,114	0	41,738
10	43	38.8	0.078	14.6	444	325	1,069	0	1,387	0	-23,843	-7,479	0	39,152
11	46	42.0	0.078	16.1	376	201	1,149	0	1,450	0	-18,520	-2,762	0	26,603
12	50	45.3	0.077	17.7	289	154	1,225	0	1,511	0	-12,386	-438	0	16,030
13	54	48.5	0.076	19.4	301	205	1,296	0	1,569	0	-10,537	1,869	0	10,835
14	58	52.0	0.076	21.3	353	239	1,365	0	1,562	0	-8,672	0	0	10,840
15	61	56.2	0.075	23.9	309	233	1,436	0	1,554	0	-2,766	0	0	3,457
16	65	59.0	0.074	25.7	247	148	1,496	0	1,548	0	656	0	153	0
17	69	61.9	0.074	27.7	382	241	1,553	0	1,541	0	6,220	0	1,451	0
18	73	66.1	0.073	30.8	467	312	1,619	0	1,533	0	18,138	0	4,232	0
19	76	68.9	0.072	33.1	412	183	1,673	0	1,526	0	23,192	0	5,411	0
20	80	70.2	0.072	34.1	280	59	1,715	0	1,521	0	18,196	0	4,246	0
21	84	70.9	0.071	34.7	238	17	1,752	0	1,516	0	16,820	0	3,925	0
22	88	72.2	0.071	35.8	105	0	1,791	0	1,551	0	8,391	0	1,958	0
23	91	72.4	0.071	35.9	32	1	1,822	0	1,586	0	2,622	9	614	0
24	95	74.7	0.070	38.0	2	0	1,866	0	1,637	0	199	0	46	0
25	99	74.9	0.070	38.2	2	0	1,895	0	1,670	0	204	0	48	0
					5,475	3,285							22,084	239,420

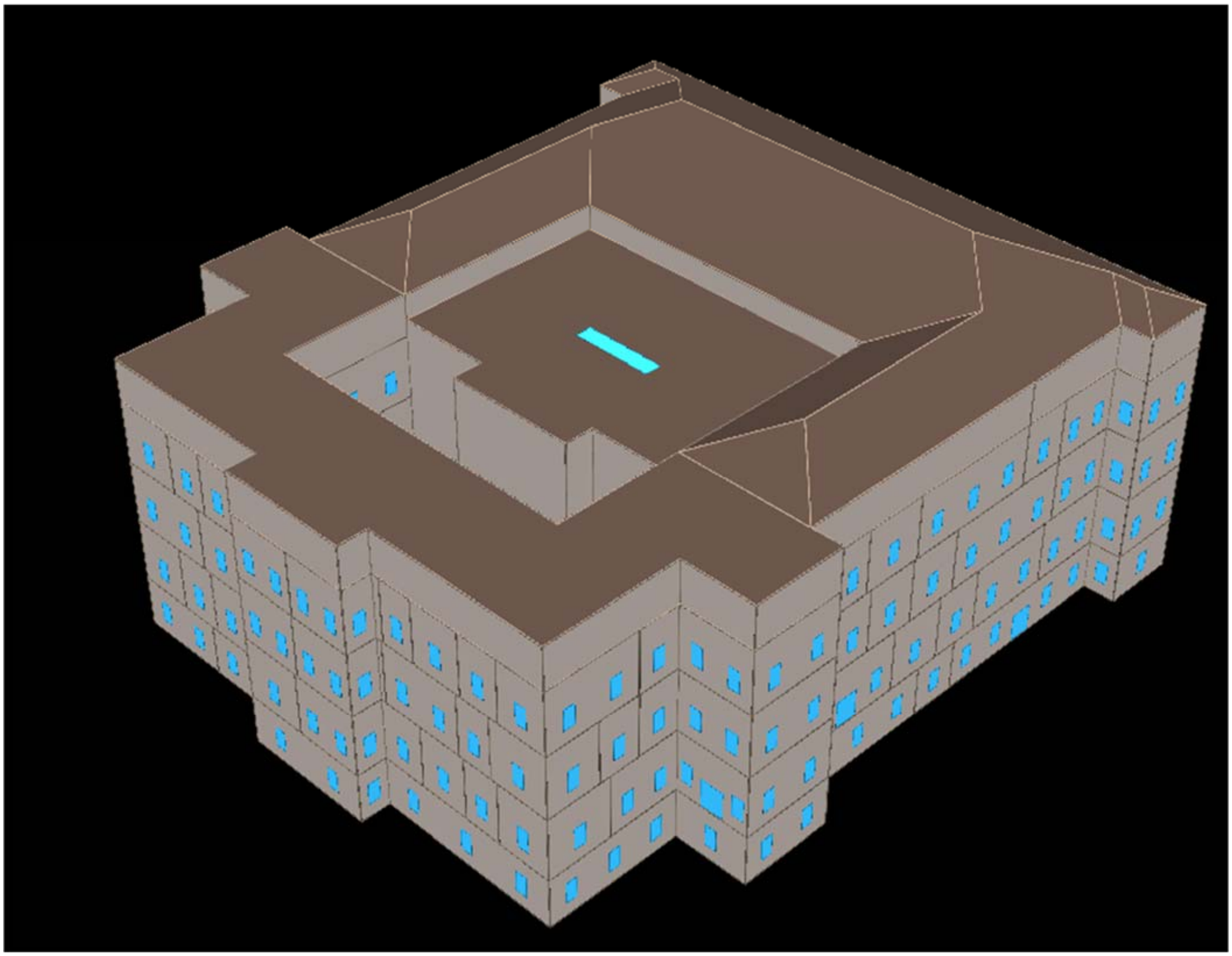
Savings Summary

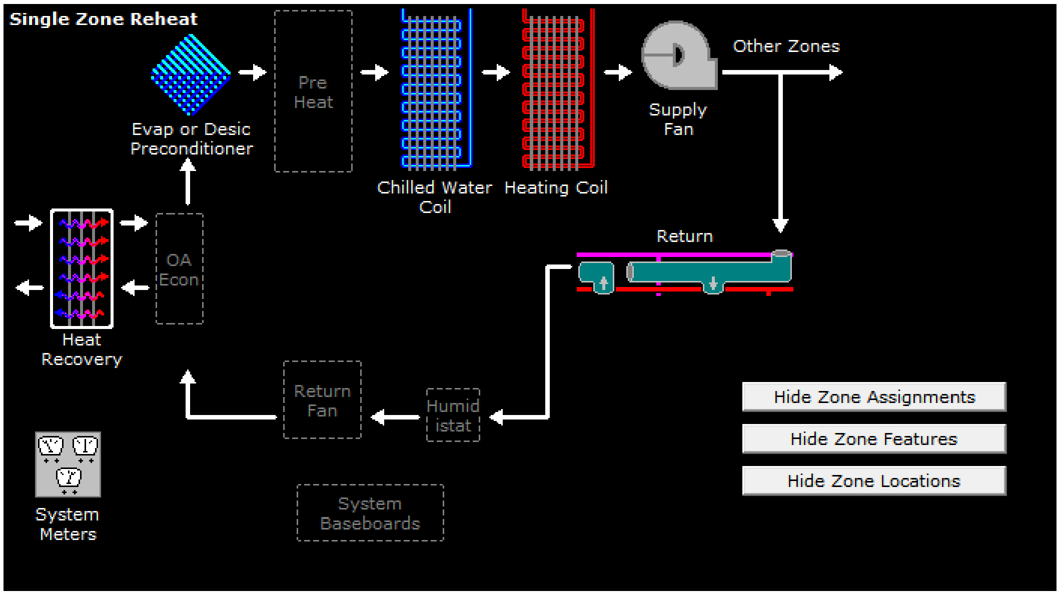
Type	Savings	Units	Utility Type
Cooling	6,471	kWh	Electricity
Heating	2,394	Therm	Natural Gas - Therm

Savings Methods – eQuest

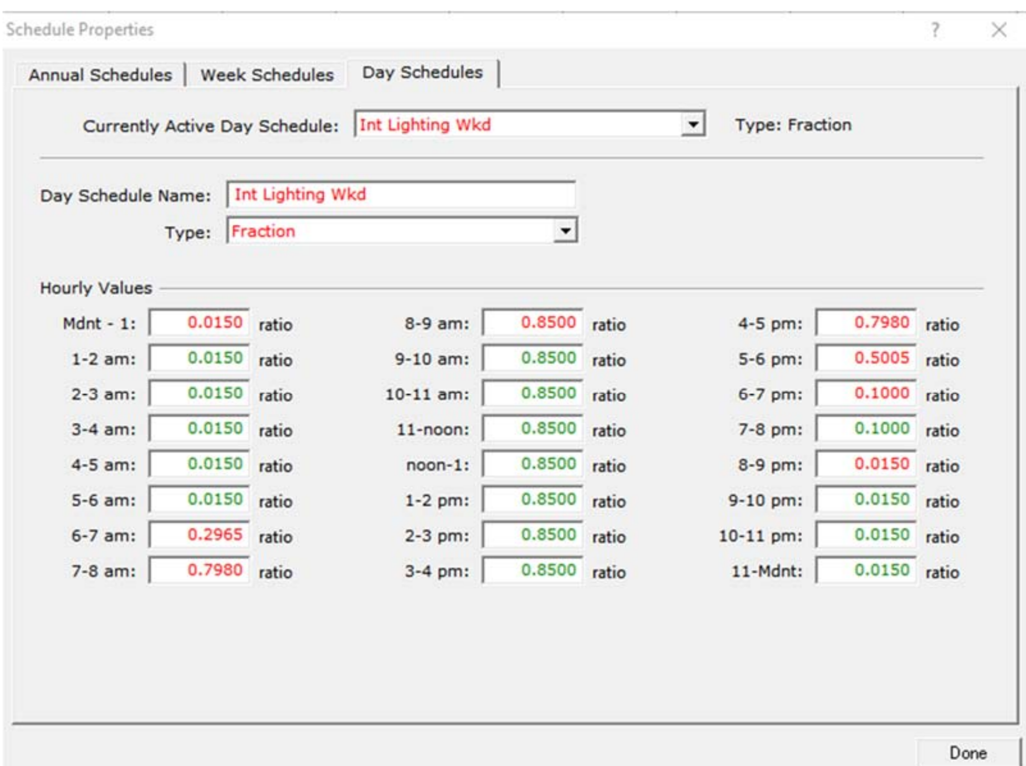
To estimate savings for key buildings, Schneider Electric modeled energy use of buildings using eQuest. eQuest was developed through funding by the United States Department of Energy (USDOE) and is used as the preferred tool for energy modeling in the industry. This modeling tool provides the unique ability to model current conditions, including combined heat and power, and proposed retrofits in order to assess energy savings.

Spaces are defined by their construction to determine thermal conductivity and mass for heat loss/gain calculations. Also included are ventilation rates, lighting, equipment, and occupant loads and schedules. Individual spaces or groups of spaces are assigned to thermal zones that are served by an air distribution system. A thermal zone is defined by the conditioned area that is served by one thermostat controlling one terminal device (if applicable). Systems may include either a central air handler or distributed equipment such as water source heat pumps. Systems are then assigned to a loop that serves heating and/or cooling coils. Loops can include chillers, cooling towers, boilers, ground source wells, and all associated pumps. Plants are then assigned to a building. Below is a screen shot of the eQuest model for Jersey City – City Hall.





Defining accurate schedules is imperative to creating an accurate model. Schedules are used to describe when and to what capacity the building is operated and occupied. Varying load levels and runtime for lighting, electrical equipment, occupancy, ventilation, fans, and temperature set-points are all modeled using schedules. Below are two screen shots showing a typical lighting schedule.



Schedule Properties

Annual Schedules | Week Schedules | Day Schedules

Currently Active Day Schedule: Int Lighting Wkd   Type: Fraction

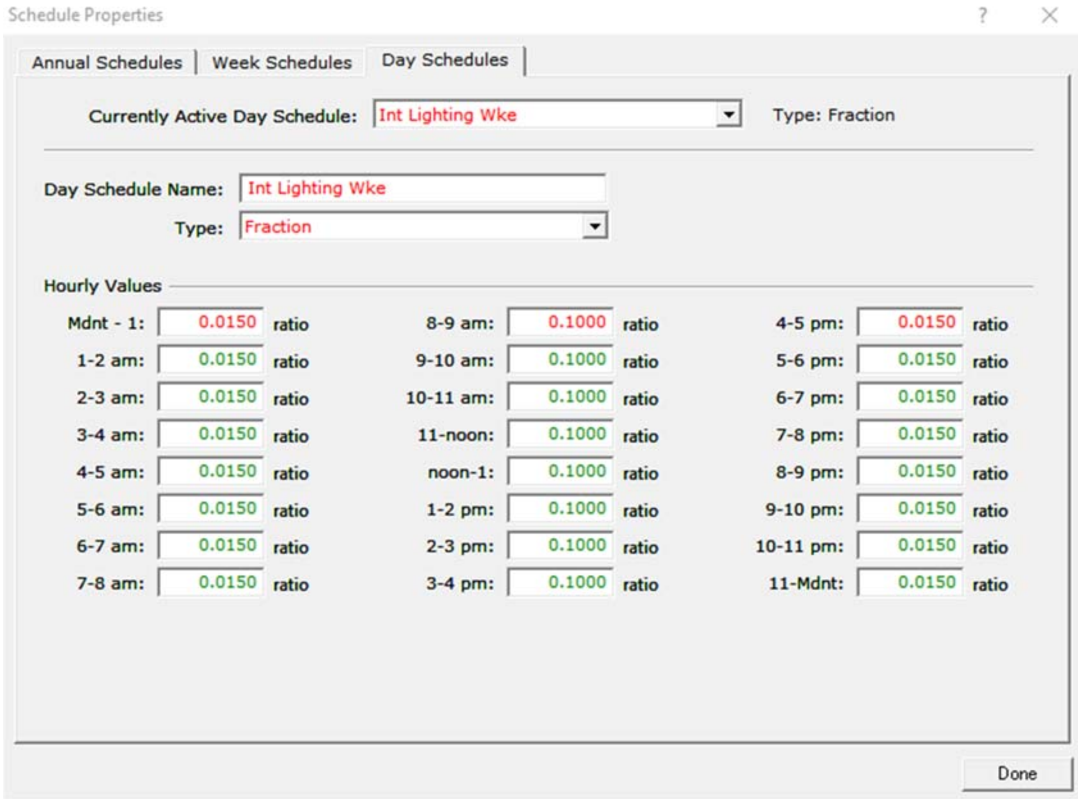
Day Schedule Name: Int Lighting Wkd

Type: Fraction

Hourly Values

Mdnt - 1:	0.0150	ratio	8-9 am:	0.8500	ratio	4-5 pm:	0.7980	ratio
1-2 am:	0.0150	ratio	9-10 am:	0.8500	ratio	5-6 pm:	0.5005	ratio
2-3 am:	0.0150	ratio	10-11 am:	0.8500	ratio	6-7 pm:	0.1000	ratio
3-4 am:	0.0150	ratio	11-noon:	0.8500	ratio	7-8 pm:	0.1000	ratio
4-5 am:	0.0150	ratio	noon-1:	0.8500	ratio	8-9 pm:	0.0150	ratio
5-6 am:	0.0150	ratio	1-2 pm:	0.8500	ratio	9-10 pm:	0.0150	ratio
6-7 am:	0.2965	ratio	2-3 pm:	0.8500	ratio	10-11 pm:	0.0150	ratio
7-8 am:	0.7980	ratio	3-4 pm:	0.8500	ratio	11-Mdnt:	0.0150	ratio

Done



Calibrating the Model

To accurately predict the energy and demand savings of the project, the model must be calibrated to replicate closely the energy and demand use profiles of the baseline building. This is accomplished by first running the model as constructed. These results are then compared to the baseline energy consumption data described above to assess how closely the model matches the baseline. After examining the results, it becomes apparent where energy or demand is too high or too low and where adjustments may need to be made. The end goal is replicating all parameters such as electric energy, electric demand, and gas use to align simultaneously. These parameters typically involve adjusting operating schedules, internal loads, equipment efficiencies, and temperature set-points. The calibration process typically requires between fifteen and twenty iterations (possibly more for complex models) to achieve a satisfactorily calibrated model. The following graphic shows the output of the energy model vs. baseline for Jersey City – City Hall

City Hall - Baseline

eQuestrian

PC20P0019 - JCNJ - City Hall - Baseline

Baseline | ECM01 | ECM02 | ECM03 | ECM04 | ECM05 | ECM06 | ECM07 | ECM08 | ECM09 | ECM10 | Update Results

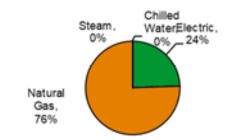
Baseline Energy

Fuel	Pre	Units	EUI
Electric	637,007	kWh	19.7
Electric	2,159	kW	-
Natural Gas	67,124	Therm	60.9
Chilled Water	-	Ton-hrs	-
Steam	-	klb	-
Total	8,886,490	kBtu	80.7

Calibration

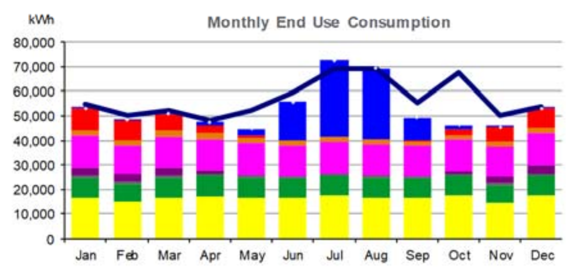
Previous	Current

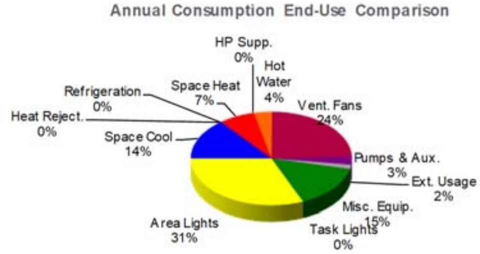
Baseline Energy Chart



Electric Energy Data

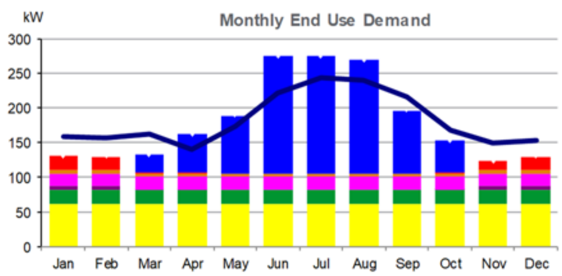
Electric Consumption (kWh)														
1	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	1
Space Cool	1	0	107	1,154	2,659	15,666	31,043	28,849	9,295	1,899	9	1	90,684	Space Cool
Heat Reject.	0	0	0	0	0	0	0	0	0	0	0	0	0	Heat Reject.
Refrigeration	0	0	0	0	0	0	0	0	0	0	0	0	0	Refrigeration
Space Heat	8,979	8,203	7,059	3,434	1,164	262	89	123	320	2,362	6,284	8,122	46,402	Space Heat
HP Supp.	0	0	0	0	0	0	0	0	0	0	0	0	0	HP Supp.
Hot Water	2,116	1,978	2,200	2,251	2,038	1,869	1,823	1,669	1,661	1,808	1,613	2,065	23,088	Hot Water
Vent. Fans	13,051	11,788	13,051	12,630	13,051	12,630	13,051	13,051	12,630	13,051	12,630	13,051	153,662	Vent. Fans
Pumps & Aux.	3,380	3,173	3,035	1,753	241	26	26	29	31	775	2,425	3,476	18,371	Pumps & Aux.
Ext. Usage	790	714	790	765	790	765	790	790	765	790	765	790	9,302	Ext. Usage
Misc. Equip.	8,025	7,257	8,030	8,226	8,019	7,957	8,299	8,019	7,957	8,293	7,128	8,299	95,509	Misc. Equip.
Task Lights	0	0	0	0	0	0	0	0	0	0	0	0	0	Task Lights
Area Lights	16,787	15,182	16,787	17,294	16,787	16,669	17,412	16,787	16,669	17,412	14,793	17,412	199,989	Area Lights
Total	53,128	48,295	51,058	47,506	44,748	55,844	72,533	69,317	49,328	46,389	45,645	53,216	**637,007**	Total Model
Utility Baseline	54,677	50,164	52,165	48,030	52,361	59,375	69,143	69,368	55,188	67,611	50,483	53,953	682,517	Utility Baseline
Error	-3%	-4%	-2%	-1%	-15%	-6%	5%	0%	-11%	-31%	-10%	-1%	-7%	

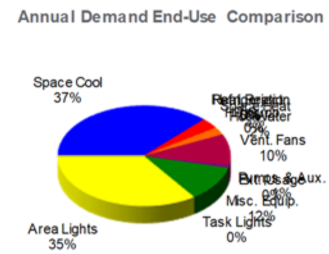




Electric Demand Data

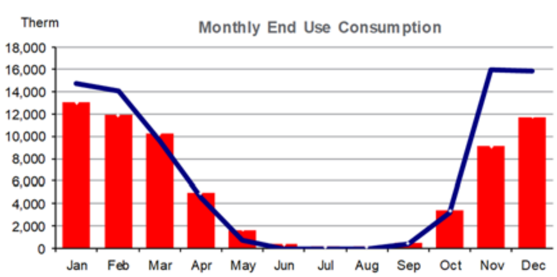
						Electric Demand								kW
1	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	1
Space Cool	0	0	25	55	83	170	169	163	90	45	0	0	801	Space Cool
Heat Reject.	0	0	0	0	0	0	0	0	0	0	0	0	0	Heat Reject.
Refrigeration	0	0	0	0	0	0	0	0	0	0	0	0	0	Refrigeration
Space Heat	20	19	1	1	0	0	0	0	0	1	12	19	74	Space Heat
HP Supp.	0	0	0	0	0	0	0	0	0	0	0	0	0	HP Supp.
Hot Water	5	5	5	5	5	5	5	5	5	5	5	5	54	Hot Water
Vent. Fans	18	18	18	18	18	18	18	18	18	18	18	18	210	Vent. Fans
Pumps & Aux.	5	5	0	0	0	0	0	0	0	0	5	5	19	Pumps & Aux.
Ext. Usage	0	0	0	0	0	0	0	0	0	0	0	0	0	Ext. Usage
Misc. Equip.	21	21	21	21	21	21	21	21	21	21	21	21	248	Misc. Equip.
Task Lights	0	0	0	0	0	0	0	0	0	0	0	0	0	Task Lights
Area Lights	63	63	63	63	63	63	63	63	63	63	63	63	751	Area Lights
Total	**130**	**129**	**132**	**162**	**188**	**275**	**275**	**269**	**196**	**152**	**122**	**129**	**2,159**	Total Model
Utility Baseline	158	157	162	139	174	221	244	240	215	169	149	153	2,181	Utility Baseline
Error	-18%	-18%	-19%	16%	8%	24%	13%	12%	-9%	-10%	-18%	-15%	-1%	

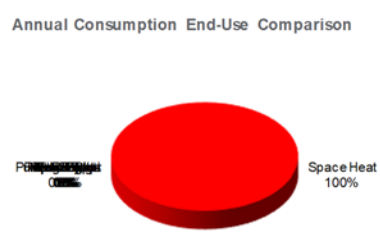




Natural Gas Energy Data

						Natural Gas Consumption								Therm
1	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	100
Space Cool	0	0	0	0	0	0	0	0	0	0	0	0	0	Space Cool
Heat Reject.	0	0	0	0	0	0	0	0	0	0	0	0	0	Heat Reject.
Refrigeration	0	0	0	0	0	0	0	0	0	0	0	0	0	Refrigeration
Space Heat	12,989	11,867	10,211	4,968	1,683	379	129	178	463	3,417	9,091	11,749	67,124	Space Heat
HP Supp.	0	0	0	0	0	0	0	0	0	0	0	0	0	HP Supp.
Hot Water	0	0	0	0	0	0	0	0	0	0	0	0	0	Hot Water
Vent. Fans	0	0	0	0	0	0	0	0	0	0	0	0	0	Vent. Fans
Pumps & Aux.	0	0	0	0	0	0	0	0	0	0	0	0	0	Pumps & Aux.
Ext. Usage	0	0	0	0	0	0	0	0	0	0	0	0	0	Ext. Usage
Misc. Equip.	0	0	0	0	0	0	0	0	0	0	0	0	0	Misc. Equip.
Task Lights	0	0	0	0	0	0	0	0	0	0	0	0	0	Task Lights
Area Lights	0	0	0	0	0	0	0	0	0	0	0	0	0	Area Lights
Total	**12,989**	**11,867**	**10,211**	**4,968**	**1,683**	**379**	**129**	**178**	**463**	**3,417**	**9,091**	**11,749**	**67,124**	Total Model
Utility Baseline	14,675	14,087	9,521	4,573	684	0	0	0	352	3,194	15,964	15,827	78,877	Utility Baseline
Error	-11%	-16%	7%	9%	146%	#DIV/0!	#DIV/0!	#DIV/0!	31%	7%	-43%	-26%	-15%	





Savings Methods – ELEMENT

The ELEMENT tool was developed to provide transparency into the end use breakdown of energy consumption for each fuel type. The simplified building inputs and schedules are used in a powerful hourly load analysis to provide quick building calibrations. Energy saving scenarios can be run quickly to see the financial impact to the overall project and generate useful graphs for visualization and reports.

Introduction

ELEMENT is Schneider Electric's proprietary Microsoft Excel based spreadsheet calculation tool used for simulating building energy consumption. Its purpose is to allow a user with prior knowledge of a facility and its energy using equipment to simulate energy consumption, compare the outputs to historical utility data of the facility, breakout the calibrated baseline into its end use components and determine the energy savings of Energy Conservation Measures (ECMs).

The tool uses a variety of Excel functions and custom generated algorithms written in Visual Basic for Applications (VBA) to quickly simulate the energy consumption of a simple to moderately complex building. Heating and cooling loads are determined on an hourly basis (8,760 hours per year) using TMY2 or TMY3 weather data and the building definitions specified by the user. Loads are generated by the user inputs and key building variables are defined and adjusted to calibrate and predict energy impacts.

Calculations

The Element tool is an hourly load and energy analysis tool used for whole building energy models. The results show end use breakdowns of energy on a monthly basis while allowing for quick calibration to utility billing data. Energy conservation measures can be easily defined and reviewed using the ECM tab to redefine variables used in the baseline model. Each new ECM run is sequential and uses the variable last defined by the previously successful run. The savings are determined by the difference in runs by either actual, percent or minimum unit method, as described previously.

The hourly outdoor air conditions and solar data are imported from the National Renewable Energy Laboratories (NREL) typical meteorological year (TMY) data set. The building calendar defines up to four typical day types that occur throughout the year. These day types are used by the hourly load percentage schedules and HVAC schedules used to define the operation of internal and external building loads, as well as the fan operation of the HVAC system. All 365 days of the year are assigned a day type as defined by the calendar and each hour of the day has an hourly load percentage for each load schedule name and on or off status for each HVAC schedule name. The occupied and unoccupied set points are also driven by the on/off status of the HVAC fan. An algorithm determines if the system is in heating or cooling mode based on the user inputs and weather data in order to determine which occupied heating or cooling set point to use.

Zone and system loads are calculated using industry standard engineering equations (ASHRAE) as listed below based on the user defined building parameters described in the baseline calculation inputs section. The total sensible system load determines if heating or cooling energy is required (negative results for heating and positive values for cooling). Calculations are repeated for each hour of the year to determine the total annual loads and energy consumption.

The following is a sampling of the variables and equations used for calculations the building loads and energy consumption and demand.

Weather and Solar Data

Outdoor Air Dry Bulb Temperature, ^{o}F
Outdoor Air Density, lbm air/ft^3
Outdoor Air Humidity Ratio, lbm water/lbm air

Solar Direct Normal Irradiance, Btu/ft^2
Solar Diffuse Horizontal Irradiance, Btu/ft^2
Sol-air Temperature, °F

- $T_{SA} = T_{OA} + (\alpha \times I_N / h_o) - (\varepsilon \times \Delta R / h_o)$
  - α = wall or roof absorptivity of solar radiation based on surface color, dimensionless
  - I_N = direct normal solar flux on wall and diffuse horizontal irradiance on roof, Btu/hr-ft^2
  - h_o = the convective heat transfer coefficient on exterior wall or roof = 3.0 Btu/h-ft^2 °F
  - ε = hemispherical emittance of exterior surface = 1.0 Btu/h-ft^2
  - ΔR = long wave radiation incident on exterior surface and blackbody radiation
    - For vertical surfaces (walls), $\Delta R = 0$ (vertical surfaces)
    - For horizontal surfaces (roof), $\Delta R = 20.0$ Btu/h-ft^2

Zone Loads

Sensible Zone Loads, Btu

- **Internal Heat Gains**
- Lighting, $Q_{S\_LTG} = L_{LTG} \times A_{BLDG} / 1000 \times HLP_{LTG} \times C$
- Equipment, $Q_{S\_EQUIP} = L_{EQUIP} \times A_{BLDG} / 1000 \times HLP_{EQUIP} \times C$
- People, $Q_{S\_PEOPLE} = n_{PEOPLE} \times HGF_{S\_PEOPLE} \times HLP_{PEOPLE}$
  - A_{BLDG} = building area, ft^2
  - C = conversion factor kW to kBtu = 3412 kBtu/kWh
  - HGF_{S_PEOPLE} = heat gain factor (sensible) based on activity level, (see Table 1), Btu/h-person
  - HLP = hourly load percentage of peak load based on assigned schedule, %
  - L = peak load density, W/ft^2
  - n_{PEOPLE} = number of people, persons
- **Envelope Loads**
- Wall, $Q_{S\_WALL} = 1/R_{WALL} \times (A_{WALL} - A_{WINDOW}) \times (T_{SA\_WALL} - T_{SP})$
- Roof, $Q_{S\_ROOF} = 1/R_{ROOF} \times (A_{ROOF}) \times (T_{SA\_ROOF} - T_{SP})$
- Window Conduction, $Q_{S\_WINDOW,C} = U_{WINDOW} \times A_{WINDOW} \times (T_{OA} - T_{SP})$
- Window Radiation, $Q_{S\_WINDOW,R} = A_{WINDOW} \times SHGC \times (1 - ES) \times I_N$
- Infiltration, $Q_{S\_INFIL} = \rho \times c_p \times q_{INF} \times A_{WALL} \times 60 \times (T_{OA} - T_{SP})$
  - ρ = density of outdoor air, lbm/ft^3
  - A_{ROOF} = roof area, ft^2
  - A_{WALL} = exterior wall area, ft^2
  - A_{WINDOW} = window area, ft^2
  - c_p = heat capacity of air = 0.24 Btu/lbm °F
  - ES = exterior shading, %
  - q_{INF} =infiltration rate per area of exterior wall, CFM/ft^2
  - R_{WALL} = R-value of roof, hr-ft^2-°F/Btu
  - R_{ROOF} = R-value of roof, hr-ft^2-°F/Btu
  - SHGC = solar heat gain coefficient based on window selection (see Table 2), dimensionless
  - T_{OA} = outdoor air dry bulb temperature, °F
  - T_{SA_ROOF} = sol-air temperature of the roof, °F
  - T_{SA_WALL} = sol-air temperature of the wall, °F
  - T_{SP} = indoor air dry bulb temperature, °F
  - U_{WINDOW} = U-value of the window based on window selection (see Table 3), Btu/h-°F-ft^2

Latent Zone Loads, Btu

- **Internal Heat Gains**
- People, $Q_{L\_PEOPLE} = n_{PEOPLE} \times HGF_{L\_PEOPLE} \times HLP_{PEOPLE}$
  - o HGF_{L_PEOPLE} = heat gain factor (latent) based on activity level (see Table 1), Btu/h-person
- **Envelope Loads**
- Infiltration, $Q_{L\_INFIL} = \rho \times h_{fg} \times q_{INF} \times A_{WALL} \times 60 \times (\omega_{OA} - \omega_{SP})$
  - o h_{fg} = latent heat of vaporization of water = 1054.8 Btu/lbm water
  - o ω_{OA} = humidity ratio of outdoor air, lbm water/lbm air
  - o ω_{SP} = humidity ratio of indoor space set point, lbm water/lbm air

Total Zone Loads, kBtu

- Sensible, $Q_{S\_ZONE} = (Q_{S\_LTG} + Q_{S\_EQUIP} + Q_{S\_PEOPLE} + Q_{S\_WALL} + Q_{S\_ROOF} + Q_{S\_WINDOW,C} + Q_{S\_WINDOW,R} + Q_{S\_INFIL}) / 1000$
- Latent, $Q_{L\_ZONE} = (Q_{L\_PEOPLE} + Q_{L\_INFIL}) / 1000$
- Total, $Q_{TOTAL\_ZONE} = Q_{S\_ZONE} + Q_{L\_ZONE}$

System Loads

Ventilation, CFM

- Ventilation Rate, $Q_{OA} = R_{PEOPLE} \times n_{PEOPLE} + R_{AREA} \times A_{BLDG}$
  - o R_{PEOPLE} = outdoor air rate per person, CFM/person
  - o R_{AREA} = outdoor air rate per floor area, CFM/ft^2

Ventilation Loads, Btu

- Ventilation Sensible, $Q_{S\_VENT} = \rho \times c_p \times 60 \times Q_{OA} \times (T_{OA} - T_{SP})$
- Ventilation Latent, $Q_{L\_VENT} = \rho \times h_{fg} \times 60 \times Q_{OA} \times (\omega_{OA} - \omega_{SP})$

Total System Loads, kBtu

- System Sensible, $Q_{S\_SYSTEM} = Q_{S\_ZONE} + (Q_{S\_VENT} / 1000)$
- System Latent, $Q_{L\_SYSTEM} = Q_{L\_ZONE} + (Q_{L\_VENT} / 1000)$
- System Total, $Q_{TOTAL\_SYSTEM} = Q_{S\_SYSTEM} + Q_{L\_SYSTEM}$

Energy Consumption

Electric, kWh

- Lighting, $E_{LTG} = L_{LTG} \times A_{BLDG} / 1000 \times HLP_{LTG}$
- Equipment, $E_{EQUIP} = L_{EQUIP} \times A_{BLDG} / 1000 \times HLP_{EQUIP}$
- Miscellaneous Electric Load 1, $E_{MISCE,1} = L_{MISCE,1} \times HLP_{MISCE,1}$ (typical of 3)
  - o $L_{MISCE,1}$ = peak miscellaneous electric load 1, kW (typical of 3)
  - o $HLP_{MISCE,1}$ = hourly load percentage of miscellaneous electric load 1 (typical of 3)
- Fans, $E_{FAN} = E_{C,FAN} + E_{P,FAN} + E_{V,FAN}$
  If the HVAC schedule is on or if the fan availability is enabled and there is a load on the system, then
  - o Constant fan speed, $E_{C,FAN} = L_{C,FAN}$
  - o Proportional fan speed, $E_{P,FAN} = L_{V,FAN} \times PL$
  - o Variable fan speed, $E_{V,FAN} = L_{V,FAN} \times PL^{2.5}$
    - $L_{C,FAN}$ = constant fan load, kW
    - $L_{V,FAN}$ = variable fan load, kW
    - S_{MIN_FAN} = minimum fan speed, %
    - PL = percentage of load equal to the maximum of $(Q_{S\_SYSTEM} / Q_{HTG\_DESIGN})$, $(Q_{TOTAL\_SYSTEM} / Q_{CLG\_DESIGN})$, or (S_{MIN_FAN})

- Pumps, $E_{PUMP} = E_{C,PUMP} + E_{P,PUMP} + E_{V,PUMP}$ (typical of heating and cooling)
  If the HVAC schedule is on or if the pump availability is enabled and there is a load on the system, then
  - Constant pump speed, $E_{C,PUMP} = L_{C,PUMP}$
  - Proportional pump speed, $E_{P,PUMP} = L_{V,PUMP} \times PL$
  - Variable pump speed, $E_{V,PUMP} = L_{V,PUMP} \times PL^{2.5}$
    - $L_{C,PUMP}$ = constant pump load, kW (typical of heating and cooling)
    - $L_{V,PUMP}$ = variable pump load, kW (typical of heating and cooling)
    - S_{MIN_PUMP} = minimum pump speed, % (typical of heating and cooling)
    - PL_{HTG} = percentage of heating load equal to the maximum of (Q_{S_SYSTEM} / Q_{HTG_DESIGN}) or $S_{MIN\_PUMP,HTG}$
    - PL_{CLG} = percentage of cooling load equal to the maximum of (Q_{TOTAL_SYSTEM} / Q_{CLG_DESIGN}) or $S_{MIN\_PUMP,CLG}$

If the HVAC schedule is on or if the fan availability is enabled and there is a load on the system, then energy calculations will be done for heating or cooling depending on the polarity of the load (positive for cooling, negative for heating).

- Heating (Electric), $E_{HTG} = (-1) \times Q_{S\_SYSTEM} \times P_{HTG,E} / \eta_{HTG\_E} / 3.412$
    - $\eta_{HTG,E}$ = electric nominal heating efficiency, %
    - $P_{HTG,E}$ = percentage of load assigned to electric heat, %
    - Q_{S_SYSTEM} = hourly calculated heating load (negative values), kBtu
- Cooling, $E_{CLG} = Q_{TOTAL\_SYSTEM} / 12 \times \eta_{CLG\_PL} \times P_{CLG}$
  - Part Load Ratio, $PLR_{CLG} = Q_{TOTAL\_SYSTEM} / (Q_{CLG\_DESIGN} \times OF_{CLG})$, dimensionless
  - Energy Input Ratio, $EIR_{CLG} = a + b \times PLR_{CLG} + c \times PLR_{CLG}^2 + d \times PLR_{CLG}^3$, dimensionless
  - Cooling Part Load Efficiency, $\eta_{CLG\_PL} = \eta_{CLG} \times PLR_{CLG} / EIR_{CLG}$, kW/ton
    - a, b, c, d = cooling efficiency curve coefficients (see Table 4) based on system selection, dimensionless
    - η_{CLG} = nominal cooling efficiency, kW/ton
    - OF_{CLG} = oversize factor used to adjust calculated cooling design load, %
    - P_{CLG} = percent of building with cooling, %
    - Q_{CLG_DESIGN} = total cooling design load based on design day conditions, kBtu
    - Q_{TOTAL_SYSTEM} = hourly calculated cooling load (positive values), kBtu

Fuel, kBtu

- Miscellaneous Fuel Load 1, $F_{MISCF,1} = L_{MISCF,1} \times HLP_{MISCF,1} / \eta_{MISCF,1}$ (typical of 3)
  - $L_{MISCF,1}$ = peak miscellaneous fuel load 1, kBtu (typical of 3)
  - $HLP_{MISCF,1}$ = hourly load percentage of miscellaneous fuel load 1 (typical of 3)
  - $\eta_{MISCF,1}$ = miscellaneous fuel load 1 stand-alone efficiency, % (typical of 3)
    - Note: $\eta_{MISCF,1} = \eta_{HTG\_PL,F}$ if miscellaneous load is included on main boiler plant

The heating energy consumption of fuel is calculated and further broken down to provide more resolution into three main end use categories: Envelope, Infiltration, and Ventilation.

- Envelope, $F_{HTG\_ENV} = (-1) \times Q_{S\_ZONE} \times (1 - P_{HTG,E}) \times (1 - P_{INF}) / \eta_{HTG\_PL,F}$
- Infiltration, $F_{HTG,INF} = (-1) \times Q_{S\_ZONE} \times (1 - P_{HTG,E}) \times P_{INF} / \eta_{HTG\_PL,F}$
- Ventilation, $F_{HTG,VENT} = (-1) \times Q_{S\_VENT} \times (1 - P_{HTG,E}) / \eta_{HTG\_PL,F}$
  - Part Load Ratio, $PLR_{HTG} = Q_{S\_SYSTEM} / (Q_{HTG\_DESIGN} \times OF_{HTG})$, dimensionless
    - For miscellaneous fuel loads on the plant, Q_{S_SYSTEM} includes these loads.
  - Energy Input Ratio, $EIR_{HTG} = a + b \times PLR_{HTG} + c \times PLR_{HTG}^2$, dimensionless

- o Fuel Part Load Efficiency, $\eta_{HTG\_PL,F} = \eta_{HTG,F}$ x PLR_{HTG} / EIR_{HTG}, %
  - a, b, c = heating efficiency curve coefficients (see Table 5) based on system selection, dimensionless
  - $\eta_{HTG,F}$ = fuel nominal heating efficiency, %
  - OF_{HTG} = oversize factor used to adjust calculated heating design load, %
  - $P_{HTG,E}$ = percentage of load assigned to electric heat, %
  - Q_{HTG_DESIGN} = heating design load calculated on design day conditions, kBtu
  - $Qs_{\_SYSTEM}$ = hourly calculated heating load (negative values), kBtu
- o Zone Envelope Sensible Load, $Qs_{\_ZONE,ENV}$ = $Qs_{\_WALL}$ + $Qs_{\_ROOF}$ + $Qs_{\_WINDOW,C}$ + $Qs_{\_WINDOW,R}$
- o Percent of Zone Sensible Load attributed to infiltration, P_{INF} = $Qs_{\_ZONE,INF}$ / ($Qs_{\_ZONE,ENV}$ + $Qs_{\_INF}$)

Energy Demand

Electric, kW

The tool determined the peak kW load of the month and displays the demand of each end use category component for that hour.

On the following page is an example of an Element model for Municipal Courthouse. The element model below was used to predict savings for modified BAS scheduling as well as other ECMs.

Baseline Breakout Analysis

Electric Consumption

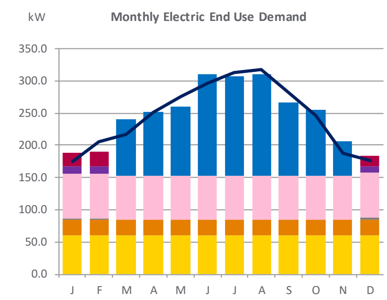
	Internal Loads		Miscellaneous Loads			Fans and Pumps			Heating and Cooling			
	Lighting	Equipment	terior Lightii	HW Pump	0	Fans	Clg Pumps	Htg Pumps	Heating	Cooling	Dehumid	Reheat
	30.6%	11.1%	1.4%	0.0%	0.0%	39.8%	0.0%	3.2%	2.4%	11.5%	0.0%	0.0%
Month	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh
1	33,930	12,311	1,596	0	0	50,142	0	7,993	7,348	0	0	0
2	31,060	11,273	1,442	0	0	46,200	0	7,259	7,093	5	0	0
3	34,135	12,384	1,596	0	0	47,238	0	6,656	4,439	690	0	0
4	33,828	12,283	1,545	0	0	40,114	0	3,783	1,904	3,552	0	0
5	34,033	12,347	1,596	0	0	36,794	0	954	297	7,203	0	0
6	33,315	12,090	1,545	0	0	39,491	0	0	0	26,307	0	0
7	34,545	12,540	1,596	0	0	47,307	0	0	0	44,560	0	0
8	33,622	12,191	1,596	0	0	45,509	0	0	0	39,443	0	0
9	33,725	12,246	1,545	0	0	37,832	0	0	0	19,346	0	0
10	34,648	12,577	1,596	0	0	38,454	0	1,809	850	9,313	0	0
11	31,572	11,438	1,545	0	0	43,987	0	6,020	3,759	436	0	0
12	34,545	12,540	1,596	0	0	50,212	0	7,796	5,898	45	0	0
	402,957	**146,221**	**18,797**	**0**	**0**	**523,279**	**0**	**42,269**	**31,588**	**150,899**	**0**	**0**

Fuel Consumption

	Miscellaneous Loads			Heating			
	DHW	0	0	Envelope	Infiltration	Ventilation	Reheat
	34.1%	0.0%	0.0%	15.3%	6.1%	44.5%	0.0%
Month	kBtu	kBtu	kBtu	kBtu	kBtu	kBtu	kBtu
1	69,349	0	0	89,858	36,448	241,923	0
2	64,533	0	0	89,836	36,502	227,476	0
3	69,431	0	0	50,497	20,003	155,131	0
4	71,662	0	0	18,673	7,212	73,429	0
5	69,390	0	0	2,179	827	13,297	0
6	68,774	0	0	0	0	0	0
7	72,277	0	0	0	0	0	0
8	66,544	0	0	0	0	0	0
9	71,621	0	0	0	0	0	0
10	72,318	0	0	8,091	3,116	33,111	0
11	60,031	0	0	43,249	17,022	132,202	0
12	72,277	0	0	67,660	26,743	203,069	0
	828,205	**0**	**0**	**370,042**	**147,873**	**1,079,638**	**0**

Electric Demand

	Internal Loads		Miscellaneous Loads			Fans and Pumps			Heating and Cooling			
	Lighting	Equipment	terior Lightii	HW Pump	0	Fans	Clg Pumps	Htg Pumps	Heating	Cooling	Dehumid	Reheat
	24.2%	9.9%	0.3%	0.0%	0.0%	28.0%	0.0%	1.1%	2.1%	34.5%	0.0%	0.0%
Month	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
1	59.8	24.5	2.1	0.0	0.0	69.2	0.0	11.0	22.5	0.0	0.0	0.0
2	59.8	24.5	2.1	0.0	0.0	69.2	0.0	11.0	24.0	0.0	0.0	0.0
3	59.8	24.5	0.0	0.0	0.0	69.2	0.0	0.0	0.0	86.7	0.0	0.0
4	59.8	24.5	0.0	0.0	0.0	69.2	0.0	0.0	0.0	97.8	0.0	0.0
5	59.8	24.5	0.0	0.0	0.0	69.2	0.0	0.0	0.0	106.2	0.0	0.0
6	59.8	24.5	0.0	0.0	0.0	69.2	0.0	0.0	0.0	156.9	0.0	0.0
7	59.8	24.5	0.0	0.0	0.0	69.2	0.0	0.0	0.0	153.5	0.0	0.0
8	59.8	24.5	0.0	0.0	0.0	69.2	0.0	0.0	0.0	156.1	0.0	0.0
9	59.8	24.5	0.0	0.0	0.0	69.2	0.0	0.0	0.0	112.8	0.0	0.0
10	59.8	24.5	0.0	0.0	0.0	69.2	0.0	0.0	0.0	101.3	0.0	0.0
11	59.8	24.5	0.0	0.0	0.0	69.2	0.0	0.0	0.0	52.3	0.0	0.0
12	59.8	24.5	3.4	0.0	0.0	69.2	0.0	11.0	15.4	0.0	0.0	0.0
	718	**294**	**8**	**0**	**0**	**830**	**0**	**33**	**62**	**1,024**	**0**	**0**



Modeling the ECMs

After the model has been calibrated, changes are made to the model, which represent implementation of the proposed scope conditions of the energy and water conservation measure. ECMs are implemented and run individually to assess the energy savings of each ECM. All ECMs are modeled with consideration to potential overlap inflating modeled savings. ECMs are run sequentially, building upon each other. This results in more accurate estimate of savings than if each ECM were run in comparison to the baseline.

ECMs outside of Energy Model

Some ECMs because of their scope, impact, and nature do not fit well within the energy models. For example, savings from water fixture replacements cannot be calculated in the eQuest or ELEMENT modeling software. When this is the case, in-house built tools are used to accurately estimate savings.

Savings Methodology by ECM

Below are the Energy Conservation Measures that are being implemented at Jersey City as part of this project.

1. Air Sealing Improvements

Schneider Electric uses typical meteorological year (TMY) weather data, draft pressure, internal space temperatures (both occupied and unoccupied), and crack size to conduct savings calculations. Schneider Electric follows ASTM E1186-03 Standard Practices for air leakage in building envelope. ASHRAE Fundamentals 16.23-48 was used to calculate the flow rate and crack method for all envelope calculations.

2. Building Automation System (BAS) Upgrades

Schneider Electric estimated savings by utilizing eQuest and/or ELEMENT. Using a parametric run, a change was made to the model to reflect new setback and setup temperature schedules. Setups and setbacks are proposed to reduce the energy used by empty spaces after normal operational hours. This same method was used with ELEMENT for applicable sites.

3. LED Lighting Upgrades

Spreadsheet calculations were utilized to accurately define the savings for this measure. Pre and post lighting wattages were compared as well as burn hours. Projected savings were also run through eQuest models or ELEMENT for several sites to ensure correctness and compliance.

4. Water Fixture Recommissioning

Schneider Electric used excel spreadsheets to compare pre and post flow rates to generate water savings for the applicable sites.

5. Pipe Insulation

Schneider Electric used excel spreadsheets and eCalc tool to compare pre and post heat loss rates from additional/upgrade of pipe insulation to generate heat energy savings.

6. High Efficiency Transformers

Schneider Electric partnered with Powersmiths to determine savings for this measure. Spreadsheet based calculations were used by Powersmiths to generate kWh savings, which were reviewed by Schneider Electric.

7. Energy Star Copier operation

Using Energy Star recommended operational settings of copiers, savings were estimated taking into account the impact of low energy mode operation of the copiers during non-office hours.

8. A) HVAC System Replacement

Schneider Electric generated savings for this measure internally using ELEMENT. Several of the units being replaced at Bethune Community Center were either in poor shape or near end of life (EOL), these will be replaced with new efficient and environmentally friendly units. The savings calculations were reviewed for accuracy and correctness.

B) Pool Boiler Replacement

The existing hot water boiler for the pool at Pershing Field House is nearing the end of its useful life and would benefit from replacement with new, high efficiency boilers sized with overall operating efficiency in mind.

C) Domestic Hot Water Heater Replacement

Schneider Electric generated savings for this measure internally using ELEMENT. The DHW units being replaced at Pershing Field House were either in poor shape or near end of life (EOL), these will be replaced with new efficient and environmentally friendly units. The savings calculations were reviewed for accuracy and correctness.

D) Combined Heat and Power (CHP)

Combined heat and power (CHP) systems can generate both heating energy as well as electrical power. Such systems can significantly reduce electric load of a building on the grid. The savings for this measure were calculated and reviewed internally.

9. Roof replacement or Repair

Upgrading roofs with higher quality material provides better heat control due to presence of higher R value insulation. This can result in both heating and cooling savings as well as providing a much more modern look to the building. The savings for this measure were calculated and reviewed internally.

10. Solar PV System

Solar savings are based off PVWatts and helioscope estimates. PVWatts is an industry standard for estimating production from solar arrays. The energy rates were then applied to the expected production to simulate financial impact.

7.2 Lighting Line-by-Line

Please see the Appendices Box folder.

7.3 New Jersey Direct Install Reports

Please see the Appendices Box folder.

7.4 PSEG Energy Savers Reports

Please see the Appendices Box folder.

7.5 Preliminary Solar PV Information

Please see the Appendices Box folder.

7.6 Preliminary Mechanical Designs

Please see the Appendices Box folder for preliminary mechanical designs.

7.7 Local Government Energy Audit (LGEA)

Please find the Local Government Energy Audit reports for all facilities located under "Jersey City, City of" on the following page:

https://njcleanenergy.com/commercial-industrial/programs/local-government-energy-audit/local-government-energy-audit/reports/A-J

7.8 Energy-Related Capital Improvements

Please see the Appendices Box folder for information on energy-related capital improvements.

7.9 Third Party Review & Approval Report

Please see the following pages for a copy of the Third-Party Review Report.

7.10 Board of Public Utilities (BPU) Approval

Please see the following pages for a copy of the BPU letter of approval.

June 22, 2021

Ms. Katherine Lawrence, PP, AICP
Sustainability Director
Office of Sustainability
280 Grove Street
Jersey City, NJ 07302

Subject: City of Jersey City Independent Third-Party Review of the Schneider Electric Energy Savings Plan

Dear Ms. Lawrence,

Gabel Associates, Inc. (Gabel) has completed a detailed review of the Energy Savings Plan (ESP) developed by Schneider Electric as part of the Jersey City's Energy Savings Improvement Program (ESIP). Schneider Electric provided drafts and revisions as follows: ESP Original Draft issued April 6, 2021, ESP Revision 1 issued April 27, 2021, ESP Revision 2 issued May 21, 2021, and ESP Revision 3 Issued June 21, 2021. The following summarizes the review process and findings.

Following an initial review of the Original Draft ESP plan calculations and associated energy conservation measures, Gabel submitted a list of questions to the Schneider Electric Energy team in Memorandum No. 1 dated April 20, 2021. This was followed by additional questions specifically related to PV Solar analysis proposal on April 26, and May 17, 2021. These memorandums and email correspondence are attached hereto as Exhibit 1, 2 and 3. Please see the attached memorandums with responses from Schneider Electric.

In addition, Gabel conducted several conference calls with Schneider Electric Team, the City of Jersey City staff, and NJ Board of Public Utilities staff to discuss specific items listed in the Energy Savings Plan, especially related to PV Solar and ESIP financing issues. Schneider Electric provided responses to these questions and released several revisions of the ESP document. The final ESP (Revision 3) was issued on June 21, 2021, which formally addressed all questions and clarifications. Gabel reviewed the calculations and associated energy conservation measures of final ESP dated June 21, 2021.

Based on the information provided and clarifications by the Schneider Electric Energy team, Gabel finds the ESP to be developed in accordance with the Board of Public Utilities' Office of Clean Energy protocols and as directed in the Local Finance Notice for ESIPs. Gross savings over the 20 year term is greater than the initial gross capital costs. As per Form VI – ESCO's Annual Cash Flow Analysis, there is positive net-cash flow to Jersey City in each year over the 20-year financing period. This final ESP includes a capital contribution from the City to buydown the cost to enable the positive net-cash flow.

We recommend the ESP be submitted to the Board of Public Utilities for their review and approval. If the City of Jersey City, BPU, or project team has any questions, please contact me via email at bojan@gabelassociates.com.

Regards,

Bojan Mitrovic

Bojan Mitrovic, C.E.M, C.E.A
Senior Associate – Advanced Energy Solutions
Gabel Associates, Inc.