Lexington High School

PBC Meeting

05/08/2025









Target Value Design (TVD)

■ Approach to TVD

HVAC Design-Confirmation

■ Approach for integrated automation systems

Electrical Design – Confirmation

□ Generator Load List

Renewable Energy – Confirmation

- ☐ Final PV Size
- ☐ Energy Storage Battery & Equipment Location
- □ EV Charging Station Quantity



Target Value Design

Town of Lexington - Lexington High School
MSBA Project #: 202101550505
RFP Concept Estimate - C.5b Bloom (including Central Office & Add/Reno Field House)
Target Value Design - BUDGET CONTROL REPORT



[Component Team	Sitework, Foundations & Structure	Envelope - Exterior Wall & Roofing	Interior Fitout	Plumbing & Mechanical	Electrical	Remediation & Demolition	Field House					
	Construction Scope	A10 Foundations B10 Super Structure G10 Site Preparation G20 Site Improvements G30 Liquid/Gas Site Util. G40 Electrical Site Impvt G50 Site Commn	8 Rooning B20 Exterior Enclosure B30 Roofing/Waterprfing	C10 Interior Construction C20 Interior Finishes D10 Conveying E10 Equipment E20 Furnishings F10 Special Construction	D20 Plumbing D30 HVAC D40 Fire Protection D80 Intgrtd Automation	D50 Electrical D60 Communications D70 Elect Safety/Security	F20 Facility Remediation F30 Demolition		Indirects	Total Construction Costs	Soft Costs	Owner Contingency	Total Project Costs
Baseline Budget - DD dtd	09-02-24	\$81,753,000	\$41,105,000	\$66,622,000	\$85,510,000	\$52,660,000	\$7,796,000	\$21,734,000	\$172,512,000	\$529,692,000	\$105,709,000	\$26,599,000	\$662,000,000
461,516		\$177	\$89	\$144	\$185	\$114	\$17	\$47	\$374	\$1,148	\$229	\$58	\$1,434
Target Budget (A.M. Foge	erty estm C.5b Bloom)	\$81,753,000	\$41,105,000	\$66,622,000	\$85,510,000	\$52,660,000	\$7,796,000	\$21,734,000	\$172,512,000	\$529,692,000	\$105,709,000	\$26,599,000	\$662,000,000
461,516	Cost / SF	\$177	\$89	\$144	\$185	\$114	\$17	\$47	\$374	\$1,148	\$229	\$58	\$1,434
Delta Overage		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Percentage		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Component Team	Sitework, Foundations & Structure	Envelope - Exterior Wall & Roofing	Interiors	Plumbing & Mechanical	Electrical	Remediation & Demolition	Field House	Indirects	Total Construction Costs	Soft Costs	Owner Contingency	Total Project Costs
Current Forecast	5/7/2025	\$81,753,000	\$41,105,000	\$66,622,000	\$85,510,000	\$52,660,000	\$7,796,000	\$21,734,000	\$172,512,000	\$529,692,000	\$105,709,000	\$26,599,000	\$662,000,000
TVD Progress To Date (A	ccepted, incld in Forecast)	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
TVD Pending Items (Requ	uiring ELT Approval)	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
TVD Approximate Items	(Pending Pricing Studies)	\$0	(\$825,000)	\$0	(\$2,100,000)	\$0	\$0	\$0	(\$1,223,000)	(\$4,148,000)	(\$830,000)	(\$208,000)	(\$5,186,000)
Subtotal of TVD Items		\$0	(\$825,000)	\$0	(\$2,100,000)	\$0	\$0	\$0	(\$1,223,000)	(\$4,148,000)	(\$830,000)	(\$208,000)	(\$5,186,000)
Remaining To TVD Target	t	\$0	(\$825,000)	\$0	(\$2,100,000)	\$0	\$0	\$0	(\$1,223,000)	(\$4,148,000)	(\$830,000)	(\$208,000)	(\$5,186,000)

Target Value Design

Town of Lexington - Lexington High School MSBA Project #: 202101550505

RFP Concept Estimate - C.5b Bloom (including Central Office & Add/Reno Field House)

Target Value Design - BUDGET CONTROL REPORT

\$ 5/7/2025 BCR #001 (Budget Control Report) Item Description Summary / Comments ACCEPTED ITEMS Sitework, Foundations & Structure Envelope - Exterior Wall & Roofing Interior Fitout Plumbing & Mechanical SUBTOTAL ACCEPTED \$529,692,000 \$105,709,000 ACCEPTED ITEMS - SLT REVIEWED / APPROVED - REQUIRES ELT DECISION Sitework, Foundations & Structure Envelope - Exterior Wall & Roofing Plumbing & Mechanica SUBTOTAL ACCEPTED ITEMS - REQUIRED ELT DECISION APPROXIMATE ITEMS (PENDING PRICING VALIDATION) Sitework, Foundations & Structure Envelope - Exterior Wall & Roofing Reduce Height of Building by 2 feet Interior Fitout Plumbing & Mechanical HVAC Option 3 - Hybrid Ground Source and Air Source Heat Pumps with 4-Pipe CHW + HW Savings includes the temporary Heating / Cooling Plant - SMMA confimed locations of wells and they can be comleted prior to occupancy. Change to long span solar panels Remediation & Demolition Field House SUBTOTAL PROPOSED **DEFERRED DECISIONS**

Target Value Design

Town of Lexington - Lexington High School MSBA Project #: 202101559059 RP Concept Estimate - C.58 Bloom (Including Central Office & Add/Reno Field House) Target Value Design - BUDGET CONTROL REPORT

5/7/2025												
BCR #001 (Budget Con	trol Report)	Summary / Comments								Concept Estimate	\$662,000,000	
										Accepted to date	\$0	
							20%	5%		Current Estimate	\$662,000,000	
Item#	Item Description	Summary / Comments	Ball In Court	Target Resolution Date	Decision Date	Total Construction Costs	Soft Costs	Owner Contingency		Total Accepted	Total Pending	Total Rejected
Envelope - Exterior Wa	II & Roofing					\$0	\$0					
						\$0	\$0					
Interior Fitout						\$0						
						\$0						
Plumbing & Mechanic						\$0	\$0					
						\$0	\$0					
Electrical						\$0	\$0		7.1			
						\$0						
Remediation & Demol	ition					\$0						
						\$0	\$0					
Field House						\$0	\$0					
						\$0	\$0					
						\$0	\$0	\$0	\$0			
SUBTOTAL DEFER	RED DECISIONS					\$0	\$0	\$0	\$0	\$0	\$0	\$0
NO LONGER	APPLICABLE / NOT ACCEPTED ITEMS											
Sitework, Foundations	& Structure					\$0	\$0	\$0	\$0			
						\$0	\$0	\$0	\$0			
Envelope - Exterior Wa	all & Roofing					\$0	\$0					
						\$0	\$0	\$0	\$0			
Interior Fitout						\$0	\$0	\$0				
						\$0	\$0		7-			
Plumbing & Mechanic	al entre					\$0	\$0	\$0				
						\$0	\$0					
Electrical						\$0	\$0					
						\$0	\$0					
Remediation & Demol	ition					\$0	*-					
						\$0	\$0					
Field House						\$0	\$0					
						\$0	\$0	\$0	\$0			
						\$0	\$0	\$0	\$0			
SUBTOTAL REJECT	FD.					\$0	\$0	\$0	\$0	\$0	\$0	\$0
JOSE STAL RESECT								- 70	- ,0	, ,,	3	

Target Value Design (TVD)

Approach to TVD

HVAC Design- Confirmation

■ Approach for integrated automation systems

Electrical Design – Confirmation

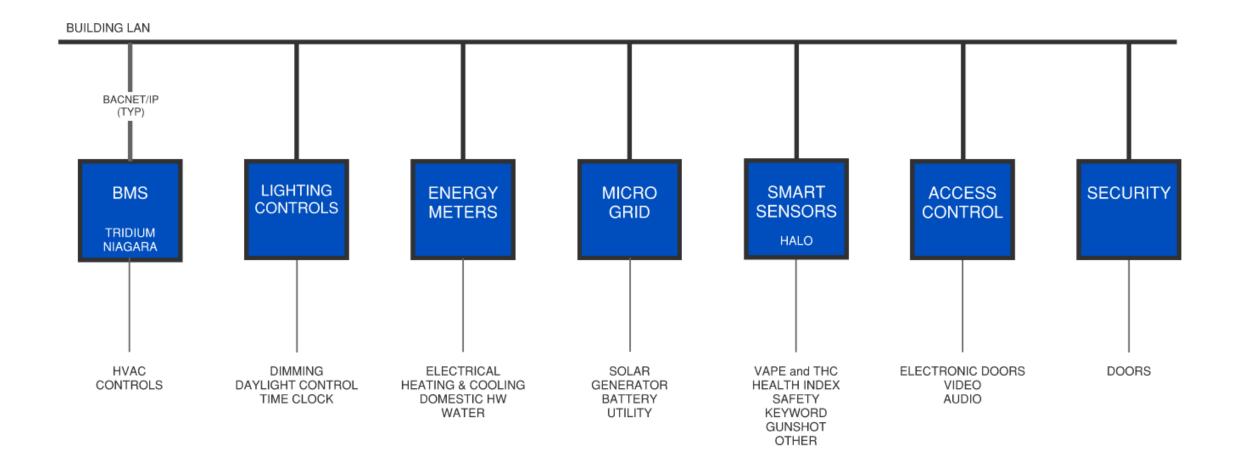
☐ Generator Load List

Renewable Energy – Confirmation

- ☐ Final PV Size
- ☐ Energy Storage Battery & Equipment Location
- **□** EV Charging Station Quantity



HVAC Design/ Approach for Integrated Automation Systems





Target Value Design (TVD)

Approach to TVD

HVAC Design- Confirmation

☐ Approach for integrated automation systems

Electrical Design – Confirmation

☐ Generator Load List

Renewable Energy – Confirmation

- ☐ Final PV Size
- ☐ Energy Storage Battery & Equipment Location
- **□** EV Charging Station Quantity



Electrical Design/ Town Shelter Requirements

Town of Lexington's Integrated Building Design Checklist

Resilience Levels

- **LEVEL 1:** Public Safety (Police, Fire, Public Services) No interruption of essential services.
- **LEVEL 2: Town Shelter -** Full electrical and thermal power necessary for life safety, food prep / refrigeration, lighting, internet connectivity and charging stations. Operational 24/7. Islanded operation maximizing use of on-site solar and storage.

 [AT GYMNASIUM & FIELD HOUSE]
- **LEVEL 3:** Continued Operation Full electrical and thermal power necessary for providing healthy conditions during extreme heat/cold conditions, providing lighting, internet connectivity, and plug load charging. Operational during normal occupied hours. Smart load reduction in emergencies, mobile or on-site backup generation to carry load for continued operation.

 [AT REST OF BUILDING]
- **LEVEL 4:** Asset Preservation Provide power to hold building temperature, provide light and manage building systems



Electrical Design/ HVAC Systems on Standby Power

- **LEVEL 1:** Public Safety (Police, Fire, Public Services) Life safety as priority. Freeze protection as standby.
- **LEVEL 2:** Town Shelter Temperature control and ventilation for Gym and Field House. Freeze protection for remainder of building. Life safety remains operational.
- **LEVEL 3:** Continued Operation Temperature control and ventilation for occupied Building. Freeze protection for remainder of building. Life safety remains operational.
- **LEVEL 4: Asset Preservation** HVAC provides freeze protection. Life safety remains operational.



Electrical Design/ Generator Load List

Town of Lexington's Integrated Building Design Checklist

Tiered Standby / Resilience Loads	Description	Backup Power Sources
Level 1 : Life Safety Loads	No interruption of life safety services including emergency lighting, internet connectivity, security system, fire alarm system, sprinkler system, and building automation.	- 350kW Diesel Generator
Level 2: Town Shelter (Gym & Fieldhouse)	Full electrical and thermal power for life safety, lighting, internet connectivity and charging stations. Operational 24/7. Islanded operation maximizing use of on-site solar and storage.	
Level 3: Continued Operation (Rest of Building)	Full electrical and thermal power for providing healthy conditions during extreme heat/cold conditions, providing lighting, internet connectivity, and plug load charging. Operational during normal occupied hours. Smart load reduction in emergencies, mobile or onsite backup generation to carry load for continued operation.	 3500 kW Solar System 2000 kW / 8000 kWh Battery 900 kW Diesel Generator
Level 4: Asset Preservation	Provide power to hold building temperature, provide light and manage building systems	

Notes:

- 1. Level 1 is code-required, aligning with NEC Article 700 emergency systems.
- 2. Level 2-4 are resilience enhancements, supported by the same resilient microgrid strategy.
- 3. Load shedding and control logic will be in place for level 2 and 3, especially when solar isn't producing or battery is depleted.
- 4. Preliminary sizes of backup power sources will continue to be evaluated as the design progresses.



Target Value Design (TVD)

Approach to TVD

HVAC Design- Confirmation

☐ Approach for integrated automation systems

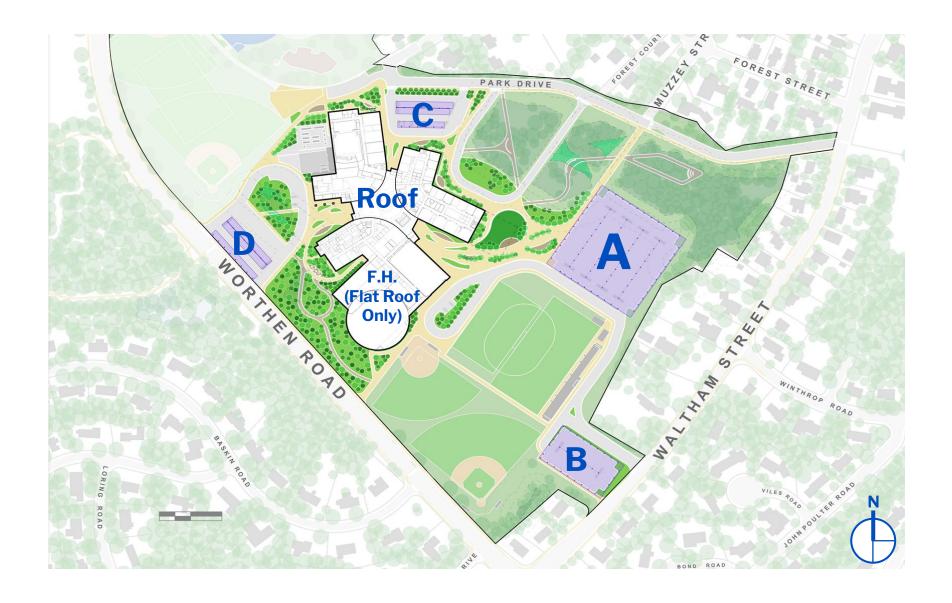
Electrical Design – Confirmation

☐ Generator Load List

Renewable Energy – Confirmation

- ☐ Final PV Size
- ☐ Energy Storage Battery & Equipment Location
- ☐ EV Charging Station Quantity

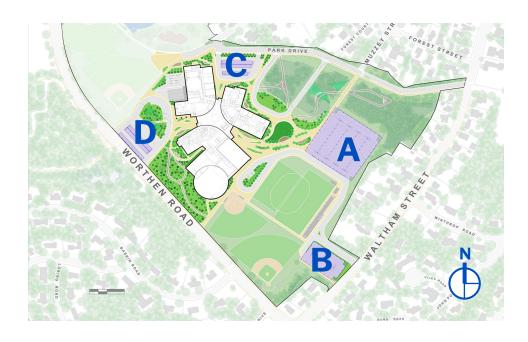






View of West Entrance, Lot D with PV





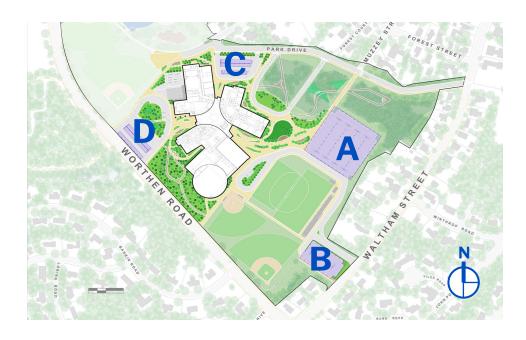
View of West Entrance, Lot D without PV





View of West Entrance, Lot D with PV





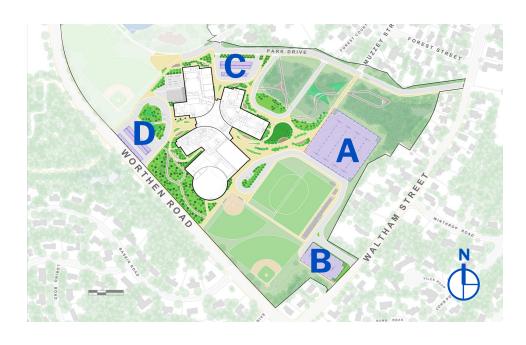
View of West Entrance, Lot D without PV





View of West Entrance, Lot D with PV





View of West Entrance, Lot D without PV





Field House

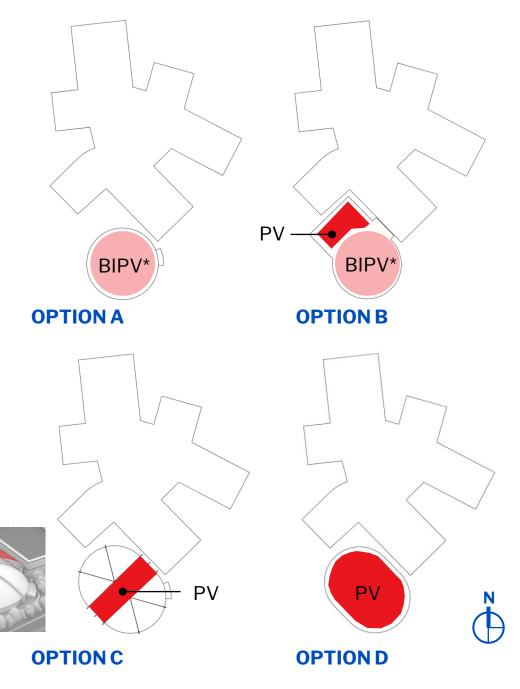
Solar PV System Field House Capacity

Estimated Total Annual Solar PV Production

	Estimated PV Production (kWh)	% of Field House Energy Use	% of NZE School
Option A BIPV*	345,305	98%	9%
Option B			
PV + BIPV*	571,182	162%	15%
PV only	225,878	64%	6%
Option C	309,544	88%	8%
Option D	734,261	209%	20%

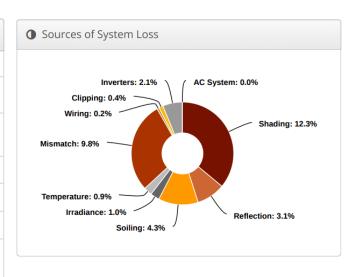
Notes:

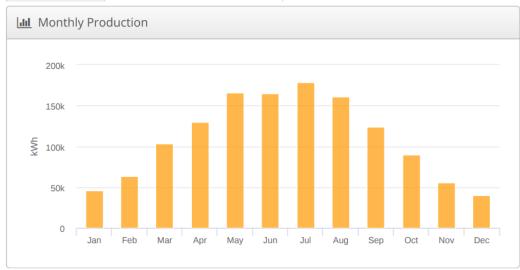
- The Estimated Total Annual Production values are PRELIMINARY and represent an optimal yield of the modeled system. Values are subject to change per design layout, stringing, shading, roof equipment screens, etc.
- A 10% margin of error must be accounted for.
- * Option A and Option B Existing curved roof consists of a BIPV roof membrane, which is **not recommended**:
 - Provides for approx. ½ of a conventional panel efficiency
 - · Procurement is limited.
 - Require additional maintenance
 - Maintenance & replacement access across the dome is difficult
 - Shorter Life Cycle costs.



Solar Study – Building Rooftop

LIII System Metrics				
Design	2025-0319 - Rooftop - Option 3			
Module DC Nameplate	1.25 MW			
Inverter AC Nameplate	970.8 kW Load Ratio: 1.29			
Annual Production	1.320 GWh			
Performance Ratio	70.0%			
kWh/kWp	1,052.9			
Weather Dataset	TMY, BOSTON LOGAN INT'L ARPT, NSRDB (tmy3, I)			
Simulator Version	e032c9a050-228dc61fe0- 0788f319b9-63b45b76d4			



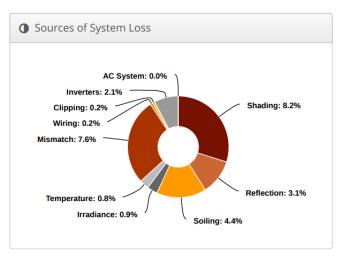


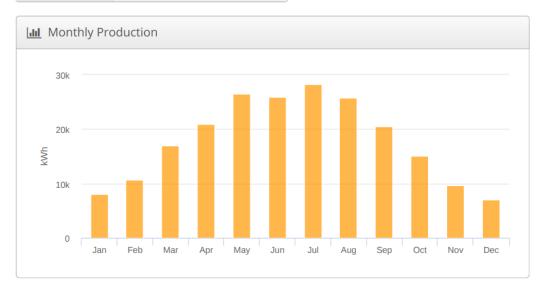


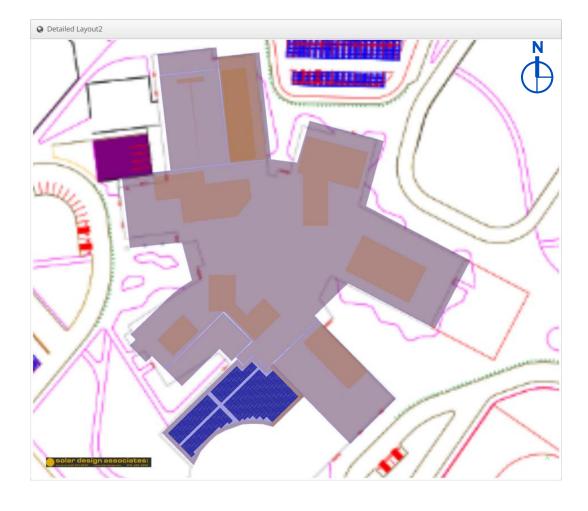


Solar Study – Building Fieldhouse (Flat Roof Only)

lılıl System Metrics				
Design	2025-0417 - Rooftop - Fieldhouse			
Module DC Nameplate	192.1 kW			
Inverter AC Nameplate	150.0 kW Load Ratio: 1.28			
Annual Production	215.2 MWh			
Performance Ratio	75.2%			
kWh/kWp	1,120.5			
Weather Dataset	TMY, BOSTON LOGAN INT'L ARPT, NSRDB (tmy3, I)			
Simulator Version	bfabe04d4f-96fc2a8ce2- 9340f8b948-7b59da0912			



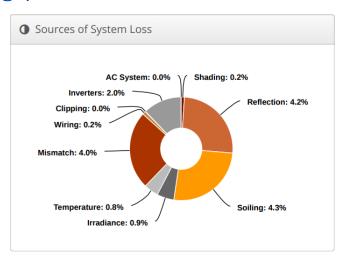


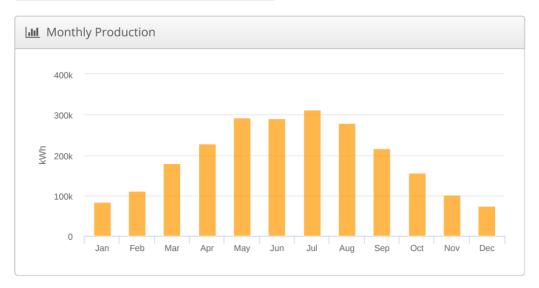


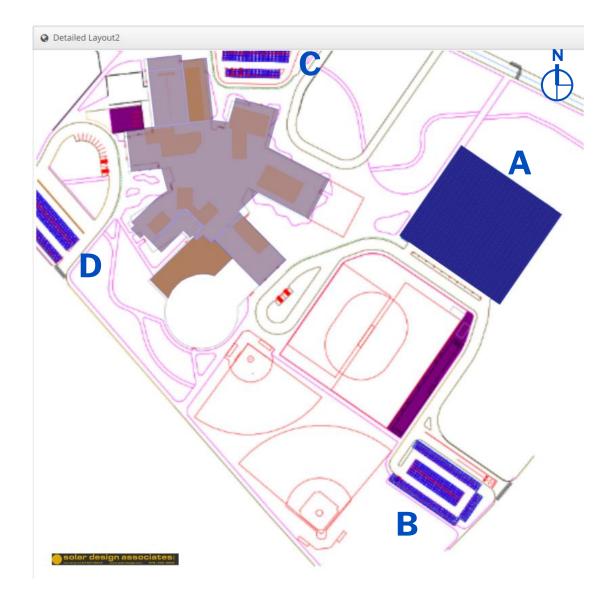


Solar Study – Canopy A Longspan

Lill System Metrics				
Design	2025-0411 - Canopies - Location A - Longspan			
Module DC Nameplate	1.96 MW			
Inverter AC Nameplate	1.63 MW Load Ratio: 1.21			
Annual Production	2.328 GWh			
Performance Ratio	84.5%			
kWh/kWp	1,188.7			
Weather Dataset	TMY, BOSTON LOGAN INT'L ARPT, NSRDB (tmy3, I)			
Simulator Version	379c79ee06-aa31df42b8- 08d6812d16-1a381e8698			



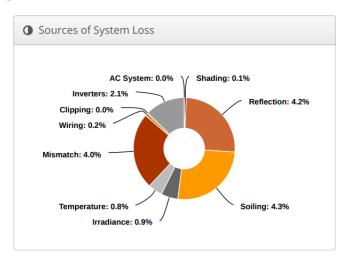


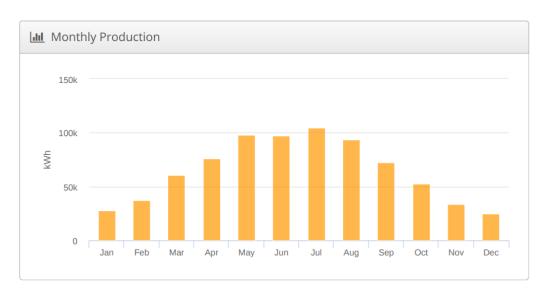


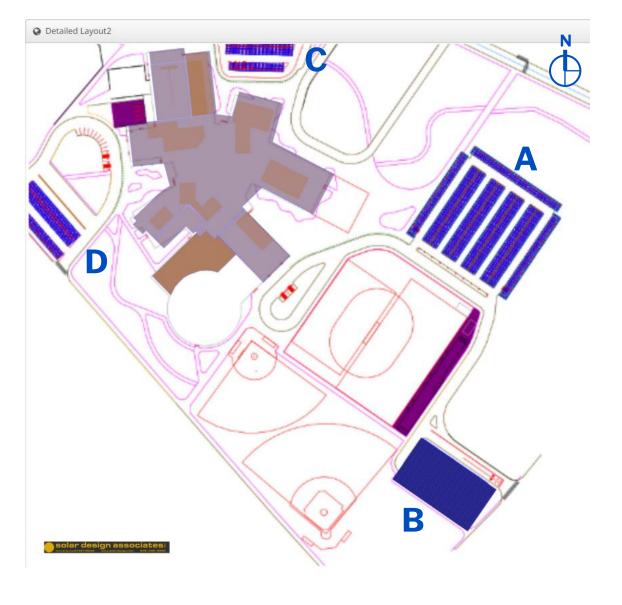


Solar Study - Canopy B Longspan

Lill System Metrics				
Design	2025-0411 - Canopies - Location B - Longspan			
Module DC Nameplate	656.4 kW			
Inverter AC Nameplate	562.5 kW Load Ratio: 1.17			
Annual Production	780.1 MWh			
Performance Ratio	84.5%			
kWh/kWp	1,188.6			
Weather Dataset	TMY, BOSTON LOGAN INT'L ARPT, NSRDB (tmy3, I)			
Simulator Version	379c79ee06-aa31df42b8- 08d6812d16-1a381e8698			



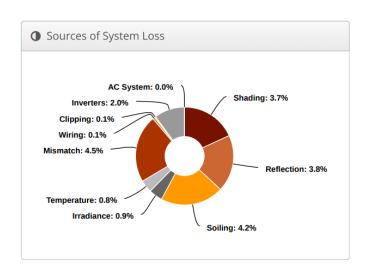


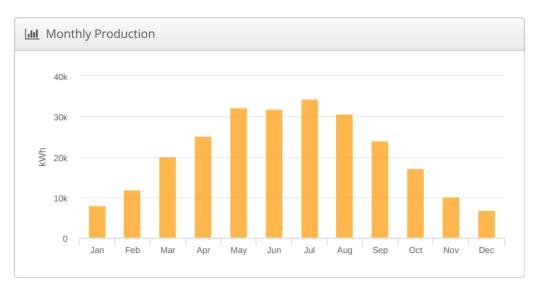


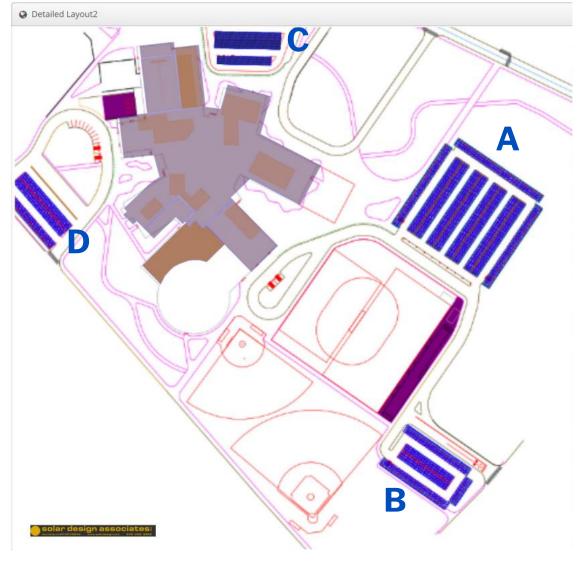


Solar Study – Canopy C

Lill System Metrics				
Design	2025-0411 - Canopies - Location C - Standard			
Module DC Nameplate	216.8 kW			
Inverter AC Nameplate	175.0 kW Load Ratio: 1.24			
Annual Production	252.1 MWh			
Performance Ratio	81.4%			
kWh/kWp	1,162.9			
Weather Dataset	TMY, BOSTON LOGAN INT'L ARPT, NSRDB (tmy3, I)			
Simulator Version	379c79ee06-aa31df42b8- 08d6812d16-1a381e8698			











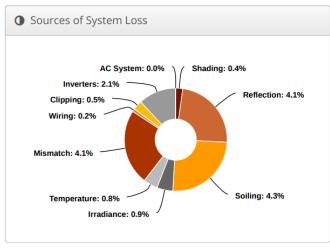
Solar Study – Canopy D

Lill System Metrics				
Design	2025-0411 - Canopies - Location D - Standard			
Module DC Nameplate	252.5 kW			
Inverter AC Nameplate	187.5 kW Load Ratio: 1.35			
Annual Production	301.6 MWh			
Performance Ratio	83.9%			
kWh/kWp	1,194.7			
Weather Dataset	TMY, BOSTON LOGAN INT'L ARPT, NSRDB (tmy3, I)			
Simulator Version	379c79ee06-aa31df42b8- 08d6812d16-1a381e8698			

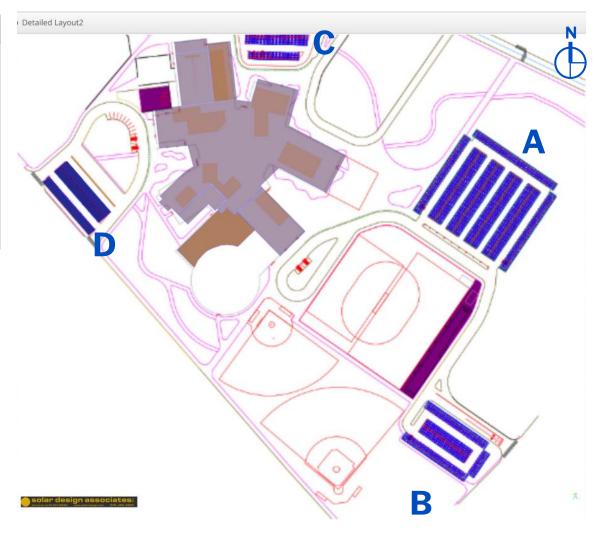
Monthly Production

50k

10k









CONFIRM

Building Area: 509,516 sf

Estimated Usage: 3,868,388 kwh/yr

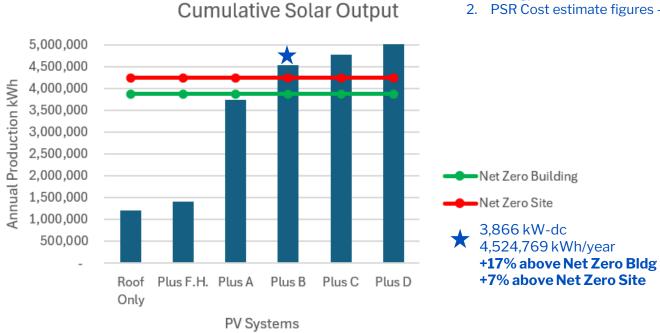
Calculated EUI: 25.9

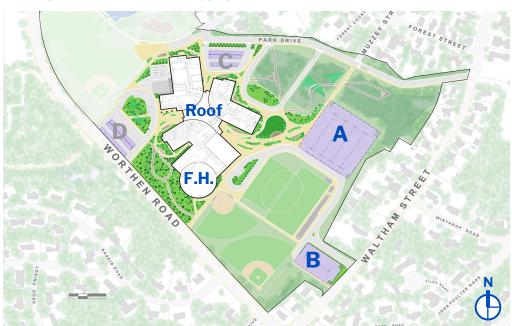
Recommendations for Schematic Design

	Photovoltaic System Location	PV Size (kW-dc)	Annual Production (kWh)	Shading Loss	Cost
*	Rooftop - Building	1,058	1,201,803	12.4%	\$4,760,550
*	Rooftop – Fieldhouse	192	215,000	8.2%	\$864,450
*	Canopy A (Longspan)	1,960	2,327,832	0.2%	\$9,800,000
*	Canopy B (Longspan)	656	780,134	0.2%	\$3,282,000
	Canopy C	217	252,136	3.7%	\$1,084,000
	Canopy D	253	301,607	0.4%	\$1,262,500

Note:

- 1. Energy values and Solar values are estimated based on current Schematic Design phase.
- 2. PSR Cost estimate figures Roof System: \$4.50/watt, Canopy System: \$5.00/watt.







Renewable Energy/ Final PV Size – Shading Analysis

Building Area: 509,516 sf

Estimated Usage: 3,868,388 kwh/yr

Calculated EUI: 25.9

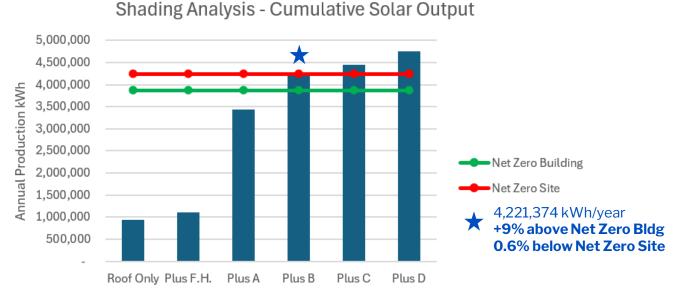
SDA Shading Feedback:

- Current rooftop layout maximizes panel coverage to support net zero goal, despite ~12–13% shading losses from HVAC and screening walls. If/when reducing panel count, the most shaded modules should be removed first.
- 2. Rooftop modules are cheaper to install than canopy systems, so removing shaded panels affects cost-effectiveness unevenly.
- 3. Outside of net zero goals, it's standard to remove modules with >10% loss, though some developers prioritize total output over efficiency due to low panel costs.
- 4. Removing all modules with >10% loss in Option 1 would eliminate ~850 modules and reduce annual production to approximately 1,051,601 kWh. Similar results for all rooftop options can be applied.

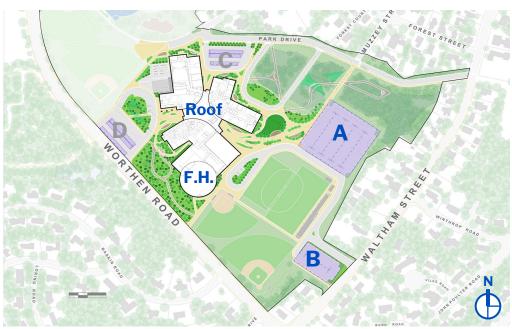
Photovoltaic System Location	Annual Production (kWh)	Production Loss
Rooftop - Building	930,658	23%
Rooftop – Fieldhouse	182,750	15%
Canopy A (Longspan)	2,327,832	0%
Canopy B (Longspan)	780,134	0%
Canopy C	252,136	0%
Canopy D	301,607	0%

Note:

1. Energy values and Solar values are estimated based on current Schematic Design phase.



PV Systems

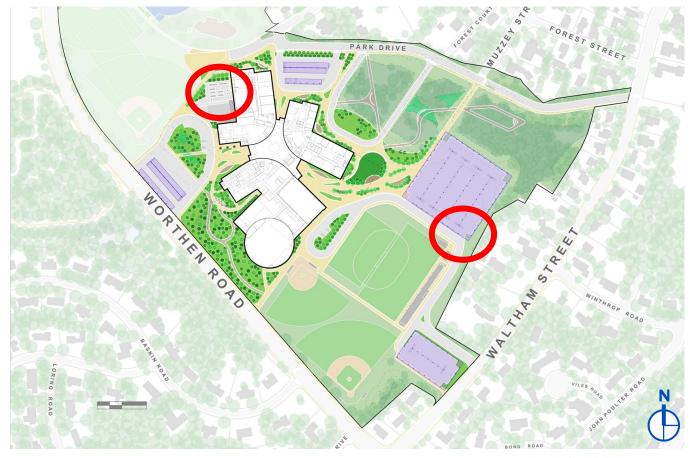




Renewable Energy/ Energy Storage Battery & Equipment Location

List of Equipment

- Utility Interconnection Switchgear
- Power Transformers
- Battery, Solar and EV Switchboards
- Battery Energy Storage System
- Two Diesel Generator





Renewable Energy/ Energy Storage Battery & Equipment Location

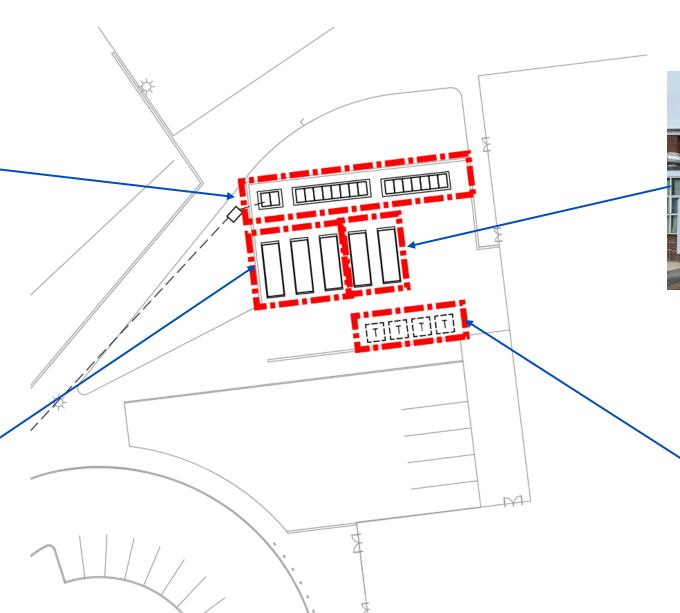


Pad-mounted Switchgear 330" x 72" x 120"H.

Pad-mounted Switchboard 192" x 72" x 96"H.



Battery Energy Storage System (BESS) 240" x 114" x 96"H.





Pad-mounted Generator 210" x 86" x 90"H.



Pad-mounted Transformer 120" x 120" x 84"H.



Renewable Energy/ Energy Storage Battery & Equipment Location



Pad-mounted Switchboard 192" x 72" x 96"H.



Pad-mounted Transformer 120" x 120" x 84"H.





Renewable Energy/ EV Charging Station Quantity



Total Planned EV Spaces

- Total Spaces = 500
- Day 1 4% of the total off-street spaces = **20 spaces**
- Day X 50% of the total off-street spaces (250-20 already installed) = 230 spaces

Capacity Requirements (Lexington EV Bylaws)

- Day 1 20 spaces installed fully functional
- Day 1 Conduits and space for transformers and switchboard for 230 spaces

% of Spots ¹	EV Spaces	EV Chargers ²	Annual Energy Usage ³	Solar Canopy Needed for Energy Offset
4%	20	10	92,505 kWh	80 kW-dc
10%	50	25	231,264 kWh	201 kW-dc
20%	100	50	404,712 kWh	352 kW-dc
30%	150	75	520,344 kWh	452 kW-dc
40%	200	100	679,338 kWh	590 kW-dc
50%	250	125	838,332 kWh	729 kW-dc

Notes:

- 1. The energy model is accounting for 4% EV charger usage.
- 2. Assumes all installed chargers will be Dual-port, level 2 chargers.
- 3. Estimated energy usage based on Lexington provided usage data. 11 Chargers downtown used 86,000 kwh in 2024. 2022 and 2023 data was as well to estimate a diminishing utilization rate, and scale for growth.



The additional PV is based on a Net Zero Site evaluation. Additional solar is reflected in parking canopy array production.05/08/2025

Thank you.

