10 SUSTAINABLE BUILDING DESIGN DOCUMENTS


Our World
Our Communities
Our Schools
TOGETHER WE ACHIEVE

10.1 Sustainable Building Design Narrative

For the Sustainable Building Design Narrative for the Florence Roche Elementary School, see Section 9.1 Sustainable Design Elements.

LEEDv4 BD+C: Schools (LEEDv4 SC)

Project Scorecard - MSBA SD Submission

Project Name: **Florence Roche Elementary School**

Date: **12/1/2020**

Y	?	N				
1	**0**	**0**		**Integrative Process**		**1**
1			Credit	Integrative Process		1
Y	**?**	**N**				
4	**3**	**8**		**Location and Transportation**		**15**
		N	Credit	LEED for Neighborhood Development Location		15
	1		Credit	Sensitive Land Protection		1
	2		Credit	High Priority Site		2
2		3	Credit	Surrounding Density and Diverse Uses (RP@4)		5
		4	Credit	Access to Quality Transit (RP@1)		4
		1	Credit	Bicycle Facilities		1
1			Credit	Reduced Parking Footprint		1
1			Credit	Electric Vehicles		1
Y	**?**	**N**				
4	**7**	**1**		**Sustainable Sites**		**12**
Y			Prereq	Construction Activity Pollution Prevention		Required
Y			Prereq	Environmental Site Assessment		Required
1			Credit	Site Assessment		1
	2		Credit	Site Development - Protect or Restore Habitat (RP@2)		2
	1		Credit	Open Space		1
1	2		Credit	Rainwater Management		3
	2		Credit	Heat Island Reduction		2
1			Credit	Light Pollution Reduction		1
		1	Credit	Site Master Plan		1
1			Credit	Joint Use of Facilities		1
Y	**?**	**N**				
4	**5**	**3**		**Water Efficiency**		**12**
Y			Prereq	Outdoor Water Use Reduction		Required
Y			Prereq	Indoor Water Use Reduction		Required
Y			Prereq	Building-Level Water Metering		Required
1		1	Credit	Outdoor Water Use Reduction		2
2	5		Credit	Indoor Water Use Reduction		7
		2	Credit	Cooling Tower Water Use		2
1			Credit	Water Metering		1
Y	**?**	**N**				
19	**9**	**3**		**Energy and Atmosphere**		**31**
Y			Prereq	Fundamental Commissioning and Verification		Required
Y			Prereq	Minimum Energy Performance		Required
Y			Prereq	Building-Level Energy Metering		Required
Y			Prereq	Fundamental Refrigerant Management		Required
5	1		Credit	Enhanced Commissioning		6
14	2		Credit	Optimize Energy Performance (RP@8)		16
	1		Credit	Advanced Energy Metering		1
	2		Credit	Demand Response		2
		3	Credit	Renewable Energy Production (RP@2)		3
	1		Credit	Enhanced Refrigerant Management		1
	2		Credit	Green Power and Carbon Offsets		2

Y	?	N				
5	**3**	**5**		**Materials and Resources**		**13**
Y			Prereq	Storage and Collection of Recyclables		Required
Y			Prereq	Construction and Demolition Waste Management Planning		Required
1	2	2	Credit	Building Life-Cycle Impact Reduction (RP@2)		5
1		1	Credit	BPDO - Environmental Product Declarations		2
	1	1	Credit	Building Product Disclosure and Optimization - Sourcing of Raw Materials		2
1		1	Credit	Building Product Disclosure and Optimization - Material Ingredients		2
2			Credit	Construction and Demolition Waste Management		2
Y	**?**	**N**				
8	**7**	**1**		**Indoor Environmental Quality**		**16**
Y			Prereq	Minimum Indoor Air Quality Performance		Required
Y			Prereq	Environmental Tobacco Smoke Control		Required
Y			Prereq	Minimum Acoustic Performance		Required
2			Credit	Enhanced Indoor Air Quality Strategies		2
2	1		Credit	Low-Emitting Materials		3
1			Credit	Construction Indoor Air Quality Management Plan		1
	2		Credit	Indoor Air Quality Assessment		2
1			Credit	Thermal Comfort		1
1		1	Credit	Interior Lighting		2
	3		Credit	Daylight		3
1			Credit	Quality Views		1
	1		Credit	Acoustic Performance		1
Y	**?**	**N**				
4	**2**	**0**		**Innovation**		**6**
1			Credit	Innovation: Resonsible Purchasing - Lamps		1
1			Credit	Innovation: Economic and GHG Analysis of Mechanical Systems		1
1			Credit	Innovation: Pilot - Integrative Analysis of Building Materials		1
	1		Credit	Innovation: TBD		1
	1		Credit	Innovation: TBD		1
1			Credit	LEED Accredited Professional		1
Y	**?**	**N**				
1	**2**	**1**		**Regional Priority (max of 4 points) Credit Names have been underlined**		**4**
		x	Credit	Surrounding Density and Diverse Uses (RP@4)		x
		x	Credit	Access to Quality Transit (RP@1)		x
	1		Credit	Site Development - Protect or Restore Habitat (RP@2)		1
1			Credit	Optimize Energy Performance (RP@8)		1
		1	Credit	Renewable Energy Production (RP@2)		1
	1		Credit	Building Life-Cycle Impact Reduction (RP@2)		1

50	38	22	**TOTALS**	Possible Points: **110**

Certified: 40 to 49 points, **Silver:** 50 to 59 points, **Gold:** 60 to 79 points, **Platinum:** 80 to 110

The Green Engineer
Sustainable Design Consulting

10.3 Signed Sustainability Letter

The Brewery 179 Boylston Street Jamaica Plain MA 02130
T 617-524-5558
F 617-524-5544

December 17, 2020

Ms. Christina Forde
Project Manager
Massachusetts School Building Authority
40 Broad Street, Suite 500
Boston, MA 02109

Florence Roche Elementary School
MSBA #2017067300010

Town of Groton
Florence Roche Elementary School
Groton, Massachusetts
Sustainability Document

Dear Ms. Forde:

This is an acknowledgement that the Groton-Dunstable Regional School District has identified a goal of 2% additional reimbursement from the MSBA High Efficiency Green School Program. As their Designer, I have submitted a complete LEEDv4 BD+C for Schools scorecard showing all prerequisites and 50 attempted points, which will meet that goal.

The scope of work for this project will include the construction elements and performance tasks to achieve that goal, and all subsequent documents, including but not limited to, specifications, drawings, and cost estimates will match the scope of work indicated in the submitted scorecard.

Please contact us if you have any questions or concerns.

Sincerely,

Studio G Architects

Gail Sullivan, FAIA
Managing Principal


Our World
Our Communities
Our Schools
TOGETHER WE ACHIEVE

RWS

HVAC

.

Electrical

.

Plumbing

.

Fire Protection

.

Code

.

Commissioning

Florence Roche Elementary School
Groton, MA

SCHEMATIC DESIGN ENERGY MODEL REPORT

December 1, 2020

Prepared for:
Studio G Architects

R.W. Sullivan Engineering

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Table of Contents

I. INTRODUCTION AND EXECUTIVE SUMMARY

The Florence Roche Elementary School project in Groton, MA consists of a new 2-story building with a total gross floor area of approximately 109,855 square feet. The building is fully air-conditioned and includes classrooms, a cafeteria, a gymnasium, kitchen, and administration wing.

The preferred HVAC option has been modeled against both MA Code and LEED V4 baselines:

- Proposed System – high efficiency chiller/boiler with displacement ventilation
- MA Code Baseline System – standard efficiency DX cooling units, hot water boilers, and standard VAV air handlers, meeting the requirements of the 2020 State Energy Code (IECC 2018/ASHRAE 90.1-2013 with MA Amendments).
- LEED V4 Baseline - standard efficiency DX cooling units, hot water boilers, and standard VAV air handlers per ASHRAE 90.1-2010

Design strategies contributing to the proposed building's energy efficiency include an improved building envelope, variable speed & energy recovery ventilation systems, displacement ventilation, demand controlled ventilation, high performance LED lighting, daylighting, and a DDC automatic temperature control system.

The results of the initial modeling indicate site energy use intensity (EUI, kBtu/ft^2 per year) as follows:

- Proposed Case – 33.9 EUI
- MA Code Baseline – 45.8 EUI
- LEED V4 Baseline – 54.1 EUI

These results provide the following estimations for building benchmark performance in terms of % savings over MA Code, % savings over LEED V4, and LEED V4 points:

- **Improvement over MA Code: 26%** (10% required to meet Stretch Code)
- **Improvement over LEED V4: 36%** (35% required to meet additional 2% MSBA Reimbursement)
- **Estimated LEED V4 Points: 14** (EApc95 Pilot for EAc2 credit)

With a predicted EUI in the mid-30's and 36% improvement over the LEED baseline, the energy model confirms the new Florence Roche Elementary School significantly exceeds MA Stretch Code requirements and puts the building on target for significant energy use reductions. In addition, the project is tracking to achieve the MSBA Sustainable Building Design Policy 2% reimbursement threshold.

II. ENERGY MODELING SOFTWARE AND INPUTS

A. General

1. The energy model compares the proposed building to baseline buildings as follows:

   a. Proposed – High Efficiency Chiller/Boiler with Displacement Ventilation

   b. MA Code Baseline – Standard Efficiency DX Cooling, Boiler with VAV Air Handlers, per MA amendments to IECC 2018/ASHRAE 901.-2013

   c. LEED V4 Baseline – Standard Efficiency DX Cooling, Boiler with VAV Air Handlers, incorporating ASHRAE 90.1-2010

2. Guidelines for detailing the building's envelope, lighting, and other attributes are given in Appendix G of ASHRAE 90.1-2010/2013, as amended by 780 CMR 13.00 for the Code baseline. The model uses the same climate data, energy rates, and modeling software as prescribed.

3. The energy model described in this report shall be used for comparison purposes only. Neither the proposed building performance nor the baseline building performance are predictions of actual energy consumption or costs for the proposed design after construction. Actual experience will differ from these calculations due to variations such as occupancy, building operation and maintenance, weather, energy use not covered by the ASHRAE procedure, changes in the energy rates between design of the building and occupancy, and the precision of the calculation tool.

B. Software

1. The building has been modeled using Trane's Trace 700 software (version 6.3.4). The program utilizes hourly energy analysis to determine annual energy consumption.

2. Trace 700 uses the ASHRAE and USGBC endorsed transfer function method for load calculations and a detailed 8,760 hour-by-hour energy simulation technique for the energy analysis. The program estimates annual energy use and costs for HVAC and non-HVAC energy consuming systems in a building by simulating building operation for each of the 8,760 hours in a year. Results of the energy analysis are used to compare the energy use and costs of alternate mechanical system designs or building envelopes so the best design can be selected. The program generates tabular and graphical reports of hourly, daily, monthly, or annual data.

3. The program requires input information on the building construction, fenestration type, insulation values, lighting levels and schedules, internal heat gains, occupant density, type of HVAC system, plant efficiency, occupancy schedules, and utility rates.

C. Utility Rates

1. The energy rates used for each option are based upon the following commercial electric and natural gas rates per the town's utility companies - Groton Electric and National Grid/Constellation Energy:

Utility	Rate
Electricity	$0.173 per kWh
Natural Gas	$1.03 per therm

D. Climatic Data

1. Groton is located in Climate Zone 5A per Table B-1 in ASHRAE 90.1-2013. The ASHRAE 0.4% outdoor design conditions are as follows:

   a. Summer dry bulb: 88°F
   b. Summer wet bulb: 75°F
   c. Winter dry bulb: 1°F

2. The energy analysis uses climatic data recorded at the closest weather station available - #744904 (Lawrence Municipal Airport), located in North Andover, MA. The weather file is titled *USA_MA_Lawrence.Muni.AP.744904_TMY3*.

E. System Temperature Setpoints

1. The building is modeled as being heated, cooled, and ventilated using mechanical means as proposed. The room temperature setpoints for the spaces in each option are as follows:

   a. Occupied Spaces: 75°F summer, 70°F winter
   b. Mechanical, Electrical, & Unoccupied: 85°F summer, 64°F winter

III. ENERGY CONSERVATION MEASURES

A. Architecture/Building Envelope

1. Increased wall & roof insulation
2. Better whole window U-value
3. Improved glazing solar heat gain coefficient (SHGC)

B. HVAC

1. High efficiency magnetic bearing chiller
2. Condensing hot water boilers
3. Variable speed pumping systems
4. Energy recovery air handlers
5. VAV Displacement Ventilation
6. Premium efficiency three-phase motors

7. Electrically commutated single-phase motors (ECMs)
8. DDC automatic temperature control system

C. Electrical & Lighting

1. LED lighting
2. Daylighting (not included in the model)

D. Plumbing

1. Condensing domestic water heaters
2. Low-flow shower and lavatory fixtures

IV. DETAILED COMPARISON OF PROPOSED AND BASELINE CASES

	Proposed	MA Code Baseline	LEED V4 Baseline
BUILDING ENVELOPE			
Roof	Assembly U-factor = 0.023 (R-40 c.i.)	Assembly U-factor = 0.027 (R-35 c.i.)	Assembly U-factor = 0.0476 (R-20 c.i.)
Wall Construction	Assembly U-factor = 0.040 (R-25 equivalent)	Assembly U-factor = 0.047 (R-21 equivalent)	Assembly U-factor = 0.064 (R-15.5 equivalent)
Windows	Double Glazed U-value = 0.33 (avg) SHGC = 0.28 with frames	Double glazed U-value = 0.357 (avg) SHGC = 0.46 with frames	Double glazed U-value = 0.50 (avg) SHGC = 0.46 with frames
Window-to-Wall Ratio (WWR)	24%	22% (per Appendix G)	24%
Infiltration	0.20 cfm/sf of wall	0.20 cfm/sf of wall	0.20 cfm/sf of wall
		Note: all baseline values incorporate IECC C406.8 UA requirements	*Note: all baseline values per ASHRAE 90.1-2010*
MECHANICAL SYSTEMS			
Central Plants	Cooling – Air-cooled High-Efficiency Magnetic Bearing Chiller. Heating – Gas fired Condensing hot water boilers. Chiller: 300-ton, 1.0 kW/ton full load efficiency 0.58 kW/ton IPLV 57°F entering water temp. 42°F leaving water temp. Boilers: Three at 2500-MBH each 95% efficient, 40°F delta T Variable frequency drives on all pumps.	Cooling – Air-cooled packaged DX Heating – Gas fired Near condensing hot water boilers. DX Cooling: 12 EER Boilers: Two @ 50% Capacity 90.2% efficient Variable frequency drives on all pumps. *Note: all values 10% improvement over Code per IECC C406.2*	Cooling – Air-cooled packaged DX Heating – Gas fired Near condensing hot water boilers. DX Cooling: 11.5 EER Boilers: Two @ 50% capacity 82% efficient Variable frequency drives on all pumps. *Note: all values per ASHRAE 90.1-2010*

	Proposed	MA Code Baseline	LEED V4 Baseline
HVAC System Types	Classrooms: Displacement ventilation with VAV air handlers with dual Energy Recovery wheels Perimeter hot water heating Admin: Overhead multi-zone VAV air handler. Cafeteria/Gym: Overhead single zone VAV air handlers with ERV wheel. Variable frequency drives on all fans.	Classrooms: Standard Overhead VAV air handlers with Energy Recovery wheels to pre-treat outside air. 30% min with reheat coils. Admin: Overhead multi-zone VAV air handler. 30% min with reheat coils. Cafeteria/Gym: Overhead single zone VAV air handlers with ERV wheel. Variable frequency drives on all fans.	Classrooms: Standard Overhead VAV air handlers with Energy Recovery wheels to pre-treat outside air. 30% min with reheat coils. Admin: Overhead multi-zone VAV air handler. 30% min with reheat coils. Cafeteria/Gym: Overhead single zone VAV air handlers with ERV wheel. Variable frequency drives on all fans.
Energy Recovery Eff.	75%	50%	50%
Outdoor Air Ventilation Rates	Per ASHRAE 90.1-2010	Per ASHRAE 90.1-2010 and equal to proposed	Per ASHRAE 90.1-2010 and equal to proposed
Air-side Economizer	All VAV Air handlers– Enthalpy switch	All VAV Air handlers– Dry Bulb switch	All VAV Air handlers– Dry Bulb switch
Exhaust Systems	Mechanical Spaces: Constant speed fans. Kitchen: 5000-cfm hood with tempered make-up air unit and DCV hood controls.	Mechanical Spaces: Constant speed fans. Kitchen: 5000-cfm hood with tempered make-up air unit	Mechanical Spaces: Constant speed fans. Kitchen: 5000-cfm hood with tempered make-up air unit
PLUMBING SYSTEMS			
System Type Fixtures	Condensing Domestic Water Heaters, 95% efficient. Low flow fixtures with 25% hot water use reduction over baseline	Standard Domestic Water Heaters, 80% efficient.	Standard Domestic Water Heaters, 80% efficient.
ELECTRICAL SYSTEMS			
Lighting Power Density – LPD per Building Area Method (W/sq. ft.)	0.5 W/sf *(Target LPD)*	0.65 W/sf *(10% improvement per IECC C406.3)*	0.99 W/sf *(Per ASHRAE 90.1-2010)*
Equipment Power Density (unregulated loads)	0.20-0.75 W/sf depending on space usage. MRL Elevator.	0.20-0.75 W/sf depending on space usage. MRL Elevator.	0.20-0.75 W/sf depending on space usage. MRL Elevator.
Kitchen Equip.	20% overall load reduction from baseline	Baseline efficiency	Baseline efficiency
Daylighting Controls	Not included in the model at this time	Not included in the model at this time	Not included in the model at this time

V. ENERGY MODEL RESULTS

A. Energy Use Data

1. The following table summarizes the results of the energy modeling based on the output from Trace 700. As the data show, the proposed building option significantly outperforms the baseline systems in terms of EUI:

Annual Energy Usage Data

Utility	Proposed	MA Code Baseline	LEED V4 Baseline
Electricity (kWh)	628,779	817,107	942,095
Natural Gas (therms)	15,266	21,737	26,411
EUI [kBtu/ft^2/yr]	**33.8**	**45.8**	**54.1**
Improvement over MA Code:	**26.0%** (10% needed to meet Stretch Code)		

B. Energy Cost Data

1. Using the local utility rates, the model also compiles the annual energy costs for each model run. Energy cost improvements form the basis for assessing performance in LEED V4, credit EAc2:

Annual Energy Cost Data

Utility	Proposed	MA Code Baseline	LEED V4 Baseline
Electricity ($)	$108,779	$141,360	$162,982
Natural Gas ($)	$15,724	$22,389	$27,203
Total Utility Cost ($):	**$124,502**	**$163,749**	**$190,185**
Improvement over MA Code (Cost):		**23.9%**	
Improvement over LEED V4 (Cost):		**34.5%**	
Improvement over LEED V4 (Pilot):		**36.0%**	
EAc2 LEED Points (Cost):		**12**	
EAc2 LEED Points (Pilot):		**14**	

VI. CONCLUSIONS

With a predicted EUI in the mid 30's, the energy model confirms the proposed new Florence Roche Elementary School greatly exceeds MA Stretch Code requirements. With LEED V4 savings at 36% and 14 points, the project is also on track to achieve the additional 2% MSBA Sustainable Building Design Policy reimbursement threshold.

VII. ENERGY MODEL OUTPUT REPORTS

Energy Cost Budget Report

Note: The percentage displayed for the "Proposed/ Base %" column of the base case is actually the percentage of the total energy consumption.

* Denotes the base alternative for the ECB study.

		* Alt-1 Proposed			Alt-2 MA Code Baseline			Alt-3 LEED V4 Baseline		
		Energy 10^6 Btu/yr	Proposed / Base %	Peak kBtuh	Energy 10^6 Btu/yr	Proposed / Base %	Peak kBtuh	Energy 10^6 Btu/yr	Proposed / Base %	Peak kBtuh
Lighting - Conditioned	Electricity	367.4	10	185	477.6	130	240	727.5	198	366
Space Heating	Gas	1,526.6	42	1,748	2,173.7	142	2,495	2,641.1	173	3,186
Space Cooling	Electricity	173.5	5	712	630.0	363	1,081	801.0	462	1,258
Pumps	Electricity	12.7	0	31	31.1	246	6	35.1	277	13
Heat Rejection	Electricity	0.0	0	0	48.7	0	85	52.4	0	93
Fans - Conditioned	Electricity	820.3	22	513	814.5	99	424	812.6	99	495
Receptacles - Conditioned	Electricity	709.9	19	409	724.6	102	416	724.6	102	416
Stand-alone Base Utilities	Electricity	62.3	2	10	62.3	100	10	62.3	100	10
Total Building Consumption		3,672.6			4,962.5			5,856.4		

		* Alt-1 Proposed	Alt-2 MA Code Baseline	Alt-3 LEED V4 Baseline
Total	**Number of hours heating load not met**	28	22	27
	Number of hours cooling load not met	52	33	29

	* Alt-1 Proposed		Alt-2 MA Code Baseline		Alt-3 LEED V4 Baseline	
	Energy 10^6 Btu/yr	Cost/yr $/yr	Energy 10^6 Btu/yr	Cost/yr $/yr	Energy 10^6 Btu/yr	Cost/yr $/yr
Electricity	2,146.0	108,779	2,788.8	141,360	3,215.4	162,982
Gas	1,526.6	15,724	2,173.7	22,389	2,641.1	27,203
Total	**3,673**	**124,502**	**4,963**	**163,749**	**5,856**	**190,185**

Monthly Energy Consumption Reports

MONTHLY ENERGY CONSUMPTION

By ROBERT W. SULLIVAN, INC.

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

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Alternative: 1	**Proposed**												
Electric													
On-Pk Cons. (kWh)	53,151	47,252	55,577	48,351	53,909	57,641	50,339	57,466	52,797	51,815	50,420	50,058	628,779
On-Pk Demand (kW)	273	273	274	270	357	463	539	539	478	287	273	273	539
Gas													
On-Pk Cons. (therms)	2,412	1,908	1,423	1,156	751	688	856	967	744	1,041	1,243	2,076	15,266
On-Pk Demand (therms/hr)	17	17	15	13	3	3	4	4	3	11	14	17	17
Water													
Cons. (1000gal)	9	8	7	5	5	5	4	5	4	5	6	8	70

Energy Consumption	
Building	33,924 Btu/(ft2-year)
Source	74,318 Btu/(ft2-year)

Environmental Impact Analysis	
CO2	753,937 lbm/year
SO2	2,359 gm/year
NOX	638 gm/year

Alternative: 2	MA Code Baseline												
Electric													
On-Pk Cons. (kWh)	58,398	52,407	59,160	51,790	76,715	91,462	82,883	93,527	81,931	59,309	54,050	55,475	817,107
On-Pk Demand (kW)	367	368	363	374	521	561	644	653	568	394	371	366	653
Gas													
On-Pk Cons. (therms)	3,544	2,914	2,038	1,622	950	763	1,072	1,205	947	1,591	1,811	3,280	21,737
On-Pk Demand (therms/hr)	25	24	19	17	5	3	6	6	4	15	18	23	25
Water													
Cons. (1000gal)	7	7	6	5	4	4	3	4	4	6	6	7	64

Energy Consumption	
Building	45,839 Btu/(ft2-year)
Source	98,424 Btu/(ft2-year)

Environmental Impact Analysis	
CO2	979,753 lbm/year
SO2	3,065 gm/year
NOX	830 gm/year

Alternative: 3	LEED V4 Baseline												
Electric													
On-Pk Cons. (kWh)	65,751	58,916	67,279	58,803	90,981	108,162	95,177	107,158	97,529	68,401	61,461	62,476	942,095
On-Pk Demand (kW)	448	449	443	451	615	662	754	761	666	470	449	446	761
Gas													
On-Pk Cons. (therms)	4,782	3,765	2,538	1,893	974	781	1,054	1,187	968	1,881	2,292	4,296	26,411
On-Pk Demand (therms/hr)	30	32	26	22	7	3	6	6	5	22	24	29	32
Water													
Cons. (1000gal)	8	7	7	7	4	4	3	4	4	7	7	8	72

Energy Consumption	
Building	54,096 Btu/(ft2-year)
Source	114,791 Btu/(ft2-year)

Environmental Impact Analysis	
CO2	1,134,570 lbm/year
SO2	3,550 gm/year
NOX	961 gm/year

LEED EApc95 Pilot Credit Worksheet for EAc2

B. Indicate the baseline and proposed total annual site energy consumption by utility.

Energy Source	*Units (Consumption)*	*Baseline*	*Proposed*
Electricity	Btu x 10^6	3,215.4	2,146.0
Natural Gas	Btu x 10^6	2,641.1	1,526.6
Total	**Btu x 10^6**	**5,856.5**	**3,672.6**
Savings			**37.29%**

C. Indicate the baseline and proposed total annual energy cost by utility.

Energy Source	*Baseline*	*Proposed*
Electricity	$ 162,982	$ 108,779
Natural Gas	$ 27,203	$ 15,724
Total	**$ 190,185**	**$ 124,503**
Savings		**34.54%**

D. Indicate the Baseline and Proposed monthly peak electric demand.

	Baseline (kW)	*Proposed (kW)*
January	***448***	***273***
February	***449***	***273***
March	***443***	***274***
April	***451***	***270***
May	***615***	***357***
June	***662***	***463***
July	***754***	***539***
August	***761***	***539***
September	***666***	***478***
October	***470***	***287***
November	***449***	***273***
December	***446***	***273***
Annual	***761***	***539***
Savings		**29.17%**

E. Indicate the data used for the Energy Source metric. If not using the energy factors reported in the ENERGY STAR Portfolio Manager Technical Reference: Source Energy, upload published data demonstrating that these ratios were determined consistently with the ENERGY STAR Portfolio Manager Technical Reference: Source Energy or ISO 16346:2013; OR if a local equivalent has been used, upload a narrative and any relevant background data explaining how the source / primary energy factors were developed and any third-party review of those calculations that have occurred.

Source Energy (US) - ENERGY STAR Portfolio Manager

Indicate the source-to-site ratios or primary energy factors for each building energy source.

Energy Source	*Source-to-Site Ratio*	*Baseline (Btu x 10^6)*	*Proposed (Btu x 10^6)*
Electricity	2.8	9,003.1	6,008.8
Natural Gas	1.05	2,773.2	1,602.9
		-	-
		-	-
		-	-
		-	-
Total		**11,776.3**	**7,611.7**
Savings			**35.36%**

F. **Indicate the data used for the Greenhouse Gas Emission factors.** With the exception of projects using the values published in the ENERGY STAR Portfolio Manager Technical Reference: Greenhouse Gas Emissions, upload the published greenhouse gas emission factors along with documentation demonstrating that these were calculated consistent with the ENERGY STAR Portfolio Manager Technical Reference: Greenhouse Gas Emissions, or ISO 16346:2013, or utility specific factors for each energy source serving the project have been verified by the Climate Registry within the last three years from the date of project registration and are the most current available. Alternatively, if a local equivalent is used, upload a narrative and any relevant background data explaining how the emissions factors were developed and any third-party review of those calculations.

ENERGY STAR Portfolio Manager Technical Reference: Greenhouse Gas Emissions Methodology

Indicate the Greenhouse gas emission factors for each building energy source.

Energy Source	*GHG Emission Factor (kG/Btu x 10^6)*	*Baseline (kg CO2 Emissions)*	*Proposed (kg CO2 Emissions)*
Electricity	70.10	225,399.5	150,434.6
Natural Gas	53.06	140,136.8	81,001.4
		-	-
		-	-
		-	-
		-	-
Total		**365,536.3**	**231,436.0**
Savings			**36.69%**

G.

TDV Energy. If the project is located in California, or opts to provide TDV Energy calculations, provide the total baseline and proposed TDV energy consumption calculated in accordance with California Energy Commission publications, and the percentage improvement in TDV energy consumption using this method.

Indicate the TDV total energy used.

Energy Source		*Baseline (TDV)*	*Proposed (TDV)*
Electricity			
Natural Gas			
Total		**-**	**-**
Savings			**0.00%**

H. **Percentage Improvement Used to Determine Minimum Energy Performance Prerequisite Compliance and Optimize Energy Performance Points:**

Savings	**36.02%**

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