

## FINANCE COMMITTEE MEETING

Meeting Minutes Approved 11/02/21  
Monday, October 12 2021 @ 6:00 P.M.  
Virtual Meeting

BROADCAST ON ZOOM AND THE GROTON CHANNEL  
PURSUANT TO GOVERNOR'S EXECUTIVE ORDER  
CONCERNING THE OPEN MEETING LAW  
<https://us02web.zoom.us/j/88410845561>  
WEBINAR ID: 88410845561

**FinCom Members Virtually Present:** B. Robertson, Chair; A. Prest, D. Manugian, M. Linskey, Clerk; S. Whitefield, C. Doody, Vice Chair

**FloRo School Building Committee Virtually Present:** F. Raynor, M. Haddad, C. Doody, L. Callahan, L. Chesson, M. Gilbert, S. Kersey, A. Manugian, B. O'Donoghue

**Select Board Virtually Present:** A. Manugian, J. Reilly, J. Degen, B. Pine (Chair), P. Cunningham

**Also Virtually Present:** P. Dufresne, Town Accountant, Representatives from Left Field (D. Saindon), PM&C (J. Roach), and Studio G

At 6:00 P.M. the Chairs of Select Board, FinCom & Building Committee called their respective meetings to order.

Mr. Saindon informed the group that he is still waiting for a waiver from the State before the expected MSBA reimbursements owed to the Town will be delivered. This should be resolved shortly.

**HVAC Design Proposal:** Ms. Raynor stated that because this is such a complex and costly decision, she called a joint meeting of these various boards in order to hear as many opinions as possible. She noted that an analysis of the mechanical system was sent out to all attendees for their review. Ms. Manugian expressed her frustration that some of the relevant materials were not delivered in a timely manner, only arriving a few hours before the meeting. Mr. Haddad agreed. Studio G disagreed, stating that the most important materials were sent several days ago which would seem to leave plenty of time for review. The whole prospect of adding a photo voltaic grid (to be provided by GELD) was a late addition to the process. An additional study of 2 different systems was undertaken in order to provide the best possible comparisons for the Town. The cost variance for the newly proposed system is \$1.45 million. This would have to come out of the design contingency and represents about 30% of the entire contingency. That said, it is very early in the project to consider spending such a large portion of that contingency. But a PV array will improve both the old and new system designs, and that is not the core decision to make tonight. A graphic of the building mechanical infrastructure was shown to the group, with chiller

unit pointed out. VRF would take the place of a chiller, and heat pumps would then run on electricity and provide heat and cooling.

Mr. Robertson said that the numbers as provided in the various documents are confusing and seem to contradict each other in places. Mr. Haddad said that he is very concerned about spending 30% of the contingency this early in the project. Mr. Degen agrees with Mr. Haddad. He pointed out that construction and supply chain costs are escalating quickly. We may need to use that contingency just to meet our budget with the current design. We should adhere to the proposal that we presented to the voters at Town Meeting.

Ms. Raynor noted that we designed a traditional building, but subsequently had a conversation with GELD about utilizing solar panels as an alternative energy source. The industry is leaning toward electric now in order to meet carbon neutral regulations. As Groton is a green community, and the town has supported this initiative, we should explore this opportunity. However, the high price tag will be difficult to absorb. Also, if GELD puts PV on the gas design, the projected carbon footprint is even lower than the electrified design.

Kevin Kelly spoke on behalf of the GELD commissioners. He explained that his board is willing to invest \$1 million in solar panels, but only if the Building Committee also invests in the greener design. GELD is not interested in subsidizing this project without Town engagement as well.

Mr. Manugian agreed with the Mr. Haddad. He suggested that the Building Committee prioritize spending and find ways to cut the budget in order to move ahead with making the building greener.

Studio G pointed out that the difference in costs provided in the various documents have to do with the idea of GELD putting PV arrays on the gas design. If the district buys PVs, the electric that comes from the grid would be at no cost to the district (excepting the capital cost). If GELD provides the PVs, that benefit is forfeit. This explains the difference in the numbers provided.

Mr. Robertson reminded the group that the project was authorized based on a specific set of numbers already presented to the Town. Also, a project with an ROI of 17.7 years is inherently problematic, unless cost is not an issue and the only concern is being carbon-neutral. This is not the case in this situation.

Ms. Manugian moved that the project move forward with the original mechanical design. Mr. Haddad seconded this motion.

Ms. Raynor encouraged additional discussion. Ms. Gilbert said that while she is concerned about building a 50-year non-green school, it is important that all new proposals are beneficial to the Town and taxpayers. She stressed that going back to Town Meeting to request more funds for this project is not an option. The project must come in under budget. She suggested that there may be a future opportunity to make the mechanical upgrade proposed tonight.

Mr. Haddad pointed out that the contingency on this project is only \$7 million and COVID has created a lot of volatility regarding construction costs. The project may struggle to meet budget limitations even without design changes at this point. Budget cuts may have to be considered

before construction is even finished. He is opposed to making the HVAC design change proposed.

Mr. Cunningham asked what the cost would be to design the HVAC to be ready for an upgrade in the future. Ms. Raynor replied that there would be no cost as the conduits, and infrastructure are in place and, in fact, required. She pointed out that the ROI calculation may not be absolutely accurate because 1 to 1 net metering is not available here.

Ms. Pine asked about the battery energy storage. Ms. Raynor replied that this is already part of the project and will be provided no matter what is decided at this meeting. Ms. Pine suggested pursuing private fundraising in support of upgrading the HVAC in the future. Mr. Degen agreed and said that any new proposal should be brought back to Town Meeting to authorize any additional funding needs. Mr. Saindon clarified that if funds were left over at the end of the construction, it would be up to the Building Committee to decide how these would be spent. They could put this toward an HVAC upgrade, or not. But the infrastructure allowing this upgrade would be in place no matter what. Mr. Degen said that gas with PV already provides a good carbon footprint result; he warned against electrifying now. Ms. Raynor confirmed that the Town could decide at any time in the future to put solar panels on the roof.

Studio G reminded the group that a decision on the HVAC must be reached at this meeting. The PV decision can come later.

Ms. Gilbert applauded the idea of private fundraising and suggested that someone should start working on this immediately. If we have the money at the end of the project, from whatever source, that would be the time to do it, once all the costs are known. She noted that if the proposal were taken back to Town Meeting, it should also be the subject of a ballot vote.

Mr. Kelly felt that the carbon footprint of the electric option would end up being lower than shown in the proposal. The group discussed the various elements to be impacted by a hybrid mechanical design. Mr. Robertson summarized saying that it is too late in the process to make an expensive change to the HVAC design. Furthermore, the ROI is not favorable. He feels this option should be considered again in the future.

Mr. Haddad moved the question and Ms. Manugian seconded that motion. The vote to move the question carried by unanimous vote. The committee then considered the main motion to proceed with the original HVAC design plan (previously moved by Ms. Manugian and seconded by Mr. Haddad). The Building Committee voted unanimously in favor of this motion.

The Finance Committee meeting adjourned at 7:00 pm

Respectfully submitted,

Patricia Dufresne, Town Accountant

## Upfront Financial Budget Analysis for Proposed Partial VRF [HVAC] Change

	[a]	[b]	[c]	[d] = [c-b]
Cost Category	Schematic Design [Project Budget]	Current Budget [CM Award]	Partial VRF	Delta Over[Under] from Current Budget to Partial VRF
Bldg.	\$ 36,984,070	\$ 36,984,070	\$ 38,164,962	\$ 1,180,892
Site	\$ 8,905,486	\$ 8,905,486	\$ 8,905,486	\$ -
<b>Trade Cost Total</b>	<b>\$ 45,889,556</b>	<b>\$ 45,889,556</b>	<b>\$ 47,070,448</b>	<b>\$ 1,180,892</b>
Design/estimating cont. [10%]	\$ 4,588,956	\$ 4,588,956	\$ 4,707,045	\$ 118,089
Escalation Allowance [5%]	\$ 2,294,478	\$ 2,294,478	\$ 2,353,522	\$ 59,045
<b>Trade Cost Total w/ Cont.</b>	<b>\$ 52,772,989</b>	<b>\$ 52,772,989</b>	<b>\$ 54,131,015</b>	<b>\$ 1,358,026</b> *
General Conditions [fixed value]	\$ 3,120,000	\$ 3,351,944	\$ 3,351,944	\$ -
General Requirements	\$ 1,583,190	\$ 1,583,190	\$ 1,623,930	\$ 40,741
Insurances	\$ 738,822	\$ 705,700	\$ 721,110	\$ 15,410
Bond	\$ 395,797	\$ 391,390	\$ 399,937	\$ 8,547
Fee [fixed value]	\$ 1,465,270	\$ 1,177,409	\$ 1,177,409	\$ -
GMP Cont.	\$ 1,465,270	\$ 1,470,130	\$ 1,505,698	\$ 35,568
<b>Total Construction [hard costs]</b>	<b>\$ 61,541,338</b>	<b>\$ 61,452,752</b>	<b>\$ 62,911,044</b>	<b>\$ 1,458,292</b>
Pre Con [fixed value]	\$ 200,000	\$ 135,000	\$ 135,000	\$ -
<b>Total Pre-Con &amp; Construction</b>	<b>\$ 61,741,338</b>	<b>\$ 61,587,752</b>	<b>\$ 63,046,044</b>	<b>\$ 1,458,292</b>
<b>Over[Under]</b>		<b>\$ (153,586)</b>	<b>\$ 1,458,292</b>	
		<b>Under</b>	<b>Over</b>	

\* Essentially, this is the value [the trade value] that should be held, or controlled.

\*\* These values are estimated values; please note that any increase beyond the \$52,772,989 trade cost value results in a prorated increase with insurance and bond costs to the CM.

Values in green represent Gilbane's CM contract

### Design/estimating contingency impact summary

Design/estimating cont. [10%]	\$ 4,588,956
Partial VRF implementation	\$ 1,458,292
Percent VRF implementation would take from Design/estimating Cont.	32%

### Executive Summary

1. The total project budget, minus the feasibility study is \$77,900,734. This is what was approved at Town Meeting and the subsequent debt exclusion vote.

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2. The Project budget for construction and pre-construction is \$61,741,338; please see column [a]. This includes and is based on the original HVAC basis of design. This is one line of many in the total project budget.

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3. The CM Award [Gilbane contract] resulted in a \$153,586 cost savings to the construction line in the Project budget; please see column [b].

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4. Based on the PM+C estimate for implementing the proposed VRF system [partial electrified HVAC], the estimated increase to the total trade costs is roughly \$1.2m. Applying the appropriate contingencies would bring this value to roughly \$1.36m; please see column [c].

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5. If the decision was made to include the proposed VRF into the project, the total estimated impact would be \$1.46m; please see column [c].

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## October 12, 2021 - Committee Meeting Outline and Proposed Motions

### Outline [Agenda]:

1. Call meeting to order
  
2. Vote to approve meeting minutes: Meeting minutes for the 9/14/21 school building committee meeting were included in the meeting packet sent out on 10/8/21. Please see item 2 in the meeting packet.  
**Proposed Motion:**  
**Motion to approve Meeting Minutes from the 9/14/2021 School Building Committee Meeting.**
  
3. Vote to approve invoices & commitments: Updated budget and invoice package #27 totaling \$388,950 are included in the meeting packet; Leftfield's periodic invoice for Design Development in the amount of \$30,000; SGA's periodic invoice for Design Development in the amount of \$346,000 and SGA's Invoice for Samiotes work associated with the Site Survey in the amount of \$12,950. Please see item 3 in the meeting packet.  
**Proposed Motion:**  
**Motion to approve Invoice Package #27 totaling \$388,950 – invoices included in this invoice package include Leftfield's invoice for Design Development in the amount of \$30,000, SGA's invoice for Design Development in the amount of \$346,000, and SGA's invoice for Samiotes associated with the site survey in the amount of \$12,950.**
  
4. Designer & OPM Updates:
  - a. Vote to approve SGA Amendment #4 [BESS, HVAC re-design]: At the 9/14/2021 SBC Meeting, the SBC voted to authorize SGA to proceed with the additional services for the implementation of the Battery Energy Storage System [BESS] into the Design for an additional service value of \$20,000. In addition, the SBC also votes to authorize SGA to study an HVAC Re-design exploration [electrified/VRF] in the amount of \$45,000. This above-mentioned work is underway and this amendment is to officially incorporate this work into SGA's contract. Please see item 4a in the meeting packet.

**Proposed Motion:**

**Motion to approve SGA Amendment #4 in the amount of \$65,000 for the HVAC Re-Design and for the implementation of a Battery Energy Storage System [BESS] into the Design.**

- b. Vote to approve Budget Revision Request [BRR] #8: A Budget Revision Request [BRR] is a document required from the MSBA when there is a budget move/transfer; this BRR allows the \$65,000 amendment mentioned in item 4a above to be paid for from Owner's Contingency as noted on the BRR. Please see item 4b in the meeting packet.

**Proposed Motion:**

**Motion to approve BRR #8 related to SGA Amendment #4 for the implementation of a BESS into the project and a study related to partially electrifying the HVAC system.**

- c. Heating, Ventilation, Air Conditioning [HVAC] Design Update: SGA and R.W. Sullivan will present their findings from the HVAC Design exploration. Please refer to the folder titled HVAC Design Study in the meeting packet. Within this folder, you will see the following files. **This is a lot of information to digest; however, I strongly urge everyone to read the executive summary PDF titled "2021-10-**

**08 FRES HVAC Electrification summary SGA"**

-  2021-10-08\_FRES\_HVAC\_Electrification Executive summary\_SGA
-  EXHIBIT\_01\_FRES\_SGA\_Additional Services\_HVAC\_2021-09-01\_
-  EXHIBIT\_02\_FRES SGA Amendment #4 - Proposals included
-  EXHIBIT\_03\_FRES MEPFP Systems Strategic Electric Narrative\_2021-09-03
-  EXHIBIT\_04\_FRES SD estimate 10.5.21 RECON FINAL with HVACElectrification
-  EXHIBIT\_05\_FRES V10 ENERGY Model Summary\_2021-10-07 Final
-  Upfront VRF cost analysis with exec summary

**Proposed Motion:**

**Proposed motion to be defined during the meeting. As stated in the SGA executive summary, a final determination is required at the meeting to avoid delays to the project schedule.**

- d. Exterior Design Update: SGA will present their updated exterior design. Please refer to the folder titled Exterior Design Update in the meeting packet. In this folder is one file which is shown below.

 2021-10-12\_FRES\_SchoolBuildingCommittee Presentation\_FINAL

5. School Building Committee Meeting Schedule: Ms. Manugian has notified us that she has a conflict going forward on Tuesday evenings; we have organized the attached availability calendar for discussion and to see if the SBC could accommodate moving future meetings to another day during the week, please see item 5 in the meeting packet for review. Please note the following when reviewing the calendar:
  - a. Mondays don't work – Select Board Meetings
  - b. Tuesdays don't work – Alison conflict
  - c. Wednesdays don't work – LF conflicts on first & third Wednesdays and School Committee meetings on second & fourth Wednesdays.
  - d. Second & fourth Thursday's work.
  - e. I assume no one is interested in meeting on a Friday night? However, I have held a few committee meetings on Friday evenings in the past!
6. Public comment
7. Adjourn

End



The Brewery 179 Boylston Street Jamaica Plain MA 02130  
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## Executive Summary

To: Florence Roche Building Committee  
c/o of Ms. Fay Raynor, Chair, Florence Roche Building Committee.

From: Steve Michener, Studio G Architects

Re: Florence Roche Elementary School (FRES)  
Executive Summary for HVAC Electrification Study

Date: October 8, 2021

On July 27<sup>th</sup> 2021, the School Building Committee (SBC) requested Studio G to explore a mostly electric powered HVAC system for the FRES project in lieu of the Basis of Design HVAC system (all gas heating) proposed in the Schematic Design (SD) submission. The intent of this study was to provide the SBC sufficient information to make a well-informed decision regarding the two HVAC system options as they relate to potential PV Array installation offer from the Groton Electric Light Department (GELD). The proposal and subsequent approval contract amendment for this study are included in this packet as Exhibit 01 and 02, respectively. Studio G and consultants RWSullivan (MEPFP Engineers), PM+C (Cost Estimating), and The Green Engineer (sustainability) completed this study with the following summarized results.

This study identified a new HVAC system that reduces the Basis of Design gas fired boiler plant and eliminates the roof mounted chiller, both of which condition air supplied by the roof top air handling units. The new HVAC system heats and cools the air supplied by the roof top air handling units with electric roof top VRF modules. In the included Exhibits, this system has been referred to as "Partial VRF Heat" (kitchen equipment, domestic hot water and radiant heating in classrooms will be still be gas fired). For the full details of the HVAC system studied by RW Sullivan, see Exhibit 03, MEP/FP Systems Strategic Electrification Narrative.

PM+C provided a schematic design level cost estimate based on the following:

- MEP/FP Systems Strategic Electrification Narrative
- discussions with RWSullivan and Studio G
- current vendor pricing for the main equipment included in the study

For detailed information on this estimate and a comparative summary of the Proposed Partial VRF [HVAC] system and the Basis of Design HVAC system, refer to Exhibit 04 in this packet (PM+C October 05, 2021 Schematic Design Estimate).

From the PM+C estimate, LeftField produced the "Upfront Financial Budget Analysis for Proposed Partial VRF [HVAC] Change", included in this packet. The analysis identifies the Total Construction cost increase for the Proposed Partial VRF [HVAC] system as \$1,458,292.00 more than the Basis of Design HVAC system.

RW Sullivan produced an energy model as part of this study and assembled the included Exhibit 05 Energy Model Summary. As expected, the Proposed Partial VRF [HVAC] system reduces the EUI for the building and when paired with the proposed rooftop PV Array offered from GELD, reduces green house gas emissions significantly.

The results table from the energy model summary is shown below:

Results Category	HVAC SYSTEM AS DESIGNED AND ESTIMATED IN SD (NOV 2020)		HVAC SYSTEM AS STUDIED FOR MORE ELECTRIFICATION AND CARBON FOOTPRINT REDUCTION		
	LEED v4 Baseline (ASHRAE 90.1-2010 App. G per LEED v4)	MA Energy Code Baseline (ASHRAE 90.1-2013 App. G w/ MA 2020 Amendments)	Proposed Design (All-Gas Heating)	Partial VRF Heat	Partial VRF Heat w/PV Generation
Building Electric Consumption (kWh) <sup>(1)</sup>	912,928	796,132	620,102	727,263	727,263
Solar PV Production (kWh/year) [300- kW array] <sup>(2)</sup>	0	0	0	0	375,540
Net Electric Consumption (kWh) <sup>(3)</sup>	912,928	796,132	620,102	727,263	351,723
Total Gas Consumption (therms)	24,700	20,293	14,187	9,042	9,042
Total Energy Consumption (10 <sup>6</sup> BTU)	5,586	4,746	3,535	3,386	2,105
Total Building Area (sq ft)	108,259	108,259	108,259	108,259	108,259
Energy Use Intensity (kBtu/sf)	51.6	43.8	32.7	31.3	19.4
GHG Emissions (tons CO <sub>2</sub> ) <sup>(7)</sup>	456	390	295	301	183
Electricity Cost <sup>(4)</sup> [2020]	\$144,243	\$125,789	\$97,976	\$114,908	\$105,895
Natural Gas Cost <sup>(5)</sup>	\$22,230	\$18,263	\$12,768	\$8,138	\$8,138
Total Energy Cost <sup>(6)</sup>	\$166,472	\$144,052	\$110,744	\$123,045	\$114,032
<sup>(2)</sup> Utility Electric rate (\$/kWh)	50.158		% Energy Savings Over MA Energy Code	25.5%	28.7%
<sup>(3)</sup> Solar PV Electric rate (\$/kWh)	50.134		GHG EMISSIONS % Savings (tons CO <sub>2</sub> )	24.5%	22.9%
			% Cost Savings Over LEED v4	33.5%	26.1%
			Estimated LEED Points (cost only)	13	11
			% Improvement using EApC95 for LEED v4	35.2%	33.3%
			Estimated LEED Points using EApC95	14	13

**Notes:**  
 (1) Wall and roof insulation values are "equivalent" R-values and include inside and outside film effects.  
 (2) Window U-value and SHGC are for fenestration total assembly.  
 (3) All proposed cooling efficiencies represent average across all units.  
 (4) All proposed lighting to be LED.  
 (5) All proposed appliances to be Energy Star rated.  
 (6) Utility rates assumed to be:  
 --- Electric: \$0.158 GELD Q1 rate, \$0.134 PV Solar Generation - GELD PPA rate  
 --- Natural Gas: \$1.03 per therm - NGRID/Sprague combined rates  
 (7) GHG CO<sub>2</sub> Emission Factors: 682 lb/MWh elec. and 117 lb/MMBtu natural gas.

As shown in the results table, the addition of the PV array significantly improves the overall energy savings and greenhouse gas emissions for the building. If GELD were to provide a PV Array of the same size for use with the Basis of Design HVAC system (All-Gas Heating), similar desirable results could also be achieved without the added expense of the equipment required for the Proposed Partial VRF [HVAC] system.

Considering that the estimated cost of the Proposed Partial VRF [HVAC] system represents 32% of the \$4,588,956 design and estimating contingency at this early stage of the project, Studio G cannot recommend that the SBC select the Proposed Partial VRF [HVAC] system for the final HVAC system unless the SBC knows of additional funds available to pay for this system, outside of the original budget for this project.

A system selection of either Basis of Design HVAC system (All-Gas Heating) or Proposed Partial VRF [HVAC] system is required at the October 12<sup>th</sup> SBC meeting to avoid further delays to the project schedule.



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## Proposal for Additional Service

To: David Saindon, Leftfield  
From: Meryl Nistler, Studio G Architects

Re: Florence Roche Elementary School (FRES)  
Additional Service for **HVAC Redesign Exploration**

Date: September 1, 2021

This proposal for Additional Service is in response to a motion put forth by the School Building Committee (SBC) on July 27<sup>th</sup> 2021, to authorize Studio G to explore a mostly electric powered HVAC system for the FRES project in lieu of the Basis of Design HVAC system proposed for the Schematic Design (SD) submission. The intent of this scope is to provide the SBC sufficient information to make a well-informed decision regarding the two HVAC system options.

This is an Additional Service because a further exploration and redesign to a Schematic Design level represents a substantial change to the previously approved Basis of Design HVAC system.

The design team will continue to do this work concurrent with our Design Development work. At this time, we do not know if this will have an impact to the overall schedule, or an intermittent impact to the overall schedule that will be mitigated through the course of the project.

The proposed scope and tasks are as follows:

### HVAC REDESIGN:

Studio G, RWSullivan and PM+C scope of study:

1. RWS to perform Schematic Design level documentation of a proposed HVAC system:
  - a. Mostly electric HVAC (kitchen equipment, domestic hot water and radiant heating in classrooms will be gas fired). This would include Variable Refrigerant Flow DX Air Handling Unit with Air Source Heat Pumps and gas fired boilers with a displaced air system. This is the HVAC system proposed at 7/13/2021 SBC meeting.
2. Comparative analysis of the Dec. 2020 SD Basis of Design HVAC system to the alternative proposed HVAC system option listed above.
  - a. Brief description of each HVAC system approach
  - b. Comparative matrix:
    - i. Energy: side-by-side chart developed to show the anticipated annual energy use and cost for each option [as designed in SD vs. proposed]
      1. Use of Energy (Electrical kWh and Gas therms) of SD basis of design HVAC system / Cost
      2. Use of Energy (Electrical kWh and Gas therms) as proposed / Cost
    - ii. Capital cost of each system – Installation and Materials of each system
    - iii. Maintenance and repair considerations of each system
    - iv. Life cycle cost analysis (LCCA) of each system
3. RW Sullivan to generate energy model (required to determine annual kWh)

September 1, 2021  
Florence Roche Elementary School  
Additional Service for HVAC Redesign Exploration  
p. 2

4. Provide executive summary of changes between SD Basis of Design HVAC system and proposed system.
5. PM+C to perform cost estimating on HVAC option above. PM+C to show comparative analysis of current budget from SD and alternative.
6. SGA review of all correspondence

ADDITIONAL SERVICE FEE:

Fixed fee. If additional scope is requested beyond what is outlined above, it will be performed at an hourly rate per the attached hourly rates.

	HOURS	FIXED FEE
RW SULLIVAN	130	\$19,500
PM&C	4.6	\$2,500
STUDIO G (10% Consultant coordination)	-	\$2,200
<b>SUB TOTAL:</b>		\$24,200
STUDIO G	138.6	\$20,800
<b>TOTAL:</b>		\$45,000

Please contact me with any questions related to this proposal.

Enclosed –

RWSullivan Proposal  
PM&C Proposal  
Attachment A Payment Schedule (GDRSD FRES Contract for Designer Services,  
dated Oct. 22, 2019)

# R.W. Sullivan Engineering

MEP/FP Engineering • Code • Commissioning

## RWS Additional Services Request Form:

<b>Date:</b> 08/24/2021	<b>RWS Project No.:</b> 190343
<b>RWS Employee:</b> Quy Vu	

<b>Client Firm:</b>	Studio G Architects
<b>Client Name:</b>	Meryl Nistler
<b>RWS Project Name:</b>	Florence Roche - All Electric HVAC System

### Additional Service Requested:

<b>Owner Requested Change:</b>	<input checked="" type="checkbox"/>	<b>Value Engineering:</b>	<input type="checkbox"/>
<b>Scope Change:</b>	<input type="checkbox"/>	<b>Other:</b>	<input type="checkbox"/>

### Additional Services to include the following:

Feasibility Study for Alternate HVAC System as outlined below:

- Air-source VRF tied to DX coils in all AHU's for heating and cooling (AH's similar to BOD units)
- Standard air-cooled VRF system for Admin w/ VRF DOAS
- Gas-fired boilers provide HW for classroom radiant panels and BOH heating only

Performing Energy Modeling (SD level) for Alternate HVAC system

Performing LCCA (cost estimates by others)

Deliverables:

- Systems narrative, Energy modeling report, and LCCA for Alternate HVAC system
- Coordination with StudioG & other consultants
- One review meeting with the SBC to review proposed options

Staffing Breakdown:

- PM: \$150/hr x 8 hours = \$1,200
- HVAC Engineer: \$150/hr x 66 hours = \$9,900
- Electrical Engineer: \$150/hr x 24 hours = \$3,600
- Plumbing Engineer: \$150/hr x 8 hours = \$1,200
- Energy Modeling Engineer: \$150/hr x 24 hours = \$3,600

### Additional Engineering Fee:

<b>Lump Sum:</b>	<input type="checkbox"/>	<b>Hourly:</b>	<input type="checkbox"/>
<b>Hourly Not-to-Exceed:</b>	<input checked="" type="checkbox"/>	<b>No Fee:</b>	<input type="checkbox"/>

<b>For the Amount of:</b>	\$19,500
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- Services will be provided in accordance with the Base Standard Terms & Conditions.
- Services will commence upon return of a signed **Additional Services Request Form**.
- By executing this form, Client acknowledges they are solely responsible for payment of fee associated with this request.

<b>Accepted by:</b>	<b>Client</b>
<b>Name / Title:</b>	Meryl Nistler, Project Manager
<b>Date:</b>	August 24, 2021



Partnering for quality results

August 3, 2021

Meryl Nistler, AIA  
Project Manager  
Studio G Architects  
179 Boylston Street #P  
Jamaica Plain, MA 02130

**Re: Florence Roche Elementary School Additional Services HVAC Study**

Dear Meryl,

Thank you for the opportunity to submit this proposal for cost estimating services for additional services for the Florence Roche Elementary School. We understand the scope is to analyze the feasibility, design impacts and cost considerations of all-electric building systems.

Our fee for cost estimating services is as follows:

Additional Services Study Estimate	
Principal: 1.6 hrs x \$150	\$250
Senior Estimator: 2 HRS x \$150	\$300
HVAC Estimator: 1 HRS x \$150	\$1,950
<b>Total:</b>	<b>\$2,500</b>

Thank you again for asking PM&C to submit a proposal on this project. If this proposal is agreeable please sign and send back to this office.

Sincerely,

Accepted By:

Peter Bradley BSC Q.S.; LEED AP  
President

Meryl Nistler August 24, 2021

Name

Date

# ATTACHMENT A

## PAYMENT SCHEDULE

Payments shall be made in accordance with the provisions outlined in the Contract and with the following schedule:

**Basic Services**

Feasibility Study Phase .....	\$240,000
Schematic Design Phase .....	\$216,000
Design Development Phase .....	
Construction Documents Phase .....	
Early Bid Packages .....	
Bidding Phase .....	
Construction Administration Phase .....	
Completion Phase .....	
Reimbursable Services [Allowance] .....	\$59,000 *
<b>TOTAL .....</b>	<b>\$515,000</b>

\* Should additional fee beyond the budgeted \$59,000 allowance be required to complete miscellaneous designer or consultant services as defined in the Designer-Owner contract and MSBA MOD 3 & 4 guidelines or as reasonably inferred within the aforementioned documents; fees as a result of such services shall be funded within the basic services of the Designers fee.

**Extra Services**

Extra Services provided pursuant to Article 8 shall be compensated as determined by the Owner (a) by a lump sum fee agreed upon in advance in writing by the Owner and the Designer, or (b) on an hourly basis in accordance with the lesser of \$150 per hour or the rate schedule set forth below for time expended, or (c) on an hourly basis in accordance with the lesser of \$150 per hour or a multiple of 2.5 times the direct personnel expense (without benefits) of the Designers or Subconsultants personnel including principals.

Hourly Rates:

<u>Title</u>	<u>Rate/Hr.</u>	<u>Title</u>	<u>Rate/Hr.</u>
Managing Principal	\$150	Staff Architect III	\$150
Principal	\$150	Staff Architect II	\$135
Associate	\$150	Staff Architect I	\$120
Senior Project Manager	\$150	Designer III	\$110
PM/Staff Architect III	\$150	Designer II	\$100
PM/Staff Architect II	\$150	Designer I	\$ 90
Asst PM/Staff Arch II	\$140	Drafter	\$ 75



**Per RWS 9/3/2021 Narrative**

Building Component	LEED v4 Baseline (ASHRAE 90.1-2010 App. G per LEED v4)	MA Energy Code Baseline (ASHRAE 90.1-2013 App. G w/ MA 2020 Amendments)	Proposed Design (All Gas Heating)	Partial VRF Heating (w/ Gas Perimeter Heating)
Outdoor Design Conditions	Summer: 88°F DB, 74°F WB Evaporation: 76°F WB Winter: 0°F	Summer: 88°F DB, 74°F WB Evaporation: 76°F WB Winter: 0°F	Summer: 88°F DB, 74°F WB Evaporation: 76°F WB Winter: 0°F	Summer: 88°F DB, 74°F WB Evaporation: 76°F WB Winter: 0°F
Roof Assembly <sup>(1)</sup>	R-20 c.i. (U-0.0476) <i>(Insulation Entirely Above Deck)</i>	R-30 c.i. (Code) -> R-35 c.i. (EEM) (U-0.0272) <i>(Insulation Entirely Above Deck)</i>	R-40 (U-0.023) <i>(R-40 Rigid Insulation)</i>	R-40 (U-0.023) <i>(R-40 Rigid Insulation)</i>
Wall Assembly <sup>(1)</sup>	Steel Framed: R-13 + R-7.5 c.i. (U-0.064)	Steel Framed: R-15 + R-13 c.i. (EEM) (U-0.0478) <i>Steel Framed: R-13 + R-10 c.i. (Code) (U-0.055)</i>	R-25 equivalent (U-0.04)	R-25 equivalent (U-0.04)
Windows & Glazing <sup>(2)</sup>	Metal Windows Fixed: U-0.45 (SHGC-0.400) Metal Windows Operable: U-0.55 (SHGC-0.400) Non-Metal Frame Windows: U-0.35 (SHGC-0.400)	Metal Fixed: U-0.357 (EEM) <i>Metal Fixed: U-0.42 (Code) (SHGC-0.400)</i> Non-Metal Frame: U-0.272 (EEM) <i>Non-Metal Frame: U-0.32 (Code) (SHGC-0.400)</i>	Double-Glazed: U-0.33 ave. (SHGC - 0.28)	Double-Glazed: U-0.33 ave. (SHGC - 0.28)
Window-to-Wall Ratio	24.0%	22% (per Appendix G)	27.1%	27.1%
External Shading	None	None	None	None
Infiltration Rate	0.30 cfm/sf of wall	0.30 cfm/sf of wall	0.30 cfm/sf of wall	0.30 cfm/sf of wall
Indoor Temperature Setpoints	<u>Occupied Areas</u> Cooling: 75°F/Heating: 70°F <u>Unoccupied Areas</u> Cooling: 85°F/Heating: 60°F	<u>Occupied Areas</u> Cooling: 75°F/Heating: 70°F <u>Unoccupied Areas</u> Cooling: 85°F/Heating: 60°F	<u>Occupied Areas</u> Cooling: 75°F/Heating: 70°F <u>Unoccupied Areas</u> Cooling: 85°F/Heating: 60°F	<u>Occupied Areas</u> Cooling: 75°F/Heating: 70°F <u>Unoccupied Areas</u> Cooling: 85°F/Heating: 60°F
Central Plants	<u>Cooling</u> Air-cooled packaged DX  <u>Heating</u> Gas fired Near condensing hot water boilers.  <u>DX Cooling:</u> 11.5 EER  <u>Boilers:</u> Two @ 50% capacity 82% efficient  Variable frequency drives on all pumps.  <i>Note: all values per ASHRAE 90.1-2010</i>	<u>Cooling</u> Air-cooled packaged DX  <u>Heating</u> Gas fired Near condensing hot water boilers.  <u>DX Cooling:</u> 12 EER  <u>Boilers:</u> Two @ 50% Capacity 90.2% efficient  Variable frequency drives on all pumps.  <i>Note: all values 10% improvement over Code per IECC C406.2</i>	<u>Cooling</u> Air-cooled High-Efficiency Magnetic Bearing Chiller  <u>Heating</u> Gas fired Condensing hot water boilers.  <u>Chiller:</u> 300-ton, 1.0 kW/ton full load efficiency 0.58 kW/ton IPLV 57oF entering water temp. 42oF leaving water temp.  <u>Boilers:</u> Three (3) 2500-MBH each 95% efficient, 40oF delta T  Variable frequency drives on all pumps.	<u>Cooling</u> Variable Refrigerant Flow (VRF air-cooled)  <u>Heating</u> Simultaneous Heating/Cooling via VRF  Gas fired Condensing hot water boilers serving perimeter - classrooms only.  <u>VRF:</u> 0.95 kW/ton Cooling 3.4 COP Heating  <u>Boilers:</u> Three (3) 1500-MBH each 95% efficient, 40oF delta T  Variable frequency drives on all pumps.
HVAC System Types	<u>Classrooms:</u> Standard Overhead VAV air handlers with Energy Recovery wheels to pre-treat outside air. 30% min with reheat coils. <u>Admin:</u> Overhead multi-zone VAV air handler. 30% min with reheat coils. <u>Cafeteria/Gym:</u> Overhead single zone VAV air handlers with ERV wheel. <u>Kitchen:</u> MUA w/ HW+DX coil  Variable frequency drives on all fans.	<u>Classrooms:</u> Standard Overhead VAV air handlers with Energy Recovery wheels to pre-treat outside air. 30% min with reheat coils. <u>Admin:</u> Overhead multi-zone VAV air handler. 30% min with reheat coils. <u>Cafeteria/Gym:</u> Overhead single zone VAV air handlers with ERV wheel. <u>Kitchen:</u> MUA w/ HW+DX coil  Variable frequency drives on all fans.	<u>Classrooms:</u> Displacement ventilation with VAV air handlers with dual Energy Recovery wheels Perimeter hot water heating <u>Admin:</u> Overhead multi-zone VAV air handler. <u>Cafeteria/Gym:</u> Overhead single zone VAV air handlers with ERV wheel. <u>Kitchen:</u> MUA w/ direct gas+CHW coil  Variable frequency drives on all fans.	<u>Classrooms:</u> Displacement ventilation with VAV air handlers with VRF coils with dual Energy Recovery wheels Perimeter hot water heating <u>Admin:</u> DOAS ERV serving VRF Fan Coils <u>Cafeteria/Gym:</u> Overhead single zone VAV air handlers with VRF Coils and ERV wheel. <u>Kitchen:</u> MUA w/ direct gas+DX coil  Variable frequency drives on all fans.
Energy Recovery Eff.	50%	50%	75%	75%
Outdoor Air Ventilation Rates	Per ASHRAE 90.1-2010 and equal to proposed	Per ASHRAE 90.1-2010 and equal to proposed	Per ASHRAE 90.1-2010	Per ASHRAE 90.1-2010
Air-side Economizer	All VAV Air handlers- Dry Bulb switch	All VAV Air handlers- Dry Bulb switch	All VAV Air handlers- Enthalpy switch	All VAV Air handlers- Enthalpy switch
Exhaust Systems	<u>Mechanical Spaces:</u> Constant speed fans. <u>Kitchen:</u> 5000-cfm hood with tempered make-up air unit and DCV hood controls.	<u>Mechanical Spaces:</u> Constant speed fans. <u>Kitchen:</u> 5000-cfm hood with tempered make-up air unit and DCV hood controls.	<u>Mechanical Spaces:</u> Constant speed fans. <u>Kitchen:</u> 5000-cfm hood with tempered make-up air unit and DCV hood controls.	<u>Mechanical Spaces:</u> Constant speed fans. <u>Kitchen:</u> 5000-cfm hood with tempered make-up air unit and DCV hood controls.
Domestic Hot Water Systems	80% eff Natural Gas Storage Tank	80% eff Natural Gas Storage Tank	95% eff Condensing Water Heater	95% eff Condensing Water Heater
Plumbing Fixture Flowrates	N/A	N/A	Low flow fixtures with 25% hot water use reduction over baseline	Low flow fixtures with 25% hot water use reduction over baseline
Lighting Power Density (LPD) <sup>(4)</sup>	0.99 W/sf (Per ASHRAE 90.1-2010)	0.65 W/sf (10% improvement per IECC C406.3)	0.5 W/sf (Target LPD)	0.5 W/sf (Target LPD)

Daylighting Controls	Not currently included in the model			
Plug Loads <sup>(4)</sup>	Cafeterium = 0.50 W/sf Classroom = 1.00 W/sf Corridor = 0.25 W/sf Gym = 0.25 W/sf IT-EMR = 10.00 W/sf Office = 2.00 W/sf MRL Elevator	Cafeterium = 0.50 W/sf Classroom = 1.00 W/sf Corridor = 0.25 W/sf Gym = 0.25 W/sf IT-EMR = 10.00 W/sf Office = 2.00 W/sf MRL Elevator	Cafeterium = 0.50 W/sf Classroom = 1.00 W/sf Corridor = 0.25 W/sf Gym = 0.25 W/sf IT-EMR = 10.00 W/sf Office = 2.00 W/sf MRL Elevator	Cafeterium = 0.50 W/sf Classroom = 1.00 W/sf Corridor = 0.25 W/sf Gym = 0.25 W/sf IT-EMR = 10.00 W/sf Office = 2.00 W/sf MRL Elevator
Kitchen Equipment	Baseline Efficiency	Baseline Efficiency	20% overall load reduction from baseline	20% overall load reduction from baseline

Whole Building Energy Model Results							
Results Category	LEED v4 Baseline (ASHRAE 90.1-2010 App. G per LEED v4)	MA Energy Code Baseline (ASHRAE 90.1-2013 App. G w/ MA 2020 Amendments)	Proposed Design (All-Gas Heating)	Proposed Design (All-Gas Heating) w/ PV Generation	Partial VRF Heat	Partial VRF Heat w/PV Generation	
Building Electric Consumption (kWh) <sup>(4)</sup>	912,928	796,132	620,102	620,102	727,263	727,263	
Solar PV Production (kWh/year) [300-KW array] <sup>(4)</sup>	0	0	0	375,540	0	375,540	
Net Electric Consumption (kWh) <sup>(4)</sup>	912,928	796,132	620,102	244,562	727,263	351,723	
Total Gas Consumption (therms)	24,700	20,293	14,187	14,187	9,042	9,042	
Total Energy Consumption (10 <sup>6</sup> BTU)	5,586	4,746	3,535	2,254	3,386	2,105	
Total Building Area (sq ft)	108,259	108,259	108,259	108,259	108,259	108,259	
Energy Use Intensity (kBtu/sf)	51.6	43.8	32.7	20.8	31.3	19.4	
GHG Emissions (tons CO <sub>2</sub> ) <sup>(7)</sup>	456	390	295	177	301	183	
Electricity Cost <sup>(5)(6)</sup>	\$144,243	\$125,789	\$97,976	\$38,641	\$114,908	\$105,895	
Natural Gas Cost <sup>(6)</sup>	\$25,441	\$20,901	\$14,612	\$14,612	\$9,313	\$9,313	
Total Energy Cost <sup>(6)</sup>	\$169,683	\$146,690	\$112,588	\$53,253	\$124,221	\$115,208	
<sup>(4)</sup> Utility Electric rate (\$/kWh)	\$0.158		% Energy Savings Over MA Energy Code	25.5%	36.2%	28.7%	55.7%
<sup>(4)</sup> Solar PV Electric rate (\$/kWh)	\$0.134		GHG EMISSIONS % Savings (tons CO <sub>2</sub> )	24.5%	40.0%	22.9%	53.1%
			% Cost Savings Over LEED v4	33.6%	68.6%	26.8%	32.1%
			Estimated LEED Points (cost only)	13	17	11	12
			% Improvement using EAp:95 for LEED v4	35.2%	68.6%	33.3%	59.8%
			Estimated LEED Points using EAp:95	14	17	13	17

- Notes:**  
(1) Wall and roof insulation values are "equivalent" R-values and include inside and outside film effects.  
(2) Window U-value and SHGC are for fenestration total assembly.  
(3) All proposed cooling efficiencies represent average across all units.  
(4) All proposed lighting to be LED.  
(5) All proposed appliances to be Energy Star rated.  
(6) Utility rates assumed to be:  
--- Electric: \$0.158 GELD G1 rate, \$0.134 PV Solar Generation - GELD PPA rate  
--- Natural Gas: \$1.03 per therm - NSRID/Sprague combined rates  
(7) GHG CO<sub>2</sub> Emission Factors: 692 lb/MWh elec. and 117 lb/MMBtu natural gas

ROI for Proposed Design (All-Gas Heating) w/ Owner Installed PV	
Cost of 300-KW PV system @ \$3.50 per Watt installed	\$1,050,000
Annual Utility Cost Savings	\$59,335
Simple Payback (ROI) [Years]	17.7

ABOVE RESULTS ASSUME Solar PPA through GELD

Per RWS 9/3/2021 Narrative				
Building Component	LEED v4 Baseline (ASHRAE 90.1-2010 App. G per LEED v3)	MA Energy Code Baseline (ASHRAE 90.1-2013 App. G w/ MA 2020 Amendments)	Proposed Design (All-Gas Heating)	Partial VRF Heating (w/ Gas Perimeter Heating)
Outdoor Design Conditions	Summer: 88°F DB, 74°F WB Evaporation: 76°F WB Winter: 0°F	Summer: 88°F DB, 74°F WB Evaporation: 76°F WB Winter: 0°F	Summer: 88°F DB, 74°F WB Evaporation: 76°F WB Winter: 0°F	Summer: 88°F DB, 74°F WB Evaporation: 76°F WB Winter: 0°F
Roof Assembly <sup>(1)</sup>	R-20 c.i. (U-0.0476) <i>(Insulation Entirely Above Deck)</i>	R-30 c.i. (Code) --> R-35 c.i. (EEM) (U-0.0272) <i>(Insulation Entirely Above Deck)</i>	R-40 (U-0.023) <i>(R-40 Rigid Insulation)</i>	R-40 (U-0.023) <i>(R-40 Rigid Insulation)</i>
Wall Assembly <sup>(1)</sup>	Steel Framed: R-13 + R-7.5 c.i. (U-0.064)	Steel Framed: R-15 + R-13 c.i. (EEM) (U-0.0478) Steel Framed: R-13 + R-10 c.i. (Code) (U-0.055)	R-25 equivalent (U-0.04)	R-25 equivalent (U-0.04)
Windows & Glazing <sup>(2)</sup>	Metal Windows Fixed: U-0.45 (SHGC-0.400) Metal Windows Operable: U-0.55 (SHGC-0.400) Non-Metal Frame Windows: U-0.35 (SHGC-0.400)	Metal Fixed: U-0.357 (EEM) Metal Fixed: U-0.42 (Code) (SHGC-0.400) Non-Metal Frame: U-0.272 (EEM) Non-Metal Frame: U-0.32 (Code) (SHGC-0.400)	Double-Glazed: U-0.33 ave. (SHGC - 0.28)	Double-Glazed: U-0.33 ave. (SHGC - 0.28)
Window-to-Wall Ratio	24.0%	22% (per Appendix G)	27.1%	27.1%
External Shading	None	None	None	None
Infiltration Rate	0.30 cfm/sf of wall	0.30 cfm/sf of wall	0.30 cfm/sf of wall	0.30 cfm/sf of wall
Indoor Temperature Setpoints	Occupied Areas Cooling: 75°F/Heating: 70°F Unoccupied Areas Cooling: 85°F/Heating: 60°F	Occupied Areas Cooling: 75°F/Heating: 70°F Unoccupied Areas Cooling: 85°F/Heating: 60°F	Occupied Areas Cooling: 75°F/Heating: 70°F Unoccupied Areas Cooling: 85°F/Heating: 60°F	Occupied Areas Cooling: 75°F/Heating: 70°F Unoccupied Areas Cooling: 85°F/Heating: 60°F
Central Plants	<b>Cooling</b> Air-cooled packaged DX  <b>Heating</b> Gas fired Near condensing hot water boilers.  <b>DX Cooling:</b> 11.5 EER  <b>Boilers:</b> Two @ 50% capacity 82% efficient  Variable frequency drives on all pumps.  <i>Note: all values per ASHRAE 90.1-2010</i>	<b>Cooling</b> Air-cooled packaged DX  <b>Heating</b> Gas fired Near condensing hot water boilers.  <b>DX Cooling:</b> 12 EER  <b>Boilers:</b> Two @ 50% Capacity 90.2% efficient  Variable frequency drives on all pumps.  <i>Note: all values 10% improvement over Code per IECC C406.2</i>	<b>Cooling</b> Air-cooled High-Efficiency Magnetic Bearing Chiller  <b>Heating</b> Gas fired Condensing hot water boilers.  <b>Chiller:</b> 300-ton, 1.0 kW/ton full load efficiency 0.58 kW/ton IPLV 57oF entering water temp. 42oF leaving water temp.  <b>Boilers:</b> Three (3) 2500-MBH each 95% efficient, 40oF delta T  Variable frequency drives on all pumps.	<b>Cooling</b> Variable Refrigerant Flow (VRF air-cooled)  <b>Heating</b> Simultaneous Heating/Cooling via VRF  Gas fired Condensing hot water boilers serving perimeter - classrooms only.  <b>VRF:</b> 0.95 kW/ton Cooling 3.4 COP Heating  <b>Boilers:</b> Three (3) 1500-MBH each 95% efficient, 40oF delta T  Variable frequency drives on all pumps.
HVAC System Types	<b>Classrooms:</b> Standard Overhead VAV air handlers with Energy Recovery wheels to pre-treat outside air. 30% min with reheat coils. <b>Admin:</b> Overhead multi-zone VAV air handler. 30% min with reheat coils. <b>Cafeteria/Gym:</b> Overhead single zone VAV air handlers with ERV wheel. <b>Kitchen:</b> MUA w/ HW+DX coil  Variable frequency drives on all fans.	<b>Classrooms:</b> Standard Overhead VAV air handlers with Energy Recovery wheels to pre-treat outside air. 30% min with reheat coils. <b>Admin:</b> Overhead multi-zone VAV air handler. 30% min with reheat coils. <b>Cafeteria/Gym:</b> Overhead single zone VAV air handlers with ERV wheel. <b>Kitchen:</b> MUA w/ HW+DX coil  Variable frequency drives on all fans.	<b>Classrooms:</b> Displacement ventilation with VAV air handlers with dual Energy Recovery wheels Perimeter hot water heating <b>Admin:</b> Overhead multi-zone VAV air handler. <b>Cafeteria/Gym:</b> Overhead single zone VAV air handlers with ERV wheel. <b>Kitchen:</b> MUA w/ direct gas+CHW coil  Variable frequency drives on all fans.	<b>Classrooms:</b> Displacement ventilation with VAV air handlers with VRF coils with dual Energy Recovery wheels Perimeter hot water heating <b>Admin:</b> DOAS ERV serving VRF Fan Coils <b>Cafeteria/Gym:</b> Overhead single zone VAV air handlers with VRF Coils and ERV wheel. <b>Kitchen:</b> MUA w/ direct gas+DX coil  Variable frequency drives on all fans.
Energy Recovery Eff.	50%	50%	75%	75%
Outdoor Air Ventilation Rates	Per ASHRAE 90.1-2010 and equal to proposed	Per ASHRAE 90.1-2010 and equal to proposed	Per ASHRAE 90.1-2010	Per ASHRAE 90.1-2010
Air-side Economizer	All VAV Air handlers—Dry Bulb switch	All VAV Air handlers—Dry Bulb switch	All VAV Air handlers—Enthalpy switch	All VAV Air handlers—Enthalpy switch
Exhaust Systems	<b>Mechanical Spaces:</b> Constant speed fans. <b>Kitchen:</b> 5000-cfm hood with tempered make-up air unit and DCV hood controls.	<b>Mechanical Spaces:</b> Constant speed fans. <b>Kitchen:</b> 5000-cfm hood with tempered make-up air unit and DCV hood controls.	<b>Mechanical Spaces:</b> Constant speed fans. <b>Kitchen:</b> 5000-cfm hood with tempered make-up air unit and DCV hood controls.	<b>Mechanical Spaces:</b> Constant speed fans. <b>Kitchen:</b> 5000-cfm hood with tempered make-up air unit and DCV hood controls.
Domestic Hot Water Systems	80% eff Natural Gas Storage Tank	80% eff Natural Gas Storage Tank	95% eff Condensing Water Heater	95% eff Condensing Water Heater
Plumbing Fixture Flowrates	N/A	N/A	Low flow fixtures with 25% hot water use reduction over baseline	Low flow fixtures with 25% hot water use reduction over baseline
Lighting Power Density (LPD) <sup>(4)</sup>	0.99 W/sf (Per ASHRAE 90.1-2010)	0.65 W/sf (10% improvement per IECC C406.3)	0.5 W/sf (Target LPD)	0.5 W/sf (Target LPD)

Daylighting Controls	Not currently included in the model			
Plug Loads <sup>(3)</sup>	Cafetorium = 0.50 W/sf Classroom = 1.00 W/sf Corridor = 0.25 W/sf Gym = 0.25 W/sf IT-EMR = 10.00 W/sf Office = 2.00 W/sf MRL Elevator	Cafetorium = 0.50 W/sf Classroom = 1.00 W/sf Corridor = 0.25 W/sf Gym = 0.25 W/sf IT-EMR = 10.00 W/sf Office = 2.00 W/sf MRL Elevator	Cafetorium = 0.50 W/sf Classroom = 1.00 W/sf Corridor = 0.25 W/sf Gym = 0.25 W/sf IT-EMR = 10.00 W/sf Office = 2.00 W/sf MRL Elevator	Cafetorium = 0.50 W/sf Classroom = 1.00 W/sf Corridor = 0.25 W/sf Gym = 0.25 W/sf IT-EMR = 10.00 W/sf Office = 2.00 W/sf MRL Elevator
Kitchen Equipment	Baseline Efficiency	Baseline Efficiency	20% overall load reduction from baseline	20% overall load reduction from baseline

Whole Building Energy Model Results						
Results Category	LEED v4 Baseline (ASHRAE 90.1-2010 App. G per LEED v4)	MA Energy Code Baseline (ASHRAE 90.1-2013 App. G w/ MA 2020 Amendments)	Proposed Design (All-Gas Heating)	Proposed Design (All-Gas Heating) w/ PV Generation	Partial VRF Heat	Partial VRF Heat w/PV Generation
Building Electric Consumption (kWh) <sup>(4)</sup>	912,928	796,132	620,102	620,102	727,263	727,263
Solar PV Production (kWh/year) [300-KW array] <sup>(5)</sup>	0	0	0	375,540	0	375,540
Net Electric Consumption (kWh) <sup>(4)</sup>	912,928	796,132	620,102	244,562	727,263	351,723
Total Gas Consumption (therms)	24,700	20,293	14,187	14,187	9,042	9,042
Total Energy Consumption (10 <sup>6</sup> BTU)	5,586	4,746	3,535	2,254	3,386	2,105
Total Building Area (sq. ft)	108,259	108,259	108,259	108,259	108,259	108,259
Energy Use Intensity (kBtu/sf)	51.6	43.8	32.7	20.8	31.3	19.4
GHG Emissions (tons CO <sub>2</sub> ) <sup>(7)</sup>	456	390	295	177	301	183
Electricity Cost <sup>(6)</sup> [kWh]	\$144,243	\$125,789	\$97,976	\$88,963	\$114,908	\$105,895
Natural Gas Cost <sup>(6)</sup>	\$25,441	\$20,901	\$14,612	\$14,612	\$9,313	\$9,313
Total Energy Cost <sup>(6)</sup>	\$169,683	\$146,690	\$112,588	\$103,575	\$124,221	\$115,208
<sup>(4)</sup> Utility Electric rate (\$/kWh)	\$0.158					
<sup>(5)</sup> Solar PV Electric rate (\$/kWh)	\$0.134					
		% Energy Savings Over MA Energy Code	25.5%	36.2%	28.7%	55.7%
		GHG EMISSIONS % Savings (tons CO <sub>2</sub> )	24.5%	40.0%	22.9%	53.1%
		% Cost Savings Over LEED v4	33.6%	39.0%	26.8%	32.1%
		Estimated LEED Points (cost only)	13	15	11	12
		% Improvement using EAp95 for LEED v4	35.2%	61.7%	33.3%	59.8%
		Estimated LEED Points using EAp95	14	17	13	17

Notes:  
(1) Wall and roof insulation values are "equivalent" R-values and include inside and outside film effects.  
(2) Window U-value and SHGC are for fenestration total assembly.  
(3) All proposed cooling efficiencies represent average across all units.  
(4) All proposed lighting to be LED.  
(5) All proposed appliances to be Energy Star rated.  
(6) Utility rates assumed to be:  
— Electric: \$0.158 GELD G1 rate, \$0.134 PV Solar Generation - GELD PPA rate  
— Natural Gas: \$1.03 per therm - INGRID/Sprague combined rates  
(7) GHG CO<sub>2</sub> Emission Factors: 682 lb/MWh elec. and 117 lb/MMBtu natural gas

ABOVE RESULTS ASSUME  
Solar PPA through  
GELD

ABOVE RESULTS ASSUME  
Solar PPA through  
GELD