

INTEGRATED DESIGN & The Friends School of Portland



NESEA BuildingEnergy '16 Conference
02092016

Naomi C. O. Beal
passivhausMaine

Phil KaplaN
Kaplan Thompson Architects

PETER WARREN
WARREN CONSTRUCTION GROUP



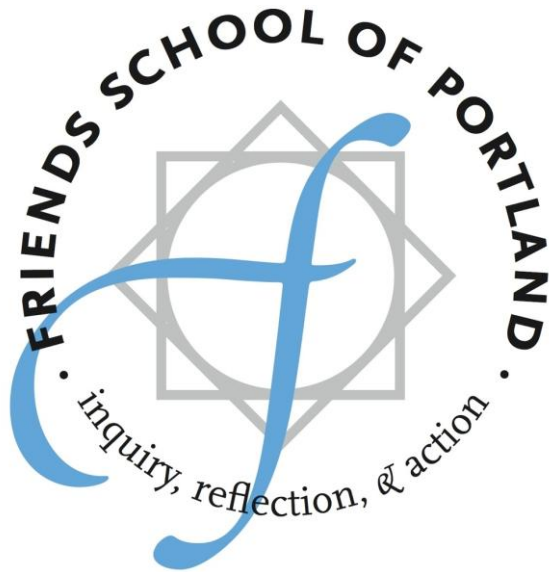
- 8 years old
- NEASC accredited (2012)
- 90 students
- Pre-K through 8th grade
- excellent stewards of finances

new building requirements:

- completed by summer 2015
- 120 students
- a larger meeting room
- add 2 classrooms
- a new gymnasium (phase 2)
- room for a future addition

Quaker Values

The Friends School of Portland challenges and empowers students to develop their intellectual, physical, emotional, creative and spiritual potential. We honor our students' natural gifts as they learn to enter the world with confidence, competence, joy and a sense of purpose. We are guided by the Quaker values of simplicity, peace, integrity, community, equality, stewardship, and truth.



- simplicity
- peace
- integrity
- community
- equality
- stewardship
- truth



We value
quiet discovery.



In essence, a school based in Nature

PLAY AREAS / OVERFLOW PARKING (73 SP)

ACCESS ROAD

PROPOSED BUILDING (PHASE I)

PROPOSED PARKING (PHASE I, 35 SP)

PROPOSED PARKING (PHASE I, 7 SP)

PROPOSED PARKING (PHASE II, 31 SP)

ENTRY ROAD / LOOP DRIVE

LEGEND

SURVEYED STREAM

SURVEYED WETLAND

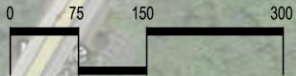
CLEARING / PLAY AREA

ROAD / PARKING / HARDSCAPE

PHASE I BUILDING

PHASE II BUILDING

EXISTING VEGETATION



Looking across to the new Meeting Room





We value
teamwork.





Friends School of Portland

EMATIC DESIGN







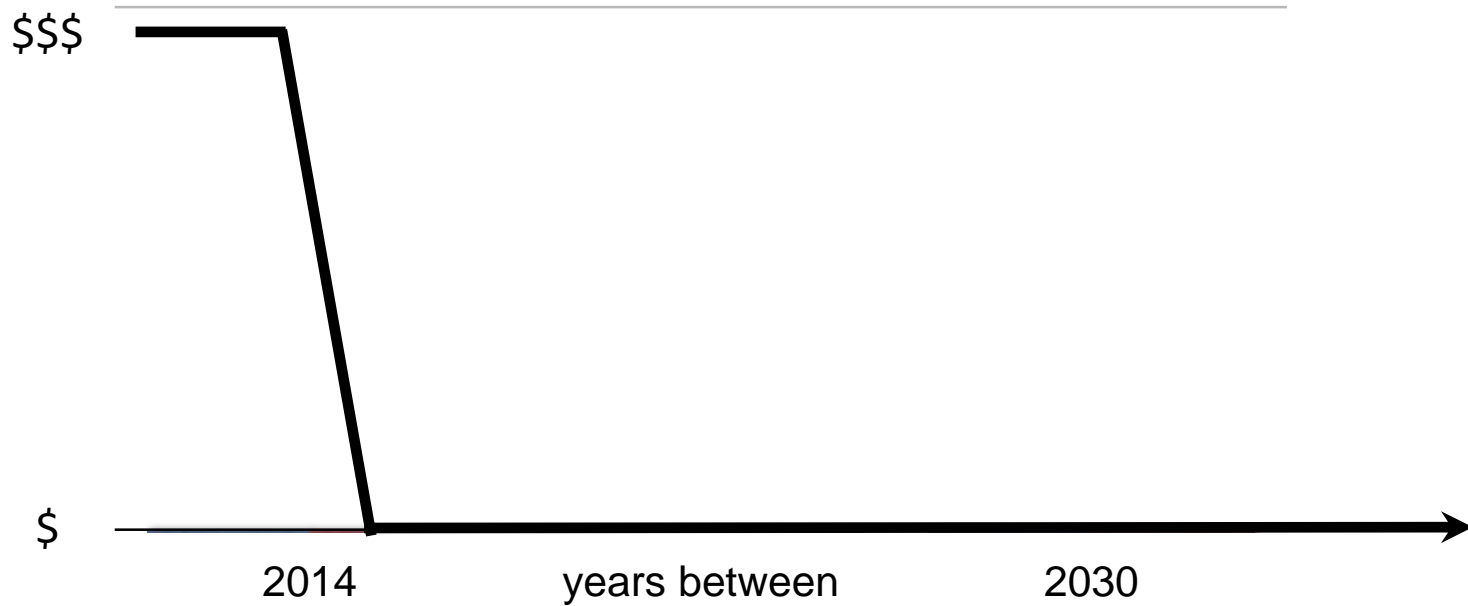








FSP future Energy costs





PROCESS



BEST LEARNING ENVIRONMENT

ENVIRONMENTALLY FRIENDLY

LOWEST ENERGY NET ZERO

BEAUTIFUL

LOST

SCHEMATIC DESIGN

SCHEMATIC DESIGN

Building Committee - priorities

1. Learning environment
2. Healthy
3. Cost
4. Environmentally friendly
5. Low energy
6. Beautiful



Design Team PRIORities

1. Learning environment
2. Low energy
3. Cost
4. Healthy
5. Beautiful
6. Environmentally friendly



no IEED certification

Net Zero was important

Passive house was only tangentially
discussed



PLAN
NORTH



2ND. FLOOR

PHASE 1 - "FLAT" ROOF



1A. General aerial view

PHASE 2 - "FLAT" ROOF



2A. General aerial view



1B. Entry from the drive circle



2B. Entry from the drive circle

PHASE 1 - LOW PITCH ROOF (3:12 SLOPE)



1A. General aerial view

PHASE 2 - LOW PITCH ROOF (3:12 SLOPE)



2A. General aerial view



1B. Entry from the drive circle



2B. Entry from the drive circle

PHASE 1 - ASYMMETRICAL GABLE (12:12 - 4:12)



1A. General aerial view

PHASE 2 - ASYMMETRICAL GABLE (12:12 - 4:12)



2A. General aerial view



1B. Entry from the drive circle



2B. Entry from the drive circle

PHASE 1 - SYMMETRICAL GABLE (8:12 SLOPE)



1A. General aerial view

PHASE 2 - SYMMETRICAL GABLE (8:12 SLOPE)



2A. General aerial view



1B. Entry from the drive circle



2B. Entry from the drive circle

PHASE 1



1A. General aerial view

PHASE 2



2A. General aerial view



1B. Entry from the drive circle



2B. Entry from the drive circle

roof form had minor ramifications
on energy modeling

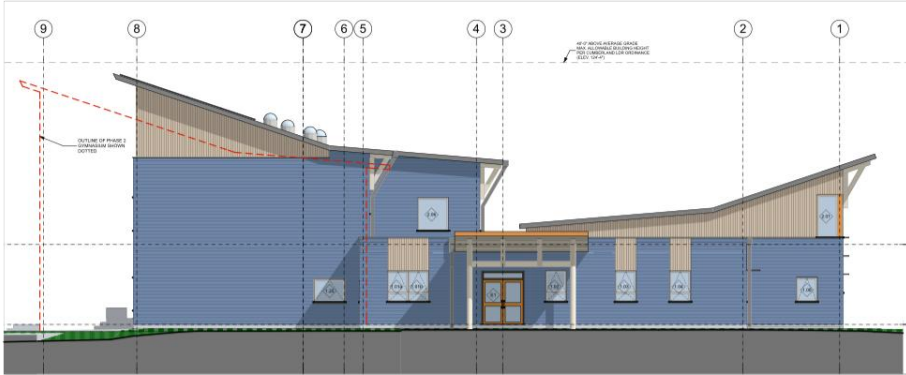






CLADDING NOTES:
 CLADDING A: WOOD BOARD (4" VERT.) NATURAL FINISH
 CLADDING B: F/C BOARD (6" HORIZ.) PAINT FINISH
 CLADDING C: F/C PANEL PAINT FINISH

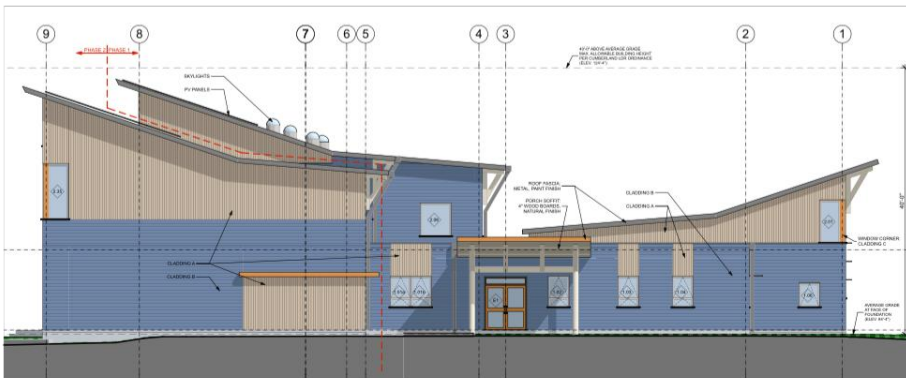




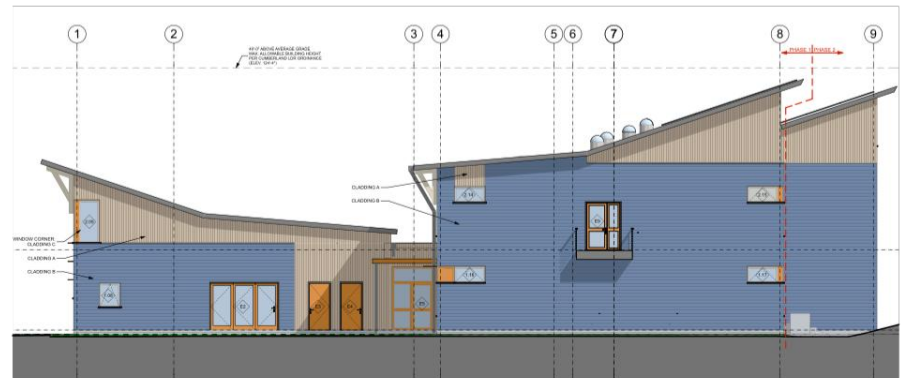
1 WEST ELEVATION - PHASE 1 (MAIN ENTRY)
SCALE: 1/8" = 1'-0"



2 EAST ELEVATION - PHASE 1
SCALE: 1/8" = 1'-0"



3 WEST ELEVATION - PHASE 1 & 2 (MAIN ENTRY WITH GYM)
SCALE: 1/8" = 1'-0"



4 EAST ELEVATION - PHASE 1 & 2 (WITH GYM)
SCALE: 1/8" = 1'-0"

CLADDING NOTES:
CLADDING A: WOOD BOARD (4" VERT) NATURAL FINISH
CLADDING B: FIC BOARD (6" HORIZ.) PAINT FINISH
CLADDING C: FIC PANEL PAINT FINISH

Please send any comments or corrections to: info@kaptan.com

ENERGY COST OPTIMIZATION		PROPOSED FRIENDS SCHOOL OF PORTLAND						Kaplan Thompson Architects	
BUILDING DATA		Cost per month to run utilities (heat, hot water & appliances) on standard utility electricity :							
Utility Electricity cost:	\$0.12	# REF!	# REF!	# REF!	# REF!	# REF!	# REF!	# REF!	# REF!
Typical kWh / Month Usage	15,000								
Construction:	New								
Description:	Private School								
Area of Occupied Floor (Square Feet):	13,580								
Constr Cost: (\$/ SF)	\$184.5								
Estimated Base Construction Cost:	\$2,505,510								
		SHELL OPTIONS							
		A: "Just OK insulation"	B: "Good insulation"	C: "High insulation"	C2: "C + better ERV"	D: "Eccor Panels"	E: "Passive House"	F: "Passive House"	
Area of Glazing (SF of windows + glass doors):	1,653	0.6 ACH50	0.6 ACH50	0.6 ACH50	0.6 ACH50	0.6 ACH50	0.5 ACH50	0.5 ACH50	
Length of Exterior Wall (Feet):	380	R-8 Subslab (2" EPS)	R-16 Subslab (4" EPS)	R-32 Subslab (8" EPS)	R-32 Subslab (8" EPS)	R-32 Subslab (8" EPS)	R-50 Subslab (12.5" EPS)	R-50 Subslab (12.5" EPS)	
Area of Roof (SF):	13,580	R-20 Foundation Walls	R-20 Foundation Walls	R-20 Foundation Walls	R-20 Foundation Walls	R-20 Foundation Walls	R-20 Foundation Walls	R-20 Foundation Walls	
Area of Basement (SF):	0	R-30 Walls (2x6, cellulose, 1.5" foam)	R-34 Walls (2x6, cellulose, 2" foam)	R-44 Walls (2x6, cellulose, 4" foam)	R-46 Walls (2x6, cellulose, 4" foam)	R-60 (Panels by Chris Corson)	R-60 (Panels by Chris Corson)	R-59 (Panels by Porter Panels)	
Area of Slab-on-grade (SF):	8,800	R-72 Roof 1 (20" loose cellulose)	R-72 Roof 1 (20" loose cellulose)	R-93 Roof 1 (26" loose cellulose)	R-93 Roof 1 (26" loose cellulose)	R-93 Roof 1 (26" loose cellulose)	R-93 Roof 1 (26" loose cellulose)	R-122 Roof 1 (34" loose cellulose)	R-122 Roof 1 (34" loose cellulose)
Area of Treated Floor Area (SF):	10,685	R-53 Roof 2 (14" TJI, cellulose, 4" foam)	R-80 Roof 2 (14" TJI, cellulose, 4" foam)	R-80 Roof 2 (14" TJI, cellulose, 4" foam)	R-80 Roof 2 (14" TJI, cellulose, 4" foam)	R-80 Roof 2 (14" TJI, cellulose, 4" foam)	R-80 Roof 2 (14" TJI, cellulose, 4" foam)	R-80 Roof 2 (14" TJI, cellulose, 4" foam)	
Location:	Cumberland ME 04021	U-0.16 Windows & Doors (uPVC)	U-0.16 Windows & Doors (uPVC)	U-0.16 Windows & Doors (uPVC)	U-0.16 Windows & Doors (uPVC)	U-0.16 Windows & Doors (uPVC)	U-0.16 Windows & Doors (uPVC)	U-0.16 Windows & Doors (uPVC)	
		Heat Pumps (air source minisplits)	Heat Pumps (air source minisplits)	Heat Pumps (air source minisplits)	Heat Pumps (air source minisplits)	Heat Pumps (air source minisplits)	Heat Pumps (air source minisplits)	Heat Pumps (air source minisplits)	
ERV efficiency	%	75	75	75	80	75	80	80	
PV for net-zero energy performance:	No. panels	163	144	134	119	131	114	114	
PV for net-zero energy performance:	kW	37.5	33.2	30.9	27.3	30.1	26.3	26.3	
Peak Heat Load (for equipment system sizing only)	BTU / Hour	86,222	75,510	65,277	50,988	61,849	44,889	44,889	
Annual Heat Demand	kBTU / YR	184,312	133,295	104,972	67,528	95,078	50,359	50,359	
Annual Heat Load	kWH / YR	54,017	39,065	30,764	19,791	27,865	14,759	14,759	
Annual Heat Load / SF (Passivhaus = 4.75 / TFA sf)	kBTU / SF / YR	17.25	12.47	9.82	6.32	8.90	4.71	4.71	
Heating System Type:									
Ventilation System Cost (exhaust only vs. HRV)									
CO2		2.5	2.5	2.5	2.5	2.5	2.5	2.5	
Annual Heating Demand	kWH / YR	177,501	132,296	106,790	71,256	97,356	54,371	54,371	
Annual Cooling Demand	kWH / YR	35,500	26,459	21,358	14,251	19,471	10,874	10,874	
Lights & Appliances	kWH / YR	30,000	30,000	30,000	30,000	30,000	30,000	30,000	
No. occupants		150	150	150	150	150	150	150	
DHW demand	kWH / YR	1,500	1,500	1,500	1,500	1,500	1,500	1,500	
Base Building Cost:		\$2,505,510	\$2,505,510	\$2,505,510	\$2,505,510	\$2,505,510	\$2,505,510	\$2,505,510	
Upgrade costs									
Shell upgade		\$0	\$33,548	\$76,464	\$76,464	\$210,474	\$224,186	\$163,757	
PV panels	\$3,120 /kW	\$114,400	\$103,584	\$96,408	\$85,176	\$94,006	\$82,056	\$82,056	
Increased ERV efficiency:		\$0	\$0	\$0	\$0	\$0	\$0	\$0	
Reduced HVAC system cost (\$ per 12,000BTU/hour):		\$8,000	-\$4,000	-\$19,000	-\$44,000	-\$44,000	-\$54,000	-\$54,000	
Net change in building cost:		\$114,400	\$133,132	\$153,872	\$117,640	\$260,480	\$252,242	\$191,813	
Net Building Cost:		\$2,619,910	\$2,638,642	\$2,659,382	\$2,623,150	\$2,765,990	\$2,757,752	\$2,697,323	

**Option A (previously C2):
Superinsulated Net Zero**

0.6 ACH50

R-32 Sublab (8" EPS)
R-20 Foundation Walls
R-46 Walls (2x6, cellulose, 4" foam)
R-93 Roof 1 (26" Loose Cellulose)
R-80 Roof 2 (14" TJI, DPC, 4" foam)
Heat Pumps (Mini Splits)
U-0.16 Windows and Doors (uPVC)

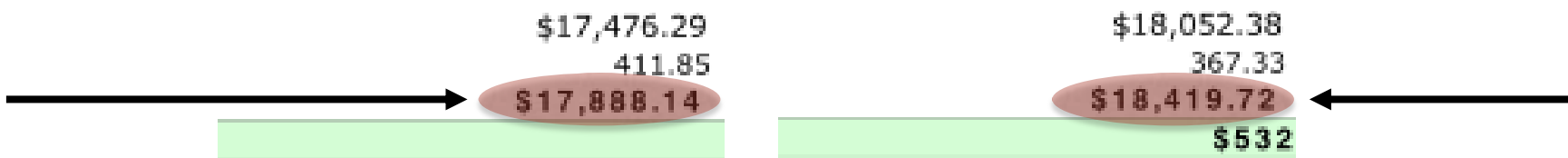
59,044
67,535
19,793
6.32
39,538
\$2,648,100
\$0

**Option B (previously F):
Passive House**

0.5 ACH50

R-50 Sublab (12.5" EPS)
R-20 Foundation Walls
R-53 Walls (Porter Panels)
R-122 Roof 1 (34" Loose Cellulose)
R-80 Roof 2 (14" TJI, DPC, 4" foam)
Heat Pumps (Mini Splits)
U-0.16 Windows and Doors (uPVC)

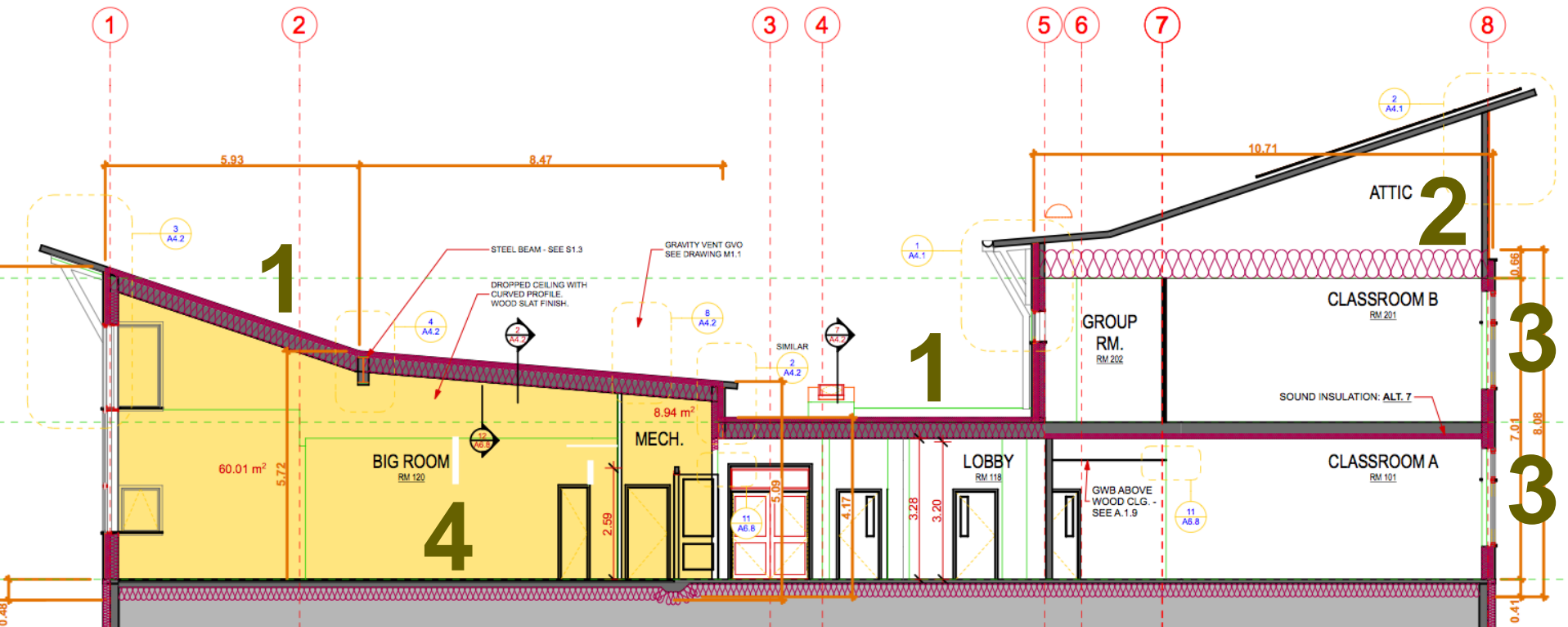
46,994
50,331
14,751
4.71
35,264
\$2,648,100
\$87,293



TOTAL mortgage COST/MONTH

INSULATION STRATEGIES

- 1- TJI ROOF W/ DPC + 4" POLYISO - R-88
- 2- TRUSS ROOF W/ 24" LBC - R-100
- 3- 2X6 WALL W/ DPC + 4" POLYISO - R-46
- 4- 6" CONC. SLAB W/ 12" EPS FOAM - R-57



CHALLENGES

HEAVILY SHADED SITE

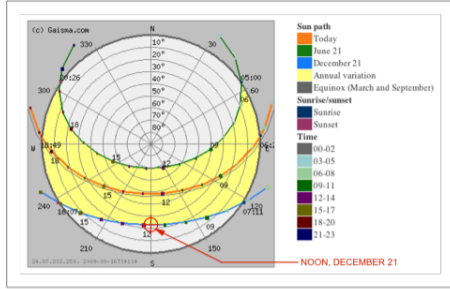
VENTILATION DESIGN REQUIREMENTS

BUDGETARY CONSTRAINTS

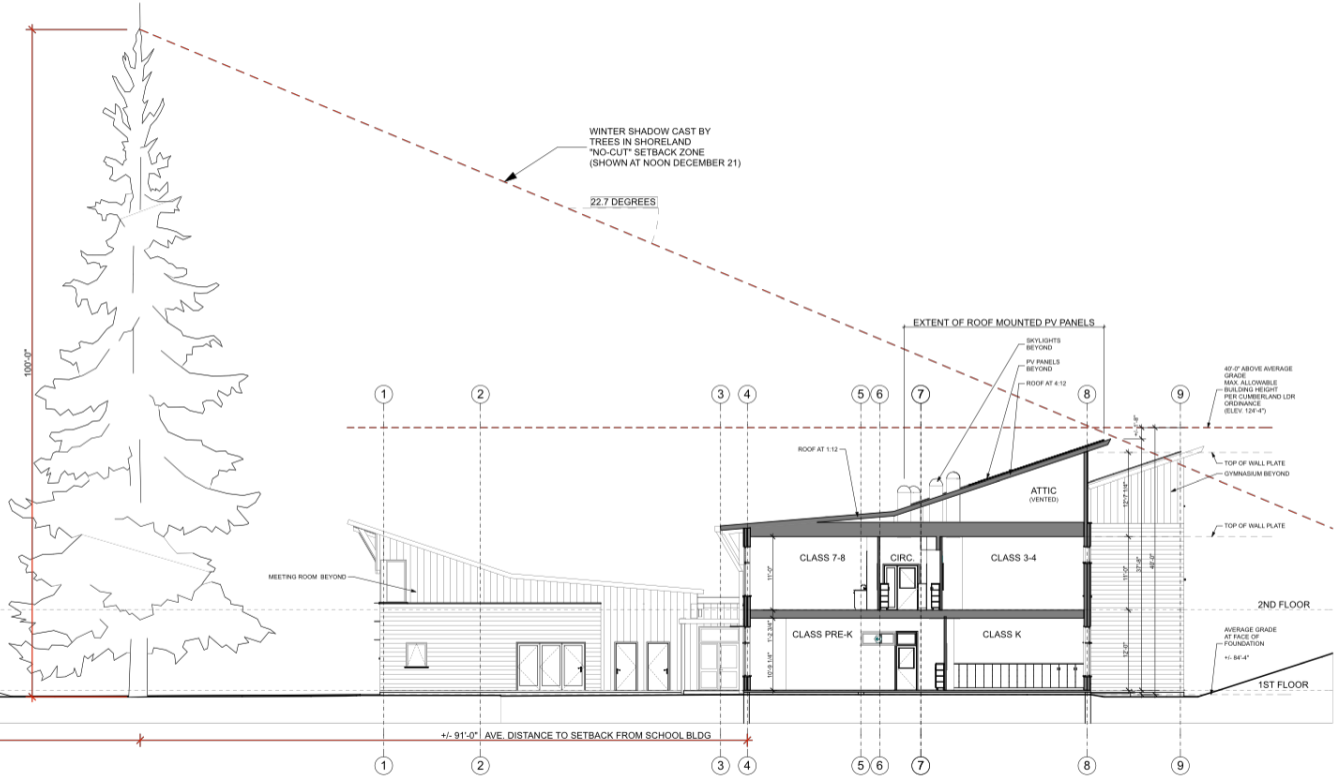
WINTER CONSTRUCTION

SHADING





2 ANNUAL SUNPATH DIAGRAM, PORTLAND ME



1 SECTION - TYPICAL AT CLASSROOM WING
SCALE: 1/8" = 1'-0"

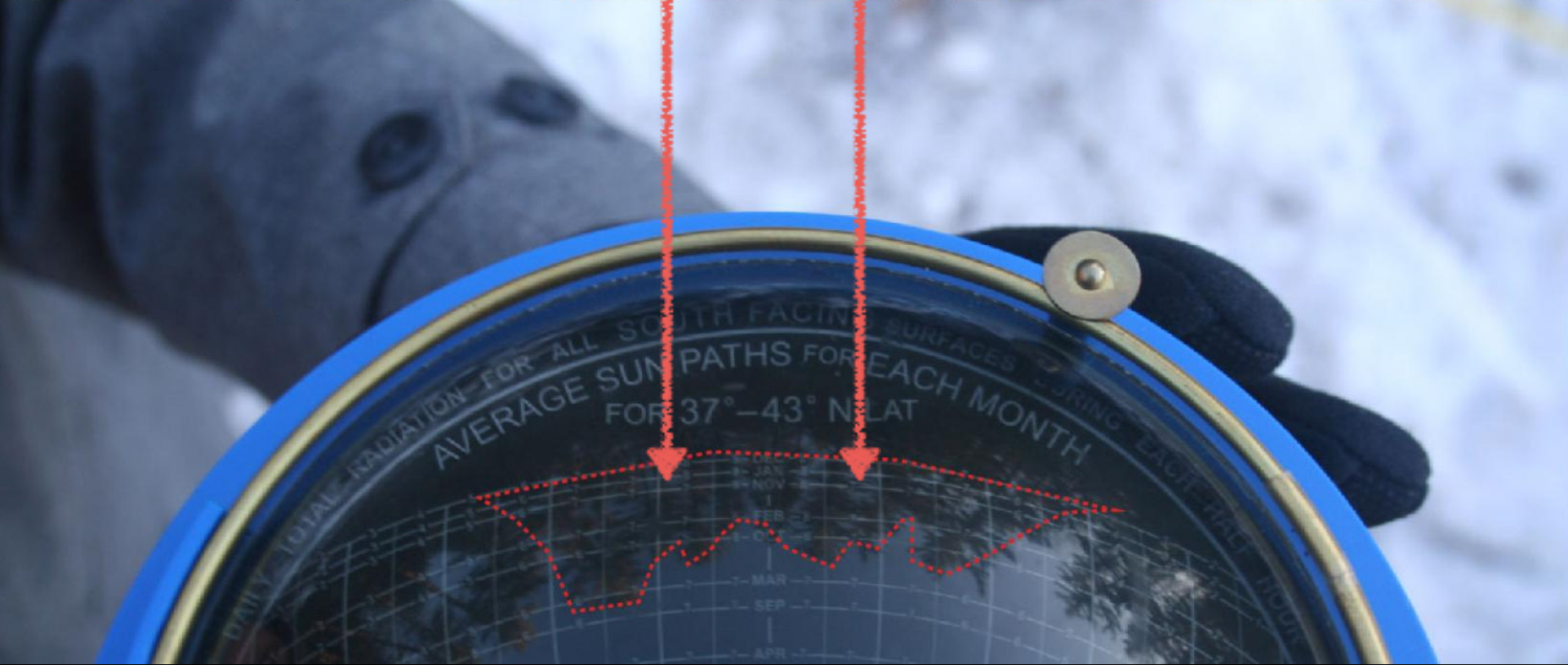


Design Development

Project:	New School Friends School of Portland Route 1, Cumberland, Maine 04021	
Drawing:	TREES & SHADE ANGLES	
Scale:		Drawn by: RTL
Date:	october 15, 2013	Revised:

PATHFINDER RESULTS

	6	7	8	9	10	11	12	1	2	3	4	5	6	7									
DEC			2	3	4	5	6	7	7	8	8	8	8	7	7	6	5	4	3	2			
JAN			2	3	4	5	6	7	7	8	8	8	8	7	7	6	5	4	3	2			
NOV		1	2	3	4	5	6	7	7	7	8	8	7	7	7	6	5	4	3	2	1		
FEB		1	2	3	4	5	6	7	7	7	8	8	7	7	7	6	5	4	3	2	1		
OCT			2	2	3	4	5	6	6	7	7	8	8	7	7	6	5	4	3	2	2		
MAR		1	2	2	3	4	5	6	6	7	7	7	7	7	6	6	5	4	3	2	2	1	
SEP		1	2	2	3	4	5	6	6	7	7	7	7	7	6	6	5	4	3	2	2	1	
APR		1	2	2	3	4	5	6	6	7	7	7	7	7	6	6	5	4	3	2	2	1	
AUG		1	2	2	3	4	5	6	6	7	7	7	7	7	6	6	5	4	3	2	2	1	
MAY		1	2	2	3	4	5	6	6	7	7	7	7	7	6	6	5	4	3	2	2	1	
JUL		1	2	2	3	4	5	6	6	7	7	7	7	7	6	6	5	4	3	2	2	1	
JUN	1	1	2	2	3	4	5	6	6	6	7	7	7	7	6	6	5	4	3	2	2	1	1







24'-11"!

INHAUS DASHBOARD

(IN EVERY HOUSE OR HAUS)

PHPP FIRST CUT: TYPICAL VALUES

JUNE 2013

PEAK LOAD **69,585** BTU / HOUR

PRIMARY ENERGY **31.93** kBTU / SF / YEAR

ANNUAL HEATING **8.84** kBTU / SF / YEAR

ANNUAL COOLING **0.66** kBTU / SF / YEAR

VENTILATION

70% % EFFICIENT

AIR TIGHTNESS

0.60 ACH50

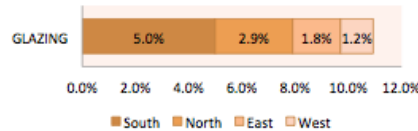
R-VALUES

20.0 SLAB
40.0 WALLS
60.0 ROOF
60.0 TRUSS ROOF
60.0 TJI ROOF

WINDOWS & DOORS

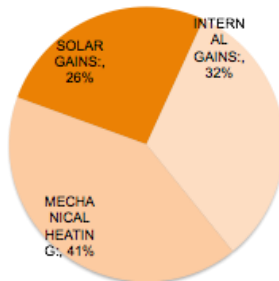
0.50 SHGC
0.15 U-VALUE GLASS
0.30 U-VALUE FRAME
0.22 U-VALUE UNIT

GLAZING % OF TFA

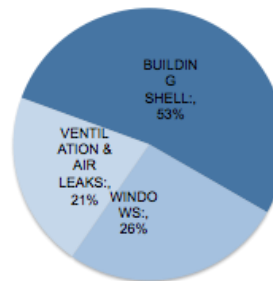


WINDOW ENERGY **(19,491)** kBTU / YEAR

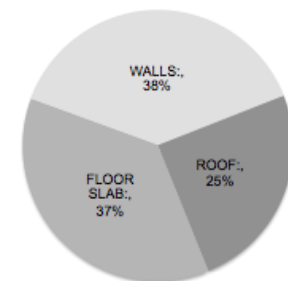
HEAT GAINS



HEAT LOSS



SHELL LOSSES



SOLAR GAINS: **26%**
 INTERNAL GAINS: **32%**
 MECHANICAL HEATING: **41%**

BUILDING SHELL: **53%**
 WINDOWS: **26%**
 VENTILATION & AIR LEAKS: **21%**

WALLS: **38%**
 ROOF: **25%**
 FLOOR SLAB: **37%**

PHPP: ZEHNDER & HIGH SHGC

JULY 2013

PEAK LOAD 64,700 BTU / HOUR

PRIMARY ENERGY 30.69 kBTU / SF / YEAR

ANNUAL HEATING 7.46 kBTU / SF / YEAR

ANNUAL COOLING 0.78 kBTU / SF / YEAR

VENTILATION

88% % EFFICIENT

AIR TIGHTNESS

0.60 ACH50

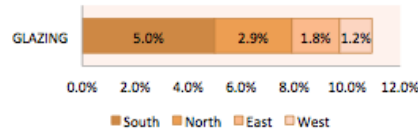
R-VALUES

20.0 SLAB
 40.0 WALLS
 60.0 ROOF
 60.0 TRUSS ROOF
 60.0 TJI ROOF

WINDOWS & DOORS

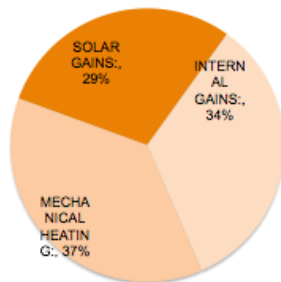
0.55 SHGC
 0.15 U-VALUE GLASS
 0.30 U-VALUE FRAME
 0.22 U-VALUE UNIT

GLAZING % OF TFA

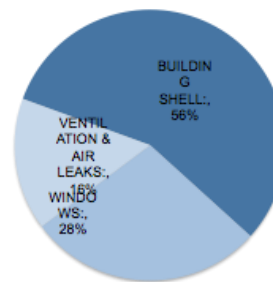


WINDOW ENERGY (15,696) kBTU / YEAR

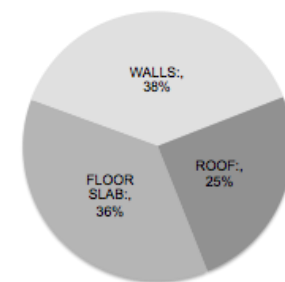
HEAT GAINS



HEAT LOSS



SHELL LOSSES



SOLAR GAINS: 29%
 INTERNAL GAINS: 34%
 MECHANICAL HEATING: 37%

BUILDING SHELL: 56%
 WINDOWS: 28%
 VENTILATION & AIR LEAKS: 16%

WALLS: 38%
 ROOF: 25%
 FLOOR SLAB: 36%

PHPP: ZEHNDER & EURO VINYL

SEPT 2013

PEAK LOAD 57,837 BTU / HOUR
PRIMARY ENERGY 29.30 kBTU / SF / YEAR

ANNUAL HEATING 5.72 kBTU / SF / YEAR
ANNUAL COOLING 1.03 kBTU / SF / YEAR

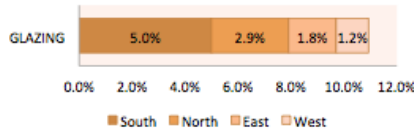
VENTILATION
 88% % EFFICIENT

AIR TIGHTNESS
 0.60 ACH50

R- VALUES
 20.0 SLAB
 40.0 WALLS
 60.0 ROOF
 60.0 TRUSS ROOF
 60.0 TJI ROOF

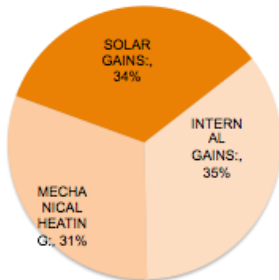
WINDOWS & DOORS
 0.62 SHGC
 0.11 U-VALUE GLASS
 0.17 U-VALUE FRAME
 0.16 U-VALUE UNIT

GLAZING % OF TFA

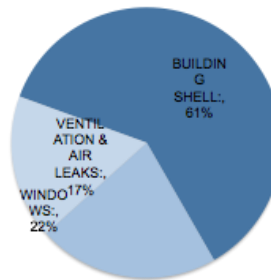


WINDOW ENERGY 6,448 kBTU / YEAR

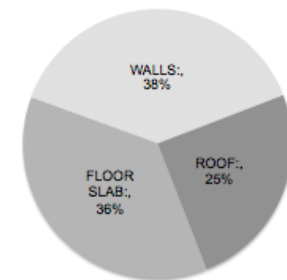
HEAT GAINS



HEAT LOSS



SHELL LOSSES



SOLAR GAINS: 34%
 INTERNAL GAINS: 35%
 MECHANICAL HEATING: 31%

BUILDING SHELL: 61%
 WINDOWS: 22%
 VENTILATION & AIR LEAKS: 17%

WALLS: 38%
 ROOF: 25%
 FLOOR SLAB: 36%

PHPP: RENEWAIRE

FEB 2014

PEAK LOAD 60,899 BTU / HOUR

PRIMARY ENERGY 29.97 kBTU / SF / YEAR

ANNUAL HEATING 6.45 kBTU / SF / YEAR

ANNUAL COOLING 1.03 kBTU / SF / YEAR

VENTILATION

75% % EFFICIENT

AIR TIGHTNESS

0.60 ACH50

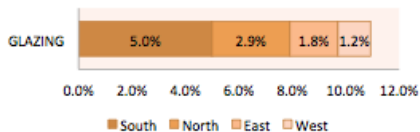
R- VALUES

20.0 SLAB
40.0 WALLS
60.0 ROOF
60.0 TRUSS ROOF
60.0 TJI ROOF

WINDOWS & DOORS

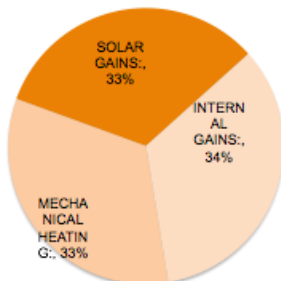
0.62 SHGC
0.11 U-VALUE GLASS
0.17 U-VALUE FRAME
0.16 U-VALUE UNIT

GLAZING % OF TFA

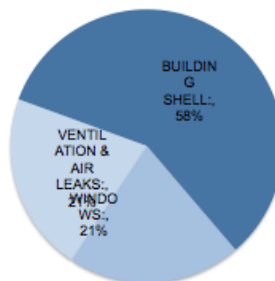


WINDOW ENERGY 6,448 kBTU / YEAR

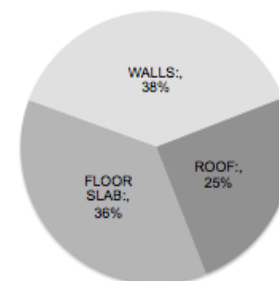
HEAT GAINS



HEAT LOSS



SHELL LOSSES



SOLAR GAINS: 33%
INTERNAL GAINS: 34%
MECHANICAL HEATING: 33%

BUILDING SHELL: 58%
WINDOWS: 21%
VENTILATION & AIR LEAKS: 21%

WALLS: 38%
ROOF: 25%
FLOOR SLAB: 36%

PRODUCTS

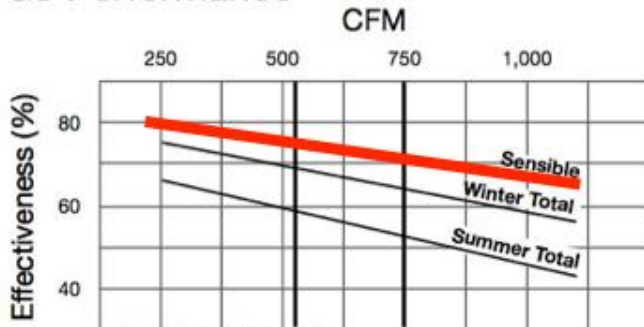


HE1XINH

Indoor Unit



G5 Performance



*At AHRI 1060 standard conditions
(See certified data on page 73 for core components.)



Specifications

Ventilation Type: Static Plate, Heat and Humidity Transfer					
Typical Airflow Range: 250-925 CFM					
AHRI 1060 Certified Core: One L125-00					
Airflow Rating Points (for AHRI): 750 CFM and 563 CFM					
Number Motors: Two direct drive blower/motor packages					
V	HZ	Phase	FLA (per motor)	Min. Cir. Amps	Max. Overcurrent Protection Device
115	60	Single	9.0	20.3	25
208-230	60	Single	4.5	10.1	15
277	60	Single	3.9	8.8	15
208-230	60	Three	1.7-2.3	5.2	15
460	60	Three	1.15	2.6	15
Standard Features: Non-fused Disconnect 24 VAC Transformer/Relay Package					
Filters: Two total, MERV 8, 2" pleated, 20" x 20" nominal size					
Weight: 211 lbs (unit), 300 lbs (shipping weight, on pallet)					
Shipping Dimensions: 62" L x 48" W x 40" H					
Options: ECM Motor - Two, 115V or 208-230V 0.75 hp (Single Phase) Fused Disconnect Double Wall Construction Motorized Isolation Dampers, OA, EA or both airstreams Factory Mounted Filter Alarms (2) Independent Blower Control					
Accessories: Wall Caps Back Draft Dampers					

63%?

or

75%?

PHPP: RENEWAIRE & CERTIFICATION

MARCH 2014

PEAK LOAD 63,726 BTU / HOUR

PRIMARY ENERGY 30.62 kBTU / SF / YEAR

ANNUAL HEATING 7.13 kBTU / SF / YEAR

ANNUAL COOLING 1.03 kBTU / SF / YEAR

VENTILATION

63% % EFFICIENT

AIR TIGHTNESS

0.60 ACH50

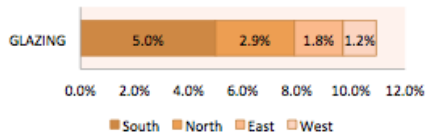
R-VALUES

20.0 SLAB
40.0 WALLS
60.0 ROOF
60.0 TRUSS ROOF
60.0 TJI ROOF

WINDOWS & DOORS

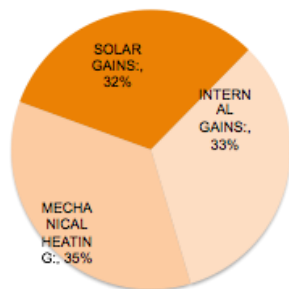
0.62 SHGC
0.11 U-VALUE GLASS
0.17 U-VALUE FRAME
0.16 U-VALUE UNIT

GLAZING % OF TFA

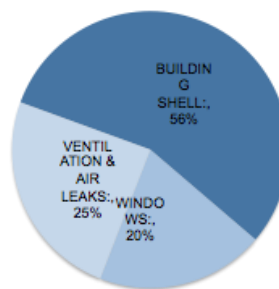


WINDOW ENERGY 6,448 KBTU / YEAR

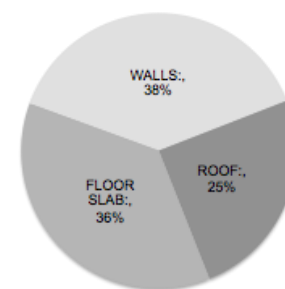
HEAT GAINS



HEAT LOSS



SHELL LOSSES



SOLAR GAINS: 32%
INTERNAL GAINS: 33%
MECHANICAL HEATING: 35%

BUILDING SHELL: 56%
WINDOWS: 20%
VENTILATION & AIR LEAKS: 25%

WALLS: 38%
ROOF: 25%
FLOOR SLAB: 36%

PHPP: MORE INSULATION

JUNE 2014

PEAK LOAD **55,305** BTU / HOUR

PRIMARY ENERGY **29.55** kBTU / SF / YEAR

ANNUAL HEATING **5.07** kBTU / SF / YEAR

ANNUAL COOLING **1.26** kBTU / SF / YEAR

VENTILATION

63% % EFFICIENT

AIR TIGHTNESS

0.60 ACH50

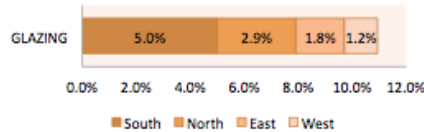
R- VALUES

57.4 SLAB
46.2 WALLS
95.2 ROOF
100.2 TRUSS ROOF
87.8 TJI ROOF

WINDOWS & DOORS

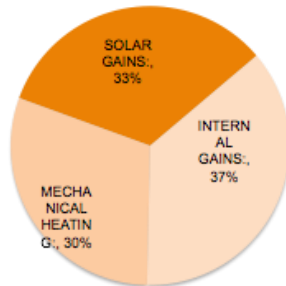
0.62 SHGC
0.11 U-VALUE GLASS
0.17 U-VALUE FRAME
0.16 U-VALUE UNIT

GLAZING % OF TFA

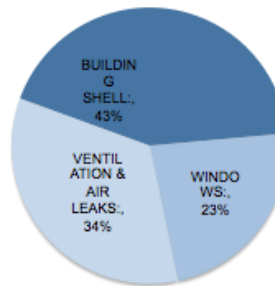


WINDOW ENERGY **6,108** KBTU / YEAR

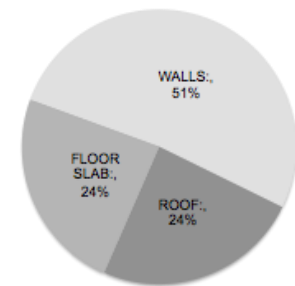
HEAT GAINS



HEAT LOSS



SHELL LOSSES



SOLAR GAINS: **33%**
 INTERNAL GAINS: **37%**
 MECHANICAL HEATING: **30%**

BUILDING SHELL: **43%**
 WINDOWS: **23%**
 VENTILATION & AIR LEAKS: **34%**

WALLS: **51%**
 ROOF: **24%**
 FLOOR SLAB: **24%**

PHPP: RENEWAIRE & INTUS

JULY 2014

PEAK LOAD 51,848 BTU / HOUR

PRIMARY ENERGY 28.86 kBTU / SF / YEAR

ANNUAL HEATING 4.24 kBTU / SF / YEAR

ANNUAL COOLING 1.26 kBTU / SF / YEAR

VENTILATION

75% % EFFICIENT

AIR TIGHTNESS

0.60 ACH50

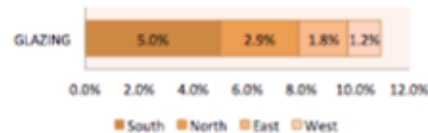
R-VALUES

57.4 SLAB
46.2 WALLS
95.2 ROOF
100.2 TRUSS ROOF
87.8 TJI ROOF

WINDOWS & DOORS

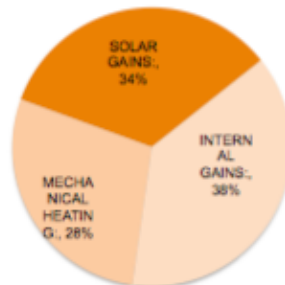
0.62 SHGC
0.11 U-VALUE GLASS
0.17 U-VALUE FRAME
0.16 U-VALUE UNIT

GLAZING % OF TFA

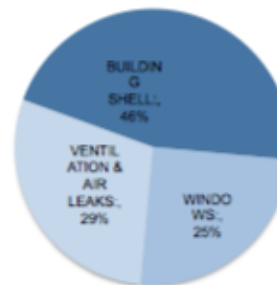


WINDOW ENERGY 6,108 kBTU / YEAR

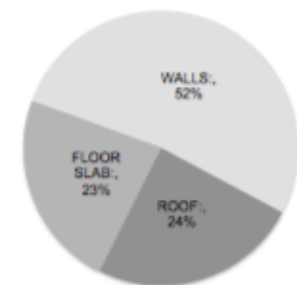
HEAT GAINS



HEAT LOSS



SHELL LOSSES



SOLAR GAINS: 34%
INTERNAL GAINS: 38%
MECHANICAL HEATING: 28%

BUILDING SHELL: 46%
WINDOWS: 25%
VENTILATION & AIR LEAKS: 29%

WALLS: 52%
ROOF: 24%
FLOOR SLAB: 23%

CURRENT PHPP: .5 ACH 50

SEPT 2014

PEAK LOAD 48,525 BTU / HOUR

PRIMARY ENERGY 28.64 kBTU / SF / YEAR

ANNUAL HEATING 3.97 kBTU / SF / YEAR

ANNUAL COOLING 1.26 kBTU / SF / YEAR

VENTILATION

75% % EFFICIENT

AIR TIGHTNESS

0.50 ACH50

R- VALUES

57.4 SLAB
 46.2 WALLS
 95.2 ROOF
 100.2 TRUSS ROOF
 87.8 TJI ROOF

WINDOWS & DOORS

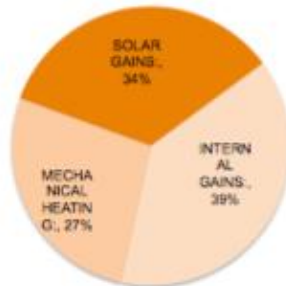
0.62 SHGC
 0.11 U-VALUE GLASS
 0.17 U-VALUE FRAME
 0.16 U-VALUE UNIT

GLAZING % OF TFA



WINDOW ENERGY 6,108 KBTU / YEAR

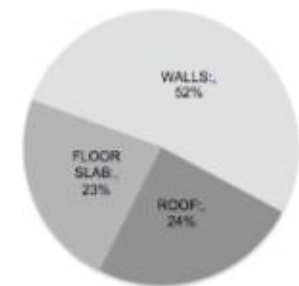
HEAT GAINS



HEAT LOSS



SHELL LOSSES



SOLAR GAINS: 34%
 INTERNAL GAINS: 39%
 MECHANICAL HEATING: 27%

BUILDING SHELL: 47%
 WINDOWS: 26%
 VENTILATION & AIR LEAKS: 27%

WALLS: 52%
 ROOF: 24%
 FLOOR SLAB: 23%

AS MODELED (PHPP): 0.50 ACH 50

ACTUAL (FINAL TEST): 0.32 ACH 50

SEPT 2014

PEAK LOAD 48,525 BTU / HOUR
PRIMARY ENERGY 28.64 kBTU / SF / YEAR

ANNUAL HEATING 3.97 kBTU / SF / YEAR
ANNUAL COOLING 1.26 kBTU / SF / YEAR

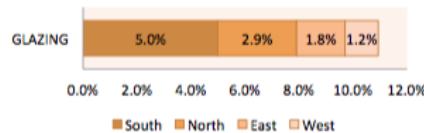
VENTILATION
75% % EFFICIENT

R-VALUES
57.4 SLAB
46.2 WALLS
95.2 ROOF
100.2 TRUSS ROOF
87.8 TJI ROOF

WINDOWS & DOORS
0.62 SHGC
0.11 U-VALUE GLASS
0.17 U-VALUE FRAME
0.16 U-VALUE UNIT

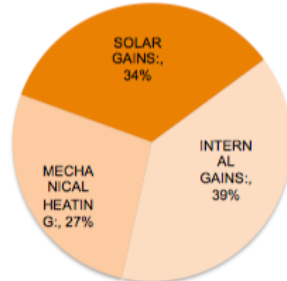
AIR TIGHTNESS
0.50 ACH50

GLAZING % OF TFA

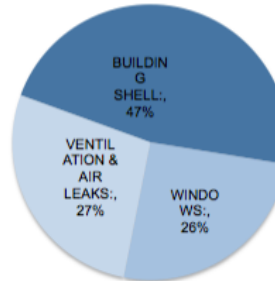


WINDOW ENERGY 6,108 kBTU / YEAR

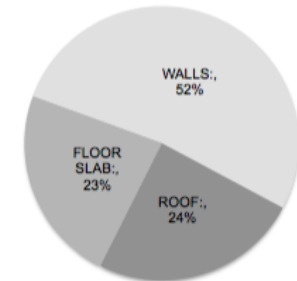
HEAT GAINS



HEAT LOSS



SHELL LOSSES



SOLAR GAINS: **34%**
 INTERNAL GAINS: **39%**
 MECHANICAL HEATING: **27%**

BUILDING SHELL: **47%**
 WINDOWS: **26%**
 VENTILATION & AIR LEAKS: **27%**

WALLS: **52%**
 ROOF: **24%**
 FLOOR SLAB: **23%**

size (in SF) 15,500
Building \$3.04 M

BUILDING Cost/sf = \$196

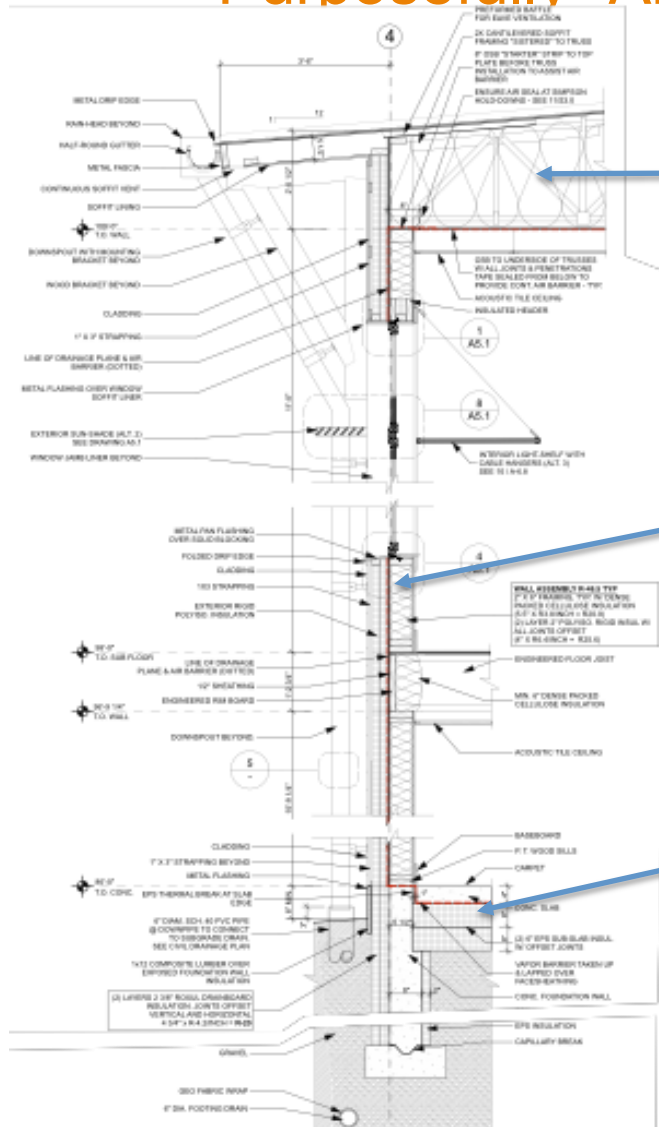
Commodity marketplace pricing



WELL PLANNED = less expensive

Commodity marketplace pricing

Purposefully “American” details



R-88 to 100 roof typ.

R-46 walls typ.

R-57 subslab typ.

THRESHOLD DETAILS







**NO DRILLING
AIRTIGHT
CONSTRUCTION**



**NO CUTTING
AIRTIGHT
MEMBRANES**

REPORT ALL PENETRATIONS TO SUPERVISOR





CONCLUSION

CLEAR VISION, SHARED VALUES

EARLY, INTEGRATED DESIGN TEAM

LEADERSHIP

QUESTIONS?

