CENTRAL ISLIP UNION FREE SCHOOL DISTRICT
SUFFOLK COUNTY, NEW YORK

REQUEST FOR PROPOSALS
TO FINANCE AN ENERGY PERFORMANCE LEASE PURCHASE AGREEMENT

Overview

The Central Islip Union Free School District, Town of Islip, Suffolk County, New York (the "District"), is seeking proposals (the "Proposal") from qualified respondents to be a third party lessor to a lease purchase agreement with the District (the "Lease"), the proceeds of which will be used to finance equipment and related work for the implementation of energy conservation measures to be located at the Central Islip Public Library (the "Library") pursuant to an energy performance energy performance contract between the Library and Renu Energy Solutions (the "Performance Contract"). The Performance Contract with Renu Energy Solutions was executed on December 21, 2023, followed by a first amendment on June 26, 2024, and a second amendment on June 25, 2025. NYSED approvals were received as of June 25, 2025. The project will not receive any building aid.

The District seeks competitive proposals for the $1,232,212 lease-purchase financing with a final maturity of August 25, 2040.

The total project cost is $2,469,057, with the Central Islip Public Library contributing $1,236,845 and the District financing the remaining $1,232,212.

Project Description

The Project contemplates implementation of various energy saving measures including installation of equipment and related work (the "Equipment") at the Library. The energy conservation measures and related work are attached to this RFP.

Lease

The proposed Lease shall define the purpose and objective of the financing and the rights and obligations of each party to the financing. Further, the Lease will specify the applicable interest rate, as well as standard contractual terms and conditions. The form of the lease purchase agreement, escrow agreement, and any related documents are to be submitted with the proposal. Proposers must recognize that credit approval will be granted prior to submitting a proposal. All finance documents are subject to negotiation and modification by the District's counsel, and no terms shall be binding on the District until final approval by District's counsel. All agreements and contractual conditions are required to conform with the laws of the State of New York, including but not limited to New York General Municipal Law, Local Finance Law, Education Law, Energy Law and the regulations of the New York State Education Department, the Commissioner of Education and the Office of the New York State Comptroller. The District's counsel will review and approve all documents before consideration and/or approval by the Board of Education.

Lessor will be required to provide a form of standard lease purchase agreement and escrow agreement with its proposal.

Lease Assignment

Assignment of the Lease and related documents by the successful proposer shall be subject to the prior, written consent of the District. The Lease must state that any assignment or transfer of the Lessor's interest shall not be effective unless the District has received prior, written notice, executed by the Lessor, of the name, contact person, address, telephone number and tax identification number of the proposed assignee and the District has given its consent in writing. No assignment will be valid unless the Lessor has received the District's prior, written consent. The lease shall further provide that certificates of participation shall not be executed.

Amount

The amount to be financed under the Lease is expected to be $1,232,212. Lessor shall be responsible for all fees of Lessor including legal, issuance, origination, commitment and closing costs. The District shall not incur or absorb any fees, costs, or expenses of Lessor related to Lessor's proposal, negotiations, closing, documentation or other activities related to this RFP or the proposed transaction. In the event that a transaction does not close because of the successful proposer's failure to meet the terms of this RFP, the successful proposer shall be responsible for any and all costs incurred by the District in connection with the failed transaction and its negotiation.

Specifications

Interest Rate: The Lease Proposal must provide interest rate terms for a lease-purchase option to mature on August 15, 2040 and shall set forth the interest rates under options proposed at by the proposing firm. The Proposal must also cite the index and margin applied in establishing the interest rates cited.

Prepayment: The Proposal must state that District will have the right, at its option, to prepay the principal portion outstanding on the Lease, in whole or in part, at any time following 30 days written notice to the Lessor. The Proposal must disclose additional fees and terms, if any, that are required upon the execution of this prepayment right, in addition to interest payable. The Proposal must also disclose how such amounts are to be calculated in the event that the District exercises its right of partial or whole prepayment. The proposal shall include an option to prepay without penalty or premium at any time, with no additional fees or charges of any kind. **Subject to the terms of the Inflation Reduction Act, the District also retains the ability to make an additional one time payment that may be eligible for a grant for a portion of the project. The District retains the ability to make an additional one time prepayment of the loan on account of grants, rebates or other funds received on account of the project.**

Lease Payments: The District will make periodic payments to the Lessor under the Lease. The Lease shall separately state the principal and interest component of the periodic payments to be made thereunder. The total of these payments, which include both principal and interest components made by the District each year throughout the term of the Lease, shall result in substantially level or declining annual debt service (without taking into account projected State aid or annual energy savings). Debt service payments shall be detailed in an amortization schedule prepared by the proposer and provided to the District with its Proposal. For illustrative purposes, please assume a closing date of August 25, 2025 when developing an amortization schedule. Thereafter, debt service payments will be made semiannually in arrears on each February 15 and August 15 with the first debt service payment (principal & interest) to begin on August 15, 2026. Lessor shall provide a statement and thirty days notification prior to each payment due date.

The Proposal must provide that the interest rate and other terms cited in the proposal will be maintained through September 10, 2025. The Lease shall not become effective until the delivery of funds.

Term: The Lease-Purchase Agreement is scheduled to close on or around August 25, 2025 and mature on August 15, 2040.

Escrow: Upon closing, it is anticipated that lease proceeds will be deposited and collateralized in an interest bearing escrow account to be utilized over the course of project construction (the "Project Fund"). The District shall not be responsible for any costs, fees, expenses or charges of any kind associated with the establishment, maintenance, administration, transfer or termination of said escrow account. The escrow provider must be a bank or trust company located and authorized to do business in New York State (the "Escrow Agent"). Investment and collateralization of the moneys in such fund will be solely at the direction of the District and must be in compliance with the New York State General Municipal Law Sections 10 and 11 as well as District investment policy. **A copy of the District's Investment Policy is attached to this RFP**. The Escrow Agent shall be an agent of the District. The Project Fund shall be free of any security interest of the Escrow Agent.

1. At the option of the District, the moneys in the Project Fund may be held uninvested in the Project Fund. If invested, the Escrow Agent shall invest amounts on deposit in the Project Fund solely at the written direction of an Authorized Officer of the District. All investments made shall be subject to the following conditions:

(a) Such obligations shall be payable or redeemable at the option of the owner within such times as the proceeds will be needed to meet expenditures for purposes for which the moneys were provided and, in the case of obligations purchased with the proceeds of bonds or notes, shall be payable or redeemable in any event, at the option of the owner, within two years of the date of purchase. Any obligation that provides for the adjustment of its interest rate on set dates shall be deemed to be payable or redeemable for purposes of this paragraph on the date on which the principal amount can be recovered through demand by the holder thereof.

(b) Such obligations, shall be registered or inscribed in the name of the District and shall be purchased through, delivered to and held in the custody of the Escrow Agent. Such obligations shall be purchased, sold or presented for redemption or payment by such Escrow Agent in obligations only in accordance with prior written authorization from an Authorized Officer. All such transactions shall be confirmed in writing to the District by the Escrow Agent.

2. All investments described above shall be made and ownership recorded in accordance with all applicable requirements of Section 10 and Section 11 of the General Municipal Law, including the required collateralization of escrow funds.

3. The Escrow Agent shall expressly acknowledge that the District is authorized to invest in no-load money market mutual funds registered under the Securities Act of 1933, as amended, and operated in accordance with Rule 2a-7 of the Investment Company Act of 1940, as amended, provided that such funds are limited to investments in obligations issued or guaranteed by, the United States of America or in obligations of agencies or instrumentalities of the United States of America where the payment of principal and interest are guaranteed by the United States of America (including contracts for the sale and repurchase of any such obligations), and are rated in the highest rating category by at least one nationally recognized statistical rating organization.

4. Monies and investments in the Escrow Fund shall not be subject to levy, attachment or lien by or for the benefit of the Escrow Agent, or any creditor thereof.

Excess Proceeds: In the event that there are excess proceeds available in the Project Fund at the end of the construction period, proceeds shall be transferred by the Escrow Agent to the Lessor and applied to the next succeeding lease payment and each lease payment thereafter until fully utilized. Such use of funds will not constitute lease prepayment and will not be subject to administrative fees or charges.

UCC Filing: The District will not provide a legal description for each District property in connection with this financing. In the event the successful proposer requires this information for the purposes of making a fixture filing pursuant to the applicable provisions of the Uniform Commercial Code, the successful proposer shall obtain such information at its own effort and expense.

Warranties: All manufacturers' warranties, expressed or implied with respect to the Equipment acquired shall be assigned by the Lessor to the District.

Annual Appropriation: The District's obligation to make lease payments is subject to appropriation each year by the Board of Education of the District.

Non-Funding/Executory Clause: Pursuant to the General Municipal Law §109-b, and the Energy Law §9-103, the Lease-Purchase Agreement shall contain an executory clause which shall state that should payments not be appropriated by the District in any fiscal year; the District will not be obligated to pay the amounts due beyond the end of the last funded fiscal year and no liability on account thereof shall be incurred by the District beyond the amount of such monies. The financing contract is not a general obligation of the District. Neither the faith and credit nor the taxing powers of the District are pledged to the payment of any amount due or to become due under the financing contract. In the case of a failure to appropriate, the sole security under the Lease shall be the Equipment. Prior to the sale or seizure of such equipment, the District shall be provided adequate written notice, no less than ninety (90) days, to cure any default. Should such a sale or seizure take place there shall be no disruption to the District's operation to the extent possible. Any such sale or seizure must be conducted in conformity with all applicable law, including the New York Uniform Commercial Code.

Financing Documents: Upon submission of the proposal and following notification of the award, the prospective Lessor must provide the District with a draft of its proposed financing documents, which will incorporate proposed terms and append sample documents. Proposed financing documents and notification of credit approval for the transaction will be due no later than July 29, 2025. All financing documents are subject to modification by District counsel. Closing is subject to successful negotiation and approval of all documents by counsel to the District, and the District shall have no liability or obligation if closing does not occur due to failure to reach agreement on documentation or obtain necessary approvals. The District reserves the right to rescind any award due to failure of successful negotiation of the parties to agree to the terms and conditions thereof and to recover its costs in connection therewith. Unless otherwise provided by a duly adopted Resolution of the Board of Education, the prospective Lessor is advised that the President of the Board of Education is the sole authorized representative of the District for the purpose of signing financing documents.

Lease Termination: Upon termination of a Lease through the exercise of Lessee's option to prepay or through payment by Lessee of all Rental Payments and other amounts due with respect to such particular Equipment, Lessor's security interest in such Equipment shall terminate, and Lessor shall execute and deliver to Lessee such documents as Lessee may reasonably request to evidence the termination of Lessor's security interest in such Equipment.

Tax Status: The Lease shall qualify as a tax-exempt lease financing, that is, the interest component of the Lease will be exempt from Federal, New York State and, where applicable, New York City taxation. The Lease-Purchase Agreement will not be designated as "a qualified tax-exempt obligation" pursuant to Section 265(b)(3)(B) of the Internal Revenue Code of 1986, as amended (the "Code"). The District will not defend or hold the Lessor harmless from any adverse changes in the tax status of the transaction, after tax yield or cash flows resulting from changes in the Federal or State tax codes or regulations.

Credit Rating: Moody's Investors Service has assigned a rating of "A1" to the outstanding bonds of the District.

Binding Authority: Each Proposal must be signed by an individual who is legally authorized to contractually bind the proposing firm.

Issue Price: The Lessor must submit to the District a certificate (the "Issue Price Certificate"), satisfactory to Bond Counsel, prior to the delivery of the Agreement, assuming the Lessor does not reoffer the Agreement to the general public, which states that the Lessor has purchased the Agreement for its own account and not with a view to distribution or resale and not in the capacity of a bond house, broker or other intermediary, and the price or prices at which such purchase was made, in such form and including such additional information as the District and Bond Counsel shall reasonably require.

Financial Information: The audited financial statements for the FYE June 30, 2020 through and including June 30, 2024 and the Energy Performance Contract and amendments may be found on Munistat's website: www.munistat.com.

Evaluation Process

During the evaluation process, the District reserves the right, where it may serve the District's best interest, to request additional information or clarifications from proposers, or to allow corrections of error or omissions.

Amendments to RFP

Any verbal information obtained from or statements made by the representative of the District or its designee at the time of examination of the documents or site shall not be construed as, in any way, amending RFP documents or binding upon the District. Only such corrections or addenda that are issued in writing to all proposers shall become a part of the RFP. Any addendum issued during RFP process shall be included in the RFP response and become a part of any subsequent contract agreement.

Legal Requirements

The Lease is required to conform to the laws of the State of New York, including, but not limited to, General Municipal Law, Local Finance Law, Education Law, Energy Law and regulations promulgated by the Commissioner of Education and the Office of the State Comptroller.

Submission Requirements

Proposals are due by 10:00 p.m. on Tuesday, July 29, 2025 by e-mail to:

Michael J. Loguercio, President
Munistat Services, Inc
12 Roosevelt Avenue
Port Jefferson Station, NY 11776
Tel: (631) 331-8888
mloguercio@munistat.com

Questions regarding this RFP may be directed to Michael J. Loguercio.

Basis of Award

The District reserves the right, in its sole discretion, to reject any and all proposals, or any part thereof, received in response to this Request for Proposals, to re-solicit for new proposals, to waive formalities, to request additional information from any proposer, and to award and negotiate the terms of the contract with any proposer. The District intends to select the firm whose proposal is most advantageous to the District and meets the District's needs and/or this lease-purchase agreement, and not necessarily the firm with the lowest cost proposal. In determining which proposal is most advantageous and in the District's best interests, the District will evaluate, among other things, the overall financing cost (inclusive of any interest and fees) to the District, optional redemption provisions, responsiveness of each proposal to the terms of this RFP and applicable law, the terms and conditions of the proposed agreement, experience and reputation of the proposer in the State of New York. The District shall not have any liability to any proposer for any costs, expenses, losses or damages of any nature incurred in connection with preparing and submitting a response to this request for proposals.

All proposals shall be signed by an individual legally authorized to bind the proposing firm and the signer's name shall also be typed or printed adjacent to or beneath the signature together with his/her title or designation.

Following receipt of the completed proposals, tentative notification may be made to the prospective Lessor whose response best meets the District's needs, in the District's sole discretion and otherwise appears to meet the basis for award. It is expected that a formal award will be made by the Board of Education at a meeting date (to be determined) in August, subject to and contingent upon final review of the Lease Purchase Agreement and all financing documents by the District's legal counsel. Note that the prospective Lessor must provide the District with a draft of its proposed financing documents, together with notification of credit approval in order for District officials to accept and grant final approval.

Tax Opinion

The successful proposer will be furnished without cost with the opinion as to tax exemption by the law firm of Hawkins Delafield & Wood LLP ("Bond Counsel"). The opinion of Bond Counsel shall contain statements to the effect that, in the opinion of said law firm, under existing statutes and court decision and assuming continuing compliance with certain tax certifications described in the Tax Certificate of the District, (i) the portion of the rental payment designated as and constituting interest paid by the District is excluded from gross income for federal income tax purposes under Section 103 of the Code; and (ii) such interest component is not treated as a preference item in calculating the alternative minimum tax under the Code; however, such interest component is included in the "adjusted financial statement income" of certain corporations that are subject to the alternative minimum tax under Section 55 of the Code. The Tax Certificate of the District, which will be delivered concurrently with the delivery of the lease will contain provisions and procedures relating to compliance with applicable requirements of the Code.

Opinion of School Attorney

At closing, the District shall furnish a validity opinion of Kevin Seaman, Esq. ("School Attorney"), dated on the closing date, including a statement to the effect that there is no controversy or litigation of any nature pending or threatened that would restrain or enjoin the execution or delivery of the installment financing agreement, to the best of the School Attorney's knowledge and based on representations made by the District.

Summary of Estimated Dates

RFP sent to providers:	July 17, 2025
Proposal Due:	July 29, 2025 (by 10:00 a.m.)
Selected Lessor Tentatively Approved:	August 11, 2025*
Closing of Lease:	August 25, 2025

*Subject to formal award by Trustees of the Board of Education. The District reserves the right to modify these dates.

Thank you for your interest in the Central Islip Union Free School District and its affiliated Central Islip Public Library (a school district public library) in undertaking a lease-purchase financing for an energy performance project/initiative.

PROPOSAL FORM

ENERGY PERFORMANCE CONTRACT

FOR

CENTRAL ISLIP UNION FREE SCHOOL DISTRICT

To:

Frank Bacchi
Assistant Superintendent for Business
Central Islip Union Free School District
c/o Michael Loguercio
President
Munistat Services, Inc.
12 Roosevelt Avenue
Port Jefferson Station, New York 11776
Phone (631) 331-8888
Fax (631) 331-8834
E-mail: mloguercio@munistat.com

Type of Equipment:	Energy Management Equipment
Transaction Size:	$1,232,212
Structure:	Initial interest payment, and subsequent semi-annual payments of principal and interest, in arrears
Lease Term:	**Please provide amortization schedule for 15 years with first payment, principal and interest starting on August 15, 2026.**

	15 Years **First Payment** **August 15, 2026**
Average Annual Interest Rate:	_____ %
All-In Interest Rate:	_____ %
Payment Structure: (include total principle payments including any Costs of Issuance):	_____
Total Interest over term of Agreement:	$ _____
Purchasers Costs:	$ _____
Total Cost to District over Agreement Term:	$ _____
Semi-annual Payment Amount:	$ _____
Prepayment:	The District will have the optional right to prepay, without incurring any penalties and/or additional expenses, costs or fees, any or all of the principal portion outstanding on any date under the Lease/Purchase upon payment of the then applicable termination value, which will be calculated as 100% of the outstanding principal balance and provided that the District gives a 30 day notice to the Lessor (as determined by the selected maturity schedule

ATTACH AMORTIZATION SCHEDULE

Proposal must identify any costs associated with this proposal and cap these costs. The following costs must be itemized and will be taken into account to determine the all-inclusive cost of borrowing:

First Payment
August 15, 2026

Other Expenses: $ _____

The undersigned Proposer certifies this proposal is firm for **45 days** from the date of submittal. It is the intent of the District to formally award the bid to the selected winner by _____.

Signed: _____

Title: _____ Date: _____

END OF RFP

APPENDIX A

FINANCIAL INFORMATION

Balance Sheet
General Fund

	June 30, 2022	June 30, 2023	June 30, 2024
Assets:			
Cash - Unrestricted	$ 39,161,647	$ 37,152,906	$ 35,671,494
Cash - Restricted	38,093,536	66,881,820	125,951,481
State and Federal Aid	2,677,849	3,181,189	2,584,299
Due from Other Governments	4,590,660	4,743,384	5,709,022
Due from Other Funds	7,603,992	8,931,303	14,824,498
Accounts Receivable	21,991	125,175	273,507
Total Assets	$ 92,149,675	$ 121,015,777	$ 185,014,301
Liabilities:			
Accounts Payable	$ 760,510	$ 2,393,799	$ 1,454,493
Accrued Liabilities	13,981,893	14,418,998	15,276,409
Due to Other Governments	4,011,175	4,281,408	5,919,283
Due to Other Funds	10,013,673	5,663,566	7,794,215
Due to Teachers' Retirement System	10,107,345	11,053,027	10,934,650
Due to Employees' Retirement System	1,086,289	1,091,288	1,328,673
Compensated Absences Payable	3,432,636	3,939,482	3,829,268
Other Liabilities		1,920	
Total Liabilities	43,393,521	42,843,488	46,536,991
Deferred Inflows of Resources:			
New York State Supplemental Aid	486,939	486,940	
Unavailable Revenue- State Aid			486,940
Unavailable Revenue- Charges for Services			293,947
Foster Tuition	407,356	459,472	
Total Deferred Inflows of Resources	894,295	946,412	780,887
Fund Balances:			
Restricted	38,093,536	66,881,820	125,587,415
Assigned	543,035	284,466	556,487
Unassigned	9,225,288	10,059,591	11,552,521
Total Fund Balances	47,861,859	77,225,877	137,696,423
Total Liabilities Deferred Inflows of Resources & Fund Balances	$ 92,149,675	$ 121,015,777	$ 185,014,301

NOTE: This schedule is NOT audited
Source: Audited Financial Statements (2022-2024)

Statement of Revenues, Expenditures and Fund Balance
General Fund

	2020	2021	2022	2023	2024
Revenues:					
Real Property Taxes	$ 85,579,349	$ 86,772,038	$ 86,877,880	$ 85,153,846	$ 85,818,746
Other Tax Items - Including STAR Reimbursement	13,577,962	13,341,753	12,519,685	11,959,958	11,261,413
Charges for Services	574,911	471,135	586,543	844,784	468,503
Use of Money and Property	379,257	142,798	33,678	1,894,157	4,949,306
Sale of Property & Compensation for Loss	1,083,744	1,367,926	1,112,332	1,612,577	2,091,332
Miscellaneous	1,479,535	3,523,454	1,577,932	1,504,761	2,350,503
Interfund Revenues	14,409	6,165			
State Sources	115,729,709	113,167,583	128,993,863	153,422,044	193,424,604
Medicaid Reimbursement	646,349	459,845	563,205		
Federal Sources		1,778,041	13,384	862,289	680,416
Total Revenues	219,065,225	221,030,738	232,278,502	257,254,416	301,044,823
Expenditures:					
General Support	22,451,819	22,560,971	24,017,278	24,908,923	26,464,277
Instruction	113,239,162	111,303,522	114,038,139	119,304,356	124,705,044
Pupil Transportation	11,111,249	9,940,289	11,708,742	11,839,297	12,426,550
Community Service					203
Employee Benefits	55,851,229	58,627,977	59,497,037	63,818,921	68,962,722
Debt Service	8,052,787	7,845,700	7,318,057	7,689,538	4,323,606
Total Expenditures	210,706,246	210,278,459	216,579,253	227,561,035	236,882,402
Excess (Deficiency) of Revenues Over Expenditures	8,358,979	10,752,279	15,699,249	29,693,381	64,162,421
Other Financing Sources and Uses					
Premiums on Obligations				3,840	
Operating Transfers In		161,294	167,640	89,394	81,687
Operating Transfers (Out)	(1,342,745)	(1,492,279)	(6,577,821)	(422,597)	(3,773,562)
Total Other Sources (Uses)	(1,342,745)	(1,330,985)	(6,410,181)	(329,363)	(3,691,875)
Excess (Deficiency) of Revenues and Other Sources Over Over Expenditures and Other (Uses)	7,016,234	9,421,294	9,289,068	29,364,018	60,470,546
Fund Balances - Beginning of Year	22,135,263	29,151,497	38,572,791	47,861,859	77,225,877
Prior Period Adjustment					
Fund Balances - End of Year	$ 29,151,497	$ 38,572,791	$ 47,861,859	$ 77,225,877	$ 137,696,423

NOTE: This schedule is NOT audited
Source: Audited Financial Statements (2020-2024)

Budget Summaries
Fiscal Year Ending June 30:

	Budget 2024-2025	Budget 2025-2026
Revenues:		
Real Property Taxes	$ 91,315,810	$ 94,438,632
PILOT (IDA) Funds	4,500,000	5,200,000
Charges for Services	2,299,000	1,200,000
Medicaid Reimbursements	595,000	
Health Services	105,000	300,000
Refund PY BOCES		750,000
Insurance Recoveries	100,000	1,475,000
Miscellaneous	1,051,000	230,000
Appropriated Fund Balance		3,500,000
State Sources	152,898,797	194,405,353
Total Revenues	$ 252,864,607	$ 301,498,985
Expenditures:		
General Support	$ 27,689,667	$ 31,370,123
Instruction	130,256,876	160,984,446
Pupil Transportation	14,141,338	16,979,803
Community Services		25,000
Employee Benefits	72,128,596	81,752,008
Debt Service	4,838,130	4,377,605
Interfund Transfers	3,810,000	6,010,000
Total Expenditures	$ 252,864,607	$ 301,498,985

Source: Adopted School Budgets
The 2024-2025 budget was approved by the voters of the District on May 21, 2024.
The 2025-2026 budget was approved by the voters of the District on May 20, 2025.

APPENDIX B

ENERGY PERFORMANCE AGREEMENTS

ENERGY SERVICES CONTRACT

BY AND BETWEEN

CENTRAL ISLIP PUBLIC LIBRARY

AND

RENU ENERGY SOLUTIONS

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THIS ENERGY SERVICES CONTRACT ("Contract") is made and entered into as of December 21, 2023 ("Effective Date"), by and between Central Islip Public Library, having its principal place of business located at 33 Hawthorne Avenue, Central Islip, NY 11722 ("Client") and RENU Energy Solutions, having its principal place of business at 20 35th Street, Copiague, NY 11726 ("ESCO"). ESCO and Client are sometimes hereinafter referred to collectively as the "Parties."

WHEREAS, Client desires to retain ESCO to provide certain energy conservation services and installations ("Scope of Services") at Client's project site described in Attachment A ("Property" or "Project Site"), and ESCO wishes to perform such services ("Project");

WHEREAS, Client owns the Property; and

WHEREAS, State of New York legislation provides the authority for public agencies or instrumentalities such as Client to contract for energy services under such terms as described in State or local regulations.

NOW, THEREFORE, in consideration of the mutual promises and agreements contained herein, the Parties hereby agree as follows:

SECTION 1 SCOPE OF SERVICES

(a) Construction Work: Once approval has been issued for this Project and, upon delivery by the Client to ESCO of a Notice To Proceed, substantially in the form attached to this Contract as Attachment D, ESCO shall furnish all labor, materials and equipment and perform all work required for the completion of the Scope of Services set forth in Attachment B, including the installation of the energy conservation measures listed therein ("ECMs"), as such Scope of Services and such Attachments may be modified in accordance with this Contract. If ESCO does not receive a Notice to Proceed from Client within (90) days of the Effective Date, ESCO may adjust the contract price accordingly. Client and ESCO shall mutually plan the scheduling of the construction work. The construction work shall be performed during regular business hours and planned to minimize the interruption of the daily routine of Client's staff and inmates unless otherwise agreed to in writing by the Parties. ESCO will list installed ECMs on Attachment J attached hereto and made a part hereof at the time that construction is complete. Attachment J may be modified as provided for herein.

(b) Disposal: ESCO shall dispose of all non-hazardous equipment and materials which are rendered useless and removed as a result of the installation of the ECMs pursuant to this Contract. In addition, ESCO shall cause all lamps and PCB-contaminated ballasts, if any, which have been rendered useless and removed as a result of the installations of the ECMs to be transported and disposed of via recycling and incineration, respectively. All other existing PCB-contaminated ballasts, lamps and any other hazardous substances, however, remain the responsibility of Client and ESCO shall assume no liability in connection with their removal, handling, transportation, and/or disposal. In all instances, with the only exception being those hazardous materials that ESCO brings to the site, the Client will be the "Generator" of record and sign any and all disposal documents (i.e. manifests, bills of lading, etc.) in order to document the abatement or removal of any such hazardous materials from the Project Site. Notwithstanding anything herein to the contrary, the parties agree and acknowledge that should ESCO encounter any hazardous substances at the Property, after notice to Client, ESCO shall coordinate with a third-party environmental contractor for the removal of the same, at Client's sole cost and expense. ESCO shall, as needed: (1) keep the area of the project site in which the work is being performed free at all times from waste materials, packing materials and other rubbish accumulated in connection with the execution of the work by collecting and depositing said material and rubbish into dumpsters provided at designated locations by ESCO, (2) clean and remove from its own work and from all contiguous work of others any soiling, staining, mortar, plaster, concrete, or dirt caused by the execution of the work, (3) upon the completion of the work in each area, perform such cleaning as may be required to leave the areas "broom clean" and (4) upon the completion of the work, remove all of its materials and/or equipment.

(c) Asbestos: Unless explicitly and specifically identified in Attachment B, ESCO's Scope of Services is predicated on the viability of this Project without any asbestos abatement being required by ESCO. In the event that (i) ESCO encounters any friable asbestos which is in the immediate vicinity of ESCO's work, or (ii)

ESCO determines that its work will result in the disturbance of asbestos material, or (iii) ESCO determines that the presence of asbestos material will impede ESCO's work, ESCO will notify Client of the same and Client will, at its cost, cause the asbestos to be promptly and properly removed, enclosed, encapsulated or otherwise abated in accordance with applicable laws and regulations, or alternatively, Client, at its cost, may provide written test reports showing that asbestos in that area has been properly removed, enclosed encapsulated or otherwise abated in accordance with applicable laws. In the event ESCO cannot determine whether any particular material does or does not contain asbestos, Client, upon ESCO's written request, will, at its cost, promptly perform tests or cause tests to be performed in order to determine whether or not such material contains asbestos and/or whether there are unacceptable levels of airborne particulate material containing asbestos or provide such a test report. Under no circumstances, shall ESCO be required to handle asbestos.

(d) Maintenance: To the extent provided for in Attachment I - "Maintenance Services," ESCO will service and maintain the equipment that is specifically identified therein, at a cost to the Client which is provided for in Section 4 and Attachments G, for the Term of this Contract. Except for ECMs (or other equipment) which are to be maintained by ESCO, Client shall be responsible for servicing and maintaining the ECMs (and such other equipment) at its own cost.

(e) Measurement & Verification: To the extent provided for in Attachment F – "Guarantee of Energy Cost Savings" - ESCO will also supply such ongoing Measurement & Verification services to Client which may be agreed upon by the Parties at an annual fee to be set forth in Section 4 and Attachment G.

(f) Compliance With Law: ESCO shall comply with and obtain, at its expense, all licenses and permits required by Federal, state and local laws in connection with the installation of the ECMs. To the extent that ESCO agrees to perform operations and/or maintenance of specified ECMs or other equipment, it, or its subcontractors shall comply with and obtain, at its expense, all licenses and permits which may be required by Federal, state and local laws in connection with the operation and/or maintenance of such specified ECMs. In the event that ESCO cannot procure any such license or permit in light of a requirement that Client is required to do so, Client will procure the same. ESCO understands and agrees that this project must be performed in accordance with New York State Labor Law.

(g) Taxes: Notwithstanding any other provision herein, Client represents that it is a governmental entity and that it will cooperate with ESCO and provide the same with appropriate documentation so that the ESCO may establish that neither it nor any lessor under the Lease shall have to pay taxes, fees and assessments or other charges of any character which may be imposed or incurred by any governmental or public authority as an incident to title to, ownership of, or operation of the ECMs or with respect to the interest component of the Lease payments which would otherwise be levied upon or in respect to said interest component of the ECMs or their operation.

(h) Non-Discrimination: ESCO agrees not to discriminate against any employee, or applicant for employment, to be employed in the performance of this Contract, with respect to hire, tenure, terms, conditions or privileges of employment, or any matter directly or indirectly related to employment, because of age, sex, race, disability, color, religion, national origin, Vietnam era military service or ancestry in accordance with applicable Federal, New York State or local laws.

(i) Standards of Service and Comfort: Client shall operate the ECMs in a manner that shall provide the standards of service and comfort provided for in Attachment K hereto.

(j) Specifications: Prior to beginning the work hereunder, ESCO may provide (or Client, at its option, may reasonably request to have ESCO provide) written specification of, any ECMs to be installed. Client shall furnish its written approval or disapproval of each such written specification within fifteen (15) working days following its receipt of written notice by ESCO of completion of each such sample installation or the provision of such written specifications to Client. Client's approval of such specifications shall be in substantially the form of Attachment M hereto. If Client disapproves any such ECM, ESCO shall have the right to provide a substitute ECM which conforms to the applicable specifications or is equivalent to any applicable sample provided. Thereafter, ESCO shall revise the Attachments to reflect the substitute ECMs (in writing). In the event that Client does not approve or disapprove of any ECM(s) within the timeframe set forth herein, Client shall be deemed to have given its approval. Client shall not unreasonably withhold any approval provided for herein.

(k) Duties, Obligations and Responsibilities of ESCO:

(i) All labor furnished under this Contract shall be competent to perform the tasks undertaken, that all materials and equipment provided shall be of appropriate quality, and that the completed work shall comply with the requirements of this Contract.

(ii) ESCO shall maintain the Project Site in a reasonably clean condition during the performance of the construction work.

(iii) ESCO shall thoroughly and regularly clean the Project Site of all nonhazardous debris, trash and excess material or equipment.

(iv) At all times relevant to this Contract, ESCO shall permit Client or any of its representatives to enter upon the Project Site to review or inspect the construction work without formality or other procedure.

(v) ESCO will provide equipment manuals and other appropriate information regarding equipment installed hereunder to Client at or about the time of Substantial Completion.

(l) Architectural Construction Services:

ESCO shall not perform professional services including engineering or architecture. ESCO shall subcontract with BBS Architects & Engineer, P.C. for the design and engineering services to be performed pursuant to this Contract. All costs associated with said firm in connection with this project shall be the responsibility of ESCO. The work performed by such professional engineering firm will provide design and engineering services in relation to the required submissions to the New York State Education Department (NYSED) in order to seek approvals for the permissible amount of New York State Building Aid available for the purposes of this Project. It is understood and agreed that the engineer selected shall provide services in connection with the contract pursuant to the requirements set forth in the RFP, Attachment 1, Scope of Architectural Services.

SECTION 2 OWNERSHIP OF ECMS

Ownership of and title to the ECMs referenced in Attachment E(1) to each Delivery and Acceptance Certificate (Attachment E) will automatically transfer to the Client upon both: (a) the delivery of each such Delivery and Acceptance Certificate and Attachment E(1) by Client to ESCO, the execution and delivery of which shall not be unreasonably withheld or delayed, and (b) completion of all Client's payment obligations to ESCO, excluding payment obligations related to maintenance or other annual services hereunder. Subject and subordinate to any lessor's rights pursuant to any lease for this project, ESCO under this Contract shall be entitled to all rights, benefits and remedies afforded a secured party under law with respect to the equipment installed pursuant to this Contract, including but not limited to those under the Uniform Commercial Code, as adopted in the State of New York or any other applicable state ("Code"). ESCO shall retain such security interest in the ECMs, pursuant to this Contract, for equipment installed hereunder until Client shall have accepted the same and title has transferred to Client. If requested by ESCO in connection therewith, Client agrees to provide to ESCO appropriate financing statements and other documents necessary in order for ESCO and/or any bank, lender or financial institution to which ESCO has assigned any interest in this Contract, to perfect said subordinate security interest in the ECMs..

SECTION 3 FINANCIAL SERVICES

ESCO shall provide Client with revised cash flow spreadsheets after the following events: (a) upon approval by the New York State Department of Education of the project submission and any related revisions; (b) upon issuance of the New York State Aid report (SA4 Report) identifying the state aid allocated for the project (if applicable); and (c) upon other agreed upon changes to the Project. Prior to commencement of the project (if applicable); and (c) upon other agreed upon changes to the Project. Prior to commencement of the Project, in the event the Project does not create positive cash flow, ESCO and Client shall agree on modifications to the Project to enable the Project to create positive cash flow.

SECTION 4 COMPENSATION AND PAYMENT

(a) The cost of the Project is Two Million Four Hundred Seventy Two Thousand One Hundred Eighty Nine Dollars ($2,472,189.00).

(b) During the period beginning as of the Effective Date and continuing through the Date of Substantial Completion with respect to each Phase, Client will make monthly progress payments to ESCO based upon the portion of the Project completed at the end of each month, as respectively provided for in Attachment G for which payment is being made. Client shall (within five (5) days of receipt) execute and deliver to ESCO completed forms E-1 (Attachment E-1) upon completion by ESCO of each ECM. A Final Delivery and Acceptance Certificate (Attachment E-2) shall be executed by Client upon final completion of the ECMs. Client shall not unreasonably withhold or delay the execution of any Delivery and Acceptance Certificate, which shall be deemed approved by ESCO if Client has not taken action with respect to any Certificate within ten (10) days of its receipt thereof. For the purposes of this Contract the term "Substantial Completion" shall mean that the subject ECM has been demonstrated by ESCO to be operating in a manner consistent with its manufacturer's intended use. For the purposes of this Contract, the terms "Final Completion" or "Final Acceptance" shall mean that ESCO has fulfilled all of its construction obligations for all ECMs installed under this Contract. This shall include the completion of all punchlist items and the submission of all required documentation.

(c) During the month following each successive twelve (12) month period beginning with the first day of the month following the date on which the Client executes a Final Delivery and Acceptance Certificate (Attachment E-2), Client shall pay the annual maintenance and measurement and verification (M&V) service fees (collectively, the "Performance Period Fee") set forth in Attachment G.

(d) Client shall pay ESCO's invoice no later than forty-five (45) days following the date on which such invoice is postmarked, when provided to Client by mail, or the date on which the invoice was emailed to Client.

(e) Amounts not in dispute and not paid to ESCO on or before the due dates specified in Sections 4(a)-(d) above will accrue interest at the maximum rate as permitted by New York Law, until such time as such amount due has been paid in full.

(f) The services provided for hereunder may overlap one another. In that regard, the payments to be made by Client to ESCO with respect to one or more services shall be in addition to one another.

(g) Client may purchase an extended warranty from ESCO on all ECMs and related equipment installed under this Contract for an amount to be mutually determined.

SECTION 5 TERM

The Term of this Contract shall begin on the Effective Date and shall end on that date which is exactly eighteen (18) years from the first day of the month following the date of execution of the Delivery and Acceptance Certificate upon Substantial Completion of this Project by the Client, unless terminated prior to such date, as provided for in Section 12 and/or Section 14 and/or Section 32 of this Contract. If not otherwise terminated as provided for herein, the Term shall terminate simultaneously with any termination of the Financing, at ESCO's sole and absolute discretion. Notwithstanding the foregoing, nothing in this Section 5 shall relieve the Client from paying amounts which accrued prior to such termination of this Contract, when due under this Contract.

SECTION 6 GUARANTEE OF ENERGY SAVINGS

ESCO will guarantee to Client the amount of energy savings determined in accordance with Attachment F, "Guarantee of Energy Cost Savings".

SECTION 7 RIGHT OF ENTRY/SPACE

During the Term, Client shall provide ESCO, and its employees, agents and subcontractors, including any utility which provides or may provide any payment under this Contract, access to the Property for the purpose of fulfilling ESCO's obligations under this Contract. Client shall provide mutually satisfactory space for the installation and operation of the ECMs and shall protect such equipment in the same careful manner that Client protects its property. Additionally, Client shall provide ESCO Contract remote electronic access to the Energy Management System (if required) during the Term of this Contract. ESCO shall obey and abide by all reasonable rules of Client relative to the Property as they would directly relate to ESCO's performance of its obligations under this Contract.

SECTION 8 CHANGES IN WORK

The quantity, quality, dimensions, type or other characteristics of the ECMs may be changed only by written consent of Client and ESCO (and, where required by the Lease, the Lessor), via the execution of a Change Order Form (Attachment H). In addition, the Scope of Services may be reduced or expanded to include other significant energy efficiency measures and facilities not included within the ECMs listed on Attachment B (and, following Substantial Completion, listed on Attachment J) by the execution of such a Change Order Form.

SECTION 9 WARRANTIES

All warranties for materials and workmanship are stipulated by ECM in Attachment B (Scope of Services). The following provisions will be in effect should any warranty language be omitted from Attachment B.

(a) ESCO warrants that the design, contracted engineering, and installation services it performs will be performed consistent with industry-standard practices and that such work is warranted to be free from defects in materials and workmanship for a period of two (2) years from the date of execution of the Delivery and Acceptance Certificate by the Client with respect to Substantial Completion. Any manufacturers' warranties which exceed this two (2) year period shall be assigned to Client to the extent allowed by the manufacturer. Except as provided above, ESCO MAKES NO WARRANTIES OR REPRESENTATIONS OF ANY KIND, WHETHER STATUTORY, WRITTEN, ORAL OR IMPLIED, INCLUDING WITHOUT LIMITATION, WARRANTIES AS TO THE VALUE, DESIGN, AND CONDITION OR FITNESS FOR USE OR PARTICULAR PURPOSE AND MERCHANTABILITY, REGARDING THE ECMs OR ANY SERVICES PROVIDED HEREUNDER.

(b) Individual ECM warranties that extend beyond the warranty defined in (a) above will transfer to Client. ESCO will not be responsible for administering extended warranties.

(c) Client may purchase extended warranty coverage for all equipment installed under this Contract as long as the annual cost of the project inclusive of the extended warranty coverage does not exceed the guarantees savings value should this Contract be subject to rules or laws requiring annual savings to exceed annual costs. Payment of such shall be in accordance with Section 4(d) and Attachment G.

SECTION 10 CLIENT ROLE AND RESPONSIBILITIES

(a) Operations: Client shall operate the equipment installed hereunder in accordance with the manufacturers' recommendations and the procedures supplied to Client by ESCO.

(b) Maintenance: Client shall, at its expense, maintain the Property in good working order during the Term of this Contract. Except as may otherwise be provided for in Attachment I, Client will maintain, at Client's expense: (i) the equipment and all other components which comprise the ECMs (following the date of Substantial Completion), and (ii) all other equipment which is attached thereto and/or is integral to the proper functioning of the ECMs.

(c) Malfunctions: Client will notify ESCO immediately in the event of any malfunction in the operation of the ECMs or the equipment installed hereunder.

(d) Protection of ECMs: Except in the case of emergency, Client will not remove, move, alter, turn off or otherwise significantly affect the operation of the equipment installed hereunder or the operation of the ECMs, or any individual part thereof, without the prior approval of ESCO, which approval shall not be unreasonably withheld. After receiving ESCO's approval, Client shall proceed as instructed. Client shall act reasonably to protect the ECMs from damage or injury, if, due to an emergency, it is not reasonable to notify ESCO before acting. Client agrees to protect and preserve the facility envelope and the operating condition of all ECMs, mechanical systems, and other energy consuming systems located on the Property.

(e) Measurement & Verification System: Client shall not alter, move, modify or otherwise change the measurement and verification system or any component thereof without the written consent of ESCO unless such action is in accordance with operating procedures provided by ESCO.

(f) Adjustment to Baseline: If, in the reasonable opinion of ESCO, Client does not reasonably protect the ECMs and/or maintain the Property in good repair and good working condition, then ESCO will equitably adjust the baseline, as referenced in Attachment F, for any increased energy usages at the Property.

(g) Changes to Property: Client will notify ESCO in writing at least thirty (30) days prior to making any change to the Property that would significantly affect the energy usage at the Property, including but not limited to changes in the hours or days that the Property is occupied or operated, the number of occupants (including, but not limited to, staff and inmates), the activity conducted, the equipment, or the size of the Property. In the event ESCO receives such notification or otherwise determines that such a change has occurred, ESCO, at Client's sole cost and expense, shall make the appropriate revisions to the Attachments or take such other action as may be provided for hereunder.

(h) Energy Usage Data: Client will make available to ESCO, on a monthly basis for the Term of this Contract, copies of all energy bills, energy usage data, and any and all other such documentation maintained by the Client, as requested by ESCO, which is necessary for ESCO to determine and satisfy all of its obligations under this Contract.

(i) Insurance and Risk of Loss or Damage: Without limiting any of its obligations or liabilities under this Contract, the Client will, at its expense, provide and maintain at all times during the Term of this Contract, sufficient insurance against the loss or theft of or damage to the ECMs related equipment and all components installed hereunder, for the full replacement value thereof.

Client shall purchase and maintain all-risk full cost replacement property insurance in form acceptable to ESCO for the duration of Project and Term. The insurance shall include ESCO, its subcontractors and sub-subcontractors as additional insureds. Client shall provide ESCO with copies of said insurance coverage prior to the commencement of the Project.

Client assumes all risk of loss of or damage to the ECMs from any cause whatsoever except to the extent that such loss or damage was caused by the negligence of ESCO. In the event of damage to any item of the equipment installed hereunder or ECMs, Client will promptly notify ESCO and immediately place the same in good repair with the proceeds of any insurance received applied to the cost of such repair. If Client determines that any item of the ECMs is lost, stolen, confiscated, destroyed or damaged beyond repair, Client will replace the same with like equipment in good repair in a timely fashion.

If, following Client's execution of the Delivery and Acceptance Certificate to be provided upon Substantial Completion and subsequent to Client's complete payment to ESCO in accordance with Section 4(a), as that amount may then have been modified in accordance with this Contract, any fire, flood, other casualty, or condemnation renders a majority of the Property incapable of being occupied and renders the ECMs or the equipment installed hereunder inoperable and, in the case of a casualty, the affected portion of such ECMs or equipment is not reconstructed or restored within one hundred and twenty (120) days from the date of such casualty, ESCO and/or Client may terminate this Contract by delivery of a written notice to the other Party. Upon such termination, Client shall pay ESCO any amounts, or pro-rata portions thereof, accrued under Section 4(b)-(e), Attachment G and the applicable Termination Value, if any, set forth on Attachment L or in Section 4. ESCO shall not be responsible for any savings deficiencies resulting from ECMs being rendered useless for the period of time prior to reconstruction of the ECM. The savings Guarantee will be adjusted to account for the unavailability of the ECM.

(j) Telephone/Broadband: Client is responsible for installing and maintaining either telephone lines or providing broadband access to the energy management system via Client's Local Area Network (LAN). Client is responsible for all associated costs for the energy management system's telephone lines or broadband access.

(k) Protection. Client shall at all times act reasonably to protect the ECMs from damage, theft or injury to the same extent and in the same manner in which it protects its other property.

(l) Alteration: Client agrees not to move, alter or change the ECMs in any way that causes a reduction in the level of efficiency or savings generated by any ECM or the equipment installed hereunder without obtaining ESCO's prior written approval which shall not be unreasonably withheld.

(m) Storage: ESCO shall store all materials, supplies, tools, and equipment ("Stored Materials") at the Property, within a rent-free area, in a location agreed to by the parties, of Client's parking lot. ESCO shall bear all risk of loss for the Stored Materials but only to the extent that any loss is not attributable to any act or omission of Client. Access to this storage area shall be limited to ESCO, its subcontractors, and Client-assigned personnel exclusively.

(n) Fuel: Client shall procure and pay for all energy and fuel for the operation of the Property.

SECTION 11 DEFAULTS BY CLIENT AND ESCO

(a) Client shall be in default under this Contract upon the occurrence of any of the following:

(i) Client fails to pay when due any amount to be paid under this Contract and such failure continues for a period of thirty (30) working days after notice of overdue payment is delivered by ESCO to Client;

(ii) Client fails to perform or meet any of its required duties or obligations under this Contract and fails to cure such failure and the effects of such failure within thirty (30) days of receipt of written notice of default, unless such failures and effects cannot be completely cured within thirty (30) days after said written notice, in which case a default shall exist only if Client does not commence and diligently pursue to cure such failure and effects as soon as possible;

(b) ESCO shall be in default under this Contract upon the occurrence of the following:

(i) ESCO fails to perform or meet any of its required duties or obligations under this Contract and fails to cure such failure or effects of such failure within thirty (30) days of receipt of written notice of default, unless such failure or effects cannot be completely cured within thirty (30) days after said written notice, in which case a default shall exist only if ESCO does not commence and diligently pursue to cure such failure as soon as possible.

SECTION 12 REMEDIES FOR DEFAULTS

(a) In the event Client defaults under this Contract, ESCO:
(i) may bring actions for any remedies available at law or in equity or other appropriate proceedings for the recovery of direct damages, (including amounts past due), and/or bring an action in equity for specific performance; and
(ii) without recourse to legal process, may terminate this Contract by delivery of written notice of termination.

(b) In the event ESCO defaults under this Contract, Client may terminate this Contract and bring an action in law for direct damages.

SECTION 13 NO ARBITRATION

Disputes involving this Contract including the breach or alleged breach thereof, may not be submitted to binding arbitration but must, instead, be heard in a court of competent jurisdiction of the State of New York.

SECTION 14 TERMINATION

At any time after the Client has executed the Delivery and Acceptance Certificate to be provided upon Substantial Completion, Client may terminate this Agreement upon thirty (30) days written notice to ESCO, provided that Client has paid to ESCO: (a) all amounts due, subject to Section 32, as set forth in Section 4 and on Attachment C.

SECTION 15 INSURANCE AND BONDING

Without limiting any of its obligations or liabilities under this Contract, ESCO shall provide and maintain at its expense the insurance policies and other coverage set forth in the Central Islip Public Library- RENU Energy Solutions Insurance Requirements Agreement dated October 25, 2023, annexed hereto in Attachment N.

(a) In accordance with Section 142 of the State Finance Law, this Contract shall be void and of no force and effect unless ESCO provides and maintains coverage during the life of the Contract for the benefit of such employees as are required to be covered by the provisions of the Workers Compensation Law.
(b) Comprehensive General Liability Insurance, including contractual liability. (Intentionally omitted).
(c) Comprehensive Automobile Liability Insurance, including owned, non-owned and hired automotive equipment. (Intentionally omitted).
(d) Payment and Performance Bond. (Intentionally omitted).

SECTION 16 INDEMNIFICATION AND LIMIT OF LIABILITY

(a) Notwithstanding any other provision herein, ESCO, its officers, employees, agents, affiliates, or subcontractors' aggregate liability in contract, tort, or otherwise, without limitation, under this Contract, shall in all cases be limited to the sum of the payments received by ESCO pursuant to this Contract.

(b) (Intentionally Omitted).

(c) ESCO shall be solely responsible for and shall indemnify and hold harmless the Client, its officers, employees, and agents (the "Indemnified Parties") from and against any and all liabilities, losses, costs, expenses (including, without limitation, reasonable attorneys' fees and disbursements) and damages ("Losses"), arising out of or in connection with any acts or omissions of ESCO or a ESCO Agent, but only to the extent taken pursuant to or authorized by this Contract and due to negligence, fault, or default, including Losses in connection with any threatened investigation, litigation or other proceeding or preparing a defense to or prosecuting the same; provided, however, that ESCO shall not be responsible for that portion, if any, of a Loss that is caused by the negligence or wrongful act of the Client.

(d) ESCO shall, upon the Client's demand and at the Client's direction, promptly and diligently defend, at ESCO's own risk, expense and by counsel by their choosing, any and all suits, actions, or proceedings which may be brought or instituted against one or more Indemnified Parties for which ESCO is responsible under this Section and ESCO shall pay and satisfy any judgment, decree, loss or settlement in connection therewith.

(e) ESCO shall, and shall cause ESCO Agents to, cooperate with the Client in connection with the investigation, defense or prosecution of any action, suit or proceeding in connection with this Contract including the acts or omissions of ESCO and/or a ESCO Agent in connection with this Contract.

(f) The provisions of this Section shall survive the termination of this Contract.

SECTION 17 CONTRACT INTERPRETATION AND PERFORMANCE

The interpretation and performance of this Contract, and the interpretation and enforcement of the rights of the Parties hereunder, shall be in accordance with and controlled by the laws of the State of New York, except where the Federal supremacy clause requires otherwise. In the event of any ambiguity or conflict in meaning, the terms of this Contract shall not be construed against the drafting Party based upon that Party's having drafted this Contract.

SECTION 18 PRIVILEGED AND PROPRIETARY INFORMATION

ESCO's systems, means, cost, and methodologies of evaluating, implementing, accomplishing and determining energy savings and the terms of the Contract for this Project shall be considered privileged and proprietary information. Client shall use the same level of effort to protect and safeguard such information as it employs to safeguard its own confidential information. Client shall not disclose such proprietary information without the express written consent of an officer of ESCO unless required to do so by statute or regulation. When any request for disclosure of such information is made under any applicable freedom of information law, Client will provide prompt verbal and written notice to ESCO such that ESCO will have the opportunity to timely object under FOIL should it desire to object to such disclosure of that information in whole or in part. In the event that Client is required to make a filing with any agency or other governmental body, which includes such information, Client shall notify ESCO and cooperate with ESCO in order to seek confidential treatment of such information included within any such filing or, if all such information cannot be protected from disclosure, to request that Client be permitted to redact portions of such information, as ESCO may designate, from that portion of said filing which is to be made available to the public.

SECTION 19 SEVERABILITY

In the event that any clause or provision of this Contract or any part thereof shall be declared invalid by any court having jurisdiction, such invalidity shall not affect the validity or enforceability of the remaining portions of this Contract.

SECTION 20 ASSIGNMENTS AND SUBCONTRACTING

(a) ESCO may elect, in its sole and absolute discretion, to use subcontractors in meeting its obligations in this section.

(b) Client shall not assign, transfer, or otherwise dispose of this Contract, the ECMs, or any interest therein, or sublet or lend the ECMs or permit the ECMs to be used by anyone other than the Client and Client's employees without the prior express written consent of ESCO (or, if applicable, the Lessor).

(c) ESCO shall not assign this Contract in whole or in part to any other party without first obtaining the consent of Client, which consent shall not be unreasonably withheld. Notwithstanding the foregoing, ESCO may assign, without obtaining the consent of Client, its rights and obligations under this Contract in whole or in part to any affiliated or associated company of ESCO. ESCO will notify Client fifteen (15) days prior to any such assignment.

SECTION 21 WAIVER

The failure of either Party to require compliance with any provision of this Contract shall not affect that Party's right to later enforce the same. It is agreed that the waiver by either Party of performance of any other terms of this Contract or of any breach thereof will not be held or deemed to be a waiver by that Party of any subsequent failure to perform the same or any other term or condition of this Contract or any breach thereof.

SECTION 22 FORCE MAJEURE

(a) If either Party shall be unable to carry out any part of its obligations under this Contract (except Client's obligation to make payments when due) due to causes beyond its control ("Force Majeure"), including but not limited to an act of God, strikes, lockouts or other industrial disturbances, acts of public enemies, orders or restraints of any kind of the government of the United States or any state or any of their departments, agencies, or officials, or any other civil governmental, transportation delays, military or judicial authority, war, blockage, insurrection, riot, sudden action of the elements, pandemic, fire, explosion, flood, earthquake, storms, drought, landslide, or explosion or nuclear emergency, this Contract shall remain in effect but the affected Party's obligations shall be suspended for a period equal to the disabling circumstances, provided that:

(i) the non-performing Party gives the other Party prompt written notice describing the particulars of the Force Majeure, including but not limited to the nature of the occurrence and its expected duration, and continues to furnish timely regular reports with respect thereto during the period of Force Majeure.

(ii) the suspension of performance is of no greater scope and of no longer duration than is required by the Force Majeure.

(iii) no obligations of either Party that arose before the Force Majeure causing the suspension of performance are excused as a result of the Force Majeure.

(iv) the non-performing Party uses reasonable efforts to remedy its inability to perform; and

(v) the Term of this Contract, at ESCO's option, shall be extended for a period equal to the number of days that the Force Majeure prevented the non-performing Party from performing.

(b) Any decision by Client to close or change the use of the facilities or ECMs at the Property shall not constitute a Force Majeure excusing Client's performance under this Contract.

SECTION 23 CONTRACT DOCUMENTS

(a) As of the Effective Date, this Contract and its Attachments will constitute the entire Contract between the Parties relating to the subject matter hereof, and supersedes all proposals, previous agreements, discussions, correspondences, and all other communications, whether oral or written, between the Parties relating to the subject matter of this Contract.

(b) Headings are for the convenience of reference only and are not to be construed as a part of the Contract.

(c) This Contract may not be modified or amended except in writing signed by the Parties.

(d) This Contract may be executed simultaneously in two (2) or more counterparts, each of which shall be deemed an original but all of which together shall constitute one and the same instrument.

SECTION 24 NOTICES

All notices and other communication under this Contract (other than regularly scheduled payments) shall be deemed properly given upon receipt if delivered in person or sent by electronic facsimile with regular mail follow-up or sent by overnight delivery service or sent by registered mail, return receipt requested and postage prepaid, addressed as follows:

To: Client
Central Islip Public Library
33 Hawthorne Avenue
Central Islip, NY 11722
Attention: Tara Kohles

To ESCO:
RENU Energy Solutions
20 35th Street
Copiague, NY 11726
Attention: Robert Ragozine, Vice President

With a Copy To:
COTTER LAW GROUP
Attorneys for RENU Energy Solutions
272 Plandome Road
Manhasset, New York 11030

Either Party may change such address from time to time by written notice to the other Party.

SECTION 25 RECORDS

ESCO shall establish and maintain complete and accurate books, records, documents and other evidence (Records) directly pertinent to performance under this Contract. The Records shall be kept for the balance of the calendar year in which they were made and for three (3) years after final payment. The State Comptroller, the Attorney General, the Commissioner of Education, and any other person or entity authorized to conduct an examination, as well as the agency or agencies involved in this contract, shall have access to the Records during normal business hours at an office of the ESCO within the State of New York or, if no such office is available, at a mutually agreeable and reasonable venue within the State, for the term specified above for the purposes of inspection, auditing and copying. Client shall take reasonable steps to protect from public disclosure any of the Records pertaining to this Contract which have been generated by ESCO and which Client maintains are exempt from disclosure under Section 87 of the Public Officer's Law (the "Statute") provide that; (i) ESCO shall timely inform the appropriate Client official, in writing, that said records should not be disclosed; and (ii) said records shall be sufficiently identified; and (iii) designation of said records as exempt under the statute is reasonable. If said records are not exempt from disclosure under Section 87 of the Public Officers Law, said records will be disclosed pursuant to law. Nothing contained herein shall diminish, or in any way adversely affect Client's right to discovery in any pending or future litigation contract.

SECTION 26 REPRESENTATIONS AND WARRANTIES

Each Party warrants and represents to the other that:

(a) It has all requisite power, authority, licenses, permits, and franchises, corporate or otherwise, to execute and deliver this Contract and perform its obligations hereunder;

(b) Its execution, delivery, and performance of this Contract have been duly authorized by, or are in accordance with, as to ESCO, its organic instruments and, as to Client, by all requisite municipal, board, or other action and are not in breach of any applicable law, code or regulation; this Contract has been duly executed and delivered by the signatories so authorized, and constitutes each Party's legal, valid and binding obligation;

(c) Its execution, delivery, and performance of this Contract shall not result in a breach or violation of, or constitute a default under, any agreement, lease or instrument to which it is a party or by which it or its properties may be bound or affected; and

(d) It has not received any notice, nor to the best of its knowledge is there pending or threatened any notice of any violation of any applicable laws, ordinances, regulations, rules, decrees, awards, permits or orders which would materially adversely affect its ability to perform hereunder.

(e) The persons executing this Contract are fully authorized by law to do so.

(f) In addition, Client warrants and represents to ESCO that Client has obtained or shall obtain all necessary governmental, legal, administrative and any other approval necessary for it to enter into this Contract.

SECTION 27 INDEPENDENT CONTRACTOR

Nothing herein shall be construed as reserving to Client any right to exercise any control over or to direct in any respect the conduct or management of business or operations of ESCO on the Property. The entire control or direction of such business and operations shall be in and shall remain in ESCO, subject only to ESCO's performance of its obligations under this Contract. Neither ESCO nor any person performing any duties or engaged in any work on the Property on behalf of ESCO shall be deemed an employee or agent of Client.

Nothing in this Section shall be deemed to be a waiver of the Client of the right to use its property. Client and ESCO are independent of one another and, except as otherwise established herein, shall have no other relationship relating to or arising out of this Contract. Neither Client and ESCO shall have or hold itself out as having the right or authority to bind or create liability for the other by its intentional or negligent act or omission, or to make any contract or otherwise assume any obligation or responsibility in the name of or on

behalf of the other.

It is understood and agreed that ESCO, its employees, agents, subcontractors and employees of such agents and subcontractors, shall adhere to Client's policies with respect to conduct on Client property as well as any and all federal, state, and local laws, rules, ordinances, Client policies and procedures applicable to construction projects on Client premises.

SECTION 28 ADDITIONAL REPRESENTATIONS AND WARRANTIES OF CLIENT

Client hereby warrants and represents to ESCO that:

(a) Client presently intends to continue to use the Property in a manner reasonably similar to its present use;

(b) Aside from the current renovations underway at the Property limited to that ESCO is aware of, Client does not presently contemplate any changes to the electrical and thermal consumption characteristics of the Property as these existed during the base period except as may have been disclosed to ESCO by Client in writing prior to the execution of this Contract, or those changes deemed necessary as a result of ESCO's discovery of concealed or unknown physical conditions while performing its work hereunder at the Property;

(c) Client has provided ESCO with all records heretofore requested by ESCO and, in that regard, ESCO acknowledges that it has received base period data from Client which appears to be complete as of the date of this Contract, and that the information set forth therein is, and all information in other records to be subsequently provided pursuant to this Contract shall be, true and accurate in all material respects except as may be disclosed by Client in writing;

(d) Client has not entered into any contracts or agreements for the Property with persons or entities other than ESCO regarding the provision of the energy services referenced herein.

(e) Any change in inmate population or other design parameter that impacts consumption will be disclosed to ESCO. The impact on energy saving calculations will be mutually agreed upon by ESCO and Client at the time a change is determined.

SECTION 29 ABSENCE OF FRAUD OR COLLUSION

In accordance with Section 139-d of the State Finance Law and/or Section 103 of the General Municipal Law, ESCO warrants, by its execution of this Contract, that no official or employee of Client has any pecuniary interest in this Contract or in the expected profits to arise here from, and that this Contract is made in good faith without fraud or collusion with any other person involved in the bidding process.

SECTION 30 NEGLIGENT/WRONGFUL ACTS

It is understood and agreed that neither Party to this Contract shall be liable for any negligent or wrongful acts, either of commission or omission, chargeable to the other, unless such liability is imposed by law, and that this Contract shall not be construed as seeking to either enlarge or diminish any obligation or duty owed by one Party against the other or against third parties.

SECTION 31 FURTHER DOCUMENTS AND EVENTS

The Parties shall execute and deliver all documents and perform all further acts that may be reasonably necessary to effectuate the provisions of this Contract, in that regard, it being understood and agreed that ESCO covenants and agrees to execute or procure the execution of all documents reasonably required to release any lien held by ESCO or its assignees upon the termination of this Contract and payment of all amounts required to be paid by Client to ESCO, pursuant to this Contract, including but not limited to the Termination Value, if any. It being further agreed and understood that Client agrees to execute all documents which may be reasonably required by an entity which provides funds for any financing contemplated herein and to cooperate with ESCO in obtaining such funds.

It is further understood that Client agrees to execute all documents which may be reasonably required to obtain all licenses, permits and governmental approvals required by ESCO for installation and operation of the ECMs. ESCO's obligations hereunder are also subject to obtaining any such licenses, permits and governmental approvals.

SECTION 32 NON-APPROPRIATION

This Contract shall be executory only to the extent of the monies appropriated and available for the purposes of the Contract, and no liability on account therefore shall be incurred beyond the amount of such monies. It is understood that neither this contract nor any representation by any public employee or officer creates any legal or moral obligation to request, appropriate or make available monies for the purpose of this Contract.

SECTION 33 THIRD-PARTY BENEFICIARIES

Except as may be specifically provided for in this Contract, the Parties hereto do not intend to create any rights for, or grant any remedies to, any third-party beneficiary of this Contract.

SECTION 34 NOTIFICATIONS OF GOVERNMENTAL ACTION - OCCUPATIONAL SAFETY AND HEALTH

The Parties agree to notify each other as promptly as is reasonably possible upon becoming aware of an inspection under, or any alleged violation of, the Occupational Safety and Health Act or any other provision of Federal, State or Local law, relating in any way to the undertakings of either Party under this Contract.

SECTION 35 REFERENCES

Unless otherwise stated all references to a particular Attachment or to Attachments herein are to the referenced Attachment or Attachments which are attached to this Contract and all such referenced Attachments are incorporated by reference within this Contract. All references herein to a Section shall refer to a Section of this Contract unless this Contract specifically provides otherwise.

SECTION 36 APPROVAL

ESCO and Client acknowledge that this Contract is subject to 8NYCRR 155.20 and, as such, requires the approval of the Commissioner of Education of the State of New York. This Contract shall not be executory until SED approval is obtained, however, Client's execution hereof signifies its obtaining of such approval. Prior to SED approval, it shall be ESCO's sole responsibility to validate each ECM with Client and gain their final approval of the savings numbers as outlined herein. Client will be responsible to secure financing for the Project.

Notwithstanding the above, should any portion of this Contract fail to be approved by SED, or, if the Scope of Work contained in this Contract is not approved by SED in its entirety, Client may, at its sole discretion, elect to terminate this Contract. Other than ESCO's entitlement to payment for any work performed, or expenses incurred, up until the date of termination, it shall have no remedy at law or in equity for such termination.

IN WITNESS WHEREOF, the duly authorized officers or representatives of the Parties have set their hand on the date first written above with the intent to be legally bound.

Central Islip Public Library

T. Kohles
Signature

Tara Kohles - Director
Print Name and Title

12/21/23
Date

RENU Energy Solutions

Robert Ragozine
Signature

Robert Ragozine, VP Energy Solutions
Print Name and Title

12/21/23
Date

ATTACHMENTS:

ATTACHMENT A - PROPERTY DESCRIPTION

ATTACHMENT B - SCOPE OF SERVICES

ATTACHMENT C – FINANCING DOCUMENTS

ATTACHMENT D - NOTICE TO PROCEED

ATTACHMENT E1 and E2 - DELIVERY AND ACCEPTANCE CERTIFICATES

ATTACHMENT F - GUARANTEE OF ENERGY COST SAVINGS

ATTACHMENT G - CONTRACT COST AND ANNUAL SERVICES

ATTACHMENT H - CHANGE ORDER FORM

ATTACHMENT I - MAINTENANCE SERVICES

ATTACHMENT J – PROPOSED CONSTRUCTION SCHEDULE

ATTACHMENT K – STANDARDS OF SERVICE

ATTACHMENT L – MODIFICATIONS TO COMPREHENSIVE ENERGY AUDIT

ATTACHMENT M - FORM OF CLIENT'S APPROVAL OF SAMPLE OR SPECIFICATIONS

ATTACHMENT N – INSURANCE REQUIREMENTS

ATTACHMENT A

PROPERTY DESCRIPTION

Table A.1 Properties	
Facility	**Address**
Central Islip Public Library Main Building and Storage Building	33 Hawthorne Avenue Central Islip, NY 11722

ATTACHMENT B

SCOPE OF SERVICES

DESCRIPTION OF THE ENERGY CONSERVATION MEASURES AND THE EQUIPMENT

Building Name	ECM #	Proposed Energy Conservation Measure (ECM)
Central Islip Public Library	1	Roof Replacement
Central Islip Public Library	2	Building Envelope Upgrades
Central Islip Public Library	3	Rooftop Solar
Central Islip Public Library	4	LED Lighting and Controls
Central Islip Public Library	5	Rooftop Unit Upgrades and VAV Boxes
Central Islip Public Library	6	Replace Heat Pump with High Efficiency Heat Pump
Central Islip Public Library	7	Replace Vestibule Fan Coil Unit with High Efficiency Heat Pump
Central Islip Public Library	8	Building Management System
Central Islip Public Library	9	Demand Control Ventilation (DCV)
Central Islip Public Library	10	High Efficiency Gas-Fired Water Heater
Central Islip Public Library	11	Plug Load Controllers

Scope of Work:

ECM 1: Roof Replacement

1. Remove/Rip existing roof down to metal deck.
2. Properly dispose of all materials, including asbestos containing materials (ACM) at an EPA approved landfill.
3. Supply and install new, tapered R-30 Poly ISO mechanically fastened to metal deck.
4. Supply and install new .060 mechanically fastened Johns Manville TPO roof system as per manufacturers specifications. White in color.
5. Flash all penetrations.
6. Supply and install new 20-year Kynar aluminum gravel stop.
7. Provide all dumpsters.
8. Provide safety and pedestrian protection.

ECM 2: Building Envelope Upgrades

Central Islip Library Main Building

1. 4 Single Doors to be weather-stripped.
2. 385' Roof/Wall Joint to be sealed
3. Supply and install foam insulation around (7) exhaust fans.
4. Re-pointing of damaged areas with air leakage
5. Re-caulking of exterior windows
6. Re-caulking of top of main entry into building

Central Islip Library Storage Building

1. 1 Single Door to be weather-stripped.
2. 1 Roll-up Garage Door to be weather-stripped (sides & top only; 30')
3. 1 Exhaust fan to be sealed at the damper to plenum connection (6')
4. 120' Roof/Wall Joint to be sealed

ECM 3: Rooftop Solar

1. Provide PV array design with ballast layout for structural approval by others.
2. Furnish and install (343) Q.Peak Duo XL or similar solar modules producing 164.64 kW.
3. Furnish and install mounting structure with aluminum top rails type TerraGEN, aluminum tilt rails and custom roll formed galvanized steel base rails. Fasteners will be stainless steel 18-supply.
4. Install rubber safety membrane for roof protection.
5. Furnish and install all inverters, (5) CPS-CPS25KW-208
6. Furnish and install Rapid shutdown devices as necessary.
7. Furnish and install all Panelboards & Electrical Disconnects
8. Furnish inverter monitoring package.
9. Roof warranty inspection upon completion.

ECM 4: LED Lighting and Lighting Controls

This ECM involves the replacement of non-LED fixtures with new LED lighting. Existing 2x4 and 2x2 fixtures will be upgraded with volumetric LED "door kits" that will make the fixture appear as if it is an entirely new fixture. In the high ceiling areas of the Library, the pendent mounted up-lights will be removed and the fixtures will be repositioned to achieve a more unified design. In the Business Office the downlights will be removed, and new 2x2 LED fixtures will be installed to provide better lighting. In the Director's bathroom, the outdated 1x1 fixture will be removed and replaced with a new 2x2 LED fixture. In the Library Stack area, new LED surface-mounted fixtures will be installed on the lower level. For the upper level of the Stack area, a new drop ceiling will be installed with 2x2 LED fixtures. Existing downlights will be replaced with new LED downlights. Exterior building-mounted Metal Halide fixtures will be replaced with new LED fixtures with photocells. The project's scope of work includes disconnecting the existing lighting system, disposing and/or recycling of the old equipment, securely installing the new LED fixture, wiring and controls connection, and thorough testing of the new fixtures to ensure proper operation.

The project's scope of work involves installing occupancy sensors, where deemed suitable, and connecting electrical wiring in accordance with New York laws and permit requirements. We do not recommend the installation of sensors for the main Library areas, the Community Room, or the Children's areas, since having lights turned off in these areas could be problematic. Our proposal does not include the installation of lighting controls in these areas.

ECM 5a: Implement Natural Gas in Existing 20-Ton York RTU

1. Installation of new natural gas piping to unit.
2. Conversion of unit to natural gas heating using existing heat exchanger in unit.
3. Commission existing unit for functionality of heat exchanger.
4. Provide new DDC controls to unit.
5. Re-commissioning of unit.
6. Provide a certified air balance report at completion of project.

ECM 5b: Maintenance on Existing RTUs and Exhaust Fans

1. Provide labor and materials to replace belts on (5) existing roof mounted exhaust fans. Exhaust fans are to remain and be re-used.

ECM 6: Replace Heat Pump with High Efficiency Heat Pump – IT Room

1. Provide labor to reclaim refrigerant from existing split system and properly dispose of.

2. Provide labor to disconnect and remove existing condenser and evaporator from site.
3. Provide labor and materials to install (1) 12,000 BTU high efficiency cooling only condenser. and (1) 12,000 BTU wall-mounted evaporator Daikin Skyair FAQ_TAVJUA.
4. Provide labor and materials to install new refrigeration and condensate piping for new unit.
5. Condensate pumps will be provided as required.
6. Provide and install (2) equipment rails and (1) pipe portal.
7. Provide rigging service to set new condenser on roof.
8. Provide startup service for new units.

ECM 7: Replace Vestibule Fan Coil Unit with High Efficiency Heat Pump

1. Provide labor to disconnect and remove existing electric fan coil unit from premises and dispose of unit.
2. Provide labor and materials to install (1) 30,000 BTU high efficiency heat pump. Daikin Model Sky Air FBQ_TBVJU condenser and (1) 30,000 BTU ceiling cassette evaporator.
3. Provide labor and materials to install new refrigeration and condensate piping for new unit.
4. Provide and install (2) equipment rails and (1) pipe portal.
5. Provide rigging service to set new condenser on roof.
6. Provide startup service for new units.

ECM 8: Building Management System (BMS)

1. Install and fully configure a new JCI Facility Explorer FX-80 Niagara web-based BMS system. The new BMS system will be provided with a full graphics package, historical trends, alarms, etc. to provide a complete, cohesive control system for the building. All equipment listed in this proposal will be networked to the new BMS system and included in the graphical user interface.
2. Provide DDC control for (5) exhaust fans.
3. Provide start/stop, status, and alarm. New graphics, schedules, trends, and alarms.
4. Provide occupancy programming/control as per owner requirements.
5. Replace the existing programmable thermostats on the (1) existing York RTU, (1) existing Aaon unit, and (1) new Carrier RTU with a new JCI FX DDC control system.
6. This includes a BACnet DDC controller as well as a new space temperature sensor, discharge air sensor, control relays, actuators, etc.
7. Provide, install, and wire a wall-mounted CO2/temperature sensor for each RTU. The RTUs will be programmed to provide a full demand-controlled ventilation sequence of operation.
8. The new control system for each RTU will be fully mapped to the new BMS system and included in the graphics, schedules, trends, alarms, etc. This includes the following points and sequences:
    - Supply Fan Start/Stop and Status Monitoring
    - Return Fan Start/Stop and Status Monitoring (if applicable)
    - Space Temperature
    - Space Relative Humidity
    - Space CO2 Level
    - Discharge Air Temperature
    - Economizer control
    - Mixed air control (including DCV control)
    - Heating control
    - Cooling control
    - Freeze protection
    - Full set point and parameter control from BMS system.
9. Design, fabricate, wire, install, program and commission a new JCI FX DDC control system for the new RTU.
10. This includes a BACnet DDC controller as well as a new space temperature sensor, discharge air sensor, control relays, actuators, etc.
11. Provide, install, and wire a wall-mounted CO2/temperature sensor for the RTU. The RTU will be programmed to provide a full demand-controlled ventilation sequence of operation.

12. The new control system for the RTU will be fully mapped to the new BMS system and included in the graphics, schedules, trends, alarms, etc. This includes the following points and sequences:
    - Supply Fan Start/Stop and Status Monitoring
    - Return Fan Start/Stop and Status Monitoring (if applicable)
    - Space Temperature
    - Space Relative Humidity
    - Space CO2 Level
    - Discharge Air Temperature
    - Economizer control
    - Mixed air control (including DCV control)
    - Heating control
    - Cooling control
    - Freeze protection
    - Full set point and parameter control from BMS system.

13. Provide, install, wire and program a new JCI FX BACnet control system for each new VAV box. This includes the following points and sequences:
    - Space Temperature
    - Space Relative Humidity
    - Space CO2 Level
    - Occupied Space Set Point
    - Unoccupied Space Set Point
    - Discharge Air Temperature
    - CFM set point (heating and cooling modes)
    - Full set point and parameter control from BMS system.

The new control points for each VAV box will be fully mapped to the new BMS system and included in the graphics, schedules, trends, alarms, etc.

The Library will provide addresses and permissions for integration to the Library's existing LAN and remote connectivity via VPN (or external IP address) and the Library will provide and maintain a VPN for our use during the project and throughout the contract period.

ECM 9: Demand Control Ventilation (DCV)

The scope of work for implementing DCV for Rooftop Units includes installing CO2 sensors in each occupied space to measure the level of CO2. Based upon the sensor readings, the ventilation rate for each RTU will be adjusted to meet the current demand. The system will be set up to provide a minimum amount of fresh air when the space is unoccupied, to maintain indoor air quality.

ECM 10: High Efficiency Gas-Fired Water Heater

1. Disconnecting, removing, and disposing of the existing electric water heater.
2. New gas lines will be furnished and installed at the location of the new water heater.
3. Supply and install a new condensing domestic water heater, AO Smith ATI-540HX3-N.
4. Supply and install all necessary piping, valves, and fittings required to connect the new units to the existing piping systems (water and gas).
5. The new portions of the piping will be insulated with fiberglass and PVC fittings.
6. Electrical power and control wiring will be provided to the new units.
7. Piping will be checked for leaks to ensure proper operation of the new water heater.

ECM 11: Plug Load Controls

Install BERT plug load controls on (25) electronic devices in the Library. The plug load controls will be installed to automatically turn off or put electronic devices in standby mode.

Device Type:	Quantity:
Projector	2
Printer	15
Large Printer/Copier	3
Coffee Maker	4
H/C Water Dispenser	1

ATTACHMENT C

FINANCING DOCUMENTS

ATTACHMENT D

NOTICE TO PROCEED

Robert Ragozine
RENU Energy Solutions
20 35th Street
Copiague, NY 11726

Subject: **Notice to Proceed**

Dear Mr. Ragozine:

In accordance with Section 1(a) of our Energy Performance Contract dated 12/21, 2023, the Client hereby submits to RENU Energy Solutions, ("ESCO") this **Notice to Proceed** in relation to the Scope of Services defined in the aforementioned Contract, for Client, dated 12/21, 2023.

Sincerely,

Central Islip Public Library

T. Kohees — Date: 12/21/23
Signature

Tara Kohees Director
Print Name and Title

ATTACHMENT E-1

DELIVERY AND ACCEPTANCE CERTIFICATE UPON SUBSTANTIAL COMPLETION

Client hereby acknowledges receipt of the Energy Conservation Measures (ECMs) described in the applicable Attachment B to the Energy Services Contract (the "Contract") between Client and ESCO, as fully installed and in good working condition, which are listed and attached hereto. Client hereby accepts the ECM(s) listed hereto after full inspection thereof as satisfactory for all purposes of the Contract to which this Attachment E is attached and the Lease executed by Client and Lessor, [INSERT FINANCING ENTITY NAME]. Client agrees to make the related payment(s) to ESCO as set forth in Section 4 of the Contract.

Substantial Completion Date:

ECM(s):

Note: ECMs to which this Delivery and Acceptance Certificate relates is attached hereto.

ATTACHMENT E-2

FINAL DELIVERY AND ACCEPTANCE CERTIFICATE
FINAL ACCEPTANCE OF PROJECT

Client hereby acknowledges Final Acceptance of all Energy Conservation Measures (the "ECMs") described in the applicable Attachment B to the Energy Performance Contract (the "Contract") between Client and ESCO. The date of Final Acceptance is the date certified by the Client that the Work has been installed, functionally tested and all punch list items completed in accordance with the Contract Documents, so that the Client has possession of the Work and can use it for its intended use. Client hereby accepts the ECMs listed hereto after full inspection thereof as satisfactory for all purposes of the Contract. Client agrees to make the required payment(s) to ESCO as set forth in Section 4 and Attachment G of the Contract.

Date Accepted by Client: 12/21/23

Accepted for: **Central Islip Public Library**

Accepted by: J. Kchles
Signature

Tara Kchles - Director
Name and Title

12/21/23
Date

Note: ECMs to which this Delivery and Acceptance Certificate relates is attached hereto.

ATTACHMENT F

GUARANTEE OF ENERGY COST SAVINGS

1. DEFINITIONS

When used in this Contract, the following capitalized words shall have the meaning ascribed to them below:

"Baseline Period" is the period of time that defines the Baseline Usage and is representative of the facilities operations, consumption, and usage that is used as the benchmark for determining cost avoidance.

"Baseline Usage" is the calculated energy usage of the Facilities prior to the implementation of the ECMs.

"Baseline Demand" is the calculated energy demand of a piece of equipment or a site prior to the implementation of the ECMs. Baseline physical conditions, such as equipment counts, nameplate data, and control strategies, will typically be determined through building occupancy, energy end-use survey and plug load surveys of the Facilities.

"Energy and Operational Cost Avoidance Guarantee Practices" are those practices identified in The Schedule of Savings, intended to achieve avoided costs in energy and/or operating expenses.

"Energy Costs" may include the cost of electricity and fuels to operate HVAC equipment, cogeneration system, facility mechanical and lighting systems, and energy management systems, and the cost of water and sewer usage, as applicable.

"ECM" the Energy Conservation Measure (ECM) is the installation of equipment or systems, or modification of equipment or systems as described in Attachment B.

"Excess Verified Savings" is the amount of Verified Savings minus Guaranteed Savings in a Guaranteed Period.

"Facilities" shall mean those described in Attachment A.

"First Guarantee Period" is defined as the period beginning on the first (1st) day of the month following the date of execution of the Delivery and Acceptance Certificate (Attachment E-2) upon Substantial Completion of this Project by the Client and ending on the day prior to the first (1st) twelve-month anniversary thereof.

"Guarantee Period" is defined as the First Guarantee Period and each of the successive twelve (12) month periods commencing on the anniversary of the commencement of the First Guarantee Period throughout the Term of this Contract.

"Guaranteed Savings" is defined as the amount of avoided Energy and Operational Costs guaranteed to the CLIENT in each Guarantee Period.

"Guaranteed Savings Report" is defined as the process and report for determining the Verified Savings in each Guarantee Period and reconciling it to the Guaranteed Savings in the same Guarantee Period.

"IPMVP" shall mean the International Performance Measurement and Verification Protocol and its Measurement and Verification Guidelines for energy savings performance contract projects. The IPMVP guidelines classify measurement & verification approaches as Option A, Option B, Option C, and Option D.

"Measurement and Verification Plan" (M&V Plan) is defined as the plan providing details on how the Guarantee Savings will be verified.

"Operational Costs" shall include the cost of operating and maintaining the Facilities, such as, but not limited to, the cost of inside and outside labor to repair and maintain Covered Systems and Equipment, the cost of custodial supplies, the cost of replacement parts, the cost of deferred maintenance, the cost of lamp and ballast disposal, and the cost of new capital equipment as defined for each ECM in Section 4, Schedule of Values.

"Term" shall be 18 years from acceptance.

"Verified Savings" is the defined as the summation of avoided Energy and Operational Costs as determined by the Measurement & Verification Plan for the Facilities in each Guarantee Period as a result of the ECMs provided by ESCO.

Table 2.1. Guaranteed Savings

ECM	Electric (kWh)	Electric Demand (kW)	Natural Gas (Therms)	Total Energy Savings ($)
1 – Roof Replacement	5,944	0	0	$990
2 – Building Envelope Improvements	5,608	0	0	$934
3- Solar Ownership	201,246	24	0	$36,907
4 – Comprehensive Lighting Upgrades and Controls	93,455	22	0	$18,784
5 – Rooftop Unit Upgrades with VAV Boxes	59,266	18	-1,693	$10,173
6 – Replace Heat Pump with High Efficiency Heat Pump	1,166	2	0	$447
7– Replace Vestibule Fan Coil Unit with High Efficiency Heat Pump	5,119	3	0	$1,251
8 – Install Building Management System (BMS)	13,444	0	0	$2,238
9 – Demand Control Ventilation	4,026	0	628	$1,517
10– Install High Efficiency Gas-Fired Water Heater	2,114	3	-76	$715
11 – Plug Load Controls	3,363	0	0	$615
TOTAL	394,750	72	-1,141	$74,570

2.1.1 Excess Savings. Annual cost savings beyond the guaranteed minimum savings will be retained by Client.

2.1.2 Savings. Prior to Final Retrofit Acceptance all energy and operational cost avoidance realized by Client and as calculated through the Measurement & Verification Plan that result from activities undertaken by ESCO prior to Final Acceptance may be applied to the Savings for the First Guarantee Period.

2.1.3 Cumulation of Savings. The Guaranteed Savings in each Guarantee Period are considered satisfied if the Savings for such Guarantee Period equals or exceeds the Guaranteed Savings for such Guarantee Period.

2.1.4 Savings Shortfalls. In the event that the Savings in any Guarantee Period is less than the Guaranteed Savings required for that Guarantee Period, ESCO shall, upon receipt of written demand from Client, compensate Client the amount of any such shortfall, limited by the value of the guarantee, within sixty (60)

calendar days. Resulting compensation shall be ESCO's sole liability for any shortfall in the Guaranteed Savings.

2.2 Savings Documentation.

ESCO will provide Client with a Guarantee Savings Report after each Guarantee Period within 120 days. Client will assist ESCO in generating the savings report by providing ESCO's receipt thereof, together with access to relevant records relating to such Energy and Operating Costs. Client will also assist ESCO by permitting access to any energy billing information, maintenance records, drawings, or other data deemed necessary by ESCO to generate the said report. Data and calculations utilized by ESCO in the preparation of its Guaranteed Savings Report will be made available to Client, along with such explanations and clarifications as Client may reasonably request.

2.2.1 Acceptance of Guaranteed Savings Report. At the end of each Guarantee Period, Client will have forty-five (45) days to review the Guaranteed Savings Report and provide written notice to ESCO of non-acceptance of the Guaranteed Savings Report for that Guarantee Year. Failure to provide written notice within forty-five (45) days of the receipt of the Guarantee Savings Report shall constitute the deemed acceptance of the Report and its findings by the Client.

2.2.2 Guaranteed Savings. Guaranteed Savings shall be based on 92.5% of the Savings and will be determined in accordance with the methodology(s), operating parameters, formulas, and constants as described below and/or defined in the Measurement & Verification Plan and/or additional methodologies defined by ESCO that may be negotiated with Client at any time. Actual savings reduction in utility bills may vary for reasons outside of ESCO's control including but not limited to: changes in energy and other utility rates and tariffs, changes in Client operating schedules and usage patterns, changes in Client loads due to addition or reductions in energy and water consuming devices, changes in weather, impacts due to the operations of ECMs, impacts due to the maintenance of ECMs maintained by Client, and additions to and/or reduction in facility space usage. For the purposes of calculating any shortfalls or excesses of Verified Savings versus Guaranteed Savings, the Measurement & Verification Plan will be utilized.

2.2.3 Activities and Events Adversely Impacting Savings. Client must promptly notify ESCO of any activities known to Client, which adversely impacts ESCO's ability to realize the Guaranteed Savings and ESCO shall be entitled to reduce the Guaranteed Savings by the amount of any such adverse impact to the extent that such adverse impact is beyond ESCO's reasonable control.

2.2.4 Guarantee Adjustment. ESCO's Guaranteed Savings obligations under this Contract are contingent upon: (1) Client following the operations and maintenance requirements for the ECMs in accordance with the Contract; (2) no alterations or additions being made by the Client without prior notice and written agreement of the Parties; (3) Client sending all current utility bills to ESCO within two (2) weeks after receipt; and (4) ESCO'S ability to render services not being impaired by circumstances beyond its control. To the extent that the Client defaults or fails to perform fully any of its obligations under this Contract, ESCO may, in its sole discretion, adjust the Guaranteed Savings obligation; provided, however, that no adjustment hereunder shall be effective unless ESCO has first provided the Client with written notice of Client's default(s) or failure(s) to perform and Client has failed to cure its default(s) and failure(s) to perform within thirty (30) days after receipt of such notice.

2.2.5 Energy Rates. The base utility rates used for calculating annual cost savings are presented in Table 2.2.5. These rates will be escalated annually utilizing the rates indicated in Table 2.3 and applied to the ECM savings at each facility to determine annual cost savings for each guarantee period. The escalated utility rates will be compared to actual utility rates during each year of the Guarantee Period, and the higher of the floor values or the actual utility rates in effect will be used to determine savings.

Table 2.2.5 Energy Rates

Building	Annual kW	Total kW $	Annual kWh	Total kWh $	$/kW	Calculated $/kWh	$/kWh (Blended)
Library	2,172	$26,003	484,480	$80,659	$11.97	$0.17	$0.22

Building	Usage (th)	Total ($)	Estimated $/Unit
Library	0	$0	$1.35

2.3 Annual Utility Rate Escalation Rate

The following table shows annual escalation of the utility rates to be used for calculating energy cost savings. The utility rates will increase by the following percentages each year over the rates in the prior year beginning in Year 1.

Table 2.3 Annual Escalation

Utility	Electricity $/kWh	Natural Gas $/Therm
Annual	3.5%	3.5%

2.4 Guaranteed Savings

The following table lists the amount of Guaranteed Savings resulting from the ECMs to be installed by ESCO.

Table 2.4 Guaranteed Savings with Escalation Rate

Period	Cost Savings
1	$77,180
2	$79,882
3	$82,678
4	$85,571
5	$88,566
6	$91,666
7	$94,875
8	$98,195
9	$101,632
10	$105,189
11	$108,871
12	$112,681
13	$116,625
14	$120,707
15	$124,932
16	$129,304
17	$133,830
18	$138,514
Total	**$1,890,898**

3. MEASUREMENT & VERIFICATION PLAN

3.1 Measurement and Verification. ESCO and the Client agree that the Verified Savings will be determined using the following Measurement and Verification Plan. Through this plan, the Guaranteed Savings generated by the ECMs installed in the Facilities will be verified and incorporated herein by reference.

Measurement & Verification Plan: ESCO and the Client agree that the Verified Savings by ECM will be determined using the following Measurement & Verification plans further described in this section. Through this plan, the guaranteed savings generated by the ECMs installed in the Facilities will be validated. The M&V methodologies proposed for these ECMs are based on the North American Measurement and Verification Protocol. The objective of the plan is to quantify the actual electrical and fossil fuel and compare those to the specific Baseline Usage for each Facility, the difference of which is the Verified Savings.

During the term of the Contract, ESCO will make adjustments to energy savings due to changes in building occupancy, weather data, and utility rate schedules, etc. The unit costs of energy will be applied to the energy savings calculated by this M&V plan. Current utility cost will be used as a basis for determining the unit cost, with floor and ceiling prices set by baseline rate information, presented herein this Attachment.

3.2 M&V Descriptions. The following matrix summarizes the M&V Plan with detailed plan descriptions for each ECM

Table 3.2 Measurement and Verification Summary Matrix						
ECM Number and Description	M&V Option	Utility Types Affected	Baseline M&V	Post-Installation M&V	Performance Period M&V	Contractually Agreed Upon Variables
ECM 1 – Roof Replacement						
The scope of work for this ECM involves removing and disposing of the existing roof system, including all roofing materials and insulation.	A	Electric (kWh)	The baseline parameters include the determination of the existing roof R-value, The R-value will need to be calculated based on building construction found during the baseline development.	Verify that proposed roofing and strategy has been implemented and is installed as intended. Post installation savings is determined from the same baseline model modified for the proposed R values.	Perform standard ASHRAE calculations to verify reduced heat transfer and infiltration. Perform short-term metering to verify building operation became more efficient or that changes in operation have been taken into consideration.	These values will be the parameters used within the model to calculate energy savings. The operation parameters include roof performance, reflectance, and space temperature.
ECM 2 – Building Envelope Upgrades						
This scope of work this ECM involves existing exhaust fans will be sealed, areas around windows and doors that need new weather stripping or caulking will be addressed, gaps in the concrete along the base of the right side of the building and the front of the storage building.	A	Electric (kWh)	Our assessments identified locations of air leakage losses and thermal transfer – the two primary modes of energy loss in buildings. The Baseline will be validated by verifying the linear feet and area contributing to infiltration.	Building envelope improvements on air infiltration will be inserted in energy calculation model and calibrated against cooling and heating load and operating hours.	Building envelope assessment evaluates sides of the building, including the roof, walls, and floors and all of intersections connecting the building's assemblies. The intent of Performance Period verification activities is to ensure that the infiltration experienced in the building prior to implementing this ECM has been reduced as a result of various building envelope improvements.	Weather, heating, and cooling system efficiency and occupancy.

ECM 3 – SOLAR						
This scope of work for this ECM involves the installation of roof-mounted photovoltaic systems using ballasted roof mounts, with an appropriate support system for the PV modules	C	Electric (kWh)	Baseline electrical energy is equivalent to the portion of the facility electrical load to be offset by the PV system electrical generation. The baseline energy was established through collection of various data parameters including: •Geographic location of array •DC system size (name plate rating) •DC-to-AC derate Factors •Array type (fixed, tracking, etc) •Array tilt, azimuth The data collected is used within the proposal to calculate baseline energy generation for the PV system.	The approach involves directly measuring the energy output from the system and quantifying any additional costs incurred or savings realized. the measurement concept assumes that energy (electrical) produced by the renewable system is used at the project site and displaces energy that would have been provided by an existing source. Savings are determined by measuring the net amount of energy produced	•Inspections of renewable energy system to ensure proper operation and maximum performance •Submeter the renewable energy source to verify energy production and savings. •There general approaches for calculating energy savings from renewable energy project is the Net energy use	System name plate DC rating, array tilt, array azimuth, DC to AC conversion efficiency, hours and intensity of solar radiation, annual kwh generation
ECM 4 – LED LIGHTING AND LIGHTING CONTROLS						
This scope of work for this ECM proposed involves the replacement of non-LED fixtures with new LED lighting.	A	Electric (kWh)	Measure a sample of fixture wattages. Determine operating hours through stipulated values. Baseline shall be generated using Energy calculations	Fixture power will be measured in a manner identical to that for the baseline fixtures. These measurements will be used to calculate actual expected energy savings	Measure a sample of fixture wattages. Annual visual inspection of a sample set of lighting fixtures and controls to ensure the integrity of the fixtures and controls and confirm that the ECM still has the potential to perform as specified.	Lighting fixture power consumption, operating hours, lighting levels.

ECM 5, 6, 7 ,8 & 9 – HVAC UPGRADES & BMS						
This scope of work for this ECM involves replacing standard efficiency packaged air conditioning units with higher efficiency conditioning units. In addition, integration to the BMS system.	D	Electric (kWh)	Observations of schedules and set points, spot measurements of temperatures, and reported operation from facility staff will be used to establish baseline operation and conditions of HVAC equipment. Baseline shall be generated using Trane trace software.	Metering to be conducted will require short and/or long-term continuous interval measurements to reflect full cycle of operation	Annual on-site inspections of HVAC controls and equipment for ongoing verification that energy control strategies are in place and sustainable. The HVAC Controls portion of the audit tool utilizes Trane Trace, an hourly building simulation model to generate baseline and post-retrofit models of the facilities energy use	System efficiency, building parameters, current and proposed operating schedules
ECM 10 – INSTALL HIGH EFFICIENCY GAS-FIRED WATER HEATER						
This scope of work for this ECM involves disconnecting, removing, and disposing of the existing electric water heater. New gas lines will be furnished and installed at the location of the new water heater.	C	Electric (kWh) and Gas (Therms)	Observations of schedules and set points, spot measurements of temperatures, and assumptions will be used to establish baseline operation. Baseline shall be generated using Energy calculations	Verify that proposed equipment has been implemented and is operating as intended. Post installation savings is determined from the same baseline model modified for the set points and energy rates.	Annual on-site inspections of the equipment and taking readings from the installed gas meter.	Size, capacity, energy efficiency rating, temperature setting and occupied days
ECM 11 – PLUG LOAD CONTROLS						
This scope of work for this ECM involves installing plug load controls on electronic devices.	A	Electric (kWh)	Reported operation from facility staff was used to establish baseline operation and equipment stipulated wattage. savings shall be generated using Energy calculations	A sample of equipment being controlled will be monitored for two-week period	Annual on-site inspections of equipment for ongoing verification that energy control strategies are in place and sustainable	Device wattage, number of Berts and Scheduled On hours

3.2.1 Overview of M&V Plan – ECM 1- Roof Replacement

The M&V plan for this ECM is based on IPMVP Option A.

The performance parameters include the determination of the envelope R-value. The R-value will need to be calculated based on building construction found during the baseline development and resulting construction in post installation. These values will be the parameters used within the model to calculate energy savings. The operation parameters include building temperature set points, setbacks, schedules, etc. Key operational parameters should be short-term metered to verify that only the improvement in R-value and reduced infiltration are being applied to savings.

Savings Verification Methodology
The savings calculation methods for roof insulation primarily rely on the comparison of pre-installation and post-installation energy consumption data. This calculation considers variables such as heating and cooling degree days, occupancy patterns, and temperature differentials.
Savings calculations includes:

- Regression analysis to account for weather variations
- Analysis of utility bills and metered data to track changes in energy use.
- Modeling and simulation tools to predict energy savings based on insulation specifications and building characteristics.
- Comparative analysis of energy consumption data before and after insulation installation to assess the impact on heating and cooling loads.

Formulas used to develop and estimate the savings:

- Load Factor = (Area A * U-value A) + (Area B * U-value B) + (Area C * U-value C)
- Sol-air Temperature Factor = ((Area A * Reflectance A) + (Area B * Reflectance B)+(Area C * Reflectance C)/(Total Area)*(Daylight & Debree Factor)
- Annual Savings (MBH/YR) = (Cooling btu/hr savings)*(% runtime)*(average days in period)
- Annual Savings (kWh/YR) = (mbh/hr savings)/(12mbh/ton)*(kW/ton)

ECM:	**Roof Replacement**					
Title	**Roof Replacement**					
Project	**Capital Projects**					
Site	**Central Islip Public Library**					
Description	Calculation of roof replacement using existing roof U-values and reflectance and proposed U-value and reflectance.					
Given	Roof Area A	20,700	s.f. from subcontractor			
	Roof Area B	-	s.f. from subcontractor			
	Roof Area C	-	s.f. from subcontractor			
	Total Roof Area	20,700	square feet			
	Total Surface Irradiance (Winter)	20	btu/hr/F	From ASHRAE standard		
	Total Surface Irradiance (Spring)	53	btu/hr/F	From ASHRAE standard		
	Total Surface Irradiance (Summer)	68	btu/hr/F	From ASHRAE standard		
	Total Surface Irradiance (Fall)	36	btu/hr/F	From ASHRAE standard		
	Existing Roof Performance A	0.040	U-value	From existing construction	R-value=	25.0
	Existing Roof Performance B	0.040	U-value	From existing construction	R-value=	25.0
	Existing Roof Performance C	0.040	U-value	From existing construction	R-value=	25.0
	New Roof Performance A	0.033	U-value	From new construction	R-value=	30.0
	New Roof Performance B	0.033	U-value	From new construction	R-value=	30.0
	New Roof Performance C	0.033	U-value	From new construction	R-value=	30.0
	MMBH Cost		$/MMBH			
	Electrical Cost		$/kwh average			
	Existing Roof Performance A	0.2	Dark	From existing construction reflectance		
	Existing Roof Performance B	0.2	Dark	From existing construction reflectance		
	Existing Roof Performance C	0.2	Dark	From existing construction reflectance		
	New Roof Performance A	0.15	Light	From new construction reflectance (Account for Solar PV shading)		
	New Roof Performance B	0.15	Light	From new construction reflectance		
	New Roof Performance C	0.15	Light	From new construction reflectance		
Assumptions	Space Temperature	72	Deg F	average		
	Boiler Efficiency	95%				
	Cooling Efficiency	1.00	kw/ton			
	Daylight & Debree Factor	0.45				

Calculation

Existing Load Factor= ((Area A 20,700)*(Ex. UA 0.040)+(Area B 0)*(Ex. UB 0.040)+(Area C 0)*(Ex. UC 0.040))= **828 btu/(h*F)**

Existing Sol-air Temperature Factor=((((Area A 20,700)*(Ex.Refl. A 0.20))+((Area B 0)*(Ex.Refl. B 0.200))-((Area C 0)*(Ex.Refl. A 0.200))/(Total Area 20,700)*(daylight & debree factor) 0.45) = **0.09**

Existing Heating & Cooling

	((OA Temp		Sol-air TF	*	Irradiance))	-	IA Temp	)*(	Heat Load Factor	)*(	Hours	)/(Conversion) =	MBH Usage Heating	MBH Usage Cooling
((	-8	-(	0.09	*	20))	-	72	)*(	828	)*(	56	)/(1000 btu/mbh) =	3,826	-
((	-3	-(	0.09	*	20))	-	72	)*(	828	)*(	72	)/(1000 btu/mbh) =	4,364	-
((	2	-(	0.09	*	20))	-	72	)*(	828	)*(	115	)/(1000 btu/mbh) =	6,494	-
((	7	-(	0.09	*	20))	-	72	)*(	828	)*(	156	)/(1000 btu/mbh) =	8,163	-
((	12	-(	0.09	*	20))	-	72	)*(	828	)*(	224	)/(1000 btu/mbh) =	10,794	-
((	17	-(	0.09	*	20))	-	72	)*(	828	)*(	280	)/(1000 btu/mbh) =	12,324	-
((	22	-(	0.09	*	20))	-	72	)*(	828	)*(	405	)/(1000 btu/mbh) =	16,183	-
((	27	-(	0.09	*	20))	-	72	)*(	828	)*(	523	)/(1000 btu/mbh) =	18,705	-
((	32	-(	0.09	*	53))	-	72	)*(	828	)*(	736	)/(1000 btu/mbh) =	21,469	-
((	37	-(	0.09	*	53))	-	72	)*(	828	)*(	805	)/(1000 btu/mbh) =	15,142	-
((	42	-(	0.09	*	53))	-	72	)*(	828	)*(	502	)/(1000 btu/mbh) =	10,487	-
((	47	-(	0.09	*	53))	-	72	)*(	828	)*(	489	)/(1000 btu/mbh) =	8,191	-
((	52	-(	0.09	*	53))	-	72	)*(	828	)*(	537	)/(1000 btu/mbh) =	6,772	-
((	57	-(	0.09	*	66))	-	72	)*(	828	)*(	802	)/(1000 btu/mbh) =	4,426	-
((	62	-(	0.09	*	66))	-	72	)*(	828	)*(	711	)/(1000 btu/mbh) =	2,284	-
((	67	-(	0.09	*	66))	-	72	)*(	828	)*(	762	)/(1000 btu/mbh) =	-	707
((	72	-(	0.09	*	66))	-	72	)*(	828	)*(	719	)/(1000 btu/mbh) =	-	3,643
((	77	-(	0.09	*	66))	-	72	)*(	828	)*(	552	)/(1000 btu/mbh) =	-	5,082
((	82	-(	0.09	*	36))	-	72	)*(	828	)*(	383	)/(1000 btu/mbh) =	-	4,196
((	87	-(	0.09	*	36))	-	72	)*(	828	)*(	209	)/(1000 btu/mbh) =	-	3,156
((	92	-(	0.09	*	36))	-	72	)*(	828	)*(	83	)/(1000 btu/mbh) =	-	1,597
((	97	-(	0.09	*	36))	-	72	)*(	828	)*(	22	)/(1000 btu/mbh) =	-	514
											8743 Hours		**149,420**	**18,899**

New Load Factor= ((Area A 20,700)*(New UA 0.033)+(Area B 0)*(New UB 0.033)+(Area C 0)*(New UC 0.033))= **890 btu/(h*F)**

Existing Sol-air Temperature Factor=((((Area A 20,700)*(New Refl. A 0.15))+((Area B 0)*(New Refl. B 0.150))-((Area C 0)*(New Refl. A 0.150))/(Total Area 20,700)*(daylight & debree factor) 0.45) = **0.07**

Baseline M&V Activities

A thermal camera will be used to measure surface temperatures and capture the thermographic image of pre-retrofit thermal leaks.

Post-Installation M&V Activities

Accuracy of the as built will be verified against the contract scope of work. A digital or thermal camera will be used one time to document the post-retrofit conditions and proper installation of insulation.

Performance Period M&V Activities

One time pre-retrofit period and one time post-retrofit period

Table 3.2.1 Guaranteed Savings Summary

Description	Electric Savings kWh
Roof Replacement	5,944

3.2.2 Overview of M&V Plan – ECM 2- Building Envelope

The M&V plan for this ECM is based on IPMVP Option A.

The M&V Plan for the Building Envelope upgrades at the Central Islip Public Library will follow M&V Option A. The Option A approach will be used to quantify the energy savings associated with the building envelope and verify that the measure continues to operate and perform as specified in the Final Proposal. Building envelope assessment evaluates sides of the building, including the roofs, walls, and floors and all of intersections connecting the building's assemblies. Our assessments identify locations of air leakage losses and thermal transfer – the two primary modes of energy loss in buildings.

Savings Verification Methodology

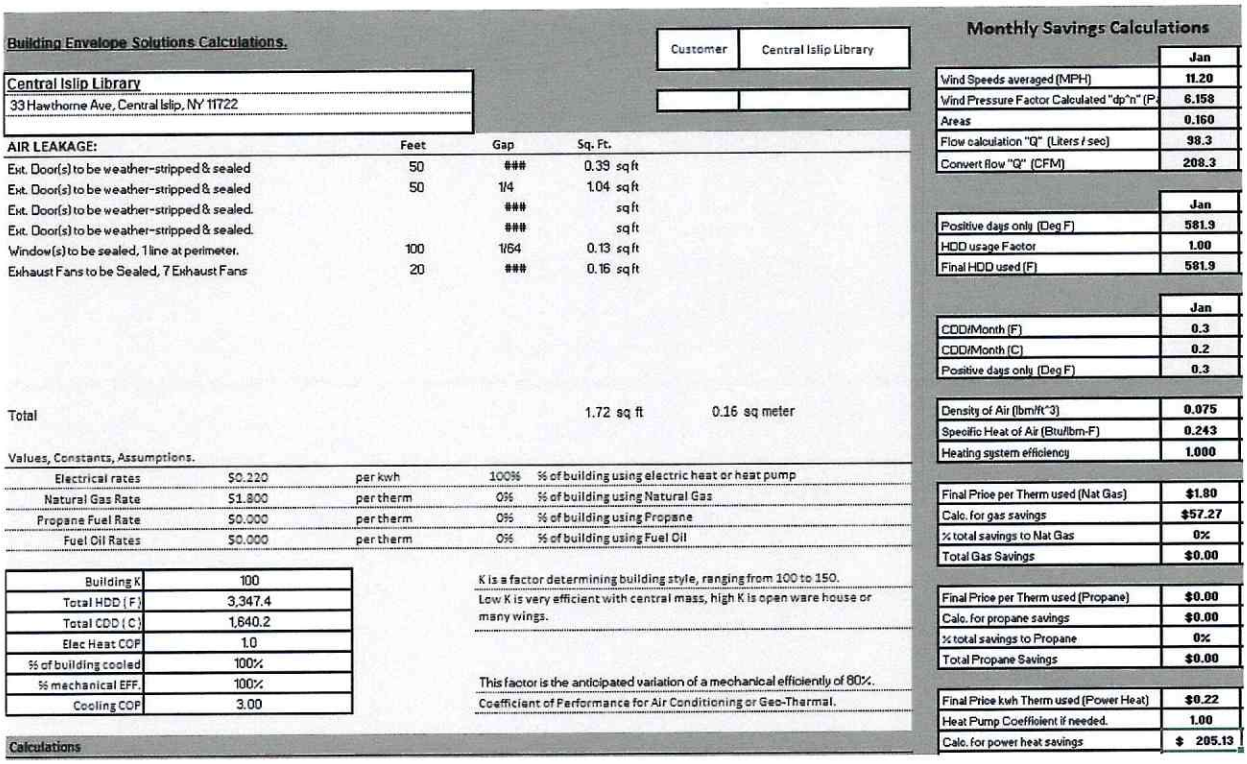
The pre-installation will be validated by verifying the linear feet and area contributing to infiltration. Accepted engineering principles were used for Baseline and Post-Installation calculations. Baseline energy use is affected by weather patterns, building loads, and building envelope deficiencies.

The information gathered during the CEA includes the following information:

- Building K value: 100
- Existing cooling COP: 2.5
- Existing heating efficiency: 80%
- Weather data based on location.
- Total gap area 1.72 sq ft

The data collected during the M&V are to use as input into calculations to create the Baselines to determine the performance of the building envelope improvements.

A Microsoft Excel spreadsheet was developed to calculate the baseline and savings for this ECM. A bin calculation method was used to estimate the savings associated with improving the building's insulation characteristics and reducing the building's unwanted infiltration. Details of the calculation can be found below



Building Envelope Solutions Calculations.

Customer	Central Islip Library

Central Islip Library
33 Hawthorne Ave, Central Islip, NY 11722

AIR LEAKAGE:	Feet	Gap	Sq. Ft.
Ext. Door(s) to be weather-stripped & sealed	50	###	0.39 sq ft
Ext. Door(s) to be weather-stripped & sealed	50	1/4	1.04 sq ft
Ext. Door(s) to be weather-stripped & sealed.		###	sq ft
Ext. Door(s) to be weather-stripped & sealed.		###	sq ft
Window(s) to be sealed, 1 line at perimeter.	100	1/64	0.13 sq ft
Exhaust Fans to be Sealed, 7 Exhaust Fans	20	###	0.16 sq ft
Total			1.72 sq ft 0.16 sq meter

Values, Constants, Assumptions.

Electrical rates	$0.220	per kwh	100%	% of building using electric heat or heat pump
Natural Gas Rate	$1.800	per therm	0%	% of building using Natural Gas
Propane Fuel Rate	$0.000	per therm	0%	% of building using Propane
Fuel Oil Rates	$0.000	per therm	0%	% of building using Fuel Oil

Building K	100
Total HDD (F)	3,347.4
Total CDD (C)	1,640.2
Elec Heat COP	1.0
% of building cooled	100%
% mechanical EFF.	100%
Cooling COP	3.00

K is a factor determining building style, ranging from 100 to 150.
Low K is very efficient with central mass, high K is open ware house or many wings.

This factor is the anticipated variation of a mechanical efficiently of 80%.
Coefficient of Performance for Air Conditioning or Geo-Thermal.

Calculations

Monthly Savings Calculations

	Jan
Wind Speeds averaged (MPH)	11.20
Wind Pressure Factor Calculated "dp"n" (P	6.158
Areas	0.160
Flow calculation "Q" (Liters / sec)	98.3
Convert flow "Q" (CFM)	208.3

	Jan
Positive days only (Deg F)	581.9
HDD usage Factor	1.00
Final HDD used (F)	581.9

	Jan
CDD/Month (F)	0.3
CDD/Month (C)	0.2
Positive days only (Deg F)	0.3

Density of Air (lbm/ft^3)	0.075
Specific Heat of Air (Btu/lbm-F)	0.243
Heating system efficiency	1.000

Final Price per Therm used (Nat Gas)	$1.80
Calc. for gas savings	$57.27
% total savings to Nat Gas	0%
Total Gas Savings	$0.00

Final Price per Therm used (Propane)	$0.00
Calc. for propane savings	$0.00
% total savings to Propane	0%
Total Propane Savings	$0.00

Final Price kwh Therm used (Power Heat)	$0.22
Heat Pump Coefficient if needed.	1.00
Calc. for power heat savings	$ 205.13

Formulas used to estimate the savings:

- Non-Electric Heat Loss = ((Bldg Leakage sq ft) x (bldg k factor) x (Wind P Factor) x (HDD) x (9/5) x 0.075 x .243 x 60 x 24) / (100,000 x Eff %)
- Electrical Heating Loss = ((Bldg Leakage sq ft) x (bldg k factor) x (Wind P Factor) x (HDD) x (.075 x .243 x 60 x 24) x (conversion to kwh)
- Cooling Loss = ((Bldg Leakage sq ft) x (bldg k factor) x (Wind P Factor) x (CDD) x (.075 x .243 x 60 x 24) x (conversion to kWh)

Baseline M&V Activities

A thermal camera will be used to measure surface temperatures and capture the thermographic image of pre-retrofit thermal leaks.

Post-Installation M&V Activities

The Post-Installation performance factors are heating system efficiencies and thermal integrity of windows, doors, roofs, and wall insulation. A digital or thermal camera will be used one time to document the post-retrofit conditions and proper installation of insulation.

Performance Period M&V Activities

Energy savings shown in the annual report will be based on the results documented in the post-installation report. Any modification of the equipment, or changes from its intended function are the responsibility of the Client.

Table 3.2.2 Guaranteed Savings Summary

Description	Electric Savings kWh
Building Envelope	5,608

3.2.3 Overview of M&V Plan – ECM 3 - Rooftop Solar

The M&V plan for this ECM is based on IPMVP Option C.

The M&V plan for this ECM assumes:

- The annual solar radiation as utilized in the calculation of the annual electrical generation of the PV array will be assumed to represent a typical meteorological year (TMY) and will be held constant during the performance period for the purpose of energy generation calculations.
- PV Module Performance and inverter efficiencies are based on manufacturer's data.
- An annual verification of the measure will be performed to document that the PV system remains installed and performing as specified in the Final Proposal.
- An annual collection of the generated electrical output from the PV system will be performed and recorded as verified savings.

Savings Verification Methodology

The PVWatts calculator determines the energy production and cost savings of grid-connected photovoltaic (PV) energy systems by creating hour-by-hour performance simulations that provide estimated monthly and annual energy production in kilowatts and energy value. Users select a geographic location of the PV installation and establish system parameters for size, electric cost, array type, tilt angle, and azimuth angle. Using typical meteorological year weather data for the selected location, the PVWatts calculator determines the solar radiation incident of the PV array and the PV cell temperature for each hour of the year. The DC energy for each hour is calculated from the PV system DC rating and the incident solar radiation and then corrected for the PV cell temperature. The AC energy for each hour is calculated by multiplying the DC energy by the overall DC-to-AC derate factor and adjusting for inverter efficiency as a function of load. Hourly values of AC energy are then summed to calculate monthly and annual AC energy production.

Project Details

Project:	Central Islip Public Library
Project Address:	33 Hawthorne Ave. Central Islip, NY, 11722
Size of Project:	164.64 kWp with 343 Modules
Module:	Q.PEAK DUO XL-G10.3/BFG with 480 Wp (87.2 x 41.1 x 1.4in, 64.2lbs)
Orientation & Tilt Angle:	Portrait at a 10 Degree Tilt Angle
Type of Installation:	Flat Roof Structure
Materials:	Support Structure: Aluminum 6063-T6 , Galvanized Steel G90 GR50 Fasteners: Stainless Steel 18-8
	The mounting structure has been quoted with aluminum top rails, aluminum tilt rails and custom roll formed galvanized steel base rails. More accurate details about the site may influence the design, engineering and pricing.
	Rubber Safety Membrane Coverage of Base Rail is approximately 36%

Design Assumptions

Basic Wind Speed:	134 mph (3 second gust)
Wind Exposure Category:	B
Snow Load:	30 psf
Distance between Base Rails (E-W):	80 inches
Roof Attachment Spacing:	N/A
Altitude:	87 ft above sea level
Roof Type:	TPO
Building Height:	19.5 ft
Parapet Height:	22 in
Importance Category:	High
Distance between Modules:	2' 7" (Module Front to Module Front is 9' 9")
Weight of Racking:	0.5 psf (excluding ballast)
Seismic Zones/Loads:	up to 0.9 g
Connection Safety Factor:	2.00
Total Racking Weight:	5816 lbs
Total Module Weight:	22021 lbs
Total Ballast Weight:	29312 lbs
Total Array Area:	11657 sqft
Global Loading:	4.9 psf
Max Point Load:	147 lbs / 116.9375" section of base rail
Code Compliance:	ASCE 7-16, [7-10, 7-05] and therefor IBC 2018 as well as State/County adaptations

Baseline M&V Activities

Given that the solar PV system is not installed at present, the energy baseline is considered to be the maximum potential annual output of the array. The baseline energy was established through collection of various data parameters including:

- Geographic location of array
- DC system size (name plate rating)
- DC-to-AC derate Factors
- Array type (fixed, tracking, etc)
- Array tilt, azimuth

The data collected is used within the proposal to generate baseline energy generation for the PV system.

Post-Installation M&V Activities

The Post install kW measurement will be used for all subsequent M&V years. The Effective Full Load Hours (EFLH) is from published weather data and is stipulated to be used in the calculation as given in the CEA.

Performance Period M&V Activities

- Inspections of renewable energy system to ensure proper operation and maximum performance.
- Submeter the renewable energy source to verify energy production and savings.
- The general approach for calculating energy savings from renewable energy projects is the Net energy used. The approach involves directly measuring the energy output from the system and quantifying any additional costs incurred or savings realized. This approach is suitable for PV, as the measurement concept assumes that energy (electrical) produced by the renewable system is used at the project site and displaces energy that would have been provided by an existing source. Savings are determined by measuring the net amount of energy produced by the renewable system and used at the project site valued at prescribed utility rates. This approach eliminates the need for a baseline.

Table 3.2.3 Guaranteed Savings Summary

Description	Electric Savings kWh
Rooftop Solar	201,246

3.2.4 Overview of M&V Plan – ECM 4 - LED Lighting and Lighting Controls

The M&V plan for this ECM is based on IPMVP Option A.

The M&V Plan for this retrofit assumes:

- Operating hours will be measured before the retrofit. The hours for the lighting fixtures will be adjusted after installation to account for the lighting controls.
- Fixture power before and after the retrofit will be measured.
- Interactive effects on heating and cooling equipment from the lighting retrofit will not be considered.
- Lighting levels will not decrease because of the lighting equipment retrofit. Existing lighting levels have been measured and recorded for each area. Results are included in the equipment inventory.

Savings Verification Methodology

Energy (kWh) and demand (kW) savings will be calculated using the following equations:

$$\text{kWh Savings} = \Sigma u\ [\ (\text{kW UsageGroupU,baseline} - \text{kW UsageGroupU,post}\ ) \times \text{Annual Hours of Operation}]$$

$$\text{kW Savings} = \Sigma u\ [(\text{kW UsageGroupU,baseline} - \text{kW UsageGroupU,post})$$

Where:

kWh Savings	=	kilowatt-hour savings realized during one-year post-installation
kW Savings	=	Coincident kilowatt demand saving realized
kW UsageGroup U,baseline	=	Lighting baseline demand for usage group u
kW UsageGroup U,post	=	Lighting demand during post-installation period for usage group u
Annual Hours of Operation	=	Annual number of operating hours for the usage group u

Baseline M&V Activities
Pre-retrofit lighting kW was analyzed and listed in the lighting line by line by location and fixture type. The kW data from the line by line will be used for pre-retrofit savings calculation. Pre-kw will be sampled and measured to validate the line by line. Light levels will be measured for sampled areas to understand existing conditions.

Typical lighting hours for facility spaces were obtained from the typical hours of operation, categorized in "usage groups" and input into the CEA lighting tool. Further, run-time meters were installed that showed actual run hours to be in line with our estimates.

Post-Installation M&V Activities
Post-kW measurements will be sampled and measured once after retrofit and these values will be used for rest of the guaranteed term. Light levels will be measured at sampled locations to ensure minimal standards are achieved. Savings predictions will be corrected based on as-built data and will be reported in the Post-Installation Report. Fixture power will be measured in a manner identical to that for the baseline fixtures. Sample sizes for measurements and procedures are described. These measurements will be used to calculate actual expected energy savings and will be detailed in the Post-Installation Report

Performance Period M&V Activities

A practical sampling approach, as advised by the IPMVP, will be implemented. Specifically, lighting fixtures representing more than 10% of the total installations will be included in the sampling process. These fixtures will be categorized into homogeneous groups, and samples will be taken to attain a precision of ±10% with 90% confidence.

The equipment will be used to achieve the verification will involve a True-RMS Wattmeter (kW measurement) and light meter (light level measurement), HOBO loggers for Logging Operating Hours: Continuous monitoring (manual or metering) on a sample population within each usage group.

Table 3.2.4 Guaranteed Savings Summary

Description	Electric Savings kWh
LED Lighting and Lighting Controls	93,455

3.2.5 Overview of M&V Plan – ECM 5,6,7,8,9 - HVAC and BMS upgrades

The M&V plan for this ECM is based on IPMVP Option D.

This method requires metering of RTU electric and load variables in both the baseline and post-installation period. Baseline metering will be performed over a short-term period, and continuous metering via the BMS will be done in the post-installation period.

The M&V plan for this retrofit assumes:

- Building occupancy hours and number of occupants will be established before the retrofit.
- Existing space temperatures, set points, RH% and schedules will be documented before the retrofit. Post retrofit temperatures, set points and schedules are held constant during the performance period for the purpose of energy savings calculations.
- An annual verification of the measure will be performed to document that temperatures, set points and schedules are as specified in the Final Proposal.

The existing RTU, heat pump and FCU will be replaced with a new, higher efficiency unit. The proposed RTU will have a nominal full-load rating of 40Ton at ARI conditions. Part-load performance is significantly improved due to the VFD option, which allows better part-load performance than the existing RTU with inlet guide vanes.

Savings Verification Methodology

RTU savings were performed using the TRANE Trace 700 software by inserting the building heating/cooling load requirements.

For Heat pump replacement spread sheets tools were used. Energy (kWh) and demand (kW) savings will be calculated using the equations below:

Energy Use (kWh) = (Capacity (Tons)*(Hours of Operation/Year)*(Scheduled Usage)*(Efficiency) [Efficiency calculation is in kW/ton for simplicity]

System Checksums

By Trane

New 40-Ton RTU — **Variable Volume Reheat (30% Min Flow Default)**

COOLING COIL PEAK — Peaked at Time: Mo/Hr: 7 / 16; Outside Air: OADB/WB/HR: 87 / 72 / 95

	Space Sens. + Lat. Btu/h	Plenum Sens. + Lat Btu/h	Net Total Btu/h	Percent Of Total (%)
Envelope Loads				
Skylite Solar	0	0	0	0
Skylite Cond	0	0	0	0
Roof Cond	0	114,432	114,432	29
Glass Solar	32,251	0	32,251	8
Glass/Door Cond	5,401	0	5,401	1
Wall Cond	18,678	11,901	30,779	8
Partition/Door	0		0	0
Floor	0		0	0
Adjacent Floor	0	0	0	0
Infiltration	11,667		11,667	3
Sub Total ==>	68,197	126,333	194,530	50
Internal Loads				
Lights	41,833	0	41,833	11
People	53,600	0	53,600	14
Misc	21,517	0	21,517	5
Sub Total ==>	116,950	0	116,950	30
Ceiling Load	25,551	-25,551	0	0
Ventilation Load	0	0	94,713	24
Adj Air Trans Heat	0		0	0
Dehumid. Ov Sizing			0	0
Ov/Undr Sizing	1,201		1,201	0
Exhaust Heat		-15,210	-15,210	-4
Sup. Fan Heat			0	0
Ret. Fan Heat		0	0	0
Duct Heat Pkup		0	0	0
Underflr Sup Ht Pkup			0	0
Supply Air Leakage		0	0	0
Grand Total ==>	211,899	85,571	392,184	100.00

CLG SPACE PEAK — Mo/Hr: 8 / 16; OADB: 86

	Space Sensible Btu/h	Percent Of Total (%)
Envelope Loads		
Skylite Solar	0	0
Skylite Cond	0	0
Roof Cond	0	0
Glass Solar	37,529	20
Glass/Door Cond	5,131	3
Wall Cond	17,948	10
Partition/Door	0	0
Floor	0	0
Adjacent Floor	0	0
Infiltration	5,008	3
Sub Total ==>	65,616	35
Internal Loads		
Lights	41,833	22
People	32,830	18
Misc	21,517	12
Sub Total ==>	96,180	52
Ceiling Load	22,849	12
Ventilation Load	0	0
Adj Air Trans Heat	0	0
Ov/Undr Sizing	1,422	1
Exhaust Heat		
OA Preheat Diff.		
RA Preheat Diff.		
Additional Reheat		
Underflr Sup Ht Pkup		
Supply Air Leakage		
Grand Total ==>	186,067	100.00

HEATING COIL PEAK — Mo/Hr: Heating Design; OADB: 15

	Space Peak Space Sens Btu/h	Coil Peak Tot Sens Btu/h	Percent Of Total (%)
Envelope Loads			
Skylite Solar	0	0	0.00
Skylite Cond	0	0	0.00
Roof Cond	0	-87,606	23.76
Glass Solar	0	0	0.00
Glass/Door Cond	-19,011	-19,011	5.16
Wall Cond	-45,633	-69,381	18.83
Partition/Door	0	0	0.00
Floor	0	0	0.00
Adjacent Floor	0	0	0
Infiltration	-34,865	-34,865	9.46
Sub Total ==>	-99,509	-210,863	57.23
Internal Loads			
Lights	0	0	0.00
People	0	0	0.00
Misc	0	0	0.00
Sub Total ==>	0	0	0.00
Ceiling Load	-38,789	0	0.00
Ventilation Load	0	-141,320	38.35
Adj Air Trans Heat	0	0	0
Ov/Undr Sizing	-30,259	-30,259	8.21
Exhaust Heat		25,568	-6.94
OA Preheat Diff.		0	0.00
RA Preheat Diff.		-11,587	3.14
Additional Reheat		0	0.00
Underflr Sup Ht Pkup		0	0.00
Supply Air Leakage		0	0.00
Grand Total ==>	-168,557	-368,462	100.00

TEMPERATURES

	Cooling	Heating
SADB	60.0	90.0
Ra Plenum	75.3	62.0
Return	75.3	63.1
Ret/OA	76.9	47.7
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

AIRFLOWS

	Cooling	Heating
Diffuser	16,692	7,560
Terminal	16,692	7,560
Main Fan	16,692	7,560
Sec Fan	0	0
Nom Vent	2,305	2,305
AHU Vent	2,305	2,305
Infil	284	569
MinStop/Rh	7,560	7,560
Return	16,969	8,115
Exhaust	2,582	2,859
Rm Exh	7	15
Auxiliary	0	0
Leakage Dwn	0	0
Leakage Ups	0	0

ENGINEERING CKS

	Cooling	Heating
% OA	13.8	30.5
cfm/ft²	0.95	0.43
cfm/ton	510.73	
ft²/ton	535.77	
Btu/hr·ft²	22.40	-21.04
No. People	134	

COOLING COIL SELECTION

	Total Capacity ton	Total Capacity MBh	Sens Cap. MBh	Coil Airflow cfm	Enter DB °F	Enter WB °F	Enter HR gr/lb	Leave DB °F	Leave WB °F	Leave HR gr/lb
Main Clg	32.7	392.2	312.9	16,571	76.9	64.4	70.6	60.0	56.8	63.9
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Total	32.7	392.2								

AREAS

	Gross Total	Glass ft²	Glass (%)
Floor	17,510		
Part	0		
Int Door	0		
ExFlr	0		
Roof	15,260	0	0
Wall	5,915	571	10
Ext Door	0	0	0

HEATING COIL SELECTION

	Capacity MBh	Coil Airflow cfm	Ent °F	Lvg °F
Main Htg	-252.8	7,560	60.0	90.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-115.6	2,305	15.0	60.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-368.5			

Project Name: RENU - Central Islip Public Library
Dataset Name: TRACE000.TRC

TRACE® 700 v6.2.4 calculated at 10:16 AM on 09/28/2023
Alternative - 1 System Checksums Report Page 3 of 6

Baseline M&V Activities

The baseline energy consumption will be established through collection of baseline data parameters including:

- Existing space temperatures, set points and schedules
- Building geometry and envelope detail

- Efficiency of existing heating and cooling equipment
- Occupancy hours, number of occupants and operating hours of equipment
- Outside air ventilation levels
- Identified operating issues and problems (from facility personnel)
- Location – weather bin data, HDD, CDD

The data collected is used within the Trane Trace software to generate baseline energy consumption for the HVAC equipment.

The equipment to be used is current transducers to record the energy consumption by providing means to measure the electric current flowing through the equipment (RTUs, Duct Heaters, FCU, HP) which contributes in:

- Current Measurement: By installing a current transducer in line with the power supply equipment, it can accurately measure the current passing through the system.
- Real-time Monitoring: The data collected by current transducers enable real-time monitoring of the electrical current drawn by the equipment. This real-time information allows for immediate awareness of variations and abnormalities in energy consumption.

Post-Installation M&V Activities

Post installation savings is determined from the same baseline model and equipment, and modified for the set points and energy rates.

Trane Trace, an hourly building simulation model to generate baseline and post-retrofit models of the facilities energy use. Trane Trace essentially utilizes standard heat transfer equations to determine heating and cooling loads based on the heat loss or gain through the building envelope, the amount of outdoor air brought into the building, and any source of internal heat gain such as lighting or occupants.

Performance Period M&V Activities

Metering to be conducted will require short and/or long-term continuous interval measurements. Continuous interval measurements are to be made to reflect the full cycle of operation. After the new HVAC units have been installed and commissioned, RENU will conduct a post-installation inspection to verify that the units installed are consistent with what was proposed and has the potential to generate the cost savings predicted.

Table 3.2.5 Guaranteed Savings Summary

Description	Electric Savings kWh
Rooftop Unit upgrades with VAV boxes	59,622
Replace Heat Pump	1,166
Fan Coil Unit Replacement	5,119
BMS (DCV and HVAC control)	17,470

3.2.6 Overview of M&V Plan – ECM 10 - Gas-Fired Water Heater

The M&V plan for this ECM is based on IPMVP Option C.

This ECM involves replacing the existing electric boiler with a more efficient instantaneous gas fired boiler. The existing boiler distributes hot water to the building to be used in the bathrooms and kitchen.

Option C will be used to quantify the savings by metering the gas usage.

Savings Verification Methodology

The detailed calculations for the energy savings and the main equations used are down below:

- Heating Value for Gallon of Water = 1btu/1lb water x 8lbs/gal x (DHW Setpoint - Incoming Water Temperature)
- Existing Energy Usage = ((DHW usage x No. of People x Occupied Days/Year x Heating Value per gal Water)/Existing Efficiency)/btu per unit
- Proposed Energy Usage = ((DHW usage x No. of People x Occupied Days/Year x Heating Value per gal Water) Proposed Efficiency)/btu per unit

Project: **Central Islip Public Library**
Site:

Description Removal of an existing domestic water heating and replacing with a high efficiency model.

Given	Fuel Energy Cost	=	$1.350	$/Therm (Nat'l Gas)	0.166 $/kWh
	Occupied Days/Year	=	250		
	Existing Temperature Setpoint	=	120	Degrees F	
	Type of Facility	=	School-Primary		
Assumptions	Number of People in Facility	=	100		
	DHW Usage	=	0.60	gal/person/day *	
	City Water Temperature	=	55	Degrees F	
	Energy to heat water	=	1	Btu/Gal/Deg	
	Existing Efficiency	=	100%	(Electric 100% Efficient)	
	Proposed Boiler Efficiency	=	95%		

Formula
Heating Value for Gallon of Water = 1btu/1lb water x 8lbs/gal x (DHW Setpoint - Incoming Water Temperature)
Existing Energy Usage = ((DHW usage x No. of People x Occupied Days/Year x Heating Value per gal Water)/Existing Efficiency)/btu per unit
Proposed Energy Usage = ((DHW usage x No. of People x Occupied Days/Year x Heating Value per gal Water)Proposed Efficiency)/btu per unit

Calculation

Heating Value for Gallon of Water = 1 x 8 x (120 - 55) = **520 btu/gal**

	DHW Usage		No. of People		Occupied Days/Yr		Htg Value		Htr Eff.		Btu/ Unit		
Existing Energy Usage =((	0.60	x	100	x	250	x	520	)/	100%	)/	100,000	=	**78 Therm**
Proposed Energy Usage =((	0.60	x	100	x	250	x	520	)/	95%	)/	100,000	=	**82 Therm**

	Usage		Cost		
Existing Energy Costs =	2285	x	$0.17	=	$ 379
Proposed Energy Costs =	82	x	$1.35	=	$ 111

Result

Existing Annual Use=		**2,285**	**kWh**	**$ 379**
Proposed Annual Use=		**82**	**Therm**	**$ 111**
Annual Savings=	=	**2285.4**	**kWh**	**$ 269**
Demand Savings =	=	**3.5**	**kW**	
Savings as Percent of Existing	=	**-82.1**	**Therm**	**$ -**

Baseline M&V Activities

The primary purpose of establishing this baseline was to establish a clear reference point against which the post-replacement performance could be effectively compared. Notable parameters incorporated into the savings estimation process included the number of occupied days per year, the total occupancy of the facility, the prevailing city water temperature, and the specific hot water demand (DHW usage).

The equipment to be used is current transducers to record the energy consumption by providing means to measure the electric current flowing through the equipment which contributes in:

- Current Measurement: By installing a current transducer in line with the power supply equipment, it can accurately measure the current passing through the system.

- Real-time Monitoring: The data collected by current transducers enable real-time monitoring of the electrical current drawn by the equipment. This real-time information allows for immediate awareness of variations and abnormalities in energy consumption.

Post-Installation M&V Activities

RENU shall record the energy consumption of loads associated with the ECM through a dedicated meter/totalizer to be installed. At the end of the M&V period, the gas consumption data will be used for comparison with the baseline and actual consumption.

Performance Period M&V Activities

The metered equipment shall be inspected at the conclusion of the M&V period and as needed to verify proper operation. All collected information and comparison results will be included in the M&V report.

Table 3.2.6 Guaranteed Savings Summary

Description	Electric Savings kWh
Gas fired water heater	2,114

3.2.7 Overview of M&V Plan – ECM 11- Plug Loads

The M&V plan for this ECM is based on IPMVP Option A.

The primary intent of the M&V plan Option A for Plug Load Control is to verify and quantify the energy savings achieved by automatically turning off or putting electronic devices in standby mode when they are not in use.

Savings Verification Methodology

Savings calculation methods for Plug Load Control often involve the comparison of pre-installation and post-installation energy consumption data.

Preliminary Savings Sheet for Central Islip Library						Project Total
# of Berts	02	15	03	04	01	25
Total Annual kWh Savings	90	1,266	675	1,261	343	3,636
Total Annual $ Savings	$11	$152	$81	$151	$41	$436
Device Type:	Projector	M Printer	Copier	Lrg Coffee	H/C Water	
Watts:	8	15	40	56	61	
# Hours Scheduled ON per Year: BASELINE	8,760	8,760	8,760	8,760	8,760	
Central Isliip Library	LIB					
# of Berts	02	15	03	04	01	25
# Hours Scheduled ON per Year: BERT	3,132	3,132	3,132	3,132	3,132	
# Hours Scheduled OFF per Year: BERT	5,628	5,628	5,628	5,628	5,628	
Total Annual kWh Savings	90	1,266	675	1,261	343	3,636
Total Annual $ Savings	$11	$152	$81	$151	$41	$436
Annual $ Savings per Device	$5.40	$10.13	$27.01	$37.82	$41.20	

Device Name	Projector	Charging Cart	M Printer	Copier	Snack Vend	Soda Vend	Lrg Coffee	H/C Water
Wattage	8	37	15	40	40	320	56	61

ES	Calendar Sta	9/1/2018	Calendar End	6/30/2019	Weekday ON Days:	215
MS	Calendar Sta	9/1/2018	Calendar End	6/30/2019	Weekday ON Days:	215
HS	Calendar Sta	8/15/2019	Calendar End	6/15/2020	Weekday ON Days:	218

Building Type	Number of Days ON per year				Number of Hours ON per day			
Building Type	Weekday ON Days	Saturday ON Days	Sunday ON Days	# Days devices OFF	Weekday ON Hours	Saturday ON Hours	Sunday ON Hours	Annual Hours Using Bert Schedule
ADMIN -12 Mont	261	0	0	104	12	0	0	3,132
ES -9 MONTHS	220	0	0	145	11	0	0	2,420
MS-9 MONTHS	220	0	0	145	12	0	0	2,640
HS - 9 MONTHS	220	0	0	145	13	10	0	2,860
UNIV - 12 MONT	261	0	0	104	13	0	0	3,393
LAB - 12 MONTH	261	0	0	104	13	0	0	3,393
PUB - 12 MONTH	261	0	0	104	12	0	0	3,132
SAFE-12 MONTH	261	0	0	104	12	0	0	3,132
FOOD-12 MONTH	261	0	0	104	13	10	0	3,393
SERV-12 MONTH	261	0	0	104	12	0	0	3,132
WARE-12 MONTH	261	0	0	104	12	10	0	3,132
LODG-12 MONTH	261	0	0	104	12	0	0	3,132
MED-12 MONTHS	261	0	0	104	12	0	0	3,132
OTHER-12 MONT	261	0	0	104	12	10	0	3,132

Reminders:

Verify data

For projects with K-12 buildings: enter the calendar start & stop dates here

For all Projects:
Enter the # Weekday ON days. For K-12 buildings, enter the numbers shown in H6:H8.

Enter 261 for buildings with 12 month occupancy

Then enter the # of ON hours for weekdays, Saturday and Sunday

Baseline M&V Activities

Key steps include:

- Calculating energy consumption before and after control measures are implemented, taking into account factors like equipment schedules and occupancy patterns.
- A sample of equipment being controlled will be monitored for a two-week period through a sample of basic plug meters that can log the current usage.

Post-Installation M&V Activities

- Installation and commissioning of plug load control devices or systems, following design specifications.
- Post-installation data collection, covering the same parameters as the pre-installation phase, to measure the impact of control measures on energy use
- The software will be used to collect usage data for a two-week period. Measured data will be used to evaluate the savings

Performance Period M&V Activities

Periodic inspections and maintenance to ensure the continued operation and optimization of plug load control systems.

Table 3.2.7 Guaranteed Savings Summary

Description	Electric Savings kWh
Plug Loads	3,363

ATTACHMENT G

CONTRACT COST AND ANNUAL SERVICES

(a) Client agrees to pay to ESCO, the amount equal to the Project Cost, as listed below, in accordance with the terms described in Section 4 of the Contract. The project payments shall be substantially the same as those found in Attachment G-1, Project Payments, attached hereto. Please note this is a projected payment schedule, subject to market conditions at the time of actual project financing approval.

Project Cost:	$2,472,189
Downpayment:	$1,050,000
Net Financed Amount:	$1,422,189

Progress Payments are attached hereto as Attachment G-1.

Schedule G-1

Year	Payment
1	$137,180
2	$137,180
3	$137,180
4	$137,180
5	$137,180
6	$137,180
7	$137,180
8	$137,180
9	$137,180
10	$137,180
11	$137,180
12	$137,180
13	$137,180
14	$137,180
15	$138,017
Total	$2,058,535

(b) Maintenance Fee: Client shall pay ESCO for annual maintenance provided under this Contract that the Parties mutually agree to have ESCO perform. Client agrees to pay the annual Maintenance Fee as provided for below with respect to such agreed upon services.

Table G-1 – Annual Maintenance Fee

Year	Fee
1	$0
2	$0
3	$0
4	$0
5	$0
6	$0
7	$0
8	$0
9	$0
10	$0
11	$0
12	$0
13	$0
14	$0
15	$0
16	$0
17	$0
18	$0
Total	$0

(c) Measurement & Verification Fee: Client shall pay ESCO for annual measurement and verification services payable at the beginning of each performance period. Client agrees to pay the annual Measurement & Verification fee as provided for below with respect to such agreed upon services.

Table G-2 – Annual M&V Fee

Year	Fee
1	$2,588
2	$2,678
3	$2,772
4	$2,869
5	$2,969
Total	$13,876

(d) Performance Period Fee: The annual performance period fee shall be the sum of the Maintenance Fee and the Measurement and Verification Fee. Client agrees to pay the following Performance Period Fees

Table G-3 – Performance Period Fee

Year	Fee
1	$2,588
2	$2,678
3	$2,772
4	$2,869
5	$2,969
6	$0
7	$0
8	$0
9	$0
10	$0
11	$0
12	$0
13	$0
14	$0
15	$0
16	$0
17	$0
18	$0
Total	$13,876

(e) Cash Flow Table

The following cash flow demonstrates the annual positive cost benefits associated with implementation of the Energy Performance Contract over the 18-year term.

Year	Guaranteed Energy Savings	O&M Savings	Total Savings	Payments	M&V Service	Total Cost	Net Cash Flow
ENERGY REBATE/ INCENTIVE			$207,888				
1	$77,180	$5,059	$82,240	$137,180	$2,588	$139,767	-$57,528
2	$79,882	$5,160	$85,042	$137,180	$2,678	$139,858	-$54,816
3	$82,678	$5,264	$87,941	$137,180	$2,772	$139,952	-$52,010
4	$85,571	$5,369	$90,940	$137,180	$2,869	$140,049	-$49,108
5	$88,566	$5,476	$94,043	$137,180	$2,969	$140,149	-$46,106
6	$91,666	$0	$91,666	$137,180	$0	$137,180	-$45,514
7	$94,875	$0	$94,875	$137,180	$0	$137,180	-$42,305
8	$98,195	$0	$98,195	$137,180	$0	$137,180	-$38,985
9	$101,632	$0	$101,632	$137,180	$0	$137,180	-$35,548
10	$105,189	$0	$105,189	$137,180	$0	$137,180	-$31,991
11	$108,871	$0	$108,871	$137,180	$0	$137,180	-$28,309
12	$112,681	$0	$112,681	$137,180	$0	$137,180	-$24,499
13	$116,625	$0	$116,625	$137,180	$0	$137,180	-$20,555
14	$120,707	$0	$120,707	$137,180	$0	$137,180	-$16,473
15	$124,932	$0	$124,932	$138,017	$0	$138,017	-$13,085
16	$129,304	$0	$129,304	$0	$0	$0	$129,304
17	$133,830	$0	$133,830	$0	$0	$0	$133,830
18	$138,514	$0	$138,514	$0	$0	$0	$138,514
TOTAL	**$1,890,898**	**$26,328**	**$2,125,114**	**$2,058,535**	**$13,875**	**$2,072,411**	**$52,704**

ATTACHMENT H

CHANGE ORDER FORM

(Request & Agreement for Change in Plans and/or Specifications and/or Contract)

Change Request No. _____

Client:_____

Department:_____

Project No._____ Contract No._____ Site:_____

Title:_____

I. REQUEST Date:_____

(a) Requested by_____ Of_____

(b) Description of change _____

_____

II. ESCO's AGREEMENT

For all costs involved in this change including extensions of time herein requested ESCO proposes to perform the work described in accordance with the provisions of the subject Contract and certifies that the attached cost data is accurate, complete and current, and mathematically correct.

Payment shall be made on the basis of:

If necessary, attach detailed estimates and breakdown for above in accordance with change order instruction. A claim for work performed under protest may be submitted in writing.

An extension of contract time of _____ calendar days to _____ is requested.

ESCO_____ by_____ Date:_____

CLIENT APPROVAL: Date:_____

Client:

By:
Title:

Contract Award	$_____
Previous Additions	$_____
Previous Deductions	$_____
Net Total	$_____
This Change	$_____
Total	$_____

ATTACHMENT I

MAINTENANCE SERVICES

Maintenance services provided by ESCO are limited to annual oversight activities as described in the M&V Plan. Oversight activities are limited to annual confirmation that the Client continues to operate, maintain, and repair the ECMs in a manner consistent with contract requirements to ensure the persistence of guarantees savings over the term of the Project.

ATTACHMENT J

PROPOSED CONSTRUCTION SCHEDULE

The installed equipment is summarized in Table J.1 and included under Attachment J summarized as follows:

1. Gantt chart of Construction Schedule

ATTACHMENT K

STANDARDS OF SERVICE

The Standards of Service documents equipment operating characteristics for the purpose of developing baseline energy use and energy efficient upgrade profiles.

Lighting Systems:
Standards of Service for lighting systems are defined as the footcandle(fc) at the work surface by the new lighting and/or other equipment to be affected by the ECMs. The pre-construction fc levels and equipment schedules are used in the development and calibration of the system baseline energy use model/analysis. The post-construction fc levels and equipment schedules are used in the development of the system energy use model/analysis, and the associated savings.

Mechanical Systems:
Standards of Service for mechanical systems are defined as the temperature settings and equipment schedules for buildings, zones, and/or other equipment to be affected by the ECMs. The pre-construction temperature settings and equipment schedules are used in the development and calibration of the system baseline energy use model/analysis. The post-construction temperature settings and equipment schedules are used in the development of the system energy use model/analysis, and the associated savings.

Water Standard of Service:
Standards of Service for water systems are defined as the pre-construction plumbing fixture flow rates (GPF & GPM), usage patterns (flushes or minutes per day) and occupancy for areas affected by the ECM. Baseline water usage is calculated based on the plumbing fixture flow rates and usage patterns. A water allocation is developed for each building and is compared to the actual (metered) water usage to validate the estimated baseline. The post-construction plumbing fixture flow rates are used to calculate the water usage of the system and the associated savings.

The following Attachments K-1 and K-2 document the Standards of Service for the mechanical and water systems, respectively.

K-1 LIGHTING STANDARDS OF SERVICE

The following average maintained standards of service and comfort shall apply:

I. SPACE LIGHT LEVELS (FC):

Description	Occupied Hours		Average Existing FC	Average Proposed FC
	From	To		
Community Room	Mon – Thurs: 8AM – 9PM Fri -Sat: 9AM- 5PM Sun: 1PM-5PM		71	75
Children's Library	Mon – Thurs: 8AM – 9PM Fri -Sat: 9AM- 5PM Sun: 1PM-5PM		61	73
Main Library	Mon – Thurs: 8AM – 9PM Fri -Sat: 9AM- 5PM Sun: 1PM-5PM		68	73
Lower Stacks	Mon – Thurs: 8AM – 9PM Fri -Sat: 9AM- 5PM Sun: 1PM-5PM		30	45

If Client is unable to meet these Standards of Comfort for any reason, Client and ESCO shall mutually agree upon an appropriate adjustment to energy savings.

K-2 MECHANICAL STANDARDS OF SERVICE

The following average maintained standards of service and comfort shall apply:

I. SPACE TEMPERATURES:

Description	Occupied Hours		Heat Temp Occ/Unocc	Cool Temp Occ/Unocc	Winter Days per Week	Summer Days per week
	From	To				
LIBRARY	Mon – Thurs: 8AM – 9PM Fri -Sat: 9AM- 5PM Sun: 1PM-5PM		72 / 66-68	72 / 76-78	7	6 (closed on Sundays)
	Mon – Thurs: 8AM – 9PM Fri -Sat: 9AM- 5PM Sun: 1PM-5PM		72/ 66-68	72 / 76-78	7	6 (closed on Sundays)
	Mon – Thurs: 8AM – 9PM Fri -Sat: 9AM- 5PM Sun: 1PM-5PM		72 / 66-68	72/76-78	7	6 (closed on Sundays)

II. HOT WATER HEATERS:
DHW 100-105°F

III. VENTILATION: Within AHSRAE 62-2007 Code.

If Client is unable to meet these Standards of Comfort for any reason, Client and ESCO shall mutually agree upon an appropriate adjustment to energy savings.

If Client is unable to meet these Standards of Service, Comfort or Consumption parameters for any reason, Client and ESCO shall mutually agree upon an appropriate adjustment to energy savings.

ATTACHMENT L

MODIFICATIONS TO COMPREHENSIVE ENERGY AUDIT

None as of December 21, 2023.

ATTACHMENT M

FORM OF CLIENT'S APPROVAL OF SAMPLE OR SPECIFICATIONS

Left intentionally blank.

ATTACHMENT N

INSURANCE REQUIREMENTS

Central Islip Public Library- Renu Energy Solution Insurance Requirements Agreement

This Agreement is made this 25th day of October in the year 2023, by and between the:

Property owner: Central Islip Public Library and the contractor: Renu Contracting & Restoration, Inc.

For services in connection with the contracted work: Energy Conservation Services and Installation

For the following project: Central Islip Public Library

Contractor shall abide by the following terms, and shall purchase and maintain insurance through carriers authorized to do business within the State of New York of the following types of coverage and limits of liability:

1. Commercial General Liability (CGL)

a. CGL with limits of insurance of not less than $1,000,000 Each Occurrence, $2,000,000 Products - Completed Operations Aggregate, $1,000,000 Personal & Advertising Injury, $1,000,000 Damage to Premises Rented to You, $5,000 Medical Expense (any one person) and $2,000,000 General Annual Aggregate. The General Annual Aggregate shall apply separately to each construction project.

b. CGL coverage shall be written on a current version of ISO Occurrence Commercial General Liability Coverage form CG 00 01 or a form providing equivalent coverage and shall cover liability arising from premises, ongoing operations, independent contractors, products-completed operations, and personal and advertising injury.

c. The Property Owner and all other parties required by the Property Owner, shall be named as additional insureds on the CGL coverage part using Additional Insured – Owners, Lessees or Contractors CG 20 10 , Additional Insured – Owners, Lessees or Contractors – Completed Operations CG 20 37, or endorsements providing equivalent coverage to the additional insureds. Coverage for the additional insureds shall be as broad as the coverage provided for the named insured Contractor. It shall apply as primary and non-contributory insurance before any other insurance or self-insurance, including any deductible, maintained by, or provided to, the additional insured.

d. Contractor shall maintain CGL coverage for itself and all additional insureds for the duration of the project and maintain Completed Operations coverage for itself and each additional insured for at least 3 years after completion of the work.

2. Automobile Liability

a. Business Auto Liability with limits of at least $1,000,000 each accident.

b. Business Auto coverage must include coverage for liability arising out of all owned, leased, hired and non-owned automobiles.

3. Commercial Umbrella

a. Umbrella limits must be at least $10,000,000 and must provide coverage over all underlying policies.

b. Umbrella coverage must include as additional insureds all entities that are additional insureds on the CGL.

4. Workers Compensation and Employers Liability

a. Employers Liability Insurance limits of at least $500,000 each accident for bodily injury by accident and $500,000 each employee for injury by disease.

b. Where applicable, U.S. Longshore and Harborworkers Compensation Act Endorsement shall be attached to the policy.

c. Where applicable, the Maritime Coverage Endorsement shall be attached to the policy.

5. Waiver of Subrogation (Waiver of Transfer of Rights of Recovery Against Others to Us)

Contractor shall waive all rights against Property Owner and their agents, officers, directors and employees for recovery of damages to the extent these damages are covered by commercial general liability, commercial umbrella liability, business auto liability or workers compensation and employer's liability insurance maintained per requirements stated above and where permitted by law.

6. Certificates of Insurance

a. Contractor shall provide the Property Owner, prior to commencement of work, valid Certificates of Insurance, and all applicable additional insured endorsements, verifying that the foregoing insurance requirements have been met, and will continue to display, upon demand, such certificates throughout the duration of the project.

b. Contractor understands the terms of this Insurance Requirements Agreement and acknowledges that it is part of any construction contract or as a stand-alone Insurance Requirements Agreement.

7. Indemnification/Hold Harmless

Contractor shall, to the fullest extent permitted by law, protect, defend, save, indemnify and hold harmless the Property Owner, its officers, shareholders, agents, servants, employees, and volunteers, from and against any and all demands, claims, lawsuits, actions or causes of actions, judgments, damages, liabilities, losses, costs and expenses, including without limitation interest, penalties and reasonable attorney's fees and expenses and reasonable investigatory and expert fees and expenses asserted against the Property Owner by any third party (including any governmental entity) arising out of any claim for loss or damage of any property, injuries to or death of persons, containment of or adverse effects on the environment, or any violation of any statutes, ordinance, order, rule or regulation of any governmental entity or agency, of any cause whatsoever,*except those claims, demands, suits or causes of action arising out of the sole negligence of the Property Owner, its officers, agents, servants, employees and volunteers. The Property Owner shall be entitled to investigators ~~and attorneys~~ of its own choosing. This term shall survive completion of work, and shall apply to completed operations and products as well as ongoing work. If such indemnity is made void or otherwise impaired by any law controlling the construction thereof, such indemnity shall be deemed to conform to the indemnity permitted by law, so as to require indemnification, in whole or in part, to the fullest extent permitted by law. The indemnity provided by requirements contained herein shall be in addition to, and not in limitation of, any rights of common law indemnity.

* but only to the extent arising out of the sole negligence of the Contractor, and

The terms and conditions set forth above are hereby agreed.

Property Owner: Central Islip Public Library Contractor Renu Contracting & Restoration, Inc.

By: T Kohler By:

Printed Name: Tara Kohler Printed Name: Dan Coffey, VP Operations

***DISCLAIMER:** Please be advised that the contract language provided is for informational purposes only. We are not attorneys, and cannot offer legal advice, or advice on the possible success or failure of the language provided. Moreover, this language may not work in all situations or all jurisdictions. Some jurisdictions interpret contracts differently, and some states restrict indemnity agreements. You should consult an attorney before deciding whether to make use of the language provided.*

FIRST AMENDMENT

THE FIRST AMENDMENT TO ENERGY SERVICES CONTRACT ("First Amendment"), dated as of June 26, 2024 ("Effective Date"), is entered by and between RENU CONTRACTING & RESTORATION, INC. d/b/a RENU ENERGY SOLUTIONS, a New York corporation, having an address at 20 35th Street, Copiague, New York 11726 ("ESCO"), and CENTRAL ISLIP PUBLIC LIBRARY, having an address at 33 Hawthorne Avenue, Central Islip, New York 11722 ("Client") (collectively, the "Parties"), in respect of that certain Energy Services Contract dated December 21, 2023 (as amended, modified or supplemented from time to time, the "Contract") between such Parties.

WITNESSETH:

WHEREAS, ESCO and Client desire to amend the Contract, as provided below, upon the terms and subject to the conditions set forth herein.

NOW, THEREFORE, in consideration for the mutual promises contained herein, and for other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the Parties hereby agree as follows:

1. **Defined Terms**. Capitalized terms used but not otherwise defined in this First Amendment shall have the meaning given to them in the Contract.

2. **Amendment**. Subject to the satisfaction of the Conditions Precedent set forth in Section 3 of this First Amendment, the Contract is amended as of the Effective Date, as follows:

    a. The cover page of the Contract is hereby deleted in its entirety and replaced with the following inserted in lieu thereof:

ENERGY SERVICES CONTRACT

BY AND BETWEEN

CENTRAL ISLIP PUBLIC LIBRARY

AND

RENU Contracting & Restoration, Inc. d/b/a RENU ENERGY SOLUTIONS

b. On page 4 of the Contract, the first paragraph is hereby deleted in its entirety and replaced with the following inserted in lieu thereof:

THIS ENERGY SERVICES CONTRACT ("Contract") is made and entered into as of December 21,2023 (“Effective Date”), by and between Central Islip Public Library, having its principal place of business located at 33 Hawthorne Avenue, Central Islip, NY 11722 (“Client”) and RENU Contracting & Restoration, Inc. d/b/a RENU Energy Solutions, having its principal place of business at 20 35th Street, Copiague, NY 11726 ("ESCO"). ESCO and Client are sometimes hereinafter referred to collectively as the ”Parties.”

c. On page 7 of the Contract, paragraph (a) of Section 4 (Compensation and Payment) is hereby deleted in its entirety and replaced with the following inserted in lieu thereof:

The cost of the Project is Two Million Four Hundred Ninety Thousand One Hundred Dollars ($2,490,100.00).

d. On page 12 of the Contract, paragraph (c) of Section 20 (Assignments and Subcontracting) is hereby deleted in its entirety and replaced with the following inserted in lieu thereof:

ESCO shall not assign this Contract in whole or in part to any other party without first obtaining the consent of Client, which consent shall not be unreasonably withheld. Notwithstanding the foregoing, ESCO may assign, without obtaining the consent of Client, its rights and obligations under this Contract in whole or in part to any affiliated or associated company of ESCO, as well as to any entity that merges with or acquires ESCO (which shall include any transaction involving the sale of substantially all of ESCO’s assets). ESCO will notify Client fifteen (15) days prior to any such assignment.

e. “Attachment B” (Scope of Services) to the Contract is hereby deleted in its entirety and replaced with a revised version of the same, which is annexed hereto as **Exhibit A**.

f. “Attachment F” (Guarantee of Energy Cost Savings) to the Contract is hereby deleted in its entirety and replaced with a revised version of the same, which is annexed hereto as **Exhibit B**.

g. “Attachment G” (Contract Cost and Annual Services) to the Contract is hereby deleted in its entirety and replaced with a revised version of the same, which is annexed hereto as **Exhibit C**.

h. "Attachment K" (Standards of Service) to the Contract is hereby deleted in its entirety and replaced with a revised version of the same, which is annexed hereto as **Exhibit D**.

i. "Attachment L" (Modifications to Comprehensive Energy Audit) to the Contract is hereby deleted in its entirety and replaced with a revised version of the same, which is annexed hereto as **Exhibit E**.

3. **Conditions Precedent**. The effectiveness of this First Amendment is subject to the following conditions precedent: (i) ESCO and Client shall have executed the First Amendment, (ii) this First Amendment may be executed in multiple counterparts, each of which shall be deemed an original, and all of which shall constitute one agreement. This First Amendment may be executed by facsimile or PDF signature by any party and such signature shall be deemed binding for all purposes hereof without delivery of an original signature being thereafter required.

4. **Full Force and Effect**. Except as expressly provided herein, the Contract, as modified by this First Amendment, remains in full force and effect.

5. **Governing Law**. This First Amendment shall be governed by and construed in accordance with the laws of the State of New York.

6. **Invalidity**. If any terms, covenant or condition of this First Amendment shall be held to be invalid, illegal or unenforceable in any respect, this First Amendment shall be construed without such provision.

IN WITNESS WHEREOF, RENU CONTRACTING & RESTORATION, INC. d/b/a RENU ENERGY SOLUTIONS and CENTRAL ISLIP PUBLIC LIBRARY have caused this First Amendment to the Agreement to be duly executed.

RENU CONTRACTING & RESTORATION, INC.
d/b/a RENU ENERGY SOLUTIONS

By: Robert Ragozine
Name: Robert Ragozine
Title: Vice President

CENTRAL ISLIP PUBLIC LIBRARY

By: T. Kohles
Name: Tara Kohles
Title: Library Director

EXHIBIT A

ATTACHMENT B

SCOPE OF SERVICES

DESCRIPTION OF THE ENERGY CONSERVATION MEASURES AND THE EQUIPMENT

Building Name	ECM #	Proposed Energy Conservation Measure (ECM)
Central Islip Public Library	1	Roof Replacement
Central Islip Public Library	2	Building Envelope Upgrades
Central Islip Public Library	3	Rooftop Solar
Central Islip Public Library	4	LED Lighting and Controls
Central Islip Public Library	5	Rooftop Unit Upgrades and VAV Boxes
Central Islip Public Library	6	Replace Heat Pump with High Efficiency Heat Pump
Central Islip Public Library	7	Replace Vestibule Fan Coil Unit with High Efficiency Heat Pump
Central Islip Public Library	8	Building Management System
Central Islip Public Library	9	Demand Control Ventilation (DCV)
Central Islip Public Library	10	High Efficiency Gas-Fired Water Heater
Central Islip Public Library	11	Plug Load Controllers

Scope of Work:

ECM 1: Roof Replacement

1. Remove/Rip existing roof down to metal deck.
2. Properly dispose of all materials, including asbestos containing materials (ACM) at an EPA approved landfill.
3. Supply and install new, tapered R-30 Poly ISO mechanically fastened to metal deck.
4. Supply and install new .060 mechanically fastened Johns Manville TPO roof system as per manufacturers specifications. White in color.
5. Flash all penetrations.
6. Supply and install new 20-year Kynar aluminum gravel stop.
7. Provide all dumpsters.
8. Provide safety and pedestrian protection.

ECM 2: Building Envelope Upgrades

Central Islip Library Main Building

1. 4 Single Doors to be weather-stripped.
2. 385’ Roof/Wall Joint to be sealed
3. Supply and install foam insulation around (7) exhaust fans.
4. Re-pointing of damaged areas with air leakage
5. Re-caulking of exterior windows
6. Re-caulking of top of main entry into building

Central Islip Library Storage Building
1. 1 Single Door to be weather-stripped.
2. 1 Roll-up Garage Door to be weather-stripped (sides & top only; 30')
3. 1 Exhaust fan to be sealed at the damper to plenum connection (6')
4. 120' Roof/Wall Joint to be sealed

ECM 3: Rooftop Solar

1. Provide PV array design with ballast layout for structural approval by others.
2. Furnish and install (343) Q.Peak Duo XL or similar solar modules producing 164.64 kW.
3. Furnish and install mounting structure with aluminum top rails type TerraGEN, aluminum tilt rails and custom roll formed galvanized steel base rails. Fasteners will be stainless steel 18-supply.
4. Install rubber safety membrane for roof protection.
5. Furnish and install all inverters, (5) CPS-CPS25KW-208
6. Furnish and install Rapid shutdown devices as necessary.
7. Furnish and install all Panelboards & Electrical Disconnects
8. Furnish inverter monitoring package.
9. Roof warranty inspection upon completion.

ECM 4: LED Lighting and Lighting Controls

The ECM proposed involves the replacement of non-LED fixtures with new LED lighting to conserve energy and improve the quality of the Library lighting. Our strategy will include upgrading existing 2x4 and 2x2 fixtures with a combination of new volumetric LED fixtures and LED "door kits" that will make the fixture appear as if it is an entirely new fixture. The benefit of using door kits is they are more cost-effective than an entire fixture replacement and they significantly reduce packaging, waste and recycling needs, making them a more sustainable solution. In the high ceiling areas of the Library, we will remove the pendent mounted up lights and reposition the fixtures to achieve a more unified design. In the Business Office we will remove the downlights and install new 2x2 LED fixtures to provide better lighting. In the Director's bathroom, we will remove the outdated 1x1 fixture and install a new 2x2 LED fixture. In the Library Stack area, we will install new LED surface-mounted fixtures on the lower level. For the upper level of the Stack area, at the Library's request we will install a new drop ceiling with LED surface mounted fixtures. Existing downlights will be replaced with new LED downlights. Exterior building-mounted Metal Halide fixtures will be replaced with new LED fixtures with photocells. The project's scope of work includes disconnecting the existing lighting system, disposing and/or recycling of the old equipment, securely installing the new LED fixture, wiring and controls connection, and thorough testing of the new fixtures to ensure proper operation.

RENU has identified several areas suitable for lighting controls using wither a wall sensor, or a sensor built right into the fixture/door kit in the ceiling. The project's scope of work involves installing occupancy sensors, where deemed suitable and connecting electrical wiring in accordance with New York laws and permit requirements. We do not recommend the installation of sensors for the main Library areas, the Community Room, or the Children's areas, since having lights turned off in these areas could be problematic. Our proposal does not include the installation of lighting controls in these areas.

ECM 5: Rooftop Unit Upgrades with VAV Boxes

1. Provide labor to reclaim refrigerant gas from existing split A/C system located on roof of building. We will dispose of all refrigerant gas as per local code requirement.
2. Provide rigging service to remove existing rooftop units and properly dispose of them.
3. Provide labor and materials to install (1) 40-ton gas fired packaged rooftop unit Carrier Model # 48K5GU40-HC5A1QAF5.
4. Modification of existing roof steel to meet unit requirements.
5. Provide labor and materials to install (9) Variable Air Volume Boxes.
6. Provide labor and materials to install new supply air and return ductwork for new rooftop. unit. New ductwork will be connected to existing supply air and return air duct. penetrations through existing roof.

7. Provide labor and materials to install all required transition ductwork that will be required for installation of new variable air volume boxes.
8. Provide labor and materials to insulate new outdoor and interior ductwork. All exterior ductwork will be insulated with 2" thickness 6 lbs. density duct board and will be weatherproof with venture clad membrane.
9. Provide a certified air balance report at completion of project.
10. Provide all required shop and as-built drawings at completion of project.
11. Provide startup service for new rooftop unit.
12. Building Management System communication and control of all (9) VAV boxes, RTU-1, RTU-2 and RTU-3.
13. Installation and control of Electric Duct Heater in Children's office Area.
14. Modifications to existing fire alarm system for CO monitoring.
15. Installation of new natural gas service by National Grid Long Island.
16. Installation of new natural gas meter and natural gas exterior mounted piping to rooftop units.

ECM 5a: Implement Natural Gas in Existing 20-Ton York RTU

1. Installation of new natural gas piping to unit.
2. Conversion of unit to natural gas heating using existing heat exchanger in unit.
3. Commission existing unit for functionality of heat exchanger.
4. Provide new DDC controls to unit and integration into new BMS system.
5. Re-commissioning of unit.
6. Provide a certified air balance report at completion of project.

ECM 6: Replace Heat Pump with High Efficiency Heat Pump – IT Room

1. Provide labor to reclaim refrigerant from existing split system and properly dispose of.
2. Provide labor to disconnect and remove existing condenser and evaporator from site.
3. Provide labor and materials to install (1) 12,000 BTU high efficiency cooling only condenser. and (1) 12,000 BTU wall-mounted evaporator Daikin Skyair FAQ_TAVJUA.
4. Provide labor and materials to install new refrigeration and condensate piping for new unit.
5. Condensate pumps will be provided as required.
6. Integration into new BMS system.
7. Provide and install (2) equipment rails and (1) pipe portal.
8. Provide rigging service to set new condenser on roof.
9. Provide startup service for new units.

ECM 7: Replace Vestibule Fan Coil Unit with High Efficiency Heat Pump

1. Provide labor to disconnect and remove existing electric fan coil unit from premises and dispose of unit.
2. Provide labor and materials to install (1) 30,000 BTU high efficiency heat pump. Daikin Model Sky Air FBQ_TBVJU condenser and (1) 30,000 BTU ceiling cassette evaporator.
3. Provide labor and materials to install new refrigeration and condensate piping for new unit.
4. Integration into new BMS system.
5. Provide and install (2) equipment rails and (1) pipe portal.
6. Provide rigging service to set new condenser on roof.
7. Provide startup service for new units.

ECM 8: Building Management System (BMS)

1. Install and fully configure a new JCI Facility Explorer FX-80 Niagara web-based BMS system. The new BMS system will be provided with a full graphics package, historical trends, alarms, etc. to provide a

complete, cohesive control system for the building. All equipment listed in this proposal will be networked to the new BMS system and included in the graphical user interface.

2. Provide DDC control for (5) exhaust fans.
3. Provide start/stop, status, and alarm. New graphics, schedules, trends, and alarms.
4. Provide occupancy programming/control as per owner requirements.
5. Replace the existing programmable thermostats on the (1) existing York RTU, (1) existing Aaon unit, and (1) new Carrier RTU with a new JCI FX DDC control system.
6. This includes a BACnet DDC controller as well as a new space temperature sensor, discharge air sensor, control relays, actuators, etc.
7. Provide, install, and wire a wall-mounted CO2/temperature sensor for each RTU. The RTUs will be programmed to provide a full demand-controlled ventilation sequence of operation.
8. The new control system for each RTU will be fully mapped to the new BMS system and included in the graphics, schedules, trends, alarms, etc. This includes the following points and sequences:
    - Supply Fan Start/Stop and Status Monitoring
    - Return Fan Start/Stop and Status Monitoring (if applicable)
    - Space Temperature
    - Space Relative Humidity
    - Space CO2 Level
    - Discharge Air Temperature
    - Economizer control
    - Mixed air control (including DCV control)
    - Heating control
    - Cooling control
    - Freeze protection
    - Full set point and parameter control from BMS system.
9. Design, fabricate, wire, install, program and commission a new JCI FX DDC control system for the new RTU.
10. This includes a BACnet DDC controller as well as a new space temperature sensor, discharge air sensor, control relays, actuators, etc.
11. Provide, install, and wire a wall-mounted CO2/temperature sensor for the RTU. The RTU will be programmed to provide a full demand-controlled ventilation sequence of operation.
12. The new control system for the RTU will be fully mapped to the new BMS system and included in the graphics, schedules, trends, alarms, etc. This includes the following points and sequences:
    - Supply Fan Start/Stop and Status Monitoring
    - Return Fan Start/Stop and Status Monitoring (if applicable)
    - Space Temperature
    - Space Relative Humidity
    - Space CO2 Level
    - Discharge Air Temperature
    - Economizer control
    - Mixed air control (including DCV control)
    - Heating control
    - Cooling control
    - Freeze protection
    - Full set point and parameter control from BMS system.

13. Provide, install, wire and program a new JCI FX BACnet control system for each new VAV box. This includes the following points and sequences:
    - Space Temperature
    - Space Relative Humidity
    - Space CO2 Level
    - Occupied Space Set Point
    - Unoccupied Space Set Point
    - Discharge Air Temperature
    - CFM set point (heating and cooling modes)
    - Full set point and parameter control from BMS system.

The (9) new control points for each VAV box, will be fully mapped to the new BMS system and included in the graphics, schedules, trends, alarms, etc.

The Library will provide addresses and permissions for integration to the Library's existing LAN and remote connectivity via VPN (or external IP address) and the Library will provide and maintain a VPN for our use during the project and throughout the contract period.

ECM 9: Demand Control Ventilation (DCV)

The scope of work for implementing DCV for Rooftop Units includes installing CO2 sensors in each occupied space to measure the level of CO2. Based upon the sensor readings, the ventilation rate for each RTU will be adjusted to meet the current demand. The system will be set up to provide a minimum amount of fresh air when the space is unoccupied, to maintain indoor air quality.

ECM 10: High Efficiency Gas-Fired Water Heater

1. Disconnecting, removing, and disposing of the existing electric water heater.
2. New gas lines will be furnished and installed at the location of the new water heater.
3. Supply and install a new condensing domestic water heater, AO Smith ATI-540HX3-N.
4. Supply and install all necessary piping, valves, and fittings required to connect the new units to the existing piping systems (water and gas).
5. The new portions of the piping will be insulated with fiberglass and PVC fittings.
6. Electrical power will be provided to the new unit.

ECM 11: Plug Load Controls

Install BERT plug load controls on (25) electronic devices in the Library. The plug load controls will be installed to automatically turn off or put electronic devices in standby mode.

Device Type:	Quantity:
Projector	2
Printer	15
Large Printer/Copier	3
Coffee Maker	4
H/C Water Dispenser	1

EXHIBIT B

ATTACHMENT F

GUARANTEE OF ENERGY COST SAVINGS

1. DEFINITIONS

When used in this Contract, the following capitalized words shall have the meaning ascribed to them below:

"Baseline Period" is the period of time that defines the Baseline Usage and is representative of the facilities operations, consumption, and usage that is used as the benchmark for determining cost avoidance.

"Baseline Usage" is the calculated energy usage of the Facilities prior to the implementation of the ECMs.

"Baseline Demand" is the calculated energy demand of a piece of equipment or a site prior to the implementation of the ECMs. Baseline physical conditions, such as equipment counts, nameplate data, and control strategies, will typically be determined through building occupancy, energy end-use survey and plug load surveys of the Facilities.

"Energy and Operational Cost Avoidance Guarantee Practices" are those practices identified in The Schedule of Savings, intended to achieve avoided costs in energy and/or operating expenses.

"Energy Costs" may include the cost of electricity and fuels to operate HVAC equipment, cogeneration system, facility mechanical and lighting systems, and energy management systems, and the cost of water and sewer usage, as applicable.

"ECM" the Energy Conservation Measure (ECM) is the installation of equipment or systems, or modification of equipment or systems as described in Attachment B.

"Excess Verified Savings" is the amount of Verified Savings minus Guaranteed Savings in a Guaranteed Period.

"Facilities" shall mean those described in Attachment A.

"First Guarantee Period" is defined as the period beginning on the first (1st) day of the month following the date of execution of the Delivery and Acceptance Certificate (Attachment E-2) upon Substantial Completion of this Project by the Client and ending on the day prior to the first (1st) twelve-month anniversary thereof.

"Guarantee Period" is defined as the First Guarantee Period and each of the successive twelve (12) month periods commencing on the anniversary of the commencement of the First Guarantee Period throughout the Term of this Contract.

"Guaranteed Savings" is defined as the amount of avoided Energy and Operational Costs guaranteed to the CLIENT in each Guarantee Period.

"Guaranteed Savings Report" is defined as the process and report for determining the Verified Savings in each Guarantee Period and reconciling it to the Guaranteed Savings in the same Guarantee Period.

"IPMVP" shall mean the International Performance Measurement and Verification Protocol and its Measurement and Verification Guidelines for energy savings performance contract projects. The IPMVP guidelines classify measurement & verification approaches as Option A, Option B, Option C, and Option D.

"Measurement and Verification Plan" (M&V Plan) is defined as the plan providing details on how the Guarantee Savings will be verified.

"Operational Costs" shall include the cost of operating and maintaining the Facilities, such as, but not limited to, the cost of inside and outside labor to repair and maintain Covered Systems and Equipment, the cost of custodial supplies, the cost of replacement parts, the cost of deferred maintenance, the cost of lamp and ballast disposal, and the cost of new capital equipment as defined for each ECM in Section 4, Schedule of Values.

"Term" shall be 18 years from acceptance.

"Verified Savings" is the defined as the summation of avoided Energy and Operational Costs as determined by the Measurement & Verification Plan for the Facilities in each Guarantee Period as a result of the ECMs provided by ESCO.

Table 2.1. Guaranteed Savings

ECM	Electric (kWh)	Electric Demand (kW)	Natural Gas (Therms)	Total Energy Savings ($)
1 – Roof Replacement	6,426	0	0	$1,070
2 – Building Envelope Improvements	6,176	0	0	$1,028
3- Solar Ownership	217,563	0	0	$36,221
4 – Comprehensive Lighting Upgrades and Controls	106,114	26	0	$21,402
5 – Rooftop Unit Upgrades with VAV Boxes	64,071	21.2	-1,830	$11,608
6 – Replace Heat Pump with High Efficiency Heat Pump	1,260	1.9	0	$483
7– Replace Vestibule Fan Coil Unit with High Efficiency Heat Pump	5,534	3	0	$1,352
8 – Install Building Management System (BMS)	15,045	0	0	$2,505
9 – Demand Control Ventilation	3,393	0	678	$1,345
10– Install High Efficiency Gas-Fired Water Heater	2,285	3.5	-82	$789
11 – Plug Load Controls	3,636	0	0	$605
TOTAL	431,503	56	-1,234	$78,410

2.1.1 Excess Savings. Annual cost savings beyond the guaranteed minimum savings will be retained by Client.

2.1.2 Savings. Prior to Final Retrofit Acceptance all energy and operational cost avoidance realized by Client and as calculated through the Measurement & Verification Plan that result from activities undertaken by ESCO prior to Final Acceptance may be applied to the Savings for the First Guarantee Period.

2.1.3 Cumulation of Savings. The Guaranteed Savings in each Guarantee Period are considered satisfied if the Savings for such Guarantee Period equals or exceeds the Guaranteed Savings for such Guarantee Period.

2.1.4 Savings Shortfalls. In the event that the Savings in any Guarantee Period is less than the Guaranteed Savings required for that Guarantee Period, ESCO shall, upon receipt of written demand from Client, compensate Client the amount of any such shortfall, limited by the value of the guarantee, within sixty (60)

calendar days. The resulting compensation shall be ESCO's sole liability for any shortfall in the Guaranteed Savings.

2.2 Savings Documentation.

ESCO will provide Client with a Guarantee Savings Report after each Guarantee Period within 120 days. Client will assist ESCO in generating the savings report by providing ESCO's receipt thereof, together with access to relevant records relating to such Energy and Operating Costs. Client will also assist ESCO by permitting access to any energy billing information, maintenance records, drawings, or other data deemed necessary by ESCO to generate the said report. Data and calculations utilized by ESCO in the preparation of its Guaranteed Savings Report will be made available to Client, along with such explanations and clarifications as Client may reasonably request.

2.2.1 Acceptance of Guaranteed Savings Report. At the end of each Guarantee Period, Client will have forty-five (45) days to review the Guaranteed Savings Report and provide written notice to ESCO of non-acceptance of the Guaranteed Savings Report for that Guarantee Year. Failure to provide written notice within forty-five (45) days of the receipt of the Guarantee Savings Report shall constitute the deemed acceptance of the Report and its findings by the Client.

2.2.2 Guaranteed Savings. Guaranteed Savings shall be based on 92.5% of the Savings and will be determined in accordance with the methodology(s), operating parameters, formulas, and constants as described below and/or defined in the Measurement & Verification Plan and/or additional methodologies defined by ESCO that may be negotiated with Client at any time. Actual savings reduction in utility bills may vary for reasons outside of ESCO's control including but not limited to: changes in energy and other utility rates and tariffs, changes in Client operating schedules and usage patterns, changes in Client loads due to addition or reductions in energy and water consuming devices, changes in weather, impacts due to the operations of ECMs, impacts due to the maintenance of ECMs maintained by Client, and additions to and/or reduction in facility space usage. For the purposes of calculating any shortfalls or excesses of Verified Savings versus Guaranteed Savings, the Measurement & Verification Plan will be utilized.

2.2.3 Activities and Events Adversely Impacting Savings. Client must promptly notify ESCO of any activities known to Client, which adversely impacts ESCO's ability to realize the Guaranteed Savings and ESCO shall be entitled to reduce the Guaranteed Savings by the amount of any such adverse impact to the extent that such adverse impact is beyond ESCO's reasonable control.

2.2.4 Guarantee Adjustment. ESCO's Guaranteed Savings obligations under this Contract are contingent upon: (1) Client following the operations and maintenance requirements for the ECMs in accordance with the Contract; (2) no alterations or additions being made by the Client without prior notice and written agreement of the Parties; (3) Client sending all current utility bills to ESCO within two (2) weeks after receipt; and (4) ESCO'S ability to render services not being impaired by circumstances beyond its control. To the extent that the Client defaults or fails to perform fully any of its obligations under this Contract, ESCO may, in its sole discretion, adjust the Guaranteed Savings obligation; provided, however, that no adjustment hereunder shall be effective unless ESCO has first provided the Client with written notice of Client's default(s) or failure(s) to perform and Client has failed to cure its default(s) and failure(s) to perform within thirty (30) days after receipt of such notice.

2.2.5 Energy Rates. The base utility rates used for calculating annual cost savings are presented in Table 2.2.5. These rates will be escalated annually utilizing the rates indicated in Table 2.3 and applied to the ECM savings at each facility to determine annual cost savings for each guarantee period. The escalated utility rates will be compared to actual utility rates during each year of the Guarantee Period, and the higher of the floor values or the actual utility rates in effect will be used to determine savings.

Table 2.2.5 Energy Rates

Building	Annual kW	Total kW $	Annual kWh	Total kWh $	$/kW	Calculated $/kWh	$/kWh (Blended)
Library	2,172	$26,003	484,480	$80,659	$11.97	$0.17	$0.22

Building	Usage (th)	Total ($)	Estimated $/Unit
Library	0	$0	$1.15

2.3 Annual Utility Rate Escalation Rate

The following table shows annual escalation of the utility rates to be used for calculating energy cost savings. The utility rates will increase by the following percentages each year over the rates in the prior year beginning in Year 1.

Table 2.3 Annual Escalation

Utility	Electricity $/kWh	Natural Gas $/Therm
Annual	3.5%	3.5%

2.4 Guaranteed Savings

The following table lists the amount of Guaranteed Savings resulting from the ECMs to be installed by ESCO.

Table 2.4 Guaranteed Savings with Escalation Rate

Period	Cost Savings
1	$78,410
2	$81,154
3	$83,995
4	$86,934
5	$89,977
6	$93,126
7	$96,386
8	$99,759
9	$103,251
10	$106,865
11	$110,605
12	$114,476
13	$118,483
14	$122,630
15	$126,922
16	$131,364
17	$135,962
18	$140,720
Total	**$1,921,017**

3. MEASUREMENT & VERIFICATION PLAN

3.1 Measurement and Verification. ESCO and the Client agree that the Verified Savings will be determined using the following Measurement and Verification Plan. Through this plan, the Guaranteed Savings generated by the ECMs installed in the Facilities will be verified and incorporated herein by reference.

Measurement & Verification Plan: ESCO and the Client agree that the Verified Savings by ECM will be determined using the following Measurement & Verification plans further described in this section. Through this plan, the guaranteed savings generated by the ECMs installed in the Facilities will be validated. The M&V methodologies proposed for these ECMs are based on the North American Measurement and Verification Protocol. The objective of the plan is to quantify the actual electrical and fossil fuel and compare those to the specific Baseline Usage for each Facility, the difference of which is the Verified Savings.

During the term of the Contract, ESCO will make adjustments to energy savings due to changes in building occupancy, weather data, and utility rate schedules, etc. The unit costs of energy will be applied to the energy savings calculated by this M&V plan. Current utility cost will be used as a basis for determining the unit cost, with floor and ceiling prices set by baseline rate information, presented herein this Attachment.

3.2 M&V Descriptions. The following matrix summarizes the M&V Plan with detailed plan descriptions for each ECM

Table 3.2 Measurement and Verification Summary Matrix						
ECM Number and Description	M&V Option	Utility Types Affected	Baseline M&V	Post-Installation M&V	Performance Period M&V	Contractually Agreed Upon Variables
ECM 1 – Roof Replacement						
The scope of work for this ECM involves removing and disposing of the existing roof system, including all roofing materials and insulation.	C	Electric (kWh)	The analysis relies on leveraging utility bills, weather data, and historical weather data to forecast the energy consumption at a given facility.	Verify that proposed equipment has been implemented and is operating as intended. Post installation savings is determined from the same baseline model modified for the set points and energy rates.	Annual on-site inspections of equipment for ongoing verification	These values will be the parameters used within the model to calculate energy savings. The operation parameters include roof performance, reflectance, and space temperature.
ECM 2 – Building Envelope Upgrades						
This scope of work this ECM involves existing exhaust fans will be sealed, areas around windows and doors that need new weather stripping or caulking will be addressed, gaps in the concrete along the base of the right side of the building and the front of the storage building.	C	Electric (kWh)	The analysis relies on leveraging utility bills, weather data, and historical weather data to forecast the energy consumption at a given facility.	Verify that proposed equipment has been implemented and is operating as intended. Post installation savings is determined from the same baseline model modified for the set points and energy rates.	Annual on-site inspections of equipment for ongoing verification. Baseline Adjustment should be made based on cooling and heating load and operating hours	Weather, heating, and cooling system efficiency and occupancy.

ECM 3 – SOLAR						
This scope of work for this ECM involves the installation of roof-mounted photovoltaic systems using ballasted roof mounts, with an appropriate support system for the PV modules	B	Electric (kWh)	Baseline electrical energy is equivalent to the portion of the facility electrical load to be offset by the PV system electrical generation. PV system generation shall be calculated from the digital acquisition system (DAS) on the inverters.	Verify that proposed PV system has been implemented and is operating as intended. Instantaneous array performance to be compared against designed system output through measurement of solar insolation, module temperature and inverter output. Post installation savings is determined from the same baseline calculation modified for the as-built condition of the PV system	Annual on-site inspections of PV equipment for ongoing verification that system is in place, operational and that guaranteed electrical generation is sustainable. Energy generation is continuously metered by the PV system's revenue grade meter. All metered generation is reported as verified savings.	System name plate DC rating, array tilt, array azimuth, DC to AC conversion efficiency, hours and intensity of solar radiation, annual kwh generation
ECM 4 – LED LIGHTING AND LIGHTING CONTROLS						
This scope of work for this ECM proposed involves the replacement of non-LED fixtures with new LED lighting.	C	Electric (kWh)	Lighting fixture power consumption, operating hours, lighting levels. The analysis relies on leveraging utility bills, weather data, and historical weather data to forecast the energy consumption at a given facility.	Verify that proposed equipment has been implemented and is operating as intended. Post installation savings is determined from the same baseline model modified for the set points and energy rates.	Annual visual inspection of a sample set of lighting fixtures and controls to ensure the integrity of the fixtures and controls and confirm that the ECM still has the potential to perform as specified.	Lighting fixture power consumption, operating hours, lighting levels.

ECM 5, 6, 7 ,8 & 9 – HVAC UPGRADES & BMS						
This scope of work for this ECM involves replacing standard efficiency packaged air conditioning units with higher efficiency conditioning units. In addition, integration to the BMS system.	C	Electric (kWh)	The analysis relies on leveraging utility bills, weather data, and historical weather data to forecast the energy consumption at a given facility.	Verify that proposed equipment has been implemented and is operating as intended. Post installation savings is determined from the same baseline model modified for the set points and energy rates.	Annual on-site inspections of HVAC controls and equipment for ongoing verification that energy control strategies are in place and sustainable.	System efficiency, building parameters, current and proposed operating schedules
ECM 10 – INSTALL HIGH EFFICIENCY GAS-FIRED WATER HEATER						
This scope of work for this ECM involves disconnecting, removing, and disposing of the existing electric water heater. New gas lines will be furnished and installed at the location of the new water heater.	C	Electric (kWh) and Gas (Therms)	The analysis relies on leveraging utility bills, weather data, and historical weather data to forecast the energy consumption at a given facility.	Verify that proposed equipment has been implemented and is operating as intended. Post installation savings is determined from the same baseline model modified for the set points and energy rates.	Annual on-site inspections of the equipment and taking readings from the installed gas meter..	Size, capacity, energy efficiency rating, temperature setting and occupied days
ECM 11 – PLUG LOAD CONTROLS						
This scope of work for this ECM involves installing plug load controls on electronic devices.	C	Electric (kWh)	The analysis relies on leveraging utility bills, weather data, and historical weather data to forecast the energy consumption at a given facility.	Verify that proposed equipment has been implemented and is operating as intended. Post installation savings is determined from the same baseline model modified for the set points and energy rates.	Annual on-site inspections of equipment for ongoing verification that energy control strategies are in place and sustainable.	Device wattage, number of Berts and Scheduled On hours

3.2.1 Overview of M&V Plan – ECM 1- Roof Replacement

The M&V plan for this ECM is based on IPMVP Option C.

Savings Verification Methodology
The savings calculation methods for roof insulation primarily rely on the comparison of pre-installation and post-installation energy consumption data. This calculation considers variables such as heating and cooling degree days, occupancy patterns, and temperature differentials.
Savings calculations includes:

- Regression analysis to account for weather variations
- Analysis of utility bills and metered data to track changes in energy use.
- Modeling and simulation tools to predict energy savings based on insulation specifications and building characteristics.
- Comparative analysis of energy consumption data before and after insulation installation to assess the impact on heating and cooling loads.

Formulas used to develop and estimate the savings:

- Load Factor = (Area A * U-value A) + (Area B * U-value B) + (Area C * U-value C)
- Sol-air Temperature Factor = ((Area A * Reflectance A) + (Area B * Reflectance B)+(Area C * Reflectance C)/(Total Area)*(Daylight & Debree Factor)
- Annual Savings (MBH/YR) = (Cooling btu/hr savings)*(% runtime)*(average days in period)
- Annual Savings (kWh/YR) = (mbh/hr savings)/(12mbh/ton)*(kW/ton)

ECM:	**Roof Replacement**					
Title	**Roof Replacement**					
Project	**Capital Projects**					
Site	**Central Islip Public Library**					
Description	Calculation of roof replacement using existing roof U-values and reflectance and proposed U-value and reflectance.					
Given	Roof Area A	20,700	s.f. from subcontractor			
	Roof Area B	-	s.f. from subcontractor			
	Roof Area C	-	s.f. from subcontractor			
	Total Roof Area	20,700	square feet			
	Total Surface Irradiance (Winter)	20	btu/hr/F	From ASHRAE standard		
	Total Surface Irradiance (Spring)	53	btu/hr/F	From ASHRAE standard		
	Total Surface Irradiance (Summer)	68	btu/hr/F	From ASHRAE standard		
	Total Surface Irradiance (Fall)	36	btu/hr/F	From ASHRAE standard		
	Existing Roof Performance A	0.040	U-value	From existing construction	R-value=	25.0
	Existing Roof Performance B	0.040	U-value	From existing construction	R-value=	25.0
	Existing Roof Performance C	0.040	U-value	From existing construction	R-value=	25.0
	New Roof Performance A	0.033	U-value	From new construction	R-value=	30.0
	New Roof Performance B	0.033	U-value	From new construction	R-value=	30.0
	New Roof Performance C	0.033	U-value	From new construction	R-value=	30.0
	MMBH Cost		$/MMBH			
	Electrical Cost		$/kwh average			
	Existing Roof Performance A	0.2	Dark	From existing construction reflectance		
	Existing Roof Performance B	0.2	Dark	From existing construction reflectance		
	Existing Roof Performance C	0.2	Dark	From existing construction reflectance		
	New Roof Performance A	0.15	Light	From new construction reflectance (Account for Solar PV shading)		
	New Roof Performance B	0.15	Light	From new construction reflectance		
	New Roof Performance C	0.15	Light	From new construction reflectance		
Assumptions	Space Temperature	72	Deg F	average		
	Boiler Efficiency	95%				
	Cooling Efficiency	1.00	kw/ton			
	Daylight & Debree Factor	0.45				

Calculation

		(Area A	)*(	Ex. UA	)+(	Area B	)*(	Ex. UB	)+(	Area C	)*(	Ex. UC	))=										
	Existing Load Factor=	20,700	)*(	0.040	)+(	0	)*(	0.040	)+(	0	)*(	0.040	))=										828 btu/(h*F)
		((Area A	)*(	Ex.Refl. A	))+((	Area B	)*(	Ex.Refl. B	))+((	Area C	)*(	Ex.Refl. A	))/(	Total Area	)*(	daylight & debree factor)=							
	Existing Sol-air Temperature Factor=((	20,700	)*(	0.20	))+((	0	)*(	0.200	))+((	0	)*(	0.200	))/(	20,700	)*(	0.45	) =	0.09					
	Existing Heating & Cooling	((OA Temp	+(	Sol-air TF	*	Irradiance))	-	IA Temp	)*(	Heat Load Factor	)*(	Hours	)/(Conversion)	=	MBH Usage Heating	MBH Usage Cooling							
	((	-8	+(	0.09	*	20	))	-	72	)*(	828	)*(	56	)/(1000 btu/mbh) =	3,626	-							
	((	-3	+(	0.09	*	20	))	-	72	)*(	828	)*(	72	)/(1000 btu/mbh) =	4,364	-							
	((	2	+(	0.09	*	20	))	-	72	)*(	828	)*(	115	)/(1000 btu/mbh) =	6,494	-							
	((	7	+(	0.09	*	20	))	-	72	)*(	828	)*(	156	)/(1000 btu/mbh) =	8,163	-							
	((	12	+(	0.09	*	20	))	-	72	)*(	828	)*(	224	)/(1000 btu/mbh) =	10,794	-							
	((	17	+(	0.09	*	20	))	-	72	)*(	828	)*(	280	)/(1000 btu/mbh) =	12,334	-							
	((	22	+(	0.09	*	20	))	-	72	)*(	828	)*(	405	)/(1000 btu/mbh) =	16,163	-							
	((	27	+(	0.09	*	20	))	-	72	)*(	828	)*(	523	)/(1000 btu/mbh) =	18,708	-							
	((	32	+(	0.09	*	53	))	-	72	)*(	828	)*(	736	)/(1000 btu/mbh) =	21,469	-							
	((	37	+(	0.09	*	53	))	-	72	)*(	828	)*(	605	)/(1000 btu/mbh) =	15,143	-							
	((	42	+(	0.09	*	53	))	-	72	)*(	828	)*(	502	)/(1000 btu/mbh) =	10,487	-							
	((	47	+(	0.09	*	53	))	-	72	)*(	828	)*(	489	)/(1000 btu/mbh) =	8,191	-							
	((	52	+(	0.09	*	53	))	-	72	)*(	828	)*(	537	)/(1000 btu/mbh) =	6,772	-							
	((	57	+(	0.09	*	68	))	-	72	)*(	828	)*(	602	)/(1000 btu/mbh) =	4,426	-							
	((	62	+(	0.09	*	68	))	-	72	)*(	828	)*(	711	)/(1000 btu/mbh) =	2,284	-							
	((	67	+(	0.09	*	68	))	-	72	)*(	828	)*(	762	)/(1000 btu/mbh) =	-	707							
	((	72	+(	0.09	*	68	))	-	72	)*(	828	)*(	719	)/(1000 btu/mbh) =	-	3,643							
	((	77	+(	0.09	*	68	))	-	72	)*(	828	)*(	552	)/(1000 btu/mbh) =	-	5,082							
	((	82	+(	0.09	*	36	))	-	72	)*(	828	)*(	383	)/(1000 btu/mbh) =	-	4,199							
	((	87	+(	0.09	*	36	))	-	72	)*(	828	)*(	209	)/(1000 btu/mbh) =	-	3,156							
	((	92	+(	0.09	*	36	))	-	72	)*(	828	)*(	83	)/(1000 btu/mbh) =	-	1,597							
	((	97	+(	0.09	*	36	))	-	72	)*(	828	)*(	22	)/(1000 btu/mbh) =	-	514							
													8743	Hours	149,420	18,899							
		(Area A	)*(	New UA	)+(	Area B	)*(	New UB	)+(	Area C	)*(	New UC	))=										
	New Load Factor= (	20,700	)*(	0.033	)+(	0	)*(	0.033	)+(	0	)*(	0.033	))=										690 btu/(h*F)
		((Area A	)*(	New Refl. A	))+((	Area B	)*(	New Refl. B	))+((	Area C	)*(	New Refl. A	))/(	Total Area	)*(	daylight & debree factor) =							
	Existing Sol-air Temperature Factor=((	20,700	)*(	0.15	))+((	0	)*(	0.150	))+((	0	)*(	0.150	))/(	20,700	)*(	0.45	) =	0.07					

Baseline M&V Activities

The M&V plan for the Roof ECM will follow IPMVP Option C using monthly facility utility bills. Option C analysis relies on leveraging utility bills, weather data, and historical weather data to forecast the energy consumption at a given facility. Typically, a baseline period is established prior to implementation of ECMs and a weather-adjusted baseline energy model is determined. This baseline model is calibrated to ensure an accurate prediction of facility consumption patterns. After the installation period, utility bills are collected again to examine the consumption once the measures have been implemented, and a new weather-adjusted energy model is developed. The baseline energy model is applied to the post-install weather conditions, and the difference between baseline and post-install is determined to be the energy savings as a result of the project. The figure below showcases the Option C methodology for determining whole-facility savings.

Post-Installation M&V Activities

- Verify installation of new roof.

- Perform standard ASHRAE calculations to verify reduced heat transfer and infiltration.
- Perform utility bill analysis to verify building operation became more efficient or that changes in operation have been taken into consideration.

Table 3.2.1 Guaranteed Savings Summary

Description	Electric Savings kWh
Roof Replacement	6,426

3.2.2 Overview of M&V Plan – ECM 2- Building Envelope

The M&V plan for this ECM is based on IPMVP Option C.

Savings Verification Methodology

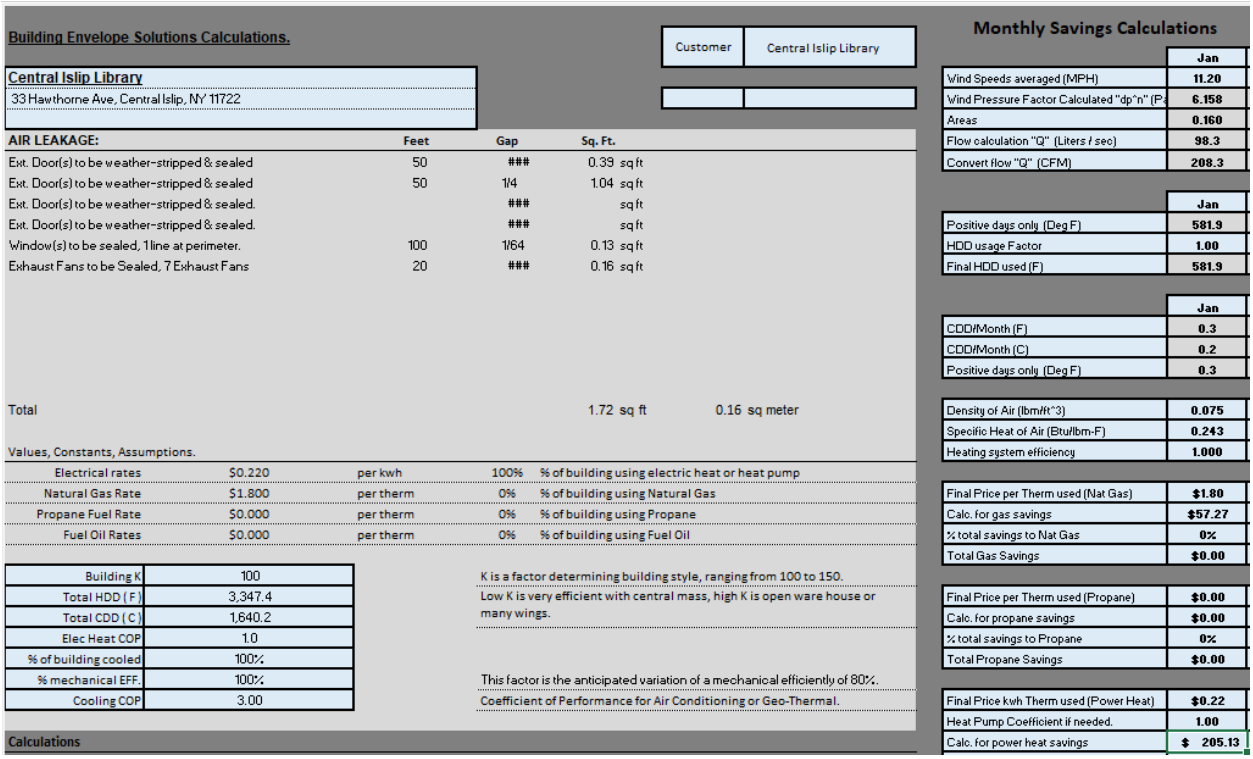
The pre-installation will be validated by verifying the linear feet and area contributing to infiltration. Accepted engineering principles were used for Baseline and Post-Installation calculations. Baseline energy use is affected by weather patterns, building loads, and building envelope deficiencies.

The information gathered during the CEA includes the following information:

- Building K value: 100
- Existing cooling COP: 2.5
- Existing heating efficiency: 80%
- Weather data based on location.
- Total gap area 1.72 sq ft

The data collected during the M&V are to use as input into calculations to create the Baselines to determine the performance of the building envelope improvements.

A Microsoft Excel spreadsheet was developed to calculate the baseline and savings for this ECM. A bin calculation method was used to estimate the savings associated with improving the building's insulation characteristics and reducing the building's unwanted infiltration. Details of the calculation can be found below



Building Envelope Solutions Calculations.

Customer	Central Islip Library

Central Islip Library
33 Hawthorne Ave, Central Islip, NY 11722

AIR LEAKAGE:	Feet	Gap	Sq. Ft.	
Ext. Door(s) to be weather-stripped & sealed	50	###	0.39	sq ft
Ext. Door(s) to be weather-stripped & sealed	50	1/4	1.04	sq ft
Ext. Door(s) to be weather-stripped & sealed.		###		sq ft
Ext. Door(s) to be weather-stripped & sealed.		###		sq ft
Window(s) to be sealed, 1 line at perimeter.	100	1/64	0.13	sq ft
Exhaust Fans to be Sealed, 7 Exhaust Fans	20	###	0.16	sq ft
Total			1.72 sq ft	0.16 sq meter

Values, Constants, Assumptions.

Electrical rates	$0.220	per kwh	100%	% of building using electric heat or heat pump
Natural Gas Rate	$1.800	per therm	0%	% of building using Natural Gas
Propane Fuel Rate	$0.000	per therm	0%	% of building using Propane
Fuel Oil Rates	$0.000	per therm	0%	% of building using Fuel Oil

Building K	100
Total HDD (F)	3,347.4
Total CDD (C)	1,640.2
Elec Heat COP	1.0
% of building cooled	100%
% mechanical EFF.	100%
Cooling COP	3.00

K is a factor determining building style, ranging from 100 to 150.
Low K is very efficient with central mass, high K is open ware house or many wings.

This factor is the anticipated variation of a mechanical efficiently of 80%.
Coefficient of Performance for Air Conditioning or Geo-Thermal.

Calculations

Monthly Savings Calculations

	Jan
Wind Speeds averaged (MPH)	11.20
Wind Pressure Factor Calculated "dp^n" (P	6.158
Areas	0.160
Flow calculation "Q" (Liters / sec)	98.3
Convert flow "Q" (CFM)	208.3

	Jan
Positive days only (Deg F)	581.9
HDD usage Factor	1.00
Final HDD used (F)	581.9

	Jan
CDD/Month (F)	0.3
CDD/Month (C)	0.2
Positive days only (Deg F)	0.3

Density of Air (lbm/ft^3)	0.075
Specific Heat of Air (Btu/lbm-F)	0.243
Heating system efficiency	1.000

Final Price per Therm used (Nat Gas)	$1.80
Calc. for gas savings	$57.27
% total savings to Nat Gas	0%
Total Gas Savings	$0.00

Final Price per Therm used (Propane)	$0.00
Calc. for propane savings	$0.00
% total savings to Propane	0%
Total Propane Savings	$0.00

Final Price kwh Therm used (Power Heat)	$0.22
Heat Pump Coefficient if needed.	1.00
Calc. for power heat savings	$ 205.13

Formulas used to estimate the savings:

- Non-Electric Heat Loss = ((Bldg Leakage sq ft) x (bldg k factor) x (Wind P Factor) x (HDD) x (9/5) x 0.075 x .243 x 60 x 24) / (100,000 x Eff %)
- Electrical Heating Loss = ((Bldg Leakage sq ft) x (bldg k factor) x (Wind P Factor) x (HDD) x (.075 x .243 x 60 x 24) x (conversion to kwh)
- Cooling Loss = ((Bldg Leakage sq ft) x (bldg k factor) x (Wind P Factor) x (CDD) x (.075 x .243 x 60 x 24) x (conversion to kWh)

<u>Baseline M&V Activities</u>

The M&V plan for the Building Envelope ECM will follow IPMVP Option C using monthly facility utility bills. Option C analysis relies on leveraging utility bills, weather data, and historical weather data to forecast the energy consumption at a given facility. Typically, a baseline period is established prior to implementation of ECMs and a weather-adjusted baseline energy model is determined. This baseline model is calibrated to ensure an accurate prediction of facility consumption patterns. After the installation period, utility bills are collected again to examine the consumption once the measures have been implemented, and a new weather-adjusted energy model is developed. The baseline energy model is applied to the post-install weather conditions, and the difference between baseline and post-install is determined to be the energy savings as a result of the project. The figure below showcases the Option C methodology for determining whole-facility savings.

<u>Post-Installation M&V Activities</u>

The Post-Installation performance factors are heating system efficiencies and thermal integrity of windows, doors, roofs, and wall insulation. The intent of Performance Period verification activities is to ensure that the

infiltration experienced in the building prior to implementing this ECM has been reduced as a result of various building envelope improvements. The intent is also to ensure that the building envelope improvements are being properly maintained.
.

Table 3.2.2 Guaranteed Savings Summary

Description	Electric Savings kWh
Building Envelope	6,176

3.2.3 Overview of M&V Plan – ECM 3 - Rooftop Solar

The M&V plan for this ECM is based on IPMVP Option B.

Savings Verification Methodology

The PVWatts calculator determines the energy production and cost savings of grid-connected photovoltaic (PV) energy systems by creating hour-by-hour performance simulations that provide estimated monthly and annual energy production in kilowatts and energy value. Users select a geographic location of the PV installation and establish system parameters for size, electric cost, array type, tilt angle, and azimuth angle. Using typical meteorological year weather data for the selected location, the PVWatts calculator determines the solar radiation incident of the PV array and the PV cell temperature for each hour of the year. The DC energy for each hour is calculated from the PV system DC rating and the incident solar radiation and then corrected for the PV cell temperature. The AC energy for each hour is calculated by multiplying the DC energy by the overall DC-to-AC derate factor and adjusting for inverter efficiency as a function of load.

Project Details

Project:	Central Islip Public Library
Project Address:	33 Hawthorne Ave. Central Islip, NY, 11722
Size of Project:	164.64 kWp with 343 Modules
Module:	Q.PEAK DUO XL-G10.3/BFG with 480 Wp (87.2 x 41.1 x 1.4in, 64.2lbs)
Orientation & Tilt Angle:	Portrait at a 10 Degree Tilt Angle
Type of Installation:	Flat Roof Structure
Materials:	Support Structure: Aluminum 6063-T6 , Galvanized Steel G90 GR50 Fasteners: Stainless Steel 18-8
	The mounting structure has been quoted with aluminum top rails, aluminum tilt rails and custom roll formed galvanized steel base rails. More accurate details about the site may influence the design, engineering and pricing.
	Rubber Safety Membrane Coverage of Base Rail is approximately 36%

Design Assumptions

Basic Wind Speed:	134 mph (3 second gust)
Wind Exposure Category:	B
Snow Load:	30 psf
Distance between Base Rails (E-W):	80 inches
Roof Attachment Spacing:	N/A
Altitude:	87 ft above sea level
Roof Type:	TPO
Building Height:	19.5 ft
Parapet Height:	22 in
Importance Category:	High
Distance between Modules:	2' 7" (Module Front to Module Front is 9' 9")
Weight of Racking:	0.5 psf (excluding ballast)
Seismic Zones/Loads:	up to 0.9 g
Connection Safety Factor:	2.00
Total Racking Weight:	5816 lbs
Total Module Weight:	22021 lbs
Total Ballast Weight:	29312 lbs
Total Array Area:	11657 sqft
Global Loading:	4.9 psf
Max Point Load:	147 lbs / 116.9375" section of base rail
Code Compliance:	ASCE 7-16, [7-10, 7-05] and therefor IBC 2018 as well as State/County adaptations

Baseline M&V Activities
Given that the solar PV system is not installed at present, the energy baseline is considered to be the maximum potential annual output of the array. The baseline energy was established through collection of various data parameters including:

- Geographic location of array
- DC system size (name plate rating)
- DC-to-AC derate Factors
- Array type (fixed, tracking, etc)
- Array tilt, azimuth

The data collected is used within the proposal to generate baseline energy generation for the PV system.

Post-Installation M&V Activities
The M&V plan for the rooftop solar panel installation will follow IPMVP Option B: Retrofit Isolation. To determine the energy consumption and costs that are offset by the onsite solar panels, data from the digital acquisition system (DAS) on the inverters is required. Additionally, cost savings will be determined based on the billing data detailing the generated energy, and details of the rate schedule. Examples of the trend data points required from the DAS and billing data are noted below.

Parameter	Units	Interval	Duration
Power Generated	kW	15 min	12 months
PV System Standby Use	kW	15 min	12 months
Power Returned to Utility	kWh	Monthly	12 months
Power Returned to Grid Cost	$/kWh	Monthly	12 months
Rated PV Capacity	kWh	N/A	One-Time

Table 3.2.3 Guaranteed Savings Summary

Description	Electric Savings kWh
Rooftop Solar	217,563

3.2.4 Overview of M&V Plan – ECM 4 - LED Lighting and Lighting Controls

The M&V plan for this ECM is based on IPMVP Option C

Savings Verification Methodology

Energy (kWh) and demand (kW) savings will be calculated using the following equations:

kWh Savings = Σu [(kW UsageGroupU,baseline - kW UsageGroupU,post) x Annual Hours of Operation]

kW Savings = Σu [(kW UsageGroupU,baseline - kW UsageGroupU,post)

Where:

kWh Savings	=	kilowatt-hour savings realized during one-year post-installation
kW Savings	=	Coincident kilowatt demand saving realized
kW UsageGroup U,baseline	=	Lighting baseline demand for usage group u
kW UsageGroup U,post	=	Lighting demand during post-installation period for usage group u
Annual Hours of Operation	=	Annual number of operating hours for the usage group u

Savings Calculation Method		
Baseline Energy Usage (kWh/yr)	=	Existing Fixture Watts x Operating Hours / yr x 1 kW / 1000 Watts
Estimated Energy Usage (kWh/yr)	=	Proposed Fixture Watts x Op. Hours/yr x 1 kW / 1000 Watts
Energy Savings (kWh /yr)	=	Baseline Energy Usage – Estimated Energy Usage
Baseline Demand (kW)	=	Existing Fixture Watts / 1000 Watts
Retrofit Demand (kW)	=	Proposed Fixture Watts / 1000 Watts
Energy Savings (kW)	=	(Existing Fixture Watts – Proposed Fixture Watts) x 1 kW / 1000 Watts

Baseline M&V Activities

The M&V plan for the LED Lighting and Lighting Controls ECM will follow IPMVP Option C using monthly facility utility bills. Option C analysis relies on leveraging utility bills, weather data, and historical weather data to forecast the energy consumption at a given facility. Typically, a baseline period is established prior to implementation of ECMs and a weather-adjusted baseline energy model is determined. This baseline model is calibrated to ensure an accurate prediction of facility consumption patterns. After the installation period, utility bills are collected again to examine the consumption once the measures have been implemented, and a new weather-adjusted energy model is developed. The baseline energy model is applied to the post-install weather conditions, and the difference between baseline and post-install is determined to be the energy savings as a result of the project. The figure below showcases the Option C methodology for determining whole-facility savings.

Post-Installation M&V Activities

Upon project completion, an as-built inventory of post-installation lighting fixtures will be supplied, including the lighting ballasts and lamps installed, and lighting illumination levels (foot-candles) in each area. Savings calculations will be corrected based on as-built data and will be reported in the Post-Installation Report.

These measurements will be used to calculate actual expected energy savings and will be detailed in the Post-Installation Report.

Table 3.2.4 Guaranteed Savings Summary

Description	Electric Savings kWh
LED Lighting and Lighting Controls	106,114

3.2.5 Overview of M&V Plan – ECM 5,6,7,8,9 - HVAC and BMS upgrades

The M&V plan for this ECM is based on IPMVP Option C.

Savings Verification Methodology
RTU savings were performed using the TRANE Trace 700 software by inserting the building heating/cooling load requirements.

For Heat pump replacement spread sheets tools were used. Energy (kWh) and demand (kW) savings will be calculated using the equations below:

Energy Use (kWh) = (Capacity (Tons)*(Hours of Operation/Year)*(Scheduled Usage)*(Efficiency) [Efficiency calculation is in kW/ton for simplicity]

RTU Trane Trace Calculation

MONTHLY ENERGY CONSUMPTION

By Trane

------- Monthly Energy Consumption -------

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Alternative: 1	**VAV Boxes w/ Gas in RTUs**												
Electric													
On-Pk Cons. (kWh)	36,492	34,258	31,536	27,107	31,517	37,445	46,262	42,398	35,636	27,189	27,169	34,228	411,236
On-Pk Demand (kW)	56	59	52	53	64	77	87	81	73	53	54	53	87
Gas													
On-Pk Cons. (therms)	562	604	238	32	0	0	0	0	0	0	12	382	1,830
On-Pk Demand (therms/hr)	1	1	1	0	0	0	0	0	0	0	0	1	1

Energy Consumption		
Building	73,181	Btu/(ft2-year)
Source	203,123	Btu/(ft2-year)
Floor Area	21,680	ft2

Environmental Impact Analysis	
CO2	421,704 lbm/year
SO2	1,616 gm/year
NOX	492 gm/year

64,071 kWh Savings
21.2 kW Savings per Month
1,830 Therm Increase

Alternative: 2	Existing Equipment												
Electric													
On-Pk Cons. (kWh)	48,100	47,173	36,118	28,719	34,508	41,796	52,784	47,233	39,246	29,551	28,554	41,524	475,307
On-Pk Demand (kW)	82	87	73	74	84	95	107	101	91	74	74	74	107

Energy Consumption		
Building	74,826	Btu/(ft2-year)
Source	224,500	Btu/(ft2-year)
Floor Area	21,680	ft2

Environmental Impact Analysis	
CO2	431,182 lbm/year
SO2	1,652 gm/year
NOX	503 gm/year

System Checksums

By Trane

New 40-Ton RTU — **Variable Volume Reheat (30% Min Flow Default)**

COOLING COIL PEAK

Peaked at Time: Mo/Hr: 7 / 16
Outside Air: OADB/WB/HR: 87 / 72 / 95

	Space Sens. + Lat. Btu/h	Plenum Sens. + Lat Btu/h	Net Total Btu/h	Percent Of Total (%)
Envelope Loads				
Skylite Solar	0	0	0	0
Skylite Cond	0	0	0	0
Roof Cond	0	114,432	114,432	29
Glass Solar	32,251	0	32,251	8
Glass/Door Cond	5,401	0	5,401	1
Wall Cond	18,878	11,901	30,779	8
Partition/Door	0		0	0
Floor	0		0	0
Adjacent Floor	0	0	0	0
Infiltration	11,667		11,667	3
Sub Total ==>	68,197	126,333	194,530	50
Internal Loads				
Lights	41,833	0	41,833	11
People	53,600	0	53,600	14
Misc	21,517	0	21,517	5
Sub Total ==>	116,950	0	116,950	30
Ceiling Load	25,551	-25,551	0	0
Ventilation Load	0	0	94,713	24
Adj Air Trans Heat	0		0	0
Dehumid. Ov Sizing			0	0
Ov/Undr Sizing	1,201		1,201	0
Exhaust Heat		-15,210	-15,210	-4
Sup. Fan Heat			0	0
Ret. Fan Heat		0	0	0
Duct Heat Pkup		0	0	0
Underflr Sup Ht Pkup			0	0
Supply Air Leakage		0	0	0
Grand Total ==>	211,899	85,571	392,184	100.00

CLG SPACE PEAK

Mo/Hr: 8 / 16
OADB: 86

	Space Sensible Btu/h	Percent Of Total (%)
Envelope Loads		
Skylite Solar	0	0
Skylite Cond	0	0
Roof Cond	0	0
Glass Solar	37,529	20
Glass/Door Cond	5,131	3
Wall Cond	17,948	10
Partition/Door	0	0
Floor	0	0
Adjacent Floor	0	0
Infiltration	5,008	3
Sub Total ==>	65,616	35
Internal Loads		
Lights	41,833	22
People	32,830	18
Misc	21,517	12
Sub Total ==>	96,180	52
Ceiling Load	22,849	12
Ventilation Load	0	0
Adj Air Trans Heat	0	0
Ov/Undr Sizing		
Exhaust Heat	1,422	1
OA Preheat Diff.		
RA Preheat Diff.		
Additional Reheat		
Underflr Sup Ht Pkup		
Supply Air Leakage		
Grand Total ==>	186,067	100.00

HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 15

	Space Peak Space Sens Btu/h	Coil Peak Tot Sens Btu/h	Percent Of Total (%)
Envelope Loads			
Skylite Solar	0	0	0.00
Skylite Cond	0	0	0.00
Roof Cond	0	-87,606	23.78
Glass Solar	0	0	0.00
Glass/Door Cond	-19,011	-19,011	5.16
Wall Cond	-45,633	-69,381	18.83
Partition/Door	0	0	0.00
Floor	0	0	0.00
Adjacent Floor	0	0	0
Infiltration	-34,865	-34,865	9.46
Sub Total ==>	-99,509	-210,863	57.23
Internal Loads			
Lights	0	0	0.00
People	0	0	0.00
Misc	0	0	0.00
Sub Total ==>	0	0	0.00
Ceiling Load	-38,789	0	0.00
Ventilation Load	0	-141,320	38.35
Adj Air Trans Heat	0	0	0
Ov/Undr Sizing	-30,259	-30,259	8.21
Exhaust Heat		25,568	-6.94
OA Preheat Diff.		0	0.00
RA Preheat Diff.		-11,587	3.14
Additional Reheat		0	0.00
Underflr Sup Ht Pkup		0	0.00
Supply Air Leakage		0	0.00
Grand Total ==>	-168,557	-368,462	100.00

TEMPERATURES

	Cooling	Heating
SADB	60.0	90.0
Ra Plenum	75.3	62.0
Return	75.3	63.1
Ret/OA	76.9	47.7
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

AIRFLOWS

	Cooling	Heating
Diffuser	16,692	7,560
Terminal	16,692	7,560
Main Fan	16,692	7,560
Sec Fan	0	0
Nom Vent	2,305	2,305
AHU Vent	2,305	2,305
Infil	284	569
MinStop/Rh	7,560	7,560
Return	16,969	8,115
Exhaust	2,582	2,859
Rm Exh	7	15
Auxiliary	0	0
Leakage Dwn	0	0
Leakage Ups	0	0

ENGINEERING CKS

	Cooling	Heating
% OA	13.8	30.5
cfm/ft²	0.95	0.43
cfm/ton	510.73	
ft²/ton	535.77	
Btu/hr·ft²	22.40	-21.04
No. People	134	

COOLING COIL SELECTION

	Total Capacity ton	Total Capacity MBh	Sens Cap. MBh	Coil Airflow cfm	Enter DB °F	Enter WB °F	Enter HR gr/lb	Leave DB °F	Leave WB °F	Leave HR gr/lb
Main Clg	32.7	392.2	312.9	16,571	76.9	64.4	70.8	60.0	56.8	63.9
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Total	32.7	392.2								

AREAS

	Gross Total ft²	Glass ft²	Glass (%)
Floor	17,510		
Part	0		
Int Door	0		
ExFlr	0		
Roof	15,260	0	0
Wall	5,915	571	10
Ext Door	0	0	0

HEATING COIL SELECTION

	Capacity MBh	Coil Airflow cfm	Ent °F	Lvg °F
Main Htg	-252.8	7,560	60.0	90.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-115.6	2,305	15.0	60.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-368.5			

Project Name: RENU - Central Islip Public Library
Dataset Name: TRACE000.TRC

TRACE® 700 v6.2.4 calculated at 10:18 AM on 09/28/2023
Alternative - 1 System Checksums Report Page 3 of 6

EQUIPMENT ENERGY CONSUMPTION
By Trane

Alternative: 1 VAV Boxes w/ Gas in RTUs

Equipment - Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	------- Monthly Consumption -------												
Cpl 3: York RTU [Sum of dsn coil capacities=17.06 tons]													
Condenser fan for MZ rooftop													
Electric (kWh)	0.0	0.0	0.0	0.0	226.9	508.5	829.9	697.2	444.9	29.4	0.0	0.0	2,736.8
Peak (kW)	0.0	0.0	0.0	0.0	1.2	1.5	1.8	1.6	1.4	0.7	0.2	0.0	1.8
Cntl panel & interlocks - 0.125 KW (Misc Accessory Equipment)													
Electric (kWh)	0.0	0.0	0.0	0.0	50.4	90.0	93.0	93.0	78.8	27.1	0.0	0.0	432.3
Peak (kW)	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1
Hpl 1: Electric Heat [Sum of dsn coil capacities=411.1 mbh]													
Electric [Nominal Capacity/F.L.Rate=411.1 mbh / 120.5 kW] (Heating Equipment)													
Electric (kWh)	19,179.9	18,620.7	13,981.3	8,841.8	3,622.9	2,407.6	2,046.8	2,336.8	2,776.1	5,693.7	8,887.4	16,915.2	105,310.2
Peak (kW)	33.2	35.5	27.5	20.3	9.4	7.3	6.0	6.6	7.7	14.3	19.3	29.3	35.5
Hpl 2: York Gas RTU [Sum of dsn coil capacities=76.25 mbh]													
Gas-fired heat exchanger - 005 [Nominal Capacity/F.L.Rate=300 mbh / 3.70 Therms] (Heating Equipment)													
Gas (therms)	213.7	233.6	85.1	6.4	0.0	0.0	0.0	0.0	0.0	0.0	1.2	138.6	678.4
Peak (therms/Hr)	0.5	0.5	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.5
Hpl 3: New 40-Ton Gas RTU [Sum of dsn coil capacities=115.6 mbh]													
Gas-fired heat exchanger - 006 [Nominal Capacity/F.L.Rate=400 mbh / 4.94 Therms] (Heating Equipment)													
Gas (therms)	347.9	370.4	153.0	25.7	0.0	0.0	0.0	0.0	0.0	0.0	11.3	243.5	1,151.7
Peak (therms/Hr)	0.7	0.8	0.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.6	0.8

HEAT PUMP REPLACMENT CALCULATION

Energy Use (kWh) = (Capacity (Tons)*(Hours of Operation/Year)*(Scheduled Usage)*(Efficiency) [Efficiency calculation is in kW/ton for simplicity]

Energy Use (kWh) = (Capacity (Tons)*(Hours of Operation/Year)*(Scheduled Usage)*(Efficiency) [Efficiency calculation is in kW/ton for simplicity]

PROJECT:
SITE:

DESCRIPTION: Replace existing cooling system with new efficient cooling system of similar size and operation.

GIVEN:	Electrical Energy Cost	=	$0.1665	$/kWh			
	Electrical Demand Cost	=	$11.97	$/kW			
	Cooling System Capacity	=	1.00	Tons			
	Operation (Hours/Year)	=	**8760**	**Hours/Year**			
	Conversion Factor	=	3,413	Btu/Kw			
	Conversion Factor	=	12,000	Btu/Ton			
	Annual Electric Energy Cost	=					
ASSUMPTION:	**Existing Cooling System Efficier**	=	**2.00**	COP			
	New Cooling System Efficiency	=	**2.20**	COP			
	Existing Cooling System Efficiency	=	6.83	(S) EER	1.76	KW/Ton	
	New Cooling System Efficiency	=	7.51	(S) EER	1.60	KW/Ton	
	Scheduled Usage	=	90%				

FORMULA:
Energy Use (Kwh)=(Capacity (Tons)*(Hours of Operation/Year)*(Scheduled Usage)*(Efficiency) [Efficiency calculation is in kw/ton for simplicity]
Energy Savings (Kwh)=(Existing Energy Use(Kwh)-New Energy Use (Kwh))
Energy Demand (Kw)=(Peak Capacity (Tons)*(Efficiency)
Energy Demand Cost ($)=(Energy Demand (Kw)*(Demand Cost ($/Kw))
Energy Cost Savings ($)=(Energy Savings(Kwh)*($/Kwh))+(Existing Demand Cost ($)-New Demand Cost ($))

CALCULATION:

USAGE	Capacity (Tons)		Hours/Year		Scheduled Usage		Efficiency (Uses kw/ton only)			
Existing Usage = (	1	)*(	8760	)*(	90%	)*(	1.76	) =	**13,860**	**Kwh**
New Usage = (	1	)*(	8760	)*(	90%	)*(	1.60	) =	**12,600**	**Kwh**

Usage Cost	kwh		$/kwh		
Existing Cost = (	13,860	)*(	$0.166	)=	**$2,307**
New Cost = (	12,600	)*(	$0.166	)=	**$2,098**

DEMAND (MONTHLY PEAK COOLING SYSTEM TONNAGE FROM LOGS AND UTILITY ANALYSIS)

MONTH		Peak Tons		EFF. (Kw/Ton)		EX. KW		Cost ($/Kw)		Ex. Demand $
JAN	(	1	)*(	1.76	) =(	1.76	)*(	$11.97	) =	$21
FEB	(	1	)*(	1.76	) =(	1.76	)*(	$11.97	) =	$21
MAR	(	1	)*(	1.76	) =(	1.76	)*(	$11.97	) =	$21
APR	(	1	)*(	1.76	) =(	1.76	)*(	$11.97	) =	$21
MAY	(	1	)*(	1.76	) =(	1.76	)*(	$11.97	) =	$21
JUN	(	1	)*(	1.76	) =(	1.76	)*(	$11.97	) =	$21
JUL	(	1	)*(	1.76	) =(	1.76	)*(	$11.97	) =	$21
AUG	(	1	)*(	1.76	) =(	1.76	)*(	$11.97	) =	$21
SEP	(	1	)*(	1.76	) =(	1.76	)*(	$11.97	) =	$21
OCT	(	1	)*(	1.76	) =(	1.76	)*(	$11.97	) =	$21
NOV	(	1	)*(	1.76	) =(	1.76	)*(	$11.97	) =	$21
DEC	(	1	)*(	1.76	) =(	1.76	)*(	$11.97	) =	$21
TOTALS						**21**				**$253**

MONTH		Peak Tons		EFF. (Kw/Ton)		New KW		Cost ($/Kw)		New Demand $
JAN	(	1	)*(	1.60	) =(	1.6	)*(	$11.97	) =	$19
FEB	(	1	)*(	1.60	) =(	1.6	)*(	$11.97	) =	$19
MAR	(	1	)*(	1.60	) =(	1.6	)*(	$11.97	) =	$19
APR	(	1	)*(	1.60	) =(	1.6	)*(	$11.97	) =	$19
MAY	(	1	)*(	1.60	) =(	1.6	)*(	$11.97	) =	$19
JUN	(	1	)*(	1.60	) =(	1.6	)*(	$11.97	) =	$19
JUL	(	1	)*(	1.60	) =(	1.6	)*(	$11.97	) =	$19
AUG	(	1	)*(	1.60	) =(	1.6	)*(	$11.97	) =	$19
SEP	(	1	)*(	1.60	) =(	1.6	)*(	$11.97	) =	$19
OCT	(	1	)*(	1.60	) =(	1.6	)*(	$11.97	) =	$19
NOV	(	1	)*(	1.60	) =(	1.6	)*(	$11.97	) =	$19
DEC	(	1	)*(	1.60	) =(	1.6	)*(	$11.97	) =	$19
TOTALS						**19**				**$230**

		kwh		$/kwh		kw		$/kw		
Existing Cost =	(	13,860	)*(	$0.166	)+(	21	)*(	$11.97	)=	**$2,560**
New Cost =	(	12,600	)*(	$0.166	)+(	19	)*(	$11.97	)=	**$2,327**

RESULTS:	**Existing Annual Use =**		**21**	**KW**			**13,860**	**kwh**	**#**	**$2,560**	#DIV/0!	of utility bill
	Proposed Annual Use =		**19**	**KW**			**12,600**	**kwh**	**#**	**$2,327**		
100%	**Annual Savings =**		**1.9**	**KW**			**1,260**	**kwh**	**#**	**$233**		
	Savings as Percent of Existing		**0.16**	**KW**	**/month**						9%	of existing

FAN COIL UNIT REPLACMENT CALCULATION

Energy Use (kWh) = (Capacity (Tons)*(Hours of Operation/Year)*(Scheduled Usage)*(Efficiency) [Efficiency calculation is in kw/ton for simplicity]

Energy Use (kWh) = (Capacity (Tons)*(Hours of Operation/Year)*(Scheduled Usage)*(Efficiency) [Efficiency calculation is in kW/ton for simplicity]

ECM:	Replace Fan Coil Unit with Heat Pump							
TITLE:	**Fan Coil Unit Replacement**							
PROJECT:								
SITE:								
DESCRIPTION:	Replace existing electric fan coil unit with new efficient heat pump system of similar size and operation.							
GIVEN:	Electrical Energy Cost	=		$0.1665	$/kWh			
	Electrical Demand Cost	=		$11.97	$/kW			
	Cooling System Capacity	=		2.50	Tons			
	Operation (Hours/Year)	=		**2000**	**Hours/Year**			
	Conversion Factor	=		3,413	Btu/Kw			
	Conversion Factor	=		12,000	Btu/Ton			
	Annual Electric Energy Cost	=						
ASSUMPTION:	**Existing Cooling System Effi**	=		**1.00**	COP	(Electric Resistance COP = 1)		
	New Cooling System Efficie	=		**2.70**	COP			
	Existing Cooling System Efficienc	=		3.41	(S) EER	3.52	KW/Ton	
	New Cooling System Efficiency	=		9.22	(S) EER	1.30	KW/Ton	
	Scheduled Usage	=		50%				
FORMULA:	Energy Use (Kwh)=(Capacity (Tons)*(Hours of Operation/Year)*(Scheduled Usage)*(Efficiency) [Efficiency calculation is in kw/ton for simplicity]							
	Energy Savings (Kwh)=(Existing Energy Use(Kwh)-New Energy Use (Kwh))							
	Energy Demand (Kw)=(Peak Capacity (Tons)*(Efficiency)							
	Energy Demand Cost ($)=(Energy Demand (Kw)*(Demand Cost ($/Kw))							
	Energy Cost Savings ($)=(Energy Savings(Kwh)*($/Kwh))+(Existing Demand Cost ($)-New Demand Cost ($))							

CALCULATION:	USAGE	Capacity (Tons)		Hours/Year		Scheduled Usage		Efficiency (Uses kw/ton only)			
	Existing Usage = (	2.5	)*(	2000	)*(	50%	)*(	3.52	)=	**8,790**	**Kwh**
	New Usage = (	2.5	)*(	2000	)*(	50%	)*(	1.30	)=	**3,256**	**Kwh**

	Usage Cost	kwh		$/kwh		
	Existing Cost = (	8,790	)*(	$0.166	)=	**$1,463**
	New Cost = (	3,256	)*(	$0.166	)=	**$542**

DEMAND (MONTHLY PEAK COOLING SYSTEM TONNAGE FROM LOGS AND UTILITY ANALYSIS)

MONTH		Peak Tons		EFF. (Kw/Ton)		EX. KW		Cost ($/Kw)		Ex. Demand $
JAN	(	3	)*(	3.52	)=(	7	)*(	$11.97	)=	$84
FEB	(	3	)*(	3.52	)=(	7	)*(	$11.97	)=	$84
MAR	(	2	)*(	3.52	)=(	7	)*(	$11.97	)=	$84
APR	(	0	)*(	3.52	)=(	0	)*(	$11.97	)=	$0
MAY	(	0	)*(	3.52	)=(	0	)*(	$11.97	)=	$0
JUN	(	0	)*(	3.52	)=(	0	)*(	$11.97	)=	$0
JUL	(	0	)*(	3.52	)=(	0	)*(	$11.97	)=	$0
AUG	(	0	)*(	3.52	)=(	0	)*(	$11.97	)=	$0
SEP	(	0	)*(	3.52	)=(	0	)*(	$11.97	)=	$0
OCT	(	2	)*(	3.52	)=(	7	)*(	$11.97	)=	$84
NOV	(	2	)*(	3.52	)=(	7	)*(	$11.97	)=	$84
DEC	(	3	)*(	3.52	)=(	7	)*(	$11.97	)=	$84
TOTALS						**42**				**$504**

MONTH		Peak Tons		EFF. (Kw/Ton)		New KW		Cost ($/Kw)		New Demand $
JAN	(	3	)*(	1.30	)=(	4	)*(	$11.97	)=	$47
FEB	(	3	)*(	1.30	)=(	4	)*(	$11.97	)=	$47
MAR	(	2	)*(	1.30	)=(	3	)*(	$11.97	)=	$31
APR	(	0	)*(	1.30	)=(	0	)*(	$11.97	)=	$0
MAY	(	0	)*(	1.30	)=(	0	)*(	$11.97	)=	$0
JUN	(	0	)*(	1.30	)=(	0	)*(	$11.97	)=	$0
JUL	(	0	)*(	1.30	)=(	0	)*(	$11.97	)=	$0
AUG	(	0	)*(	1.30	)=(	0	)*(	$11.97	)=	$0
SEP	(	0	)*(	1.30	)=(	0	)*(	$11.97	)=	$0
OCT	(	2	)*(	1.30	)=(	3	)*(	$11.97	)=	$31
NOV	(	2	)*(	1.30	)=(	3	)*(	$11.97	)=	$31
DEC	(	3	)*(	1.30	)=(	4	)*(	$11.97	)=	$47
TOTALS						**20**				**$234**

	kwh		$/kwh		kw		$/kw		
Existing Cost = (	8,790	)*(	$0.166	)+(	42	)*(	$11.97	)=	**$1,967**
New Cost = (	3,256	)*(	$0.166	)+(	20	)*(	$11.97	)=	**$776**

RESULTS:									
	Existing Annual Use =	**42**	**KW**	**8,790**	**kwh**	**$**	**$1,967**	**#DIV/0!**	**of utility bill**
	Proposed Annual Use =	**20**	**KW**	**3,256**	**kwh**	**$**	**$776**		
100%	**Annual Savings =**	**23**	**KW**	**5,534**	**kwh**	**$**	**$1,192**		
	Savings as Percent of Existing	**1.88**	**KW**	**/Month**				**61%**	**of existing**

BMS Controls Calculation
Temperature setback based on occupancy

DOES NOT ADJUST EFFECIENCY BASED ON DB TEMP

UNOCCUPIED THERMOSTAT SETBACK/SETUP
District-wide Elem. Schools

	Units Qty	Cooling Size (tons)	Heating Size (MBH)	Total Cooling (tons)	Total Heating (MBH)
	1	40	400	40	400
	1	20	300	20	300
	1	6	0	6	0
	0	0	0	0	0
	0	0	0	0	0
	0	0	0	0	0
	0	0	0	0	0
	0	0	0	0	0
	0	0	0	0	0
	0		0	0	0
Total				66	700

BUILDING PARAMETERS

kW-h Saved	3,050
Electric Savings $	$ -
Therms Saved	986
Fuel Savings $	$ -
Total Savings $	$ -

Cooling Capacity (Tons)	66
Heating Capacity (MBH)	700

Derating factor	75%

THERMOSTAT SETPOINTS

	Occupied	Unoccupied
Cooling:	72	77
Heating:	72	67

CALCULATION PARAMETERS

Cooling Plant kW/Ton:	1.15
Heating Plant Efficiency:	82.0%
Existing Weekend = Unoccupied?	No
Retrofit Weekend = Unoccupied?	No
Electric Rate: ($/kW-H):	
Natural Gas Rate: ($/THERM):	
Electric Heat (Yes/No):	No
Cooling Load	3%
Heating Load	1%

HEAT/COOL SCHEDULE

Month	Mode
1	Heat
2	Heat
3	Heat
4	Heat
5	Cool
6	Cool
7	Cool
8	Cool
9	Cool
10	Heat
11	Heat
12	Heat

OCCUPANCY SCHEDULE

Hour	Existing % Occupied	Proposed % Occupied
1	Occ	Unocc
2	Occ	Unocc
3	Occ	Unocc
4	Occ	Unocc
5	Occ	Unocc
6	Occ	Unocc
7	Occ	Unocc
8	Occ	Occ
9	Occ	Occ
10	Occ	Occ
11	Occ	Occ
12	Occ	Occ
13	Occ	Occ
14	Occ	Occ
15	Occ	Occ
16	Occ	Occ
17	Occ	Occ
18	Occ	Occ
19	Occ	Occ
20	Occ	Occ
21	Occ	Unocc
22	Occ	Unocc
23	Occ	Unocc
24	Occ	Unocc

ASSUMPTIONS
Only skin loads are considered

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
						Occupancy		Cooling		Fuel Heating		Electric Heating		Savings		$ Savings	
	Month	Hour	Weekend Yes/No	DB	Season	Existing	Proposed	Existing kW-h	Proposed kW-h	Existing Heat MBTU	Proposed Heat MBTU	Existing Heat (KW-H)	Proposed Heat (KW-H)	kw-h	BTU	Electric	Fuel
1-Jan	1	1	NO	35	Heat	Occ	Unocc	-	-	316	273	-	-	-	43	-	-
	1	2	NO	34	Heat	Occ	Unocc	-	-	324	282	-	-	-	43	-	-

RTUs

UNIT	SERVES	HP	Efficiency
RTU1	Main Library	20.00	92.0%
RTU2	Community Room	5.0	90.0%
		-	88.5%
		-	88.5%
		-	88.5%

CALCULATION PARAMETERS

Cooling Capacity (Tons):	66.0
Cooling % Load:	0%
DX Disable Setpoint (F):	55
Heating Capacity (MBH):	700
Heating % Load:	0%
Combustion Efficiency (%):	82.0%
Heating Override Setpoint (F):	60
Fan/Pump Motor Load:	50%
Existing Weekend = Unoccupied?	No
Retrofit Weekend = Unoccupied?	No
Electric Heat (Yes/No):	No
Electric Rate ($/kW-h):	$ -
Gas Rate ($/ Therm):	$ -

EQUIPMENT SCHEDULE

Hour	Existing Occupied	Proposed Occupied
1	Occ	Unocc
2	Occ	Unocc
3	Occ	Unocc
4	Occ	Unocc
5	Occ	Unocc
6	Occ	Unocc
7	Occ	Unocc
8	Occ	Occ
9	Occ	Occ
10	Occ	Occ
11	Occ	Occ
12	Occ	Occ
13	Occ	Occ
14	Occ	Occ
15	Occ	Occ
16	Occ	Occ
17	Occ	Occ
18	Occ	Occ
19	Occ	Occ
20	Occ	Occ
21	Occ	Unocc
22	Occ	Unocc
23	Occ	Unocc
24	Occ	Unocc

RESULTS

Therms Saved	-
Fuel $ Saved	$ -
kW-h Saved	11,995
Electric $ Saved	$ -
Derating factor	75%

ENGINEERING CHECKS

Annual $/kW-h	$ -
Annual $/Therm	#DIV/0!
Refrigeration Energy Saved (kW-h)	-
Electric Heating Energy Saved (kW-h)	-
Fan Energy Saved (kW-h)	15,993
Percent Run Time Reduced	42.5%
Run Hours Reduced	4,001

ASSUMPTIONS
Savings only calculated for the unoccupied hours
Assumed Size

COOLING LOAD PROFILE

outside drybulb	load %flow
97.5	100%
60	50%
slope	0.0133333
intercept	-0.3

FAN LOAD PROFILE

outside drybulb	load %flow
97.5	100%
60	65%
slope	0.0093
intercept	0.09

kW/Ton

outside drybulb	Chiller kW/ton
97.5	1.55
55	1.45
slope	0.0023529
intercept	1.3205882

HEATING PROFILE

outside drybulb	Elec. Heat % Output
60	25%
20	100%
slope	-0.01875
intercept	1.375

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)			(13)	(14)
				Outdoor	Occupancy		Supply/Return Fans		Direct Expansion		Fuel Heating		Electric Heating		Savings	
	Month	Hour	Weekend (Yes/No)	Air Temp. DB	Existing	Proposed	Existing KWH	Retrofit KWH	Existing KWH	Retrofit KWH	Existing THERM	Retrofit THERM	Existing KW-H	Retrofit KW-H	Therms	kw-h
	1	1	NO	35	Occ	Unocc	3.5	-	-	-	-	-	-	-	-	3.5
	1	2	NO	34	Occ	Unocc	3.5	-	-	-	-	-	-	-	-	3.5

Demand Control Ventilation (DCV)

Savings Calculation Method		
Baseline Energy Usage (MBH / yr)	=	Sum of all BINs(Existing OA% x Heating/Cooling Efficiency x BIN data (Temperature Difference x # of hours))
Estimated Energy Usage (MBH / yr)	=	Sum of all BINs(New OA% x Heating/Cooling Efficiency x BIN data (Temperature Difference x # of hours))
Energy Savings (MBH / yr)	=	Baseline Energy Usage – Estimated Energy Usage

Baseline M&V Activities

The M&V plan for the HVAC and BMS ECMs will follow IPMVP Option C using monthly facility utility bills. Option C analysis relies on leveraging utility bills, weather data, and historical weather data to forecast the energy consumption at a given facility. Typically, a baseline period is established prior to implementation of ECMs and a weather-adjusted baseline energy model is determined. This baseline model is calibrated to ensure an accurate prediction of facility consumption patterns. After the installation period, utility bills are collected again to examine the consumption once the measures have been implemented, and a new weather-adjusted energy model is developed. The baseline energy model is applied to the post-install weather conditions, and the difference between baseline and post-install is determined to be the energy savings as a result of the project. The figure below showcases the Option C methodology for determining whole-facility savings.

Post-Installation M&V Activities

The HVAC Controls portion of the audit tool utilizes Trane Trace, an hourly building simulation model to generate baseline and post-retrofit models of the facilities energy use. Trane Trace essentially utilizes standard heat transfer equations to determine heating and cooling loads based on the heat loss or gain through the building envelope, the amount of outdoor air brought into the building, and any source of internal heat gain such as lighting or occupants.

After the new HVAC units have been installed and commissioned, RENU will conduct a post-installation inspection to verify that the units installed is consistent with what was proposed and has the potential to generate the cost savings predicted.

3.2.5 Guaranteed Savings Summary

Description	Electric Savings kWh
Rooftop Unit upgrades with VAV boxes	64,071
Replace Heat Pump	1,260
Fan Coil Unit Replacement	5,534
BMS (DCV and HVAC control)	18,438

3.2.6 Overview of M&V Plan – ECM 10 - Gas-Fired Water Heater

The M&V plan for this ECM is based on IPMVP Option C.

Savings Verification Methodology

The detailed calculations for the energy savings and the main equations used are down below:

- Heating Value for Gallon of Water = 1btu/1lb water x 8lbs/gal x (DHW Setpoint - Incoming Water Temperature)
- Existing Energy Usage = ((DHW usage x No. of People x Occupied Days/Year x Heating Value per gal Water)/Existing Efficiency)/btu per unit
- Proposed Energy Usage = ((DHW usage x No. of People x Occupied Days/Year x Heating Value per gal Water) Proposed Efficiency)/btu per unit

Project:	**Central Islip Public Library**																
Site:																	
Description	Removal of an existing domestic water heating and replacing with a high efficiency model.																
Given	Fuel Energy Cost		=						$1.350	$/Therm (Nat'l Gas)				0.166	$/kWh		
	Occupied Days/Year		=						250								
	Existing Temperature Setpoint		=						120	Degrees F							
	Type of Facility		=						School-Primary								
Assumptions	Number of People in Facility		=						100								
	DHW Usage		=						0.60	gal/person/day *							
	City Water Temperature		=						55	Degrees F							
	Energy to heat water		=						1	Btu/Gal/Deg							
	Existing Efficiency		=						100%	(Electric 100% Efficient)							
	Proposed Boiler Efficiency		=						95%								
Formula	Heating Value for Gallon of Water = 1btu/1lb water x 8lbs/gal x (DHW Setpoint - Incoming Water Temperature)																
	Existing Energy Usage = ((DHW usage x No. of People x Occupied Days/Year x Heating Value per gal Water)/Existing Efficiency)/btu per unit																
	Proposed Energy Usage = ((DHW usage x No. of People x Occupied Days/Year x Heating Value per gal Water)Proposed Efficiency)/btu per unit																
Calculation	Heating Value for Gallon of Water =	1	x	8	x (	120	-	55	)					=	520	**btu/gal**	
		DHW Usage		No. of People		Occupied Days/Yr		Htg Value		Htr Eff.		Btu/ Unit					
	Existing Energy Usage =((	0.60	x	100	x	250	x	520	)/	100%	)/	100,000	=		78	**Therm**	
	Proposed Energy Usage =((	0.60	x	100	x	250	x	520	)/	95%	)/	100,000	=		82	**Therm**	
		Usage		Cost													
	Existing Energy Costs =	2285	x	$0.17	=	**$ 379**											
	Proposed Energy Costs =	82	x	$1.35	=	**$ 111**											
Result	**Existing Annual Use=**								**2,285**	**kWh**	$	**379**					
	Proposed Annual Use=								**82**	**Therm**	$	**111**					
	Annual Savings=				=				**2285.4**	**kWh**	$	**269**					
	Demand Savings =				=				**3.5**	**kW**							
	Savings as Percent of Existing				=				**-82.1**	**Therm**	$	-					

Baseline M&V Activities

- The M&V plan for the Hot Water Heater ECM will follow IPMVP Option C using monthly facility utility bills. Option C analysis relies on leveraging utility bills, weather data, and historical weather data to forecast the energy consumption at a given facility. Typically, a baseline period is established prior to implementation of ECMs and a weather-adjusted baseline energy model is determined. This baseline model is calibrated to ensure an accurate prediction of facility consumption patterns. After the installation period, utility bills are collected again to examine the consumption once the measures have been implemented, and a new weather-adjusted energy model is developed. The baseline energy model is applied to the post-install weather conditions, and the difference between baseline and post-install is determined to be the energy

savings as a result of the project. The figure below showcases the Option C methodology for determining whole-facility savings.

Post-Installation M&V Activities

RENU shall record the energy consumption of loads associated with the ECM. At the end of the one-year M&V period, summarize the gas consumption data for comparison with the baseline and expected consumption. The metered equipment shall be inspected at the conclusion of the M&V period and as needed to verify proper operation. All collected information and comparison results will be included in the M&V report. portion will be used to extrapolate if appropriate. Extension of the M&V period is also an option for mitigating the effect of lost data.

Table 3.2.6 Guaranteed Savings Summary

Description	Electric Savings kWh
Gas fired water heater	2,285

3.2.7 Overview of M&V Plan – ECM 11- Plug Loads

The M&V plan for this ECM is based on IPMVP Option C.

Savings Verification Methodology

Savings calculation methods for Plug Load Control often involve the comparison of pre-installation and post-installation energy consumption data.

Preliminary Savings Sheet for Central Islip Library						Project Total
# of Berts	02	15	03	04	01	25
Total Annual kWh Savings	90	1,266	675	1,261	343	3,636
Total Annual $ Savings	$11	$152	$81	$151	$41	$436
Device Type:	Projector	M Printer	Copier	Lrg Coffee	H/C Water	
Watts:	8	15	40	56	61	
# Hours Scheduled ON per Year: BASELINE	8,760	8,760	8,760	8,760	8,760	
Central Isliip Library	LIB					
# of Berts	02	15	03	04	01	25
# Hours Scheduled ON per Year: BERT	3,132	3,132	3,132	3,132	3,132	
# Hours Scheduled OFF per Year: BERT	5,628	5,628	5,628	5,628	5,628	
Total Annual kWh Savings	90	1,266	675	1,261	343	3,636
Total Annual $ Savings	$11	$152	$81	$151	$41	$436
Annual $ Savings per Device	$5.40	$10.13	$27.01	$37.82	$41.20	

Device Name	Projector	Charging Cart	M Printer	Copier	Snack Vend	Soda Vend	Lrg Coffee	H/C Water
Wattage	8	37	15	40	40	320	56	61

ES	Calendar Sta	9/1/2018	Calendar End	6/30/2019	Weekday ON Days:	215
MS	Calendar Sta	9/1/2018	Calendar End	6/30/2019	Weekday ON Days:	215
HS	Calendar Sta	8/15/2019	Calendar End	6/15/2020	Weekday ON Days:	218

Building Type	Number of Days ON per year				Number of Hours ON per day			
Building Type	Weekday ON Days	Saturday ON Days	Sunday ON Days	# Days devices OFF	Weekday ON Hours	Saturday ON Hours	Sunday ON Hours	Annual Hours Using Bert Schedule
ADMIN -12 Mont	261	0	0	104	12	0	0	3,132
ES -9 MONTHS	220	0	0	145	11	0	0	2,420
MS-9 MONTHS	220	0	0	145	12	0	0	2,640
HS - 9 MONTHS	220	0	0	145	13	10	0	2,860
UNIV - 12 MONT	261	0	0	104	13	0	0	3,393
LAB - 12 MONTH	261	0	0	104	13	0	0	3,393
PUB - 12 MONTH	261	0	0	104	12	0	0	3,132
SAFE-12 MONTH	261	0	0	104	12	0	0	3,132
FOOD-12 MONTH	261	0	0	104	13	10	0	3,393
SERV-12 MONTH	261	0	0	104	12	0	0	3,132
WARE-12 MONT	261	0	0	104	12	10	0	3,132
LODG-12 MONTH	261	0	0	104	12	0	0	3,132
MED-12 MONTH	261	0	0	104	12	0	0	3,132
OTHER-12 MONT	261	0	0	104	12	10	0	3,132

Reminders:

Verify data

For projects with K-12 buildings: enter the calendar start & stop dates here

For all Projects:
Enter the # Weekday ON days. For K-12 buildings, enter the numbers shown in H6:H8.

Enter 261 for buildings with 12 month occupancy

Then enter the # of ON hours for weekdays, Saturday and Sunday

Baseline M&V Activities

The M&V plan for the Plug Load Controller ECM will follow IPMVP Option C using monthly facility utility bills. Option C analysis relies on leveraging utility bills, weather data, and historical weather data to forecast the energy consumption at a given facility. Typically, a baseline period is established prior to implementation of ECMs and a weather-adjusted baseline energy model is determined. This baseline model is calibrated to ensure an accurate prediction of facility consumption patterns. After the installation period, utility bills are collected again to examine the consumption once the measures have been implemented, and a new weather-adjusted energy model is developed. The baseline energy model is applied to the post-install weather conditions, and the difference between baseline and post-install is determined to be the energy savings as a result of the project. The figure below showcases the Option C methodology for determining whole-facility savings.

Post-Installation M&V Activities

- Commissioning of plug load control devices or systems, following design specifications.
- Post-installation data collection, covering the same parameters as the pre-installation phase, to measure the impact of control measures on energy use.
- Periodic inspections and maintenance to ensure the continued operation and optimization of plug load control systems.

Table 3.2.7 Guaranteed Savings Summary

Description	Electric Savings kWh
Plug Loads	3,636

EXHIBIT C

ATTACHMENT G

CONTRACT COST AND ANNUAL SERVICES

(a) Client agrees to pay to ESCO, the amount equal to the Project Cost, as listed below, in accordance with the terms described in Section 4 of the Contract. The project payments shall be substantially the same as those found in Attachment G-1, Project Payments, attached hereto. Please note this is a projected payment schedule, subject to market conditions at the time of actual project financing approval.

Project Cost:	$2,490,100
Downpayment:	$1,050,000
Net Financed Amount:	$1,440,100

Progress Payments are attached hereto as Attachment G-1.

Schedule G-1

Year	Payment
1	$138,908
2	$138,908
3	$138,908
4	$138,908
5	$138,908
6	$138,908
7	$138,908
8	$138,908
9	$138,908
10	$138,908
11	$138,908
12	$138,908
13	$138,908
14	$138,908
15	$139,755
Total	$2,084,461

(b) Maintenance Fee: Client shall pay ESCO for annual maintenance provided under this Contract that the Parties mutually agree to have ESCO perform. Client agrees to pay the annual Maintenance Fee as provided for below with respect to such agreed upon services.

Table G-1 – Annual Maintenance Fee

Year	Fee
1	$0
2	$0
3	$0
4	$0
5	$0
6	$0
7	$0
8	$0
9	$0
10	$0
11	$0
12	$0
13	$0
14	$0
15	$0
16	$0
17	$0
18	$0
Total	$0

(c) Measurement & Verification Fee: Client shall pay ESCO for annual measurement and verification services payable at the beginning of each performance period. Client agrees to pay the annual Measurement & Verification fee as provided for below with respect to such agreed upon services.

Table G-2 – Annual M&V Fee

Year	Fee
1	$2,588
2	$2,639
3	$2,692
4	$2,746
5	$2,801
Total	$13,466

(d) Performance Period Fee: The annual performance period fee shall be the sum of the Maintenance Fee and the Measurement and Verification Fee. Client agrees to pay the following Performance Period Fees

Table G-3 – Performance Period Fee

Year	Fee
1	$2,588
2	$2,639
3	$2,692
4	$2,746
5	$2,801
6	$0
7	$0
8	$0
9	$0
10	$0
11	$0
12	$0
13	$0
14	$0
15	$0
16	$0
17	$0
18	$0
Total	$13,466

(e) Cash Flow Table

The following cash flow demonstrates the annual positive cost benefits associated with implementation of the Energy Performance Contract over the 18-year term.

Year	Guaranteed Energy Savings	O&M Savings	Total Savings	Payments	M&V Service	Total Cost	Net Cash Flow
ENERGY REBATE/ INCENTIVE			$207,888				
1	$78,410	$5,059	$83,469	$138,908	$2,588	$141,495	$149,862
2	$81,154	$5,160	$86,315	$138,908	$2,639	$141,547	-$55,232
3	$83,995	$5,264	$89,258	$138,908	$2,692	$141,600	-$52,341
4	$86,934	$5,369	$92,303	$138,908	$2,746	$141,653	-$49,350
5	$89,977	$5,476	$95,453	$138,908	$2,801	$141,708	-$46,255
6	$93,126	$0	$93,126	$138,908	$0	$138,908	-$45,781
7	$96,386	$0	$96,386	$138,908	$0	$138,908	-$42,522
8	$99,759	$0	$99,759	$138,908	$0	$138,908	-$39,148
9	$103,251	$0	$103,251	$138,908	$0	$138,908	-$35,657
10	$106,865	$0	$106,865	$138,908	$0	$138,908	-$32,043
11	$110,605	$0	$110,605	$138,908	$0	$138,908	-$28,303
12	$114,476	$0	$114,476	$138,908	$0	$138,908	-$24,432
13	$118,483	$0	$118,483	$138,908	$0	$138,908	-$20,425
14	$122,630	$0	$122,630	$138,908	$0	$138,908	-$16,278
15	$126,922	$0	$126,922	$139,755	$0	$139,755	-$12,834
16	$131,364	$0	$131,364	$0	$0	$0	$131,364
17	$135,962	$0	$135,962	$0	$0	$0	$135,962
18	$140,720	$0	$140,720	$0	$0	$0	$140,720
TOTAL	**$1,921,017**	**$26,328**	**$2,155,233**	**$2,084,461**	**$13,466**	**$2,097,926**	**$57,307**

EXHIBIT D

ATTACHMENT K

STANDARDS OF SERVICE

The Standards of Service documents equipment operating characteristics for the purpose of developing baseline energy use and energy efficient upgrade profiles.

Lighting Systems:
Standards of Service for lighting systems are defined as the footcandle(fc) at the work surface by the new lighting and/or other equipment to be affected by the ECMs. The pre-construction fc levels and equipment schedules are used in the development and calibration of the system baseline energy use model/analysis. The post-construction fc levels and equipment schedules are used in the development of the system energy use model/analysis, and the associated savings.

Mechanical Systems:
Standards of Service for mechanical systems are defined as the temperature settings and equipment schedules for buildings, zones, and/or other equipment to be affected by the ECMs. The pre-construction temperature settings and equipment schedules are used in the development and calibration of the system baseline energy use model/analysis. The post-construction temperature settings and equipment schedules are used in the development of the system energy use model/analysis, and the associated savings.

Water Standard of Service:
Standards of Service for water systems are defined as the pre-construction plumbing fixture flow rates (GPF & GPM), usage patterns (flushes or minutes per day) and occupancy for areas affected by the ECM. Baseline water usage is calculated based on the plumbing fixture flow rates and usage patterns. A water allocation is developed for each building and is compared to the actual (metered) water usage to validate the estimated baseline. The post-construction plumbing fixture flow rates are used to calculate the water usage of the system and the associated savings.

The following Attachments K-1 and K-2 document the Standards of Service for the mechanical and water systems, respectively.

K-1 LIGHTING STANDARDS OF SERVICE

The following average maintained standards of service and comfort shall apply:

I. SPACE LIGHT LEVELS (FC):

Description	Occupied Hours		Average Existing FC	Average Proposed FC
	From	To		
Community Room	Mon – Thurs: 8AM – 9PM Fri -Sat: 9AM- 5PM Sun: 1PM-5PM		60	60
Children's Library	Mon – Thurs: 8AM – 9PM Fri -Sat: 9AM- 5PM Sun: 1PM-5PM		60	60
Main Library	Mon – Thurs: 8AM – 9PM Fri -Sat: 9AM- 5PM Sun: 1PM-5PM		60	60
Lower Stacks	Mon – Thurs: 8AM – 9PM Fri -Sat: 9AM- 5PM Sun: 1PM-5PM		30	45

If Client is unable to meet these Standards of Comfort for any reason, Client and ESCO shall mutually agree upon an appropriate adjustment to energy savings.

K-2 MECHANICAL STANDARDS OF SERVICE

The following average maintained standards of service and comfort shall apply:

I. SPACE TEMPERATURES:

Description	Occupied Hours		Heat Temp Occ/Unocc	Cool Temp Occ/Unocc	Winter Days per Week	Summer Days per week
	From	To				
LIBRARY	Mon – Thurs: 8AM – 9PM Fri -Sat: 9AM- 5PM Sun: 1PM-5PM		72 / 66-68	72 / 76-78	7	6 (closed on Sundays)
	Mon – Thurs: 8AM – 9PM Fri -Sat: 9AM- 5PM Sun: 1PM-5PM		72/ 66-68	72 / 76-78	7	6 (closed on Sundays)
	Mon – Thurs: 8AM – 9PM Fri -Sat: 9AM- 5PM Sun: 1PM-5PM		72 / 66-68	72/76-78	7	6 (closed on Sundays)

II. HOT WATER HEATERS:
DHW 100-105°F

III. VENTILATION: Within AHSRAE 62-2007 Code.

If Client is unable to meet these Standards of Comfort for any reason, Client and ESCO shall mutually agree upon an appropriate adjustment to energy savings.

If Client is unable to meet these Standards of Service, Comfort or Consumption parameters for any reason, Client and ESCO shall mutually agree upon an appropriate adjustment to energy savings.

EXHIBIT E

ATTACHMENT L

MODIFICATIONS TO COMPREHENSIVE ENERGY AUDIT

This contract is based on the revised CEA dated June 18th 2024.

SECOND AMENDMENT

THE SECOND AMENDMENT TO ENERGY SERVICES CONTRACT ("Second Amendment"), dated as of June 2, 2025 ("Effective Date"), is entered by and between RENU CONTRACTING & RESTORATION, INC. d/b/a RENU ENERGY SOLUTIONS, a New York corporation, having an address at 20 35th Street, Copiague, New York 11726 ("ESCO"), and CENTRAL ISLIP PUBLIC LIBRARY, having an address at 33 Hawthorne Avenue, Central Islip, New York 11722 ("Client") (collectively, the "Parties"), in respect of that certain Energy Services Contract dated December 21, 2023 (as amended, modified or supplemented from time to time, the "Contract") between such Parties.

WITNESSETH:

WHEREAS, ESCO and Client desire to amend the Contract, as provided below, upon the terms and subject to the conditions set forth herein.

NOW, THEREFORE, in consideration for the mutual promises contained herein, and for other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the Parties hereby agree as follows:

1. **Defined Terms**. Capitalized terms used but not otherwise defined in this Second Amendment shall have the meaning given to them in the Contract.

2. **Amendment**. Subject to the satisfaction of the Conditions Precedent set forth in Section 3 of this Second Amendment, the Contract is amended as of the Effective Date, as follows:

    a. On page 7 of the Contract, paragraph (a) of Section 4 (Compensation and Payment) is hereby deleted in its entirety and replaced with the following inserted in lieu thereof:

    The cost of the Project is Two Million Four Hundred Sixty Nine Thousand Fifty Seven Dollars ($2,469,057.00).

    b. On page 8, Section 8 (Changes In Work) inert the sentence "Project and change orders are not executory until the approval of the Commissioner is obtained and the Project costs will not exceed appropriated monies' at the end of the paragraph.

    c. "Attachment B" (Scope of Services) to the Contract is hereby deleted in its entirety and replaced with a revised version of the same, which is annexed hereto as **Exhibit A**.

    d. "Attachment F (Guarantee of Energy Cost Savings) to the Contract is hereby deleted in its entirety and replaced with a revised version of the same, which is annexed hereto as **Exhibit B**.

    e. "Attachment G" (Contract Cost and Annual Services) to the Contract is hereby deleted in its entirety and replaced with a revised version of the same, which is annexed hereto as **Exhibit C**.

f. "Attachment L" (Modifications to Comprehensive Energy Audit) to the Contract is hereby deleted in its entirety and replaced with a revised version of the same, which is annexed hereto as **Exhibit D**.

g. The Guarantee of Rebates is attached as Exhibit E.

3. **Conditions Precedent**. The effectiveness of this Second Amendment is subject to the following conditions precedent: (i) ESCO and Client have executed the Second Amendment, (ii) this Second Amendment may be executed in multiple counterparts, each of which shall be deemed an original, and all of which shall constitute one agreement. This Second Amendment may be executed by facsimile or PDF signature by any party and such signature shall be deemed binding for all purposes hereof without delivery of an original signature being thereafter required.

4. **Full Force and Effect**. Except as expressly provided herein, the Contract, as modified by this Second Amendment, remains in full force and effect.

5. **Governing Law**. This Second Amendment shall be governed by and construed in accordance with the laws of the State of New York.

6. **Invalidity**. If any terms, covenant or condition of this Second Amendment shall be held to be invalid, illegal or unenforceable in any respect, this Second Amendment shall be construed without such provision.

IN WITNESS WHEREOF, RENU CONTRACTING & RESTORATION, INC. d/b/a RENU ENERGY SOLUTIONS and CENTRAL ISLIP PUBLIC LIBRARY have caused this Second Amendment to the Agreement to be duly executed.

RENU CONTRACTING & RESTORATION, INC.
d/b/a RENU ENERGY SOLUTIONS

By: _____
Name: Robert Ragozine
Title: Vice President Energy Solutions

CENTRAL ISLIP PUBLIC LIBRARY

By: _____
Name:
Title:

EXHIBIT A – Scope of Services

ATTACHMENT B - SCOPE OF SERVICES

DESCRIPTION OF THE ENERGY CONSERVATION MEASURES AND THE EQUIPMENT

Building Name	ECM #	Proposed Energy Conservation Measure (ECM)
Central Islip Public Library	1	Roof Replacement
Central Islip Public Library	2	Building Envelope Upgrades
Central Islip Public Library	3	Rooftop Solar
Central Islip Public Library	4	LED Lighting and Controls
Central Islip Public Library	5	Rooftop Unit Upgrades and VAV Boxes
Central Islip Public Library	6	Replace Heat Pump with High Efficiency Heat Pump
Central Islip Public Library	7	Replace Vestibule Fan Coil Unit with High Efficiency Heat Pump
Central Islip Public Library	8	Building Management System
Central Islip Public Library	9	High Efficiency Gas-Fired Water Heater
Central Islip Public Library	10	Plug Load Controllers

Scope of Work:

ECM 1: Roof Replacement

1. Remove/Rip existing roof down to metal deck.
2. Properly dispose of all materials, including asbestos containing materials (ACM) at an EPA approved landfill.
3. Supply and install new, tapered R-30 Poly ISO mechanically fastened to metal deck.
4. Supply and install new .060 mechanically fastened Johns Manville TPO roof system as per manufacturers specifications. White in color.
5. Flash all penetrations.
6. Supply and install new 20-year Kynar aluminum gravel stop.
7. Provide all dumpsters.
8. Provide safety and pedestrian protection.

ECM 2: Building Envelope Upgrades

Central Islip Library Main Building

1. 4 Single Doors to be weather-stripped.
2. 385’ Roof/Wall Joint to be sealed
3. Supply and install foam insulation around (7) exhaust fans.
4. Re-pointing of damaged areas with air leakage
5. Re-caulking of exterior windows
6. Re-caulking of top of main entry into building

Central Islip Library Storage Building

1. 1 Single Door to be weather-stripped.
2. 1 Roll-up Garage Door to be weather-stripped (sides & top only; 30')
3. 1 Exhaust fan to be sealed at the damper to plenum connection (6')
4. 120' Roof/Wall Joint to be sealed

ECM 3: Rooftop Solar

1. Provide PV array design with ballast layout for structural approval by others.
2. Furnish and install (343) Q.Peak Duo XL or similar solar modules producing 164.64 kW.
3. Furnish and install mounting structure with aluminum top rails type TerraGEN, aluminum tilt rails and custom roll formed galvanized steel base rails. Fasteners will be stainless steel 18-supply.
4. Install rubber safety membrane for roof protection.
5. Furnish and install all inverters, (5) CPS-CPS25KW-208
6. Furnish and install Rapid shutdown devices as necessary.
7. Furnish and install all Panelboards & Electrical Disconnects
8. Furnish inverter monitoring package.
9. Roof warranty inspection upon completion.

ECM 4: LED Lighting and Lighting Controls

This ECM involves the replacement of non-LED fixtures with new LED lighting. Existing 2x4 and 2x2 fixtures will be upgraded with volumetric LED "door kits" that will make the fixture appear as if it is an entirely new fixture. In the high ceiling areas of the Library, the pendent mounted up-lights will be removed and the fixtures will be repositioned to achieve a more unified design. In the Business Office the downlights will be removed, and new 2x2 LED fixtures will be installed to provide better lighting. In the Director's bathroom, the outdated 1x1 fixture will be removed and replaced with a new 2x2 LED fixture. In the Library Stack area, new LED surface-mounted fixtures will be installed on the lower level. For the upper level of the Stack area, a new drop ceiling will be installed with 2x2 LED fixtures. Existing downlights will be replaced with new LED downlights. Exterior building-mounted Metal Halide fixtures will be replaced with new LED fixtures with photocells. The project's scope of work includes disconnecting the existing lighting system, disposing and/or recycling of the old equipment, securely installing the new LED fixture, wiring and controls connection, and thorough testing of the new fixtures to ensure proper operation.

The project's scope of work involves installing occupancy sensors, where deemed suitable, and connecting electrical wiring in accordance with New York laws and permit requirements. We do not recommend the installation of sensors for the main Library areas, the Community Room, or the Children's areas, since having lights turned off in these areas could be problematic. Our proposal does not include the installation of lighting controls in these areas.

ECM 5: Rooftop Unit Upgrades with VAV Boxes

Scope of Work (40-Ton RTU and VAV Boxes)

1. Provide labor to reclaim refrigerant gas from existing split A/C system located on roof of building. We will dispose of all refrigerant gas as per local code requirement.
2. Provide rigging service to remove existing rooftop units and properly dispose of them.
3. Provide labor and materials to install (1) 40-ton gas fired packaged rooftop unit Carrier Model # 48K5GW40-JH5A1QAF5.
4. Modification of existing roof steel to meet unit requirements.
5. Provide labor and materials to install (9) Variable Air Volume Boxes.
6. Provide labor and materials to install new supply air and return ductwork for new rooftop. unit. New ductwork will be connected to existing supply air and return air duct. penetrations through existing roof.
7. Provide labor and materials to install all required transition ductwork that will be required for installation of new variable air volume boxes.

8. Provide labor and materials to insulate new outdoor and interior ductwork. All exterior ductwork will be insulated with 2" thickness 6 lbs. density duct board and will be weatherproof with venture clad membrane.
9. Provide a certified air balance report at completion of project.
10. Provide all required shop and as-built drawings at completion of project.
11. Provide startup service for new rooftop unit.
12. Building Management System communication and control of all VAV boxes, RTU-1, RTU-2 and RTU-3.
13. Installation and control of Electric Duct Heater in Children's office Area.
14. Modifications to existing fire alarm system.

Scope of Work (Implement Natural Gas in Existing 20-Ton RTU)

1. Provide labor to burn out existing heat exchanger once gas piping is completed.
2. Provide a certified air balance report.

ECM 6: Replace Heat Pump with High Efficiency Heat Pump – IT Room

1. Provide labor to reclaim refrigerant from existing split system and properly dispose of.
2. Provide labor to disconnect and remove existing condenser and evaporator from site.
3. Provide labor and materials to install (1) 12,000 BTU high efficiency cooling only condenser and (1) 12,000 BTU wall-mounted evaporator Daikin Skyair FAQ_TAVJUA.
4. Provide labor and materials to install new refrigeration and condensate piping for new unit.
5. Condensate pumps will be provided as required.
6. Provide and install (2) equipment rails and (1) pipe portal.
7. Provide rigging service to set new condenser on roof.
8. Provide startup service for new units.

ECM 7: Replace Vestibule Fan Coil Unit with High Efficiency Heat Pump

1. Provide labor to disconnect and remove existing electric fan coil unit from premises and dispose of unit.
2. Provide labor and materials to install (1) 30,000 BTU high efficiency heat pump. Daikin Model Sky Air FBQ_TBVJU condenser and (1) 30,000 BTU ceiling cassette evaporator.
3. Provide labor and materials to install new refrigeration and condensate piping for new unit.
4. Provide and install (2) equipment rails and (1) pipe portal.
5. Provide rigging service to set new condenser on roof.
6. Provide startup service for new units.

ECM 8: Building Management System (BMS)

1. Install and fully configure a new JCI Facility Explorer FX-80 Niagara web-based BMS system. The new BMS system will be provided with a full graphics package, historical trends, alarms, etc. to provide a complete, cohesive control system for the building. All equipment listed in this proposal will be networked to the new BMS system and included in the graphical user interface.
2. Provide DDC control for (5) exhaust fans.
3. Provide start/stop, status, and alarm. New graphics, schedules, trends, and alarms.
4. Provide occupancy programming/control as per owner requirements.
5. Replace the existing programmable thermostats on the (1) existing York RTU, (1) existing Aaon unit, and (1) new Carrier RTU with a new JCI FX DDC control system.
6. This includes a BACnet DDC controller as well as a new space temperature sensor, discharge air sensor, control relays, actuators, etc.
7. Provide, install, and wire a wall-mounted CO2/temperature sensor for each RTU. The RTUs will be programmed to provide a full demand-controlled ventilation sequence of operation.
8. The new control system for each RTU will be fully mapped to the new BMS system and included in the graphics, schedules, trends, alarms, etc. This includes the following points and sequences:
    - Supply Fan Start/Stop and Status Monitoring
    - Return Fan Start/Stop and Status Monitoring (if applicable)

- Space Temperature
- Space Relative Humidity
- Space CO2 Level
- Discharge Air Temperature
- Economizer control
- Mixed air control (including DCV control)
- Heating control
- Cooling control
- Freeze protection
- Full set point and parameter control from BMS system.

9. Design, fabricate, wire, install, program and commission a new JCI FX DDC control system for the new RTU.
10. This includes a BACnet DDC controller as well as a new space temperature sensor, discharge air sensor, control relays, actuators, etc.
11. Provide, install, and wire a wall-mounted CO2/temperature sensor for the RTU. The RTU will be programmed to provide a full demand-controlled ventilation sequence of operation.
12. The new control system for the RTU will be fully mapped to the new BMS system and included in the graphics, schedules, trends, alarms, etc. This includes the following points and sequences:
    - Supply Fan Start/Stop and Status Monitoring
    - Return Fan Start/Stop and Status Monitoring (if applicable)
    - Space Temperature
    - Space Relative Humidity
    - Space CO2 Level
    - Discharge Air Temperature
    - Economizer control
    - Mixed air control (including DCV control)
    - Heating control
    - Cooling control
    - Freeze protection
    - Full set point and parameter control from BMS system.
13. Provide, install, wire and program a new JCI FX BACnet control system for each new VAV box. This includes the following points and sequences:
    - Space Temperature
    - Space Relative Humidity
    - Space CO2 Level
    - Occupied Space Set Point
    - Unoccupied Space Set Point
    - Discharge Air Temperature
    - CFM set point (heating and cooling modes)
    - Full set point and parameter control from BMS system.

The new control points for each VAV box will be fully mapped to the new BMS system and included in the graphics, schedules, trends, alarms, etc.

The Library will provide addresses and permissions for integration to the Library's existing LAN and remote connectivity via VPN (or external IP address) and the Library will provide and maintain a VPN for our use during the project and throughout the contract period.

ECM 9: High Efficiency Gas-Fired Water Heater

1. Disconnecting, removing, and disposing of the existing electric water heater.
2. New gas lines will be furnished and installed at the location of the new water heater.
3. Supply and install a new condensing domestic water heater, AO Smith ATI-540HX3-N.
4. Supply and install all necessary piping, valves, and fittings required to connect the new units to the existing piping systems (water and gas).
5. The new portions of the piping will be insulated with fiberglass and PVC fittings.

6. Electrical power and control wiring will be provided to the new units.
7. Piping will be checked for leaks to ensure proper operation of the new water heater.

ECM 10: Plug Load Controls

Install BERT plug load controls on (25) electronic devices in the Library. The plug load controls will be installed to automatically turn off or put electronic devices in standby mode.

Device Type:	Quantity:
Projector	2
Printer	15
Large Printer/Copier	3
Coffee Maker	4
H/C Water Dispenser	1

EXHIBIT B – Guarantee of Energy Cost Savings

Table 2.1. Guaranteed Savings

ECM	Electric (kWh)	Electric Demand (kW)		Natural Gas (Therms)	Total Energy Savings ($)
1 – Roof Replacement	8,687	0		0	$1,374
2 – Building Envelope Improvements	6,176	0		0	$977
3- Solar Ownership	217,563	0		0	$34,410
4 – Comprehensive Lighting Upgrades and Controls	106,114	26		0	$20,332
5 – Rooftop Unit Upgrades with VAV Boxes	64,071	21.2		-1,830	$11,028
6 – Replace Heat Pump with High Efficiency Heat Pump	1,260	1.9		0	$459
7– Replace Vestibule Fan Coil Unit with High Efficiency Heat Pump	5,534	3		0	$1,285
8 – Install Building Management System (BMS)	15,045	0		0	$2,380
9– Install High Efficiency Gas-Fired Water Heater	2,285	3.5		-82	$750
10 – Plug Load Controls	3,636	0		0	$575
TOTAL	430,371	56		-1,912	$73,568

Table 2.4 Guaranteed Savings with Escalation Rate

Period	Cost Savings
1	$76,143
2	$78,808
3	$81,566
4	$84,421
5	$87,375
6	$90,434
7	$93,599
8	$96,875
9	$100,265
10	$103,775

Period	Cost Savings
11	$107,407
12	$111,166
13	$115,057
14	$119,084
15	$123,252
16	$127,566
17	$132,030
18	$136,651
Total	**$1,865,473**

3. MEASUREMENT & VERIFICATION PLAN

3.1 Measurement and Verification. ESCO and the Client agree that the Verified Savings will be determined using the following Measurement and Verification Plan. Through this plan, the Guaranteed Savings generated by the ECMs installed in the Facilities will be verified and incorporated herein by reference.

Measurement & Verification Plan: ESCO and the Client agree that the Verified Savings by ECM will be determined using the following Measurement & Verification plans further described in this section. Through this plan, the guaranteed savings generated by the ECMs installed in the Facilities will be validated. The M&V methodologies proposed for these ECMs are based on the North American Measurement and Verification Protocol. The objective of the plan is to quantify the actual electrical and fossil fuel and compare those to the specific Baseline Usage for each Facility, the difference of which is the Verified Savings.

During the term of the Contract, ESCO will make adjustments to energy savings due to changes in building occupancy, weather data, and utility rate schedules, etc. The unit costs of energy will be applied to the energy savings calculated by this M&V plan. Current utility cost will be used as a basis for determining the unit cost, with floor and ceiling prices set by baseline rate information, presented herein this Attachment.

3.2 M&V Descriptions. The following matrix summarizes the M&V Plan with detailed plan descriptions for each ECM.

Table 3.2 Measurement and Verification Summary Matrix						
ECM Number and Description	M&V Option	Utility Types Affected	Baseline M&V	Post-Installation M&V	Performance Period M&V	Contractually Agreed Upon Variables
ECM 1 – Roof Replacement						
The scope of work for this ECM involves removing and disposing of the existing roof system, including all roofing materials and insulation.	C	Electric (kWh)	The analysis relies on leveraging utility bills, weather data, and historical weather data to forecast the energy consumption at a given facility.	Verify that proposed equipment has been implemented and is operating as intended. Post installation savings is determined from the same baseline model modified for the set points and energy rates.	Annual on-site inspections of equipment for ongoing verification	These values will be the parameters used within the model to calculate energy savings. The operation parameters include roof performance, reflectance, and space temperature.
ECM 2 – Building Envelope Upgrades						
This scope of work this ECM involves existing exhaust fans will be sealed, areas around windows and doors that need new weather stripping or caulking will be addressed, gaps in the concrete along the base of the right side of the building and the front of the storage building.	C	Electric (kWh)	The analysis relies on leveraging utility bills, weather data, and historical weather data to forecast the energy consumption at a given facility.	Verify that proposed equipment has been implemented and is operating as intended. Post installation savings is determined from the same baseline model modified for the set points and energy rates.	Annual on-site inspections of equipment for ongoing verification. Baseline Adjustment should be made based on cooling and heating load and operating hours	Weather, heating, and cooling system efficiency and occupancy.

ECM 3 – SOLAR						
This scope of work for this ECM involves the installation of roof-mounted photovoltaic systems using ballasted roof mounts, with an appropriate support system for the PV modules	B	Electric (kWh)	Baseline electrical energy is equivalent to the portion of the facility electrical load to be offset by the PV system electrical generation. PV system generation shall be calculated from the digital acquisition system (DAS) on the inverters.	Verify that proposed PV system has been implemented and is operating as intended. Instantaneous array performance to be compared against designed system output through measurement of solar insolation, module temperature and inverter output. Post installation savings is determined from the same baseline calculation modified for the as-built condition of the PV system	Annual on-site inspections of PV equipment for ongoing verification that system is in place, operational and that guaranteed electrical generation is sustainable. Energy generation is continuously metered by the PV system's revenue grade meter. All metered generation is reported as verified savings.	System name plate DC rating, array tilt, array azimuth, DC to AC conversion efficiency, hours and intensity of solar radiation, annual kwh generation
ECM 4 – LED LIGHTING AND LIGHTING CONTROLS						
This scope of work for this ECM proposed involves the replacement of non-LED fixtures with new LED lighting.	C	Electric (kWh)	Lighting fixture power consumption, operating hours, lighting levels. The analysis relies on leveraging utility bills, weather data, and historical weather data to forecast the energy consumption at a given facility.	Verify that proposed equipment has been implemented and is operating as intended. Post installation savings is determined from the same baseline model modified for the set points and energy rates.	Annual visual inspection of a sample set of lighting fixtures and controls to ensure the integrity of the fixtures and controls and confirm that the ECM still has the potential to perform as specified.	Lighting fixture power consumption, operating hours, lighting levels.

ECM 5, 6, 7 & 8 – HVAC UPGRADES & BMS						
This scope of work for this ECM involves replacing standard efficiency packaged air conditioning units with higher efficiency conditioning units. In addition, integration to the BMS system.	C	Electric (kWh)	The analysis relies on leveraging utility bills, weather data, and historical weather data to forecast the energy consumption at a given facility.	Verify that proposed equipment has been implemented and is operating as intended. Post installation savings is determined from the same baseline model modified for the set points and energy rates.	Annual on-site inspections of HVAC controls and equipment for ongoing verification that energy control strategies are in place and sustainable.	System efficiency, building parameters, current and proposed operating schedules
ECM 9 – INSTALL HIGH EFFICIENCY GAS-FIRED WATER HEATER						
This scope of work for this ECM involves disconnecting, removing, and disposing of the existing electric water heater. New gas lines will be furnished and installed at the location of the new water heater.	C	Electric (kWh) and Gas (Therms)	The analysis relies on leveraging utility bills, weather data, and historical weather data to forecast the energy consumption at a given facility.	Verify that proposed equipment has been implemented and is operating as intended. Post installation savings is determined from the same baseline model modified for the set points and energy rates.	Annual on-site inspections of the equipment and taking readings from the installed gas meter..	Size, capacity, energy efficiency rating, temperature setting and occupied days
ECM 10 – PLUG LOAD CONTROLS						
This scope of work for this ECM involves installing plug load controls on electronic devices.	C	Electric (kWh)	The analysis relies on leveraging utility bills, weather data, and historical weather data to forecast the energy consumption at a given facility.	Verify that proposed equipment has been implemented and is operating as intended. Post installation savings is determined from the same baseline model modified for the set points and energy rates.	Annual on-site inspections of equipment for ongoing verification that energy control strategies are in place and sustainable.	Device wattage, number of Berts and Scheduled On hours

3.2.1 Overview of M&V Plan – ECM 1- Roof Replacement

The M&V plan for this ECM is based on IPMVP Option C. Savings

Verification Methodology
The savings calculation methods for roof insulation primarily rely on the comparison of pre-installation and post-installation energy consumption data. This calculation considers variables such as heating and cooling degree days, occupancy patterns, and temperature differentials.
Savings calculations includes:

- Regression analysis to account for weather variations
- Analysis of utility bills and metered data to track changes in energy use.
- Modeling and simulation tools to predict energy savings based on insulation specifications and building characteristics.
- Comparative analysis of energy consumption data before and after insulation installation to assess the impact on heating and cooling loads.

Formulas used to develop and estimate the savings:

- Load Factor = (Area A * U-value A) + (Area B * U-value B) + (Area C * U-value C)
- Sol-air Temperature Factor = ((Area A * Reflectance A) + (Area B * Reflectance B)+(Area C * Reflectance C)/(Total Area)*(Daylight & Debree Factor)
- Annual Savings (MBH/YR) = (Cooling btu/hr savings)*(% runtime)*(average days in period)
- Annual Savings (kWh/YR) = (mbh/hr savings)/(12mbh/ton)*(kW/ton)

Baseline M&V Activities
The M&V plan for the Roof ECM will follow IPMVP Option C using monthly facility utility bills. Option C analysis relies on leveraging utility bills, weather data, and historical weather data to forecast the energy consumption at a given facility. Typically, a baseline period is established prior to implementation of ECMs and a weather- adjusted baseline energy model is determined. This baseline model is calibrated to ensure an accurate prediction of facility consumption patterns. After the installation period, utility bills are collected again to examine the consumption once the measures have been implemented, and a new weather-adjusted energy model is developed. The baseline energy model is applied to the post-install weather conditions, and the difference between baseline and post-install is determined to be the energy savings as a result of the project. The figure below showcases the Option C methodology for determining whole-facility savings.

Post-Installation M&V Activities

- Verify installation of new roof.
- Perform standard ASHRAE calculations to verify reduced heat transfer and infiltration.
- Perform utility bill analysis to verify building operation became more efficient or that changes in operation have been taken into consideration.

Table 3.2.1 Guaranteed Savings Summary

Description	Electric Savings kWh
Roof Replacement	8,687

3.2.2 Overview of M&V Plan – ECM 2- Building Envelope

The M&V plan for this ECM is based on IPMVP Option C. Savings

Verification Methodology

The pre-installation will be validated by verifying the linear feet and area contributing to infiltration. Accepted engineering principles were used for Baseline and Post-Installation calculations. Baseline energy use is affected by weather patterns, building loads, and building envelope deficiencies.

The information gathered during the CEA includes the following information:

- Building K value: 100
- Existing cooling COP: 2.5
- Existing heating efficiency: 80%
- Weather data based on location.
- Total gap area 1.72 sq ft

The data collected during the M&V are to use as input into calculations to create the Baselines to determine the performance of the building envelope improvements.

A Microsoft Excel spreadsheet was developed to calculate the baseline and savings for this ECM. A bin calculation method was used to estimate the savings associated with improving the building's insulation characteristics and reducing the building's unwanted infiltration. Details of the calculation can be found in the CEA.

Formulas used to estimate the savings:

- Non-Electric Heat Loss = ((Bldg Leakage sq ft) x (bldg k factor) x (Wind P Factor) x (HDD) x (9/5) x 0.075 x .243 x 60 x 24) / (100,000 x Eff %)
- Electrical Heating Loss = ((Bldg Leakage sq ft) x (bldg k factor) x (Wind P Factor) x (HDD) x (.075 x .243 x 60 x 24) x (conversion to kwh)
- Cooling Loss = ((Bldg Leakage sq ft) x (bldg k factor) x (Wind P Factor) x (CDD) x (.075 x .243 x 60 x 24) x (conversion to kWh)

Baseline M&V Activities

The M&V plan for the Building Envelope ECM will follow IPMVP Option C using monthly facility utility bills. Option C analysis relies on leveraging utility bills, weather data, and historical weather data to forecast the energy consumption at a given facility. Typically, a baseline period is established prior to implementation of ECMs and a weather-adjusted baseline energy model is determined. This baseline model is calibrated to ensure an accurate prediction of facility consumption patterns. After the installation period, utility bills are collected again to examine the consumption once the measures have been implemented, and a new weather-adjusted energy model is developed. The baseline energy model is applied to the post-install weather conditions, and the difference between baseline and post-install is determined to be the energy savings as a result of the project. The figure below showcases the Option C methodology for determining whole-facility savings.

Post-Installation M&V Activities

The Post-Installation performance factors are heating system efficiencies and thermal integrity of windows, doors, roofs, and wall insulation. The intent of Performance Period verification activities is to ensure that the infiltration experienced in the building prior to implementing this ECM has been reduced as a result of various building envelope improvements. The intent is also to ensure that the building envelope improvements are being properly maintained.

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Table 3.2.2 Guaranteed Savings Summary

Description	Electric Savings kWh
Building Envelope	6,176

3.2.3 Overview of M&V Plan – ECM 3 - Rooftop Solar

The M&V plan for this ECM is based on IPMVP Option B. Savings

Verification Methodology
The PVWatts calculator determines the energy production and cost savings of grid-connected photovoltaic (PV) energy systems by creating hour-by-hour performance simulations that provide estimated monthly and annual energy production in kilowatts and energy value. Users select a geographic location of the PV installation and establish system parameters for size, electric cost, array type, tilt angle, and azimuth angle. Using typical meteorological year weather data for the selected location, the PVWatts calculator determines the solar radiation incident of the PV array and the PV cell temperature for each hour of the year. The DC energy for each hour is calculated from the PV system DC rating and the incident solar radiation and then corrected for the PV cell temperature. The AC energy for each hour is calculated by multiplying the DC energy by the overall DC-to-AC derate factor and adjusting for inverter efficiency as a function of load.

Baseline M&V Activities
Given that the solar PV system is not installed at present, the energy baseline is considered to be the maximum potential annual output of the array. The baseline energy was established through collection of various data parameters including:

- Geographic location of array
- DC system size (name plate rating)
- DC-to-AC derate Factors
- Array type (fixed, tracking, etc)
- Array tilt, azimuth

The data collected is used within the proposal to generate baseline energy generation for the PV system.

Post-Installation M&V Activities
The M&V plan for the rooftop solar panel installation will follow IPMVP Option B: Retrofit Isolation. To determine the energy consumption and costs that are offset by the onsite solar panels, data from the digital acquisition system (DAS) on the inverters is required. Additionally, cost savings will be determined based on the billing data detailing the generated energy, and details of the rate schedule. Examples of the trend data points required from the DAS and billing data are noted below.

Parameter	Units	Interval	Dura1on
Power Generated	kW	15 min	12 months
PV System Standby Use	kW	15 min	12 months
Power Returned to Utility	kWh	Monthly	12 months
Power Returned to Grid Cost	$/kWh	Monthly	12 months
Rated PV Capacity	kWh	N/A	One-Time

Table 3.2.3 Guaranteed Savings Summary

Description	Electric Savings kWh
Rooftop Solar	217,563

3.2.4 Overview of M&V Plan – ECM 4 - LED Lighting and Lighting Controls

The M&V plan for this ECM is based on IPMVP Option C

Savings Verification Methodology

Energy (kWh) and demand (kW) savings will be calculated using the following equations:

kWh Savings = Σu [(kW UsageGroupU,baseline - kW UsageGroupU,post) x Annual Hours of Operation]

kW Savings = Σu [(kW UsageGroupU,baseline - kW UsageGroupU,post)

Where:

kWh Savings	=	kilowatt-hour savings realized during one-year post-installation
kW Savings	=	Coincident kilowatt demand saving realized
kW UsageGroup U,baseline	=	Lighting baseline demand for usage group u
kW UsageGroup U,post	=	Lighting demand during post-installation period for usage group u
Annual Hours of Operation	=	Annual number of operating hours for the usage group u

Savings Calculation Method		
Baseline Energy Usage (kWh/yr)	=	Existing Fixture Watts x Operating Hours / yr x 1 kW / 1000 Watts
Estimated Energy Usage (kWh/yr)	=	Proposed Fixture Watts x Op. Hours/yr x 1 kW / 1000 Watts
Energy Savings (kWh /yr)	=	Baseline Energy Usage – Estimated Energy Usage
Baseline Demand (kW)	=	Existing Fixture Watts / 1000 Watts
Retrofit Demand (kW)	=	Proposed Fixture Watts / 1000 Watts
Energy Savings (kW)	=	(Existing Fixture Watts – Proposed Fixture Watts) x 1 kW / 1000 Watts

Baseline M&V Activities

The M&V plan for the LED Lighting and Lighting Controls ECM will follow IPMVP Option C using monthly facility utility bills. Option C analysis relies on leveraging utility bills, weather data, and historical weather data to forecast the energy consumption at a given facility. Typically, a baseline period is established prior to implementation of ECMs and a weather-adjusted baseline energy model is determined. This baseline model is calibrated to ensure an accurate prediction of facility consumption patterns. After the installation period, utility bills are collected again to examine the consumption once the measures have been implemented, and a new weather-adjusted energy model is developed. The baseline energy model is applied to the post-install weather conditions, and the difference between baseline and post-install is determined to be the energy savings as a result of the project. The figure below showcases the Option C methodology for determining whole-facility savings.

Post-Installation M&V Activities

Upon project completion, an as-built inventory of post-installation lighting fixtures will be supplied, including the lighting ballasts and lamps installed, and lighting illumination levels (foot-candles) in each area. Savings calculations will be corrected based on as-built data and will be reported in the Post-Installation Report.

These measurements will be used to calculate actual expected energy savings and will be detailed in the Post-Installation Report.

Table 3.2.4 Guaranteed Savings Summary

Description	Electric Savings kWh
LED Lighting and Lighting Controls	106,114

3.2.5 Overview of M&V Plan – ECM 5,6,7 & 8 - HVAC and BMS upgrades

The M&V plan for this ECM is based on IPMVP Option C. Savings

Savings Verification Methodology

RTU savings were performed using the TRANE Trace 700 software by inserting the building heating/cooling load requirements.

For heat pump replacement spread sheets tools were used. Energy (kWh) and demand (kW) savings will be calculated using the equations below:

Energy Use (kWh) = (Capacity (Tons)*(Hours of Operation/Year)*(Scheduled Usage)*(Efficiency) [Efficiency calculation is in kW/ton for simplicity]

HEAT PUMP REPLACMENT CALCULATION

Energy Use (kWh) = (Capacity (Tons)*(Hours of Operation/Year)*(Scheduled Usage)*(Efficiency) [Efficiency calculation is in kW/ton for simplicity]

Energy Use (kWh) = (Capacity (Tons)*(Hours of Operation/Year)*(Scheduled Usage)*(Efficiency) [Efficiency calculation is in kW/ton for simplicity]

FAN COIL UNIT REPLACMENT CALCULATION

Energy Use (kWh) = (Capacity (Tons)*(Hours of Operation/Year)*(Scheduled Usage)*(Efficiency) [Efficiency calculation is in kw/ton for simplicity]

Energy Use (kWh) = (Capacity (Tons)*(Hours of Operation/Year)*(Scheduled Usage)*(Efficiency) [Efficiency calculation is in kW/ton for simplicity]

BMS Controls Calculation
Temperature setback based on occupancy

Baseline M&V Activities

The M&V plan for the HVAC and BMS ECMs will follow IPMVP Option C using monthly facility utility bills. Option C analysis relies on leveraging utility bills, weather data, and historical weather data to forecast the energy consumption at a given facility. Typically, a baseline period is established prior to implementation of ECMs and a weather-adjusted baseline energy model is determined. This baseline model is calibrated to ensure an accurate prediction of facility consumption patterns. After the installation period, utility bills are collected again to examine the consumption once the measures have been implemented, and a new weather-adjusted energy model is developed. The baseline energy model is applied to the post-install weather conditions, and the difference between baseline and post-install is determined to be the energy savings as a result of the project. The figure below showcases the Option C methodology for determining whole-facility savings.

Post-Installation M&V Activities

The HVAC Controls portion of the audit tool utilizes Trane Trace, an hourly building simulation model to generate baseline and post-retrofit models of the facilities energy use. Trane Trace essentially utilizes standard heat transfer equations to determine heating and cooling loads based on the heat loss or gain through the building envelope, the amount of outdoor air brought into the building, and any source of internal heat gain such as lighting or occupants.

After the new HVAC units have been installed and commissioned, RENU will conduct a post-installation inspection to verify that the units installed is consistent with what was proposed and has the potential to generate the cost savings predicted.

3.2.5 Guaranteed Savings Summary

Description	Electric Savings kWh
Rooftop Unit upgrades with VAV boxes	64,071
Replace Heat Pump	1,260
Fan Coil Unit Replacement	5,534
BMS (DCV and HVAC control)	15,045

3.2.6 Overview of M&V Plan – ECM 10 - Gas-Fired Water Heater

The M&V plan for this ECM is based on IPMVP Option C. Savings

Savings Verification Methodology

The detailed calculations for the energy savings and the main equations used are down below:

- Heating Value for Gallon of Water = 1btu/1lb water x 8lbs/gal x (DHW Setpoint - Incoming Water Temperature)
- Existing Energy Usage = ((DHW usage x No. of People x Occupied Days/Year x Heating Value per gal Water)/Existing Efficiency)/btu per unit
- Proposed Energy Usage = ((DHW usage x No. of People x Occupied Days/Year x Heating Value per gal Water) Proposed Efficiency)/btu per unit

Baseline M&V Activities

- The M&V plan for the Hot Water Heater ECM will follow IPMVP Option C using monthly facility utility bills. Option C analysis relies on leveraging utility bills, weather data, and historical weather data to forecast the energy consumption at a given facility. Typically, a baseline period is established prior to implementation of ECMs and a weather-adjusted baseline energy model is determined. This baseline model is calibrated to ensure an accurate prediction of facility consumption patterns. After the installation period, utility bills are collected again to examine the consumption once the measures have been implemented, and a new weather-adjusted energy model is developed. The baseline energy model is applied to the post-install weather conditions, and the difference between baseline and post-install is determined to be the energy savings as a result of the project. The figure below showcases the Option C methodology for determining whole-facility savings.

Post-Installation M&V Activities

RENU shall record the energy consumption of loads associated with the ECM. At the end of the one-year M&V period, summarize the gas consumption data for comparison with the baseline and expected consumption. The metered equipment shall be inspected at the conclusion of the M&V period and as needed to verify proper operation. All collected information and comparison results will be included in the M&V report. portion will be used to extrapolate if appropriate. Extension of the M&V period is also an option for mitigating the effect of lost data.

Table 3.2.6 Guaranteed Savings Summary

Description	Electric Savings kWh
Gas fired water heater	2,285

3.2.7 Overview of M&V Plan – ECM 11- Plug Loads

The M&V plan for this ECM is based on IPMVP Option C.

Energy Savings Verification Methodology

Savings calculation methods for Plug Load Control often involve the comparison of pre-installation and post- installation energy consumption data.

Baseline M&V Activities

The M&V plan for the Plug Load Controller ECM will follow IPMVP Option C using monthly facility utility bills. Option C analysis relies on leveraging utility bills, weather data, and historical weather data to forecast the energy consumption at a given facility. Typically, a baseline period is established prior to implementation of ECMs and a weather-adjusted baseline energy model is determined. This baseline model is calibrated to ensure an accurate prediction of facility consumption patterns. After the installation period, utility bills are collected again to examine the consumption once the measures have been implemented, and a new weather-adjusted energy model is developed. The baseline energy model is applied to the post-install weather conditions, and the difference between baseline and post-install is determined to be the energy savings as a result of the project. The figure below showcases the Option C methodology for determining whole-facility savings.

Post-Installation M&V Activities

- Commissioning of plug load control devices or systems, following design specifications.
- Post-installation data collection, covering the same parameters as the pre-installation phase, to measure the impact of control measures on energy use.
- Periodic inspections and maintenance to ensure the continued operation and optimization of plug load control systems.

Table 3.2.7 Guaranteed Savings Summary

Description	Electric Savings kWh
Plug Loads	3,636

EXHIBIT C – Contract Cost and Annual Services

ATTACHMENT G - CONTRACT COST AND ANNUAL SERVICES

(a) Client agrees to pay to ESCO, the amount equal to the Project Cost, as listed below, in accordance with the terms described in Section 4 of the Contract. The project payments shall be substantially the same as those found in Attachment G-1, Project Payments, attached hereto. Please note this is a projected payment schedule, subject to market conditions at the time of actual project financing approval.

Project Cost:	$2,469,057
Downpayment:	$1,050,000
Net Financed Amount:	$1,419,057

Schedule G-1

Year	Payment
1	$136,878
2	$136,878
3	$136,878
4	$136,878
5	$136,878
6	$136,878
7	$136,878
8	$136,878
9	$136,878
10	$136,878
11	$136,878
12	$136,878
13	$136,878
14	$136,878
15	$137,713
Total	$2,054,003

EXHIBIT D – Modifications to Comprehensive Energy Audit

The Comprehensive Energy Audit (CEA) is revised as of May 12, 2025 and is attached hereto.

EXHIBIT E – Guarantee of Rebates

For the Central Islip Public Library EPC, RENU Energy Solutions guarantees the total rebate amount of $207,888 in full without exception. Any shortfall will be paid by RENU to the Library.

RENU
ENERGY SOLUTIONS
A DIVISION OF RENU CONTRACTING RESTORATION

Central Islip Public Library

COMPREHENSIVE ENERGY AUDIT

Central Islip, New York

CEA 6-18-24 Revision 5-12-25

renuny.com

Table of Contents

Section 1. Executive Summary

1.1 Overview

RENU Energy Solutions (RENU) is pleased to submit this Comprehensive Energy Audit (CEA) for the Central Islip Public Library. The purpose of this CEA is to assess the energy performance of Central Islip Public Library and present energy conservation measures (ECM) that will reduce operating costs and improve energy efficiency. The CEA was conducted in accordance with industry-standard procedures and guidelines and includes a comprehensive analysis of the building's energy systems, utility bills, and energy usage patterns.

Overall, the Comprehensive Energy Audit for Central Islip Public Library provides a comprehensive analysis of the building's energy performance, identifies cost-effective energy conservation measures, and provides a detailed financial analysis to assist the Central Islip Public Library in making informed decisions about implementing these measures. By implementing the recommended measures, the building can significantly reduce energy consumption, lower operating costs, improve energy efficiency, and address several needed capital upgrades.

1.2 Benefits

RENU has evaluated various energy-saving measures to develop the CEA. Based on the findings, several energy conservation measures were identified that could significantly reduce energy consumption and operating costs. These measures included but were not limited to upgrades to the building's HVAC systems, lighting upgrades, enhanced controls, installation of a rooftop photovoltaic system, and improvements to the building envelope. Each measure was evaluated based on its potential energy savings, capital cost, and payback period.

1.3 Simple Payback Summary

See attached Appendix 1 for the Project Simple Payback Summary.

Section 2. Introduction

This Comprehensive Energy Audit (CEA) addresses the following facilities:

Building	Address	Total Square Footage
Central Islip Public Library & Storage Building	33 Hawthorne Ave	24,000 ft^2

2.1 Facility Description

Central Islip Public Library

Background Information

Central Islip Public Library is located at 33 Hawthorne Ave, Central Islip, New York. This 23,000 ft^2 facility was originally built in 1976 and remains in good condition. Central Islip Public Library consists of mostly one (1) floor of office space and open Library space. There is one small section of book stacks which has two (2) floors. There is also a detached 1,000 square foot storage building at the back of the property.

Building Occupancy

Occupancy of the building is approximately 230 people, including staff and daily visitors.

Hours of Operation

- Monday through Thursday - 9:30 am to 9:00 pm
- Friday through Saturday - 9:30 am to 5:00 pm
- Sunday (Oct-May) – 1:00 pm to 5:00 pm
- Sunday (June-Sept) – Closed

2.1.1 Roof

The building has a flat roof that was installed in 1976 and appears to be in poor condition. The existing foam roof is frequently in need of repair and the roof needs complete replacement. In addition, on August 10, 2023, RENU enlisted JC Broderick to perform bulk sampling and analysis of suspect asbestos containing materials (ACM) that may be disturbed by the proposed scope of work. Sampling was performed in accordance with the United States Environmental Protection Agency (U.S. EPA) 40 CFR Part 763.86 (AHERA).

A chain of custody forms was prepared for the samples collected and were delivered to EMSL Analytical Laboratories, Inc. (EMSL) for analysis. Based on this analysis, asbestos was determined to be present in the main roofing system.

2.1.2 Building Envelope

The building is constructed of masonry walls with a brick façade. The building has double pane operable windows with metal frames and interior shades. The exterior doors are typically metal with glass panes and metal.

The sealant around these frames is in fair condition and the windows area a source of air infiltration. The exterior doors, in some instances, have either missing or worn weather-stripping materials which show signs of infiltration. The building envelope has deficiencies and contributes to a small amount of air infiltration.

It was noted that the corner Children's Area office was previously a garage. The occupant of the space noted that in the winter the space is cold enough to have required the district to install a 5-kW electric heater to supplement the heating load.

2.1.3 Renewable Energy Generation

The Central Islip Public Library currently does not have any source of on-site renewable energy generation.

2.1.4 Lighting

The building is primarily lit by linear fluorescent fixtures which contain 32W T8 lamps. Fixtures throughout the building include pendant mounted continuous rows fixtures, surface mounted wraps, or recessed troffer fixture. Some areas have recessed can fixtures.

The open Library areas are primarily illuminated by 2-lamp 2x2 fluorescent fixtures. Many of lamps and ballasts in these fixtures need replacement, causing uneven lighting levels throughout the space. Lamps are changed less frequently than required, due to the high ceiling requiring a lift in order to change into a single lamp. During the site walkthrough, it was noted that the lamps directly over bookshelves were burnt out and left unchanged for longer than those not over furniture. There are sections of the building which have had minor renovations to install LED Lights. Portions of the office spaces, community room and lobby restrooms have already been converted to LEDs. Most of these LEDs are made up of 2x2 fixtures and round recessed LEDs.

The exterior lighting includes building mounted Metal Halide lamps. The exterior of both the storage building and main Library are illuminated by 250-watt Metal Halide wall-pack fixtures. Parking lot lights have previously been upgraded to LED.

2.1.5 Lighting Controls

The lighting in individual rooms is manually controlled via wall switches. There are currently no occupancy sensors nor a BMS to control on/off the existing facility lights.

2.1.6 Mechanical Systems

HVAC Systems and Equipment:

The Central Islip Public Library is served by (3) rooftop units (RTUs)/air handling units (AHUs) which provide ventilation and cooling duties for the entire building. The Library does not have any existing natural gas-fired heaters or boilers and all heating is done with electric resistance.

A 20-ton York RTU and a 75-ton Trane AHU paired with a Trane condenser serve the majority of the building. Downstream of the ductwork, there are eight electric duct heaters of various capacities which provide all the heating duty. Table 1 shows the available existing duct heater information. The York unit serves the Community Room and lobby area while the Trane unit serves offices, book stacks and the main Library.

Table 1: Existing Electric Duct Heaters

Designation	Location	Serves	Capacity (KW)	Capacity (CFM)
Duct Heater	Back Circulation Office	Elec Room, Conf. Room & Copy Room	11.4	890
Duct Heater	Office Hallway	Back Offices	39.4	2262
Duct Heater	Computer Lab	Comp. Lab and Offices	20.0	1130
Duct Heater	Circulation Office	Children's Library	31.8	3200
Duct Heater	Circulation Office	Main Library	67.7	9500
Duct Heater	Main Library	Book Stacks	26.7	5000
Duct Heater	Gallery	Gallery	11.0	2600
Duct Heater	Gallery	Café, Restrooms & Community Room	45.7	5500

The third RTU is a small, 6-ton Aaon unit which only serves the Children's space and a corner office. This unit is equipped with electric heat and does not have any existing electric duct heaters. The thermostat for the unit is in the Children's Room. During RENU's walkthrough, it was noted by staff in the office that the room gets too cold in the winter. There is an electric unit heater which was installed to supplement the heating requirement. However, it was indicated that

the unit heater is too noisy and requires to be switched on/off at the unit which requires a ladder to do so.

Due to the delicate nature of the IT server equipment, there is also a dedicated 1-ton mini-split heat pump that only serves the IT room. This unit is extremely important as it provides cooling for the sensitive electrical components in the room even when the RTUs are turned off.

The entry vestibule is heated by a fan coil unit. This section of the building is only kept at 55 degrees during the winter months, so as to only temper the air as the vestibule is only for entering and leaving the building, not for continuous occupancy.

The detached storage building provides heat by two electric unit heaters. The building has no air conditioning but has an exhaust fan to exhaust hot air during the warmer months.

2.1.7 Motors

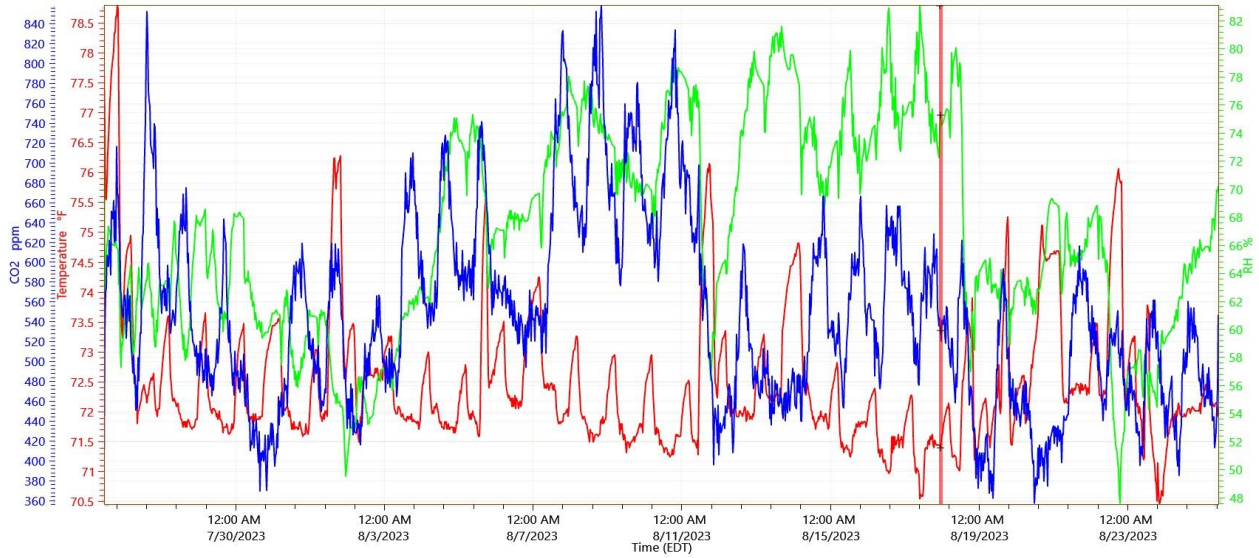
The HVAC systems that serve the building utilize fan motors which are generally in good condition and of standard to high efficiency. These systems include exhaust fan motors and supply fan motors. All motors more than 5 horsepower were analyzed for retrofit. The existing Trane AHU has a 20 HP supply fan motor.

2.1.8 Building Controls (HVAC Controls)

The Library has no central building management system (BMS) to control temperature setpoints or track and record data. Temperature in the spaces is controlled by wall-mounted thermostats, one for each big RTU, which can be manually changed by staff.

There are two wall-mounted time clocks which were used to control the two main RTUs. These time clocks are set to turn the unit completely off at night and turn the unit back on in the morning. However, at the date of the walk-through, these time clocks were switched to the "permanently-on" override mode.

There is an absence of a humidity control sequence, which creates humidity conditions that fluctuate inside the building. This is indicated by the green graph line for humidity levels monitored through the period 7/30/2023-8/23/2023.


CO2 ppm
Temperature °F
RH %
12:00 AM 7/30/2023
12:00 AM 8/3/2023
12:00 AM 8/7/2023
12:00 AM 8/11/2023
12:00 AM 8/15/2023
12:00 AM 8/19/2023
12:00 AM 8/23/2023
Time (EDT)

2.1.9 Hot Water Systems (Domestic Hot Water)

The building does not have any boilers that produce heating hot water for any equipment. Most of the domestic hot water is distributed by a 30-gallon, 4500 watt electric water heater. However, there is an additional electric water heater for a private office as well as another electric water heater for the main lobby restrooms.

Given the timeframe of when work would commence for this project, we will replace the existing main electric water heater with a new gas-fired water heater that operates at an efficiency of up to 97%. This will be possible with the addition of natural gas to the site.

Table 2: Existing Electric Water Heaters

Designation	Location	Floor/ Serves	Manufacturer	Model/ Make	Date	Type	Capacity
DHW 1	Elec Room	Whole Building	Rheem	82V30-2	2013	Electric	4500 W
DHW **2**	Office Closet	Private Office	Rheem	81VP6S	1998	Electric	2000 W
DHW 3	Restrooms	Lobby Restrooms	Rheem	-	-	Electric	4500 W

2.1.10 Kitchen Equipment

The Library does not offer a public commercial kitchen but does have a small residential-style kitchen in the break room for staff. The kitchen utilizes electric cooking equipment as well as some toasters and microwaves. There is a residential-style refrigerator, but there are no walk-in freezers or walk-in fridges of any kind.

2.1.11 Plug Loads

Office equipment is regularly left in the 'on' state at all times allowing the individual machine to revert to the 'Sleep' mode based on an internal timer. This measure will plug the office equipment into a networkable device that will allow for scheduling of the plugged-in equipment. The existing plug loads were observed to have no existing plug load controls. Plug loads with significant parasitic loses will be investigated to determine viability of installing plug load controls, though not all existing plug loads will be good candidates for plug load controllers due to low energy savings.

RENU observed to following plug loads:

Table 3: Existing Plug Loads

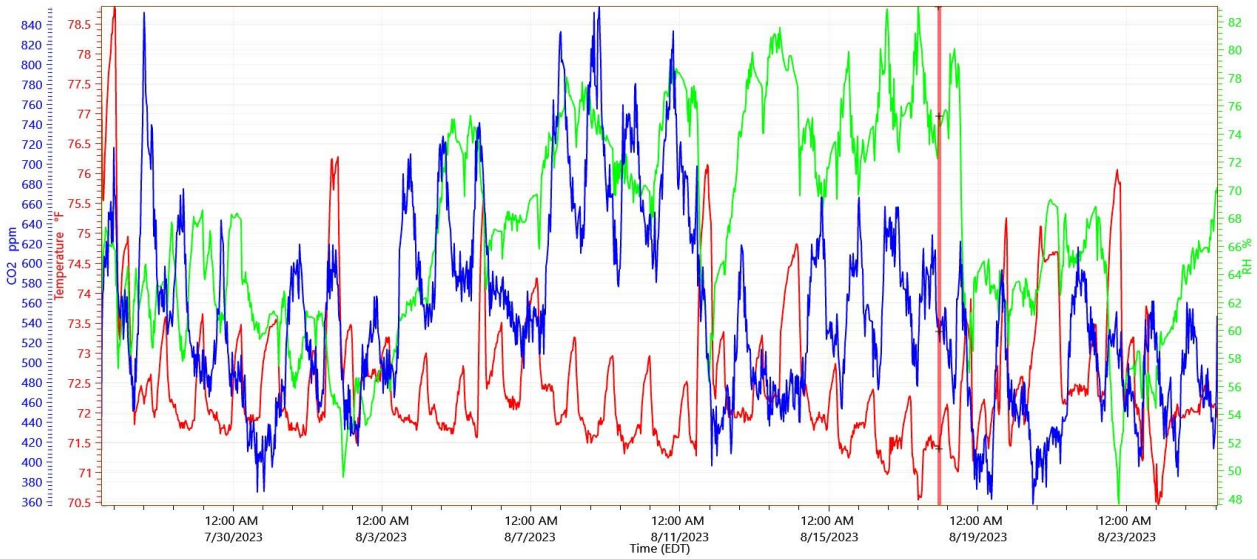
Device Type:	Quantity:
Projector	2
Computers	69
TV/LCD/Smart TV	2
Printer	15
Large Printer/Copier	3
3D Printer	1
Desk/Personal Fans	10
Microwave/Toaster/Toaster Oven	3
Coffee Maker	4
H/C Water Dispenser	1
Paper Shredder	3

2.1.12 CO_2, Temperature and Light Meters

RENU installed (3) Light/Temperature meters and (1) CO2/Temperature meters across the Library in order to gather data to better understand the building's trends throughout the day. The following graphs show the data from the end of July through the end of August 2023 (~30 Days).

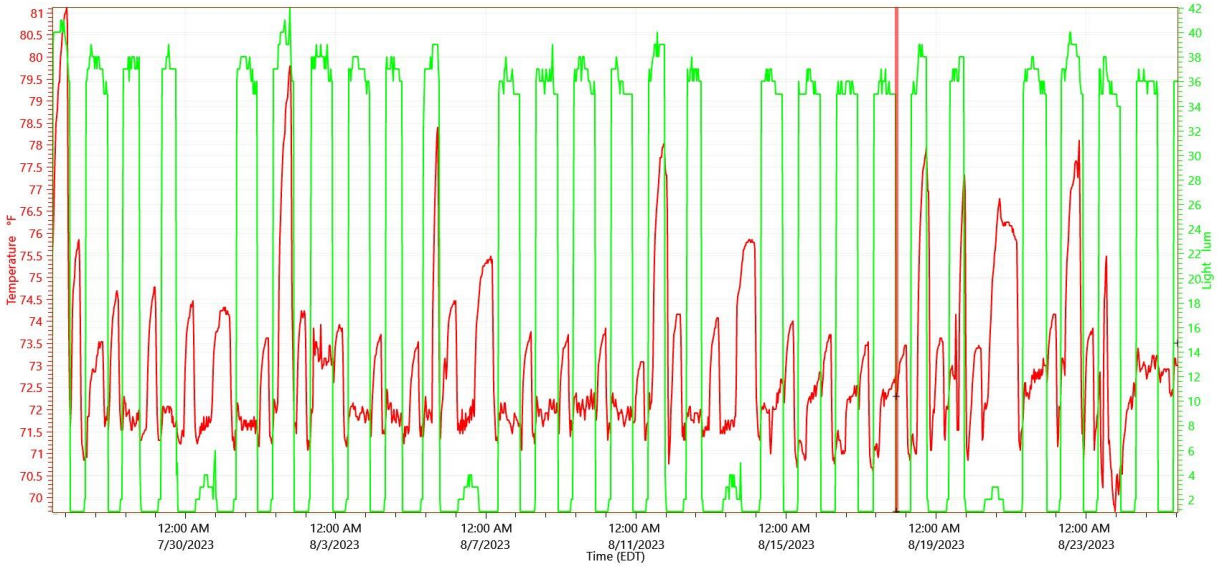
The following graph shows the trends of CO2 (Blue), Relative Humidity (Green) and Temperature (Red) in the Library over the month the meters were first installed. One meter was installed in the main circulation desk area, a location that was central to the Library as well as a primary way people enter and exit the Library. The CO2 levels in space are a good indicator of ventilation provided by the mechanical system. Approximately 400 PPM is typical for the outdoor environment. Indoor spaces at less than 800-1000 Parts Per Million (PPM) are properly ventilated by code. Between 400-800 PPM, the building would be considered over-ventilated, while over 1000+ PPM, the building would be under-ventilated, potentially leading to health risks depending on the concentration of CO2 and length of exposure.

As seen from the data, the Library is properly ventilated, as it only exceeded 800 PPM a few times over the data collection. In fact, the data indicates that at times, the building is over-ventilated, meaning that the outside air brought in is far greater than what is required to offset the CO2. Over-ventilating can lead to an additional heating or cooling load on the equipment, increasing energy consumption. The Library could benefit from demand control ventilation to modulate the amount of outside air depending on the occupancy in the space at a given time.

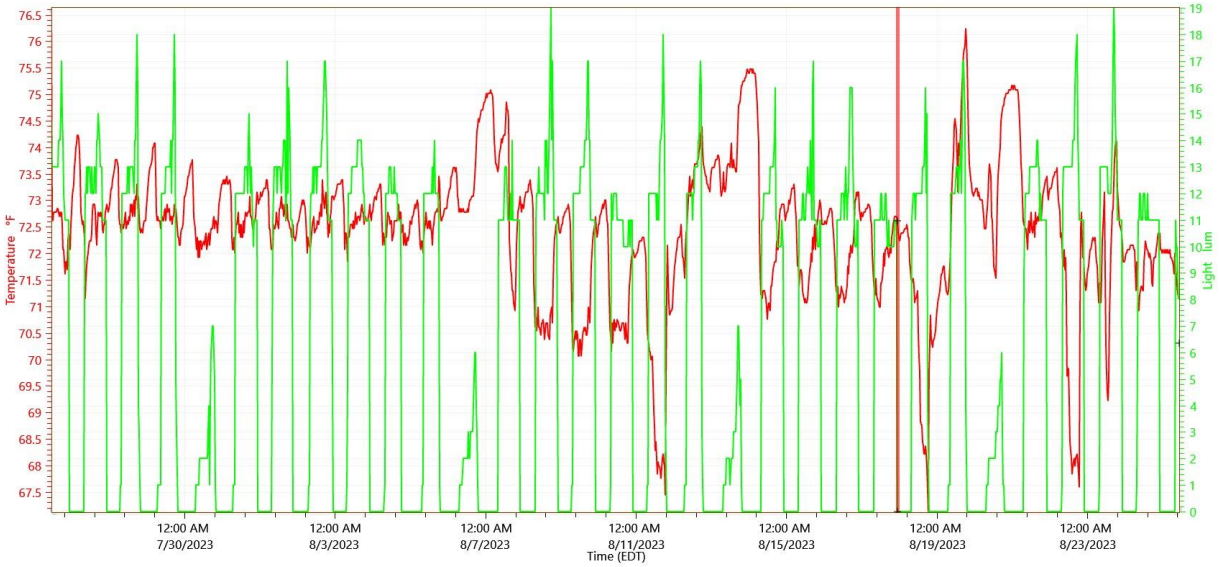


CO2 Meter at Main Circulation Desk

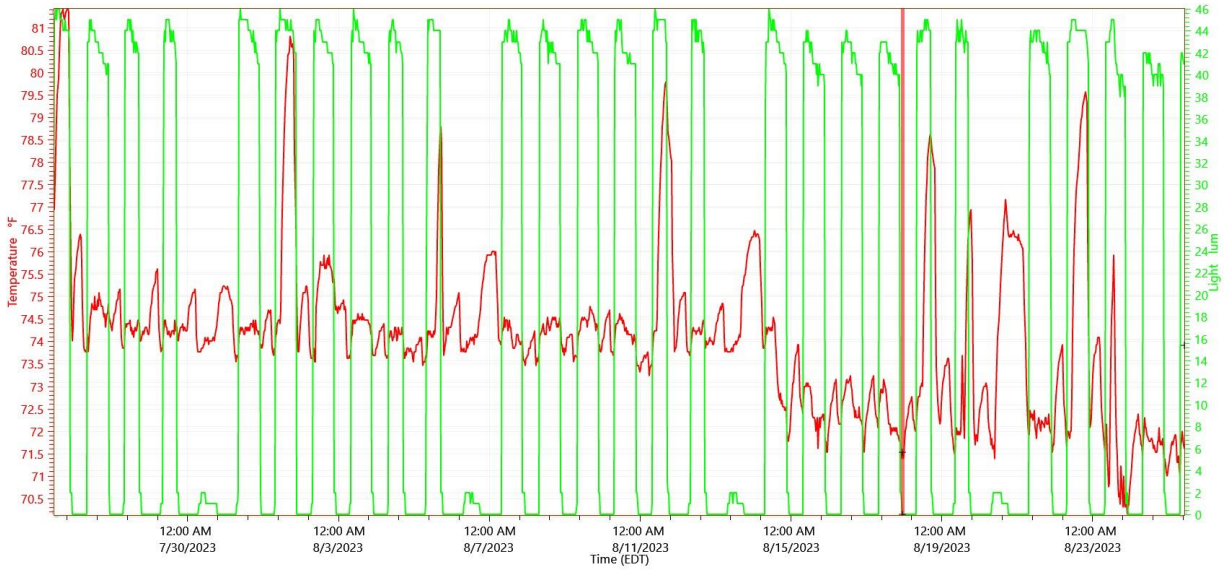
The following (3) graphs show the trend of temperature (Red) and light levels (Green) in the Children's Library Area, Main Lobby Entrance, and the Office Section in the Library. The data shows the trend of the lighting level (lumens) going from a peak during the daytime and going to zero once the building is closed for the day. The temperature across the meters also holds steady with slight changes throughout the day, dropping slightly every night. The Library could benefit from adding temperature setbacks which would decrease energy usage during unoccupied times by letting the temperature setpoint drift. For instance, the Library does not need the HVAC units to keep the temperature at 70°F during the night. The units could be set to 60°F for the night, and setback to normal temperature an hour or two before opening, still allowing the space to be at a comfortable temperature for the occupants.



Light Meter in Children's Library Area



Light Meter in Main Lobby



Light Meter in Office Area

2.2 Utility Analysis

Utility Baseline

2.2.1 Electric

Electrical energy is provided to Central Islip Public Library from PSE&G Long Island. PSEG Long Island is both the electric transport company as well as the commodity supplier. The Library does not currently purchase electricity from a 3rd party. The electric rate used by the Library is Rate 285 – Primary, Commercial, Large, Multiple Periods. The electric utility measures consumption in kilowatt-hours (kWh). One kWh usage is equivalent to 1,000 watts running for one hour.

The following table shows the utility breakdown of the Central Islip Public Library. For the most current 12-months of utility data the Library currently uses 484,480 kWh/year which costs the Library $106,662/year. The next 12-months of utility data showed the Library used 557,280 kWh/year which costs the Library $117,411.84/year.

For the purpose of establishing a baseline energy usage for the building, the past 24-months of available utility data were used to obtain an average annual usage (kWh) and an average annual cost ($). Therefore, the baseline usage for the Library is 520,880 kWh/year resulting in an annual cost of $112,037/year.

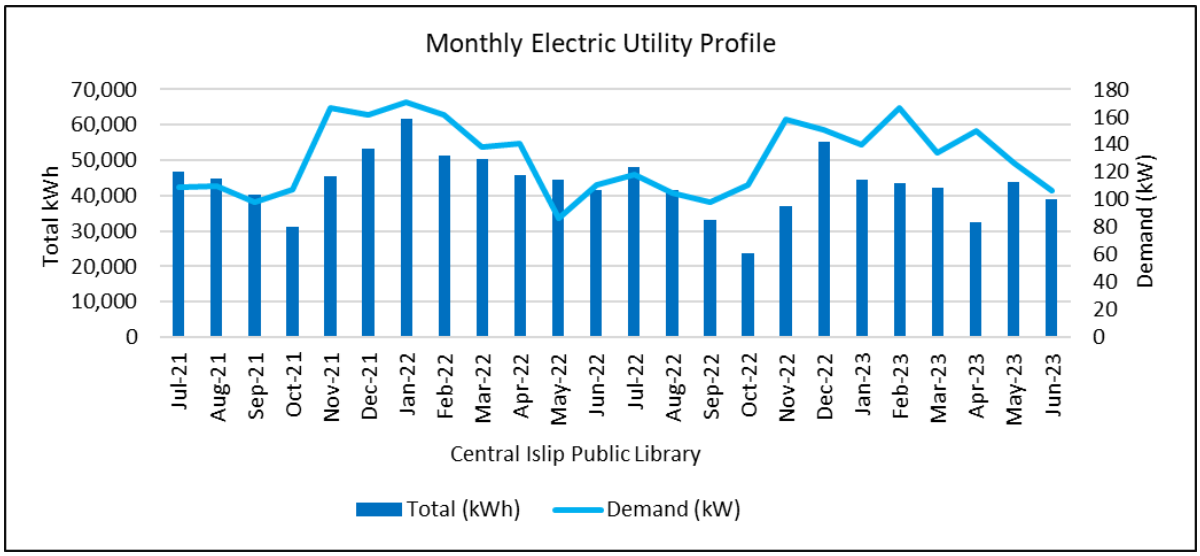
Electric										Natural Gas		Total Utility Cost ($)
Annual Usage (kWh)	Annual Demand (kW)	Annual Peak Demand (kW)	kWh Cost ($)	kW Cost ($)	Total Electric Cost ($)	Avg. $/kWh	Avg. $/kW	Avg. Blended ($/kWh)	$/ft²	Therms	Cost ($)	
484,480	2,172	167	$80659.17	$26003.38	$106662.55	$0.166486	$11.97209	$0.22	$4.44	0.00	$0.00	$106,662.55

Year	Annual Consumption (kWh)	Annual Demand (kW)	Annual Cost ($)	Annual Consumption (Therms)	Annual Cost ($)	Annual Cost ($)
2022-2023	484,480	2,172	$106,662.55	-	-	$106,662.55
2021-2022	557,280	2,134	$117,411.84	-	-	$117,411.84
Average	**520,880**	**2,153**	**$ 112,037.20**			**$ 112,037.20**

	SUMMARY TABLE						
	# DAYS	Usage	Demand	Load Factor	Total Billing Charges	Blended Rate	Usage/ Day
2023	181	244,160 kWh	230.60 kW	37.2%	$45,263.00	$0.19	1,352 kWh/Day
2022	365	532,800 kWh	248.60 kW	36.7%	$120,259.99	$0.23	1,462 kWh/Day
2021	186	258,880 kWh	229.10 kW	33.3%	$57,398.20	$0.22	1,389 kWh/Day

Breakout of Electric Bill Charges

Start Date	End Date	# Days	Usage	Demand	Load Factor	PSEG Delivery & System Charges	PSEG Power Supply Charges	Other Charges	Total Billing Charges	Blended Rate	Usage/ Day kWh/Day
6/2/23	7/3/23	31	39,040 kWh	230.60 kW	22.8%	$6,145	$4,053	$501	$10,700	$0.27	1,259 kWh/day
5/1/23	6/2/23	32	42,080 kWh	126.90 kW	43.2%	$2,297	$4,318	$322	$6,937	$0.16	1,315 kWh/day
4/3/23	5/1/23	28	32,640 kWh	149.60 kW	32.5%	$2,131	$2,916	$256	$5,305	$0.16	1,166 kWh/day
3/1/23	4/3/23	33	42,240 kWh	133.90 kW	39.8%	$2,431	$3,949	$326	$6,707	$0.16	1,280 kWh/day
2/1/23	3/1/23	28	43,520 kWh	166.60 kW	38.9%	$2,468	$4,764	$352	$7,585	$0.17	1,554 kWh/day
1/3/23	2/1/23	29	44,640 kWh	139.70 kW	45.9%	$2,343	$5,321	$362	$8,027	$0.18	1,539 kWh/day
12/1/22	1/3/23	33	55,200 kWh	150.60 kW	46.3%	$2,908	$6,955	$684	$10,548	$0.19	1,673 kWh/day
11/1/22	12/1/22	30	36,960 kWh	158.20 kW	32.4%	$2,429	$5,099	$543	$8,073	$0.22	1,232 kWh/day
10/3/22	11/1/22	29	23,840 kWh	110.90 kW	30.9%	$1,753	$3,210	$371	$5,335	$0.22	822 kWh/day
9/1/22	10/3/22	32	33,120 kWh	216.20 kW	19.9%	$5,395	$4,423	$876	$10,695	$0.32	1,035 kWh/day
8/1/22	9/1/22	31	41,600 kWh	213.80 kW	26.2%	$5,678	$5,759	$971	$12,410	$0.30	1,342 kWh/day
7/1/22	8/1/22	31	48,000 kWh	248.60 kW	26.0%	$6,468	$6,199	$1,099	$13,766	$0.29	1,548 kWh/day
6/2/22	7/1/22	29	41,600 kWh	243.30 kW	24.6%	$6,060	$5,497	$1,011	$12,569	$0.30	1,434 kWh/day
5/2/22	6/2/22	31	43,200 kWh	137.30 kW	42.3%	$2,429	$5,576	$575	$8,581	$0.20	1,394 kWh/day
4/1/22	5/2/22	31	45,920 kWh	140.60 kW	43.9%	$2,605	$5,672	$607	$8,886	$0.19	1,481 kWh/day
3/1/22	4/1/22	31	50,240 kWh	138.10 kW	48.9%	$2,636	$6,427	$633	$9,698	$0.19	1,621 kWh/day
2/1/22	3/1/22	28	51,360 kWh	161.60 kW	47.3%	$2,619	$6,181	$628	$9,428	$0.18	1,834 kWh/day
1/3/22	2/1/22	29	61,760 kWh	170.60 kW	52.0%	$2,951	$6,604	$710	$10,266	$0.17	2,130 kWh/day
12/1/21	1/3/22	33	53,280 kWh	161.40 kW	41.7%	$2,849	$6,260	$663	$9,773	$0.18	1,615 kWh/day
11/1/21	12/1/21	30	45,600 kWh	166.40 kW	38.1%	$2,565	$5,222	$576	$8,363	$0.18	1,520 kWh/day
10/4/21	11/1/21	28	31,200 kWh	107.40 kW	43.2%	$1,802	$3,543	$398	$5,744	$0.18	1,114 kWh/day
9/1/21	10/4/21	33	37,280 kWh	206.40 kW	22.8%	$5,065	$4,333	$776	$10,175	$0.27	1,130 kWh/day
8/2/21	9/1/21	30	44,800 kWh	229.10 kW	27.2%	$5,712	$5,003	$888	$11,604	$0.26	1,493 kWh/day
7/1/21	8/2/21	32	46,720 kWh	227.50 kW	26.7%	$5,932	$4,888	$915	$11,736	$0.25	1,460 kWh/day



MONTH	Demand	Usage
June 2023	230.60 kW	39,040 kWh
May 2023	126.90 kW	42,080 kWh
April 2023	149.60 kW	32,640 kWh
March 2023	133.90 kW	42,240 kWh
February 2023	166.60 kW	43,520 kWh
January 2023	139.70 kW	44,640 kWh
December 2022	150.60 kW	55,200 kWh
November 2022	76.00 kW	40,800 kWh
October 2022	110.90 kW	23,840 kWh
September 2022	216.20 kW	33,120 kWh
August 2022	213.80 kW	41,600 kWh
July 2022	248.60 kW	48,000 kWh
June 2022	243.30 kW	41,600 kWh
May 2022	137.30 kW	43,200 kWh
April 2022	140.60 kW	45,920 kWh
March 2022	138.10 kW	50,240 kWh
February 2022	161.60 kW	51,360 kWh
January 2022	170.60 kW	61,760 kWh

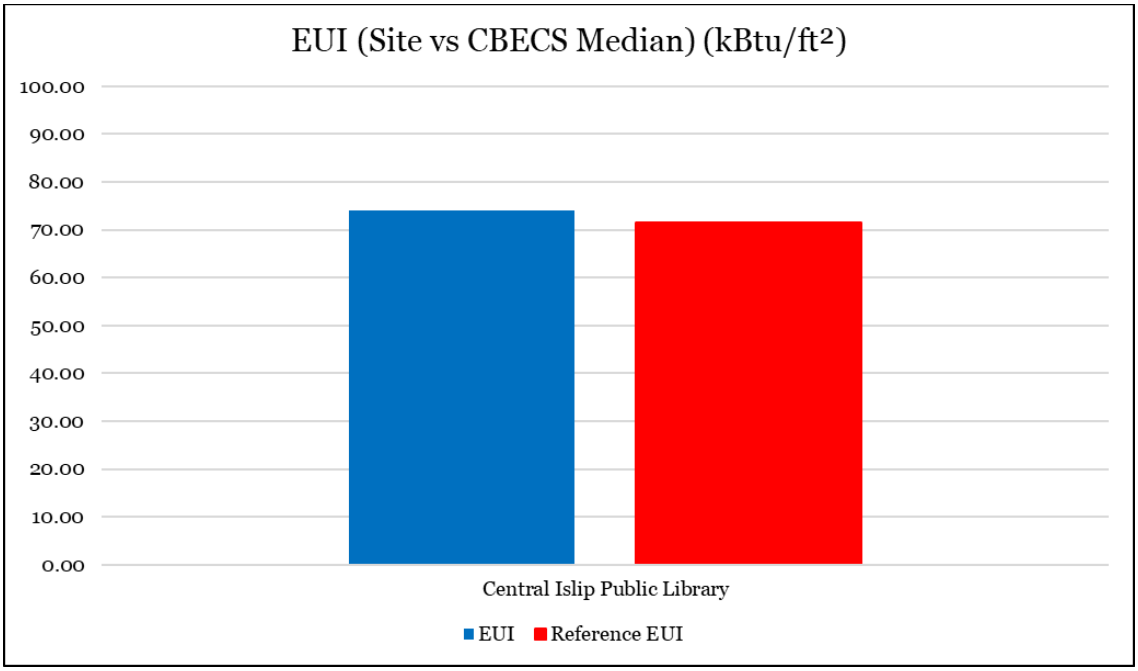
Month	Demand	Usage
December 2021	161.40 kW	53,280 kWh
November 2021	166.40 kW	45,600 kWh
October 2021	107.40 kW	31,200 kWh
September 2021	206.40 kW	37,280 kWh
August 2021	229.10 kW	44,800 kWh
July 2021	227.50 kW	46,720 kWh

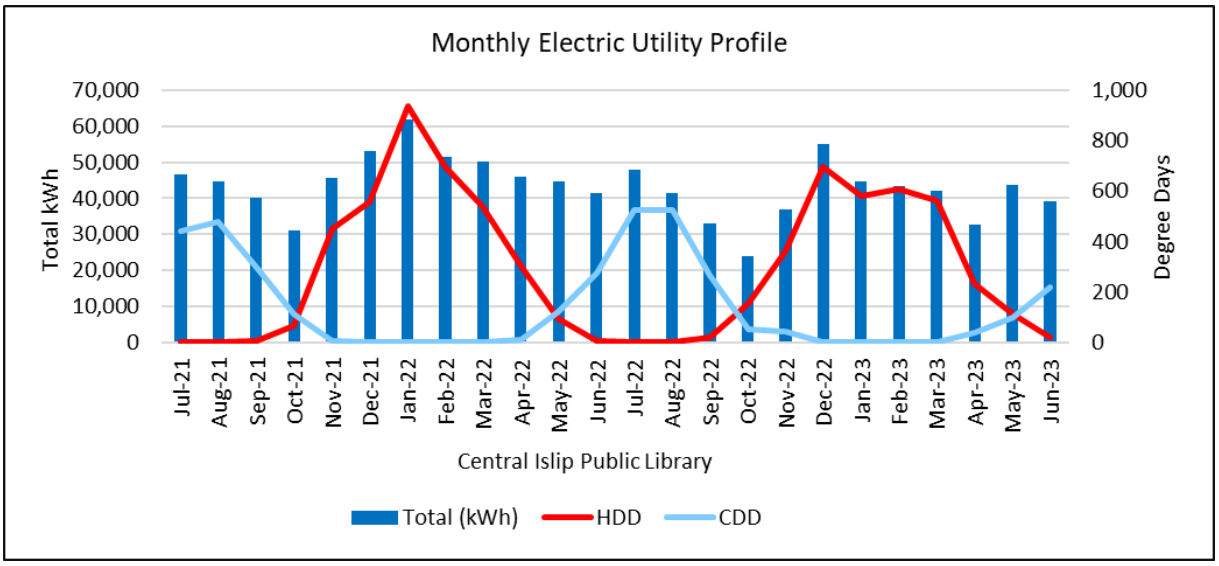
2.2.2 Natural Gas

The Library does not currently have a natural gas service, resulting in only electricity usage. If natural gas were to be added, the utility from which the Library would purchase natural gas would be National Grid. The gas utility measures consumption in cubic feet x 100 (CCF) and converts the quantity into therms of energy.

2.2.3 Energy Use Index

The Energy Use Index (EUI) refers to the amount of energy used per square foot of building area annually. The units for EUI are in kBTU/ft², which requires converting natural gas (therms) and electricity (kWh) consumption into kBTU. The EUI helps compare buildings of similar type to gauge how good or bad they are doing lowering energy consumption. Typically, the lower the EUI, the more energy efficient a building is. The Library has an EUI of 74.07, which is just around the U.S. National Median EUI of 71.6. This means that the Library is slightly higher than other libraries throughout the U.S. in terms of energy consumption per square foot.





RENU analyzed the utility bills provided by the district for the most recent 24-month period (July 2021 – June 2023). The monthly kWh usage was then graphed against the Heating Degree Days (HDD) and the Cooling Degree Days (CDD) for that region. Degree days measure how cold or warm a location is. A degree day compares the mean (the average of the high and low) outdoor temperatures recorded to 60°F. The more extreme the outside temperature, the higher the number of degree days. A high number of degree days generally results in higher energy use for space heating or cooling. This helps check whether the energy use trend is reasonable for the given outdoor conditions for a building.

2.2.4 Marginal Rates

For the purposes of determining how energy conservation measures will affect the utility bill, it is important to understand what portions of the cost can be saved. In general, there are costs associated with utility bills that are fixed and independent of usage, such as the monthly meter charge. For example, in the case of a monthly meter charge, this charge often exists even if the energy usage were zero. An energy conservation measure often cannot produce a cost savings on this portion of the bill. The utility rate structure has to, therefore, be analyzed to determine what portion of the bill a cost savings can be produced using a specific energy conservation measure. For the purposes of this report, the blended average utility rate is the total cost divided by the total energy units. The effective rate is the portion of the bill effected by energy saving or the applied energy conservation measure.

The utility rates identified below were used for purposes of calculating the dollar effect of the energy used.

Electric

Electric Rates	$/kWh	$/kW
Rate 285	$0.166486	$11.972090

The effective supply kWh rate is the most recent in the baseline period. The effective transport $/kWh and $/kW demand rates are based on the most recent utility tariff rates as of June 2023. The total effective $/kWh rate is the summation of the supply and transport effective rates.

Gas

Due to the fact that the building does not currently have natural gas, it was estimated that if natural gas were to be added to the building, the new usage would cost $1.15/therm. This number was used in any calculation which resulted in added natural gas usage.

2.2.5 Utility Escalation Rates

The utility escalation rates used in the financial analysis for the project is shown in the table below:

Name of Building	Energy					
	Electric Consumption		Annual Electric Demand		Natural Gas	
	Escalation Rate	Start Year of Escalation	Escalation Rate	Start Year of Escalation	Escalation Rate	Start Year of Escalation
Central Islip Public Library	3.5%	Year 1	3.5%	Year 1	3.5%	Year 1

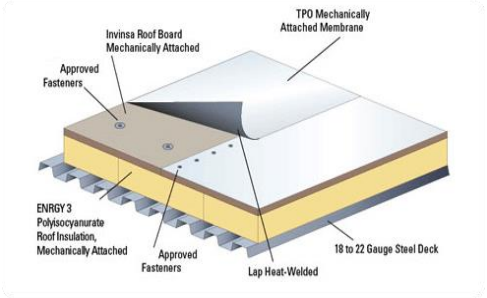
Section 3. Energy Conservation Measures

ECM #	ECM	Central Islip Public Library
ECM 1	Roof Replacement	X
ECM 2	Building Envelope Upgrades	X
ECM 3	Rooftop Solar	X
ECM 4	LED Lighting and Lighting Controls	X
ECM 5	Rooftop Uit Upgrades with VAV Boxes	X
ECM 6	Heat Pump Replacement	X
ECM 7	Fan Coil Unit Replacement	X
ECM 8	Building Management System	X
ECM 9	Water Heater Replacement	X
ECM 10	Plug Load Controllers	X

ECM 1: Roof Replacement

Project Cost	Estimated Rebates/Incentives	Net Cost	Annual Energy Savings	O&M Savings
$573,375	$0	$573,375	$1,446	$500

Existing Foam Roof



TPO Roofing System

ECM General Description

Roofing will be replaced with a new roof system that meets all code requirements regarding roof pitch, insulation thickness, and thermal resistance (R) value. The existing roofing system is a foam system which is constantly needing to be patched/resprayed. During RENU's walkthrough, the foam in many sections was bubbling and causing water to get trapped, restricting drainage. The new roofing system will reduce water infiltration and maintenance. The TPO roof system will come standard with a 20-year warranty, this will also accommodate roof mounted solar photovoltaic across the systems useful life, most commonly 25+ years.

The scope of work for this ECM involves removing and disposing of the existing roof system, including all roofing materials and insulation. Any underlying structural or moisture damage will be inspected and need to be repaired as necessary, although these costs were not factored into our original preliminary assessment. In August 2023, RENU enlisted the services of JC Broderick to take samples of the existing roof to determine whether there was the presence of asbestos, and in fact, there is. The existing roof will be removed and properly remediated as part of this project. The new roofing system will consist of materials that meet energy efficiency standards to reduce solar heat gain and increase energy efficiency. New thermal insulation materials will also be installed to improve energy efficiency and provide a more comfortable indoor environment. A new roofing membrane will be installed to provide superior water resistance and durability. Flashing and sealant materials will be installed to ensure proper waterproofing and long-term performance.

Benefits:

By replacing the existing roof with an energy-efficient roofing system, the building is expected to experience reduced energy consumption, improved thermal insulation, and increased comfort for occupants. The roof replacement provides energy savings and improved indoor comfort, while reducing long-term maintenance costs associated with roof repairs and replacements and will eliminate the presence of asbestos in the roof.

Scope of Work

1. Remove/Rip existing roof down to metal deck.
2. Properly dispose of all materials, including asbestos containing materials (ACM) at an EPA approved landfill.
3. Supply and install new, tapered R-30 Poly ISO mechanically fastened to metal deck.
4. Supply and install new .060 mechanically fastened Johns Manville TPO roof system as per manufacturers specifications.
5. Flash all penetrations.
6. Supply and install new 20-year Kynar aluminum gravel stop.
7. Provide all dumpsters.
8. Provide safety and pedestrian protection.

Savings Calculation Method		
Baseline Energy Usage (MBH / yr)	=	Sum of all BINs((Existing Insulation U-Value x Roof Area) + (Existing Roofing Reflectance x Roof Area) x BIN data (Temperature Difference x # of hours))
Estimated Energy Usage (MBH / yr)	=	Sum of all BINs((New Insulation U-Value x Roof Area) + (New Roofing Reflectance x Roof Area) x BIN data (Temperature Difference x # of hours))
Energy Savings (MBH / yr)	=	Baseline Energy Usage – Estimated Energy Usage

Formulas used to develop and estimate the savings:

- Load Factor = (Area A * U-value A) + (Area B * U-value B) + (Area C * U-value C)
- Heating Load=((Load Factor * (IA temp - OA temp))
- Cooling Load=((Load Factor * (OA temp - IA temp))
- Annual Savings (MBtu/YR) = (Cooling BTU/hr savings)*(% runtime)*(average days in period)
- Annual Savings (kWh/YR)=(mBtu/hr savings)/(12mbh/ton)*(kW/ton)

ECM:	**Roof Replacement**										
Title	**Roof Replacement**										
Project	**Capital Projects**										
Site	**Central Islip Public Library**										
Description	Calculation of roof replacement using existing roof U-values and reflectance and proposed U-value and reflectance.										
Given	Roof Area A	20,700	s.f. from subcontractor								
	Roof Area B	0	s.f. from subcontractor								
	Roof Area C	0	s.f. from subcontractor								
	Total Roof Area	20,700	square feet								
	Total Surface Irradiance (Winter)	20	btu/(hr*SF)	From ASHRAE standard							
	Total Surface Irradiance (Spring)	53	btu/(hr*SF)	From ASHRAE standard							
	Total Surface Irradiance (Summer)	68	btu/(hr*SF)	From ASHRAE standard							
	Total Surface Irradiance (Fall)	36	btu/(hr*SF)	From ASHRAE standard							
	Existing Roof Performance A (U-Value)	0.040	btu/(hr*F*SF)	From existing construction		R-value	=	25.0	(SF*F*hr)/btu		
	Existing Roof Performance B (U-Value)	0.040	btu/(hr*F*SF)	From existing construction		R-value	=	25.0	(SF*F*hr)/btu		
	Existing Roof Performance C (U-Value)	0.040	btu/(hr*F*SF)	From existing construction		R-value	=	25.0	(SF*F*hr)/btu		
	New Roof Performance A (U-Value)	0.033	btu/(hr*F*SF)	From new construction		R-value	=	30.0	(SF*F*hr)/btu		
	New Roof Performance B (U-Value)	0.033	btu/(hr*F*SF)	From new construction		R-value	=	30.0	(SF*F*hr)/btu		
	New Roof Performance C (U-Value)	0.033	btu/(hr*F*SF)	From new construction		R-value	=	30.0	(SF*F*hr)/btu		
	MMBH Cost		$/MMBH								
	Electrical Cost	$0.1665	$/kwh average								
	Existing Roof Performance A	0.2	Dark	From existing construction reflectance							
	Existing Roof Performance B	0.2	Dark	From existing construction reflectance							
	Existing Roof Performance C	0.2	Dark	From existing construction reflectance							
	New Roof Performance A	0.15	Light	From new construction reflectance (Account for Solar PV shading)							
	New Roof Performance B	0.15	Light	From new construction reflectance							
	New Roof Performance C	0.15	Light	From new construction reflectance							
Assumptions	Space Temperature	72	Deg F	average							
	Heating Efficiency	99%									
	Cooling Efficiency	1.00	kw/ton								
	Daylight & Debree Factor	0.45									
Formula	Load Factor=(Area A * U-value A)+(Area B * U-value B)+(Area C * U-value C)										
	Heating Load=((Load Factor * (IA temp - OA temp))										
	Cooling Load=((Load Factor * (OA temp - IA temp))										
	Annual Savings (MBtu/YR)=(Cooling btu/hr savings)*(% runtime)*(average days in period)										
	Annual Savings (kwh/YR)=(mBtu/hr savings)/(12mbh/ton)*(kw/ton)										

Calculation	(Area A	)*(	Ex. UA	)+(	Area B	)*(	Ex. UB	)+(	Area C	)*(	Ex. UC	)=	
	Existing Load Factor=	20,700	)*(	0.040	)+(	0	)*(	0.040	)+(	0	)*(	0.040	)=	**828 btu/(h*F)**

	Existing Heating & Cooling	((OA Temp		IA Temp	Load Factor	Hours	)/(Conversion) =	MBtu Usage Heating	MBtu Usage Cooling
		((	-8	72	828	56	)/(1000 btu/mbh) =	3,709	-
		((	-3	72	828	72	)/(1000 btu/mbh) =	4,471	-
		((	2	72	828	115	)/(1000 btu/mbh) =	6,665	-
		((	7	72	828	156	)/(1000 btu/mbh) =	8,396	-
		((	12	72	828	224	)/(1000 btu/mbh) =	11,128	-
		((	17	72	828	280	)/(1000 btu/mbh) =	12,751	-
		((	22	72	828	405	)/(1000 btu/mbh) =	16,767	-
		((	27	72	828	523	)/(1000 btu/mbh) =	19,487	-
		((	32	72	828	736	)/(1000 btu/mbh) =	24,377	-
		((	37	72	828	605	)/(1000 btu/mbh) =	17,533	-
		((	42	72	828	502	)/(1000 btu/mbh) =	12,470	-
		((	47	72	828	489	)/(1000 btu/mbh) =	10,122	-
		((	52	72	828	537	)/(1000 btu/mbh) =	8,893	-
		((	57	72	828	602	)/(1000 btu/mbh) =	7,477	-
		((	62	72	828	711	)/(1000 btu/mbh) =	5,887	-
		((	67	72	828	762	)/(1000 btu/mbh) =	3,155	-
		((	72	72	828	719	)/(1000 btu/mbh) =	-	-
		((	77	72	828	552	)/(1000 btu/mbh) =	-	2,285
		((	82	72	828	383	)/(1000 btu/mbh) =	-	3,171
		((	87	72	828	209	)/(1000 btu/mbh) =	-	2,596
		((	92	72	828	83	)/(1000 btu/mbh) =	-	1,374
		((	97	72	828	22	)/(1000 btu/mbh) =	-	455
						8743	**Hours**	**173,290**	**9,882**

			(Area A	)*(	New UA	)+(	Area B	)*(	New UB	)+(	Area C	)*(	New UC	))=								
	New Load Factor=	(	20,700	)*(	0.033	)+(	0	)*(	0.033	)+(	0	)*(	0.033	))=								**690 btu/(h*F)**
	New Heating & Cooling		((OA Temp						IA Temp		Heat Load Factor			Hours	)/(Conversion)	=	MBtu Usage Heating	MBtu Usage Cooling				
			((-8						72		690			56	)/(1000 btu/mbh)	=	3,091	-				
			((-3						72		690			72	)/(1000 btu/mbh)	=	3,726	-				
			((2						72		690			115	)/(1000 btu/mbh)	=	5,555	-				
			((7						72		690			156	)/(1000 btu/mbh)	=	6,997	-				
			((12						72		690			224	)/(1000 btu/mbh)	=	9,274	-				
			((17						72		690			280	)/(1000 btu/mbh)	=	10,626	-				
			((22						72		690			405	)/(1000 btu/mbh)	=	13,973	-				
			((27						72		690			523	)/(1000 btu/mbh)	=	16,239	-				
			((32						72		690			736	)/(1000 btu/mbh)	=	20,314	-				
			((37						72		690			605	)/(1000 btu/mbh)	=	14,611	-				
			((42						72		690			502	)/(1000 btu/mbh)	=	10,392	-				
			((47						72		690			489	)/(1000 btu/mbh)	=	8,435	-				
			((52						72		690			537	)/(1000 btu/mbh)	=	7,411	-				
			((57						72		690			602	)/(1000 btu/mbh)	=	6,231	-				
			((62						72		690			711	)/(1000 btu/mbh)	=	4,906	-				
			((67						72		690			762	)/(1000 btu/mbh)	=	2,629	-				
			((72						72		690			719	)/(1000 btu/mbh)	=	-	-				
			((77						72		690			552	)/(1000 btu/mbh)	=	-	1,904				
			((82						72		690			383	)/(1000 btu/mbh)	=	-	2,643				
			((87						72		690			209	)/(1000 btu/mbh)	=	-	2,163				
			((92						72		690			83	)/(1000 btu/mbh)	=	-	1,145				
			((97						72		690			22	)/(1000 btu/mbh)	=	-	380				
														8743	**Hours**		**144,408**	**8,235**				

			(Ex. Heating Use)-(		New Heating Use)/(		3.412 kWh/mbh)/(		Heating Eff. ton/kw													
		Total Heating Savings=((	173,290	)-(	144,408	)/(	3.41	)/(	99%)=		**8,550 kwh**											**- based on existing heating supplied by electric heating coils**
			(Ex. Cooling Use)-(		New Cooling Use)/(		12 mbh/ton)/(		Cooling Efficiency)=													
		Total Cooling Savings=((	9,882	)-(	8,235	)/(	12	)/(	1.00) =		**137 kwh**											

Result	**Existing Use**	**51301.31**	**kwh**	**$8,541**		**824**	**kwh**	**$**	**137**	**$**	**8,678**											
	New Use	**42751.09**	**kwh**	**$7,117**		**686**	**kwh**	**$**	**114**	**$**	**7,232**											
	Annual Savings (kWh)	**8550.22**	**kwh**	**$1,423**		**137**	**kwh**	**$**	**23**	**$**	**1,446**											
	Percentage of existing	**16.7%**		**16.7%**		**16.7%**			**16.7%**		**16.7%**											

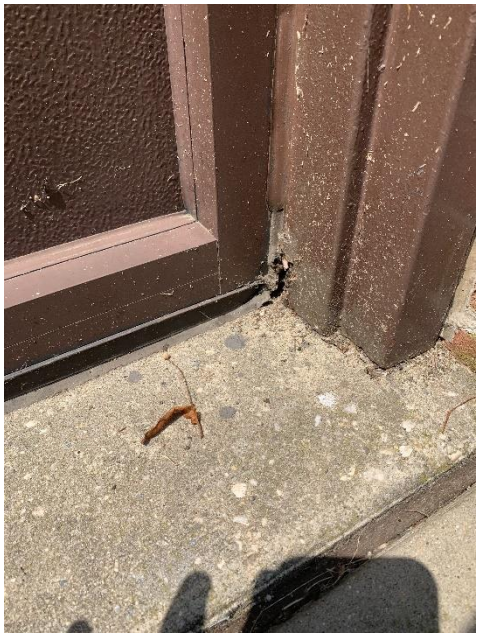
ECM 2: Building Envelope Upgrades

Project Cost	Estimated Rebates/Incentives	Net Cost	Annual Energy Savings	O&M Savings
$16,620	$0	$16,620	$1,028	$0

ECM General Description:

Building envelope upgrades involve improving the exterior of a building to improve its energy efficiency, comfort, and durability. The building envelope is the physical barrier between the interior and exterior of a building, and includes components such as walls, windows, doors, and roofing systems. Upgrades to the building envelope can include installing or replacing insulation, air sealing, improving ventilation, and upgrading windows and doors.

The goal of building envelope upgrades is to reduce a building's energy consumption, improve indoor air quality, and increase the building's overall durability. This can lead to significant cost savings on energy bills. Building envelope upgrades can be customized to the specific needs of a building and its occupants and can be performed as standalone upgrades or as part of a larger renovation project.



During the CEA, we identified several areas in the Library that will benefit from new weatherization measures. First, existing exhaust fans will be sealed as part of the new roof installation, along with sealing of the exhaust fan in the storage building. Second, areas around windows and doors that need new weather stripping or caulking will be addressed. It should be noted that a door on the left side of the building, and two windows on the right side of the building along the driveway were already addressed by RENU in a separate project, since these were causing damage inside the Library. Third, gaps in the concrete along the base of the right side of the building, and the front of the storage building, will be sealed to stop air and water penetration.

Scope of Work

1. Supply and install multi-purpose silicone sealant, will be in accordance with Section 2603 of NYS Building Code, unaffected by sunlight, rain, sleet, snow, UV, airborne contamination, ozone or temperature extremes around windows, doors, control joints, copings etc. where gaps exist.
2. Clean and apply cement around gaps along base of right side of building, along with front right corner of the storage building.
3. Supply and install foam insulation around (7) exhaust fans.
4. Seal area between top of building walls and roof.
5. Weatherstripping on doors with comply with section 1104.8 of 2020 NY State Fire Code.

NE Envelope Solutions Inc
SD - Single Door
- Roof/Wall Joint
- Roof Exhaust Fans

References for equations and constants:
0.075 is the density of air in pounds per cubic ft.
0.243 is the specific heat of air in btu per pound per degree Fahrenheit.
60 is a time conversion factor in minutes to hours.
24 is a time conversion factor in hours a day.

The equation is based ASHRAE methodologies for calculating heat loss and energy consumption through air infiltration, heat transfer, and energy modeling.

Savings Calculation Method

INFILTRATION/ EXFILTRATION SAVINGS CALCULATION METHODOLOGY

Cooling Savings

			Flow Factor		$(\Delta P)^{n}$		A		CFM Reduction
1)	Q	=	Flow Factor	x	Wind Pressure	x	Aggregate Air Leakage Pathway Hole	=	Cubic Feet / Minute (CFM)
			Total Heat Constant		CFM Reduction		Enthalpy		Tons
2)	Tons	=	4.5	x	CFM Reduction / 12,000	x	Enthalpy Value	=	Tons
					BTU Hour per Ton				
			Tons		kW per Ton		Cooling Hours		kWh
3)	kWh Savings	=	Tons	x	1.2	x	Cooling Hours for Location	=	kWh
			kWh		Fuel Cost/kWh				
4)	Savings	=	kWh Savings	x	Fuel Cost in $	=	Savings in Dollars		
5)	Savings from Air Leakage Control		.....					=	Savings in Dollars
6)	Project Investment		.....					=	Investment in Dollars
7)	Simple Payback		.....					=	Investment / Savings

Savings Methodology

Mechanical Insulation Savings Calculations

This section describes our methodology for calculating energy savings. We use standard heat transfer methods to compute heat loss from bare and insulated mechanical systems (piping, valves, fittings, tanks and ductwork). The difference in heat loss is the energy savings, as follows:

Energy Savings = [Existing Heat Loss] – [Insulated Heat Loss]

Methodology

We use standard heat transfer methods to compute radiation, convection, and conduction heat loss from

(Alternatively, gain to, for cold systems) bare and insulated systems. Key parameters that affect the heat transfer rate include: temperature of fluid (e.g. steam, hot water, chilled water, etc.); surface temperature of the component (e.g. pipe, fitting, tank, ductwork); temperature of environment; emissivity of surface; average wind speed where applicable; percentage of existing component covered with insulation; and condition of existing insulation, where applicable.

Energy Use

Existing and proposed energy use are computed as follows:

Pipes & Fittings

Heat Loss (Btu/h) = (Heat Loss / lin.ft. bare pipe) * (lin.ft. of pipe) * [1 – (%insulated)] +
(Heat Loss / lin.ft. insulated pipe) * (lin.ft. of pipe) * (%insulated)

Fuel Loss (MMBTU/yr) = (Heat Loss Btu/h) * (heating hrs/year) ÷ (efficiency)
Electric Loss (kWh/yr) = (Heat Loss Btu/h) * (cooling hrs/year) ÷ (12,000 Btu/ton-hr) x (cooling kW/ton)

Tanks Plates, & Ductwork

Existing and proposed heat loss for tanks, plates, and ductwork are calculated as follows:

Heat Loss (Btu/h) = (Heat Loss / sq.ft.) * (sq.ft. of component) * (qty) * [1 – (%insulated)] +
(Heat Loss / sq.ft. insulated) * (qty) * (sq.ft. of component) * (%insulated)
Fuel Loss (MMBTU/yr) = (Heat Loss Bu/h) * (heating hrs/year) ÷ efficiency)
Electric Loss (kWh/yr) = (Heat Loss Btu/h) * (cooling hrs/year) ÷ (12,000 Btu/ton-hr) x (cooling kW/ton)

Energy Savings

Energy savings are the difference between esting and prosed heat loss:

Fuel Savings (MMBTU/yr) = (Existing Fuel Loss) – roposed Fuel Loss)
Electric Sangs (MMBTU/yr) = (Existing Electric Loss) – (Proposed Electric Loss)
Cost Savings ($/yr) (Fuel Savings MMBTU/yr) * (Fuel Rate $/MMBTU) +
(Electric Savings kWh/yr) * (Elctric Rate $/kWh)

Heat Transfer: Bare Systems

Bare systems are subject to convection and radiation heat transfer. We ignore conductive heat transfer through the pipe/fitting material (e.g. steel, copper, PVC etc.) as this is negligible as compared to heat transfer through insulation and air convection.

Pipes & Fittings

This section describes the heat transfer calculations for pipes and fittings for indoor systems subject to natural convection (no wind). The calculations for outdoor systems subject to forced convection (wind) are similar except that the formulas are more complicated. These methods are presented following this section.

For fittings (valves, elbows, strainers, etc.), we estimate heat loss based on equivalent length of straight pipe, which is the ratio of the area of the fitting to the area of 1 linear foot of pipe of the same size (fitting equivalent length = Area of fitting, ft^2 / Area of pipe of equivalent diameter, ft^2).

$$q_{pipe} = \frac{2 * \pi * \Delta T}{\frac{1}{h * \left(D_{outer}/_2\right)}}$$

Where:
q_{pipe} = *heat loss per linear foot = Btu/h/lin.ft.*

$h = total\ convective\ heat\ transfer\ factor = h_{convection} + h_{radiation}$

$$h_{convection} = 0.213 * \left(\frac{\Delta T}{D}\right)^{\left(\frac{1}{4}\right)}$$ [ASHRAE 2005, Ch. 3, Eq. T10.16]

$T = T_{surface} - T_{air}$
$\Delta T = T_{surface} - T_{air}$
D = Outer diameter

$$h_{radiation} = \varepsilon * \sigma * \left(T_{surface}^4 - T_{air}^4\right) / \left(T_{surface} - T_{air}\right)$$

e = emissivity of surface
s = Stefan-Boltzmann constant = 0.1714 x 10-8 Btu / (hr-ft^2-°R^4)
$T_{surface}$ = *Temperature of surface*
T_{air} = *Average ambient air temperature*

Heat Transfer: Insulated Systems

Insulated systems are subject to convection, radiation, and conductive heat transfer. We ignore conductive heat transfer through the pipe/fitting material (e.g. steel, copper, PVC etc.) as this is negligible when compared to heat transfer through insulation and air convection.

$$q_{pipe} = \frac{2 * \pi * \Delta T}{\frac{ln\left(D_{outer}/D_{inner}\right)}{k} + \frac{1}{h * \left(D_{outer}/2\right)}}$$

Where:
q_{pipe} = *heat loss per linear foot = Btu/h/lin.ft.*

$$h_{convection} = 0.213 * \left(\frac{\Delta T}{D}\right)^{\left(\frac{1}{4}\right)}$$ [ASHRAE 2005, Ch. 3, Eq. T10.16]

$T = T_{surface} - T_{air}$
$\Delta T = T_{surface} - T_{air}$
D = Outer diameter

$$h_{radiation} = \varepsilon * \sigma * \left(T_{surface}^4 - T_{air}^4\right) / \left(T_{surface} - T_{air}\right)$$

e = emissivity of surface
s = Stefan-Boltzmann constant = 0.1714 x 10-8 Btu / (hr-ft^2-°R^4)
$T_{surface}$ = *Temperature of surface*
T_{air} = *Average ambient air temperature*
L = Pipe length or fitting equivalent length

Heat Transfer for Outdoor Systems

The methods for computing heat loss for outdoor systems subject to forced convection (wind) are identical to the methods for indoors systems described above except that the formulas to compute the convective heat transfer coefficient h is more complicated. These methods are described below:

Pipes & Fittings: Outdoor Systems

The convection heat transfer coefficient is:

$$h_{convection} = Nu * k / D_{outer}$$

$$Nu = Nussault\ number = 0.3 + \frac{0.62 * Re^{\left(\frac{1}{2}\right)} * Pr^{\left(\frac{1}{3}\right)}}{\left[1 + \left(\frac{0.4}{Pr}\right)^{\left(\frac{2}{3}\right)}\right]^{\left(\frac{1}{2}\right)}} * \left[1 + \left(\frac{Re}{282{,}000}\right)^{\left(\frac{5}{8}\right)}\right]^{\left(\frac{4}{5}\right)}$$

$$Re = Reynolds\ number = \frac{V * D_{outer}}{v}$$

$Pr = Prandtl\ number = 0.7\ (for\ air)$
$v = kinematic\ viscosity\ of\ air$
$V = wind\ speed$
$D_{outer} = outer\ pipe\ diameter$

Plates, Tanks, Ductwork: Outdoor Systems

The convection heat transfer coefficient for flat surfaces is estimated as follows

$$h_{convection} = Nu * k / D_{outer}$$

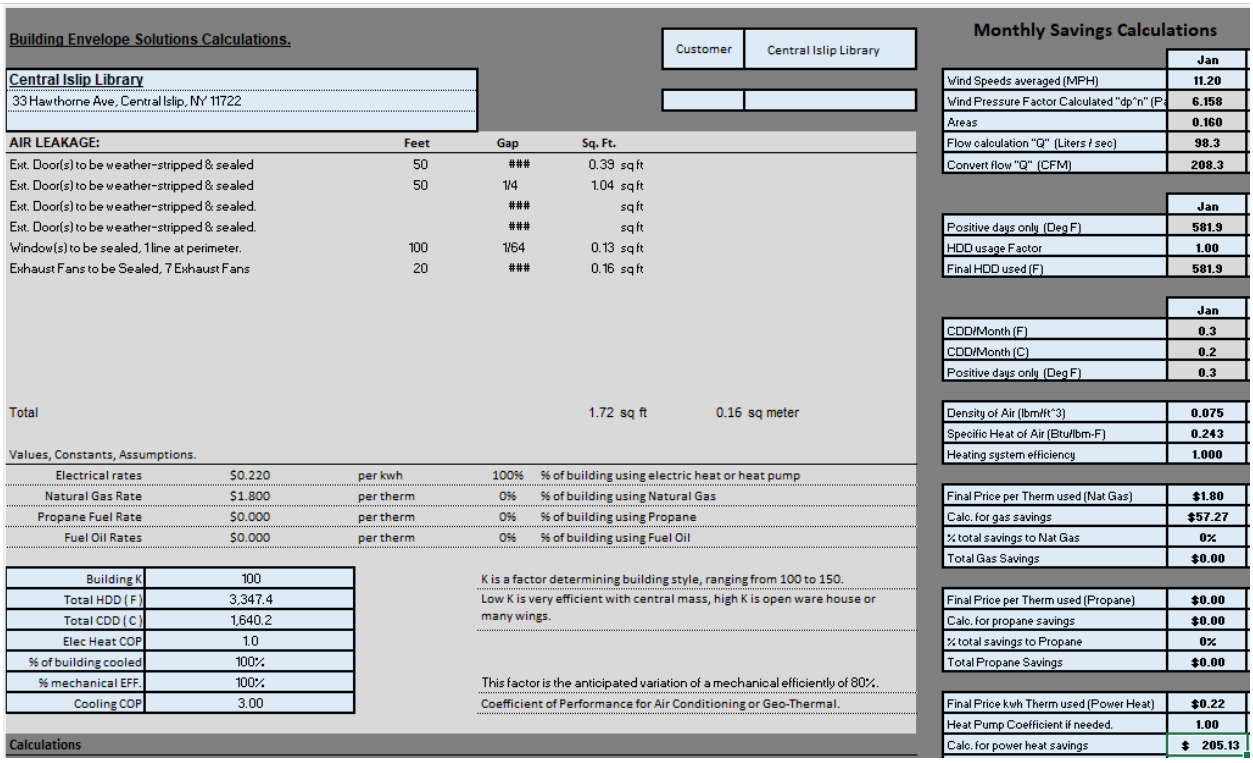
$$Nu = Nussault\ number = 0.415 * Re^{\left(\frac{1}{2}\right)} * Pr^{\left(\frac{1}{3}\right)}$$

$$Re = Reynolds\ number = \frac{V * L}{v}$$

$Pr = Prandtl\ number = 0.7\ (for\ air)$
$v = kinematic\ viscosity\ of\ air$
$V = wind\ speed$
$L = width\ or\ diameter\ of\ component$

Energy Savings Calculations and Methodology

A model was developed to calculate the baseline and savings for this ECM. A bin calculation method was used to estimate the savings associated with improving the building's insulation characteristics and reducing the building's unwanted infiltration. Details of the calculation can be found below:



Building Envelope Solutions Calculations.

Customer	Central Islip Library

Central Islip Library
33 Hawthorne Ave, Central Islip, NY 11722

AIR LEAKAGE:	Feet	Gap	Sq. Ft.
Ext. Door(s) to be weather-stripped & sealed	50	###	0.39 sq ft
Ext. Door(s) to be weather-stripped & sealed	50	1/4	1.04 sq ft
Ext. Door(s) to be weather-stripped & sealed.		###	sq ft
Ext. Door(s) to be weather-stripped & sealed.		###	sq ft
Window(s) to be sealed, 1 line at perimeter.	100	1/64	0.13 sq ft
Exhaust Fans to be Sealed, 7 Exhaust Fans	20	###	0.16 sq ft
Total			1.72 sq ft 0.16 sq meter

Values, Constants, Assumptions.

Electrical rates	$0.220	per kwh	100%	% of building using electric heat or heat pump
Natural Gas Rate	$1.800	per therm	0%	% of building using Natural Gas
Propane Fuel Rate	$0.000	per therm	0%	% of building using Propane
Fuel Oil Rates	$0.000	per therm	0%	% of building using Fuel Oil

Building K	100
Total HDD (F)	3,347.4
Total CDD (C)	1,640.2
Elec Heat COP	1.0
% of building cooled	100%
% mechanical EFF.	100%
Cooling COP	3.00

K is a factor determining building style, ranging from 100 to 150. Low K is very efficient with central mass, high K is open ware house or many wings.

This factor is the anticipated variation of a mechanical efficiently of 80%.
Coefficient of Performance for Air Conditioning or Geo-Thermal.

Calculations

Monthly Savings Calculations

	Jan
Wind Speeds averaged (MPH)	11.20
Wind Pressure Factor Calculated "dp"n" (P	6.158
Areas	0.160
Flow calculation "Q" (Liters / sec)	98.3
Convert flow "Q" (CFM)	208.3

	Jan
Positive days only (Deg F)	581.9
HDD usage Factor	1.00
Final HDD used (F)	581.9

	Jan
CDD/Month (F)	0.3
CDD/Month (C)	0.2
Positive days only (Deg F)	0.3

Density of Air (lbm/ft^3)	0.075
Specific Heat of Air (Btu/lbm-F)	0.243
Heating system efficiency	1.000
Final Price per Therm used (Nat Gas)	$1.80
Calc. for gas savings	$57.27
% total savings to Nat Gas	0%
Total Gas Savings	$0.00
Final Price per Therm used (Propane)	$0.00
Calc. for propane savings	$0.00
% total savings to Propane	0%
Total Propane Savings	$0.00
Final Price kwh Therm used (Power Heat)	$0.22
Heat Pump Coefficient if needed.	1.00
Calc. for power heat savings	$ 205.13

Formulas used to calculate the savings:

- Non-Electric Heat Loss = (Bldg Leakage sq mtrs) x (bldg k factor) x (Wind P Factor) x (HDD) x (9/5) x 0.075 x .243 x 60 x 24) / (100,000 x Eff %)

- Electrical Heating Loss = (Bldg Leakage sq mtrs) x (bldg k factor) x (Wind P Factor) x (HDD) x (.075 x .243 x 60 x 24) x (conversion to kWh)

  Cooling Loss = (Bldg Leakage sq mtrs) x (bldg k factor) x (Wind P Factor) x (CDD) x (.075 x .243 x 60 x 24) x (conversion to kWh)

0.075 is the density of air in pounds per cubic ft

0.243 is the specific heat of air in btu per pound per degree Fahrenheit

60 is a time conversion factor in minutes to hours

24 is a time conversion factor in hours per day

The equation is based ASHRAE methodologies for calculating heat loss and energy consumption through air infiltration, heat transfer, and energy modeling.

ECM 3: Rooftop Solar

Project Cost	Estimated Rebates/Incentives	Net Cost	Annual Energy Savings	O&M Savings
$623,549	$187,065	$436,484	$36,221	$0

ECM General Description:

Grid-tied solar electric systems convert sunlight into electricity, with solar panels that can be mounted either on the roof or on the ground. By connecting to the existing electric service, the clean electricity generated by the solar electric system can be used in a business or even "banked" into the utility grid for future use. Through a process known as net metering, excess solar power can be sold to the utility, and the grid can supply reliable power when the solar system is not generating enough electricity. The utility company will calculate the bill based on the difference between solar production and electric use. Our site visits revealed that the Library has flat roof sections that are suitable for installing a solar system as the roof is already being replaced as part of this project.

The solar panel installation on the Library includes the installation of roof-mounted photovoltaic systems using ballasted roof mounts, with an appropriate support system for the PV modules. If necessary, approved roofing contractors will be hired to preserve the proposed roof warranty in the event of penetration. In addition, inverters will be installed in the building and an energy revenue grade metering system will be included to track the generated energy.

A network link for internet access will be required near each inverter, and a data gateway will be installed to communicate recorded information over the internet. A structural strength analysis of the existing school structure will be performed to ensure that it can support the proposed PV system, and a roofing placement plan for all components will be provided. A registered professional engineering review will also be conducted to ensure that the proposed system meets applicable electrical and structural codes.

We will provide start-up and commissioning services for the PV system and will provide an Operations & Maintenance manual that includes a detailed summary of inverter operation, troubleshooting, and maintenance. The system documentation will include as-built drawings, site plan, electrical diagram, conduit route diagram, inverter diagram, string diagram, and component data sheets such as module data sheet, inverter data sheet, and racking data sheet. Additionally, we will provide warranty documentation.

Since one of the proposed ECMs is a rooftop photovoltaic system, a structural analysis was performed on September 1, 2023, by Reilly Tarantino Engineering to determine whether the existing structure could support a proposed solar array. Based on Reilly Tarantino Engineering's analysis, they determined that the existing joist could support the solar array loads without reinforcement, as stated in the 2020 New York State Building Code.

ECM Scope of Work

1. Supply and install (343) Q.Peak Duo XL or similar solar modules producing 164 kWp.
2. Mount panels in a portrait orientation with a 10 degree tilt angle on new flat roof.
3. Supply and install mounting structure with aluminum top rails, aluminum tilt rails and custom roll formed galvanized steel base rails. Fasteners will be stainless steel 18-8.
4. Supply and install rubber safety membrane.

Savings Calculation Method		
Estimate Energy production (kWh / yr)	=	Proposed Solar Generation

Energy Savings Calculations and Methodology

SOLAR PRODUCTION CALCULATIONS

PVWatts Calculator

RESULTS

217,610 kWh/Year*

System output may range from 212,496 to 223,094 kWh per year near this location.

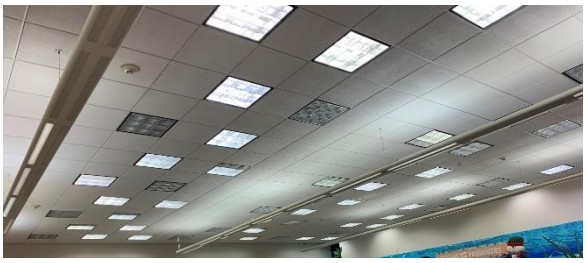
Month	Solar Radiation (kWh / m^2 / day)	AC Energy (kWh)
January	2.46	10,818
February	3.65	14,555
March	4.65	19,877
April	5.45	21,773
May	5.83	23,328
June	6.55	24,764
July	6.58	25,269
August	5.87	22,768
September	4.83	18,598
October	3.69	15,238
November	2.72	11,294
December	2.14	9,328
Annual	4.54	217,610

Location and Station Identification	
Requested Location	33 hawthorne ave, central islip 11722
Weather Data Source	Lat, Lng: 40.81, -73.18 1.3 mi
Latitude	40.81° N
Longitude	73.18° W

PV System Specifications	
DC System Size	164.64 kW
Module Type	Standard
Array Type	Fixed (roof mount)
System Losses	15.79%
Array Tilt	10°
Array Azimuth	163°
DC to AC Size Ratio	1.36
Inverter Efficiency	96.5%
Ground Coverage Ratio	0.4
Albedo	*From weather file*
Bifacial	No (0)
Monthly Irradiance Loss	Jan 0% Feb 0% Mar 0% Apr 0% May 0% June 0% July 0% Aug 0% Sept 0% Oct 0% Nov 0% Dec 0%

ECM 4: LED Lighting and Lighting Controls

Project Cost	Estimated Rebates/Incentives	Net Cost	Annual Energy Savings	O&M Savings
$237,933	$15,401	$205,474	$21,402	$960



Existing Light Fixtures in Library

Typical Flat Panel LED Light Fixture

New Lighting Controls

ECM General Description:

The ECM proposed involves the replacement of fluorescent lamp-containing fixtures with new LED light fixtures to conserve energy and improve the quality of lighting throughout the Library. The use of LED technology can significantly reduce power consumption while providing an equivalent level of light output. In some instances, fluorescent fixtures can be retrofitted with screw-based LED lamps. Although replacing the entire fixture with a new LED fixture generally provides better lighting, in some cases the fluorescent lamp replacement with a plug-in or screw-in LED lamp is a cost-effective solution. Replacing fluorescent lamps with LEDs also provides maintenance savings since LED lamps have a longer lifespan than other light sources, thus reducing the need for frequent replacements. The project's general scope of work includes disconnecting the existing lighting system, disposing of the old fluorescent fixtures, securely installing the new LED fixtures, wiring and controls connection, and thorough testing of the new fixture to ensure proper operation. Lighting levels will meet or exceed the minimum lighting levels set forth in Table S804-1 of the NY State Education Department Manual of Planning

Standards. Emergency lighting coverage will comply with requirements of Section 1008, Sec-sections 1008.1, 1008.2 and 1008.3, as well as Section 1104, sub sections 1104.3, 1104.4 and 1104.5 of the 2020 NY State Fire Code.

Scope of Work

The ECM proposed involves the replacement of non-LED fixtures with new LED lighting to conserve energy and improve the quality of the Library lighting. Our strategy will include upgrading existing 2x4 and 2x2 fixtures with a combination of new volumetric LED fixtures and LED "door kits" that will make the fixture appear as if it is an entirely new fixture. The benefit of using door kits is they are more cost-effective than an entire fixture replacement and they significantly reduce packaging, waste and recycling needs, making them a more sustainable solution. In the high ceiling areas of the Library, we will remove the pendent mounted up lights and reposition the fixtures to achieve a more unified design. In the Business Office we will remove the downlights and install new 2x2 LED fixtures to provide better lighting. In the Director's bathroom, we will remove the outdated 1x1 fixture and install a new 2x2 LED fixture. In the Library Stack area, we will install new LED surface-mounted fixtures on the lower level. For the upper level of the Stack area, at the Library's request we will install a new drop ceiling with LED surface mounted fixtures. Existing downlights will be replaced with new LED downlights. Exterior building-mounted Metal Halide fixtures will be replaced with new LED fixtures with photocells. The project's scope of work includes disconnecting the existing lighting system, disposing and/or recycling of the old equipment, securely installing the new LED fixture, wiring and controls connection, and thorough testing of the new fixtures to ensure proper operation.

RENU has identified several areas suitable for lighting controls using wither a wall sensor, or a sensor built right into the fixture/door kit in the ceiling. The project's scope of work involves installing occupancy sensors, where deemed suitable and connecting electrical wiring in accordance with New York laws and permit requirements. We do not recommend the installation of sensors for the main Library areas, the Community Room, or the Children's areas, since having lights turned off in these areas could be problematic. Our proposal does not include the installation of lighting controls in these areas.

Benefits:

Replacing existing fixtures containing fluorescent lamps with new LED light fixtures offers several benefits. First, the measure saves energy by installing LEDs which use less power than other technologies with comparable or better light output. This results in reduced electricity consumption and lower energy bills. Second, maintenance savings are achieved since LED lamps last longer than other light sources and therefore do not need to be replaced as often. This reduces the frequency of lamp replacements, which can result in lower maintenance costs and less downtime. Third, replacing an existing fluorescent fixture with a new LED fixture will generally provide better overall lighting optics. This can result in improved lighting quality and comfort for occupants and may even contribute to increased productivity in workspaces. The benefit of the installation of occupancy sensor lighting controls is energy savings. By using

occupancy sensors to automatically switch lights on and off when a room is occupied or empty, the amount of time that lights are left on unnecessarily is reduced, resulting in lower energy usage and cost savings. Additionally, the use of lighting controls can also extend the lifespan of lighting fixtures and reduce maintenance costs by reducing the frequency of replacement. Overall, the installation of occupancy sensor lighting controls can help to create a more energy-efficient and cost-effective lighting system.

Savings Calculation Method		
Baseline Energy Usage (kWh/yr)	=	Existing Fixture Watts x Operating Hours / yr x 1 kW / 1000 Watts
Estimated Energy Usage (kWh/yr)	=	Proposed Fixture Watts x Op. Hours/yr x 1 kW / 1000 Watts
Energy Savings (kWh /yr)	=	Baseline Energy Usage – Estimated Energy Usage
Baseline Demand (kW)	=	Existing Fixture Watts / 1000 Watts
Retrofit Demand (kW)	=	Proposed Fixture Watts / 1000 Watts
Energy Savings (kW)	=	(Existing Fixture Watts – Proposed Fixture Watts) x 1 kW / 1000 Watts

Energy (kWh) and demand (kW) savings will be calculated using the following equations:

Equation 3-2: kWh Savings = Σu [(kW $UsageGroup_{,baseline}$ - kW $UsageGroup_{,post}$) x Annual Hours of Operation]

Equation 3-3: kW Savings = Σu [(kW $UsageGroup_{,baseline}$ - kW $UsageGroup_{,post}$)

where

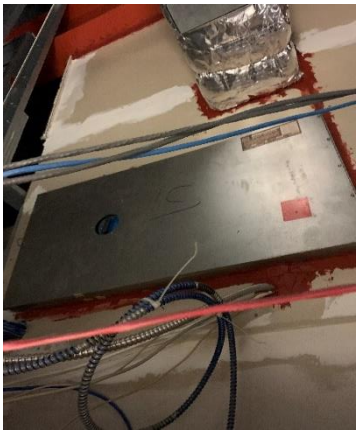
kWh Savings	=	kilowatt-hour savings realized during one year post-installation
kW Savings	=	Coincident kilowatt demand saving realized
kW $UsageGroup_{,baseline}$	=	Lighting baseline demand for usage group
kW $UsageGroup_{,post}$	=	Lighting demand during post-installation period for usage group
Annual Hours of Operation	=	Annual number of operating hours for the usage group

ECM 5: Rooftop Unit Upgrades with VAV Boxes

Project Cost	Estimated Rebates/Incentives	Net Cost	Annual Energy Savings	O&M Savings
$641,781	$2,902	$638,879	$11,608	$3,500

Existing Rooftop Units – RTU-1

Existing Rooftop Unit – RTU-2



Existing Electric Reheat Coil

Typical Variable Air Volume Box

ECM General Description:

This ECM involves modifying the existing RTU HVAC system. Proposed is replacing the standard efficiency packaged air conditioning unit/heating unit (RTU-1) with a high efficiency packaged air conditioning unit/heating unit with hot gas reheat for humidity control and retrofitting the existing RTU-2 unit, which will result in energy savings dependent on the relative efficiency of the old versus new unit, the average cooling load, and the estimated annual operating hours. A new natural gas service will be installed to serve RTU1 and the existing RTU-2, allowing for the utilization of natural gas in heating mode. The scope of work for RTU-1 includes demolishing and removing the existing Trane RTU-1, condensing unit, and piping, and installing a new 40-ton packaged Rooftop Unit with electrical power and control wiring integrated with the proposed BMS. For RTU-2, the scope of work involves providing new natural gas piping from the proposed service, electrical power, and control wiring for the unit, and communication with the proposed

BMS. Please note that we did not include the cost to bring natural gas from the street to the building in our preliminary assessment, however National Grid has agreed to absorb this cost.

The Library currently uses electric duct reheat coils for the majority of the heating of the building. This ECM aims to install (9) variable air volume (VAV) boxes in tandem with the existing duct reheat coils. The new VAV boxes will reduce the overall cost of heating and cooling the building compared to the existing system. The proposed system will also include DDC controls that will allow the system to be integrated into the Building Management System. Integration into the Building Management System allows for a more effective and efficient use of the system.

The new system of VAV boxes will now be able to modulate the airflow, allowing for better and more effective zone temperature control. During the initial walkthrough, it was identified that the Children's Area office was getting too cold in the Winter months and required a supplemental 5 kW unit heater installed to provide adequate temperature for the staff located there. It was found that the room was ducted from the Children's Area, which had its own thermostat controlling both rooms. RENU proposes that a new dedicated electric reheat coil be installed for this space to achieve the desired space conditions.

The scope of work will include the modification of existing ductwork to install (9) new VAVs and system control via the new building management system. New wall mounted thermostats will be installed in each zone with temperature, CO2, and humidity sensors to control airflow and to operate the electric duct reheat coils. Warranty, start-up, and training for Library staff will be included.

Benefits:

Replacing standard efficiency air conditioning units with high efficiency units and utilizing natural gas in heating mode can lead to reduced energy consumption, resulting in cost savings and a more sustainable operation. Additionally, upgrading to newer and more efficient equipment can improve indoor air quality and increase occupant comfort. Finally, integrating the upgraded equipment with the proposed Building Management System (BMS) can provide better control and monitoring of the building's systems, leading to improved performance and potentially further energy savings.

Installation of Variable Air Volume (VAV) boxes offers several benefits, including energy savings, improved temperature control, better air quality, flexibility, and cost savings. VAV boxes will use less energy by adjusting the amount of hot/cold air supplied to a space, while the duct reheat coils warm the air as needed. This results in precise temperature control and improved comfort conditions for building occupants. CO2 and humidity sensors also help maintain good indoor air quality by adjusting the amount of fresh air supplied based on occupancy levels and humidity. VAV boxes are also flexible and can be adjusted to meet changing temperature and occupancy requirements, making them a more effective heating solution for buildings with varying HVAC loads.

Scope of Work (40-Ton RTU and VAV Boxes)

1. Provide labor to reclaim refrigerant gas from existing split A/C system located on roof of building. We will dispose of all refrigerant gas as per local code requirement.
2. Provide rigging service to remove existing rooftop units and properly dispose of them.
3. Provide labor and materials to install (1) 40-ton gas fired packaged rooftop unit Carrier Model # 48K5GW40-JH5A1QAF5.
4. Modification of existing roof steel to meet unit requirements.
5. Provide labor and materials to install (9) Variable Air Volume Boxes.
6. Provide labor and materials to install new supply air and return ductwork for new rooftop.
   unit. New ductwork will be connected to existing supply air and return air duct.
   penetrations through existing roof.
7. Provide labor and materials to install all required transition ductwork that will be required for installation of new variable air volume boxes.
8. Provide labor and materials to insulate new outdoor and interior ductwork. All exterior ductwork will be insulated with 2” thickness 6 lbs. density duct board and will be weatherproof with venture clad membrane.
9. Provide a certified air balance report at completion of project.
10. Provide all required shop and as-built drawings at completion of project.
11. Provide startup service for new rooftop unit.
12. Building Management System communication and control of all VAV boxes, RTU-1, RTU-2 and RTU-3.
13. Installation and control of Electric Duct Heater in Children’s office Area.
14. Modifications to existing fire alarm system.

Scope of Work (Implement Natural Gas in Existing 20-Ton RTU)

1. Provide labor to burn out existing heat exchanger once gas piping is completed.
2. Provide a certified air balance report.

Savings Calculation Method		
Estimated Energy savings (MBH/yr)	=	Existing Energy Usage Simulation – Proposed Energy Usage Simulation

Energy Savings Calculations and Methodology

RTU savings were performed using the TRANE Trace 700 software by inserting the building heating/cooling load requirements.

RTU Trane Trace Calculation

MONTHLY ENERGY CONSUMPTION

By Trane

------- Monthly Energy Consumption -------

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Alternative: 1	**VAV Boxes w/ Gas in RTUs**												
Electric													
On-Pk Cons. (kWh)	36,492	34,258	31,536	27,107	31,517	37,445	46,262	42,398	35,636	27,189	27,169	34,228	411,236
On-Pk Demand (kW)	56	59	52	53	64	77	87	81	73	53	54	53	87
Gas													
On-Pk Cons. (therms)	562	604	238	32	0	0	0	0	0	0	12	382	1,830
On-Pk Demand (therms/hr)	1	1	1	0	0	0	0	0	0	0	0	1	1

Energy Consumption		
Building	73,181	Btu/(ft2-year)
Source	203,123	Btu/(ft2-year)
Floor Area	21,680	ft2

Environmental Impact Analysis	
CO2	421,704 lbm/year
SO2	1,616 gm/year
NOX	492 gm/year

64,071 kWh Savings
21.2 kW Savings per Month
1,830 Therm Increase

Alternative: 2	Existing Equipment												
Electric													
On-Pk Cons. (kWh)	48,100	47,173	36,118	28,719	34,508	41,796	52,784	47,233	39,246	29,561	28,554	41,524	475,307
On-Pk Demand (kW)	82	87	73	74	84	95	107	101	91	74	74	74	107

Energy Consumption		
Building	74,826	Btu/(ft2-year)
Source	224,500	Btu/(ft2-year)
Floor Area	21,680	ft2

Environmental Impact Analysis	
CO2	431,182 lbm/year
SO2	1,652 gm/year
NOX	503 gm/year

System Checksums

By Trane

New 40-Ton RTU — **Variable Volume Reheat (30% Min Flow Default)**

COOLING COIL PEAK

Peaked at Time: Mo/Hr: 7 / 16
Outside Air: OADB/WB/HR: 87 / 72 / 95

	Space Sens. + Lat. Btu/h	Plenum Sens. + Lat Btu/h	Net Total Btu/h	Percent Of Total (%)
Envelope Loads				
Skylite Solar	0	0	0	0
Skylite Cond	0	0	0	0
Roof Cond	0	114,432	114,432	29
Glass Solar	32,251	0	32,251	8
Glass/Door Cond	5,401	0	5,401	1
Wall Cond	18,878	11,901	30,779	8
Partition/Door	0		0	0
Floor	0		0	0
Adjacent Floor	0	0	0	0
Infiltration	11,667		11,667	3
Sub Total ==>	68,197	126,333	194,530	50
Internal Loads				
Lights	41,833	0	41,833	11
People	53,600	0	53,600	14
Misc	21,517	0	21,517	5
Sub Total ==>	116,950	0	116,950	30
Ceiling Load	25,551	-25,551	0	0
Ventilation Load	0	0	94,713	24
Adj Air Trans Heat	0		0	0
Dehumid. Ov Sizing			0	0
Ov/Undr Sizing	1,201		1,201	0
Exhaust Heat		-15,210	-15,210	-4
Sup. Fan Heat			0	0
Ret. Fan Heat		0	0	0
Duct Heat Pkup		0	0	0
Underflr Sup Ht Pkup			0	0
Supply Air Leakage		0	0	0
Grand Total ==>	211,899	85,571	392,184	100.00

CLG SPACE PEAK

Mo/Hr: 8 / 16
OADB: 86

	Space Sensible Btu/h	Percent Of Total (%)
Envelope Loads		
Skylite Solar	0	0
Skylite Cond	0	0
Roof Cond	0	0
Glass Solar	37,529	20
Glass/Door Cond	5,131	3
Wall Cond	17,948	10
Partition/Door	0	0
Floor	0	0
Adjacent Floor	0	0
Infiltration	5,008	3
Sub Total ==>	65,616	35
Internal Loads		
Lights	41,833	22
People	32,830	18
Misc	21,517	12
Sub Total ==>	96,180	52
Ceiling Load	22,849	12
Ventilation Load	0	0
Adj Air Trans Heat	0	0
Ov/Undr Sizing		
Exhaust Heat	1,422	1
OA Preheat Diff.		
RA Preheat Diff.		
Additional Reheat		
Underflr Sup Ht Pkup		
Supply Air Leakage		
Grand Total ==>	186,067	100.00

HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 15

	Space Peak Space Sens Btu/h	Coil Peak Tot Sens Btu/h	Percent Of Total (%)
Envelope Loads			
Skylite Solar	0	0	0.00
Skylite Cond	0	0	0.00
Roof Cond	0	-87,606	23.78
Glass Solar	0	0	0.00
Glass/Door Cond	-19,011	-19,011	5.16
Wall Cond	-45,633	-69,381	18.83
Partition/Door	0	0	0.00
Floor	0	0	0.00
Adjacent Floor	0	0	0
Infiltration	-34,865	-34,865	9.46
Sub Total ==>	-99,509	-210,863	57.23
Internal Loads			
Lights	0	0	0.00
People	0	0	0.00
Misc	0	0	0.00
Sub Total ==>	0	0	0.00
Ceiling Load	-38,789	0	0.00
Ventilation Load	0	-141,320	38.35
Adj Air Trans Heat	0	0	0
Ov/Undr Sizing	-30,259	-30,259	8.21
Exhaust Heat		25,568	-6.94
OA Preheat Diff.		0	0.00
RA Preheat Diff.		-11,587	3.14
Additional Reheat		0	0.00
Underflr Sup Ht Pkup		0	0.00
Supply Air Leakage		0	0.00
Grand Total ==>	-168,557	-368,462	100.00

TEMPERATURES

	Cooling	Heating
SADB	60.0	90.0
Ra Plenum	75.3	62.0
Return	75.3	63.1
Ret/OA	76.9	47.7
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

AIRFLOWS

	Cooling	Heating
Diffuser	16,692	7,560
Terminal	16,692	7,560
Main Fan	16,692	7,560
Sec Fan	0	0
Nom Vent	2,305	2,305
AHU Vent	2,305	2,305
Infil	284	569
MinStop/Rh	7,560	7,560
Return	16,969	8,115
Exhaust	2,582	2,859
Rm Exh	7	15
Auxiliary	0	0
Leakage Dwn	0	0
Leakage Ups	0	0

ENGINEERING CKS

	Cooling	Heating
% OA	13.8	30.5
cfm/ft²	0.95	0.43
cfm/ton	510.73	
ft²/ton	535.77	
Btu/hr·ft²	22.40	-21.04
No. People	134	

COOLING COIL SELECTION

	Total Capacity ton	Total Capacity MBh	Sens Cap. MBh	Coil Airflow cfm	Enter DB °F	Enter WB °F	Enter HR gr/lb	Leave DB °F	Leave WB °F	Leave HR gr/lb
Main Clg	32.7	392.2	312.9	16,571	76.9	64.4	70.8	60.0	56.8	63.9
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Total	32.7	392.2								

AREAS

	Gross Total	Glass ft²	Glass (%)
Floor	17,510		
Part	0		
Int Door	0		
ExFlr	0		
Roof	15,260	0	0
Wall	5,915	571	10
Ext Door	0	0	0

HEATING COIL SELECTION

	Capacity MBh	Coil Airflow cfm	Ent °F	Lvg °F
Main Htg	-252.8	7,560	60.0	90.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-115.6	2,305	15.0	60.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-368.5			

Project Name: RENU - Central Islip Public Library
Dataset Name: TRACE000.TRC

TRACE® 700 v6.2.4 calculated at 10:18 AM on 09/28/2023
Alternative - 1 System Checksums Report Page 3 of 6

EQUIPMENT ENERGY CONSUMPTION

By Trane

Alternative: 1 VAV Boxes w/ Gas in RTUs

------- Monthly Consumption -------

Equipment - Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Cpl 3: York RTU [Sum of dsn coil capacities=17.06 tons]													
Condenser fan for MZ rooftop													
Electric (kWh)	0.0	0.0	0.0	0.0	226.9	508.5	829.9	697.2	444.9	29.4	0.0	0.0	2,736.8
Peak (kW)	0.0	0.0	0.0	0.0	1.2	1.5	1.8	1.6	1.4	0.7	0.2	0.0	1.8
Cntl panel & interlocks - 0.125 KW (Misc Accessory Equipment)													
Electric (kWh)	0.0	0.0	0.0	0.0	50.4	90.0	93.0	93.0	78.8	27.1	0.0	0.0	432.3
Peak (kW)	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1
Hpl 1: Electric Heat [Sum of dsn coil capacities=411.1 mbh]													
Electric [Nominal Capacity/F.L.Rate=411.1 mbh / 120.5 kW] (Heating Equipment)													
Electric (kWh)	19,179.9	18,620.7	13,981.3	8,841.8	3,622.9	2,407.6	2,046.8	2,336.8	2,776.1	5,693.7	8,887.4	16,915.2	105,310.2
Peak (kW)	33.2	35.5	27.5	20.3	9.4	7.3	6.0	6.6	7.7	14.3	19.3	29.3	35.5
Hpl 2: York Gas RTU [Sum of dsn coil capacities=76.25 mbh]													
Gas-fired heat exchanger - 005 [Nominal Capacity/F.L.Rate=300 mbh / 3.70 Therms] (Heating Equipment)													
Gas (therms)	213.7	233.6	85.1	6.4	0.0	0.0	0.0	0.0	0.0	0.0	1.2	138.6	678.4
Peak (therms/Hr)	0.5	0.5	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.5
Hpl 3: New 40-Ton Gas RTU [Sum of dsn coil capacities=115.6 mbh]													
Gas-fired heat exchanger - 006 [Nominal Capacity/F.L.Rate=400 mbh / 4.94 Therms] (Heating Equipment)													
Gas (therms)	347.9	370.4	153.0	25.7	0.0	0.0	0.0	0.0	0.0	0.0	11.3	243.5	1,151.7
Peak (therms/Hr)	0.7	0.8	0.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.6	0.8

ECM 6: Replace Heat Pump with High Efficiency Heat Pump

Project Cost	Estimated Rebates/Incentives	Net Cost	Annual Energy Savings	O&M Savings
$20,625	$2,520	$18,105	$483	$0

Existing Heat Pump

High Efficiency Ductless Heat Pump

ECM General Description:

The Library's IT room is currently conditioned using a heat pump system that is nearing the end of its useful life. To reduce the total cost of heating and cooling the IT room, the proposed ECM involves replacing the existing heat pump system with a high efficiency system. Additionally, the proposed system includes DDC controls that will allow for integration into the Building Management System, resulting in more effective and efficient use of the system. The scope of work for this ECM includes demolishing, removing, and disposing of the existing equipment, providing, and installing a new heat pump system, and providing start-up, warranty, and training for Library staff.

Benefits:

The proposed ECM involves replacing the current heat pump system with a more efficient one, which offers several benefits. These include reduced heating and cooling costs, lower energy consumption, and improved reliability. Integration of the new system with the BMS will enable better control and monitoring, leading to more efficient use and potential further energy savings. Overall, this ECM will result in cost savings, environmental benefits, and improved system performance for the Library.

Scope of Work

1. Provide labor to reclaim refrigerant from existing split system and properly dispose of.
2. Provide labor to disconnect and remove existing condenser and evaporator from site.
3. Provide labor and materials to install (1) 12,000 BTU high efficiency cooling only. condenser and (1) 12,000 BTU wall mounted evaporator.
4. Provide labor and materials to install new refrigeration and condensate piping for new. unit. Condensate pumps will be provided as required.
5. Provide (2) equipment rails and (1) pipe portal.
6. Provide rigging service to set new condenser on roof.
7. Provide startup service for new units.
8. Integration of system in new Building Management System.

Savings Calculation Method		
Cooling Savings (kWh)	=	Unit-Size (Tons) x Cooling gradient (%) x (Existing Unit kW/Ton – New Unit kW/Ton) x Bin Hours

Energy Savings Calculations and Methodology

HEAT PUMP REPLACMENT CALCULATION

Energy Use (kWh) = (Capacity (Tons)*(Hours of Operation/Year)*(Scheduled Usage)*(Efficiency) [Efficiency calculation is in kW/ton for simplicity]

Energy Use (kWh) = (Capacity (Tons)*(Hours of Operation/Year)*(Scheduled Usage)*(Efficiency) [Efficiency calculation is in kW/ton for simplicity]

GIVEN:

Electrical Energy Cost	=	$0.1665	$/kWh
Electrical Demand Cost	=	$11.97	$/kW
Cooling System Capacity	=	1.00	Tons
Operation (Hours/Year)	=	**8760**	**Hours/Year**
Conversion Factor	=	3,413	Btu/Kw
Conversion Factor	=	12,000	Btu/Ton
Annual Electric Energy Cost	=		

ASSUMPTION:

Existing Cooling System E	=	**2.00**	COP		
New Cooling System Effici	=	**2.20**	COP		
Existing Cooling System Efficien	=	6.83	(S) EER	1.76	KW/Ton
New Cooling System Efficiency	=	7.51	(S) EER	1.60	KW/Ton
Scheduled Usage	=	90%			

FORMULA:

Energy Use (Kwh)=(Capacity (Tons)*(Hours of Operation/Year)*(Scheduled Usage)*(Efficiency) [Efficiency calculation is in kw/ton for simplicity]
Energy Savings (Kwh)=(Existing Energy Use(Kwh)-New Energy Use (Kwh))
Energy Demand (Kw)=(Peak Capacity (Tons)*(Efficiency)
Energy Demand Cost ($)=(Energy Demand (Kw)*(Demand Cost ($/Kw))
Energy Cost Savings ($)=(Energy Savings(Kwh)*($/Kwh))+(Existing Demand Cost ($)-New Demand Cost ($))

CALCULATION:

USAGE	Capacity (Tons)	Hours/Year	Scheduled Usage	Efficiency (Uses kw/ton only)		
Existing Usage =	1	8760	90%	1.76	=	13,860 Kwh
New Usage =	1	8760	90%	1.60	=	12,600 Kwh

Usage Cost	kwh	$/kwh		
Existing Cost =	13,860	$0.166	=	$2,307
New Cost =	12,600	$0.166	=	$2,098

DEMAND (MONTHLY PEAK COOLING SYSTEM TONNAGE FROM LOGS AND UTILITY ANALYSIS)

MONTH	Peak Tons	EFF. (Kw/Ton)	EX. KW	Cost ($/Kw)		Ex. Demand $
JAN	1	1.76	2	$11.97	=	$21
FEB	1	1.76	2	$11.97	=	$21
MAR	1	1.76	2	$11.97	=	$21
APR	1	1.76	2	$11.97	=	$21
MAY	1	1.76	2	$11.97	=	$21
JUN	1	1.76	2	$11.97	=	$21
JUL	1	1.76	2	$11.97	=	$21
AUG	1	1.76	2	$11.97	=	$21
SEP	1	1.76	2	$11.97	=	$21
OCT	1	1.76	2	$11.97	=	$21
NOV	1	1.76	2	$11.97	=	$21
DEC	1	1.76	2	$11.97	=	$21
TOTALS			**21**			**$253**

MONTH	Peak Tons	EFF. (Kw/Ton)	New KW	Cost ($/Kw)		New Demand $
JAN	1	1.60	2	$11.97	=	$19
FEB	1	1.60	2	$11.97	=	$19
MAR	1	1.60	2	$11.97	=	$19
APR	1	1.60	2	$11.97	=	$19
MAY	1	1.60	2	$11.97	=	$19
JUN	1	1.60	2	$11.97	=	$19
JUL	1	1.60	2	$11.97	=	$19
AUG	1	1.60	2	$11.97	=	$19
SEP	1	1.60	2	$11.97	=	$19
OCT	1	1.60	2	$11.97	=	$19
NOV	1	1.60	2	$11.97	=	$19
DEC	1	1.60	2	$11.97	=	$19
TOTALS			**19**			**$230**

RESULTS:

Existing Annual Use =	**21**	**KW**	**13,860**	**kwh**	
Proposed Annual Use =	**19**	**KW**	**12,600**	**kwh**	
100% **Annual Savings =**	**1.9**	**KW**	**1,260**	**kwh**	**$483**

ECM 7: Replace Vestibule Fan Coil Unit with High Efficiency Heat Pump

Project Cost	Estimated Rebates/Incentives	Net Cost	Annual Energy Savings	O&M Savings
$34,375	$0	$34,375	$1,352	$0

Typical Ducted Heat Pump System

ECM General Description:

The vestibule of Central Islip Library is currently conditioned using a fan coil unit which is reaching the end of its useful life. To reduce heating and cooling costs and increase efficiency, RENU recommends replacing the existing system with a high-efficiency system that includes DDC controls, enabling integration into the new Building Management System. The scope of work includes the removal and disposal of the current unit, installation of a new heat pump system, and the extension or reconnection of supply and return ducting to the existing distribution systems. The project also involves start-up, warranty, and training for maintenance personnel.

Benefits:

The proposed ECM involves replacing the current heat pump system with a more efficient one, which offers several benefits. These include reduced heating, lower energy consumption, and improved reliability. Integration of the new system with the BMS will enable better control and monitoring, leading to more efficient use and potential further energy savings. Overall, this ECM will result in cost savings, environmental benefits, and improved system performance for the Library.

Scope of Work

1. Provide labor to disconnect and remove existing electric fan coil unit from premises and dispose of unit.
2. Provide labor and materials to install (1) 30,000 BTU high efficiency heat pump.

condenser and (1) 30,000 BTU ceiling cassette evaporator.
3. Provide labor and materials to install new refrigeration and condensate piping for new unit.
4. Provide (2) equipment rails and (1) pipe portal.
5. Provide rigging service to set new condenser on roof.
6. Provide startup service for new units.
7. Integration of system in new Building Management System.

Savings Calculation Method		
Heating Savings (kWh)	=	Unit-Size (Tons) x Heating gradient (%) x (Existing Unit kW/Ton – New Unit kW/Ton) x Bin Hours

Energy Savings Calculations and Methodology

FAN COIL UNIT REPLACMENT CALCULATION

Energy Use (kWh) = (Capacity (Tons)*(Hours of Operation/Year)*(Scheduled Usage)*(Efficiency) [Efficiency calculation is in kW/ton]

Energy Use (kWh) = (Capacity (Tons)*(Hours of Operation/Year)*(Scheduled Usage)*(Efficiency) [Efficiency calculation is in kW/ton]

GIVEN:

Electrical Energy Cost	=	$0.1665	$/kWh	
Electrical Demand Cost	=	$11.97	$/kW	
Cooling System Capacity	=	2.50	Tons	
Operation (Hours/Year)	=	**2000**	**Hours/Year**	
Conversion Factor	=	3,413	Btu/Kw	
Conversion Factor	=	12,000	Btu/Ton	
Annual Electric Energy Cost	=			

ASSUMPTION:

Existing Cooling System E	=	**1.00**	COP 2			(Electric Resistance COP = 1)
New Cooling System Effici	=	**2.70**		COP		
Existing Cooling System Efficien	=	3.41		($) EER	3.52	KW/Ton
New Cooling System Efficiency	=	9.22		($) EER	1.30	KW/Ton
Scheduled Usage	=	50%				

FORMULA:

Energy Use (Kwh)=(Capacity (Tons)*(Hours of Operation/Year)*(Scheduled Usage)*(Efficiency) [Efficiency calculation is in kw/ton for simplicity]
Energy Savings (Kwh)=(Existing Energy Use(Kwh)-New Energy Use (Kwh))
Energy Demand (Kw)=(Peak Capacity (Tons)*(Efficiency)
Energy Demand Cost ($)=(Energy Demand (Kw)*(Demand Cost ($/Kw))
Energy Cost Savings ($)=(Energy Savings(Kwh)*($/Kwh))+(Existing Demand Cost ($)-New Demand Cost ($))

CALCULATION:

USAGE	Capacity (Tons)		Hours/Year		Scheduled Usage		Efficiency (Uses kw/ton only)			
Existing Usage = (	2.5	)*(	2000	)*(	50%	)*(	3.52	) =	**8,790**	**Kwh**
New Usage = (	2.5	)*(	2000	)*(	50%	)*(	1.30	) =	**3,256**	**Kwh**

Usage Cost	kwh		$/kwh		
Existing Cost = (	8,790	)*(	$0.166	)=	**$1,463**
New Cost = (	3,256	)*(	$0.166	)=	**$542**

DEMAND (MONTHLY PEAK COOLING SYSTEM TONNAGE FROM LOGS AND UTILITY ANALYSIS)

MONTH		Peak Tons		EFF. (Kw/Ton)		EX. KW		Cost ($/Kw)		Ex. Demand $
JAN	(	3	)*(	3.52	)=(	11	)*(	$11.97	) =	$126
FEB	(	3	)*(	3.52	)=(	11	)*(	$11.97	) =	$126
MAR	(	2	)*(	3.52	)=(	7	)*(	$11.97	) =	$84
APR	(	0	)*(	3.52	)=(	0	)*(	$11.97	) =	$0
MAY	(	0	)*(	3.52	)=(	0	)*(	$11.97	) =	$0
JUN	(	0	)*(	3.52	)=(	0	)*(	$11.97	) =	$0
JUL	(	0	)*(	3.52	)=(	0	)*(	$11.97	) =	$0
AUG	(	0	)*(	3.52	)=(	0	)*(	$11.97	) =	$0
SEP	(	0	)*(	3.52	)=(	0	)*(	$11.97	) =	$0
OCT	(	2	)*(	3.52	)=(	7	)*(	$11.97	) =	$84
NOV	(	2	)*(	3.52	)=(	7	)*(	$11.97	) =	$84
DEC	(	3	)*(	3.52	)=(	11	)*(	$11.97	) =	$126
TOTALS						**53**				**$631**

MONTH		Peak Tons		EFF. (Kw/Ton)		New KW		Cost ($/Kw)		New Demand $
JAN	(	3	)*(	1.30	)=(	4	)*(	$11.97	) =	$47
FEB	(	3	)*(	1.30	)=(	4	)*(	$11.97	) =	$47
MAR	(	2	)*(	1.30	)=(	3	)*(	$11.97	) =	$31
APR	(	0	)*(	1.30	)=(	0	)*(	$11.97	) =	$0
MAY	(	0	)*(	1.30	)=(	0	)*(	$11.97	) =	$0
JUN	(	0	)*(	1.30	)=(	0	)*(	$11.97	) =	$0
JUL	(	0	)*(	1.30	)=(	0	)*(	$11.97	) =	$0
AUG	(	0	)*(	1.30	)=(	0	)*(	$11.97	) =	$0
SEP	(	0	)*(	1.30	)=(	0	)*(	$11.97	) =	$0
OCT	(	2	)*(	1.30	)=(	3	)*(	$11.97	) =	$31
NOV	(	2	)*(	1.30	)=(	3	)*(	$11.97	) =	$31
DEC	(	3	)*(	1.30	)=(	4	)*(	$11.97	) =	$47
TOTALS						**20**				**$234**

RESULTS:

Existing Annual Use =	**53**	**KW**	**8,790**	**kwh**	
Proposed Annual Use =	**20**	**KW**	**3,256**	**kwh**	
Annual Savings =	**33**	**KW**	**5,534**	**kwh**	**$1,352**
100% Savings as Percent of Existin =					

ECM 8: Building Management System (BMS)

Project Cost	Estimated Rebates/Incentives	Net Cost	Annual Energy Savings	O&M Savings
$180,366	$0	$180,366	$2,505	$0

ECM General Description:

The addition of a Direct Digital Control (DDC) Building Management System (BMS) is an effective energy conservation measure for a building with no current BMS. A DDC BMS is a computerized system that controls and monitors various building systems, such as HVAC, lighting, and security, to optimize their performance and energy efficiency. The system uses sensors and algorithms to gather data and make adjustments in real-time, allowing for more precise control over building operations. The DDC system will improve the response time for service and maintenance issues during periods when the facility is not under regular maintenance supervision, such as after-hours. The existing control points will be integrated into the new DDC system as applicable. Each building system will be re-commissioned to confirm and implement the proper day and night schedules for each major piece of equipment on the BMS. The controls required will also be provided, with specific sequencing to handle unoccupied ventilation, pre-occupancy purge, and post-occupancy flush to reduce CO2 concentration. Furthermore, the BMS will monitor indoor and outdoor CO2 levels, and sensor calibration will be carried out annually.

Equipment scheduling will be implemented to control equipment run time, and the implementation of an occupancy schedule is recommended to ensure efficient operation. The unoccupied thermostat setback/setup measure will also be put in place to conserve energy during unoccupied periods. The operation of equipment during unoccupied hours will only be required if the unoccupied space temperature setpoint is exceeded, and AHUs, RTUs, and Exhaust Fans may cycle on briefly, as required, to maintain the setpoint.

Benefits:

Implementing the DDC system offers several benefits to the Library, including improved energy efficiency, reduced energy consumption, and lower energy bills. The addition of a Building Management System will enable the Library to better monitor and control the various building systems, resulting in optimal performance and energy savings. By integrating existing points and new points into the new system and commissioning each building system, the Library will be able to confirm and implement the proper day and night schedules for each major piece of equipment, further reducing energy consumption during unoccupied periods.

Scope of Work

1. There is presently no BMS system at this site. We propose to design, install and fully configure a new JCI Facility Explorer FX-80 Niagara web-based BMS system. The new BMS system will be provided with a full graphics package, historical trends, alarms, etc. to provide a complete, cohesive control system for the building. All equipment listed in this proposal will be networked to the new BMS system and included in the graphical user interface.
2. Provide DDC control for (5) exhaust fans.
3. Provide start/stop, status, and alarm.
4. Provide occupancy programming/control as per occupancy requirements.
5. The new control points for each EF will be fully mapped to the new BMS system and included in the graphics, schedules, trends, alarms, etc.
6. We will replace the existing programmable thermostats on the (1) existing York RTU, (1) existing Aaon unit, and (1) new RTU with a new JCI FX DDC control system.
7. This includes a BACnet DDC controller as well as a new space temperature sensor, discharge air sensor, control relays, actuators, etc.
8. We will provide, install, and wire a wall-mounted CO2/temperature/humidity sensor for each RTU. The RTU's will be programmed to provide a full demand-controlled ventilation sequence of operation.
9. The new control system for each RTU will be fully mapped to the new BMS system and included in the graphics, schedules, trends, alarms, etc. This includes the following points and sequences:
   - o Supply Fan Start/Stop and Status Monitoring
   - o Return Fan Start/Stop and Status Monitoring (if applicable)
   - o Space Temperature
   - o Space Relative Humidity
   - o Space CO2 Level
   - o Discharge Air Temperature
   - o Economizer control
   - o Mixed air control (including DCV control)
   - o Heating control
   - o Cooling control
   - o Freeze protection
   - o Full set point and parameter control from BMS system.
10. We will design, fabricate, wire, install, program and commission a new JCI FX DDC control system for the new RTU.
11. This includes a BACnet DDC controller as well as a new space temperature sensor, discharge air sensor, control relays, actuators, etc.
12. We will provide, install, and wire a wall-mounted CO2/temperature/humidity sensor for the RTU. The RTU will be programmed to provide a full demand-controlled ventilation sequence of operation.

13. The new control system for the RTU will be fully mapped to the new BMS system and included in the graphics, schedules, trends, alarms, etc. This includes the following points and sequences:
    - o Supply Fan Start/Stop and Status Monitoring
    - o Return Fan Start/Stop and Status Monitoring (if applicable)
    - o Space Temperature
    - o Space Relative Humidity
    - o Space CO2 Level
    - o Discharge Air Temperature
    - o Economizer control
    - o Mixed air control (including DCV control)
    - o Heating control
    - o Cooling control
    - o Freeze protection
    - o Full set point and parameter control from BMS system.
14. Provide, install, wire and program a new JCI FX BACnet control system for each new VAV box and associated electric duct heater. This includes the following points and sequences:
    - o New Temperature, CO2, and Humidity Wall Sensor
    - o Control of new Electric Duct Heater in Children's office.
    - o Space Temperature
    - o Space Relative Humidity
    - o Space CO2 Level
    - o Occupied Space Set Point
    - o Unoccupied Space Set Point
    - o Discharge Air Temperature
    - o CFM set point (heating and cooling modes)
    - o Full set point and parameter control from BMS system.

• The new control points for each VAV box will be fully mapped to the new BMS system and included in the graphics, schedules, trends, alarms, etc.

This assumes that the Library's IT Department will provide addresses and permissions for integration to the Library's existing LAN and remote connectivity via VPN (or external IP address) and that the Library will provide and maintain a VPN for our use during the project and throughout the warranty period.

<u>Building Setpoints are as follows:</u>

The unoccupied setpoints:	Winter: 67F
	Summer: 77F
Occupied setpoints:	Winter 72 F
	Summer: 72 F

Sequence of Operation.

1. Front-end
   a. Furnish and install all temperature controls including all devices and accessories required for the installation of a complete Johnson web-based energy management and control system.
      i. Furnish and install (1) PC Server Workstation with Johnson N4 FX Server with minimum specifications as follows: iCore9 processor, 32GB RAM, 1TB SSD, with JCI FX Server licensed for communication to the FX80 controllers.

2. Air Handling Unit (RTU1) – with Hot Gas Reheat Coil

   a. Occupied/unoccupied cycle will be determined by schedules resident in the central Johnson FX BMS front-end. Whenever the supply fan is off, the outside air damper will be fully closed.

   b. Occupied Cycle - Heating Mode: The supply fan will start and indicate to the DDC controller via a current relay wired to a binary input of the controller that the fan is running. Once the supply fan is proven running, the outdoor, return and exhaust dampers will move to their minimum ventilation positions (adjustable). Whenever the return air temperature is below the return air set point of 68°F (adjustable), the heating will be modulated to maintain the discharge air temperature at the discharge heating set point. The discharge air set point shall be reset automatically between the discharge high limit of 120°F (adjustable) and low limit of 60°F (adjustable) based on deviation of the return air temperature from the return air heating set point.

   c. Occupied Cycle - Free Cooling Mode: Whenever the return air temperature is above the return air set point, and the outdoor air temperature is below 65°, the outdoor, return and exhaust dampers shall be modulated to maintain the discharge air low limit of 60° (adjustable).

   d. Occupied Cycle - Cooling Mode: When free cooling is not available, the unit will be indexed into cooling mode via central Johnson FX BMS front-end (based on outside air temperature) and shall operate as follows. During the occupied cycle the unit's supply fan will run continuously, and once proven running, the DDC controller shall cycle the stages of DX cooling to maintain a discharge air cooling set point of 55° (adjustable). DX cooling will be locked out whenever the outside air temperature is below the cooling lockout set point of 65°F (adjustable).

   e. Occupied Cycle – Dehumidification Mode: Whenever the space humidity level is above the space humidity set point (one space humidity sensor will be installed in a representative location), the unit's dehumidification mode shall be enabled, starting the DX coil and energizing the hot gas reheat valve. When the space humidity drops

3% below the space humidity set point, the unit's dehumidification mode shall be disabled.

f. Unoccupied Cycle (Night Setback): The DDC controller will cycle the supply fan and heating stage(s) to maintain the unoccupied space heating set point of 60°F (adjustable). The outside air damper will be fully closed. There will be no cooling operation during unoccupied mode.

3. Air Handling Unit (EX RTU-2, EX RTU-3)

a. General: Occupied/unoccupied cycle will be determined by schedules resident in the central Johnson FX BMS front-end. Whenever the supply fan is off, the outside air damper will be fully closed.

b. Pre-Occupancy Purge: Thirty minutes prior to the scheduled occupancy time of the AHU/RTU, the unit will be indexed into a pre-occupancy cycle. This cycle shall consist of the AHU/RTU running for 30 minutes. Once the supply fan is proven running, the outdoor air damper will open to 100% and remain there until the interior CO2 concentration is not greater than 100ppm over that of the outside air. The outside air damper shall then return to the minimum position. The heating stage(s) will be under control of the discharge air sensor, maintaining a discharge air temperature of at least 60°F.

c. Occupied Cycle:

1. Damper Control during Occupied Periods:

The economizer dampers will be controlled to provide CO^2 based Demand Controlled Ventilation. Once the supply has been proven running, and the pre-purge period is over, the outside air damper will modulate open and the return air damper will modulate closed starting at an interior CO^2 concentration of not greater than 100ppm over that of the outside air. Dampers shall modulate such that concentrations never exceed upper limit for space CO^2 (adjustable).

2. Heating Mode:

The supply fan will start and indicate to the DDC controller via a current relay wired to a binary input of the controller that the fan is running. Whenever the return air temperature is below the return air set point of 68°F (adjustable), the heating will be cycled on to maintain discharge air temperature at the discharge heating set point. The discharge air set point shall reset automatically between the discharge high limit of 100°F (adjustable) and low limit 60°F (adjustable) based on deviation of the return air temperature from the return air heating set point.

The dew point inside the building space shall be monitored from the return air and the supply air setpoint should be adjusted to be below the dew point so the supply air can absorb the internal humidity loads to maintain the proposed humidity range.

3. Cooling Mode:

When free cooling is not available, the unit will be indexed into cooling mode via central Johnson FX BMS front-end (based on outside air temperature) and shall operate as follows. During the occupied cycle the unit's supply fan will run continuously, and once proven running, the DDC controller shall cycle the stages of DX cooling to maintain a discharge air cooling set point of 55° (adjustable). DX cooling will be locked out whenever the outside air temperature is below the cooling lockout set point of 65°F (adjustable).

The dew point inside the building space shall be monitored from the return air and the supply air setpoint should be adjusted to be below the dew point so the supply air can absorb the internal humidity loads to maintain the proposed humidity range.

4. Post-Occupancy Flush:

When the central Johnson FX BMS front-end indexes the unit to unoccupied mode, the unit will run in a post-occupancy flush cycle, with the supply fan running and outdoor air damper open to 100%. The unit will remain in this mode to reduce the space CO^2 concentration to that of the outdoor air. When this is accomplished, the unit will shut down. The heating stage(s) will be under control of the discharge air sensor, maintaining a discharge air temperature of at least 60°F.

5. Unoccupied Cycle (Night Setback):

The DDC controller will cycle the supply fan and heating stage(s) to maintain the unoccupied heating set point of 60°F (adjustable). The outside air damper will be fully closed. There will be no cooling operation during the unoccupied mode.

6. Supply Air Duct Static Pressure Control (RTU-1):

The controller shall measure duct static pressure and shall modulate the supply fan VFD speed to maintain a duct static pressure setpoint of 1.5 in H_2O (adj.). The supply fan VFD speed shall not drop below 30% (adj.).

D. Alarms:

1. High Supply Air Static Pressure: If the supply air static pressure is 25 % (adj.) greater than setpoint.
2. Low Supply Air Static Pressure: If the supply air static pressure is 25% (adj.) less than setpoint.
3. Supply Fan VFD Fault.

4. VAV BOXES (VAV 1-9):

A. General: The variable volume VAV terminal unit shall be controlled independent of system pressure fluctuations by the DDC controller utilizing electric actuation. The space served by the VAV terminal unit shall be controlled in occupied and unoccupied modes as follows:

B. Occupied Mode:
The VAV terminal unit shall be controlled within user defined minimum and maximum supply air volume settings. The controller shall monitor the room temperature sensor, air flow sensor and heating/cooling mode of the associated AHU/RTU and modulate the supply air damper to maintain the room heating and cooling set points.

C. Occupied Cooling Mode:
Whenever the space temperature is higher than the space cooling set point, the VAV controller shall modulate the VAV box damper open, up to the maximum cooling CFM set point. As the space temperature falls, the VAV box damper shall modulate closed to the minimum cooling CFM set point. When the space is satisfied, the VAV box damper shall deliver the minimum cooling CFM to the space.

D. Occupied Heating Mode:
Whenever the space temperature is at or above the space heating set point, the VAV controller shall modulate the VAV box damper to maintain the minimum heating CFM set point. As the space temperature falls, the VAV box damper shall modulate open to the maximum heating CFM set point and the BMS system shall energize the zone's electric reheat coil (where applicable).

E. Unoccupied Mode:
The VAV box shall be controlled using the night heating set point of 60°F (adjustable). The controller may reset to the occupied mode for a predetermined time period upon receiving a signal from the control system or manually at the room sensor.

5. EXHAUST FANS

A. Supply and install all required DDC controllers, controls and required hardware to allow the following sequences of operation to occur.

B. The fan will run continuously during the occupied mode and be off during the unoccupied mode. Fan status will be monitored at the BMS. If a fan is commanded on and is not proven running within 30 seconds, a fan failure alarm will be annunciated at the BMS front-end.

6. ELECTRIC DUCT HEATER (EDH-1, RHC 2 - 8,)

A. The controller shall measure the zone temperature and stage the reheating to maintain its setpoint. To prevent short cycling, there shall be a user definable (adj.) delay between stages, and each stage shall have a user definable (adj.) minimum runtime.

B. The reheating shall be enabled whenever:
   a. Outside air temperature is less than 50°F (adj.).
   b. AND the zone temperature is below setpoint.
   c. AND sufficient airflow is provided.

C. Reheating - High Discharge Air Temperature Limit:

   The controller shall measure the discharge air temperature and limit reheating if the discharge air temperature is more than 95°F (adj.).

D. Discharge Air Temperature:
   The controller shall monitor the discharge air temperature.

E. Alarms shall be provided as follows:
   a. High Discharge Air Temp: If the discharge air temperature is greater than 120°F (adj.).
   b. Low Discharge Air Temp: If the discharge air temperature is less than 40°F (adj.).

Savings Calculation Method
RTU Unoccupied Temperature setback
RTU Equipment Scheduling

ECM **OA damper Controls**

School Central Islip Library

Heating Gas — RTU Details

Cooling Yes — Cfm 24000

Qty 1

Exisiting		
RTU Airflow	24,000	cfm
Existing Percent Outdoor Air	15%	%
Clg Coil Entering Air Design Enthalpy (h ent)	32	btu/lb of dry air
Clg Coil Leaving Air Design Enthalpy (h lvg)	22.9	btu/lb of dry air
Htg Coil Entering Air Design Temperature (T ent	55	deg F
Htg Coil Leaving Air Design Temperature (T lvg)	95	deg F

Assumptions		
RTU Efficiency	3.05	COP
Heating Plant Efficiency	82.0%	%
Summer Demand Utilization Factor	50%	
Proposed Percent Outdoor Air	10.0%	
Summer Operating Period	5	Months
Winter Demand Utilization Factor	50%	
Winter Operating Period	7	Months
Probability that Reduction Occurs During	50%	(% Dem Reductic
Total Hours of cooling	3612	Hours
Total Hours of Heating	5057	Hours
Total Hours of Equip. Operation	8669	Hours
% Time at Equivalent Full Load (Summer)	35%	
% Time at Equivalent Full Load (Winter)	35%	

1264	Equivalent Full Load Cooling Hours
1770	Equivalent Full Load Heating Hours

Operating Schedule

	Summer		Winter	
Day	Existing [Hrs/day]	Proposed Reduction [Hrs/day]	Existing [Hrs/day]	Proposed Reduction [Hrs/day]
Monday	24	12	24	12
Tuesday	24	12	24	12
Wednesday	24	12	24	12
Thursday	24	12	24	12
Friday	24	12	24	12
Saturday	24	12	24	12
Sunday	24	12	24	12
Total	168	84	168	84
Percent Reduced (%Red.)		50%		50%

Calculation

Exist.Cooling Consumption	17,903	**kWh**
Exist. Heating Consumption	3,357	**Therm**
Exist. Clg Annual Demand	10	**kW**
Exist. Htg Annual Demand	-	**Therm**
Prop. Cooling Consumption	8,952	**kWh**
Prop Heating Consumption	1,119	**Therm**
Prop Clg Annual Demand	5	**kW**
Prop Htg Annual Demand	-	**Therm**
Cooling Savings	8,952	**kWh**
Heating Savings	2,238	**Therm**
Cooling Demand Savings	5	**kw**
Heating Demand Savings	-	**Therm**

EQUIPMENT SCHEDULING
Central Islip Library

RTUs

UNIT	SERVES	HP	Efficiency
RTU1	Main Library	20.00	92.0%
RTU2	Community Room	5.0	90.0%
		-	88.5%
		-	88.5%
		-	88.5%

CALCULATION PARAMETERS

Cooling Capacity (Tons):	66.0
Cooling % Load:	0%
DX Disable Setpoint (F):	55
Heating Capacity (MBH):	700
Heating % Load:	0%
Combustion Efficiency (%):	82.0%
Heating Override Setpoint (F):	60
Fan/Pump Motor Load:	50%
Existing Weekend = Unoccupied?	No
Retrofit Weekend = Unoccupied?	No
Electric Heat (Yes/No):	No
Electric Rate ($/kW-h):	$ -
Gas Rate ($/ Therm):	$ -

EQUIPMENT SCHEDULE

Hour	Existing Occupied	Proposed Occupied
1	Occ	Unocc
2	Occ	Unocc
3	Occ	Unocc
4	Occ	Unocc
5	Occ	Unocc
6	Occ	Unocc
7	Occ	Unocc
8	Occ	Occ
9	Occ	Occ
10	Occ	Occ
11	Occ	Occ
12	Occ	Occ
13	Occ	Occ
14	Occ	Occ
15	Occ	Occ
16	Occ	Occ
17	Occ	Occ
18	Occ	Occ
19	Occ	Occ
20	Occ	Occ
21	Occ	Unocc
22	Occ	Unocc
23	Occ	Unocc
24	Occ	Unocc

RESULTS

Therms Saved	-
Fuel $ Saved	$ -
kW-h Saved	15,993
Electric $ Saved	$ -

ENGINEERING CHECKS

Annual $/kW-h	$ -
Annual $/Therm	#DIV/0!
Refrigeration Energy Saved (kW-h)	-
Electric Heating Energy Saved (kW-h	-
Fan Energy Saved (kW-h)	15,993
Percent Run Time Reduced	42.5%
Run Hours Reduced	4,001

ASSUMPTIONS

Savings only calculated for the unoccupied hours
Assumed Size

COOLING LOAD PROFILE

outside drybulb	load %flow
97.5	100%
60	50%
slope	0.01333
intercept	-0.3

FAN LOAD PROFILE

outside drybulb	load %flow
97.5	100%
60	65%
slope	0.0093
intercept	0.03

kW/Ton

outside drybulb	Chiller kW/ton
97.5	1.55
55	1.45
slope	0.00235
intercept	1.32059

HEATING PROFILE

outside drybulb	Elec. Heat % Output
60	25%
20	100%
slope	-0.01875
intercept	1.375

UNOCCUPIED THERMOSTAT SETBACK/SETUP
Central Islip Library

BUILDING PARAMETERS

kW-h Saved	**4,067**
Electric Savings $	**$ -**
Therms Saved	**986**
Fuel Savings $	**$ -**
Total Savings $	**$ -**

Cooling Capacity (Tons)	66
Heating Capacity (MBH)	700

Units Qty	Cooling Size (tons)	Heating Size (MBH)	Total Cooling (tons)	Total Heating (MBH)
1	40	400	40	400
1	20	300	20	300
1	6	0	6	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0		0		0
Total			**66**	**700**

THERMOSTAT SETPOINTS

	Occupied	Unoccupied
Cooling:	72	77
Heating:	72	67

CALCULATION PARAMETERS

Cooling Plant kW/Ton:	1.15
Heating Plant Efficiency	82.0%
Existing Weekend = Unoccupied?	No
Retrofit Weekend = Unoccupied?	No
Electric Rate: ($/kW-H):	
Natural Gas Rate: ($/THERM):	
Electric Heat (Yes/No):	No
Cooling Load (1/ °F)	3%
Heating Load (1/ °F)	1%

HEAT/COOL SCHEDULE

Month	Mode
1	Heat
2	Heat
3	Heat
4	Heat
5	Cool
6	Cool
7	Cool
8	Cool
9	Cool
10	Heat
11	Heat
12	Heat

OCCUPANCY SCHEDULE

Hour	Existing % Occupied	Proposed % Occupied
1	Occ	Unocc
2	Occ	Unocc
3	Occ	Unocc
4	Occ	Unocc
5	Occ	Unocc
6	Occ	Unocc
7	Occ	Unocc
8	Occ	Occ
9	Occ	Occ
10	Occ	Occ
11	Occ	Occ
12	Occ	Occ
13	Occ	Occ
14	Occ	Occ
15	Occ	Occ
16	Occ	Occ
17	Occ	Occ
18	Occ	Occ
19	Occ	Occ
20	Occ	Occ
21	Occ	Unocc
22	Occ	Unocc
23	Occ	Unocc
24	Occ	Unocc

ASSUMPTIONS
Only skin loads are considered

EQUIPMENT SCHEDULING
Central Islip Library

RTUs

UNIT	SERVES	HP	Efficiency
RTU1	Main Library	20.00	92.0%
RTU2	Community Room	5.0	90.0%
		-	88.5%
		-	88.5%
		-	88.5%

CALCULATION PARAMETERS

Cooling Capacity (Tons):	66.0
Cooling % Load:	0%
DX Disable Setpoint (F):	55
Heating Capacity (MBH):	700
Heating % Load:	0%
Combustion Efficiency (%):	82.0%
Heating Override Setpoint (F):	60
Fan/Pump Motor Load:	50%
Existing Weekend = Unoccupied?	No
Retrofit Weekend = Unoccupied?	No
Electric Heat (Yes/No):	No
Electric Rate ($/kW-h):	$ -
Gas Rate ($/ Therm):	$ -

EQUIPMENT SCHEDULE

Hour	Existing Occupied	Proposed Occupied
1	Occ	Unocc
2	Occ	Unocc
3	Occ	Unocc
4	Occ	Unocc
5	Occ	Unocc
6	Occ	Unocc
7	Occ	Unocc
8	Occ	Occ
9	Occ	Occ
10	Occ	Occ
11	Occ	Occ
12	Occ	Occ
13	Occ	Occ
14	Occ	Occ
15	Occ	Occ
16	Occ	Occ
17	Occ	Occ
18	Occ	Occ
19	Occ	Occ
20	Occ	Occ
21	Occ	Unocc
22	Occ	Unocc
23	Occ	Unocc
24	Occ	Unocc

RESULTS

Therms Saved	-
Fuel $ Saved	**$ -**
kW-h Saved	**15,993**
Electric $ Saved	**$ -**

ENGINEERING CHECKS

Annual $/kW-h	$ -
Annual $/Therm	#DIV/0!
Refrigeration Energy Saved (kW-h)	-
Electric Heating Energy Saved (kW-h	-
Fan Energy Saved (kW-h)	15,993
Percent Run Time Reduced	42.5%
Run Hours Reduced	4,015

ASSUMPTIONS
Savings only calculated for the unoccupied hours
Assumed Size

COOLING LOAD PROFILE

outside drybulb	load %flow
97.5	100%
60	50%
slope	0.0133333
intercept	-0.3

FAN LOAD PROFILE

outside drybulb	load %flow
97.5	100%
60	65%
slope	0.0093
intercept	0.09

kW/Ton

outside drybulb	Chiller kW/ton
97.5	1.55
55	1.45
slope	0.0023529
intercept	1.3205882

HEATING PROFILE

outside drybulb	Elec. Heat % Output
60	25%
20	100%
slope	-0.01875
intercept	1.375

ECM 9: High Efficiency Gas-Fired Water Heater

Project Cost	Estimated Rebates/Incentives	Net Cost	Annual Energy Savings	O&M Savings
$17,875	$0	$17,875	$773	$0

Existing Electric Domestic Water Heater

High Efficiency Domestic Hot Water Heater

ECM General Description:

The Central Islip Public Library has an existing domestic water heater that is approaching the end of its useful life. As the water heater ages, it can experience a reduction in efficiency due to fouling and scaling on the internal heat exchange components, which results in an increase in maintenance costs. To address this issue, RENU plans to replace the existing electric water heater with a new tankless gas-fired water heater that operates at an efficiency of up to 97%. This will be possible with the addition of natural gas to the site. The new tankless water heater will reduce thermal stand-by losses when compared to storage tank water heaters.

The scope of work for this project includes disconnecting, removing, and disposing of the existing electric water heater. New gas lines will be furnished and installed at the location of the new water heater, and a new condensing domestic tankless water heater will be furnished and installed. Additionally, all necessary piping, valves, and fittings required to connect the new units to the existing piping systems (water and gas) will be furnished and installed. The new portions of the piping will be insulated with fiberglass and PVC fittings, and electrical power and control wiring will be provided to the new units. Finally, the piping will be checked for leaks to ensure proper operation of the new water heater.

Scope of Work:

1. Disconnecting, removing, and disposing of the existing electric water heater.
2. New gas lines will be furnished and installed at the location of the new water heater.
3. Supply and install a new condensing domestic water heater.

4. Supply and install all necessary piping, valves, and fittings required to connect the new units to the existing piping systems (water and gas).
5. The new portions of the piping will be insulated with fiberglass and PVC fittings.
6. Electrical power and control wiring will be provided to the new units.
7. Piping will be checked for leaks to ensure proper operation of the new water heater.

Benefits:

Natural gas water heaters are generally more energy-efficient than electric water heaters, resulting in lower energy bills. Replacing a unit at the end of its useful life, and before it leaks and causes other damage, can be beneficial. Natural gas water heaters also typically have a longer lifespan than electric water heaters, requiring less frequent replacement and maintenance.

Savings Calculation Method		
Existing DHW Usage	=	Existing Electric Hot Water Usage
Proposed DHW Usage	=	Proposed Gas-Fired Hot Water Usage
Energy Savings	=	+ Electric Savings | - Therm Usage

Energy Savings Calculations and Methodology

Excel spreadsheet was used to perform the detailed calculations for the energy savings, the main equations used are down below:

- Heating Value for Gallon of Water = 1btu/1lb water x 8lbs/gal x (DHW Setpoint - Incoming Water Temperature)
- Existing Energy Usage = ((DHW usage x No. of People x Occupied Days/Year x Heating Value per gal Water)/Existing Efficiency)/btu per unit
- Proposed Energy Usage = ((DHW usage x No. of People x Occupied Days/Year x Heating Value per gal Water) Proposed Efficiency)/btu per unit

Description	Removal of an existing domestic water heating and replacing with a high efficiency model.					
Given	Fuel Energy Cost	=	$1.150	$/Therm (Nat'l Gas)	0.1665	
	Occupied Days/Year	=	250			
	Existing Temperature Setpoint	=	120	Degrees F		
	Type of Facility	=	School-Primary			
Assumptions	Number of People in Facility	=	100			
	DHW Usage	=	0.60	gal/person/day *		
	City Water Temperature	=	55	Degrees F		
	Energy to heat water	=	1	Btu/Gal/Deg		
	Existing Efficiency	=	100%	(Electric 100% Efficient)		
	Proposed Boiler Efficiency	=	95%			

Formula

Heating Value for Gallon of Water = 1btu/1lb water x 8lbs/gal x (DHW Setpoint - Incoming Water Temperature)

Existing Energy Usage = ((DHW usage x No. of People x Occupied Days/Year x Heating Value per gal Water)/Existing Efficiency)/btu per unit

Proposed Energy Usage = ((DHW usage x No. of People x Occupied Days/Year x Heating Value per gal Water)Proposed Efficiency)/btu per unit

Calculation

Heating Value for Gallon of Water = 1 x 8 x (120 - 55) = **520** **btu/gal**

	DHW Usage		No. of People		Occupied Days/Yr		Htg Value		Htr Eff.		Btu/ Unit		
Existing Energy Usage =((	0.60	x	100	x	250	x	520	)/	100%	)x	100,000	=	**78** **Therm**
Proposed Energy Usage =((	0.60	x	100	x	250	x	520	)/	95%	)x	100,000	=	**82** **Therm**

	Usage		Cost		
Existing Energy Costs =	2285	x	$0.17	=	**$ 380**
Proposed Energy Costs =	82	x	$1.15	=	**$ 94**

Result				
Existing Annual Use=	**2,285**	**kWh**	**$**	**380**
Exiting Demand Saved =	**3.5**	**kW**	**$**	**487**
Proposed Annual Use=	**82**	**Therm**	**$**	**94**
Annual Savings=	**(4)**	**Therm**	**$**	**773**

ECM 10: Plug Load Controls

Project Cost	Estimated Rebates/Incentives	Net Cost	Annual Energy Savings	O&M Savings
$4,984	$0	$4,984	$605	$0

Existing Copier in Library

BERT Plug Load Management Devises

ECM General Description:

Modern electrical devices often continue to consume power even after they have been turned off, a phenomenon commonly known as phantom or vampire power. The amount of power consumed in this state varies depending on the type of equipment and the manufacturer. RENU proposes the installation of plug load controls in a Library to reduce energy consumption from plugged-in electronic devices. Plug loads are a significant source of energy use in commercial buildings, including libraries. Plug load controls can reduce energy consumption by automatically turning off or putting electronic devices in standby mode when they are not in use. RENU evaluated a plug load control device from Bert (or a comparable manufacturer) as a potential solution for turning off power to electronic devices when they are not being used.

Scope of Work

Install plug load controls on 25 electronic devices in the Library, such as computers, printers, copiers, and projector equipment. The plug load controls will be installed to automatically turn off or put electronic devices in standby mode.

Plug Loads to Install BERT Plug Load Devices

Device Type:	Quantity:
Projector	2
Printer	15
Large Printer/Copier	3
Coffee Maker	4
H/C Water Dispenser	1

Benefits:

Plug load controls will reduce energy consumption from plugged-in electronic devices, resulting in energy cost savings for the Library. The ECM will also contribute to the Library's sustainability goals by reducing its carbon footprint and promoting energy efficiency. Overall, the proposed ECM for plug load controls is expected to provide significant energy savings, reduce environmental impact, and support the Library's commitment to sustainability.

Savings Calculation Methodology		
Baseline Energy Usage (kWh / yr)	=	Average kW x Baseline Weekly Hours x 4.348 wks/mo. x Months/yr
Proposed Energy Usage (kWh/ yr)	=	Average kW x Proposed Weekly Hours x 4.348 wks/mo. x Months/yr
Electrical Savings (kWh/ yr)	=	Baseline Energy Usage – Proposed Energy Usage

Energy Savings Calculations and Methodology

Preliminary Savings Sheet for Central Islip Library						Project Total			
# of Berts	02	15	03	04	01	25			
Total Annual kWh Savings	90	1,266	675	1,261	343	3,636	kWh	0.166	/kWh
Total Annual $ Savings	$15	$211	$112	$210	$57	$605			
Device Type:	Projector	M Printer	Copier	Lrg Coffee	H/C Water				
Watts:	8	15	40	56	61				
# Hours Scheduled ON per Year: BASELINE	8,760	8,760	8,760	8,760	8,760				
Central Isliip Library	LIB								
# of Berts	02	15	03	04	01	25			
# Hours Scheduled ON per Year: BERT	3,132	3,132	3,132	3,132	3,132				
# Hours Scheduled OFF per Year: BERT	5,628	5,628	5,628	5,628	5,628				
Total Annual kWh Savings	90	1,266	675	1,261	343	3,636			
Total Annual $ Savings	$15	$211	$112	$210	$57	$605			
Annual $ Savings per Device	$7.50	$14.05	$37.48	$52.47	$57.16				

									Reminders:
Device Name	Projector	Charging Cart	M Printer	Copier	Snack Vend	Soda Vend	Lrg Coffee	H/C Water	
Wattage	8	37	15	40	40	320	56	61	Verify data
ES	Calendar Sta	9/1/2018	Calendar End	6/30/2019	Weekday ON Days:		215		For projects with K-12 buildings:
MS	Calendar Sta	9/1/2018	Calendar End	6/30/2019	Weekday ON Days:		215		enter the calendar start &
HS	Calendar Sta	8/15/2019	Calendar End	6/15/2020	Weekday ON Days:		218		stop dates here

Building Type	Number of Days ON per year				Number of Hours ON per day				
Building Type	Weekday ON Days	Saturday ON Days	Sunday ON Days	# Days devices OFF	Weekday ON Hours	Saturday ON Hours	Sunday ON Hours	Annual Hours Using Bert Schedule	For all Projects:
ADMIN -12 Mont	261	0	0	104	12	0	0	3,132	Enter the # Weekday ON
ES -9 MONTHS	220	0	0	145	11	0	0	2,420	days. For K-12 buildings,
MS-9 MONTHS	220	0	0	145	12	0	0	2,640	enter the numbers shown in
HS - 9 MONTHS	220	0	0	145	13	10	0	2,860	H6:H8.
UNIV - 12 MONTI	261	0	0	104	13	0	0	3,393	
LAB - 12 MONTH	261	0	0	104	13	0	0	3,393	Enter 261 for buildings with
PUB - 12 MONTH	261	0	0	104	12	0	0	3,132	12 month occupancy
SAFE-12 MONTH	261	0	0	104	12	0	0	3,132	
FOOD-12 MONTH	261	0	0	104	13	10	0	3,393	Then enter the # of ON
SERV-12 MONTH	261	0	0	104	12	0	0	3,132	hours for weekdays,
WARE-12 MONTI	261	0	0	104	12	10	0	3,132	Saturday and Sunday
LODG-12 MONTH	261	0	0	104	12	0	0	3,132	
MED-12 MONTH	261	0	0	104	12	0	0	3,132	
OTHER-12 MONT	261	0	0	104	12	10	0	3,132	

3.1 ECMs Considered But Not Recommended

Combined Heat and Power - CHP is a specific form of distributed generation (DG), which refers to the strategic placement of electric power generating units at or near customer facilities to supply onsite energy needs. CHP enhances the advantages of distributed generation by the simultaneous production of useful thermal and power output, thereby increasing the overall efficiency. In the right application, such as facilities that have year-round need for thermal output, CHP offers energy and environmental benefits over electric-only and thermal-only systems in both central and distributed power generation applications. CHP systems have the potential for a wide range of applications and the higher efficiencies result in lower emissions than separate heat and power generation. After further investigation, the above ECM is not recommended as it does not prove to benefit Central Islip Public Library financially. The cost of purchasing, installing, and maintaining the ECM does not outweigh the potential savings that would be generated over the project timeline.

Water Conservations Strategies – This ECM was proposed but the Library decided not to have this measure included in the project.

Destratification Fans - Destratification fans are designed to address the natural tendency of heated or cooled air to stratify, or separate, within a building. This stratification can lead to temperature differentials between the floor and ceiling, which can reduce the efficiency of HVAC systems and result in higher energy costs. Destratification fans work by circulating the air within a building, which helps to mix the heated or cooled air and reduce temperature differentials. In addition to their energy efficiency benefits, destratification fans can also improve the comfort and air quality within a building. By circulating the air, the fans can help to reduce the buildup of pollutants and improve air quality. They can also improve the comfort of occupants by creating a more uniform temperature distribution throughout the building. This measure is not recommended at this time.

Replacement of Electric Reheat Coils with VRF Fan Coil Units - The Library uses electric reheat coils for the majority of the heating of the building. These systems are nearing their end of useful life. This measure would replace the existing reheat coils with VRF fan coil units. VRF fan coil units are an advanced heating and cooling system designed to offer more precise and efficient temperature control in commercial and residential buildings. Unlike traditional HVAC systems, VRF fan coil units use a single outdoor unit that is connected to multiple indoor fan coils, each with its own thermostat for individual temperature control. After further investigation, the above ECM is not recommended as it does not prove to benefit Central Islip Public Library financially. As opposed to this option, RENU proposes the addition of VAV boxes with Electric Reheat instead.

Section 4: Measurement & Verification (M&V) Methodologies

This section contains a description of the types of Measurement and Verification (M&V) methodologies that RENU will use to guarantee the performance of this project. They have been developed and defined by two independent authorities:

1. International Performance Measurement and Verification Protocol (IPMVP)
2. Federal Energy Management Program (FEMP)

4.1 M&V Options

There are four guarantee options that may be used to measure and verify the performance of a particular energy conservation measure. Each one is described below.

1. Option A – Retrofit Isolation: Key Parameter Measurement

Energy savings is determined by field measurement of the key parameters affecting the energy use of the system(s) to which an improvement measure was applied separate from the energy use of the rest of the facility. Measurement frequency ranges from short-term to continuous, depending on the expected variations in the measured parameter, and the length of the reporting period.

Measurement of key parameters means that those parameters not selected for field measurement will be estimated. Estimates can be based on historical data, manufacturer's specifications, or engineering judgment. Documentation of the source or justification of the estimated parameter will be described in the M&V plan in the contract. Energy savings is determined through engineering calculations of the baseline and post-retrofit energy used based on the combination of measured and estimated parameters, along with any routine adjustments.

2. Option B – Retrofit Isolation: All Parameter Measurement

Like Option A, energy savings is determined by field measurement of the energy use of the systems to which an improvement measure was applied separate from the energy use of the rest of the facility. However, all of the key parameters affecting energy use are measured; there are no estimated parameters used for Option B. Measurement frequency ranges from short-term to continuous, depending on the expected variations in the savings and the length of the reporting period. Energy savings is determined through engineering calculations of the baseline and post-retrofit energy used based on the measured parameters, along with any routine adjustments.

3. Option C – Whole Building Metering/Utility Bill Comparisons

Option C involves the use of utility meters or whole building sub-meters to assess the energy performance of a total building. Option C assesses the impact of any type of improvement measure, but not individually if more than one is applied to an energy meter. This option determines the collective savings of all improvement measures applied to the part of the facility

monitored by the energy meter. In addition, since whole building meters are used, savings reported under Option C include the impact of any other change made in facility energy use (positive or negative). Option C may be used in cases where there is a high degree of interaction between installed improvement measures or between improvement measures and the rest of the building or the isolation and measurement of individual improvement measures is difficult or too costly.

This Option is intended for projects where savings are expected to be large enough to be discernable from the random or unexplained energy variations that are normally found at the level of the whole facility meter. The larger the savings, or the smaller the unexplained variations in the baseline, the easier it will be to identify savings. In addition, the longer the period of savings analysis after installing the improvement measure, the less significant is the impact of short-term unexplained variations. Typically, savings should be more than 20% of the baseline energy use if they are to be separated from the noise in the baseline data.

Periodic inspections should be made of all equipment and operations in the facility after the improvement measure installation. These inspections will identify changes from baseline conditions or intended operations. Accounting for changes (other than those caused by the improvement measures) is the major challenge associated with Option C-particularly when savings are to be monitored for long periods. Savings are calculated through analysis of whole facility utility meter or sub-meter data using techniques from simple comparison to regression analysis.

4. Option D – Calibrated Simulation

Option D involves the use of computer simulation software to predict energy use, most often in cases where baseline data does not exist. Such simulation models must be calibrated so that it predicts an energy use and demand pattern that reasonably matches actual utility consumption and demand data from either the base-year or a post-retrofit year. Option D may be used to assess the performance of all improvement measures in a facility, akin to Option C. However, different from Option C, multiple runs of the simulation in Option D allow estimates of the savings attributable to each improvement measure within a multiple improvement measure project.

Option D may also be used to assess just the performance of individual systems within a facility, akin to Option A and B. In this case, the system's energy use must be isolated from that of the rest of the facility by appropriate meters. Savings are calculated using energy use simulation models, calibrated with hourly or monthly utility billing data and/or end-use metering.

4.2 M&V Plan and Energy Savings Calculations

The goal of this project is to achieve energy savings through upgrades to the building's lighting, improvements in the HVAC system by the installation of new, more efficient equipment and the installation of Building Management System (BMS), the addition of solar photovoltaic panels to offset the electric usage and building envelope upgrades (roof replacement, air infiltration treatments, plug loads). This project will also result in improved lighting levels and more reliable HVAC operation, thereby reducing maintenance costs. The objective of Measurement and Verification (M&V) activities at the Project level is to confirm that the Measures that are recommended for the Library energy performance contract (EPC) are installed and resulting in energy savings.

Table 4: Proposed Annual Savings Summary

ECM	Electric energy savings (kWh/yr)	Electric demand savings (kW/yr)	Natural gas savings (therms)
Roof Replacement	8,687	0.0	0
Building Envelope Improvements	6,176	0.0	0
Rooftop Solar	217,563	0.0	0
Comprehensive Lighting Upgrades and Controls	106,114	26.0	0
Rooftop Unit Upgrades with VAV Boxes	64,071	21.2	-1,830
Replace Heat Pump with High Efficiency Heat Pump	1,260	1.9	0
Replace Vestibule Fan Coil Unit with High Efficiency Heat Pump	5,534	3.0	0
Install Building Management System (BMS)	15,045	0.0	0
Install High Efficiency Gas-Fired Water Heater	2,285	3.5	-82
Plug Load Controls	3,636	0.0	0
Total	**430,371**	**56**	**-1,912**

The expected annual consumption values above will be adjusted based on weather data, occupancy levels, and system operating parameters realized during the year-long period during which energy consumption measurements are in place. The adjusted expected savings will then be compared to actual savings.

Renu will perform measurement and verification (M&V) activities for each of the ECMs in order to estimate the actual cost savings achieved in the project. The M&V plans for the ECMs are described in Sections down below of this document and are summarized in the Table down the below.

ECM and Recommended M&V option	Summary of M&V Plan	
ECM-1 The Roof Replacement **M&V Option: C**	Key Parameters	Roof performance, Reflectance, and space Temperature
	Baseline	The analysis relies on leveraging utility bills, weather data, and historical weather data to forecast the energy consumption at a given facility.
	Post- Installation	Verify that proposed equipment has been implemented and is operating as intended. Post installation savings is determined from the same baseline model modified for the set points and energy rates.
	Performance Period	Annual on-site inspections of equipment for ongoing verification
ECM-2 Building Envelope Upgrades **M&V Option: C**	Key Parameters	Weather, heating, and cooling system efficiency
	Baseline	The analysis relies on leveraging utility bills, weather data, and historical weather data to forecast the energy consumption at a given facility.
	Post- Installation	Verify that proposed equipment has been implemented and is operating as intended. Post installation savings is determined from the same baseline model modified for the set points and energy rates.
	Performance Period	Annual on-site inspections of equipment for ongoing verification. Baseline Adjustment should be made based on cooling and heating load and operating hours
ECM-3 Solar **M&V Option: B**	Key Parameters	System name plate DC rating, array tilt, array azimuth, DC to AC conversion efficiency, hours and intensity of solar radiation, annual kwh generation
	Baseline	Baseline electrical energy is equivalent to the portion of the facility electrical load to be offset by the PV system electrical generation. PV system generation shall be calculated from the digital acquisition system (DAS) on the inverters.
	Post- Installation	Verify that proposed PV system has been implemented and is operating as intended. Instantaneous array performance to be compared against designed system output through measurement of solar insolation, module temperature and inverter output. Post installation savings is determined from the same baseline calculation modified for the as-built condition of the PV system
	Performance Period/	Annual on-site inspections of PV equipment for ongoing verification that system is in place, operational and that guaranteed electrical generation is sustainable. Energy generation is continuously metered by the PV system's revenue grade meter. All metered generation is reported as verified savings.
ECM-4 LED Lighting and	Key Parameters	Lighting fixture power consumption, operating hours, lighting levels.

Lighting Controls **M&V Option: C**	Baseline	The analysis relies on leveraging utility bills, weather data, and historical weather data to forecast the energy consumption at a given facility.
	Post- Installation	Verify that proposed equipment has been implemented and is operating as intended. Post installation savings is determined from the same baseline model modified for the set points and energy rates.
	Performance Period	Annual visual inspection of a sample set of lighting fixtures and controls to ensure the integrity of the fixtures and controls and confirm that the ECM still has the potential to perform as specified.
ECM-5,6,7,8 HVAC Upgrades **M&V Option: C**	Key Parameters	System efficiency, building parameters, current and proposed operating schedules
	Baseline	The analysis relies on leveraging utility bills, weather data, and historical weather data to forecast the energy consumption at a given facility.
	Post- Installation	Verify that proposed equipment has been implemented and is operating as intended. Post installation savings is determined from the same baseline model modified for the set points and energy rates.
	Performance Period	Annual on-site inspections of HVAC controls and equipment for ongoing verification that energy control strategies are in place and sustainable.
ECM-9 Install High Efficiency Gas-Fired Water Heater: **M&V Option: C**	Key Parameters	Size, capacity, energy efficiency rating, temperature setting and occupied days
	Baseline	The analysis relies on leveraging utility bills, weather data, and historical weather data to forecast the energy consumption at a given facility.
	Post- Installation	Verify that proposed equipment has been implemented and is operating as intended. Post installation savings is determined from the same baseline model modified for the set points and energy rates.
	Performance Period	Annual on-site inspections of the equipment and taking readings from the installed gas meter.
ECM-10 Plug Load Controls **M&V Option: C**	Key Parameters	Device wattage, number of Berts and Scheduled ON hours
	Baseline	The analysis relies on leveraging utility bills, weather data, and historical weather data to forecast the energy consumption at a given facility.
	Post- Installation	Verify that proposed equipment has been implemented and is operating as intended. Post installation savings is determined from the same baseline model modified for the set points and energy rates.
	Performance Period	Annual on-site inspections of equipment for ongoing verification that energy control strategies are in place and sustainable

4.3 Project Data and Assumptions

Table 5 lists the utility rates that are to be utilized with for calculation of the baseline energy costs and retrofit cost savings of the equipment within the scope of the proposed project.

Table 5: Utility Rates

Site: Central Islip Library			
Utility Type	**Utility Provider**	**Utility Unit Cost**	**Unit**
Electricity	PSEG	$0.166486	$/kWh
Electricity Demand	PSEG	$11.972090	$/kW
Natural Gas	National Grid	$1.15	$/Therm

4.3.1 Development of the Baseline

The model of the existing building will accurately represent the building's physical dimensions, construction materials, thermal properties, HVAC zoning, etc. This information was collected from plans and site surveys. In addition, data on the building's operation schedule, zone set-points, occupancy rate, etc. was collected from HOBO data logging devices. Actual weather data for the 12-month period between 07/22 and 07/23 was obtained from the closet airport weather station. This data will be used to construct the existing building model. Data that has been used in the existing building model to characterize the building's operation conditions and occupancy rates will be reviewed and updated, as necessary. Any unanticipated changes in the new equipment's performance, discovered during the course of its installation or commissioning process, will be noted and used to model the post-installation building. Weather data from the local weather station will be collected and prepared for use in the post-installation model.

Measurement Boundary
All ECMs at the facility are fed by the same electric meter, so the building's billed energy usage, encompassing the heating, cooling, and DHW systems as well as other loads, is the measurement boundary for the facility.

Interactive Effects
ECMs for the building envelope and roof replacement interact with HVAC upgrades and BMS installation, as they are all associated with the operation of the building's heating and cooling system. As a result, the actual operation of the new RTUs at the facility will impact these measures. These interactive effects are inherently captured as a part of the billing analysis option C.

4.3.2 Verification of Savings

Because the building will receive several energy efficiencies upgrades, a combination of M&V options B and C is preferred. Utility bill analysis and metering will be performed.

The installed BMS control system will be used to monitor building performance variables during the post-installation period, and data will be reviewed during each post installation year to

ensure proper operation of the equipment. The collected data will be used to verify that the new equipment performs as expected to generate savings.

Determination of First-year Savings.
Once the basic model of the existing building is developed, it will be tuned with the best available data in order to make it reasonably accurate in predicting the existing building's monthly energy usage. Increased model accuracy is achieved by investigating the model's simulation of its energy-consuming sub-systems and adjusting model inputs until it reasonably predicts monthly kWh usage in comparison with the utility bills. We will also use spot measurements of kW on the existing RTUs, and lighting circuits and compare them to the model's predicted usage of the same equipment to determine whether discrepancies exist, and to decide which adjustments to make. Monitoring of RTU and building performance data: The BMS control system will be set up to poll data from the new RTU. This data will be used for calibrating the post-installation model. The simulated building's subsystems of interest (RTUs and heat pumps) will be compared with the monitored data. The whole-building's kWh usage will be compared with the 12 monthly utility bills.

The estimated first-year savings will be calculated by subtracting the annual kWh usage of the post-installation model from that of the baseline model. Lighting savings will be determined by subtracting lighting kWh usage of the post installation model from that of the baseline model. The annual kWh savings from the building envelope, roof insulation, and plug loads will be determined from the differences in usages between the post-installation model and the baseline model.

4.4 ECM #1, 2, & 4 – 11: M&V Baseline

The M&V plan for the facility upgrades and improvements will follow IPMVP Option C using monthly facility utility bills. Option C analysis relies on leveraging utility bills, weather data, and historical weather data to forecast the energy consumption at a given facility. Typically, a baseline period is established prior to implementation of ECMs and a weather-adjusted baseline energy model is determined. This baseline model is calibrated to ensure an accurate prediction of facility consumption patterns. After the installation period, utility bills are collected again to examine the consumption once the measures have been implemented, and a new weather-adjusted energy model is developed. The baseline energy model is applied to the post-install weather conditions, and the difference between baseline and post-install is determined to be the energy savings as a result of the project. The figure below showcases the Option C methodology for determining whole-facility savings.

4.4.1 ECM 3 — Rooftop Solar Baseline

The M&V Plan for the Solar PV installations at the Central Islip Library will follow M&V Option B. The Option B approach will be used to quantify the energy savings associated with the Solar PV installation and annually verify that the measure continues to operate.

The M&V plan for this ECM assumes:

- The annual solar radiation as utilized in the calculation of the annual electrical generation of the PV array will be assumed to represent a typical meteorological year (TMY) and will be held constant during the performance period for the purpose of energy generation calculations.
- PV Module Performance and inverter efficiencies are based on manufacturer's data.
- An annual verification of the measure will be performed to document that the PV system remains installed and performing as specified in the Final Proposal.
- An annual collection of the generated electrical output from the PV system will be performed and recorded as verified savings.

Given that the solar PV system is not installed at present, the energy baseline is considered to be the maximum potential annual output of the array. The baseline energy was established through collection of various data parameters including:

- Geographic location of array
- DC system size (name plate rating)
- DC-to-AC derate Factors
- Array type (fixed, tracking, etc)
- Array tilt, azimuth

The data collected is used within the proposal to generate baseline energy generation for the PV system.

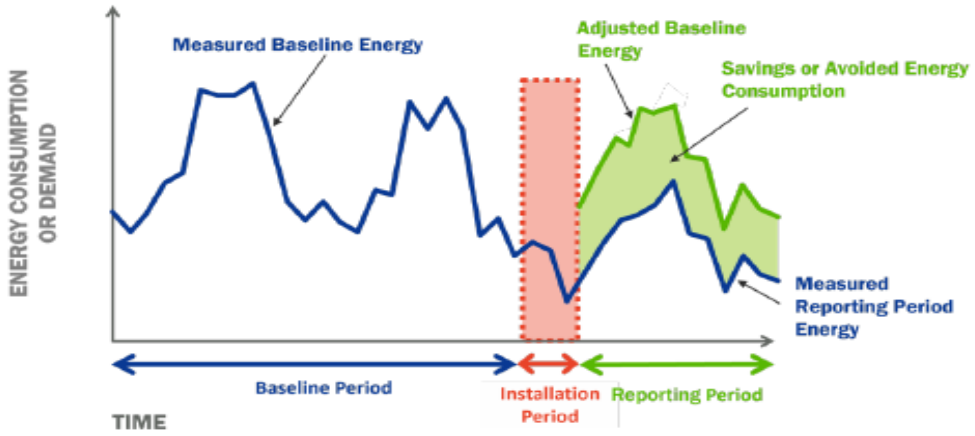
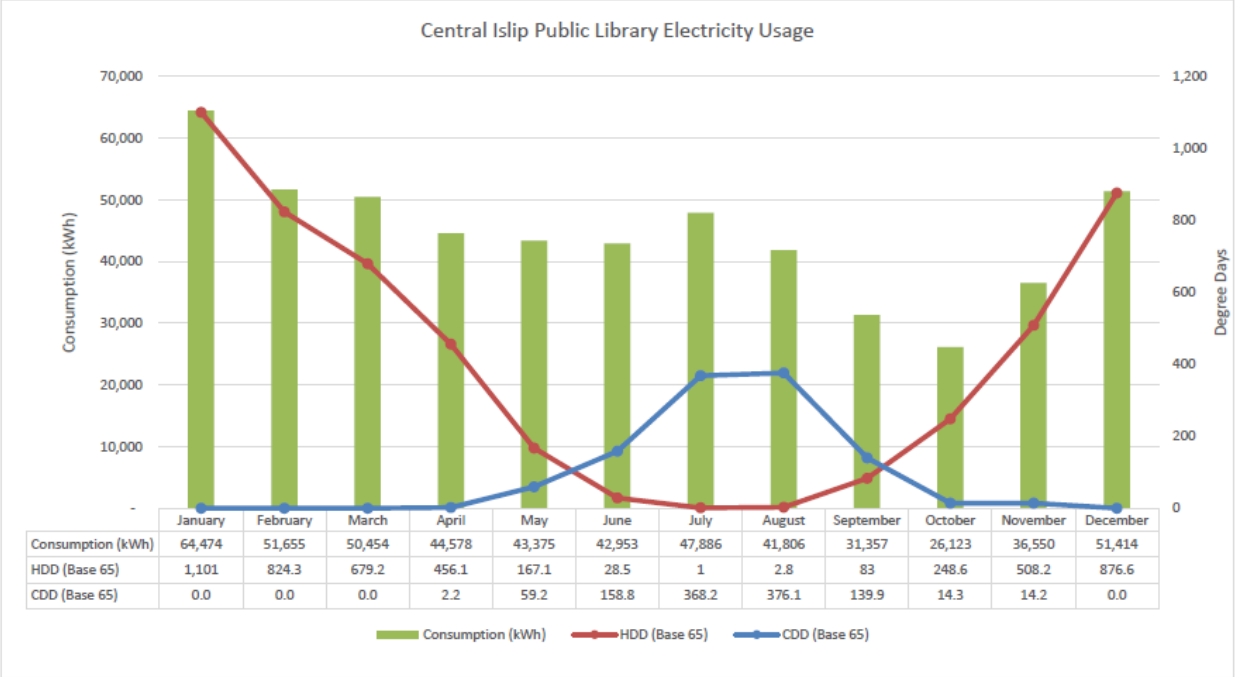


Figure 1: Option C Procedure (https://evo-world.org/en/products-services-mainmenu-en/protocols/ipmvp)

Since these ECMs improve the entire facility's efficiency in energy usage, operations, and weatherization, the interactive effects between these ECMs create a difficulty in isolating the savings contributed on a per ECM basis. In such cases, Option C analysis allows for a high-level view in determining the energy savings that can be attributed to a project overall. RENU will utilize facility electricity and gas utility bills for the Central Islip Public Library to determine the energy savings associated with the facility upgrades.

Electricity consumption from utility billing information was collected for all of 2022, as well as the observed heating/cooling degree days for the corresponding months. This information can be used to estimate the amount of conditioning a facility will need for a given period, in this case monthly. A regression model between monthly energy consumption and degree days was generated to describe how energy is consumed at this facility. For the Central Islip Public Library which currently relies solely on electricity to meet its heating, cooling and baseload needs, the following relationship was seen:



	January	February	March	April	May	June	July	August	September	October	November	December
Consumption (kWh)	64,474	51,655	50,454	44,578	43,375	42,953	47,886	41,806	31,357	26,123	36,550	51,414
HDD (Base 65)	1,101	824.3	679.2	456.1	167.1	28.5	1	2.8	83	248.6	508.2	876.6
CDD (Base 65)	0.0	0.0	0.0	2.2	59.2	158.8	368.2	376.1	139.9	14.3	14.2	0.0

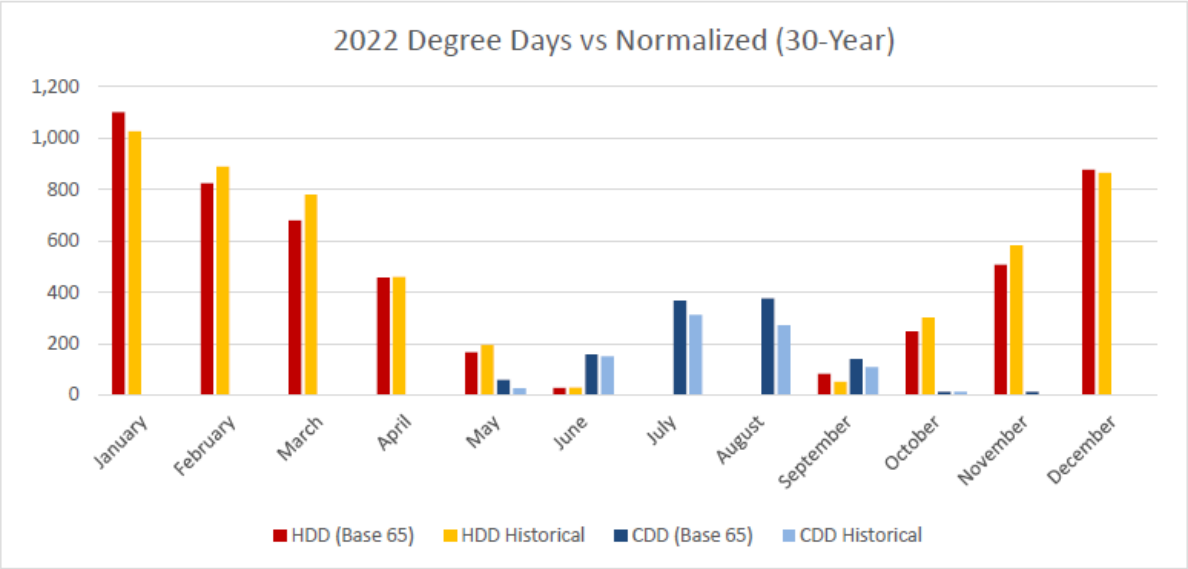
The graph above shows that as expected, the facility consumption is correlated with both heating and cooling degree days. The regression model determined to describe this behavior is shown below:

General Regression Equation	Consumption = b*Days + h*HDD + c*CDD
HDD Base Temperature (°F)	65
CDD Base Temperature (°F)	65
HDD Coeff. (kWh/HDD)	31.40
CDD Coeff. (kWh/CDD)	50.68
Baseload Coeff. (kWh/day)	871.94
Adjusted R2	0.64*
CVRMSE	0.14

The low R2 value for the regression equation is a result of the high building base load, as shown by the high baseload coefficient.

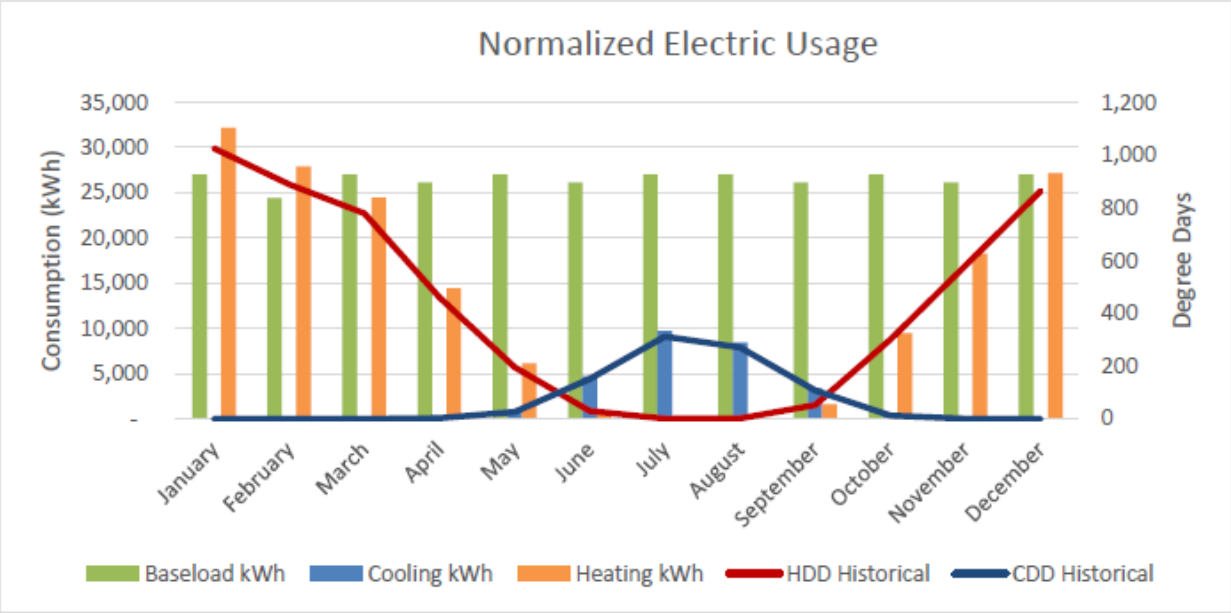
The regression equation is then applied to a 30-year normalized heating and cooling degree day dataset from a local weather station[1] to determine the facility baseline usage for a normalized

year. Normalized weather data is utilized to account for yearly variations in weather conditions. Shown below is a comparison of the degree days in the baseline year vs. the normalized degree days.



WBAN:04781 (KISP)		Observed		Normalized	
Month	Days	HDD (Base 65)	CDD (Base 65)	HDD Historical	CDD Historical
January	31	1,101	0.0	1,026	0
February	28	824.3	0.0	888.9	0
March	31	679.2	0.0	779.6	0
April	30	456.1	2.2	460	3
May	31	167.1	59.2	195.7	27
June	30	28.5	158.8	30.1	152
July	31	1	368.2	0.9	312
August	31	2.8	376.1	1.6	271
September	30	83	139.9	52.7	108
October	31	248.6	14.3	300.9	13
November	30	508.2	14.2	582.1	0
December	31	876.6	0.0	864.8	0
Total	365	4,976	1,133	5,183	885

Applying the regression model to the normalized weather data yields the facility baseline usage as follows.



	Consumption (kWh)
Normalized Baseline Usage	448,480
Baseline Year Usage	532,625

4.5 ECM #1, 2, & 4 – 11: M&V Phase

The purpose of the Measurement & Verification phase of the project will be to verify that the energy conservation measures that target the operations of the facility are implemented and functioning as designed. Utility bill analysis similar to the analysis above will be performed during the post-install period. In addition, to monitor the operational improvements and verify the intended control upgrades are functioning, the following trend points will be needed for operational verification:

4.5.1 Operational Verification Notes:

The parameter list is subject to change as the sequence of operation is finalized throughout the design process. To accurately determine operations and necessary additional trend points, RENU will require the intended sequence of operations of the new system during the design phase. Additionally, the Sample Areas will be chosen to capture unique space types that will be affected by the energy upgrades and any data collected will only be used to determine if the operational changes are implemented correctly. Data will not be used to determine energy savings.

General Notes:
This M&V plan assumes dedicated utility bills are available for the Central Islip Public Library. In the event that multiple gas/electric meters serve the library, it should be determined what equipment is associated with a given meter to ensure accurate savings estimates and realization rates.

4.6 ECMs — Post Installation and Performance Period Activities

4.6.1 ECM 1 — Roof Replacement

- Verify installation of new roof.
- Perform standard ASHRAE calculations to verify reduced heat transfer and infiltration.
- Through utility bill analysis to verify building operation became more efficient or that changes in operation have been taken into consideration.

4.6.2 ECM 2 — Building Envelope

The Post-Installation performance factors are heating system efficiencies and thermal integrity of windows, doors, roofs, and wall insulation. The intent of Performance Period verification activities is to ensure that the infiltration experienced in the building prior to implementing this ECM has been reduced as a result of various building envelope improvements. The intent is also to ensure that the building envelope improvements are being properly maintained.

4.6.3 ECM 3 — Rooftop Solar

The M&V plan for the rooftop solar panel installation will follow IPMVP Option B: Retrofit Isolation. To determine the energy consumption and costs that are offset by the onsite solar panels, data from the digital acquisition system (DAS) on the inverters is required. Additionally, cost savings will be determined based on the billing data detailing the generated energy, and details of the rate schedule. Examples of the trend data points required from the DAS and billing data are noted below.

Parameter	Units	Interval	Duration
Power Generated	kW	15 min	12 months
PV System Standby Use	kW	15 min	12 months
Power Returned to Utility	kW	Monthly	12 months
Power Returned to Grid Cost	$/kWh	Monthly	12 months
Rated PV Capacity	kW	N/A	One-Time

4.6.4 ECM 4 — LED Lighting and Lighting Controls

Upon project completion, an as-built inventory of post-installation lighting fixtures will be supplied, including the lighting ballasts and lamps installed, and lighting illumination levels (foot-candles) in each area. Savings predictions will be corrected based on as-built data and will be reported in the Post-Installation Report.

These measurements will be used to calculate actual expected energy savings and will be detailed in the Post-Installation Report. Additionally, we will measure the illumination levels in selected areas to gain insight into the current lighting conditions.

4.6.5 ECM 5, 6, 7, 8 - HVAC BMS Upgrades

The HVAC Controls portion of the audit tool utilizes Trane Trace, an hourly building simulation model to generate baseline and post-retrofit models of the facilities energy use. Trane Trace essentially utilizes standard heat transfer equations to determine heating and cooling loads based on the heat loss or gain through the building envelope, the amount of outdoor air brought into the building, and any source of internal heat gain such as lighting or occupants.

After the new HVAC units has been installed and commissioned, RENU will conduct a post-installation inspection to verify that the units installed is consistent with what was proposed and has the potential to generate the cost savings predicted.

4.6.6 ECM 9 — High Efficiency Gas-Fired Water Heater

RENU shall record the energy consumption of loads associated with the ECM. At the end of the one-year M&V period, summarize the gas consumption data for comparison with the baseline and expected consumption. The metered equipment shall be inspected at the conclusion of the M&V period and as needed to verify proper operation. All collected information and comparison results will be included in the M&V report. portion will be used to extrapolate if appropriate. Extension of the M&V period is also an option for mitigating the effect of lost data.

4.6.7 ECM 10 — Plug Load Controls

- Installation and commissioning of plug load control devices or systems, following design specifications.
- Post-installation data collection, covering the same parameters as the pre-installation phase, to measure the impact of control measures on energy use.
- Periodic inspections and maintenance to ensure the continued operation and optimization of plug load control systems.

Section 5: Appendices

Appendix 1 – Simple Payback Table

Appendix 2 – Project Proforma

Appendix 1 – Simple Payback Table

ECM #	Energy Conservation Measure "ECM" Description	Total Installed Cost	Rebates Financial Incentives	Net Installed Cost	Total Annual Energy Savings kWh	Total kW Savings	Total Annual Therm Savings	Total Annual Energy Savings $	Annual O&M Savings	Guaranteed Annual Energy Savings	Simple Payback
1	Roof Replacement	$573,375	$0	$573,375	8,687	0.0	0	$1,446	$500	$1,374	230.96
2	Building Envelope Improvements	$16,620	$0	$16,620	6,176	0.0	0	$1,028	$0	$977	9.42
3	Solar Ownership	$623,549	$187,065	$436,484	217,563	0.0	0	$36,221	$0	$34,410	4.59
4	Comprehensive Lighting Upgrades and Controls	$237,933	$15,401	$222,532	106,114	26.0	0	$21,402	$960	$20,332	5.72
5	Rooftop Unit Upgrades with VAV Boxes	$641,781	$2,902	$638,879	64,071	21.2	-1,830	$11,608	$3,500	$11,028	31.95
6	Replace Heat Pump with High Efficiency Heat Pump	$20,625	$2,520	$18,105	1,260	1.9	0	$483	$0	$459	19.40
7	Replace Vestibule Fan Coil Unit with High Efficiency Heat Pump	$34,375	$0	$34,375	5,534	3.0	0	$1,352	$0	$1,285	14.81
8	Install Building Management System (BMS)	$180,366	$0	$180,366	15,045	0.0	0	$2,505	$0	$2,380	41.95
9	Install High Efficiency Gas-Fired Water Heater	$17,875	$0	$17,875	2,285	3.5	-82	$789	$0	$750	13.20
10	Plug Load Controls	$4,984	$0	$4,984	3,636	0.0	0	$605	$0	$575	4.80
	Architect Fees	$117,574									
	Without $1,050,000 Library Contribution	$2,469,057	$207,888	$2,261,170	430,371	56	-1,912	$77,440	$4,960	$73,568	16.46
	With $1,050,000 Library Contribution*	$1,419,057	$207,888	$1,211,170							

*The Library is going to pay $1,050,000 to RENU to reduce the cost of the project to $1,419,057 before rebates and federal incentives.

Appendix 2 – Project Proforma

Project Cost	$2,351,483
CM Fee	$0
Architect Fee (5%)	$117,574
Financed Amount	$2,469,057

NPV = $1,374,296

Central Islip Public Library

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Total
Current Annual Energy Cost	$106,663	$110,396	$114,260	$118,259	$122,398	$126,682	$131,116	$135,705	$140,454	$145,370	$150,458	$155,724	$161,174	$166,816	$172,654	$178,697	$184,951	$191,425	$2,613,200
Post Installation Annual Energy Cost	$26,511	$27,439	$28,399	$29,393	$30,422	$31,487	$32,589	$33,729	$34,910	$36,132	$37,396	$38,705	$40,060	$41,462	$42,913	$44,415	$45,970	$47,578	$649,509
Annual Energy Savings	$80,152	$82,957	$85,860	$88,866	$91,976	$95,195	$98,527	$101,975	$105,544	$109,238	$113,062	$117,019	$121,115	$125,354	$129,741	$134,282	$138,982	$143,846	$1,963,690
Annual Guaranteed Savings	$76,143	$78,808	$81,566	$84,421	$87,375	$90,434	$93,599	$96,875	$100,265	$103,775	$107,407	$111,166	$115,057	$119,084	$123,252	$127,566	$132,030	$136,651	$1,865,473
Savings During Construction	$30,457																		
O&M Savings	$5,059	$5,160	$5,264	$5,369	$5,476	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$26,328
Rebates/Incentives	$207,888	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$207,888
Total Savings	$319,547	$83,968	$86,830	$89,790	$92,852	$90,434	$93,599	$96,875	$100,265	$103,775	$107,407	$111,166	$115,057	$119,084	$123,252	$127,566	$132,030	$136,651	$2,130,146
Project Finance Payment	$136,878	$136,878	$136,878	$136,878	$136,878	$136,878	$136,878	$136,878	$136,878	$136,878	$136,878	$136,878	$136,878	$136,878	$137,713	$0	$0	$0	$2,054,003
Payment for On-going Services	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
M&V Costs	$2,588	$2,639	$2,692	$2,746	$2,801	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$13,465
Total Costs	$139,465	$139,517	$139,570	$139,624	$139,679	$136,878	$136,878	$136,878	$136,878	$136,878	$136,878	$136,878	$136,878	$136,878	$137,713	$0	$0	$0	$2,067,468
Net Benefit w/o State Aid	$180,081	-$55,549	-$52,740	-$49,834	-$46,827	-$46,444	-$43,279	-$40,003	-$36,612	-$33,103	-$29,471	-$25,712	-$21,821	-$17,794	-$14,461	$127,566	$132,030	$136,651	$62,677
State Aid (0%)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Net Benefit with State Aid	$180,081	-$55,549	-$52,740	-$49,834	-$46,827	-$46,444	-$43,279	-$40,003	-$36,612	-$33,103	-$29,471	-$25,712	-$21,821	-$17,794	-$14,461	$127,566	$132,030	$136,651	$62,677
Cumulative Cash Flow with State Aid	$180,081	$124,532	$71,792	$21,958	-$24,869	-$71,313	-$114,592	-$154,595	-$191,208	-$224,311	-$253,782	-$279,494	-$301,315	-$319,109	-$333,570	-$206,004	-$73,974	$62,677	$62,677

Project Assumptions

Financing Term:	15 Years
Contract Term:	18 Years
Interest Rate:	5.00%
Utility Cost Inflation Rate:	3.5%
Discount Rate	5.5%
State Aid:	0%
Contribution from the District:	$1,050,000
RENU Savings Guarantee:	95.0%