

**BUILDING INFORMATION**

Category:	<b>Non-residential</b>
Status:	<b>In planning</b>
Building type:	<b>New construction</b>
Year of construction:	
Units:	<b>1</b>
Number of occupants:	<b>6 (Design)</b>
Occupant density:	<b>482.2 ft²/Person</b>

**Boundary conditions**

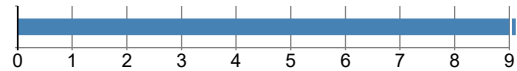
Climate:	<b>BUFFALO NIAGARA INTL AP NY</b>
Internal heat gains:	<b>2.5 Btu/hr ft²</b>
Interior temperature:	<b>68 °F</b>
Overheat temperature:	<b>77 °F</b>

**Building geometry**

Enclosed volume:	<b>62,906 ft³</b>
Net-volume:	<b>47,808.6 ft³</b>
Total area envelope:	<b>9,323.6 ft²</b>
Area/Volume Ratio:	<b>0.1 1/ft</b>
Floor area:	<b>2,893 ft²</b>
Envelope area/iCFA:	<b>3.223</b>

**PASSIVEHOUSE REQUIREMENTS****Certificate criteria:** **PHIUS+ 2018****Heating demand**

specific:	<b>15.46 kBtu/ft²yr</b>
target:	<b>25 kBtu/ft²yr</b>
total:	<b>44,735.21 kBtu/yr</b>

**Cooling demand**

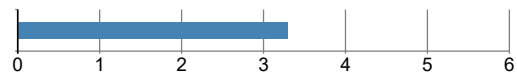
sensible:	<b>6.15 kBtu/ft²yr</b>
latent:	<b>0.19 kBtu/ft²yr</b>
specific:	<b>6.34 kBtu/ft²yr</b>
target:	<b>25 kBtu/ft²yr</b>
total:	<b>18,339.57 kBtu/yr</b>

**Heating load**

specific:	<b>10.4 Btu/hr ft²</b>
target:	<b>25 Btu/hr ft²</b>
total:	<b>30,079.03 Btu/hr</b>

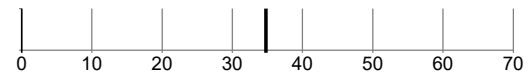
**Cooling load**

specific:	<b>3.3 Btu/hr ft²</b>
target:	<b>25 Btu/hr ft²</b>
total:	<b>9,536.66 Btu/hr</b>



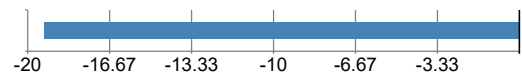
## Source energy

total: 0 kWh/yr  
 specific: 0 kBtu/ft²yr  
 target: 34.8 kBtu/ft²yr  
 total: 0 kBtu/yr  
 specific: 0 kBtu/ft²yr



## Site energy

total: -55,879.6 kBtu/yr  
 specific: -19.32 kBtu/ft²yr  
 total: -16,378.31 kWh/yr  
 specific: -5.66 kWh/ft²



## Air tightness

ACH50: 0.94 1/hr  
 CFM50 per envelope area: 0.08 cfm/ft²  
 target: 0.7 1/hr  
 target CFM50: 0.06 cfm/ft²

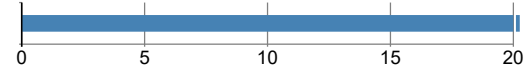


## PASSIVEHOUSE RECOMMENDATIONS

Sensible recovery efficiency: 74.6 %



Frequency of overheating: 33.7 %  
 Cooling system is required



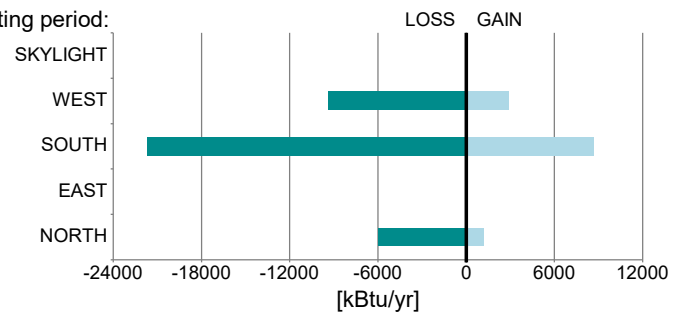
Frequency of overheating only applies if there is not a [properly sized] cooling system installed.

## BUILDING ELEMENTS

### Windows

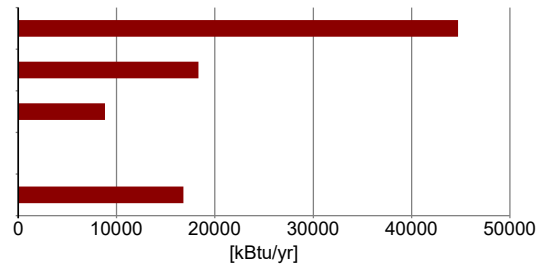
Average SHGC:	<b>0.38</b>	
Average solar reduction factor heating:	<b>0.43</b>	
Average solar reduction factor cooling:	<b>0.46</b>	
Average U-value:	<b>0.441</b>	Btu/hr ft <sup>2</sup> °F
Total glazing area:	<b>386.4</b>	ft <sup>2</sup>
Total window area:	<b>516.1</b>	ft <sup>2</sup>

Heat gain/loss heating period:



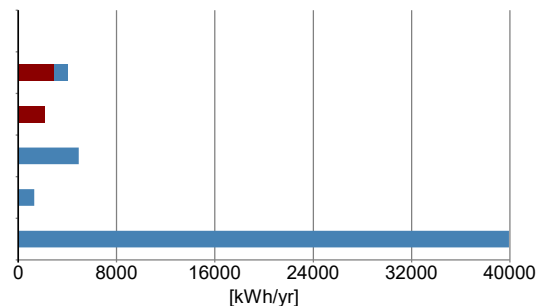
### HVAC

Total heating demand:	<b>44,735</b>	kBtu/yr
Total cooling demand:	<b>18,340</b>	kBtu/yr
Total DHW energy demand:	<b>8,828</b>	kBtu/yr
Solar DHW contribution:	<b>0</b>	kBtu/yr
Auxiliary electricity:	<b>16,783</b>	kBtu/yr



### Electricity

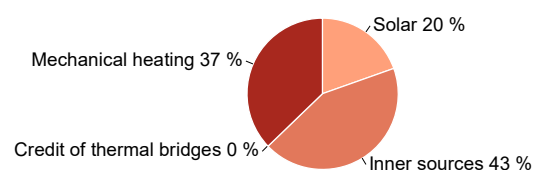
Direct heating / DHW:	<b>0</b>	kWh/yr
Heatpump heating:	<b>4,044</b>	kWh/yr
Cooling:	<b>2,190</b>	kWh/yr
HVAC auxiliary energy:	<b>4,919</b>	kWh/yr
Appliances:	<b>1,299</b>	kWh/yr
Renewable generation, coincident production and use:	<b>39,911</b>	kWh/yr
Total electricity demand:	<b>0</b>	kWh/yr



## HEAT FLOW - HEATING PERIOD

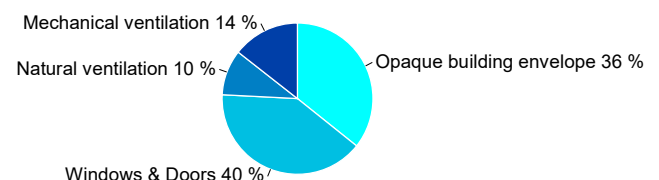
### Heat gains

Solar:	<b>18,155</b>	kBtu/yr
Inner sources:	<b>40,288</b>	kBtu/yr
Credit of thermal bridges:	<b>0</b>	kBtu/yr
Mechanical heating:	<b>44,735</b>	kBtu/yr



### Heat losses

Opaque building envelope:	<b>36,867</b>	kBtu/yr
Windows & Doors:	<b>41,374</b>	kBtu/yr
Natural ventilation:	<b>10,083</b>	kBtu/yr
Mechanical ventilation:	<b>14,854</b>	kBtu/yr

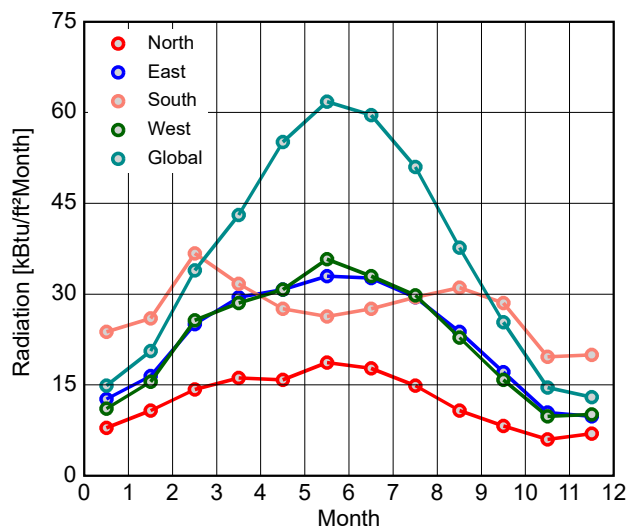
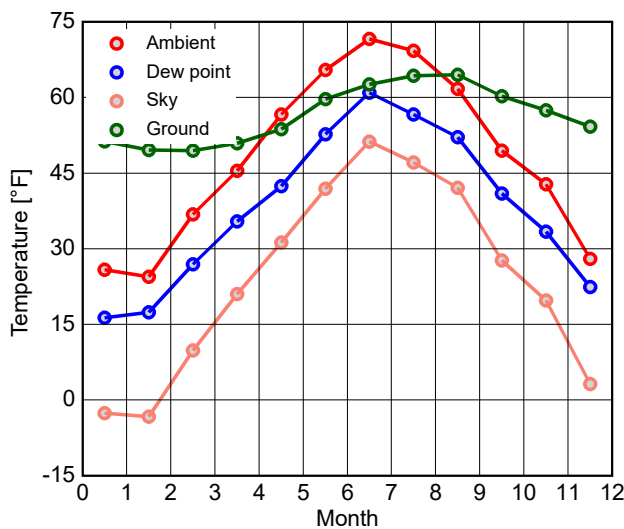


## CLIMATE

Latitude: **42.9 °**  
Longitude: **-78.7 °**  
Elevation of weather station: **705.4 ft**  
Elevation of building site: **623 ft**  
Heat capacity air: **0.018 Btu/ft³F**  
Daily temperature swing summer: **18 °F**  
Average wind speed: **13.1 ft/s**

## Ground

Average ground surface temperature: **50.2 °F**  
Amplitude ground surface temperature: **55.6 °F**  
Ground thermal conductivity: **1.2 Btu/hr ft °F**  
Ground heat capacity: **29.8 Btu/ft³F**  
Depth below grade of groundwater: **9.8 ft**  
Flow rate groundwater: **0.2 ft/d**



## Calculation parameters

Length of heating period: **303 days/yr**  
Heating degree hours: **163.1 kFh/a**  
Phase shift months: **1.3 mths**  
Time constant heating demand: **51.2 hr**  
Time constant cooling demand: **0 hr**  
Time constant cooling demand with night ventilation: **0 hr**

Climate for	Heating load 1	Heating load 2	Cooling
Temperature [°F]	12.2	26.8	77
Solar radiation North [Btu/hr ft²]	16.8	9.5	21.9
Solar radiation East [Btu/hr ft²]	29.5	12.4	40.9
Solar radiation South [Btu/hr ft²]	50.1	19.3	36.8
Solar radiation West [Btu/hr ft²]	25.4	11.7	28.5
Solar radiation Global [Btu/hr ft²]	33.9	15.8	72.3

Relevant boundary conditions for heating load calculation: Heating load 1

## ANNUAL HEAT DEMAND

Transmission losses :	<b>78,241</b> kBtu/yr
Ventilation losses:	<b>24,937</b> kBtu/yr
Total heat losses:	<b>103,178</b> kBtu/yr

Solar heat gains:	<b>23,520</b> kBtu/yr
Internal heat gains:	<b>52,195</b> kBtu/yr
Total heat gains:	<b>75,715</b> kBtu/yr
Utilization factor:	<b>77.2</b> %
Useful heat gains:	<b>58,442</b> kBtu/yr

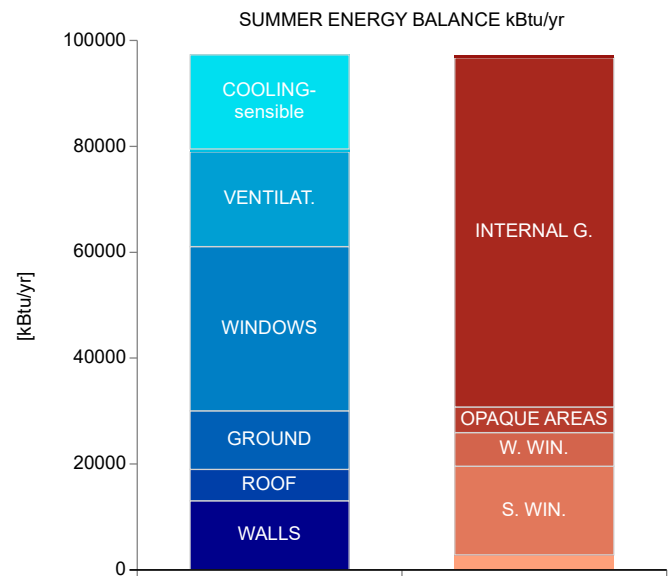
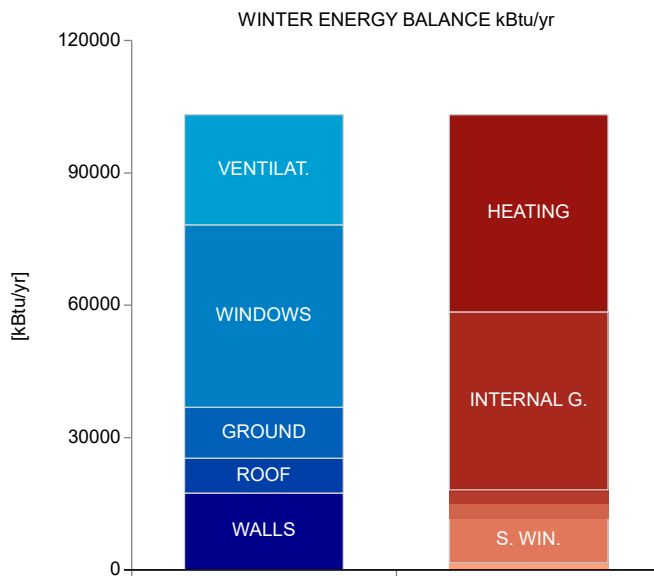
Annual heat demand:	<b>44,735</b> kBtu/yr
Specific annual heat demand:	<b>15,464.8</b> Btu/ft <sup>2</sup> yr

## ANNUAL COOLING DEMAND

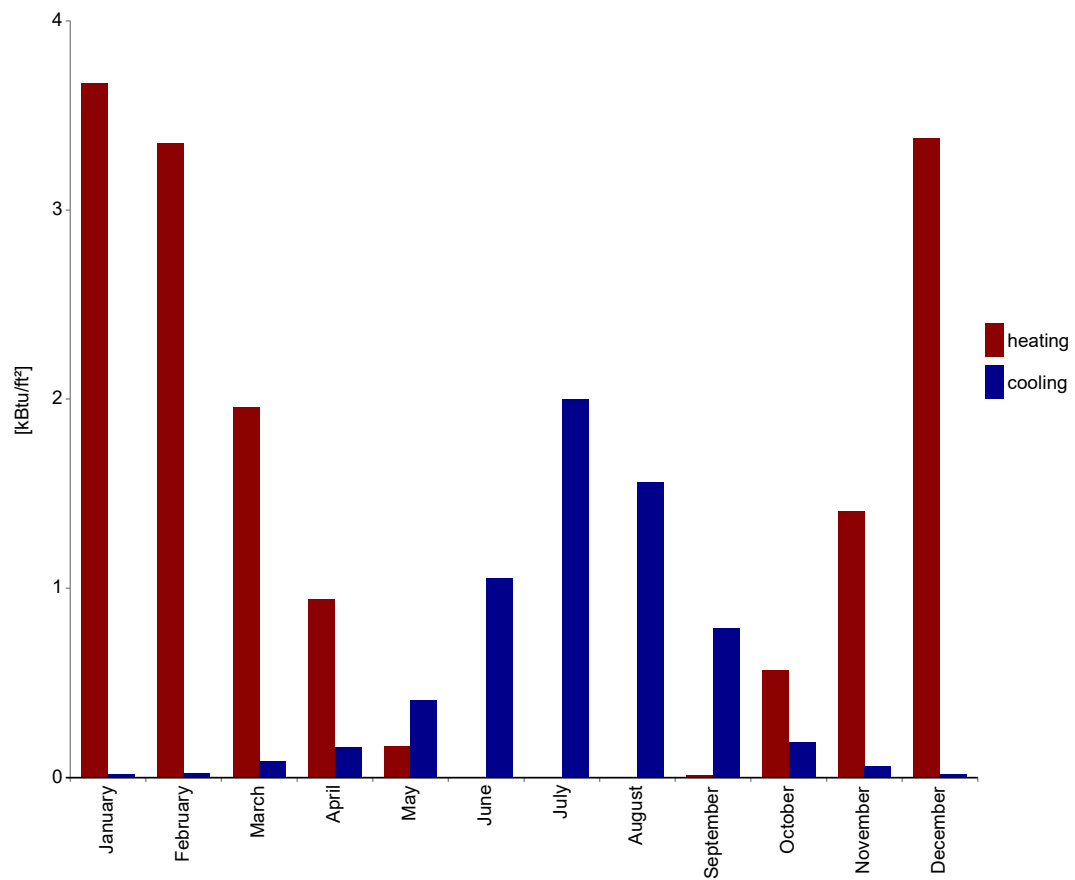
Solar heat gains:	<b>30,749</b> kBtu/yr
Internal heat gains:	<b>65,970</b> kBtu/yr
Total heat gains:	<b>96,719</b> kBtu/yr

Transmission losses :	<b>117,015</b> kBtu/yr
Ventilation losses:	<b>34,186</b> kBtu/yr
Total heat losses:	<b>151,201</b> kBtu/yr
Utilization factor:	<b>52.2</b> %
Useful heat losses:	<b>78,941</b> kBtu/yr

Cooling demand - sensible:	<b>17,778</b> kBtu/yr
Cooling demand - latent:	<b>561</b> kBtu/yr
Annual cooling demand:	<b>18,340</b> kBtu/yr
Specific annual cooling demand:	<b>6.3</b> kBtu/ft <sup>2</sup> yr



## SPECIFIC HEAT/COOLING DEMAND MONTHLY



Month	Heating [kBtu/ft²]	Cooling [kBtu/ft²]
January	3.7	0
February	3.4	0
March	2	0.1
April	0.9	0.2
May	0.2	0.4
June	0	1.1
July	0	2
August	0	1.6
September	0	0.8
October	0.6	0.2
November	1.4	0.1
December	3.4	0

## HEATING LOAD

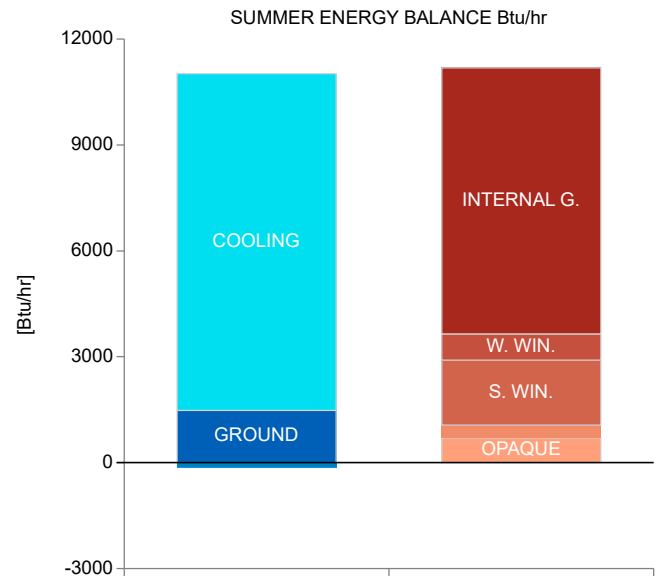
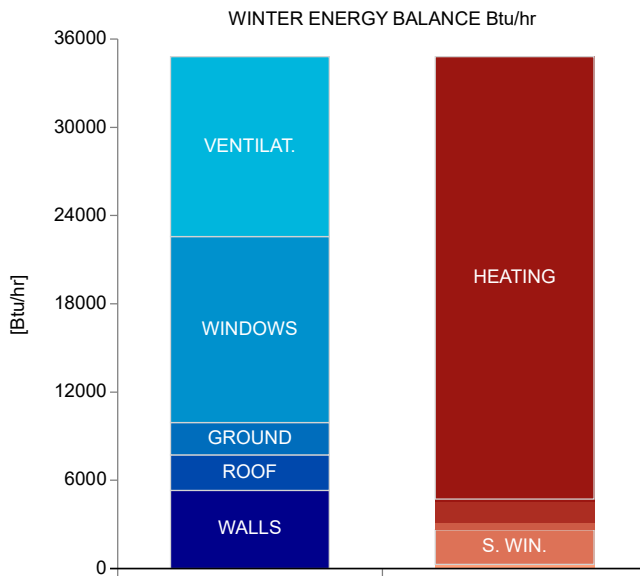
	First climate	Second climate
Transmission heat losses:	<b>22,566.3</b> Btu/hr	<b>17,218.4</b> Btu/hr
Ventilation heat losses:	<b>12,234.6</b> Btu/hr	<b>9,022.2</b> Btu/hr
Total heat loss:	<b>34,800.9</b> Btu/hr	<b>26,240.6</b> Btu/hr
Solar heat gain:	<b>3,254.5</b> Btu/hr	<b>1,326</b> Btu/hr
Internal heat gain:	<b>1,467.3</b> Btu/hr	<b>1,467.3</b> Btu/hr
Total heat gains heating:	<b>4,721.9</b> Btu/hr	<b>2,793.3</b> Btu/hr
Heating load:	<b>30,079</b> Btu/hr	<b>23,447.3</b> Btu/hr

Relevant heating load: **30,079** Btu/hr  
Specific heating load: **10.4** Btu/hr ft<sup>2</sup>

## COOLING LOAD

Solar heat gain:	<b>3,650.8</b> Btu/hr
Internal heat gain:	<b>7,531.5</b> Btu/hr
Total heat gains cooling:	<b>11,182.3</b> Btu/hr
Transmission heat losses:	<b>1,682.9</b> Btu/hr
Ventilation heat losses:	<b>-37.2</b> Btu/hr
Total heat loss:	<b>1,645.7</b> Btu/hr
Cooling load - sensible:	<b>9,536.7</b> Btu/hr
Cooling load - latent:	<b>0</b> Btu/hr

Relevant cooling load: **9,536.7** Btu/hr  
Specific maximum cooling load: **3.3** Btu/hr ft<sup>2</sup>



## AREAS

### Transmission heat losses - areas

Name	Area [ft²]	Average U-value [Btu/hr ft² °F]	Absorption coefficient	Emission coefficient	Reduction factor shading [%]	Transmission losses heating [kBtu/yr]	Transmission losses cooling [kBtu/yr]
VC.1: Slab On Grade: Horizontal (2468.38 ft², width 68.25 ft)	2468.4	0.048	0	0	0	11549	21224.9
VC.2: Above Grade Walls: SE (A149°, 87.75 ft², width 4.875 ft)	87.8	0.024	0.4	0.9	100	375.8	539.7
VC.2: Above Grade Walls: SW (A239°, 214.5 ft², width 11.917 ft)	214.5	0.024	0.4	0.9	100	918.6	1319.3
VC.2: Above Grade Walls: SE (A149°, 108 ft², width 6 ft)	108	0.024	0.4	0.9	100	462.5	664.3
VC.2: Above Grade Walls: SE (A149°, 139 ft², width 12.167 ft)	139	0.024	0.4	0.9	100	595.2	855
VC.2: Above Grade Walls: SE (A149°, 141.75 ft², width 7.875 ft)	141.8	0.024	0.4	0.9	100	607	871.9
VC.2: Above Grade Walls: SW (A239°, 208.5 ft², width 11.583 ft)	208.5	0.024	0.4	0.9	100	892.9	1282.4
VC.2: Above Grade Walls: NE (A59°, 651 ft², width 36.167 ft)	651	0.024	0.4	0.9	100	2787.8	4004.2
VC.2: Above Grade Walls: NW (A329°, 1040 ft², width 68.25 ft)	1040	0.024	0.4	0.9	100	4453.6	6396.8
VC.2: Above Grade Walls: SW (A239°, 96.94 ft², width 12.667 ft)	96.9	0.024	0.4	0.9	100	415.1	596.2
VC.2: Above Grade Walls: SE (A149°, 108 ft², width 6 ft)	108	0.024	0.4	0.9	100	462.5	664.3
VC.2: Above Grade Walls: SE (A149°, 121.42 ft², width 12.167 ft)	121.4	0.024	0.4	0.9	100	520	746.8
VC.2: Above Grade Walls: SE (A149°, 225 ft², width 19.167 ft)	225	0.024	0.4	0.9	100	963.5	1383.9
VC.2: Above Grade Walls: SW (A239°, 63.29 ft², width 36.167 ft)	63.3	0.024	0.4	0.9	100	271	389.3
VC.2: Above Grade Walls: NW (A329°, 119.37 ft², width 68.214 ft)	119.4	0.024	0.4	0.9	100	511.2	734.2
VC.2: Above Grade Walls: SE (A149°, 119.37 ft², width 68.214 ft)	119.4	0.024	0.4	0.9	100	511.2	734.2
VC.2: Above Grade Walls: NE (A59°, 63.29 ft², width 36.167 ft)	63.3	0.024	0.4	0.9	100	271	389.3
VC.2: Above Grade Walls: SW (A239°, 81.38 ft², width 36.167 ft)	81.4	0.024	0.4	0.9	100	348.5	500.5
VC.2: Above Grade Walls: NE (A59°, 81.38 ft², width 36.167 ft)	81.4	0.024	0.4	0.9	100	348.5	500.5
VC.3: Roof: NW (A329°, 656.06 ft², width 68.214 ft)	656.1	0.017	0.4	0.9	100	2027.6	2912.3
VC.4: Roof: SE (A149°, 1912.04 ft², width 68.214 ft)	1912	0.017	0.4	0.9	100	5909.4	8487.7
VC.9: Garage Door: NW (A329°, 80 ft², width 8 ft)	80	0.036	0.4	0.9	100	529.6	760.7
VC.10: Solid Door: NW (A329°, 21 ft², width 3 ft)	21	0.297	0.4	0.9	100	1135.2	1630.6

### Degree hours [kFh/a]

	Heating	Cooling
Ambient heating	101	145.1
Ground heating	54.1	99.5









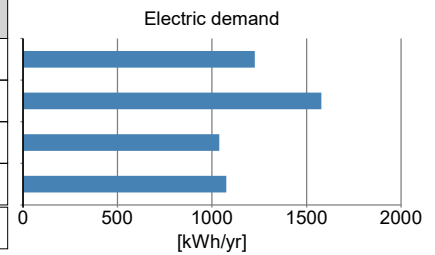






## ELECTRICITY DEMAND - AUXILIARY ELECTRICITY

Type	Quantity	Indoor	Norm demand	Electric demand [kWh/yr]	Source energy [kBtu/yr]
Other	1	yes	233 W	1225.6	11708
Ventilation winter	1	yes	1 W/cfm	1578.4	15078.3
Ventilation Defrost	1	yes	2,281 W	1039	9925.5
Ventilation summer	1	yes	1 W/cfm	1076.2	10281.2
$\Sigma$				4919.2	46993

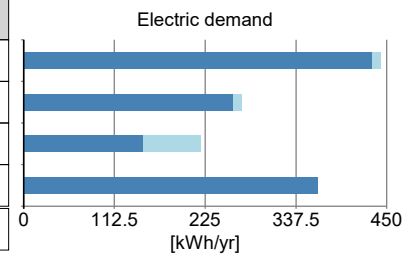


## ELECTRICITY DEMAND NON-RESIDENTIAL BUILDING

## Equipment

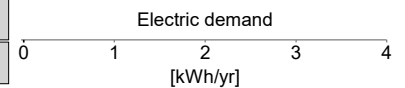
Type	Quantity	Indoor	Utilization pattern	Power rating norm demand	Electric demand [kWh/yr]	Source energy [kBtu/yr]
PC	3	yes	Pattern 1: Office	83 (+5) W	431.4 (+11.1)	4227.5
Monitor	3	yes	Pattern 1: Office	50 (+5) W	259.9 (+11.1)	2589
Printer	1	yes	Pattern 1: Office	540 (+29) W	148.5 (+71.8)	2104.3
Refrigerator	1	yes	Pattern 1: Office	1 kWh/d	365	3486.9
$\Sigma$	8				1,204.8 (+94.1)	12407.7

Values in brackets ( ) display energy saving mode



## Lighting

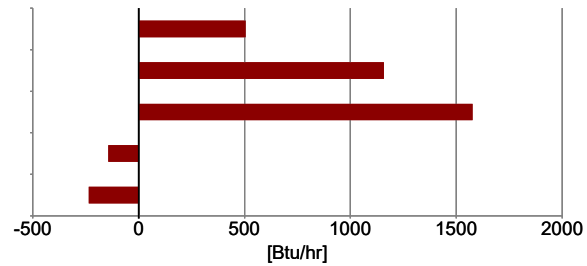
Name	Utilization pattern	Installed lighting power [W/ft²]	Daylight utilization	Lighting full load hours [hrs/yr]	Electric demand [kWh/yr]	Source energy [kBtu/yr]
$\Sigma$					0	0



## INTERNAL HEAT GAINS

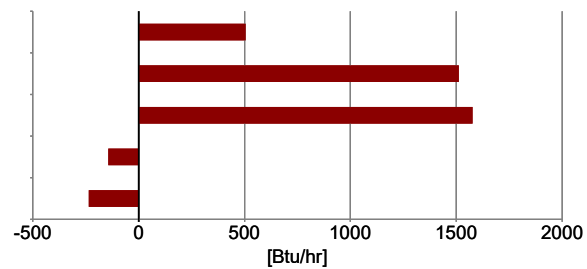
### Heating season

Electricity total:	<b>505.9</b>	Btu/hr
Auxiliary electricity:	<b>1,158</b>	Btu/hr
People:	<b>1,576.8</b>	Btu/hr
Cold water:	<b>-143</b>	Btu/hr
Evaporation:	<b>-235.4</b>	Btu/hr
$\Sigma$ :	<b>7,178.2</b>	Btu/hr
Specific internal heat gains:	<b>2.5</b>	Btu/hr ft <sup>2</sup>



### Cooling season

Electricity total:	<b>505.9</b>	Btu/hr
Auxiliary electricity:	<b>1,511.4</b>	Btu/hr
People:	<b>1,576.8</b>	Btu/hr
Cold and hot water:	<b>-143</b>	Btu/hr
Evaporation:	<b>-235.4</b>	Btu/hr
$\Sigma$ :	<b>7,178.2</b>	Btu/hr
Specific internal heat gains:	<b>2.5</b>	Btu/hr ft <sup>2</sup>





**DHW AND DISTRIBUTION**

DHW consumption per person per day: **3.2** gal/Person/day  
 Average cold water temperature supply: **50.2** °F

Useful heat DHW: **7,900.6** kBtu/yr  
 Specific useful heat DHW: **2,731.2** Btu/ft²yr

Total heat losses of the DHW system: **927.6** kBtu/yr  
 Specific losses of the DHW system: **320.7** Btu/ft²yr  
 Performance ratio DHW distribution system and storage: **1.1**  
 Utilization ratio DHW distribution system and storage: **0.9**  
 Total heat demand of DHW system: **8,828.2** kBtu/yr  
 Total specific heat demand of DHW system: **3,051.9** Btu/ft²yr

Total heat losses of the hydronic heating distribution: **0** kBtu/yr  
 Specific losses of the hydronic heating distribution: **0** Btu/ft²yr  
 Performance ratio of heat distribution: **100** %

Region	Length [ft]	Annual heat loss [kBtu/yr]
Hydronic heating distribution pipes		
Σ	0	0
DHW circulation pipes		
In conditioned space	0	0
Σ	0	0
Individual pipes		
In conditioned space		0
Σ		0
Water storage		
Σ		0

## Property/Site

Building name:

### Property information

Owner's name:

Property address:

City:

Zip:

### Site information

Climate Location: **BUFFALO NIAGARA INTL AP NY**

## Building

### Building Information

Area of Conditioned Space: **2,893 ft<sup>2</sup>**  
 Volume of conditioned space: **47,808.6 ft<sup>3</sup>**  
 Number of bedrooms: **4**  
 Foundation Type: **Slab on grade**  
 Winter setpoint temperature: **68 °F**  
 Summer setpoint temperature: **77 °F**

### Slab floor

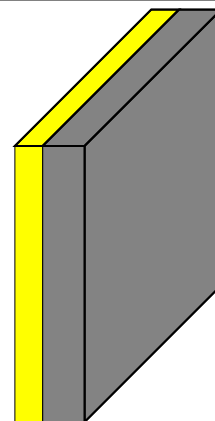
Name	Area [ft <sup>2</sup> ]	Assembly
Slab On Grade	2,468.4	R-20 Slab

#### Assembly (Id.3): R-20 Slab

Homogenous layers

Thermal resistance: 19.861 hr ft<sup>2</sup> °F/Btu (without Rsi, Rse)

Thickness: 10 in



Nr.	Material/Layer (from outside to inside)	$\rho$ [lb/ft <sup>3</sup> ]	$c$ [Btu/lb °F]	$\lambda$ [Btu/hr ft °F]	Thickness [in]	Color
1	XPS Core (heat cond.: 0,03 W/mK)	2.5	0.36	0.0173	4	Yellow
2	Concrete	131.35	0.19	0.7933	6	Gray

## Slab on grade

Floor slab area: **2,489.4** ft<sup>2</sup>  
 U-Value of basement slab: **0.1** Btu/hr ft<sup>2</sup> °F  
 Floor slab perimeter (P): **209.6** ft  
 Total R-value of perimeter insulation: **15** hr ft<sup>2</sup> °F/Btu

## Above-grade walls & Rim/band joists

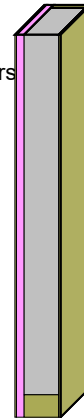
Name	Orientation	Area [ft <sup>2</sup> ]	Short wave radiation absorption	Assembly
Above Grade Walls	SE (29 %), SW (18 %), NE (22 %), NW (32 %)	3,669.9	0.4	2X10 R-30 cellulose w/ ZIP R-12 sheathing
Roof	Horizontal (100 %)	656.1	0.4	Attic R-60 Blown
Roof	Horizontal (100 %)	1,912	0.4	Attic R-60 Blown
Garage Door	NW (100 %)	80	0.4	Garage Doors
Solid Door	NW (100 %)	21	0.4	Hollow Metal Door
Total		<b>6,339</b>		

### Assembly (Id.11): 2X10 R-30 cellulose w/ ZIP R-12 sheathing

Inhomogenous layers

Thermal resistance: 41.451 / 48.683 hr ft<sup>2</sup> °F/Btu (EN ISO 6946 / homogenous layers)

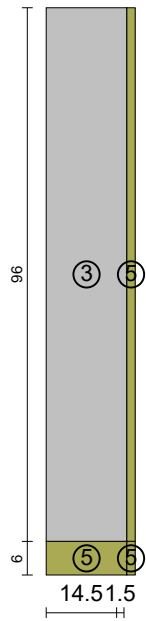
Thickness: 12.234 in



Nr.	Material/Layer (from outside to inside)	ρ [lb/ft <sup>3</sup> ]	c [Btu/lb °F]	λ [Btu/hr ft °F]	Thickness [in]	Color
1	Oriented Strand Board	40.58	0.45	0.0532	0.492	
2	Polyisocyanurate Board	2.03	0.35	0.0139	2	
3	Cellulose Fibre Insulation	1.87	0.45	0.0219	9.25	
4	Oriented Strand Board	40.58	0.45	0.0532	0.492	
Exchange materials						
5	Southern Yellow Pine	31.21	0.45	0.0688	---	

Exchange material(s), Assembly (Id.11): 2X10 R-30 cellulose w/ ZIP R-12 sheathing

Layer: 3

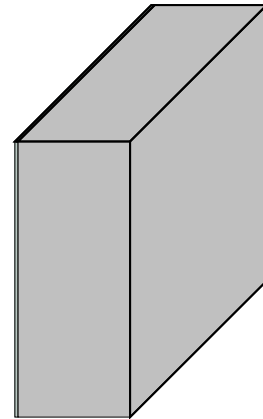


#### Assembly (Id.8): Attic R-60 Blown

Homogenous layers

Thermal resistance: 58.036 hr ft<sup>2</sup> °F/Btu (without R<sub>si</sub>, R<sub>se</sub>)

Thickness: 16.492 in



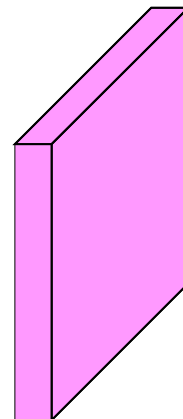
Nr.	Material/Layer (from outside to inside)	$\rho$ [lb/ft <sup>3</sup> ]	$c$ [Btu/lb °F]	$\lambda$ [Btu/hr ft °F]	Thickness [in]	Color
1	Gypsum Board (USA)	53.06	0.21	0.0942	0.492	
2	Cellulose Fibre Insulation	1.87	0.45	0.0231	16	

#### Assembly (Id.10): Garage Doors

Homogenous layers

Thermal resistance: 26.5 hr ft<sup>2</sup> °F/Btu (without R<sub>si</sub>, R<sub>se</sub>)

Thickness: 5.3 in



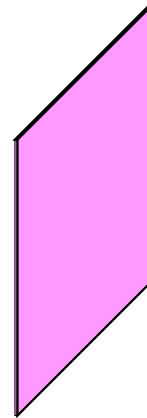
Nr.	Material/Layer (from outside to inside)	$\rho$ [lb/ft³]	c [Btu/lb°F]	$\lambda$ [Btu/hr ft °F]	Thickness [in]	Color
1	Polyisocyanurate Board	2.03	0.35	0.0167	5.3	

**Assembly (Id.12): Hollow Metal Door**

Homogenous layers

Thermal resistance: 2.398 hr ft² °F/Btu (without Rsi, Rse)

Thickness: 0.4 in



Nr.	Material/Layer (from outside to inside)	$\rho$ [lb/ft³]	c [Btu/lb°F]	$\lambda$ [Btu/hr ft °F]	Thickness [in]	Color
1	Polyisocyanurate Board	2.03	0.35	0.0139	0.4	

**Windows and Glass Doors**

Name	Orientation	Area [ft²]	Window type
Fixed Windows	SE (55 %), SW (23 %), NW (22 %)	393.6	TubeLite Fixed (calc)
Operable Windows	SE (100 %)	40.5	TubeLite Casement (calc)
Glass Doors	SE (100 %)	40.1	TU2400
Glass Doors	SW (100 %)	42	TU2400
Total		<b>516.1</b>	

**Window type (Id 6): TubeLite Fixed (calc)****Basic data**

Uw -mounted	[Btu/hr ft² °F]	0.3774
Frame factor		0.8387
Glass U-value	[Btu/hr ft² °F]	0.29
SHGC/Solar energy transmittance (perpendicular)		0.38

**Frame data**

Setting	Left	Right	Top	Bottom
Frame width [in]	2	2	3	2
Frame U-value [Btu/hr ft² °F]	0.55	0.55	0.55	0.55
Glazing-to-frame psi-value [Btu/hr ft °F]	0.023	0.023	0.023	0.023
Frame-to-Wall psi-value [Btu/hr ft °F]	0.029	0.029	0.029	0.029

**Solar radiation angle dependent data**

Angle [°]	Total solar trans.
0	

**Window type (Id 5): TubeLite Casement (calc)****Basic data**

Uw -mounted	[Btu/hr ft <sup>2</sup> °F]	0.4387
Frame factor		0.8387
Glass U-value	[Btu/hr ft <sup>2</sup> °F]	0.29
SHGC/Solar energy transmittance (perpendicular)		0.38

**Frame data**

Setting	Left	Right	Top	Bottom
Frame width [in]	2	2	3	2
Frame U-value [Btu/hr ft <sup>2</sup> °F]	0.93	0.93	0.93	0.93
Glazing-to-frame psi-value [Btu/hr ft °F]	0.023	0.023	0.023	0.023
Frame-to-Wall psi-value [Btu/hr ft °F]	0.029	0.029	0.029	0.029

**Solar radiation angle dependent data**

Angle [°]	Total solar trans.
0	

**Window type (Id 3): TU2400****Basic data**

Uw -mounted	[Btu/hr ft <sup>2</sup> °F]	0.5046
Frame factor		0.6573
Glass U-value	[Btu/hr ft <sup>2</sup> °F]	0.29
SHGC/Solar energy transmittance (perpendicular)		0.38

**Frame data**

Setting	Left	Right	Top	Bottom
Frame width [in]	5	5	5	5
Frame U-value [Btu/hr ft <sup>2</sup> °F]	0.79	0.79	0.79	0.79
Glazing-to-frame psi-value [Btu/hr ft °F]	0.023	0.023	0.023	0.023
Frame-to-Wall psi-value [Btu/hr ft °F]	0.029	0.029	0.029	0.029

**Solar radiation angle dependent data**

Angle [°]	Total solar trans.
0	

**Ceilings**

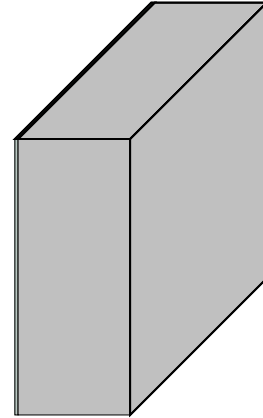
Name	Area [ft <sup>2</sup> ]	Short wave radiation absorption	Assembly
Roof	656.1	0.4	Attic R-60 Blown
Roof	1,912	0.4	Attic R-60 Blown
Total	<b>2,568.1</b>		

**Assembly (Id.8): Attic R-60 Blown**

Homogenous layers

Thermal resistance: 58.036 hr ft² °F/Btu (without Rsi, Rse)

Thickness: 16.492 in



Nr.	Material/Layer (from outside to inside)	$\rho$ [lb/ft³]	c [Btu/lb°F]	$\lambda$ [Btu/hr ft °F]	Thickness [in]	Color
1	Gypsum Board (USA)	53.06	0.21	0.0942	0.492	
2	Cellulose Fibre Insulation	1.87	0.45	0.0231	16	

**Space heating**

Type	Performance ratio of heat generator [-]	Fuel type
Heat pump	0.23	Electricity

**Space cooling**

Type	Distribution	Capacity [kBtu/hr]	COP
Heat pump	Recirculation air	60	4
Total		<b>60</b>	

**Water heating**

Type	Performance ratio of heat generator [-]	Fuel type
Heat pump	0.41	Electricity

**Water storage**

Nr	Capacity [gal]
----	-------------------

**Infiltration/Ventilation**ACH @ 50 Pascal **0.9** 1/hrCFM @ 50 Pascal **745.3** cfm

Nr	Sensible recovery efficiency [-]	Rate [cfm]	Electric efficiency [W/cfm]	Fan [W]	Defrost	Temperature below which defrost must be used [°F]	Subsoil heat exchanger efficiency [-]
5	0.45	249.7	0.03	249.7	yes	16.48	0
Total	<b>0.45</b>	<b>249.7</b>		<b>249.7</b>			

**Lights and appliances**

Type	Energy use [kWh/yr]	In conditioned space
Other	1,225.58	yes
Ventilation winter	1,578.37	yes
Ventilation Defrost	1,038.98	yes
Ventilation summer	1,076.22	yes
Total	<b>4,919.16</b>	



Project name:

Climate:

Type:

Interior conditioned floor area:

Number of units:

Occupants:

Site energy use:

Specific site energy use:

Site energy use:

Specific site energy use:

Site energy use per person:

Net site energy use (with 100% renewables):

Specific net site energy use (with 100% renewables):

Net site energy use (with 100% renewables):

Specific net site energy use (with 100% renewables):

Net site energy use per person (with 100% renewables):

**As Built Final**

**BUFFALO NIAGARA INTL AP NY**

**Non-residential**

**2,893 ft<sup>2</sup>**

**1**

**6**

**-55,879.6 kBtu/yr**

**-19.3 kBtu/ft<sup>2</sup>yr**

**-16,378.3 kWh/yr**

**-5.7 kWh/ft<sup>2</sup>yr**

**-2,729.7 kWh/Person yr**

**-55,879.6 kBtu/yr**

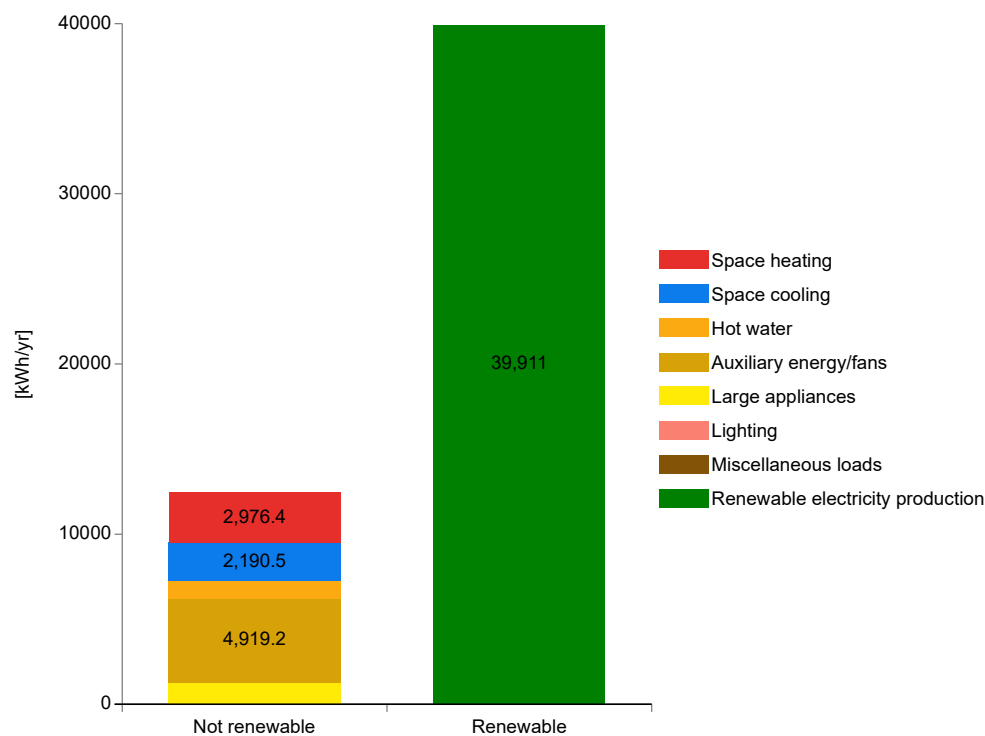
**-19.3 kBtu/ft<sup>2</sup>yr**

**-16,378.3 kWh/yr**

**-5.7 kWh/ft<sup>2</sup>yr**

**-2,729.7 kWh/Person yr**

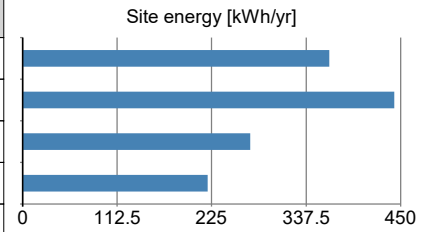
## OVERVIEW





## LARGE APPLIANCES

Type	Site Energy [kWh/yr]	Specific site energy [kWh/ft² yr]	Site Energy [kBtu/yr]	Specific Site Energy [kBtu/ft² yr]
Refrigerator	365	0.1	1,245.3	0.4
PC	442.5	0.2	1,509.8	0.5
Monitor	271	0.1	924.6	0.3
Printer	220.3	0.1	751.5	0.3
<b>Total</b>	<b>1,298.8</b>	<b>0.4</b>	<b>4,431.3</b>	<b>1.5</b>



## LIGHTING

Type	Site Energy [kWh/yr]	Specific site energy [kWh/ft² yr]	Site Energy [kBtu/yr]	Specific Site Energy [kBtu/ft² yr]
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

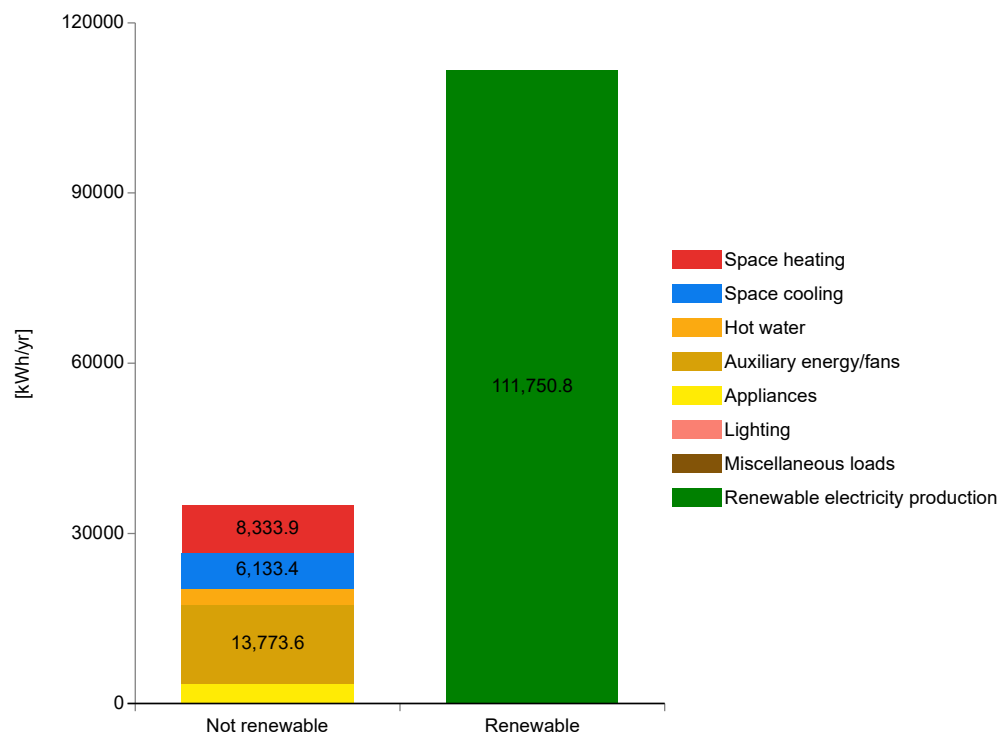
## MISC LOADS

Type	Site Energy [kWh/yr]	Specific site energy [kWh/ft² yr]	Site Energy [kBtu/yr]	Specific Site Energy [kBtu/ft² yr]
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

Project name:	<b>As Built Final</b>
Climate:	<b>BUFFALO NIAGARA INTL AP NY</b>
Type:	<b>Non-residential</b>
Interior conditioned floor area:	<b>2,893 ft²</b>
Number of units:	<b>1</b>
Occupants:	<b>6</b>
Source energy use:	<b>0 kBtu/yr</b>
Specific source energy use:	<b>0 kBtu/ft²yr</b>
Source energy use:	<b>0 kWh/yr</b>
Source energy use per person:	<b>0 kWh/Person yr</b>
Net source energy use (with 100% renewables):	<b>-156,462.9 kBtu/yr</b>
Specific net source energy use (with 100% renewables):	<b>-54.1 kBtu/ft²yr</b>
Net source energy use (with 100% renewables):	<b>-45,859.3 kWh/yr</b>
Specific source energy use per person (with 100% renewables):	<b>-7,643.2 kWh/Person yr</b>

**PHIUS+ Source Zero:** **YES**

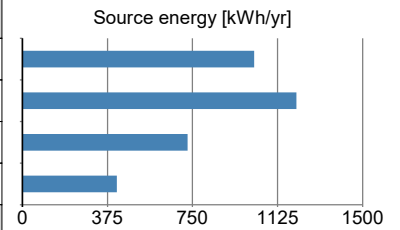
## OVERVIEW





## LARGE APPLIANCES

Type	Source energy [kWh/yr]	Specific source energy [kWh/ft² yr]	Source energy [kBtu/yr]	Specific source energy [kBtu/ft² yr]	Source energy factor [kWh/kWh]	Source
Refrigerator	1,022	0.4	3,486.9	1.2	2.8	Electricity
PC	1,207.9	0.4	4,121.1	1.4	2.8	Electricity
Monitor	727.7	0.3	2,482.6	0.9	2.8	Electricity
Printer	415.8	0.1	1,418.6	0.5	2.8	Electricity
<b>Total</b>	<b>3,373.3</b>	<b>1.2</b>	<b>11,509.2</b>	<b>4</b>		



## LIGHTING

Type	Source energy [kWh/yr]	Specific source energy [kWh/ft² yr]	Source energy [kBtu/yr]	Specific source energy [kBtu/ft² yr]	Source energy factor [kWh/kWh]	Source
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>		

## MISC LOADS

Type	Source energy [kWh/yr]	Specific source energy [kWh/ft² yr]	Source energy [kBtu/yr]	Specific source energy [kBtu/ft² yr]	Source energy factor [kWh/kWh]	Source
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>		

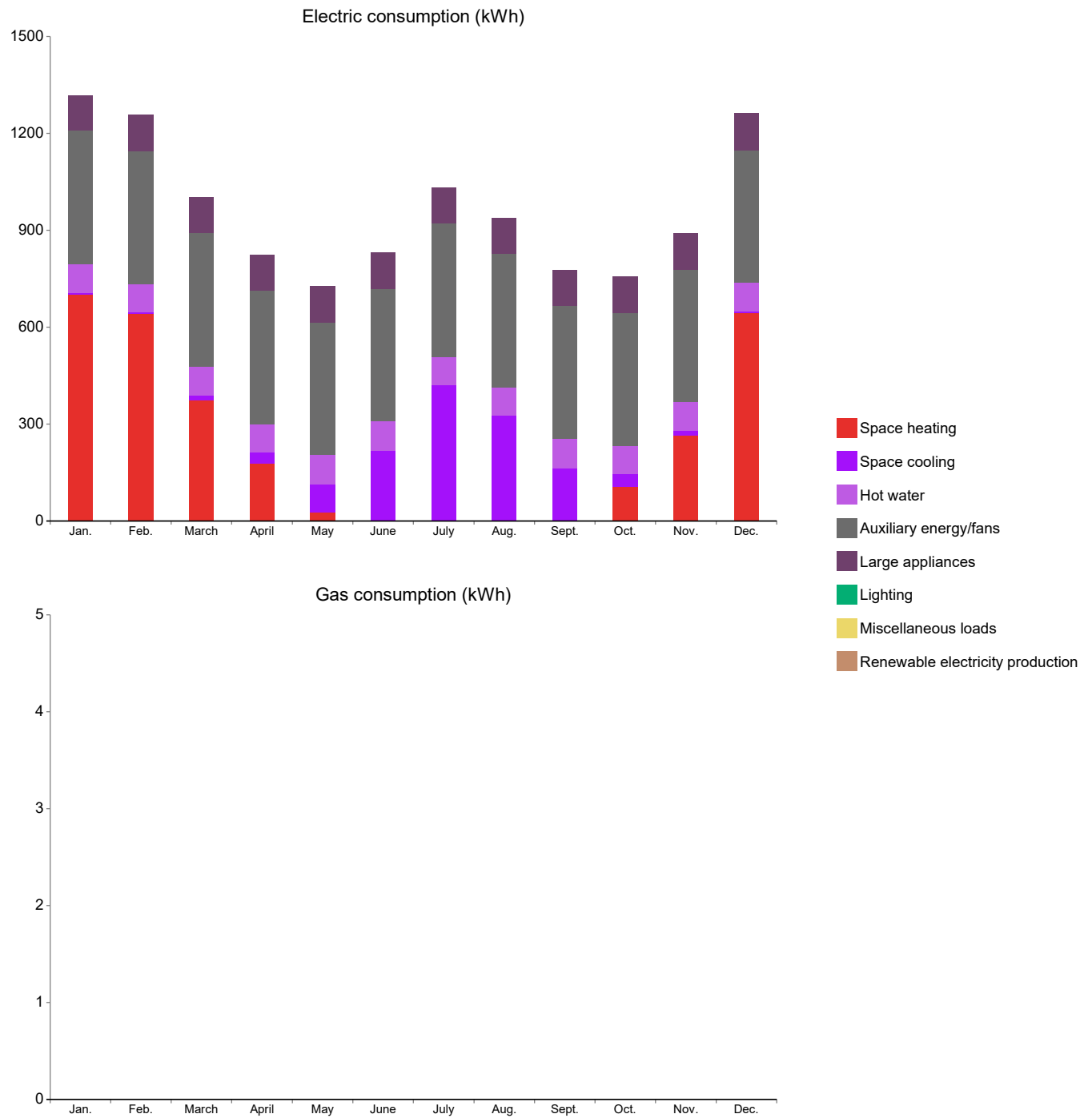
## SITE ENERGY MONTHLY REPORT

### ELECTRICITY USE [kWh]

Type	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Space heating	706.21	645.71	377.22	181.49	31.81	0.37	0	0	2.24	109.17	271.17	651.02
Space cooling	3.94	4.58	17.76	34.36	86.57	223.58	423.81	330.27	166.88	39.13	12.94	3.95
Hot water	88.98	88.98	88.98	88.98	88.98	88.98	88.98	88.98	88.98	88.98	88.98	88.98
Auxiliary energy/fans	409.93	409.93	409.93	409.93	409.93	409.93	409.93	409.93	409.93	409.93	409.93	409.93
Large appliances	108.23	108.23	108.23	108.23	108.23	108.23	108.23	108.23	108.23	108.23	108.23	108.23
Lighting	0	0	0	0	0	0	0	0	0	0	0	0
Miscellaneous loads	0	0	0	0	0	0	0	0	0	0	0	0
Renewable electricity production	0	0	0	0	0	0	0	0	0	0	0	0

### GAS USE [kWh]

Type	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Space heating	0	0	0	0	0	0	0	0	0	0	0	0
Space cooling	0	0	0	0	0	0	0	0	0	0	0	0
Hot water	0	0	0	0	0	0	0	0	0	0	0	0
Auxiliary energy/fans	0	0	0	0	0	0	0	0	0	0	0	0
Large appliances	0	0	0	0	0	0	0	0	0	0	0	0
Lighting	0	0	0	0	0	0	0	0	0	0	0	0
Miscellaneous loads	0	0	0	0	0	0	0	0	0	0	0	0
Renewable electricity production	0	0	0	0	0	0	0	0	0	0	0	0





## Project data

Client	
Surname & Name	
Locality	
Postal code	
Street	
Tel.	
e-mail	
Building	
Name/Type	
Locality	
Postal code	
Street	
Country	
Owner	
Surname & Name	
Locality	
Postal code	
Street	
Responsible	
Surname & Name	
Locality	
Postal code	
Street	
Tel.	
e-mail	
Date	9.9.2020

## Climate

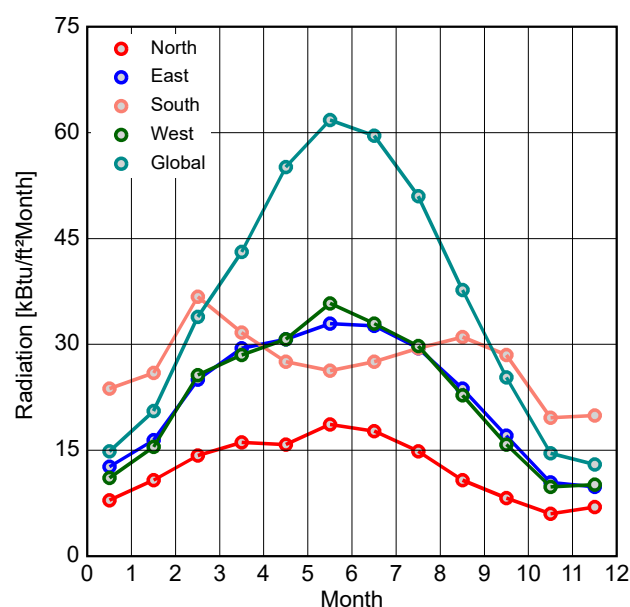
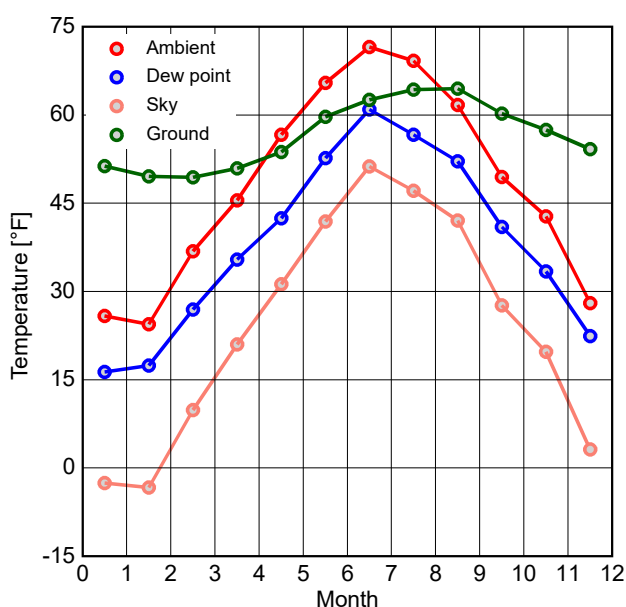
## Case 1: Climate

## Location: BUFFALO NIAGARA INTL AP NY

Latitude	[°]	42.933
Longitude	[°]	-78.733
Altitude weather station	[ft]	705.38058
Altitude building	[ft]	623
Daily temperature swing summer	[°F]	18
Average wind speed	[ft/s]	13.1234
<b>Additional data</b>		
Ground thermal conductivity	[Btu/hr ft °F]	1.1556
Ground heat capacity	[Btu/lb °F]	0.2388
Ground density	[lb/ft³]	124.8559
Depth below grade of groundwater	[ft]	9.8425
Flow rate of groundwater	[ft/d]	0.164

## Climate Data

Setting	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Heating W. 1	Heating W. 2	Cooling W. 1	Cooling W. 2
Temperature [°F]																
Ambient	25.9	24.4	36.9	45.5	56.7	65.5	71.6	69.3	61.7	49.5	42.8	28	12.2	26.8	77	
Dew point	16.3	17.4	27	35.4	42.4	52.7	61	56.7	52.2	41	33.4	22.5				
Sky	-2.6	-3.3	9.9	21	31.3	41.9	51.3	47.1	42.1	27.7	19.8	3.2				
Ground	51.3	49.6	49.5	51	53.7	59.7	62.6	64.4	64.5	60.3	57.5	54.2				
Solar radiation [kBtu/ft²Month]													Solar radiation [Btu/hr ft²]			
North	7.9	10.8	14.3	16.2	15.8	18.7	17.8	14.9	10.8	8.2	6	7	16.8	9.5	21.9	
East	12.7	16.5	25	29.5	30.7	33	32.7	29.5	23.8	17.1	10.5	9.8	29.5	12.4	40.9	
South	23.8	26	36.8	31.7	27.6	26.3	27.6	29.5	31.1	28.5	19.7	20	50.1	19.3	36.8	
West	11.1	15.5	25.7	28.5	30.7	35.8	33	29.8	22.8	15.8	9.8	10.1	25.4	11.7	28.5	
Global	14.9	20.6	33.9	43.1	55.2	61.8	59.6	51	37.7	25.4	14.6	13	33.9	15.8	72.3	



## Passive house data

## General data

Building category	Non-residential
Occupancy type	School
Building status	In planning
Type	New construction
Indoor temperature	[°F] 68
Internal gains setting	Calculated
Internal heat gains	[Btu/hr ft²] 2.481
Occupancy setting method	Design
Number of occupants	6
Number of units	1
Number of floors	1
Visualized volume	[ft³] 54299.9
Gross volume	[ft³] 62906
Net volume	[ft³] 47808.6
Floor area	[ft²] 2893

## Additional data

Preferred minimum indoor temperature for night ventilation	[°F] 68
Overheating temperature threshold	[°F] 77
Fresh air per person	[cfm] 12
Hot water tap-openings per person per day	3
Hot water tap-opening utilization days per year	[days/yr] 365
Air-tightness metric	Envelope airtightness at 50 Pa
Envelope airtightness at 50 Pa	[cfm/ft²] 0.08
Non combustible materials	No
Type of ventilation system	Balanced PH ventilation
Max. humidity ratio (if dehumidification)	[lbw/lba] 0.012
Building wind exposure	Several sides exposed - moderate screening
Wind screening coefficient (e)	0.07
Wind exposure factor (f)	15
Wind shield factor	0.05
DHW consumption (60°) per person per day	[gal/Person/day] 3.2
Average cold water temperature of the supply	[°F]
Mechanical room temperature	[°F] 68

**Foundation interface: Slab**

Type	Slab on grade
Floor slab area	[ft²] 2489.4
U-Value of basement slab	[Btu/hr ft² °F] 0.05
Floor slab perimeter (P)	[ft] 209.6
Position of the perimeter insulation	Not defined
Perimeter insulation width/depth	[ft] 4
Thickness of perimeter insulation	[in] 3
Conductivity perimeter insulation	[Btu/hr ft °F] 0.01667
Phase shift months	[months]
Harmonic fraction	[Btu/hr F]

**Utilization pattern: 1, Office**

Begin utilization	[hr] 7
End utilization	[hr] 18
Annual utilization	[days/yr] 250
Illumination level	[lux] 500
Height of utilization level	Level 2: 2.62 ft
Relative absence	[-] 0.3
Part use factor of building operating period for lighting	[-] 0.9
Optional data	
Average occupancy	[ft²/Person]
Room setpoint temperature	[°F]
Heating reduction temperature	[°F]
Daily utilization hours	[hrs/d]
Annual utilization hours	[hrs/yr]
Annual utilization hours during daytime	[hrs/yr]
Annual utilization hours during nighttime	[hrs/yr]
Daily heating operation hours	[hrs/d]
Daily ventilation operation hours	[hrs/d]
Number of max water tap openings per day	[-]

**Utilization pattern: 2, Workshop**

Begin utilization	[hr]	7
End utilization	[hr]	18
Annual utilization	[days/yr]	200
Illumination level	[lux]	300
Height of utilization level		Level 2: 2.62 ft
Relative absence	[-]	0
Part use factor of building operating period for lighting	[-]	0.7
Optional data		
Average occupancy	[ft²/Person]	
Room setpoint temperature	[°F]	
Heating reduction temperature	[°F]	
Daily utilization hours	[hrs/d]	
Annual utilization hours	[hrs/yr]	
Annual utilization hours during daytime	[hrs/yr]	
Annual utilization hours during nighttime	[hrs/yr]	
Daily heating operation hours	[hrs/d]	
Daily ventilation operation hours	[hrs/d]	
Number of max water tap openings per day	[-]	

**Ventilation utilization pattern**

Name	Operating days per week	Weeks per year	Additional data
Office	5	52	12 h/d (100%); 12 h/d (40%)
Workshop	5	52	12 h/d (100%); 6 h/d (77%); 6 h/d (40%)

## Zones / Components

## Case 1/Zone 1

## Case 1/Zone 1: General data

Name	PUSH Training Center
Type	Simulated zone
PH case	
<b>Geometry</b>	
Gross volume	[ft <sup>3</sup> ] 62906
Net volume	[ft <sup>3</sup> ] 47808.56
Floor area	[ft <sup>2</sup> ] 2893
Clearance height	[ft] 8.2
<b>Other data</b>	
Specific heat capacity	[Btu/ft <sup>2</sup> F] 11
Humidity capacity	[lb/(lbw/lbda) ft <sup>2</sup> ] 143.3713

## Inner load / occupancy

Occupant quantity	6
Humidity sources	[lb/(ft <sup>2</sup> hr)] 4.096E-4
<b>Additional data</b>	
Heat loss due to evaporation (per person)	[Btu/hr] 51
Heat loss due to flushing toilets (cold water)	Yes
Number of flush toilets	3
Toilet utilization pattern	Pattern 1: Office
Use default values for school	Yes

Name	Utilization pattern	Activity of persons	Occupant quantity	Floor area of utilization zone [ft <sup>2</sup> ]
Office	Pattern 1: Office	Adult, sitting	2	
Workshop	Pattern 2: Workshop	Adult, standing or light work	17	

## Office equipment: 1

Application type	PC
Utilization pattern	Pattern 1: Office
Quantity	3
Within thermal envelope	Yes
Power rating	[W] 83
Power rating (energy saving mode)	[W] 5

## Office equipment: 2

Application type	Monitor
Utilization pattern	Pattern 1: Office
Quantity	3
Within thermal envelope	Yes
Power rating	[W] 50
Power rating (energy saving mode)	[W] 5

**Office equipment: 3**

Application type	Printer
Utilization pattern	Pattern 1: Office
Quantity	1
Within thermal envelope	Yes
Power rating [W]	540
Power rating (energy saving mode) [W]	29
Duration of utilization time in energy saving mode* [hrs/yr]	

**Kitchen equipment: 1**

Application type	Refrigerator
Quantity	1
Within thermal envelope	Yes
Norm demand [kWh/d]	1

**Process loads: 1, Plainer**

Name	Plainer
Total energy use [kWh/yr]	1760
Quantity	1
Include in source energy total	Yes
Increase source energy allowance	No
Inside thermal envelope	Yes
Power rating [W]	4400
Annual use hours [hr]	400
Comment	

**Process loads: 2, Table Top AC Unit**

Name	Table Top AC Unit
Total energy use [kWh/yr]	1800
Quantity	4
Include in source energy total	Yes
Increase source energy allowance	No
Inside thermal envelope	Yes
Power rating [W]	1800
Annual use hours [hr]	1000
Comment	

**Process loads: 3, Residential AC Trainer**

Name	Residential AC Trainer
Total energy use [kWh/yr]	3600
Quantity	1
Include in source energy total	Yes
Increase source energy allowance	No
Inside thermal envelope	Yes
Power rating [W]	3600
Annual use hours [hr]	1000
Comment	

**Process loads: 4, Joiner**

Name	Joiner
Total energy use [kWh/yr]	1760
Quantity	1
Include in source energy total	Yes
Increase source energy allowance	No
Inside thermal envelope	Yes
Power rating [W]	4400
Annual use hours [hr]	400
Comment	

**Process loads: 5, Dust Collector**

Name	Dust Collector
Total energy use [kWh/yr]	960
Quantity	1
Include in source energy total	Yes
Increase source energy allowance	No
Inside thermal envelope	Yes
Power rating [W]	2400
Annual use hours [hr]	400
Comment	

**Process loads: 6, Table Saw**

Name	Table Saw
Total energy use [kWh/yr]	600
Quantity	1
Include in source energy total	Yes
Increase source energy allowance	No
Inside thermal envelope	Yes
Power rating [W]	1500
Annual use hours [hr]	400
Comment	

**Process loads: 7, Table Saw**

Name	Table Saw
Total energy use [kWh/yr]	600
Quantity	1
Include in source energy total	Yes
Increase source energy allowance	No
Inside thermal envelope	Yes
Power rating [W]	1500
Annual use hours [hr]	400
Comment	

**Ventilation / Rooms**

Name	Room type	Quantity	Utilization pattern	Design volume flow rate [cfm]		Average volume flow rate [cfm]		Average air change rate [1/hr]
				Supply Air	Exhaust Air	Supply Air	Exhaust Air	
	User defined	1	Pattern 1: Office	40	40	0	0	
	User defined	1	Pattern 2: Workshop	500	500	0	0	
			Total	540	540	0	0	



ACH via natural ventilation (day)	[1/hr]	
Average mechanical ventilation air change rate	[1/hr]	
ACH via natural ventilation (night)	[1/hr]	

## Case 1/Zone 1: Visualized components

## Zone 1/Component 1: General data

Name	Slab On Grade
Type	Opaque
Inner side	Zone 1: PUSH Training Center
Outer side	Ground
Assembly	Assembly (Id.3): R-20 Slab
U	[Btu/hr ft² °F] 0.048
Geometry	
Area	[ft²] 2468.4
Inclination	[°] 180
Orientation	Horizontal (100 %)
Surface	
Rse / Rsi (According to component type)	[hr ft² °F/Btu] 0 / 0.9653

## Zone 1/Component 2: General data

Name	Above Grade Walls
Type	Opaque
Inner side	Zone 1: PUSH Training Center
Outer side	Outer air
Assembly	Assembly (Id.11): 2X10 R-30 cellulose w/ ZIP R-12 sheathing
U	[Btu/hr ft² °F] 0.0236
Geometry	
Area	[ft²] 3669.9
Inclination	[°] 90
Orientation	South-East (29 %), South-West (18 %), North-East (22 %), North-West (32 %)
Surface	
Rse / Rsi (According to component type)	[hr ft² °F/Btu] 0.2271 / 0.7382
Absorption / Emission (User defined)	[-] 0.4 / 0.9

## Zone 1/Component 3: General data

Name	Roof
Type	Opaque
Inner side	Zone 1: PUSH Training Center
Outer side	Outer air
Assembly	Assembly (Id.8): Attic R-60 Blown
U	[Btu/hr ft² °F] 0.017
Geometry	
Area	[ft²] 656.1
Inclination	[°] 27.9
Orientation	Horizontal (100 %)
Surface	
Rse / Rsi (According to component type)	[hr ft² °F/Btu] 0.2271 / 0.5678
Absorption / Emission (User defined)	[-] 0.4 / 0.9

**Zone 1/Component 4: General data**

Name	Roof
Type	Opaque
Inner side	Zone 1: PUSH Training Center
Outer side	Outer air
Assembly	Assembly (Id.8): Attic R-60 Blown
U	[Btu/hr ft <sup>2</sup> °F] 0.017
Geometry	
Area	[ft <sup>2</sup> ] 1912
Inclination	[°] 9.2
Orientation	Horizontal (100 %)
Surface	
Rse / Rsi (According to component type)	[hr ft <sup>2</sup> °F/Btu] 0.2271 / 0.5678
Absorption / Emission (User defined)	[-] 0.4 / 0.9

**Zone 1/Component 5: General data**

Name	Fixed Windows
Type	Transparent
Inner side	Zone 1: PUSH Training Center
Outer side	Outer air
Window type	Window type (Id 6): TubeLite Fixed (calc)
Uw -mounted	[Btu/hr ft <sup>2</sup> °F] 0.3774
Geometry	
Area	[ft <sup>2</sup> ] 393.6
Inclination	[°] 90
Orientation	South-East (55 %), South-West (23 %), North-West (22 %)

**Zone 1/Component 6: General data**

Name	Operable Windows
Type	Transparent
Inner side	Zone 1: PUSH Training Center
Outer side	Outer air
Window type	Window type (Id 5): TubeLite Casement (calc)
Uw -mounted	[Btu/hr ft <sup>2</sup> °F] 0.4387
Geometry	
Area	[ft <sup>2</sup> ] 40.5
Inclination	[°] 90
Orientation	South-East (100 %)

**Zone 1/Component 7: General data**

Name	Glass Doors
Type	Transparent
Inner side	Zone 1: PUSH Training Center
Outer side	Outer air
Window type	Window type (Id 3): TU2400
Uw -mounted	[Btu/hr ft <sup>2</sup> °F] 0.5046
Geometry	
Area	[ft <sup>2</sup> ] 40.1
Inclination	[°] 90
Orientation	South-East (100 %)

**Zone 1/Component 8: General data**

Name	Glass Doors
Type	Transparent
Inner side	Zone 1: PUSH Training Center
Outer side	Outer air
Window type	Window type (Id 3): TU2400
Uw -mounted	[Btu/hr ft <sup>2</sup> °F] 0.5046
Geometry	
Area	[ft <sup>2</sup> ] 42
Inclination	[°] 90
Orientation	South-West (100 %)

**Zone 1/Component 9: General data**

Name	Garage Door
Type	Opaque
Inner side	Zone 1: PUSH Training Center
Outer side	Outer air
Assembly	Assembly (Id.10): Garage Doors
U	[Btu/hr ft <sup>2</sup> °F] 0.0364
Geometry	
Area	[ft <sup>2</sup> ] 80
Inclination	[°] 90
Orientation	North-West (100 %)
Surface	
Rse / Rsi (According to component type)	[hr ft <sup>2</sup> °F/Btu] 0.2271 / 0.7382
Absorption / Emission (User defined)	[-] 0.4 / 0.9

**Zone 1/Component 10: General data**

Name	Solid Door
Type	Opaque
Inner side	Zone 1: PUSH Training Center
Outer side	Outer air
Assembly	Assembly (Id.12): Hollow Metal Door
U	[Btu/hr ft <sup>2</sup> °F] 0.2973
Geometry	
Area	[ft <sup>2</sup> ] 21
Inclination	[°] 90
Orientation	North-West (100 %)
Surface	
Rse / Rsi (According to component type)	[hr ft <sup>2</sup> °F/Btu] 0.2271 / 0.7382
Absorption / Emission (User defined)	[-] 0.4 / 0.9

**Case 1/Zone 1: Thermal bridges**

## Assemblies/window types

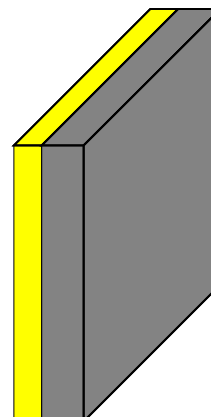
**Assembly (Id.3): R-20 Slab**

Homogenous layers

Thermal resistance: 19.861 hr ft² °F/Btu (without Rsi, Rse)

Heat transfer coefficient (U-value): 0.048 Btu/hr ft² °F

Thickness: 10 in



Nr.	Material/Layer (from outside to inside)	$\rho$ [lb/ft³]	$c$ [Btu/lb°F]	$\lambda$ [Btu/hr ft °F]	Thickness [in]	Color
1	XPS Core (heat cond.: 0,03 W/mK)	2.5	0.36	0.0173	4	Yellow
2	Concrete	131.35	0.19	0.7933	6	Grey

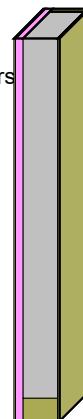
**Assembly (Id.11): 2X10 R-30 cellulose w/ ZIP R-12 sheathing**

Inhomogenous layers

Thermal resistance: 41.451 / 48.683 hr ft² °F/Btu (EN ISO 6946 / homogenous layers)

Heat transfer coefficient (U-value): 0.024 Btu/hr ft² °F

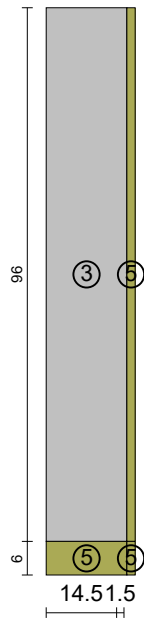
Thickness: 12.234 in



Nr.	Material/Layer (from outside to inside)	$\rho$ [lb/ft³]	$c$ [Btu/lb°F]	$\lambda$ [Btu/hr ft °F]	Thickness [in]	Color
1	Oriented Strand Board	40.58	0.45	0.0532	0.492	Yellow
2	Polyisocyanurate Board	2.03	0.35	0.0139	2	Pink
3	Cellulose Fibre Insulation	1.87	0.45	0.0219	9.25	Grey
4	Oriented Strand Board	40.58	0.45	0.0532	0.492	Yellow
Exchange materials						
5	Southern Yellow Pine	31.21	0.45	0.0688	---	Yellow

Exchange material(s), Assembly (Id.11): 2X10 R-30 cellulose w/ ZIP R-12 sheathing

Layer: 3



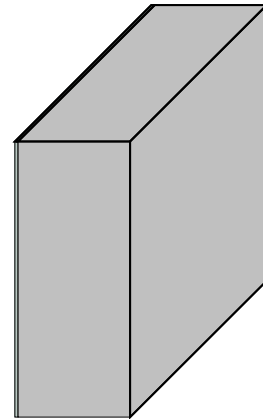
#### Assembly (Id.8): Attic R-60 Blown

Homogenous layers

Thermal resistance: 58.036 hr ft² °F/Btu (without Rsi, Rse)

Heat transfer coefficient (U-value): 0.017 Btu/hr ft² °F

Thickness: 16.492 in



Nr.	Material/Layer (from outside to inside)	$\rho$ [lb/ft³]	$c$ [Btu/lb °F]	$\lambda$ [Btu/hr ft °F]	Thickness [in]	Color
1	Gypsum Board (USA)	53.06	0.21	0.0942	0.492	
2	Cellulose Fibre Insulation	1.87	0.45	0.0231	16	

#### Window type (Id 6): TubeLite Fixed (calc)

##### Basic data

Uw -mounted	[Btu/hr ft² °F]	0.3774
Frame factor		0.8387
Glass U-value	[Btu/hr ft² °F]	0.29
SHGC/Solar energy transmittance (perpendicular)		0.38

##### Frame data

Setting	Left	Right	Top	Bottom
Frame width [in]	2	2	3	2
Frame U-value [Btu/hr ft² °F]	0.55	0.55	0.55	0.55
Glazing-to-frame psi-value [Btu/hr ft °F]	0.023	0.023	0.023	0.023
Frame-to-Wall psi-value [Btu/hr ft °F]	0.029	0.029	0.029	0.029

**Solar radiation angle dependent data**

Angle [°]	Total solar trans.
0	

**Window type (Id 5): TubeLite Casement (calc)****Basic data**

Uw -mounted	[Btu/hr ft² °F]	0.4387
Frame factor		0.8387
Glass U-value	[Btu/hr ft² °F]	0.29
SHGC/Solar energy transmittance (perpendicular)		0.38

**Frame data**

Setting	Left	Right	Top	Bottom
Frame width [in]	2	2	3	2
Frame U-value [Btu/hr ft² °F]	0.93	0.93	0.93	0.93
Glazing-to-frame psi-value [Btu/hr ft °F]	0.023	0.023	0.023	0.023
Frame-to-Wall psi-value [Btu/hr ft °F]	0.029	0.029	0.029	0.029

**Solar radiation angle dependent data**

Angle [°]	Total solar trans.
0	

**Window type (Id 3): TU2400****Basic data**

Uw -mounted	[Btu/hr ft² °F]	0.5046
Frame factor		0.6573
Glass U-value	[Btu/hr ft² °F]	0.29
SHGC/Solar energy transmittance (perpendicular)		0.38

**Frame data**

Setting	Left	Right	Top	Bottom
Frame width [in]	5	5	5	5
Frame U-value [Btu/hr ft² °F]	0.79	0.79	0.79	0.79
Glazing-to-frame psi-value [Btu/hr ft °F]	0.023	0.023	0.023	0.023
Frame-to-Wall psi-value [Btu/hr ft °F]	0.029	0.029	0.029	0.029

**Solar radiation angle dependent data**

Angle [°]	Total solar trans.
0	

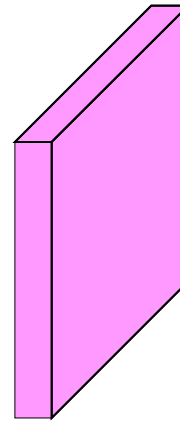
**Assembly (Id.10): Garage Doors**

Homogenous layers

Thermal resistance: 26.5 hr ft² °F/Btu (without Rsi, Rse)

Heat transfer coefficient (U-value): 0.036 Btu/hr ft² °F

Thickness: 5.3 in



Nr.	Material/Layer (from outside to inside)	$\rho$ [lb/ft³]	$c$ [Btu/lb°F]	$\lambda$ [Btu/hr ft °F]	Thickness [in]	Color
1	Polyisocyanurate Board	2.03	0.35	0.0167	5.3	

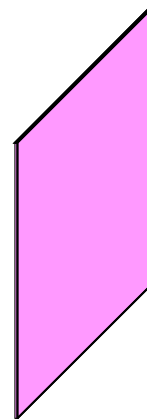
**Assembly (Id.12): Hollow Metal Door**

Homogenous layers

Thermal resistance: 2.398 hr ft² °F/Btu (without Rsi, Rse)

Heat transfer coefficient (U-value): 0.297 Btu/hr ft² °F

Thickness: 0.4 in



Nr.	Material/Layer (from outside to inside)	$\rho$ [lb/ft³]	$c$ [Btu/lb°F]	$\lambda$ [Btu/hr ft °F]	Thickness [in]	Color
1	Polyisocyanurate Board	2.03	0.35	0.0139	0.4	



## HVAC

## System 1 (User defined): Basic, Device

## Heat pump, Heat pump: GSHP Water Furnace NBH049

Annual heating coefficient of performance (COP)	[-]	4.4
Total system performance ratio of heat generator	[-]	0.227
Coverage		Heating 1, Cooling 1

## Heat pump, Heat Pump water heater (HPWH) inside: HPTU-50N

Annual heating coefficient of performance (COP)	[-]	4.41
Total system performance ratio of heat generator	[-]	0.23
HPWH EF	[-]	3.45
Coverage		DHW 1

## Photovoltaic / renewable energy: PV - Per worst case

Photovoltaic / renewable energy	[kWh/yr]	39911
Utilization factor	[-]	1

## Mechanical ventilation: RenewAire

Sensible recovery efficiency	[-]	0.77
Humidity recovery efficiency	[-]	0.4
Electric efficiency	[W/cfm]	1
Equipped with frost protection		Yes
Subsoil heat exchanger efficiency	[-]	
Quantity		1
HRV/ERV in conditioned space		Yes
No summer bypass feature (summer ventilation with HRV/ERV)		No
Defrost active		Yes
Temperature below which defrost must be used	[°F]	28
Rooms ventilated by this unit		Z.1, R.1, User defined, Z.1, R.2, User defined

## System 1 (User defined): Basic, Distribution

## Heating distibution

Setting	In conditioned space	Outside conditioned space 1	Outside conditioned space 2
Design flow temperature [°F]			
Length of distribution pipes [ft]			
Heat loss coefficient per ft pipe [Btu/hr ft °F]			
Temperature of the room the pipes pass through [°F]			
Design system heating load [kBtu/hr]			
Flow temperature controlled	No	No	No

**DHW distribution**

Setting	In conditioned space	Outside conditioned space 1	Outside conditioned space 2
Circulation pipes			
Design flow temperature [°F]			
Length of circulation pipes [ft]			
Heat loss coefficient per ft pipe [Btu/hr ft °F]			
Temperature of the room the pipes pass through [°F]			
Daily running hours of the circulation [hr]			
Individual pipes			
Length of individual pipes [ft]			
Exterior pipe diameter [in]			
Storage			
Average heat released from storage* [Btu/hr]			

**Cooling distribution**

Cooling via ventilation air	No
Cooling via air recirculation	Yes
Dehumidification	Yes
Panel cooling	No
Additional data	
Recirculation air cooling is single-speed	No
Minimum temperature of cooling coil (for recirculation air) [°F]	45
Recirculation air flow rate [cfm]	1500

**Ventilation distribution****Duct 1**

Duct type	Supply / outdoor air duct
Duct shape	Round
Quantity [-]	2
Duct length [ft]	10
Duct diameter, nominal width [in]	10
Insulation thickness [in]	2
Thermal conductivity [Btu/hr ft °F]	0.02778
Is reflective	Yes
Assigned ventilation units	RenewAire

**Duct 2**

Duct type	Extract / Exhaust air duct
Duct shape	Round
Quantity [-]	2
Duct length [ft]	10
Duct diameter, nominal width [in]	10
Insulation thickness [in]	2
Thermal conductivity [Btu/hr ft °F]	0.02778
Is reflective	Yes
Assigned ventilation units	RenewAire

**Supportive device / auxiliary energy**

Name	Type	Quantity	In conditioned space	Energy norm demand [Btu/hr]	Additional info
GSHP	Other	1	Yes	233	Period of operation 5.26 khr/yr

## Results

## Main results

Specific space heating demand	[kBtu/ft <sup>2</sup> yr]	15.5
Specific sensible cooling energy demand	[kBtu/ft <sup>2</sup> yr]	6.1
Specific dehumidification energy demand	[kBtu/ft <sup>2</sup> yr]	0
Specific heating load	[Btu/hr ft <sup>2</sup> ]	10.4
Specific cooling load	[Btu/hr ft <sup>2</sup> ]	3.3
Specific source energy demand	[kBtu/ft <sup>2</sup> yr]	0
Pressurization test result	[ACH50]	0.935
Average U-value exterior wall ambient	[Btu/hr ft <sup>2</sup> °F]	0.025
Average U-value exterior wall ground	[Btu/hr ft <sup>2</sup> °F]	0
Average U-value roof ceiling ambient	[Btu/hr ft <sup>2</sup> °F]	0.017
Average U-value floor slab basement ceiling	[Btu/hr ft <sup>2</sup> °F]	0.048
Average ΔU thermal bridges	[Btu/hr ft <sup>2</sup> °F]	0
Average U-value window total	[Btu/hr ft <sup>2</sup> °F]	0.441
Effective heat recovery efficiency	[%]	74.6