

# Green Factor Report

## 1740 Massachusetts Ave

Cambridge, MA



Prepared by:

enviENERGY Studio

Date:

March 12, 2026

## Green Factor Certification Form

This is for projects that are subject to the Green Factor Standard in Section 22.90 of the Cambridge Zoning Ordinance, which requires site and landscape design features that reduce urban heat.

*Review Section 22.90 of the Cambridge Zoning Ordinance and the Cambridge Cool Score Information and Guidelines before completing this form. When submitting a completed form, attach the supporting materials listed in the Green Factor Checklist.*

**Project Address/Location:** 1740 Massachusetts Avenue, Cambridge, MA 02138

**Planning Board (PB) and/or Board of Zoning Appeal (BZA) case number (if applicable):** PBAC-002

**Developer Name and Contact Information**

Name: Old North Development Company LLC

Mailing Address: 810 Memorial Drive, Suite 105, Cambridge, MA 02139

Email Address: adam@sgldevelopment.com

Telephone #: 978.314.7075

**Applicability: Section 22.92 & Section 5.22.5**

Is this project subject to Green Building Requirements (Section 22.20)?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Does this project involve the construction of a new building?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Does this project enlarge an existing building’s footprint by at least 50%?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Does this project involve the creation of new surface parking area?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No

*Answer the questions below if the answer is “Yes” to any of the above*

**Requirements**

*Cool Roof Requirement*

Does this project involve the construction of a new building roof or replacement of more than 50% of an existing roof?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Has this project received a Certificate of Appropriateness from the Cambridge Historical Commission or a Neighborhood Conservation District Commission, or a determination of adverse effect by the Executive Director of the Cambridge Historical Commission? [if “Yes,” attach the document to your submission]	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A

Last Updated: March 2024

How much of the new or replaced roof area (in sq. ft.) has a slope (rise:run) of less than 2:12? [Cool Roof Requirement is not applicable to roof area with a 2:12 or steeper slope]	9,825 - sf
What is the initial Solar Reflectance Index (SRI) of the proposed roof surface material for the area described above, excluding any solar energy systems or green roof area? [Minimum is 82]	82

*Cool Score – Base information on the attached Cool Score Sheet and Site/Roof Plan*

What is the Cool Score of the proposed site design? [Minimum is 1.0 except per below]	1.04
What is the Cool Score of the existing site? [Only answer if the project does not involve a new building or enlargement of a building footprint. The proposed Cool Score must not be less than the Cool Score of the existing site]	N/A

*Modifications to Requirements*

Has the project received, or will the project seek, a special permit from the Planning Board to modify the Green Factor Standard for this proposal?	<input type="checkbox"/> Received SP (date: _____) <input type="checkbox"/> Seeking SP <input checked="" type="checkbox"/> No modification
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03/10/2026

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Signature of Applicant Date

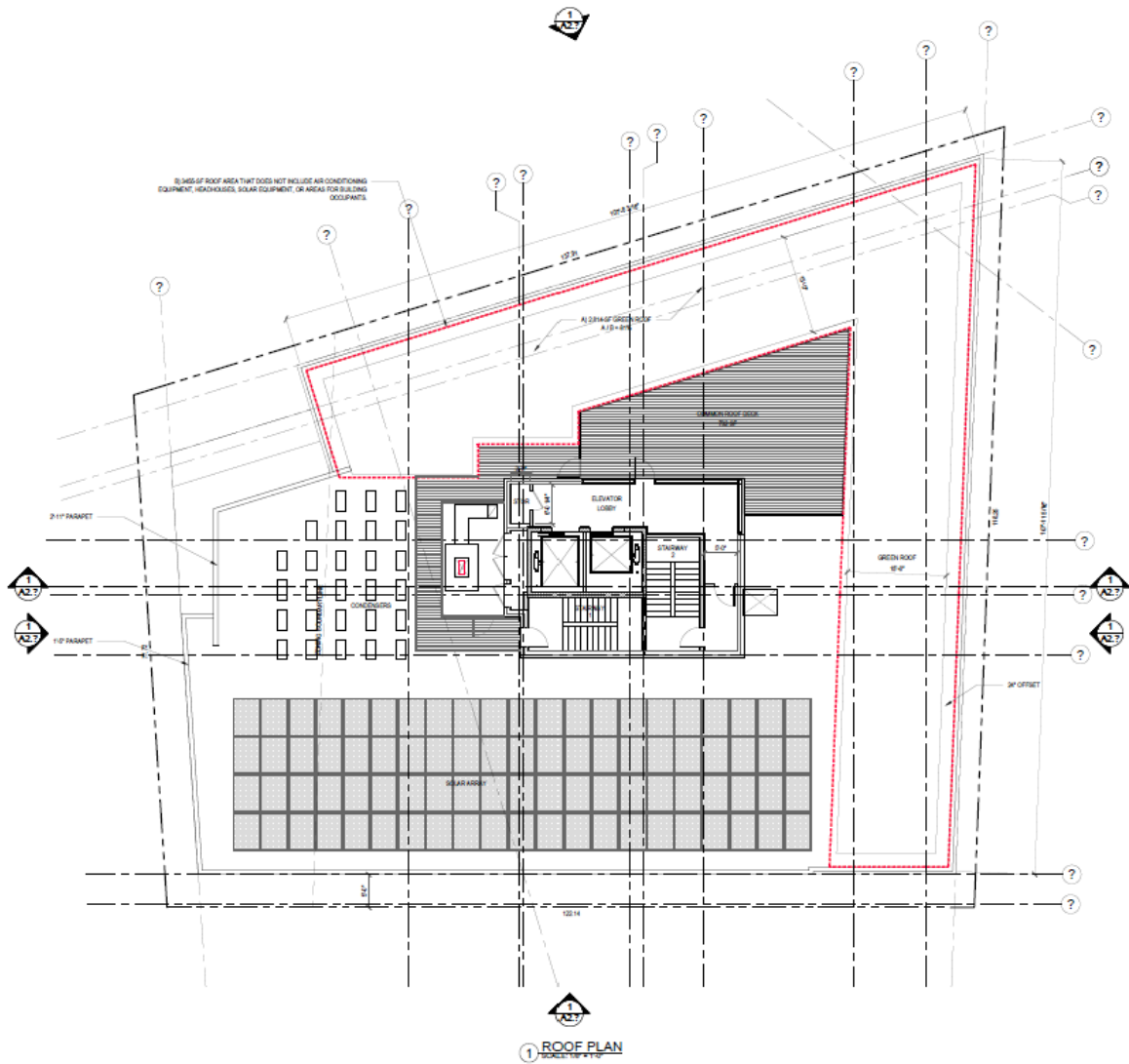
## Green Factor Checklist

Project Phase	Required Submissions
<input checked="" type="checkbox"/> <b>Special Permit/Design Review (if applicable)</b>	<input checked="" type="checkbox"/> Green Factor Certification Form <input checked="" type="checkbox"/> Cool Score Sheet <input checked="" type="checkbox"/> Site and Roof Plans
<input type="checkbox"/> <b>Building Permit</b>	<input type="checkbox"/> Green Factor Certification Form (updated from prior version) <input type="checkbox"/> Cool Score Sheet (updated from prior version) <input type="checkbox"/> Site and Roof Plans (updated from prior version) <input type="checkbox"/> Catalog of plant species including height and canopy spread of trees and height and soil depth of high and low planting areas <input type="checkbox"/> Specifications of roof surface material including initial Solar Reflectivity Index (SRI) <input type="checkbox"/> Specifications of paving material including SRI (if applicable) <input type="checkbox"/> Specifications of green roof installation with operations and maintenance plan (if applicable)
<input type="checkbox"/> <b>Certificate of Occupancy</b>	<p><b><i>All materials updated based on as-built conditions:</i></b></p> <input type="checkbox"/> Green Factor Certification Form (updated from prior version) <input type="checkbox"/> Cool Score Sheet (based on as-built conditions) <input type="checkbox"/> Site and Roof Plans (based on as-built conditions) <input type="checkbox"/> Catalog of plant species including height and canopy spread of trees and height and soil depth of high and low planting areas <input type="checkbox"/> Specifications of roof surface material including initial Solar Reflectivity Index (SRI) <input type="checkbox"/> Specifications of paving material including SRI (if applicable) <input type="checkbox"/> Specifications of green roof installation with operations and maintenance plan (if applicable)

Last Updated: March 2024

## Green Factor

In accordance with Section 22.93.1, new building roof membrane should have an initial SRI of at least 82. The 1740 Mass Ave project is targeting an SRI value of 82 which exceeds these requirements; a portion of the roof will be covered by Solar PV array. As is shown below, a significant portion of the roof will be dedicated to mechanical equipment but the design team reserved areas for on-site Renewable Energy generation and green roof. The project achieves a Cool Factor of 1.04 which exceeds the minimum requirements of 1.0, and therefore, the Green Factor requirements are met. Please refer to page 6 for detailed Cool Factor calculations.



**City of  
Cambridge**

**Cool Score Sheet**

**3/11/2024**

Project Address 1740 Massachusetts Avenue	Special Permit Number PB-XXX	Total Lot Area (SF) 12,430
Applicant Name Adam Siegel	Phone Number 617-429-5795	Open Space Requirement (%) 20%
Applicant Contact / Address	Email Address adam@sg1development.com	Zoning District Residence C-1
Project Description Multi-Use Development		Result Pass

Enter minimum required open space ratio. If the ratio is less than 20%, enter 20 here.

		Outside 20' of Street	Value Factor		Within 20' of Street	Value Factor	Contributing Area	
<b>Trees</b> Enter the number of trees in each category. Count each tree only once on this form.	<b>Preserved Existing Trees</b>							
	A1	Understory tree currently <10' canopy spread	0	0.80	+	0	1.60	-
	A2	Understory tree currently >10' canopy spread	0	1.00	+	0	2.00	-
	A3	Canopy tree currently <15' canopy spread	0	0.80	+	0	1.60	-
	A4	Canopy tree currently between 15' and 25' canopy spread	0	1.00	+	0	2.00	-
	A5	Canopy tree currently >25' canopy spread	0	1.20	+	0	2.40	-
	<b>New or Transplanted Trees</b>							
A6	Understory tree	0	0.60	+	1	1.20	180	
A7	Canopy tree	0	0.70	+	0	1.40	-	
<b>Planting Areas</b> Enter area in square feet of each component in the box provided	B1	Lawn Area	0	0.30	+	0	0.60	-
	B2	Low Planting Area	0	0.40	+	45	0.80	36
	B3	High Planting Area	379	0.50	+	74	1.00	264
<b>Green Roofs &amp; Facades</b> For definitions, see reference document.	C1	Green Façade	0	0.10	+	0	0.20	-
	C2	Living Wall	0	0.30	+	0	0.60	-
	C3	Green Roof Area	274	0.30	+	2,540	0.60	1,606
	C4	Short Intensive Green Roof Area	0	0.50	+	0	1.00	-
	C5	Intensive Green Roof Area	0	0.60	+	0	1.20	-
<b>Paving &amp; Structures</b>	D1	Low Slope Roof	5,135	N/A				
	D2	High-SRI Paving	0	0.1				-
	D3	Shaded Area	0	0.2	+	1,246	0.40	498
<b>Project Summary</b>	Portion of lot area utilizing green strategies ..... 17% Portion of score from green strategies ..... 81% Portion of score from trees ..... 7% Portion of score contributing to public realm cooling ..... 89%						<b>Total Contributing Area</b>	<b>2,584</b>
							<b>Total Area Goal</b>	<b>2,486</b>
							<b>COOL FACTOR SCORE</b>	<b>1.04</b>

When entering strategies that are within 20' of the street (including sidewalks), do not also enter them in column H.

High-SRI Paving areas within 20' of a Street do not count towards the Cool Score

If your project scores 1 or above, you have successfully met the requirements of the Cool Factor.

Project Address 1740 Massachusetts Avenue	Special Permit Number	Total Lot Area (SF) 12430
Applicant Name Adam Siegel	Phone Number	Open Space Requirement (%) 20.1%
Applicant Contact / Address	Email Address adam@sgldevelopment.com	
Project Description Multi-Use Development		Result Pass

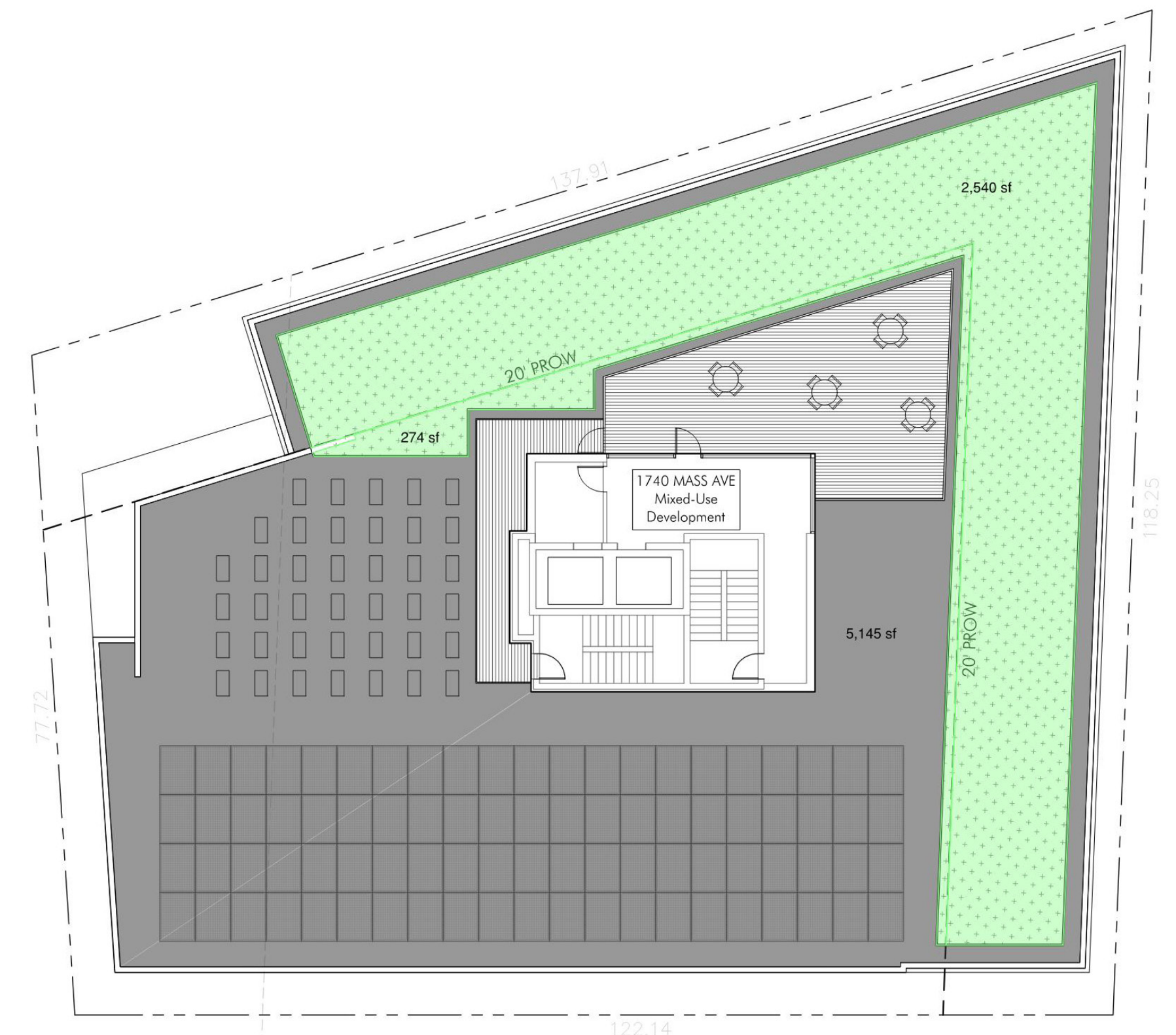
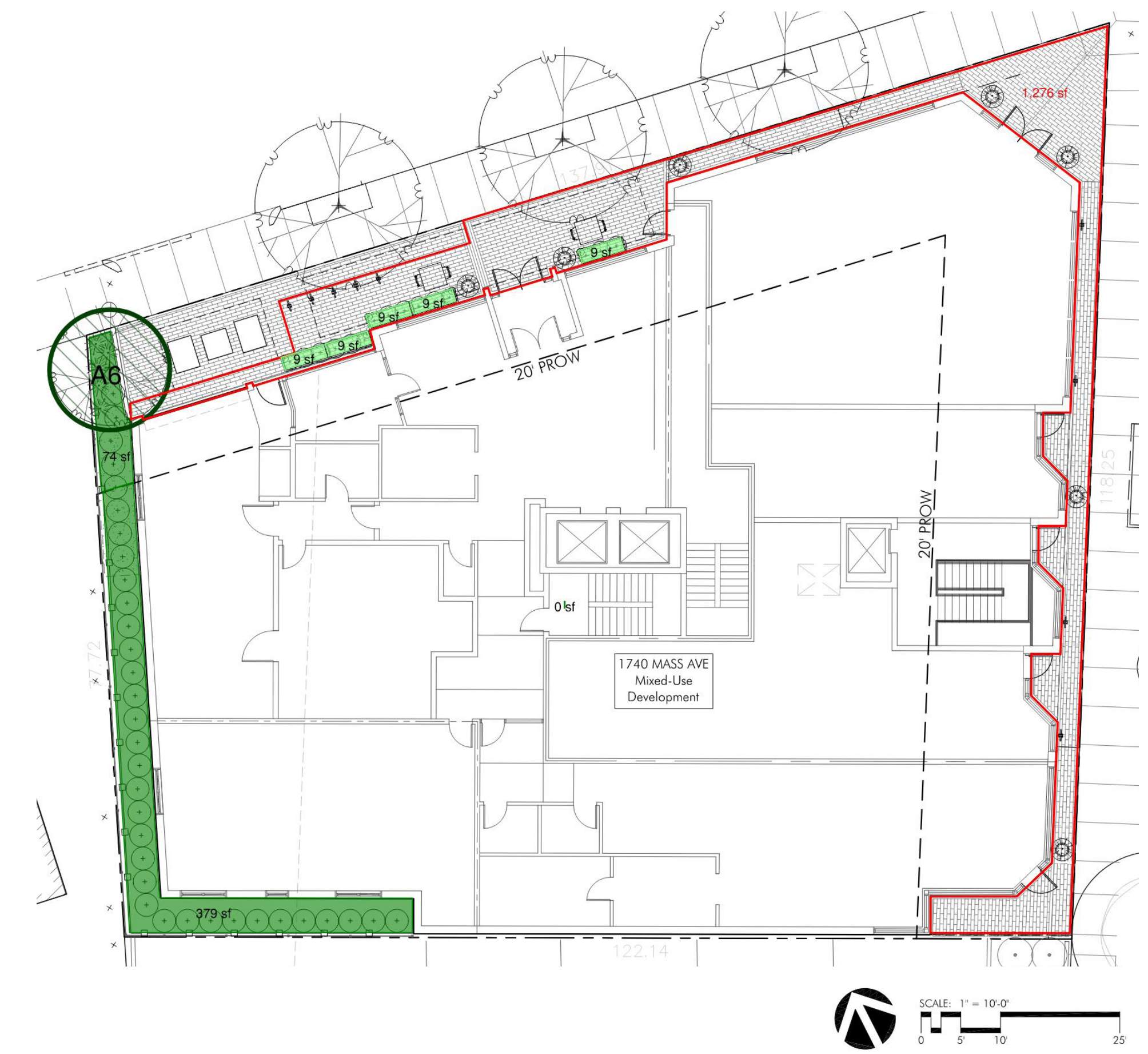
Enter minimum required open space ratio. If the ratio is less than 20%, enter 20 here.

		Outside 20' of PROW	Value Factor		Within 20' of PROW	Value Factor	Contributing Area		
<b>Trees</b> Enter the number of trees in each category. Count each tree only once on this form.	<b>Preserved Existing Trees</b>								
	A1	Understory tree currently <10' canopy spread	0	0.80	+	0	1.60		
	A2	Understory tree currently >10' canopy spread	0	1.00	+	0	2.00		
	A3	Canopy tree currently <15' canopy spread	0	0.80	+	0	1.60		
	A4	Canopy tree currently between 15' and 25' canopy spread	0	1.00	+	0	2.00		
	A5	Canopy tree currently >25' canopy spread	0	1.20	+	0	2.40		
	<b>New or Transplanted Trees</b>								
	A6	Understory tree	0	0.60	+	1	1.20	180	
	A7	Canopy tree	0	0.70	+	0	1.40	-	
	<b>Planting Areas</b> Enter area in square feet of each component in the box provided	B1	Lawn Area	0	0.30	+	0	0.60	-
B2		Low Planting Area	0	0.40	+	45	0.80	36	
B3		High Planting Area	379	0.50	+	74	1.00	264	
<b>Green Roofs &amp; Facades</b> For definitions, see reference document.	C1	Green Façade	0	0.10	+	0	0.20	-	
	C2	Living Wall	0	0.30	+	0	0.60	-	
	C3	Green Roof Area	274	0.30	+	2540	0.60	1,606	
	C4	Short Intensive Green Roof Area	0	0.50	+	0	1.00	-	
	C5	Intensive Green Roof Area	0	0.60	+	0	1.20	-	
<b>Paving &amp; Structures</b>	D1	High-SRI Roof		N/A					
	D2	High-SRI Paving	0	0.1				-	
	D3	Shaded Area	0	0.2	+	1276	0.40	510	
<b>Project Summary</b>	Portion of lot area utilizing green strategies . . . . . 17%						Total Contributing Area		2,596
	Portion of score from green strategies . . . . . 80%						Total Area Goal		2,498
	Portion of score from trees . . . . . 7%						COOL FACTOR		1.04
	Portion of score contributing to public realm cooling . . . . . 90%						SCORE		

When entering strategies that are within 20' of the public right of way (column I), do not also enter them in column H.

High-SRI roofs are a prerequisite of the Cool Factor and therefore are not assigned a point value.

If your project scores 1 or above, you have successfully met the requirements of the Cool Factor.



Legend: Trees And Plantings

Type	Color	Description/Size
A1	NA	Understory Tree, currently <10' Canopy
A2	NA	Understory Tree, currently >10' Canopy
A3	See Plan	Understory Tree, currently <15' Canopy
A4	See Plan	Canopy Tree, currently between 15' and 25' Canopy
A5	See Plan	Canopy Tree, currently >25' Canopy
A6	NA	Understory Tree
A7	See Plan	Canopy Tree
B1	107s???	Lawn Area
B2		Low Planting Area, min. 12" Soil Depth, Mature Plant Height <2'
B3		High Planting Area, min. 18" Soil Depth, Mature Plant Height >2'

Legend: Green Roofs+Facades, Paving+Structures

Type	Color	Description	SRI
C1	NA	Green Façade (15' x 10' Wide)	
C2	NA	Living Wall	
C3	NA	Green Roof	
C4	NA	Short Intensive Green Roof Area	
C5	NA	Intensive Green Roof Area	
D2		High SRI Paving	NA
D3		Shaded Area	

Legend: Low Slope and Steep Slope Roof

Type	Color	Description	Area	SRI
D1		Low Slope Roof (<2:12)	approx. 5135sf	MIN 82 SEE ARCH PLANS
N/A	NA	Steep Slope Roof (>2:12)	NA	NA

PLANT LIST | 1740 MASS AVE ROOF LEVEL

KEY QTY LATIN NAME COMMON NAME

SEDUM

Sedum Green Roof: 2,814SF InstaGreen Sedum Carpet by Hydrotech OR Similar

PLANT LIST | 1740 MASS AVE

KEY	QTY	LATIN NAME	COMMON NAME	SIZE	NOTES	SIZE AT MATURITY
<b>TREES:</b>						
AC	1	Amelanchier canadensis	Shadblow Serviceberry	2-2.5" cal.	B&B	+10' Canopy; +20' Ht.
UA	3	Ulmus americana 'Homestead'	American Elm (Disease-Resistant)	2.5-3" cal.	B&B	+30' Canopy; +40' Ht.
<b>SHRUBS:</b>						
HP	10	Hydrangea paniculata 'Little Lime'	Dwarf Panicle Hydrangea	3 gal.	Pots	
IG	5	Ilex glabra 'Gem Box'	Dwarf Inkberry	3 gal.	Pots	
RA	34	Rhus aromatica 'Gro-Low'	Gro-Low Fragrant Sumac	3 gal.	Pots	
<b>PERENNIALS &amp; GRASSES:</b>						
ca	5	Calamagrostis x acutiflora 'Karl Foerster'	Feather Reed Grass	1 gal.	Pots	
he	5	Heuchera	Coral Bells	1 qt.	Shade-Tolerant Variety	

NOTE: All tree planting areas shall consist of planting soil of 36" depth. All high and low planting areas shall consist of planting soil minimum 18" depth. All planting areas shall be prepared with subsoils loosened to minimum -36" below finish grade.



REVISIONS	MARK	ISSUE	DATE

DRAWING INFORMATION  
ISSUE: \_\_\_\_\_  
DATE: 09/23/2026  
SCALE: AS NOTED

PROJECT NUMBER:  
DRAWN BY: EH  
CHECKED BY: KP

DRAWING TITLE  
**COOL FACTOR**

DRAWING NUMBER

**L3**



# Article 22 Green Building Report

## 1740 Massachusetts Ave

Cambridge, MA



Prepared by:

enviENERGY Studio

Date:

March 12, 2026

## Green Building Project Checklist

### Green Building

Project Location: 1740 Mass Ave, Cambridge, MA

### Applicant

Name: Old North Development Company LLC

Address: 810 Memorial Drive, Suite 105, Cambridge, MA 02139

#### Contact Information

Email Address: adam@sgldevelopment.com

Telephone #: 978.314.7075

### Project Information (select all that apply):

- New Construction – GFA: 71,481 square feet
- Addition – GFA of Addition: \_\_\_\_\_
- Rehabilitation of Existing Building – GFA of Rehabilitated Area: \_\_\_\_\_
- Existing Use(s) of Rehabilitated Area: \_\_\_\_\_
- Proposed Use(s) of Rehabilitated Area: \_\_\_\_\_
- Requires Planning Board Special Permit approval
- Subject to Section 19.50 Building and Site Plan Requirements
- Site was previously subject to Green Building Requirements

### Green Building Rating Program/System:

- Leadership in Energy and Environmental Design (LEED) – Version: \_\_\_\_\_
- Building Design + Construction (BD+C) – Subcategory: \_\_\_\_\_
- Residential BD+C – Subcategory: \_\_\_\_\_
- Interior Design + Construction (ID+C) – Subcategory: \_\_\_\_\_
- Other: \_\_\_\_\_
- Passive House – Version: PHIUS CORE 2024
- PHIUS+
- Passivhaus Institut (PHI)
- Other: \_\_\_\_\_
- Enterprise Green Communities – Version: \_\_\_\_\_



## Project Phase

SPECIAL PERMIT/

**DEVELOPMENT REVIEW**

*Review Section 22.25.1 of the Cambridge Zoning Ordinance. Attach the supporting materials listed.*

## Required Submissions

All rating programs:

- Rating system checklist (Not Applicable)
- Rating system narrative
- Net zero narrative (see example template for guidance)
- Affidavit signed by Green Building Professional with attached credentials – use City form provided (Special Permit/ Development Review)

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## Rating System Narrative

The 1740 Massachusetts Avenue project consists of a new six-story residential development containing 71 dwelling units in Cambridge, Massachusetts. The design team has prioritized high-performance building strategies throughout the project in order to support long-term sustainability goals. Key objectives include reducing energy and water consumption, improving the durability and operational efficiency of building systems, and minimizing environmental impacts on the surrounding community and municipal infrastructure.

The project is subject to the City of Cambridge Article 22 requirements as well as the Opt-In Specialized Energy Code Passive House provisions. Consistent with the requirements of Section 22.20 of the Cambridge Zoning Ordinance, the project demonstrates compliance with the following provisions:

- **22.23 Green Building Rating Programs:** Section 22.23.1 authorizes three compliance pathways: LEED, Passive House, and Enterprise Green Communities. The 1740 Mass Ave development will pursue Passive House certification under the PHIUS CORE 2024 standard through the Passive House Institute US (PHIUS), satisfying this requirement. Additional information is provided in the Passive House section of this report.
- **22.24.2 Green Commissioning:** A commissioning team has been retained to provide enhanced commissioning services comparable to LEED v4 Enhanced Commissioning and aligned with the City of Cambridge Green Commissioning requirements. The commissioning scope will confirm that building systems and assemblies are properly designed, installed, tested, and operating as intended to meet the project's sustainability and performance objectives.
- **22.24.5 Flood Resilience:** The project has been designed to comply with applicable flood resilience requirements.
- **22.24.6 Green Factor:** The development will meet the requirements of Section 22.90 – Cambridge Green Factor Standard. Details are provided in the Green Factor documentation.

Pursuing PHIUS CORE 2024 certification reflects the project team's commitment to significantly reducing building energy demand while maintaining a high level of indoor environmental quality for residents. This approach supports both the City of Cambridge's climate action objectives and the Commonwealth of Massachusetts' decarbonization targets. The project will comply with the Massachusetts Stretch and Specialized Energy Codes through the all-electric and Certified Performance pathways.

As a PHIUS-certified building, the design focuses on lowering heating and cooling loads and improving overall building efficiency, which in turn helps reduce peak demand on the local electrical grid. Key design strategies include a highly insulated enclosure with minimized thermal bridging, a continuous air barrier, and high-performance windows. Balanced mechanical ventilation with energy recovery will provide filtered outdoor air to all residential units. Heating and cooling will be delivered using cold-climate air-source heat pumps, and the domestic hot water system will be fully electric.

The enviENERGY Studio team, which includes two Certified Passive House Consultants (CPHCs), is providing Passive House and sustainability consulting services for the project. The team will guide the design through PHIUS certification while also ensuring compliance with all applicable local and state energy regulations. As the project advances, the design team will continue to coordinate closely through regular sustainability and performance workshops to ensure that the project's environmental goals are fully integrated into both design and construction

## Passive House Feasibility Report

### 1. EXECUTIVE SUMMARY

enviENERGY Studio is providing Passive House Institute US (Phius) consulting services for the 1740 Massachusetts Ave development project. This study evaluates the project's compliance with the 2023/2025 Massachusetts Stretch Energy Code and the Specialized Opt-In Energy Code, utilizing the Certified Performance Standard pathway. The scope of this feasibility study focuses on a new mixed-use building in Cambridge, Massachusetts. It is a six-story, approximately 64,350-square-foot multifamily building with 5,550 square feet of commercial space on the first floor. This analysis does not include the commercial.

This project will meet all the requirements of Phius CORE 2024, which require the design to comply with annual and peak heating and cooling load requirements, as well as limits on source energy use and air infiltration. The building performance simulations were developed utilizing the provided Schematic Design drawings, mechanical equipment narratives, and the Phius 2024 Passive Building Standard Certified Guidebook v25.1.0.

The study and analysis presented in this report focus on aspects of the building envelope and mechanical equipment performance to enhance thermal comfort, mitigate moisture and condensation risk, lower annual and peak heating and cooling loads, and reduce energy consumption of the proposed building.

In this analysis, we compare two HVAC configurations. The first will incorporate a combination of packaged heat pumps and mini-split heat pumps in the units and common areas. The second will be an entirely packaged heat pump system for residential units with mini-splits in the common areas. The results summaries for these design scenarios can be found on the following page.

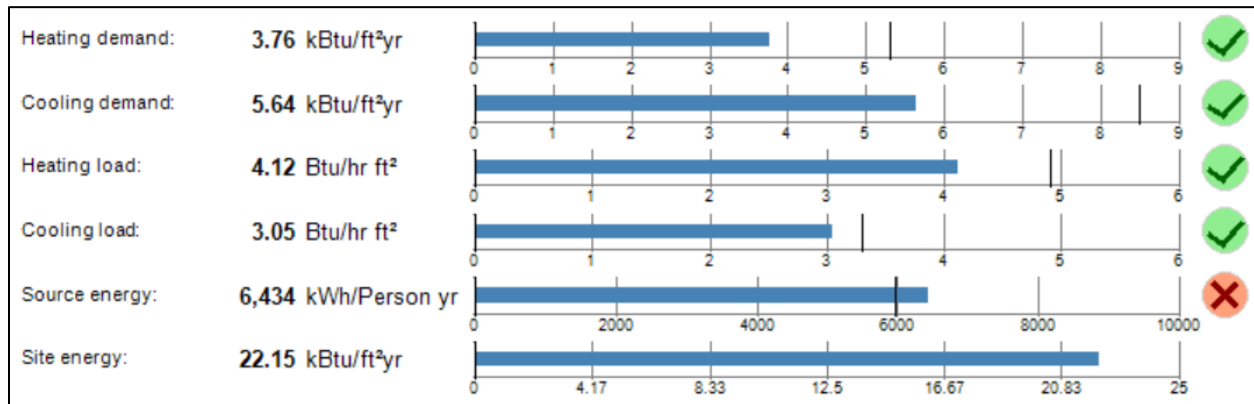
**Table 1.1: Phius CORE 2024 Results Summary**

(iCFA*: 59,500)				
Phius CORE 2024 Criteria	Limit	PTHP Only	PTHP + Mini-Split	Margin (%)
Heating Demand (kBtu/ft2yr)	5.3	3.75	3.76	29.1%
Cooling Demand (kBtu/ft2yr)	8.5	5.51	5.64	33.6%
Peak Heating Load (Btu/ft2hr)	4.9	4.12	4.12	15.9%
Peak Cooling Load (Btu/ft2hr)	3.3	3.02	3.05	7.6%
Source Energy (kWh/person.yr)	6950	6360	6434	7.4%
Site Energy (kBtu/ft2yr)	N/A	21.90	21.97	

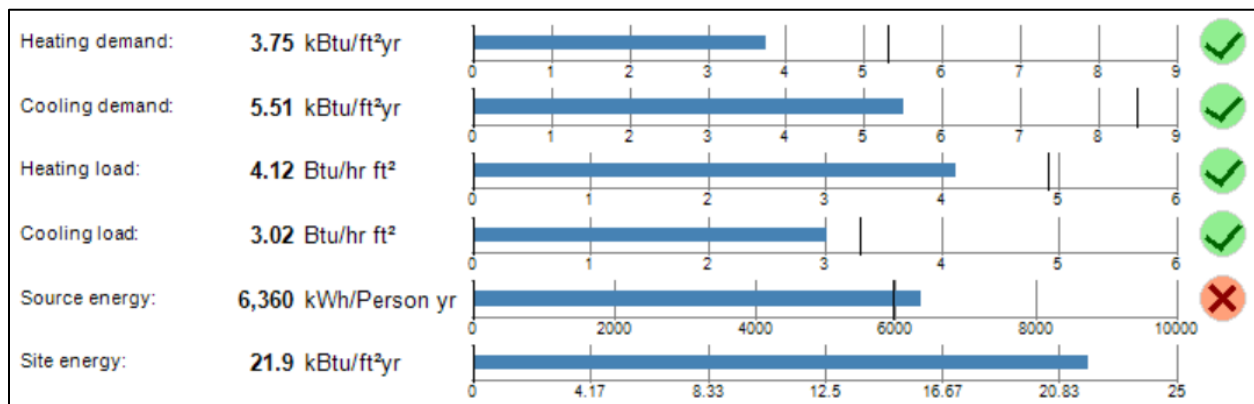
\*iCFA = interior conditioned floor area, measured from the interior dimension of exterior walls.

The following images are results directly from the WUFI Passive software. Note that the latest version of the software has not been updated and still calculates Phius CORE 2021 source energy targets. While the software indicates a source energy target of 6,000 kWh/Person.yr, the target for this project is 6,950 kWh/Person.yr to meet Phius CORE 2024 compliance.

**Figure 1.1: Results from WUFI Passive (PTHP + Mini-Split)**



**Figure 1.2: Results from WUFI Passive (PTHP Only)**



Note: WUFI Passive is an envelope compliance tool rather than an energy estimation tool. This report's predicted energy use intensity (pEUI) does not necessarily represent actual building energy performance. Phius uses default values for interior lighting and miscellaneous equipment and do not align with the ASHRAE energy modeling procedures.

## 2. ENERGY MODELING ASSUMPTIONS AND APPROACH

Using the guidelines outlined in the Phius 2024 Passive Building Standard Certified Guidebook v25.1.0, the model was defined using the provided Schematic Design drawings, mechanical narratives, and cut sheets. Design scenarios were modeled in accordance with the Phius energy modeling protocol in Section 1.4.4 of the Guidebook, covering the building envelope, HVAC systems, domestic hot water (DHW) system, lighting, miscellaneous loads, and occupancy and equipment schedules. The proposed design scenarios provide a pathway to Phius CORE 2024 certification through energy-conservation and peak-load-mitigation measures.

At this stage, a 5-10% buffer is recommended in all compliance criteria to hedge against future design modifications and the impact of thermal bridging, which is not yet captured in this study.

### 2.1 Building Envelope

The modeled building performance assumes a thermally robust and airtight envelope. The vertical elements of the envelope consist of wood-framed insulated walls on floors 2-6 and the penthouse level, while the ground floor will be metal-framed. Ground-level glazing consists primarily of storefront windows, while the upper levels feature a combination of fixed and casement windows, as well as glazed balcony doors and windows. The tables below summarize the thermal performance of the proposed building envelope in compliance with Phius performance requirements. The estimated window-to-wall ratio and proposed U/R values are based on early design and massing plans. As the design progresses, the project team will continue to evaluate technologies and approaches to optimize the envelope performance.

**Table 2-1: Exterior Opaque Assembly Performance**

Exterior Envelope Component	Thermal Properties
Roof	R-30 c.i. above deck
Exterior Walls	R-19 cavity + R-10 c.i. ( $R_{\text{eff}}=34$ )
Slab on Grade ( $R_{\text{eff}}$ -value)	2" R-10 c.i. below
Footing Insulation (Exterior-Side)	R-10 c.i. (down to footing)

\*  $R_{\text{eff}}$ -value refers to the effective thermal resistance when considering framing and other assembly components.

**Table 2-2: Exterior Transparent Assembly Performance**

Exterior Envelope Component	Thermal Properties
Punch, Fixed ( $U_w$ -value* / SHGC)	U-0.15 / SHGC-0.23
Punch, Casement ( $U_w$ -value* / SHGC)	U-0.17 / SHGC-0.23
Balcony Glass ( $U_w$ -value / SHGC)	U-0.63 / SHGC-0.35
Storefront ( $U_w$ -value / SHGC)	U-0.35 / SHGC-0.30
Entryways ( $U_w$ -value / SHGC)	U-0.63 / SHGC-0.35
WWR (%)	25.4%

\*  $U_w$ -value refers to the effective thermal resistance when considering framing and other assembly components.

## 2.2 Building Airtightness

The Phius requirement for the maximum allowable air leakage rate of the building envelope is 0.06 CFM/ft<sup>2</sup> @ 50 Pascals (Pa). This is significantly lower than the Massachusetts Stretch Energy Code maximum rate of 0.23 CFM/ft<sup>2</sup> @ 50 Pa of pressure. Note that 0.08 CFM/ft<sup>2</sup> @ 50 Pascals (Pa) has been captured in the WUFI Passive model for this feasibility study, as onsite verification may identify sources of allowable adjustments to the maximum infiltration rate in line with Phius requirements. This allows the project to ensure that compliance with the standard is not impacted by this adjustment.

The detailed drawings will include a clear definition of the building's continuous air barrier, as well as individual details of all building component connections, penetrations, and window installations. To meet these stringent requirements, the design and construction team will ensure that all joints, penetrations, and openings are adequately taped or sealed. The Phius Verifier will conduct blower door testing at the end of construction to confirm the project's compliance with air leakage requirements.

## 2.3 Thermal Bridging

Thermal bridging was not accounted for in this feasibility study, as it is not required at this stage of modeling. However, the impact of thermal bridging will be included in the WUFI Passive model used for Design Certification through 2-D THERM analysis. Problematic thermal bridges can be mitigated through better-insulated, thermally broken constructions at critical junctions in the building envelope. If necessary, iterative design and modeling will be performed to optimize these building envelope connections and minimize thermal bridging.

## 2.4 Occupancy

According to Section 1.3.4.2 of the Phius 2024 Guidebook v25.1.0, residential building loads and ventilation rates are established under the assumption that these systems will operate continuously. The peak occupancy density is calculated as the number of bedrooms plus 1 for residential spaces, with studio apartments counted as 0-bedroom units.

**Table 2-3: Phius 2024 Occupancy Inputs**

Category	Amount
Design Occupancy	121
Number of Units	71
Number of Bedrooms*	50

\* Studio units are counted as zero-bedroom units

## 2.5 Internal Loads

Phius requires that the lighting and plug loads used in the WUFI Passive model be calculated using the Phius Multifamily Lighting & MEL (Miscellaneous Electric Loads) Calculator. The calculated values for interior and exterior lighting and MELs were then input into the model. All lighting is assumed to be LED, and common areas are assumed to have occupancy sensors. All equipment, such as washer machines, dryers, and dishwashers, assume the national average for ENERGY STAR-rated appliances. These values must be updated as equipment is specified for the project.

**Table 2-4: Lighting and Plug Loads**

Load Source	Annual Consumption
Interior Lighting	73,193 kWh/yr
Exterior Lighting	1,856 kWh/yr
MEL ( <i>Misc. Electric Loads</i> )	70,554 kWh/yr

## 2.6 Setpoints

The setpoints are modeled to match the required temperature setpoints for Phius certification. Below are the modeled temperature setpoints.

Heating set point: 68 °F                      Cooling set point: 77 °F

## 2.7 Space Heating and Cooling

Heating and cooling equipment were modeled in accordance with the MEP narrative, which specifies ducted split systems per unit with LGRED Cold Climate heat pumps as the basis of design. To model the proposed equipment in WUFI Passive, the Phius Heat Pump Performance Estimator v25.1.1 calculated the following weighted averages for all equipment efficiencies and capacities:

**Table 2-5: WUFI Passive Cooling Equipment Inputs**

Equipment Parameter (Cooling)	WUFI Passive Input PTHP Only	WUFI Passive Input PTHP + Mini-Split
Modeled Cooling Capacity/System	613 kBtu/hr	634 kBtu/hr
Modeled Cooling COP	3.32	3.68
Number of Systems Needed	2	2

**Table 2-6: WUFI Passive Heating Equipment Inputs**

Equipment Parameter (Heating)	WUFI Passive Input PTHP Only	WUFI Passive Input PTHP + Mini-Split
Rated COP (17 °F)	1.57	1.63
Rated COP (47 °F)	2.31	2.08

## 2.8 Mechanical Ventilation

The proposed energy recovery systems include centralized, packaged rooftop ERUs that distribute preconditioned air to common areas, and unitary ERVs for each individual dwelling unit. The ventilation air for the dwelling unit differs between the two scenarios: the PTHP scenario uses entirely integrated ERVs, while the PTHP + mini-split scenario uses integrated ERVs for smaller units and standalone Panasonic unitary ERVs for larger units.

Building ventilation rates at this stage were estimated based on Phius ventilation requirements for dwelling units in multifamily buildings and IMC 2024 minimum requirements for non-residential spaces. Note that the ventilation rates have been increased by 10% as a buffer to account for future design or testing penalties.

**Table 2-7: Mechanical Ventilation Systems**

ERV Specifications	Ephoca Vertical Stack ERV	Panasonic ERV (110 CFM)	Panasonic ERV (135 CFM)	Central ERUs*
Sensible Heat Recovery (%)	80%	81%	77%	70%
Latent Heat Recovery (%)	70%	77%	72%	66%
Fan Power (W/cfm)	0.30 W/cfm	0.556 W/cfm	0.714 W/cfm	1.2 W/cfm

\* If no third-party verification data is available, a deration of 12% must be applied to energy recovery efficiencies.

**Table 2-8: Ventilation Airflow**

Unit Sizes	Model Input
Studio	85 CFM
1 Bedroom	85 CFM
2 Bed + 2 Bath	110 CFM
3 Bed + 3 Bath	135 CFM

It is important to note that the total measured supply and exhaust airflow must differ by no more than 10%. Additionally, the proposed ERV equipment must meet the following requirements for indoor air quality:

- Install MERV 8 filter on the supply intake ductwork (recommend MERV 13 or higher).
- Install MERV 8 filter on the exhaust ductwork.

## 2.9 Domestic Hot Water

The DHW system will consist of unitary electric-resistance DHW tanks per dwelling unit. Both scenarios use electric-resistance DHW heaters with a UEF (Uniform Energy Factor) of 0.92.

Table 2-9: DHW Systems

Design Scenario	Model Input
Electric Resistance DHW	Unitary Storage Tanks (UEF 0.92)

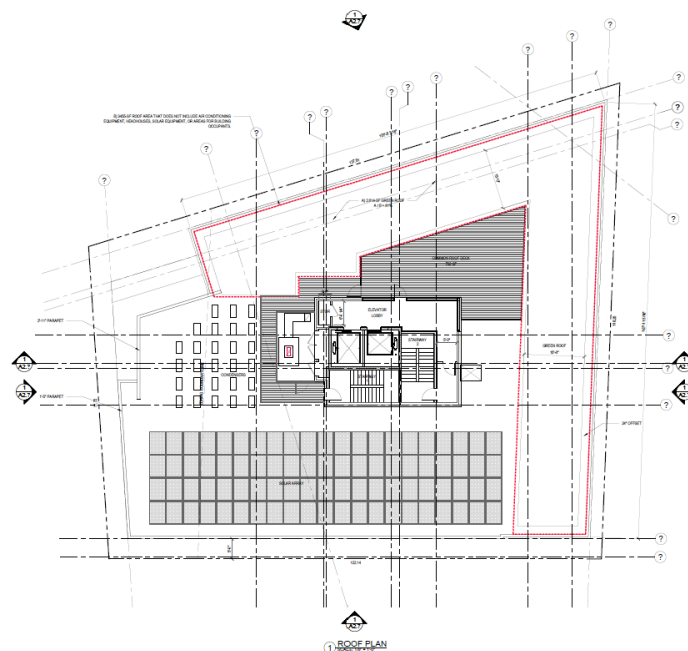
In addition to the proposed DHW design, the following criteria must be met:

- Minimum of R-3 insulation on all DHW distribution pipes (R-8 recommended).
- Pass the EPA WaterSense Hot Water Delivery requirement; a maximum of 1.8 gallons of water stored in the longest run of DHW piping to the fixture for multifamily projects with individual water heaters.

### 2.10 On-site Renewable Energy

To meet the source energy requirements set by Phius, projects may use on-site solar photovoltaic (PV) systems. Because both scenarios without solar PV receive a <1.0% buffer over the performance criteria, the following analysis has been included using NREL's PVWatts Calculator<sup>1</sup>. Note that the following estimate is subject to change as the design progresses.

- It is estimated that a 33-kW roof-mount photovoltaic (PV) array will offset the source energy margin for the building. This system will generate approximately 35,000 kWh/yr and cover an estimated 2,000 ft<sup>2</sup>.



<sup>1</sup> <https://pwwatts.nrel.gov/pwwatts.php>

**RESULTS**

Print Results

**36,662 kWh/Year\***

System output may range from 35,188 to 37,997 kWh per year near this location. Click [HERE](#) for more information.

Month	Solar Radiation ( kWh / m <sup>2</sup> / day )	AC Energy ( kWh )
January	2.12	1,756
February	2.93	2,204
March	4.05	3,320
April	4.78	3,636
May	5.80	4,395
June	5.71	4,099
July	6.08	4,472
August	5.35	3,946
September	4.63	3,377
October	3.11	2,420
November	2.10	1,645
December	1.73	1,392
<b>Annual</b>	<b>4.03</b>	<b>36,662</b>

Assumptions:

- Module: 400-Watt
- DC to AC Size Ratio: 1.17
- Soiling %: 6
- Inverter Efficiency: 96%
- System loss: 16.2%
- DC Size: 33-kW

**2.11 DOE Zero Energy Ready Homes (ZERH)**

**Solar-Ready**

Because this project will be all-electric with no fossil fuel usage, compliance with the Specialized Opt-in Code requirement to install on-site solar PV is not required. However, for Phius CORE 2024 certification, a project must comply with the DOE Zero Energy Ready Home Multifamily PV-Ready Checklist. This includes reserving 40% of the roof area for future solar photovoltaic (PV) installation, providing the necessary blocking for the future solar array, and marking its location in a design drawing.

**Electric Vehicle-Ready**

There are no parking spaces on site and therefore, requirements are met.

**2.12 ENERGY STAR Multifamily New Construction (MFNC)**

This building must meet the co-requisite requirements for ENERGY STAR Multifamily New Construction (MFNC). This entails two potential pathways for compliance:

**ASHRAE Path**

If the project chooses to pursue the ASHRAE Path to compliance, the source energy requirement must be lowered by 15% from the threshold established by the Phius Performance Criteria Calculator without renewable energy. This pathway won't be pursued.

**ERI Path**

Project will pursue the ERI Path. This requires each individual unit's HERS rating to be equivalent to the minimum requirements of the ENERGY STAR Multifamily Reference Design, as assessed by an EPA-recognized Home Certification Organization (HCO).

## Net Zero Narrative

Project Name/ Address: 1740 Mass Ave, Cambridge, MA

## Net Zero Narrative

### Project Profile

#### Development Characteristics

<b>Lot Area (sq.ft.):</b>	12,430
<b>Existing Land Use(s) and Gross Floor Area (sq.ft.), by Use:</b>	Existing building to be replaced
<b>Proposed Land Use(s) and Gross Floor Area (sq.ft.), by Use:</b>	Residential and Commercial; 71,481 SF
<b>Proposed Building Height(s) (ft. and stories):</b>	69.95'
<b>Proposed Dwelling Units:</b>	71
<b>Proposed Open Space (sq.ft.):</b>	951 SF
<b>Proposed Parking Spaces:</b>	0
<b>Proposed Bicycle Parking Spaces (Long-Term and Short-Term):</b>	75 long-term (basement); 13 short-term on grade

#### Green Building Rating System

Choose the Rating System selected for this project:

LEED-Leadership in Energy & Environmental Design (U.S. Green Building Council)					
<b>Rating System &amp; Version:</b>	N/A	<b>Seeking Certification?*</b>	Yes	No	TBD
<b>Rating Level:</b>		<b># of Points:</b>			

Enterprise Green Communities					
<b>Rating System &amp; Version:</b>	N/A	<b>Seeking Certification?*</b>	Yes	No	TBD
<b>Rating Level:</b>		<b># of Points:</b>			

Passive House Institute US (PHIUS) or Passivhaus Institut (PHI)					
<b>Rating System &amp; Version:</b>	PHIUS CORE 2024	<b>Seeking Certification?*</b>	Yes	No	TBD

\*NOTE: Certification is not required through the Green Building Requirements. However, you may choose to indicate if the Project Team intends to pursue formal certification through these Green Building Rating Programs (or their affiliates).

## Proposed Project Design Characteristics

### Building Envelope

**Assembly Descriptions:**

<b>Roof:</b>	<i>R-30 c.i. above deck</i>
<b>Foundation:</b>	<i>R-10 c.i. down to footing; R-10 c.i. under slab</i>
<b>Exterior Walls:</b>	<i>R-19 cavity + R-10 c.i.</i>
<b>Windows:</b>	<i>Punch: U-0.15 &amp; 0.17 /SHGC-0.23 Balcony glass: U-0.63/ SHGC-0.35 Storefront: U-0.35/ SHGC-0.30</i>
<b>Window-to-Wall Ratio:</b>	<i>25.4%</i>
<b>Other Components:</b>	<i>Entryways: U-0.63/ SHGC-0.35</i>

**Envelope Performance:**

**[Project Team Comment: Project is pursuing Passive House certification pathway for energy code compliance. There is no baseline to compare to. Additionally, Passive House envelope design is significantly better than IECC 2021 prescriptive requirements.]**

*Provide estimates of the thermal transmittance (U-value) for the building envelope compared to “Baseline”*

*standards required by the Massachusetts Stretch Energy Code, latest adopted edition.*

	<b>Proposed</b>		<b>Baseline</b>	
	<i>Area (sf)</i>	<i>U-value</i>	<i>Area (sf)</i>	<i>U-Value</i>
Window				
Wall				
Roof				

**Envelope Commissioning Process:**

*Project pursues Passive House certification. Envelope review and verification are requirements of Passive House certification.*

**Building Mechanical Systems**

**Systems Descriptions:**

<b>Space Heating:</b>	<i>High-efficiency ducted mini split heat pump</i>
<b>Space Cooling:</b>	<i>High-efficiency ducted mini split heat pump</i>
<b>Heat Rejection:</b>	<i>N/A</i>
<b>Pumps &amp; Auxiliary:</b>	<i>N/A</i>
<b>Ventilation:</b>	<i>Central Energy Recovery system for common areas and unitary ERUs for residential units</i>
<b>Domestic Hot Water:</b>	<i>Electric resistance water heaters per residential units</i>
<b>Interior Lighting:</b>	<i>All LED and meets IECC 2021 requirements</i>
<b>Exterior Lighting:</b>	<i>LED and meets IECC 2021 requirements</i>
<b>Other Equipment:</b>	<i>All appliances will be Energy Star certified</i>

**Systems Commissioning Process:**

*The project team has engaged a Commissioning Team who will perform enhanced commissioning services, equivalent to LEED v4 Enhanced Commissioning, and consistent with Passive House verification procedures. The team will verify and document that all building systems and assemblies are planned, designed, installed, tested, and operated to meet the Green Commissioning requirements.*

## Building Energy Performance Measures

### Overview

Broadly describe the ways in which building energy performance has been integrated into the following aspects of the project’s planning, design, engineering, and commissioning. More detail on specific measures can be provided in appendices.

<b>Land Uses:</b>	<i>The site has been previously developed . The selected site will provide access to public transportation, bicycle network and facilities.</i>
<b>Building Orientation and Massing:</b>	<i>The building orientation is largely dictated by the site and surrounding buildings; however, it has been optimized to the extent possible to reduce heating and cooling loads.</i>
<b>Envelope Systems:</b>	<i>The building envelope is designed to Passive House standards and incorporates continuous insulation and a highly airtight system.</i>
<b>Mechanical Systems:</b>	<i>All-electric building incorporating high-efficiency heat pump for heating and cooling and Energy Recovery Units (ERUS) for ventilation.</i>
<b>Renewable Energy Systems:</b>	<i>Approximately 2,000-SF of roof area is reserved for on-site Solar PV array. Per preliminary calculations, this can accommodate a 33-kW DC systems, generating approximately 35,000 kWh per year.</i>
<b>District-Wide Energy Systems:</b>	<i>N/A</i>
<b>Other Systems:</b>	<i>N/A</i>

### Integrative Design Process

*Describe how different parties in the development process (owners, developers, architects, engineers, contractors, commissioning agents) have collaborated in the design.*

*Include the Basis of Design and*

*Owner's Project Requirements and describe how they have been informed by planning activities such as meetings or design charettes. Describe how continuing collaborative processes will inform Schematic/Design and Construction Documents.*

*The project team includes several Certified Passive House Consultants (CPHC), who will lead the sustainability efforts and initiatives throughout the design and construction process. Sustainable design and energy efficiency goals were established early and will be evaluated in each phase as the project develops. Strategies associated with the building envelope attributes, lighting design, thermal comfort ranges, plug and process loads, and operational parameters and their impact on the building energy performance were explored and discussed in an early-design WUFI model. An early design WUFI Passive model was developed and used as an interactive and dynamic platform to evaluate systems synergies and the various pathways for achieving the targeted heating and cooling load and demand and required performance improvements in the most cost-effective manner.*

### Green Building Incentive Program Assistance

*Describe any programs applicable to this project that would support improved energy performance or reduced greenhouse gas emissions, and which of those programs have been contacted and may be pursued. Programs may be offered by utility companies, government agencies, and other organizations, and might include rebates, grants, financing, technical assistance, and other incentives.*

*Project is registered with Mass Save Passive House Incentives program.*

**Net Zero Scenario Transition**

*Describe the technical framework by which the project can be transitioned to net zero greenhouse gas emissions prior to 2050, acknowledging that such a transition might not be economically feasible at first. This description should explain the future condition and the process of transitioning from the proposed design to the future condition.*

	<b>Net Zero Condition:</b>	<b>Transition Process:</b>
<b>Building Envelope:</b>	<i>The building envelop will be designed and constructed to Passive House standards. High-performance and air-tight envelope.</i>	<i>The project envelope design is already in compliance with Net Zero Carbon goals.</i>
<b>HVAC Systems:</b>	<i>The building HVAC system will be all-electric, utilizing high-efficiency Heat Pump systems.</i>	<i>The current design is Zero Carbon Ready.</i>
<b>Domestic Hot Water:</b>	<i>The domestic hot water system will be unitary electric resistance heaters. Low-flow plumbing fixtures will be used.</i>	<i>The project team will evaluate the heat pump water heaters.</i>
<b>Lighting:</b>	<i>All LED light fixtures will be used throughout the building.</i>	<i>The current design is Zero Carbon Ready.</i>
<b>Renewable Energy Systems:</b>	<i>Approximately 2,000 sf of roof area is available and approximately 33-kW PV array can be accommodated.</i>	<i>The current design is Zero Carbon ready.</i>
<b>Other Strategies:</b>	<i>N/A</i>	<i>N/A</i>

## Energy Systems Comparison

### Overview

*This section should describe the results of an analysis comparing the technical and financial feasibility to meet the projected HVAC and domestic hot water demands of the building using energy systems that do not consume carbon-based fuels on-site compared to code-compliant energy systems that consume carbon-based fuels on-site.*

*The project is all-electric and extremely efficient.*

### Assumptions

*Describe what building energy systems were included and excluded in your analysis and why.*

	Included in analysis?		Describe the systems for which this was analyzed or explain why it was not included in the analysis:
	Yes	No	
<b>Solar Photovoltaics:</b>	X		A 33-kW solar PV system was included in the analysis and Passive House compliance calculations.
<b>Solar Hot Water:</b>		X	
<b>Ground-Source Heat Pumps (Geothermal):</b>		X	Due to challenges with site-related logistics and feasibility, geothermal analysis will not be pursued.

<b>Water-Source Heat Pumps:</b>		X	Not ideal for Passive House project and this size building.
<b>Air-Source Heat Pumps:</b>	X		Basis of design
<b>Non-Carbon-Fuel District Energy:</b>		X	
<b>Other Non-Carbon-Fuel Systems:</b>		X	

**Non-Carbon-Fuel Scenario**

*Project is all-electric and doesn't use any fossil fuel.*

**Solar-Ready Roof Assessment**

The purpose of this assessment is to determine the technical feasibility of solar energy system installation, either as part of the proposed project or in the future. It is helpful to supplement this narrative with a plan depicting the information provided.

<b>Total Roof Area (sq. ft.):</b>	<i>9,825 sf</i>
<b>Unshaded Roof Area (sq. ft.):</b>	<i>9,825 sf</i>
<b>Structural Support:</b>	<i>Structure is sufficient for support</i>
<b>Electrical Infrastructure:</b>	<i>Inverter and other required infrastructure will be provided.</i>
<b>Other Roof Appurtenances:</b>	<i>A significant portion of the roof will be occupied by condensers</i>
<b>Solar-Ready Roof Area (sq. ft.):</b>	<i>Solar PV area = 2,000 Sf</i>
<b>Capacity of Solar Array:</b>	<i>84 panels; 33-kW</i>
<b>Financial Incentives:</b>	<i>TBD</i>
<b>Cost Feasibility:</b>	<i>TBD</i>

**Results**

Briefly summarize the results of the analysis and how it has informed the design of the project. Also include figures for the “Non-Carbon-Fuel Scenario” in the concluding Summary Table at the end of the Net Zero Narrative. Attachments can be provided with more specific figures and metrics regarding installation, maintenance, and upkeep costs (exclusive of operating fuel expenses), but a full report is not necessary.

	<i>Proposed Design</i>		<i>Non-Carbon-Fuel Scenario</i>	
	<i>Installation Cost</i>	<i>Maintenance Cost</i>	<i>Installation Cost</i>	<i>Maintenance Cost</i>
<b>Space Heating</b>				
<b>Space Cooling</b>				
<b>Heat Rejection</b>				
<b>Pumps &amp; Aux.</b>				
<b>Ventilation</b>				
<b>Domestic Hot Water</b>				
<b>(Financial Incentives)</b>				
<b>Total Building Energy System Cost</b>				

*Project is all-electric and doesn't use any fossil fuel.*

## Anticipated Energy Loads and Greenhouse Gas Emissions

### Assumptions

Describe the assumptions and methodology used to conduct preliminary energy modeling and set energy targets for the project. Specifically describe what components of the building were included and excluded.

*This project will meet all the requirements of Phius CORE 2024, which requires the design to comply with annual and peak heating and cooling load requirements, as well as limits on source energy usage and air infiltration. The building performance simulations were developed utilizing the provided drawings, mechanical equipment narratives, and the Phius 2024 Passive Building Standard Certified Guidebook v25.1.0. Two system scenarios were studied and both meet the Passive House requirements.*

(iCFA*: 59,500)				
Phius CORE 2024 Criteria	Limit	PTHP Only	PTHP + Mini-Split	Margin (%)
Heating Demand (kBtu/ft2yr)	5.3	3.75	3.76	29.1%
Cooling Demand (kBtu/ft2yr)	8.5	5.51	5.64	33.6%
Peak Heating Load (Btu/ft2hr)	4.9	4.12	4.12	15.9%
Peak Cooling Load (Btu/ft2hr)	3.3	3.02	3.05	7.6%
Source Energy (kWh/person.yr)	6950	6360	6434	7.4%
Site Energy (kBtu/ft2yr)	N/A	21.90	21.97	

\*iCFA = interior conditioned floor area, measured from the interior dimension of exterior walls.

*Note: WUFI Passive is an envelope compliance tool rather than an energy estimation tool. This report's predicted energy use intensity (pEUI) does not necessarily represent actual building energy performance. Phius uses default values for interior lighting and miscellaneous equipment and do not align with the ASHRAE energy modeling procedures.*

**Annual Projected Energy Consumption and Greenhouse Gas (GHG) Emissions**

**[Project Team Comment: Project is pursuing Passive House certification pathway for energy code compliance. There is no baseline to compare to. The basis of design is all-electric, utilizing high-performance systems and it is net zero carbon ready and therefore, no additional scenarios were studied.]**

*The preliminary energy modeling results should be shown in a concluding table format similar to what is shown on the next page. It should compare the “baseline building” (Massachusetts Stretch Energy Code) to the proposed design, as well as the “net zero” scenario projected by 2050 and described later in this narrative.*

	Baseline Building		Proposed Design		Future Net Zero Scenario		Non-Carbon-Fuel Scenario	
	kWh or Therms	% of Total	kWh or Therms	% of Total	kWh or Therms	% of Total	kWh or Therms	% of Total
Space Heating								
Space Cooling								
Heat Rejection								
Pumps & Aux.								
Ventilation								
Domestic Hot Water								
Interior Lighting								
Exterior Lighting								
Misc. Equipment								
	\$US, kBTU, kBTU/SF		\$US, kBTU, kBTU/SF	% Reduction from Baseline	\$US, kBTU, kBTU/SF	% Reduction from Baseline	\$US, kBTU, kBTU/SF	% Reduction from Baseline
Site EUI								
Source EUI								
Total Energy Use								
Total Energy Cost								
	kWh or Therms	% Total Energy	kWh or Therms	% Total Energy	kWh or Therms	% Total Energy	kWh or Therms	% Total Energy
On-Site Renewable Energy Generation								
Off-Site Renewable Energy Generation								
	Tons CO <sub>2</sub> [/SF]		Tons CO <sub>2</sub> [/SF]	% Reduction from Baseline				
GHG Emissions								
GHG Emissions per SF								

*It may be helpful to present this information in a chart or graph. The following page provides examples.*

## CITY OF CAMBRIDGE EMBODIED CARBON REPORTING TEMPLATE

**[City of Cambridge Zoning Ordinance Amendment to Section 22.25.1\(c\) of Article 22, entitled Sustainable Design and Development \(Ordinance No. 2022-20\), Section 7. Embodied Emissions:](#)**

“A whole building lifecycle analysis of the estimated emissions generated by the construction of the Green Building Project. The Assistant City Manager for Community Development shall promulgate regulations for how these estimated emissions are to be reported.

Such regulations shall include at minimum the required reporting of estimated lifecycle emissions generated by the use of major building materials, including but not limited to wood, concrete, steel, aluminum and glass, using embodied emissions modeling software and industry standards acceptable to CDD staff. This paragraph will become effective on the date of final promulgation of the regulations for Green Building Projects that have not yet completed the initial stage of administrative review by such date, and shall not impose a requirement on any building project that does not meet the standard threshold for project review special permit of 50,000 square feet or includes housing

**Applicability: For Projects after date of final promulgation of regulations (01/01/2024)**

Is this project subject to Green Building Requirements (Section 22.20)?	X Yes <input type="checkbox"/> No
Does this project meet the threshold for Project Review special permit (Section 19.23)?	X Yes <input type="checkbox"/> No
Is the gross floor area of this project 50,000 square feet or more?	X Yes <input type="checkbox"/> No
Does this project <u>exclude</u> dwelling units?	<input type="checkbox"/> Yes X No

Complete this reporting template if the answer is “Yes” to ALL of the above

## **Appendix**

**Affidavit**

**WUFI Passive Verification Report**

## Affidavit Form for Green Building Professional Special Permit/Development Review

Green Building

Project Location:

1740 MASSACHUSETTS AVE. CAMBRIDGE  
MA 02138

**Green Building Professional**

Name:

PETER QUINN

Architect

Engineer

License Number:

RA 7510

Company:

PETER QUINN ARCHITECTS

Address:

259 ELM ST # 301 SOMERVILLE MA 02144

Contact Information

Email Address:

PQUINN@PQARCH.COM

Telephone Number:

617 354 3989

I, PETER S. QUINN, as the Green Building Professional for this Green Building Project, have reviewed all relevant documents for this project and confirm to the best of my knowledge that those documents indicate that the project is being designed to achieve the requirements of Section 22.24 under Article 22.20 of the Cambridge Zoning Ordinance.



(Signature)

3/9/26  
(Date)

Attach either:

- Credential from the applicable Green Building Rating Program indicating advanced knowledge and experience in environmentally sustainable development in general as well as the applicable Green Building Rating System for this Green Building Project.
- If the Green Building Rating Program does not offer such a credential, evidence of experience as a project architect or engineer, or as a consultant providing third-party review, on at least three (3) projects that have been certified using the applicable Green Building Rating Program.





phius  
certified  
consultant

**Robert Donohue**

has fulfilled the requirements for becoming a

# Phius Certified Consultant: CPHC®

This certificate hereby attests that the above-named Consultant has completed training provided by Phius (Passive House Institute US) relating to construction of buildings that can meet the criteria of the Phius standards for all climate zones and has passed Phius' examination.

Buildings designed, modeled and constructed to meet the Phius standards are ultra-efficient and characterized by superior indoor air quality, thermal comfort, resilience and durability.

**116003**

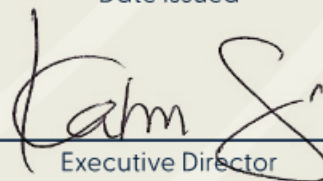
Phius ID

**Aug 7, 2023**

Date Issued

**Aug 7, 2026**

Valid Through



Executive Director

## BUILDING INFORMATION

Category:	<b>Residential</b>
Status:	<b>In planning</b>
Building type:	<b>New construction</b>
Year of construction:	
Units:	<b>71</b>
Number of occupants:	<b>121 (Design)</b>
Occupant density:	<b>495.6 ft<sup>2</sup>/Person</b>

### Boundary conditions

Climate:	<b>BOSTON LOGAN INT ARPT MA</b>
Internal heat gains:	<b>1.6 Btu/hr ft<sup>2</sup></b>
Interior temperature:	<b>68 °F</b>
Overheat temperature:	<b>77 °F</b>

### Building geometry

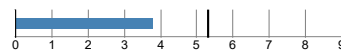
Enclosed volume:	<b>718,845.3 ft<sup>3</sup></b>
Net-volume:	<b>546,322.4 ft<sup>3</sup></b>
Total area envelope:	<b>49,986.2 ft<sup>2</sup></b>
Area/Volume Ratio:	<b>0.1 1/ft</b>
Floor area:	<b>59,962 ft<sup>2</sup></b>
Envelope area/iCFA:	<b>0.834</b>

## PASSIVEHOUSE REQUIREMENTS

**Certificate criteria:** Phius CORE 2021

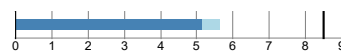
### Heating demand

specific:	<b>3.76 kBtu/ft<sup>2</sup>yr</b>
target:	<b>5.3 kBtu/ft<sup>2</sup>yr</b>
total:	<b>225,536.28 kBtu/yr</b>



### Cooling demand

sensible:	<b>5.18 kBtu/ft<sup>2</sup>yr</b>
latent:	<b>0.46 kBtu/ft<sup>2</sup>yr</b>
specific:	<b>5.64 kBtu/ft<sup>2</sup>yr</b>
target:	<b>8.5 kBtu/ft<sup>2</sup>yr</b>
total:	<b>338,126.25 kBtu/yr</b>



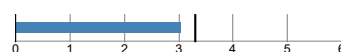
### Heating load

specific:	<b>4.12 Btu/hr ft<sup>2</sup></b>
target:	<b>4.9 Btu/hr ft<sup>2</sup></b>
total:	<b>247,169.61 Btu/hr</b>



### Cooling load

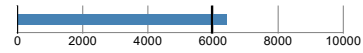
specific:	<b>3.05 Btu/hr ft<sup>2</sup></b>
target:	<b>3.3 Btu/hr ft<sup>2</sup></b>
total:	<b>182,918.03 Btu/hr</b>



Note that the latest version of the software has not been updated and still calculates Phius CORE 2021 source energy targets. While the software indicates a source energy target of 6,000 kWh/Person.yr, the target for this project is 6,950 kWh/Person.yr to meet Phius CORE 2024 compliance

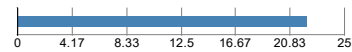
## Source energy

total: **778,522.61** kWh/yr  
 specific: **6,434** kWh/Person yr  
 target: **5,975** kWh/Person yr  
 total: **2,656,167.2** kBtu/yr  
 specific: **44.3** kBtu/ft<sup>2</sup>yr



## Site energy

total: **1,328,083.6** kBtu/yr  
 specific: **22.15** kBtu/ft<sup>2</sup>yr  
 total: **389,261.3** kWh/yr  
 specific: **6.49** kWh/ft<sup>2</sup>



## Air tightness

ACH50: **0.55** 1/hr  
 CFM50 per envelope area: **0.08** cfm/ft<sup>2</sup>  
 target: **0.41** 1/hr  
 target CFM50: **0.06** cfm/ft<sup>2</sup>



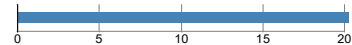
Note that 0.08 CFM/ft<sup>2</sup> @ 50 Pascals (Pa) has been captured in the WUFI Passive model for this feasibility study, as onsite verification may identify sources of allowable adjustments to the maximum infiltration rate in line with Phius requirements. This allows the project to ensure that compliance with the standard is not impacted by this adjustment.

## PASSIVEHOUSE RECOMMENDATIONS

Sensible recovery efficiency: **78.2** %



Frequency of overheating: **48.1** %  
 Cooling system is required

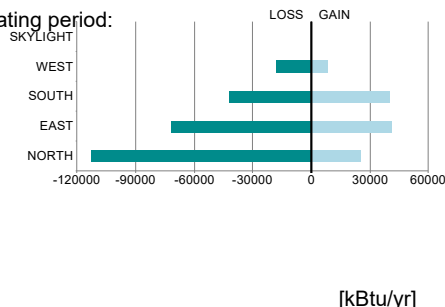


Frequency of overheating only applies if there is not a [properly sized] cooling system installed.

## BUILDING ELEMENTS

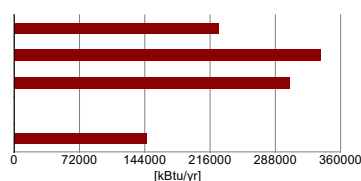
### Windows

Heat gain/loss heating period:	
Average SHGC:	<b>0.19</b>
Average solar reduction factor heating:	<b>0.58</b>
Average solar reduction factor cooling:	<b>0.53</b>
Average U-value:	<b>0.182 Btu/hr ft<sup>2</sup> °F</b>
Total glazing area:	<b>7,161.6 ft<sup>2</sup></b>
Total window area:	<b>9,513.6 ft<sup>2</sup></b>



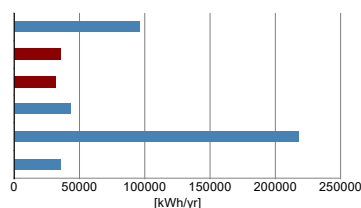
### HVAC

Total heating demand:	<b>225,536 kBtu/yr</b>
Total cooling demand:	<b>338,126 kBtu/yr</b>
Total DHW energy demand:	<b>303,614 kBtu/yr</b>
Solar DHW contribution:	<b>0 kBtu/yr</b>
Auxiliary electricity:	<b>146,267 kBtu/yr</b>



### Electricity

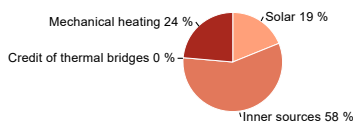
Direct heating / DHW:	<b>96,073 kWh/yr</b>
Heatpump heating:	<b>35,373 kWh/yr</b>
Cooling:	<b>31,487 kWh/yr</b>
HVAC auxiliary energy:	<b>42,871 kWh/yr</b>
Appliances:	<b>218,458 kWh/yr</b>
Renewable generation, coincident production and use:	<b>35,000 kWh/yr</b>
Total electricity demand:	<b>389,261 kWh/yr</b>



## HEAT FLOW - HEATING PERIOD

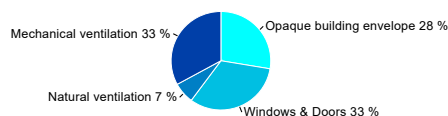
### Heat gains

Solar:	<b>150,738 kBtu/yr</b>
Inner sources:	<b>460,153 kBtu/yr</b>
Credit of thermal bridges:	<b>0 kBtu/yr</b>
Mechanical heating:	<b>225,536 kBtu/yr</b>



### Heat losses

Opaque building envelope:	<b>231,050 kBtu/yr</b>
Windows & Doors:	<b>272,006 kBtu/yr</b>
Natural ventilation:	<b>57,719 kBtu/yr</b>
Mechanical ventilation:	<b>275,652 kBtu/yr</b>

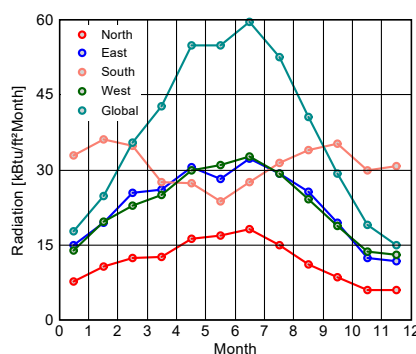
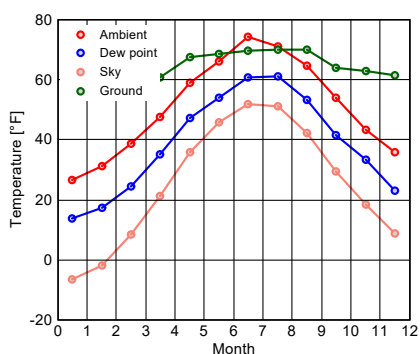


## CLIMATE

Latitude: **42.4 °**  
 Longitude: **-71 °**  
 Elevation of weather station: **19.7 ft**  
 Elevation of building site: **26 ft**  
 Heat capacity air: **0.018 Btu/ft³F**  
 Daily temperature swing summer: **14.8 °F**  
 Average wind speed: **13.1 ft/s**

### Ground

Average ground surface temperature: **52.8 °F**  
 Amplitude ground surface temperature: **55.8 °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 **243 days/yr**  
 Heating degree hours **141.3 kFh/a**  
 Phase shift months **1.1 mths**  
 Time constant heating demand **107.4 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]	16.9	31.6	83.5
Solar radiation North [Btu/hr ft²]	12	7.9	27.6
Solar radiation East [Btu/hr ft²]	22.8	13.3	61.5
Solar radiation South [Btu/hr ft²]	49.5	27.3	41.8
Solar radiation West [Btu/hr ft²]	22.2	11.4	53.3
Solar radiation Global [Btu/hr ft²]	26.9	16.5	101.4

Relevant boundary conditions for heating load calculation: Heating load 1

## ANNUAL HEAT DEMAND

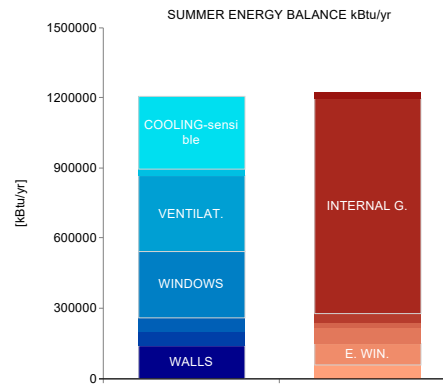
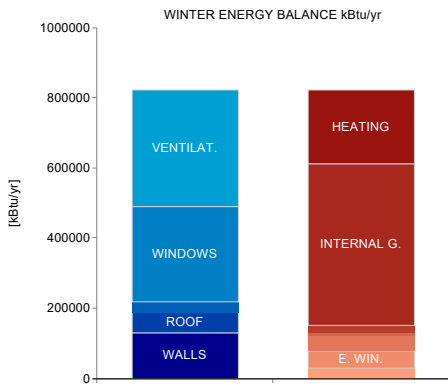
Transmission losses :	<b>503,056</b> kBtu/yr
Ventilation losses:	<b>333,371</b> kBtu/yr
Total heat losses:	<b>836,427</b> kBtu/yr
Solar heat gains:	<b>180,109</b> kBtu/yr
Internal heat gains:	<b>549,813</b> kBtu/yr
Total heat gains:	<b>729,922</b> kBtu/yr
Utilization factor:	<b>83.7</b> %
Useful heat gains:	<b>610,891</b> kBtu/yr

Annual heat demand:	<b>225,536</b> kBtu/yr
Specific annual heat demand:	<b>3,761.7</b> Btu/ft <sup>2</sup> yr

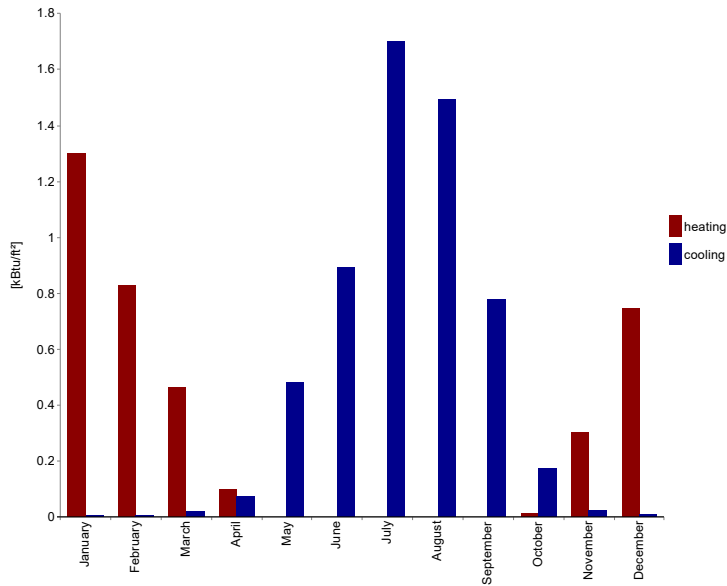
## ANNUAL COOLING DEMAND

Solar heat gains:	<b>276,150</b> kBtu/yr
Internal heat gains:	<b>917,891</b> kBtu/yr
Total heat gains:	<b>1,194,041</b> kBtu/yr
Transmission losses :	<b>822,719</b> kBtu/yr
Ventilation losses:	<b>484,112</b> kBtu/yr
Total heat losses:	<b>1,306,831</b> kBtu/yr
Utilization factor:	<b>67.6</b> %
Useful heat losses:	<b>883,596</b> kBtu/yr

Cooling demand - sensible:	<b>310,445</b> kBtu/yr
Cooling demand - latent:	<b>27,681</b> kBtu/yr
Annual cooling demand:	<b>338,126</b> kBtu/yr
Specific annual cooling demand:	<b>5.6</b> kBtu/ft <sup>2</sup> yr



## SPECIFIC HEAT/COOLING DEMAND MONTHLY



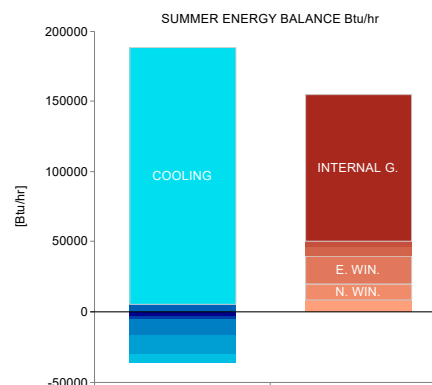
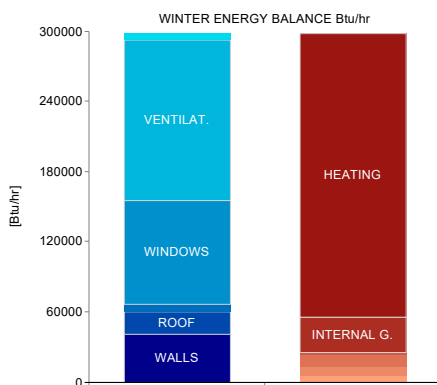
Month	Heating [kBtu/ft²]	Cooling [kBtu/ft²]
January	1.3	0
February	0.8	0
March	0.5	0
April	0.1	0.1
May	0	0.5
June	0	0.9
July	0	1.7
August	0	1.5
September	0	0.8
October	0	0.2
November	0.3	0
December	0.7	0

## HEATING LOAD

	First climate	Second climate
Transmission heat losses:	<b>165,522.8</b> Btu/hr	<b>121,794.2</b> Btu/hr
Ventilation heat losses:	<b>137,394.1</b> Btu/hr	<b>97,740.1</b> Btu/hr
Total heat loss:	<b>302,916.9</b> Btu/hr	<b>219,534.2</b> Btu/hr
Solar heat gain:	<b>25,334.7</b> Btu/hr	<b>14,586</b> Btu/hr
Internal heat gain:	<b>30,412.6</b> Btu/hr	<b>30,412.6</b> Btu/hr
Total heat gains heating:	<b>55,747.2</b> Btu/hr	<b>44,998.6</b> Btu/hr
Heating load:	<b>247,169.6</b> Btu/hr	<b>174,535.7</b> Btu/hr
Relevant heating load:	<b>247,169.6</b> Btu/hr	
Specific heating load:	<b>4.1</b> Btu/hr ft <sup>2</sup>	

## COOLING LOAD

Solar heat gain:	<b>50,183.6</b> Btu/hr
Internal heat gain:	<b>104,792.4</b> Btu/hr
Total heat gains cooling:	<b>154,976</b> Btu/hr
Transmission heat losses:	<b>-14,166.4</b> Btu/hr
Ventilation heat losses:	<b>-13,775.6</b> Btu/hr
Total heat loss:	<b>-27,942</b> Btu/hr
Cooling load - sensible:	<b>182,918</b> Btu/hr
Cooling load - latent:	<b>0</b> Btu/hr
Relevant cooling load:	<b>182,918</b> Btu/hr
Specific maximum cooling load:	<b>3.1</b> Btu/hr ft <sup>2</sup>



## 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: WALLS - FIRST FLOOR: West (A272.4°, 81 ft², width 4.5 ft)	81	0.044	0.4	0.9	100	557.5	854.3
VC.1: WALLS - FIRST FLOOR: South (A182.4°, 158.05 ft², width 8.781 ft)	158	0.044	0.4	0.9	100	1087.9	1666.9
VC.1: WALLS - FIRST FLOOR: West (A268.7°, 419.25 ft², width 30.25 ft)	419.2	0.044	0.4	0.9	100	2885.8	4421.6
VC.1: WALLS - FIRST FLOOR: South (A182.4°, 415.5 ft², width 32.5 ft)	415.5	0.044	0.4	0.9	100	2860	4382
VC.1: WALLS - FIRST FLOOR: NE (A46.6°, 43.53 ft², width 6.052 ft)	43.5	0.044	0.4	0.9	100	299.6	459.1
VC.1: WALLS - FIRST FLOOR: East (A94.5°, 51.31 ft², width 7.62 ft)	51.3	0.044	0.4	0.9	100	353.2	541.1
VC.1: WALLS - FIRST FLOOR: South (A182.4°, 67.5 ft², width 4.5 ft)	67.5	0.044	0.4	0.9	100	464.6	711.9
VC.1: WALLS - FIRST FLOOR: East (A94.5°, 37.3 ft², width 4.67 ft)	37.3	0.044	0.4	0.9	100	256.7	393.4
VC.1: WALLS - FIRST FLOOR: North (A345.5°, 191.05 ft², width 14.337 ft)	191.1	0.044	0.4	0.9	100	1315.1	2014.9
VC.1: WALLS - FIRST FLOOR: West (A254°, 30 ft², width 2 ft)	30	0.044	0.4	0.9	100	206.5	316.4
VC.1: WALLS - FIRST FLOOR: North (A345.5°, 219.12 ft², width 39.938 ft)	219.1	0.044	0.4	0.9	100	1508.2	2310.9
VC.2: WALLS - UPPER FLOORS: West (A268.7°, 2498.73 ft², width 64.054 ft)	2498.7	0.033	0.4	0.9	100	12887.7	19746.3
VC.2: WALLS - UPPER FLOORS: West (A255.5°, 575.71 ft², width 17.829 ft)	575.7	0.033	0.4	0.9	100	2969.3	4549.5
VC.2: WALLS - UPPER FLOORS: North (A345.5°, 494.99 ft², width 22.167 ft)	495	0.033	0.4	0.9	100	2553	3911.6
VC.2: WALLS - UPPER FLOORS: South (A184.5°, 103.53 ft², width 3 ft)	103.5	0.033	0.4	0.9	100	534	818.2
VC.2: WALLS - UPPER FLOORS: East (A94.5°, 964.32 ft², width 46.198 ft)	964.3	0.033	0.4	0.9	100	4973.7	7620.6
VC.2: WALLS - UPPER FLOORS: North (A4.5°, 103.53 ft², width 3 ft)	103.5	0.033	0.4	0.9	100	534	818.2
VC.2: WALLS - UPPER FLOORS: South (A182.4°, 606.61 ft², width 25.264 ft)	606.6	0.033	0.4	0.9	100	3128.7	4793.7
VC.2: WALLS - UPPER FLOORS: North (A345.5°, 165.26 ft², width 23.453 ft)	165.3	0.033	0.4	0.9	100	852.4	1306
VC.2: WALLS - UPPER FLOORS: West (A255.5°, 103.53 ft², width 3 ft)	103.5	0.033	0.4	0.9	100	534	818.2
VC.2: WALLS - UPPER FLOORS: East (A75.5°, 103.53 ft², width 3 ft)	103.5	0.033	0.4	0.9	100	534	818.2
VC.2: WALLS - UPPER FLOORS: North (A345.5°, 131.84 ft², width 18.469 ft)	131.8	0.033	0.4	0.9	100	680	1041.8
VC.2: WALLS - UPPER FLOORS: West (A272.4°, 127.83 ft², width 15.529 ft)	127.8	0.033	0.4	0.9	100	659.3	1010.1
VC.2: WALLS - UPPER FLOORS: North (A2.4°, 52.75 ft², width 5 ft)	52.7	0.033	0.4	0.9	100	272.1	416.8
VC.2: WALLS - UPPER FLOORS: East (A94.5°, 352.4 ft², width 24.048 ft)	352.4	0.033	0.4	0.9	100	1817.6	2784.8
VC.2: WALLS - UPPER FLOORS: North (A3.7°, 72.04 ft², width 3 ft)	72	0.033	0.4	0.9	100	371.6	569.3
VC.2: WALLS - UPPER FLOORS: East (A94.5°, 2051.67 ft², width 108.94 ft)	2051.7	0.033	0.4	0.9	100	10581.9	16213.4
VC.2: WALLS - UPPER FLOORS: North (A345.5°, 2178.53 ft², width 108.523 ft)	2178.5	0.033	0.4	0.9	100	11236.2	17215.9
VC.2: WALLS - UPPER FLOORS: West (A272.4°, 94.55 ft², width 4.5 ft)	94.5	0.033	0.4	0.9	100	487.7	747.2
VC.2: WALLS - UPPER FLOORS: North (A2.4°, 90.69 ft², width 28 ft)	90.7	0.033	0.4	0.9	100	467.7	716.7
VC.2: WALLS - UPPER FLOORS: West (A272.4°, 74 ft², width 9.25 ft)	74	0.033	0.4	0.9	100	381.7	584.8
VC.2: WALLS - UPPER FLOORS: North (A0°, 14 ft², width 1.75 ft)	14	0.033	0.4	0.9	100	72.2	110.6
VC.2: WALLS - UPPER FLOORS: West (A270°, 100 ft², width 12.5 ft)	100	0.033	0.4	0.9	100	515.8	790.3
VC.2: WALLS - UPPER FLOORS: South (A180°, 14 ft², width 1.75 ft)	14	0.033	0.4	0.9	100	72.2	110.6
VC.2: WALLS - UPPER FLOORS: West (A270°, 28.5 ft², width 6 ft)	28.5	0.033	0.4	0.9	100	147	225.2
VC.2: WALLS - UPPER FLOORS: South (A180°, 218.08 ft², width 27.259 ft)	218.1	0.033	0.4	0.9	100	1124.8	1723.3
VC.2: WALLS - UPPER FLOORS: East (A92.4°, 152.12 ft², width 26.609 ft)	152.1	0.033	0.4	0.9	100	784.6	1202.1
VC.2: WALLS - UPPER FLOORS: West (A272.4°, 54.44 ft², width 5.2 ft)	54.4	0.033	0.4	0.9	100	280.8	430.2
VC.2: WALLS - UPPER FLOORS: North (A345.5°, 18 ft², width 6 ft)	18	0.033	0.4	0.9	100	92.8	142.3
VC.2: WALLS - UPPER FLOORS: North (A345.5°, 18 ft², width 6 ft)	18	0.033	0.4	0.9	100	92.8	142.3
VC.2: WALLS - UPPER FLOORS: North (A345.5°, 18 ft², width 6 ft)	18	0.033	0.4	0.9	100	92.8	142.3
VC.2: WALLS - UPPER FLOORS: North (A345.5°, 18 ft², width 6 ft)	18	0.033	0.4	0.9	100	92.8	142.3
VC.2: WALLS - UPPER FLOORS: North (A345.5°, 31.5 ft², width 10.5 ft)	31.5	0.033	0.4	0.9	100	162.5	248.9
VC.2: WALLS - UPPER FLOORS: North (A345.5°, 31.5 ft², width 10.5 ft)	31.5	0.033	0.4	0.9	100	162.5	248.9
VC.2: WALLS - UPPER FLOORS: North (A345.5°, 31.5 ft², width 10.5 ft)	31.5	0.033	0.4	0.9	100	162.5	248.9
VC.2: WALLS - UPPER FLOORS: North (A345.5°, 31.5 ft², width 10.499 ft)	31.5	0.033	0.4	0.9	100	162.4	248.9
VC.2: WALLS - UPPER FLOORS: North (A345.5°, 114 ft², width 4.001 ft)	114	0.033	0.4	0.9	100	588	900.9
VC.2: WALLS - UPPER FLOORS: North (A345.5°, 114 ft², width 4.001 ft)	114	0.033	0.4	0.9	100	588	900.9
VC.2: WALLS - UPPER FLOORS: North (A345.5°, 114 ft², width 4.001 ft)	114	0.033	0.4	0.9	100	588	900.9
VC.2: WALLS - UPPER FLOORS: South (A182.4°, 3862.41 ft², width 114.671 ft)	3862.4	0.033	0.4	0.9	100	19921.1	30522.8

Transmission heat losses - areas (continue)

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.2: WALLS - UPPER FLOORS: North (A345.5°, 143.76 ft², width 50.5 ft)	143.8	0.033	0.4	0.9	100	741.5	1136.1
VC.2: WALLS - UPPER FLOORS: North (A345.5°, 86.65 ft², width 2.752 ft)	86.6	0.033	0.4	0.9	100	446.9	684.7
VC.2: WALLS - UPPER FLOORS: North (A345.5°, 143.25 ft², width 50.498 ft)	143.2	0.033	0.4	0.9	100	738.8	1132
VC.2: WALLS - UPPER FLOORS: North (A345.5°, 86.59 ft², width 2.749 ft)	86.6	0.033	0.4	0.9	100	446.6	684.3
VC.4: WALLS - BELOW GRADE: West (A254°, 20 ft², width 2 ft)	20	0.11	0	0	0	84	238
VC.4: WALLS - BELOW GRADE: North (A345.5°, 328.33 ft², width 32.833 ft)	328.3	0.11	0	0	0	1379.3	3906.8
VC.4: WALLS - BELOW GRADE: West (A272.4°, 52 ft², width 5.2 ft)	52	0.11	0	0	0	218.5	618.8
VC.4: WALLS - BELOW GRADE: North (A345.5°, 399.38 ft², width 39.938 ft)	399.4	0.11	0	0	0	1677.8	4752.2
VC.4: WALLS - BELOW GRADE: West (A268.7°, 620 ft², width 62 ft)	620	0.11	0	0	0	2604.6	7377.3
VC.4: WALLS - BELOW GRADE: South (A182.4°, 414.52 ft², width 41.452 ft)	414.5	0.11	0	0	0	1741.4	4932.2
VC.4: WALLS - BELOW GRADE: East (A94.5°, 312.73 ft², width 31.273 ft)	312.7	0.11	0	0	0	1313.8	3721.1
VC.5: WALLS - INTERIOR (COMMERCIAL): North (A2.4°, 626.75 ft², width 27.77 ft)	626.8	0.088	0	0	0	0	0
VC.5: WALLS - INTERIOR (COMMERCIAL): South (A182.4°, 143.85 ft², width 5.754 ft)	143.9	0.088	0	0	0	0	0
VC.5: WALLS - INTERIOR (COMMERCIAL): West (A274.5°, 141.77 ft², width 5.671 ft)	141.8	0.088	0	0	0	0	0
VC.5: WALLS - INTERIOR (COMMERCIAL): West (A274.5°, 418.64 ft², width 25.602 ft)	418.6	0.088	0	0	0	0	0
VC.5: WALLS - INTERIOR (COMMERCIAL): South (A182.4°, 220.16 ft², width 22.016 ft)	220.2	0.088	0	0	0	0	0
VC.5: WALLS - INTERIOR (COMMERCIAL): South (A182.4°, 262.74 ft², width 17.516 ft)	262.7	0.088	0	0	0	0	0
VC.5: WALLS - INTERIOR (COMMERCIAL): South (A182.4°, 216.82 ft², width 8.673 ft)	216.8	0.088	0	0	0	0	0
VC.5: WALLS - INTERIOR (COMMERCIAL): East (A94.5°, 262.69 ft², width 10.508 ft)	262.7	0.088	0	0	0	0	0
VC.5: WALLS - INTERIOR (COMMERCIAL): South (A182.4°, 662.98 ft², width 26.519 ft)	663	0.088	0	0	0	0	0
VC.5: WALLS - INTERIOR (COMMERCIAL): East (A94.5°, 458.66 ft², width 18.347 ft)	458.7	0.088	0	0	0	0	0
VC.5: WALLS - INTERIOR (COMMERCIAL): East (A94.5°, 112.58 ft², width 4.503 ft)	112.6	0.088	0	0	0	0	0
VC.5: WALLS - INTERIOR (COMMERCIAL): North (A2.4°, 100.6 ft², width 4.024 ft)	100.6	0.088	0	0	0	0	0
VC.5: WALLS - INTERIOR (COMMERCIAL): North (A2.4°, 143.75 ft², width 5.75 ft)	143.7	0.088	0	0	0	0	0
VC.5: WALLS - INTERIOR (COMMERCIAL): North (A2.4°, 100.07 ft², width 4.003 ft)	100.1	0.088	0	0	0	0	0
VC.5: WALLS - INTERIOR (COMMERCIAL): East (A94.5°, 650.22 ft², width 27.27 ft)	650.2	0.088	0	0	0	0	0
VC.5: WALLS - INTERIOR (COMMERCIAL): South (A182.4°, 152.36 ft², width 50.787 ft)	152.4	0.088	0	0	0	0	0
VC.5: WALLS - INTERIOR (COMMERCIAL): East (A92.4°, 851.26 ft², width 34.05 ft)	851.3	0.088	0	0	0	0	0
VC.6: WALLS - INTERIOR (LOADING DOCK): West (A255.5°, 78.83 ft², width 5.256 ft)	78.8	0.084	0	0	0	981.2	1503.3
VC.6: WALLS - INTERIOR (LOADING DOCK): West (A270°, 162.5 ft², width 10.833 ft)	162.5	0.084	0	0	0	2022.4	3098.8
VC.6: WALLS - INTERIOR (LOADING DOCK): North (A0°, 22.5 ft², width 1.5 ft)	22.5	0.084	0	0	0	280	429.1
VC.6: WALLS - INTERIOR (LOADING DOCK): West (A270°, 86.25 ft², width 5.75 ft)	86.3	0.084	0	0	0	1073.5	1644.7
VC.6: WALLS - INTERIOR (LOADING DOCK): North (A2.4°, 255 ft², width 17 ft)	255	0.084	0	0	0	3173.7	4862.7
VC.7: WALLS - INTERIOR (TRASH ROOM): West (A270°, 97.5 ft², width 6.5 ft)	97.5	0.088	0.4	0.9	100	1337.5	2049.3
VC.7: WALLS - INTERIOR (TRASH ROOM): South (A180°, 308.75 ft², width 20.583 ft)	308.8	0.088	0.4	0.9	100	4235.5	6489.5
VC.7: WALLS - INTERIOR (TRASH ROOM): West (A270°, 107.5 ft², width 7.167 ft)	107.5	0.088	0.4	0.9	100	1474.7	2259.5
VC.7: WALLS - INTERIOR (TRASH ROOM): South (A180°, 66.25 ft², width 4.417 ft)	66.3	0.088	0.4	0.9	100	908.8	1392.5
VC.7: WALLS - INTERIOR (TRASH ROOM): North (A0°, 70 ft², width 4.667 ft)	70	0.088	0.4	0.9	100	960.3	1471.3
VC.7: WALLS - INTERIOR (TRASH ROOM): North (A0°, 305 ft², width 20.333 ft)	305	0.088	0.4	0.9	100	4184	6410.7
VC.7: WALLS - INTERIOR (TRASH ROOM): West (A270°, 154.6 ft², width 10.306 ft)	154.6	0.088	0.4	0.9	100	2120.8	3249.4
VC.7: WALLS - INTERIOR (TRASH ROOM): East (A90°, 128.35 ft², width 8.556 ft)	128.3	0.088	0.4	0.9	100	1760.7	2697.7
VC.8: WALLS - INTERIOR (TRASH CHUTE): East (A90°, 277.81 ft², width 5 ft)	277.8	0.088	0	0	0	0	0
VC.8: WALLS - INTERIOR (TRASH CHUTE): North (A0°, 111.13 ft², width 2 ft)	111.1	0.088	0	0	0	0	0
VC.8: WALLS - INTERIOR (TRASH CHUTE): West (A270°, 277.81 ft², width 5 ft)	277.8	0.088	0	0	0	0	0
VC.8: WALLS - INTERIOR (TRASH CHUTE): South (A180°, 111.13 ft², width 2 ft)	111.1	0.088	0	0	0	0	0
VC.9: ROOF - MAIN: Horizontal (776.05 ft², width 30.108 ft)	776	0.032	0.4	0.9	100	3826.3	5862.6
VC.9: ROOF - MAIN: Horizontal (34.54 ft², width 4.932 ft)	34.5	0.032	0.4	0.9	100	170.3	261
VC.9: ROOF - MAIN: Horizontal (30.49 ft², width 4.866 ft)	30.5	0.032	0.4	0.9	100	150.3	230.3
VC.9: ROOF - MAIN: Horizontal (6208.56 ft², width 106.494 ft)	6208.6	0.032	0.4	0.9	100	30611.3	46902
VC.10: ROOF - GREEN: Horizontal (3260.64 ft², width 105.068 ft)	3260.6	0.032	0.4	0.9	100	16076.6	24632.2

### Transmission heat losses - areas (continue)

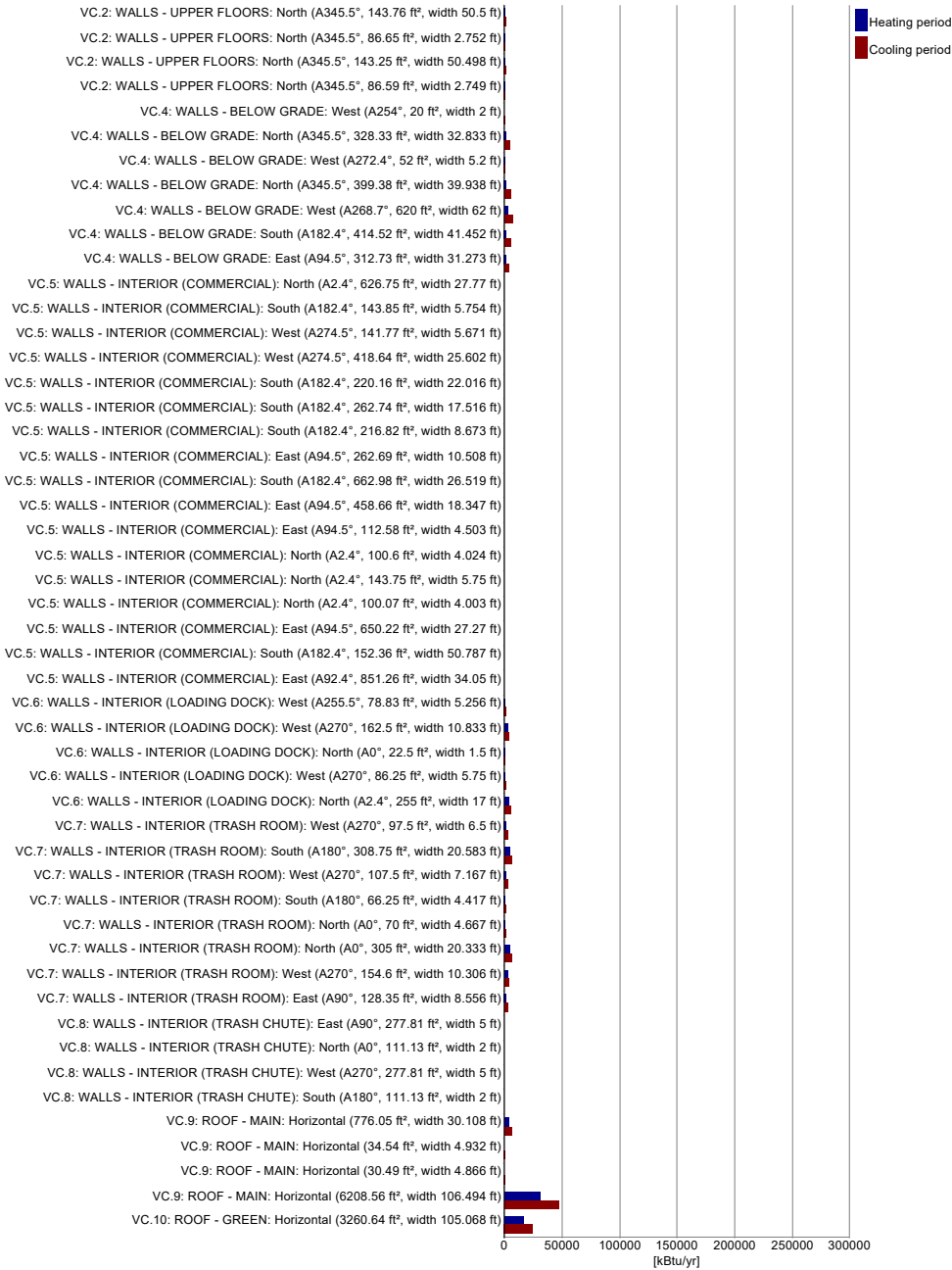
Name	Area [ft²]	Average U-value [Btu/hr ft² °F]	Absorption coefficient	Emission coefficient	Reduction factor shading [%]	Transmission losses heating [kBtu/yr]	Transmission losses cooling [kBtu/yr]
VC.11: ROOF - OVERHANGS: Horizontal (172.81 ft², width 27.147 ft)	172.8	0.052	0.4	0.9	100	1414.8	2167.7
VC.11: ROOF - OVERHANGS: Horizontal (138.59 ft², width 6.649 ft)	138.6	0.052	0.4	0.9	100	1134.7	1738.5
VC.11: ROOF - OVERHANGS: Horizontal (125.45 ft², width 22.833 ft)	125.5	0.052	0.4	0.9	100	1027.1	1573.7
VC.11: ROOF - OVERHANGS: Horizontal (151.5 ft², width 49.643 ft)	151.5	0.052	0.4	0.9	100	1240.3	1900.4
VC.11: ROOF - OVERHANGS: Horizontal (200.26 ft², width 23.954 ft)	200.3	0.052	0.4	0.9	100	1639.5	2512.1
VC.11: ROOF - OVERHANGS: Horizontal (39.9 ft², width 9.13 ft)	39.9	0.052	0.4	0.9	100	326.6	500.5
VC.12: FLOOR - EXPOSED: Horizontal (105.79 ft², width 8.107 ft)	105.8	0.032	0.4	0.9	100	523.1	801.5
VC.12: FLOOR - EXPOSED: Horizontal (34.54 ft², width 4.932 ft)	34.5	0.032	0.4	0.9	100	170.8	261.7
VC.12: FLOOR - EXPOSED: Horizontal (203.24 ft², width 10.695 ft)	203.2	0.032	0.4	0.9	100	1004.9	1539.7
VC.12: FLOOR - EXPOSED: Horizontal (124.88 ft², width 15.689 ft)	124.9	0.032	0.4	0.9	100	617.5	946.1
VC.12: FLOOR - EXPOSED: Horizontal (590.76 ft², width 93.442 ft)	590.8	0.032	0.4	0.9	100	2921.1	4475.6
VC.13: FLOOR - INTERIOR (COMMERCIAL): Horizontal (290.19 ft², width 22.385 ft)	290.2	0.089	0	0	0	0	0
VC.14: FLOOR - INTERIOR (COMMERCIAL): Horizontal (4984.66 ft², width 80.493 ft)	4984.7	0.086	0	0	0	0	0
VC.14: FLOOR - INTERIOR (COMMERCIAL): Horizontal (10 ft², width 25 ft)	10	0.086	0	0	0	0	0
VC.15: FLOOR - INTERIOR (LOADING DOCK): Horizontal (618.08 ft², width 19.223 ft)	618.1	0.081	0	0	0	7398.3	11335.5
VC.16: FLOOR - INTERIOR (TRASH ROOM): Horizontal (509.58 ft², width 25 ft)	509.6	0.086	0	0	0	0	0
VC.17: SLAB - MAIN: Horizontal (39.9 ft², width 9.13 ft)	39.9	0.147	0	0	0	223.6	633.3
VC.17: SLAB - MAIN: Horizontal (720.6 ft², width 28.195 ft)	720.6	0.147	0	0	0	4038.3	11437.9
VC.17: SLAB - MAIN: Horizontal (4759.5 ft², width 82.108 ft)	4759.5	0.147	0	0	0	26672.5	75545.8
VC.24: DOOR - OPAQUE: West (A270°, 19.5 ft², width 3 ft)	19.5	0.168	0.4	0.9	100	511	782.9
VC.24: DOOR - OPAQUE: West (A272.4°, 23.56 ft², width 3.25 ft)	23.6	0.168	0.4	0.9	100	617.4	946

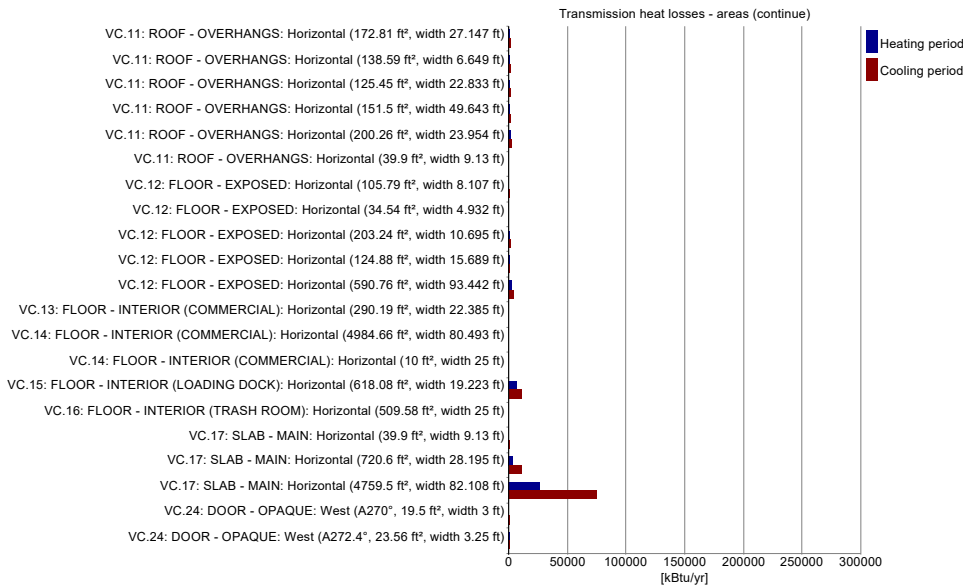
### Degree hours [kFh/a]

	Heating	Cooling
Ambient heating	86.8	133.1
Ground heating	21.2	60



Transmission heat losses - areas (continue)





## THERMAL BRIDGES

### Transmission heat losses - thermal bridges

Name	Length [ft]	Psi-value [Btu/hr ft °F]	Transmission losses [kBtu/yr]	Transmission losses cooling [kBtu/yr]



Transmission heat losses - windows (continue)

Name	Quantity	Inclination [°]	U-value total [Btu/hr ft² °F]	SHGC (perpendicular)	Reduction factor shading [%]	Reduction factor shading summer [%]	Solar gain heating [kBtu/yr]	Solar gain cooling [kBtu/yr]	Transmission losses heating [kBtu/yr]	Transmission losses cooling [kBtu/yr]
VC.3: WALLS - SPANDREL: North (A345.5°, 4.5 ft², width 3 ft)	1	90	0.188	0	NaN	NaN	0	0	132.5	203.1
VC.3: WALLS - SPANDREL: North (A345.5°, 4.5 ft², width 3 ft)	1	90	0.188	0	NaN	NaN	0	0	132.5	203.1
VC.3: WALLS - SPANDREL: North (A345.5°, 9 ft², width 6 ft)	1	90	0.169	0	NaN	NaN	0	0	237.7	364.3
VC.3: WALLS - SPANDREL: North (A345.5°, 18 ft², width 6 ft)	1	90	0.122	0	NaN	NaN	0	0	343.1	525.7
VC.3: WALLS - SPANDREL: North (A345.5°, 18 ft², width 6 ft)	1	90	0.122	0	NaN	NaN	0	0	343.1	525.7
VC.3: WALLS - SPANDREL: North (A345.5°, 18 ft², width 6 ft)	1	90	0.122	0	NaN	NaN	0	0	343.1	525.7
VC.3: WALLS - SPANDREL: North (A345.5°, 18 ft², width 6 ft)	1	90	0.122	0	NaN	NaN	0	0	343.1	525.7
VC.3: WALLS - SPANDREL: North (A345.5°, 18 ft², width 6 ft)	1	90	0.122	0	NaN	NaN	0	0	343.1	525.7
VC.3: WALLS - SPANDREL: North (A345.5°, 18 ft², width 6 ft)	1	90	0.122	0	NaN	NaN	0	0	343.1	525.7
VC.3: WALLS - SPANDREL: North (A345.5°, 11.25 ft², width 1.5 ft)	1	90	0.165	0	NaN	NaN	0	0	290.3	444.8
VC.3: WALLS - SPANDREL: North (A345.5°, 11.25 ft², width 1.5 ft)	1	90	0.165	0	NaN	NaN	0	0	290.3	444.8
VC.3: WALLS - SPANDREL: North (A345.5°, 11.25 ft², width 1.5 ft)	1	90	0.165	0	NaN	NaN	0	0	290.3	444.8
VC.3: WALLS - SPANDREL: North (A345.5°, 11.25 ft², width 1.5 ft)	1	90	0.165	0	NaN	NaN	0	0	290.3	444.8
VC.3: WALLS - SPANDREL: North (A345.5°, 11.25 ft², width 1.5 ft)	1	90	0.165	0	NaN	NaN	0	0	290.3	444.8
VC.3: WALLS - SPANDREL: North (A345.5°, 11.25 ft², width 1.5 ft)	1	90	0.165	0	NaN	NaN	0	0	290.3	444.8
VC.3: WALLS - SPANDREL: North (A345.5°, 11.25 ft², width 1.5 ft)	1	90	0.165	0	NaN	NaN	0	0	290.3	444.8
VC.3: WALLS - SPANDREL: East (A94.5°, 11.25 ft², width 1.5 ft)	1	90	0.165	0	NaN	NaN	0	0	290.3	444.8
VC.3: WALLS - SPANDREL: East (A94.5°, 11.25 ft², width 1.5 ft)	1	90	0.165	0	NaN	NaN	0	0	290.3	444.8
VC.3: WALLS - SPANDREL: East (A94.5°, 11.25 ft², width 1.5 ft)	1	90	0.165	0	NaN	NaN	0	0	290.3	444.8
VC.3: WALLS - SPANDREL: East (A94.5°, 11.25 ft², width 1.5 ft)	1	90	0.165	0	NaN	NaN	0	0	290.3	444.8
VC.3: WALLS - SPANDREL: East (A94.5°, 11.25 ft², width 1.5 ft)	1	90	0.165	0	NaN	NaN	0	0	290.3	444.8
VC.3: WALLS - SPANDREL: East (A94.5°, 29.25 ft², width 9.75 ft)	1	90	0.113	0	NaN	NaN	0	0	518.6	794.5
VC.3: WALLS - SPANDREL: East (A94.5°, 18 ft², width 6 ft)	1	90	0.122	0	NaN	NaN	0	0	343.1	525.7
VC.3: WALLS - SPANDREL: East (A94.5°, 18 ft², width 6 ft)	1	90	0.122	0	NaN	NaN	0	0	343.1	525.7
VC.3: WALLS - SPANDREL: East (A94.5°, 18 ft², width 6 ft)	1	90	0.122	0	NaN	NaN	0	0	343.1	525.7
VC.3: WALLS - SPANDREL: East (A94.5°, 58.5 ft², width 1.5 ft)	1	90	0.153	0	NaN	NaN	0	0	1,394.9	2,137.3
VC.3: WALLS - SPANDREL: East (A94.5°, 11.25 ft², width 1.5 ft)	1	90	0.165	0	NaN	NaN	0	0	290.3	444.8
VC.3: WALLS - SPANDREL: East (A94.5°, 11.25 ft², width 1.5 ft)	1	90	0.165	0	NaN	NaN	0	0	290.3	444.8
VC.3: WALLS - SPANDREL: East (A94.5°, 11.25 ft², width 1.5 ft)	1	90	0.165	0	NaN	NaN	0	0	290.3	444.8
VC.3: WALLS - SPANDREL: East (A94.5°, 29.25 ft², width 9.75 ft)	1	90	0.113	0	NaN	NaN	0	0	518.6	794.5
VC.3: WALLS - SPANDREL: East (A94.5°, 11.25 ft², width 1.5 ft)	1	90	0.165	0	NaN	NaN	0	0	290.3	444.8
VC.3: WALLS - SPANDREL: East (A94.5°, 29.25 ft², width 9.75 ft)	1	90	0.113	0	NaN	NaN	0	0	518.6	794.5
VC.3: WALLS - SPANDREL: East (A94.5°, 11.25 ft², width 1.5 ft)	1	90	0.165	0	NaN	NaN	0	0	290.3	444.8
VC.3: WALLS - SPANDREL: East (A94.5°, 11.25 ft², width 1.5 ft)	1	90	0.165	0	NaN	NaN	0	0	290.3	444.8
VC.3: WALLS - SPANDREL: East (A94.5°, 18 ft², width 6 ft)	1	90	0.122	0	NaN	NaN	0	0	343.1	525.7
VC.3: WALLS - SPANDREL: East (A94.5°, 58.5 ft², width 1.5 ft)	1	90	0.153	0	NaN	NaN	0	0	1,394.9	2,137.3
VC.3: WALLS - SPANDREL: East (A94.5°, 18 ft², width 6 ft)	1	90	0.122	0	NaN	NaN	0	0	343.1	525.7
VC.3: WALLS - SPANDREL: East (A94.5°, 18 ft², width 6 ft)	1	90	0.122	0	NaN	NaN	0	0	343.1	525.7
VC.3: WALLS - SPANDREL: East (A94.5°, 15 ft², width 5 ft)	1	90	0.126	0	NaN	NaN	0	0	296.3	454
VC.3: WALLS - SPANDREL: East (A94.5°, 15 ft², width 5 ft)	1	90	0.126	0	NaN	NaN	0	0	296.3	454
VC.3: WALLS - SPANDREL: East (A94.5°, 15 ft², width 5 ft)	1	90	0.126	0	NaN	NaN	0	0	296.3	454
VC.3: WALLS - SPANDREL: East (A94.5°, 58.5 ft², width 1.5 ft)	1	90	0.153	0	NaN	NaN	0	0	1,394.9	2,137.3
VC.3: WALLS - SPANDREL: East (A94.5°, 11.25 ft², width 1.5 ft)	1	90	0.165	0	NaN	NaN	0	0	290.3	444.8
VC.3: WALLS - SPANDREL: East (A94.5°, 11.25 ft², width 1.5 ft)	1	90	0.165	0	NaN	NaN	0	0	290.3	444.8
VC.3: WALLS - SPANDREL: East (A94.5°, 11.25 ft², width 1.5 ft)	1	90	0.165	0	NaN	NaN	0	0	290.3	444.8
VC.3: WALLS - SPANDREL: East (A94.5°, 11.25 ft², width 1.5 ft)	1	90	0.165	0	NaN	NaN	0	0	290.3	444.8
VC.3: WALLS - SPANDREL: East (A94.5°, 11.25 ft², width 1.5 ft)	1	90	0.165	0	NaN	NaN	0	0	290.3	444.8
VC.3: WALLS - SPANDREL: East (A94.5°, 11.25 ft², width 1.5 ft)	1	90	0.165	0	NaN	NaN	0	0	290.3	444.8
VC.3: WALLS - SPANDREL: East (A94.5°, 11.25 ft², width 1.5 ft)	1	90	0.165	0	NaN	NaN	0	0	290.3	444.8
VC.3: WALLS - SPANDREL: East (A94.5°, 22.5 ft², width 7.5 ft)	1	90	0.118	0	NaN	NaN	0	0	413.3	633.2
VC.3: WALLS - SPANDREL: East (A94.5°, 9 ft², width 3 ft)	1	90	0.144	0	NaN	NaN	0	0	202.7	310.6

Transmission heat losses - windows (continue)

Name	Quantity	Inclination [°]	U-value total [Btu/hr ft² °F]	SHGC (perpendicular)	Reduction factor shading [%]	Reduction factor shading summer [%]	Solar gain heating [kBtu/yr]	Solar gain cooling [kBtu/yr]	Transmission losses heating [kBtu/yr]	Transmission losses cooling [kBtu/yr]
VC.3: WALLS - SPANDREL: East (A94.5°, 9 ft², width 1.5 ft)	1	90	0.169	0	NaN	NaN	0	0	237.7	364.3
VC.3: WALLS - SPANDREL: East (A94.5°, 9 ft², width 1.5 ft)	1	90	0.169	0	NaN	NaN	0	0	237.7	364.3
VC.3: WALLS - SPANDREL: North (A345.5°, 58.5 ft², width 1.5 ft)	1	90	0.153	0	NaN	NaN	0	0	1,394.9	2,137.3
VC.3: WALLS - SPANDREL: North (A345.5°, 58.5 ft², width 1.5 ft)	1	90	0.153	0	NaN	NaN	0	0	1,394.9	2,137.3
VC.3: WALLS - SPANDREL: North (A345.5°, 13.5 ft², width 4.5 ft)	1	90	0.129	0	NaN	NaN	0	0	272.9	418.1
VC.3: WALLS - SPANDREL: North (A345.5°, 58.5 ft², width 1.5 ft)	1	90	0.153	0	NaN	NaN	0	0	1,394.9	2,137.3
VC.3: WALLS - SPANDREL: North (A345.5°, 18 ft², width 6 ft)	1	90	0.122	0	NaN	NaN	0	0	343.1	525.7
VC.3: WALLS - SPANDREL: North (A345.5°, 18 ft², width 6 ft)	1	90	0.122	0	NaN	NaN	0	0	343.1	525.7
VC.3: WALLS - SPANDREL: North (A345.5°, 18 ft², width 6 ft)	1	90	0.122	0	NaN	NaN	0	0	343.1	525.7
VC.3: WALLS - SPANDREL: North (A345.5°, 24.75 ft², width 8.25 ft)	1	90	0.116	0	NaN	NaN	0	0	448.4	687
VC.3: WALLS - SPANDREL: North (A345.5°, 24.75 ft², width 8.25 ft)	1	90	0.116	0	NaN	NaN	0	0	448.4	687
VC.3: WALLS - SPANDREL: North (A345.5°, 24.75 ft², width 8.25 ft)	1	90	0.116	0	NaN	NaN	0	0	448.4	687
VC.3: WALLS - SPANDREL: North (A345.5°, 58.5 ft², width 1.5 ft)	1	90	0.153	0	NaN	NaN	0	0	1,394.9	2,137.3
VC.3: WALLS - SPANDREL: North (A345.5°, 11.25 ft², width 1.5 ft)	1	90	0.165	0	NaN	NaN	0	0	290.3	444.8
VC.3: WALLS - SPANDREL: North (A345.5°, 11.25 ft², width 1.5 ft)	1	90	0.165	0	NaN	NaN	0	0	290.3	444.8
VC.3: WALLS - SPANDREL: North (A345.5°, 9 ft², width 1.5 ft)	1	90	0.169	0	NaN	NaN	0	0	237.7	364.3
VC.3: WALLS - SPANDREL: North (A345.5°, 9 ft², width 1.5 ft)	1	90	0.169	0	NaN	NaN	0	0	237.7	364.3
VC.3: WALLS - SPANDREL: North (A345.5°, 13.5 ft², width 4.5 ft)	1	90	0.129	0	NaN	NaN	0	0	272.9	418.1
VC.3: WALLS - SPANDREL: North (A345.5°, 13.5 ft², width 4.5 ft)	1	90	0.129	0	NaN	NaN	0	0	272.9	418.1
VC.18: WINDOW - FIXED: West (A272.4°, 18 ft², width 3 ft)	1	90	0.154	0.2	97.1	85	385.6	639.5	432.4	662.6
VC.18: WINDOW - FIXED: North (A345.5°, 39.37 ft², width 5.25 ft)	1	90	0.132	0.2	100	85	518.5	823.5	810.5	1,241.8
VC.18: WINDOW - FIXED: North (A345.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	51.5	81.8	165.4	253.4
VC.18: WINDOW - FIXED: North (A345.5°, 18 ft², width 3 ft)	1	90	0.154	0.2	100	85	217.7	345.7	432.4	662.6
VC.18: WINDOW - FIXED: North (A345.5°, 18 ft², width 3 ft)	1	90	0.154	0.2	100	85	217.7	345.7	432.4	662.6
VC.18: WINDOW - FIXED: North (A345.5°, 27 ft², width 4.5 ft)	1	90	0.14	0.2	100	85	344.9	547.7	590	904
VC.18: WINDOW - FIXED: North (A345.5°, 18 ft², width 3 ft)	1	90	0.154	0.2	100	85	217.7	345.7	432.4	662.6
VC.18: WINDOW - FIXED: North (A345.5°, 18 ft², width 3 ft)	1	90	0.154	0.2	100	85	217.7	345.7	432.4	662.6
VC.18: WINDOW - FIXED: North (A345.5°, 18 ft², width 3 ft)	1	90	0.154	0.2	100	85	217.7	345.7	432.4	662.6
VC.18: WINDOW - FIXED: North (A345.5°, 18 ft², width 3 ft)	1	90	0.154	0.2	100	85	217.7	345.7	432.4	662.6
VC.18: WINDOW - FIXED: North (A345.5°, 18 ft², width 3 ft)	1	90	0.154	0.2	100	85	217.7	345.7	432.4	662.6
VC.18: WINDOW - FIXED: North (A345.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	51.5	81.8	165.4	253.4
VC.18: WINDOW - FIXED: North (A345.5°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	100	85	276.3	438.8	526.7	807
VC.18: WINDOW - FIXED: North (A345.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	51.5	81.8	165.4	253.4
VC.18: WINDOW - FIXED: North (A345.5°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	99.2	84	272.6	435.5	526.7	807
VC.18: WINDOW - FIXED: North (A345.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	96.6	80.5	49.8	78.9	165.4	253.4
VC.18: WINDOW - FIXED: North (A345.5°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	93.4	76.3	264.7	410.1	526.7	807
VC.18: WINDOW - FIXED: North (A345.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	95	78.4	49.6	77.7	165.4	253.4
VC.18: WINDOW - FIXED: North (A345.5°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	87.7	73.6	243.4	385	526.7	807
VC.18: WINDOW - FIXED: North (A345.5°, 33.75 ft², width 4.5 ft)	1	90	0.136	0.2	72.4	56.1	338.9	504	715.9	1,096.9
VC.18: WINDOW - FIXED: North (A345.5°, 33.75 ft², width 4.5 ft)	1	90	0.136	0.2	74.5	57.6	349.4	518.4	715.9	1,096.9
VC.18: WINDOW - FIXED: North (A345.5°, 33.75 ft², width 4.5 ft)	1	90	0.136	0.2	78.2	60.4	366.9	544.4	715.9	1,096.9
VC.18: WINDOW - FIXED: North (A345.5°, 33.75 ft², width 4.5 ft)	1	90	0.136	0.2	100	85	437.8	695.3	715.9	1,096.9
VC.18: WINDOW - FIXED: North (A345.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	51.5	81.8	165.4	253.4
VC.18: WINDOW - FIXED: North (A345.5°, 39.37 ft², width 5.25 ft)	1	90	0.132	0.2	100	85	518.5	823.5	810.5	1,241.8
VC.18: WINDOW - FIXED: North (A345.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	51.5	81.8	165.4	253.4
VC.18: WINDOW - FIXED: North (A345.5°, 39.37 ft², width 5.25 ft)	1	90	0.132	0.2	100	85	518.5	823.5	810.5	1,241.8
VC.18: WINDOW - FIXED: North (A345.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	99.3	84.1	51.5	81.2	165.4	253.4
VC.18: WINDOW - FIXED: North (A345.5°, 39.37 ft², width 5.25 ft)	1	90	0.132	0.2	96.1	84	489.9	791.6	810.5	1,241.8
VC.18: WINDOW - FIXED: North (A345.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	51.5	81.8	165.4	253.4
VC.18: WINDOW - FIXED: North (A345.5°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	99.4	84.2	276.3	436	526.7	807
VC.18: WINDOW - FIXED: North (A345.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	51.5	81.8	165.4	253.4

Transmission heat losses - windows (continue)

Name	Quantity	Inclination [°]	U-value total [Btu/hr ft² °F]	SHGC (perpendicular)	Reduction factor shading [%]	Reduction factor shading summer [%]	Solar gain heating [kBtu/yr]	Solar gain cooling [kBtu/yr]	Transmission losses heating [kBtu/yr]	Transmission losses cooling [kBtu/yr]
VC.18: WINDOW - FIXED: North (A345.5°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	100	85	276.3	438.8	526.7	807
VC.18: WINDOW - FIXED: North (A345.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	51.5	81.8	165.4	253.4
VC.18: WINDOW - FIXED: North (A345.5°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	100	85	276.3	438.8	526.7	807
VC.18: WINDOW - FIXED: North (A345.5°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	100	85	276.3	438.8	526.7	807
VC.18: WINDOW - FIXED: North (A345.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	51.5	81.8	165.4	253.4
VC.18: WINDOW - FIXED: North (A345.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	51.5	81.8	165.4	253.4
VC.18: WINDOW - FIXED: North (A345.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	51.5	81.8	165.4	253.3
VC.18: WINDOW - FIXED: North (A345.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	51.5	81.8	165.4	253.4
VC.18: WINDOW - FIXED: North (A345.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	51.5	81.8	165.4	253.4
VC.18: WINDOW - FIXED: North (A345.5°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	99.4	84.2	276.3	436	526.7	807
VC.18: WINDOW - FIXED: North (A345.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	51.5	81.8	165.4	253.4
VC.18: WINDOW - FIXED: North (A345.5°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	100	85	276.3	438.8	526.7	806.9
VC.18: WINDOW - FIXED: North (A345.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	51.5	81.8	165.4	253.4
VC.18: WINDOW - FIXED: North (A345.5°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	100	85	276.3	438.8	526.7	807
VC.18: WINDOW - FIXED: North (A345.5°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	100	85	276.3	438.8	526.7	807
VC.18: WINDOW - FIXED: North (A345.5°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	100	85	276.3	438.8	526.7	807
VC.18: WINDOW - FIXED: North (A345.5°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	100	85	276.3	438.8	526.7	807
VC.18: WINDOW - FIXED: North (A345.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	51.5	81.8	165.4	253.4
VC.18: WINDOW - FIXED: North (A345.5°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	100	85	276.3	438.8	526.7	806.9
VC.18: WINDOW - FIXED: North (A345.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	51.5	81.8	165.4	253.3
VC.18: WINDOW - FIXED: North (A345.5°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	99.4	84.2	276.3	436	526.7	807
VC.18: WINDOW - FIXED: North (A345.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	51.5	81.8	165.4	253.4
VC.18: WINDOW - FIXED: North (A345.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	51.5	81.8	165.4	253.4
VC.18: WINDOW - FIXED: North (A345.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	99.4	84.2	51.5	81.2	165.4	253.4
VC.18: WINDOW - FIXED: North (A345.5°, 5.25 ft², width 2.999 ft)	1	90	0.202	0.2	99.4	84.2	51.5	81.2	165.3	253.3
VC.18: WINDOW - FIXED: North (A345.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	99.4	84.2	51.5	81.2	165.4	253.3
VC.18: WINDOW - FIXED: North (A345.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	51.5	81.8	165.4	253.4
VC.18: WINDOW - FIXED: North (A345.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	51.5	81.8	165.4	253.4
VC.18: WINDOW - FIXED: North (A345.5°, 18 ft², width 3 ft)	1	90	0.154	0.2	100	85	217.7	345.7	432.4	662.6
VC.18: WINDOW - FIXED: North (A345.5°, 18 ft², width 3 ft)	1	90	0.154	0.2	100	85	217.7	345.7	432.4	662.6
VC.18: WINDOW - FIXED: North (A345.5°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	100	85	276.3	438.8	526.7	807
VC.18: WINDOW - FIXED: North (A345.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	51.5	81.8	165.4	253.4
VC.18: WINDOW - FIXED: North (A345.5°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	100	85	276.3	438.8	526.7	807
VC.18: WINDOW - FIXED: North (A345.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	51.5	81.8	165.4	253.4
VC.18: WINDOW - FIXED: North (A345.5°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	90.4	77.1	249.2	396.7	526.7	807
VC.18: WINDOW - FIXED: North (A345.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	51.5	81.8	165.4	253.4
VC.18: WINDOW - FIXED: North (A345.5°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	100	85	276.3	438.8	526.7	807
VC.18: WINDOW - FIXED: North (A345.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	51.5	81.8	165.4	253.4
VC.18: WINDOW - FIXED: North (A345.5°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	88.3	75.6	242.4	387.3	526.7	807
VC.18: WINDOW - FIXED: North (A345.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	99.3	84.1	51.5	81.2	165.4	253.4
VC.18: WINDOW - FIXED: North (A345.5°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	100	85	276.3	438.8	526.7	807
VC.18: WINDOW - FIXED: North (A345.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	51.5	81.8	165.4	253.4
VC.18: WINDOW - FIXED: North (A345.5°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	86	74	235.1	377.3	526.7	807
VC.18: WINDOW - FIXED: North (A345.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	99.3	84.1	51.5	81.2	165.4	253.4
VC.18: WINDOW - FIXED: North (A345.5°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	99.3	84.1	276.3	435.8	526.7	807
VC.18: WINDOW - FIXED: North (A345.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	51.5	81.8	165.4	253.4
VC.18: WINDOW - FIXED: North (A345.5°, 18 ft², width 3 ft)	1	90	0.154	0.2	81	70.5	172.6	279.8	432.4	662.6
VC.18: WINDOW - FIXED: North (A345.5°, 18 ft², width 3 ft)	1	90	0.154	0.2	90.1	77	195.6	311.6	432.4	662.6
VC.18: WINDOW - FIXED: North (A345.5°, 18 ft², width 3 ft)	1	90	0.154	0.2	99.3	84.1	217.7	343.2	432.4	662.6

Transmission heat losses - windows (continue)

Name	Quantity	Inclination [°]	U-value total [Btu/hr ft² °F]	SHGC (perpendicular)	Reduction factor shading [%]	Reduction factor shading summer [%]	Solar gain heating [kBtu/yr]	Solar gain cooling [kBtu/yr]	Transmission losses heating [kBtu/yr]	Transmission losses cooling [kBtu/yr]
VC.18: WINDOW - FIXED: North (A345.5°, 18 ft², width 3 ft)	1	90	0.154	0.2	84.5	73	181.5	292.1	432.4	662.6
VC.18: WINDOW - FIXED: North (A345.5°, 18 ft², width 3 ft)	1	90	0.154	0.2	100	85	217.7	345.7	432.4	662.6
VC.18: WINDOW - FIXED: North (A345.5°, 18 ft², width 3 ft)	1	90	0.154	0.2	100	85	217.7	345.7	432.4	662.6
VC.18: WINDOW - FIXED: North (A345.5°, 18 ft², width 3 ft)	1	90	0.154	0.2	84.5	73	181.6	292.2	432.4	662.6
VC.18: WINDOW - FIXED: North (A345.5°, 18 ft², width 3 ft)	1	90	0.154	0.2	100	85	217.7	345.7	432.4	662.6
VC.18: WINDOW - FIXED: North (A345.5°, 18 ft², width 3 ft)	1	90	0.154	0.2	100	85	217.7	345.7	432.4	662.6
VC.18: WINDOW - FIXED: North (A345.5°, 18 ft², width 3 ft)	1	90	0.154	0.2	80.3	70.1	170.9	277.5	432.4	662.6
VC.18: WINDOW - FIXED: North (A345.5°, 18 ft², width 3 ft)	1	90	0.154	0.2	100	85	217.7	345.7	432.4	662.6
VC.18: WINDOW - FIXED: North (A345.5°, 18 ft², width 3 ft)	1	90	0.154	0.2	83.4	72.2	178.7	288.2	432.4	662.6
VC.18: WINDOW - FIXED: North (A345.5°, 18 ft², width 3 ft)	1	90	0.154	0.2	100	85	217.7	345.7	432.4	662.6
VC.18: WINDOW - FIXED: North (A345.5°, 18 ft², width 3 ft)	1	90	0.154	0.2	100	85	217.7	345.7	432.4	662.6
VC.18: WINDOW - FIXED: North (A345.5°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	100	85	276.3	438.8	526.7	807
VC.18: WINDOW - FIXED: North (A345.5°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	100	85	276.3	438.8	526.7	807
VC.18: WINDOW - FIXED: North (A345.5°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	100	85	276.3	438.8	526.7	807
VC.18: WINDOW - FIXED: North (A345.5°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	93.1	80.4	251.1	408.5	526.7	807
VC.18: WINDOW - FIXED: West (A268.7°, 17.25 ft², width 2.875 ft)	1	90	0.156	0.2	71.8	62.3	283.2	450	419.3	642.4
VC.18: WINDOW - FIXED: West (A268.7°, 17.25 ft², width 2.875 ft)	1	90	0.156	0.2	100	85	400.4	626.8	419.3	642.4
VC.18: WINDOW - FIXED: West (A268.7°, 17.25 ft², width 2.875 ft)	1	90	0.156	0.2	100	85	400.4	626.8	419.3	642.4
VC.18: WINDOW - FIXED: West (A268.7°, 17.25 ft², width 2.875 ft)	1	90	0.156	0.2	100	85	400.4	626.8	419.3	642.4
VC.18: WINDOW - FIXED: West (A268.7°, 17.25 ft², width 2.875 ft)	1	90	0.156	0.2	100	85	400.4	626.8	419.3	642.4
VC.18: WINDOW - FIXED: West (A268.7°, 17.25 ft², width 2.875 ft)	1	90	0.156	0.2	100	85	400.4	626.8	419.3	642.4
VC.18: WINDOW - FIXED: West (A268.7°, 17.25 ft², width 2.875 ft)	1	90	0.156	0.2	100	85	400.4	626.8	419.3	642.4
VC.18: WINDOW - FIXED: West (A268.7°, 17.25 ft², width 2.875 ft)	1	90	0.156	0.2	100	85	400.4	626.8	419.3	642.4
VC.18: WINDOW - FIXED: West (A268.7°, 17.25 ft², width 2.875 ft)	1	90	0.156	0.2	100	85	400.4	626.8	419.3	642.4
VC.18: WINDOW - FIXED: West (A268.7°, 17.25 ft², width 2.875 ft)	1	90	0.156	0.2	100	85	400.4	626.8	419.3	642.4
VC.18: WINDOW - FIXED: West (A268.7°, 17.25 ft², width 2.875 ft)	1	90	0.156	0.2	100	85	400.4	626.8	419.3	642.4
VC.18: WINDOW - FIXED: West (A268.7°, 17.25 ft², width 2.875 ft)	1	90	0.156	0.2	100	85	400.4	626.8	419.3	642.4
VC.18: WINDOW - FIXED: West (A268.7°, 17.25 ft², width 2.875 ft)	1	90	0.156	0.2	100	85	400.4	626.8	419.3	642.4
VC.18: WINDOW - FIXED: West (A268.7°, 17.25 ft², width 2.875 ft)	1	90	0.156	0.2	100	85	400.4	626.8	419.3	642.4
VC.18: WINDOW - FIXED: West (A268.7°, 17.25 ft², width 2.875 ft)	1	90	0.156	0.2	100	85	400.4	626.8	419.3	642.4
VC.18: WINDOW - FIXED: West (A268.7°, 17.25 ft², width 2.875 ft)	1	90	0.156	0.2	100	85	400.4	626.8	419.3	642.4
VC.18: WINDOW - FIXED: West (A268.7°, 17.25 ft², width 2.875 ft)	1	90	0.156	0.2	100	85	400.4	626.8	419.3	642.4
VC.18: WINDOW - FIXED: East (A94.5°, 18 ft², width 3 ft)	1	90	0.154	0.2	100	85	441.5	673.6	432.4	662.6
VC.18: WINDOW - FIXED: East (A94.5°, 18 ft², width 3 ft)	1	90	0.154	0.2	100	85	441.5	673.6	432.4	662.6
VC.18: WINDOW - FIXED: East (A94.5°, 18 ft², width 3 ft)	1	90	0.154	0.2	100	85	441.5	673.6	432.4	662.6
VC.18: WINDOW - FIXED: East (A94.5°, 18 ft², width 3 ft)	1	90	0.154	0.2	100	85	441.5	673.6	432.4	662.6
VC.18: WINDOW - FIXED: East (A94.5°, 39.37 ft², width 5.25 ft)	1	90	0.132	0.2	100	85	1,051.9	1,604.6	810.5	1,241.8
VC.18: WINDOW - FIXED: East (A94.5°, 30 ft², width 5 ft)	1	90	0.137	0.2	100	85	785.6	1,198.4	642.5	984.4
VC.18: WINDOW - FIXED: East (A94.5°, 18 ft², width 3 ft)	1	90	0.154	0.2	100	85	441.5	673.6	432.4	662.6
VC.18: WINDOW - FIXED: East (A94.5°, 37.5 ft², width 5 ft)	1	90	0.133	0.2	100	85	997.3	1,521.3	779	1,193.5
VC.18: WINDOW - FIXED: East (A94.5°, 37.5 ft², width 5 ft)	1	90	0.133	0.2	100	85	997.3	1,521.3	779	1,193.5
VC.18: WINDOW - FIXED: East (A94.5°, 37.5 ft², width 5 ft)	1	90	0.133	0.2	90.7	83.8	854	1,380.2	779	1,193.5
VC.18: WINDOW - FIXED: East (A94.5°, 37.5 ft², width 5 ft)	1	90	0.133	0.2	89.5	82.5	836.3	1,361.7	779	1,193.5
VC.18: WINDOW - FIXED: East (A94.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	104.4	159.3	165.4	253.4
VC.18: WINDOW - FIXED: East (A94.5°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	100	85	560.5	855.1	526.7	807
VC.18: WINDOW - FIXED: East (A94.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	104.4	159.3	165.4	253.4
VC.18: WINDOW - FIXED: East (A94.5°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	100	85	560.5	855.1	526.7	807
VC.18: WINDOW - FIXED: East (A94.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	104.4	159.3	165.4	253.4
VC.18: WINDOW - FIXED: East (A94.5°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	100	85	560.5	855.1	526.7	807
VC.18: WINDOW - FIXED: East (A94.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	104.4	159.3	165.4	253.4
VC.18: WINDOW - FIXED: East (A94.5°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	100	85	560.5	855.1	526.7	807

Transmission heat losses - windows (continue)

Name	Quantity	Inclination [°]	U-value total [Btu/hr ft² °F]	SHGC (perpendicular)	Reduction factor shading [%]	Reduction factor shading summer [%]	Solar gain heating [kBtu/yr]	Solar gain cooling [kBtu/yr]	Transmission losses heating [kBtu/yr]	Transmission losses cooling [kBtu/yr]
VC.18: WINDOW - FIXED: East (A94.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	104.4	159.3	165.4	253.4
VC.18: WINDOW - FIXED: East (A94.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	104.4	159.3	165.4	253.4
VC.18: WINDOW - FIXED: East (A94.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	104.4	159.3	165.4	253.4
VC.18: WINDOW - FIXED: East (A94.5°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	100	85	560.5	855.1	526.7	807
VC.18: WINDOW - FIXED: East (A94.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	104.4	159.3	165.4	253.4
VC.18: WINDOW - FIXED: East (A94.5°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	100	85	560.5	855.1	526.7	807
VC.18: WINDOW - FIXED: East (A94.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	104.4	159.3	165.4	253.4
VC.18: WINDOW - FIXED: East (A94.5°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	97.6	82.3	556.6	834.6	526.7	807
VC.18: WINDOW - FIXED: East (A94.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	104.4	159.3	165.4	253.4
VC.18: WINDOW - FIXED: East (A94.5°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	97.6	82.2	556.6	834.4	526.7	807
VC.18: WINDOW - FIXED: East (A94.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	104.4	159.3	165.4	253.4
VC.18: WINDOW - FIXED: East (A94.5°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	97.6	82.2	556.7	834.5	526.7	807
VC.18: WINDOW - FIXED: East (A94.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	104.4	159.3	165.4	253.4
VC.18: WINDOW - FIXED: East (A94.5°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	100	85	560.5	855.1	526.7	807
VC.18: WINDOW - FIXED: East (A94.5°, 30 ft², width 5 ft)	1	90	0.137	0.2	100	85	785.6	1,198.4	642.5	984.4
VC.18: WINDOW - FIXED: East (A94.5°, 37.5 ft², width 5 ft)	1	90	0.133	0.2	100	85	997.3	1,521.3	779	1,193.5
VC.18: WINDOW - FIXED: East (A94.5°, 30 ft², width 5 ft)	1	90	0.137	0.2	100	85	785.6	1,198.4	642.5	984.4
VC.18: WINDOW - FIXED: East (A94.5°, 37.5 ft², width 5 ft)	1	90	0.133	0.2	100	85	997.3	1,521.3	779	1,193.5
VC.18: WINDOW - FIXED: East (A94.5°, 37.5 ft², width 5 ft)	1	90	0.133	0.2	100	85	997.3	1,521.3	779	1,193.5
VC.18: WINDOW - FIXED: East (A94.5°, 37.5 ft², width 5 ft)	1	90	0.133	0.2	100	85	997.3	1,521.3	779	1,193.5
VC.18: WINDOW - FIXED: East (A94.5°, 37.5 ft², width 5 ft)	1	90	0.133	0.2	100	85	997.3	1,521.3	779	1,193.5
VC.18: WINDOW - FIXED: East (A94.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	104.4	159.3	165.4	253.4
VC.18: WINDOW - FIXED: East (A94.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	104.4	159.3	165.4	253.4
VC.18: WINDOW - FIXED: East (A94.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	104.4	159.3	165.4	253.4
VC.18: WINDOW - FIXED: East (A94.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	104.4	159.3	165.4	253.4
VC.18: WINDOW - FIXED: East (A94.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	94.7	85	95	150.9	165.4	253.4
VC.18: WINDOW - FIXED: East (A94.5°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	98.3	85	544	840.3	526.7	807
VC.18: WINDOW - FIXED: East (A94.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	94.7	85	95	150.9	165.4	253.4
VC.18: WINDOW - FIXED: East (A94.5°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	98.3	85	544	840.4	526.7	807
VC.18: WINDOW - FIXED: East (A94.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	94.7	85	95	150.9	165.4	253.4
VC.18: WINDOW - FIXED: East (A94.5°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	98.3	85	544.6	840.8	526.7	807
VC.18: WINDOW - FIXED: East (A94.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	104.4	159.3	165.4	253.4
VC.18: WINDOW - FIXED: East (A94.5°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	100	85	560.5	855.1	526.7	807
VC.18: WINDOW - FIXED: East (A94.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	104.4	159.3	165.4	253.4
VC.18: WINDOW - FIXED: East (A94.5°, 39.37 ft², width 5.25 ft)	1	90	0.132	0.2	100	85	1,051.9	1,604.6	810.5	1,241.8
VC.18: WINDOW - FIXED: East (A94.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	104.4	159.3	165.4	253.4
VC.18: WINDOW - FIXED: East (A94.5°, 39.37 ft², width 5.25 ft)	1	90	0.132	0.2	100	85	1,051.9	1,604.6	810.5	1,241.8
VC.18: WINDOW - FIXED: East (A94.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	104.4	159.3	165.4	253.4
VC.18: WINDOW - FIXED: East (A94.5°, 39.37 ft², width 5.25 ft)	1	90	0.132	0.2	100	85	1,051.9	1,604.6	810.5	1,241.8
VC.18: WINDOW - FIXED: East (A94.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	104.4	159.3	165.4	253.4
VC.18: WINDOW - FIXED: East (A94.5°, 18 ft², width 3 ft)	1	90	0.154	0.2	100	85	441.5	673.6	432.4	662.6
VC.18: WINDOW - FIXED: East (A94.5°, 18 ft², width 3 ft)	1	90	0.154	0.2	100	85	441.5	673.6	432.4	662.6
VC.18: WINDOW - FIXED: East (A94.5°, 18 ft², width 3 ft)	1	90	0.154	0.2	100	85	441.5	673.6	432.4	662.6
VC.18: WINDOW - FIXED: East (A94.5°, 18 ft², width 3 ft)	1	90	0.154	0.2	100	85	441.5	673.6	432.4	662.6
VC.18: WINDOW - FIXED: East (A94.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	104.4	159.3	165.4	253.4
VC.18: WINDOW - FIXED: East (A94.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	104.4	159.3	165.4	253.4
VC.18: WINDOW - FIXED: East (A94.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	104.4	159.3	165.4	253.4
VC.18: WINDOW - FIXED: East (A94.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	104.4	159.3	165.4	253.4
VC.18: WINDOW - FIXED: East (A94.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	104.4	159.3	165.4	253.4
VC.18: WINDOW - FIXED: East (A94.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	104.4	159.3	165.4	253.4
VC.18: WINDOW - FIXED: East (A94.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	104.4	159.3	165.4	253.4
VC.18: WINDOW - FIXED: East (A94.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	104.4	159.3	165.4	253.4
VC.18: WINDOW - FIXED: East (A94.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	104.4	159.3	165.4	253.4
VC.18: WINDOW - FIXED: East (A94.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	104.4	159.3	165.4	253.4
VC.18: WINDOW - FIXED: East (A94.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	104.4	159.3	165.4	253.4

Transmission heat losses - windows (continue)

Name	Quantity	Inclination [°]	U-value total [Btu/hr ft² °F]	SHGC (perpendicular)	Reduction factor shading [%]	Reduction factor shading summer [%]	Solar gain heating [kBtu/yr]	Solar gain cooling [kBtu/yr]	Transmission losses heating [kBtu/yr]	Transmission losses cooling [kBtu/yr]
VC.18: WINDOW - FIXED: East (A94.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	104.4	159.3	165.4	253.4
VC.18: WINDOW - FIXED: East (A94.5°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	104.4	159.3	165.4	253.4
VC.18: WINDOW - FIXED: East (A94.5°, 45 ft², width 6 ft)	1	90	0.129	0.2	100	85	1,215.7	1,854.5	905.1	1,386.8
VC.18: WINDOW - FIXED: East (A94.5°, 45 ft², width 6 ft)	1	90	0.129	0.2	100	85	1,215.7	1,854.5	905.1	1,386.8
VC.18: WINDOW - FIXED: East (A94.5°, 45 ft², width 6 ft)	1	90	0.129	0.2	100	85	1,215.7	1,854.5	905.1	1,386.8
VC.18: WINDOW - FIXED: East (A94.5°, 45 ft², width 6 ft)	1	90	0.129	0.2	100	85	1,215.7	1,854.5	905.1	1,386.8
VC.18: WINDOW - FIXED: East (A94.5°, 45 ft², width 6 ft)	1	90	0.129	0.2	100	85	1,215.7	1,854.5	905.1	1,386.8
VC.18: WINDOW - FIXED: South (A182.4°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	159.7	209.6	165.4	253.4
VC.18: WINDOW - FIXED: South (A182.4°, 18 ft², width 3 ft)	1	90	0.154	0.2	100	85	675	886.2	432.4	662.6
VC.18: WINDOW - FIXED: South (A182.4°, 18 ft², width 3 ft)	1	90	0.154	0.2	93.9	75.2	651	832.4	432.4	662.6
VC.18: WINDOW - FIXED: South (A182.4°, 18 ft², width 3 ft)	1	90	0.154	0.2	81.6	58.4	590.5	723.3	432.4	662.6
VC.18: WINDOW - FIXED: South (A182.4°, 18 ft², width 3 ft)	1	90	0.154	0.2	100	85	675	886.2	432.4	662.6
VC.18: WINDOW - FIXED: South (A182.4°, 18 ft², width 3 ft)	1	90	0.154	0.2	81	58.4	584.1	717.6	432.4	662.6
VC.18: WINDOW - FIXED: South (A182.4°, 18 ft², width 3 ft)	1	90	0.154	0.2	100	85	675	886.2	432.4	662.6
VC.18: WINDOW - FIXED: South (A182.4°, 18 ft², width 3 ft)	1	90	0.154	0.2	81.6	58.4	590.5	723.3	432.4	662.6
VC.18: WINDOW - FIXED: South (A182.4°, 18 ft², width 3 ft)	1	90	0.154	0.2	100	85	675	886.2	432.4	662.6
VC.18: WINDOW - FIXED: South (A182.4°, 18 ft², width 3 ft)	1	90	0.154	0.2	100	85	675	886.2	432.4	662.6
VC.18: WINDOW - FIXED: South (A182.4°, 18 ft², width 3 ft)	1	90	0.154	0.2	100	85	675	886.2	432.4	662.6
VC.18: WINDOW - FIXED: South (A182.4°, 18 ft², width 3 ft)	1	90	0.154	0.2	100	85	675	886.2	432.4	662.6
VC.18: WINDOW - FIXED: South (A182.4°, 18 ft², width 3 ft)	1	90	0.154	0.2	100	85	675	886.2	432.4	662.6
VC.18: WINDOW - FIXED: South (A182.4°, 18 ft², width 3 ft)	1	90	0.154	0.2	100	85	675	886.2	432.4	662.6
VC.18: WINDOW - FIXED: South (A182.4°, 18 ft², width 3 ft)	1	90	0.154	0.2	100	85	675	886.2	432.4	662.6
VC.18: WINDOW - FIXED: South (A182.4°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	159.7	209.6	165.4	253.4
VC.18: WINDOW - FIXED: South (A182.4°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	100	85	856.9	1,125	526.7	807
VC.18: WINDOW - FIXED: South (A182.4°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	159.7	209.6	165.4	253.4
VC.18: WINDOW - FIXED: South (A182.4°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	100	85	856.9	1,125	526.7	807
VC.18: WINDOW - FIXED: South (A182.4°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	98.7	82.5	159.7	206.8	165.4	253.4
VC.18: WINDOW - FIXED: South (A182.4°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	84.4	62.2	767.7	949.4	526.7	807
VC.18: WINDOW - FIXED: South (A182.4°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	159.7	209.6	165.4	253.4
VC.18: WINDOW - FIXED: South (A182.4°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	100	85	856.9	1,125	526.7	807
VC.18: WINDOW - FIXED: South (A182.4°, 17.25 ft², width 3 ft)	1	90	0.155	0.2	100	85	644.7	846.4	416.7	638.5
VC.18: WINDOW - FIXED: South (A182.4°, 17.25 ft², width 3 ft)	1	90	0.155	0.2	100	85	644.7	846.4	416.7	638.5
VC.18: WINDOW - FIXED: South (A182.4°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	159.7	209.6	165.4	253.4
VC.18: WINDOW - FIXED: South (A182.4°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	100	85	856.9	1,125	526.7	807
VC.18: WINDOW - FIXED: South (A182.4°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	159.7	209.6	165.4	253.4
VC.18: WINDOW - FIXED: South (A182.4°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	100	85	856.9	1,125	526.7	807
VC.18: WINDOW - FIXED: South (A182.4°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	98.7	82.5	159.7	206.8	165.4	253.4
VC.18: WINDOW - FIXED: South (A182.4°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	84.3	62.1	767.4	948.7	526.7	807
VC.18: WINDOW - FIXED: South (A182.4°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	159.7	209.6	165.4	253.4
VC.18: WINDOW - FIXED: South (A182.4°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	100	85	856.9	1,125	526.7	807
VC.18: WINDOW - FIXED: South (A182.4°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	98.6	82.4	159.7	206.7	165.4	253.4
VC.18: WINDOW - FIXED: South (A182.4°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	83.9	61.4	765.5	944.3	526.7	807
VC.18: WINDOW - FIXED: South (A182.4°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	159.7	209.6	165.4	253.4
VC.18: WINDOW - FIXED: South (A182.4°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	100	85	856.9	1,125	526.7	807
VC.18: WINDOW - FIXED: South (A182.4°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	159.7	209.6	165.4	253.4
VC.18: WINDOW - FIXED: South (A182.4°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	100	85	856.9	1,125	526.7	807
VC.18: WINDOW - FIXED: South (A182.4°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	98.7	82.5	159.7	206.8	165.4	253.4
VC.18: WINDOW - FIXED: South (A182.4°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	84.4	62.2	767.7	949.4	526.7	807
VC.18: WINDOW - FIXED: South (A182.4°, 17.25 ft², width 3 ft)	1	90	0.155	0.2	100	85	644.7	846.4	416.7	638.5
VC.18: WINDOW - FIXED: South (A182.4°, 17.25 ft², width 3 ft)	1	90	0.155	0.2	100	85	644.7	846.4	416.7	638.5
VC.18: WINDOW - FIXED: South (A182.4°, 17.25 ft², width 3 ft)	1	90	0.155	0.2	100	85	644.7	846.4	416.7	638.5
VC.18: WINDOW - FIXED: South (A182.4°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	97.4	80.3	158.3	204.3	165.4	253.4

Transmission heat losses - windows (continue)

Name	Quantity	Inclination [°]	U-value total [Btu/hr ft² °F]	SHGC (perpendicular)	Reduction factor shading [%]	Reduction factor shading summer [%]	Solar gain heating [kBtu/yr]	Solar gain cooling [kBtu/yr]	Transmission losses heating [kBtu/yr]	Transmission losses cooling [kBtu/yr]
VC.18: WINDOW - FIXED: South (A182.4°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	90.7	73.1	795.5	1,020.1	526.7	807
VC.18: WINDOW - FIXED: South (A182.4°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	159.7	209.6	165.4	253.4
VC.18: WINDOW - FIXED: South (A182.4°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	92.6	76.4	804.5	1,041.3	526.7	807
VC.18: WINDOW - FIXED: South (A182.4°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	98.7	82.5	159.7	206.8	165.4	253.4
VC.18: WINDOW - FIXED: South (A182.4°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	84.4	62.2	767.7	949.4	526.7	807
VC.18: WINDOW - FIXED: South (A182.4°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	159.7	209.6	165.4	253.4
VC.18: WINDOW - FIXED: South (A182.4°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	100	85	856.9	1,125	526.7	807
VC.18: WINDOW - FIXED: South (A182.4°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	100	85	856.9	1,125	526.7	807
VC.18: WINDOW - FIXED: South (A182.4°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	159.7	209.6	165.4	253.4
VC.18: WINDOW - FIXED: South (A182.4°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	100	85	856.9	1,125	526.7	807
VC.18: WINDOW - FIXED: South (A182.4°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	159.7	209.6	165.4	253.4
VC.18: WINDOW - FIXED: South (A182.4°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	100	85	856.9	1,125	526.7	807
VC.18: WINDOW - FIXED: South (A182.4°, 5.25 ft², width 3 ft)	1	90	0.202	0.2	100	85	159.7	209.6	165.4	253.4
VC.18: WINDOW - FIXED: South (A182.4°, 22.5 ft², width 3 ft)	1	90	0.15	0.2	100	85	856.9	1,125	526.7	807
VC.18: WINDOW - FIXED: East (A94.5°, 37.5 ft², width 5 ft)	1	90	0.133	0.2	100	85	997.3	1,521.3	779	1,193.5
VC.18: WINDOW - FIXED: East (A94.5°, 37.5 ft², width 5 ft)	1	90	0.133	0.2	100	85	997.3	1,521.3	779	1,193.5
VC.18: WINDOW - FIXED: East (A94.5°, 37.5 ft², width 5 ft)	1	90	0.133	0.2	100	85	997.3	1,521.3	779	1,193.5
VC.19: WINDOW - CASEMENT: North (A345.5°, 18 ft², width 3 ft)	1	90	0.176	0.2	100	85	181	287.4	495.5	759.2
VC.19: WINDOW - CASEMENT: North (A345.5°, 18 ft², width 3 ft)	1	90	0.176	0.2	100	85	181	287.4	495.5	759.2
VC.19: WINDOW - CASEMENT: North (A345.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	172.3	273.7	477.7	732
VC.19: WINDOW - CASEMENT: North (A345.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	172.3	273.7	477.7	732
VC.19: WINDOW - CASEMENT: North (A345.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	172.3	273.7	477.7	732
VC.19: WINDOW - CASEMENT: North (A345.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	92	78.6	156.7	251.7	477.7	732
VC.19: WINDOW - CASEMENT: North (A345.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	88.1	74	152.4	241.1	477.7	732
VC.19: WINDOW - CASEMENT: North (A345.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	95.9	79.6	166.1	262.5	477.7	732
VC.19: WINDOW - CASEMENT: North (A345.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	172.3	273.7	477.7	732
VC.19: WINDOW - CASEMENT: North (A345.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	172.3	273.7	477.7	732
VC.19: WINDOW - CASEMENT: North (A345.5°, 18 ft², width 3 ft)	1	90	0.176	0.2	100	85	181	287.4	495.5	759.2
VC.19: WINDOW - CASEMENT: North (A345.5°, 18 ft², width 3 ft)	1	90	0.176	0.2	100	85	181	287.4	495.5	759.2
VC.19: WINDOW - CASEMENT: North (A345.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	172.3	273.7	477.7	732
VC.19: WINDOW - CASEMENT: North (A345.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	172.3	273.7	477.7	732
VC.19: WINDOW - CASEMENT: North (A345.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	172.3	273.7	477.7	732
VC.19: WINDOW - CASEMENT: North (A345.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	172.3	273.7	477.7	732
VC.19: WINDOW - CASEMENT: North (A345.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	172.3	273.7	477.7	732
VC.19: WINDOW - CASEMENT: North (A345.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	172.3	273.7	477.7	732
VC.19: WINDOW - CASEMENT: North (A345.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	172.3	273.7	477.7	732
VC.19: WINDOW - CASEMENT: North (A345.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	172.3	273.7	477.7	732
VC.19: WINDOW - CASEMENT: North (A345.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	172.3	273.7	477.7	732
VC.19: WINDOW - CASEMENT: North (A345.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	172.3	273.7	477.7	732
VC.19: WINDOW - CASEMENT: North (A345.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	172.3	273.7	477.7	732
VC.19: WINDOW - CASEMENT: North (A345.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	172.3	273.7	477.7	732
VC.19: WINDOW - CASEMENT: North (A345.5°, 17.25 ft², width 2.999 ft)	1	90	0.177	0.2	100	85	172.3	273.6	477.7	731.9
VC.19: WINDOW - CASEMENT: North (A345.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	172.3	273.7	477.7	732
VC.19: WINDOW - CASEMENT: North (A345.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	96.1	84	162.8	263.1	477.7	732
VC.19: WINDOW - CASEMENT: North (A345.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	93.3	80.5	157	255.2	477.7	732
VC.19: WINDOW - CASEMENT: North (A345.5°, 18 ft², width 3 ft)	1	90	0.176	0.2	100	85	181	287.4	495.5	759.2
VC.19: WINDOW - CASEMENT: North (A345.5°, 18 ft², width 3 ft)	1	90	0.176	0.2	100	85	181	287.4	495.5	759.2

Transmission heat losses - windows (continue)

Name	Quantity	Inclination [°]	U-value total [Btu/hr ft² °F]	SHGC (perpendicular)	Reduction factor shading [%]	Reduction factor shading summer [%]	Solar gain heating [kBtu/yr]	Solar gain cooling [kBtu/yr]	Transmission losses heating [kBtu/yr]	Transmission losses cooling [kBtu/yr]
VC.19: WINDOW - CASEMENT: North (A345.5°, 18 ft², width 3 ft)	1	90	0.176	0.2	100	85	181	287.4	495.5	759.2
VC.19: WINDOW - CASEMENT: North (A345.5°, 18 ft², width 3 ft)	1	90	0.176	0.2	100	85	181	287.4	495.5	759.2
VC.19: WINDOW - CASEMENT: North (A345.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	172.3	273.7	477.7	732
VC.19: WINDOW - CASEMENT: North (A345.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	172.3	273.7	477.7	732
VC.19: WINDOW - CASEMENT: North (A345.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	172.3	273.7	477.7	732
VC.19: WINDOW - CASEMENT: North (A345.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	99.3	84.1	172.3	271.8	477.7	732
VC.19: WINDOW - CASEMENT: North (A345.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	172.3	273.7	477.7	732
VC.19: WINDOW - CASEMENT: North (A345.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	90.2	77	155	246.8	477.7	732
VC.19: WINDOW - CASEMENT: North (A345.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	172.3	273.7	477.7	732
VC.19: WINDOW - CASEMENT: North (A345.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	172.3	273.7	477.7	732
VC.19: WINDOW - CASEMENT: North (A345.5°, 18 ft², width 3 ft)	1	90	0.176	0.2	100	85	181	287.4	495.5	759.2
VC.19: WINDOW - CASEMENT: North (A345.5°, 18 ft², width 3 ft)	1	90	0.176	0.2	100	85	181	287.4	495.5	759.2
VC.19: WINDOW - CASEMENT: North (A345.5°, 18 ft², width 3 ft)	1	90	0.176	0.2	90.1	77	162.7	259	495.5	759.2
VC.19: WINDOW - CASEMENT: West (A272.4°, 18 ft², width 3 ft)	1	90	0.176	0.2	90.2	84	283.6	492.9	495.5	759.2
VC.19: WINDOW - CASEMENT: West (A268.7°, 17.25 ft², width 2.875 ft)	1	90	0.179	0.2	72.9	62	240.6	376.9	481.4	737.5
VC.19: WINDOW - CASEMENT: West (A268.7°, 17.25 ft², width 2.875 ft)	1	90	0.179	0.2	100	85	330.4	517.2	481.4	737.5
VC.19: WINDOW - CASEMENT: West (A268.7°, 17.25 ft², width 2.875 ft)	1	90	0.179	0.2	100	85	330.4	517.2	481.4	737.5
VC.19: WINDOW - CASEMENT: West (A268.7°, 17.25 ft², width 2.875 ft)	1	90	0.179	0.2	100	85	330.4	517.2	481.4	737.5
VC.19: WINDOW - CASEMENT: West (A268.7°, 17.25 ft², width 2.875 ft)	1	90	0.179	0.2	100	85	330.4	517.2	481.4	737.5
VC.19: WINDOW - CASEMENT: West (A268.7°, 17.25 ft², width 2.875 ft)	1	90	0.179	0.2	100	85	330.4	517.2	481.4	737.5
VC.19: WINDOW - CASEMENT: West (A268.7°, 17.25 ft², width 2.875 ft)	1	90	0.179	0.2	100	85	330.4	517.2	481.4	737.5
VC.19: WINDOW - CASEMENT: West (A268.7°, 17.25 ft², width 2.875 ft)	1	90	0.179	0.2	100	85	330.4	517.2	481.4	737.5
VC.19: WINDOW - CASEMENT: West (A268.7°, 17.25 ft², width 2.875 ft)	1	90	0.179	0.2	100	85	330.4	517.2	481.4	737.5
VC.19: WINDOW - CASEMENT: West (A268.7°, 17.25 ft², width 2.875 ft)	1	90	0.179	0.2	100	85	330.4	517.2	481.4	737.5
VC.19: WINDOW - CASEMENT: West (A268.7°, 17.25 ft², width 2.875 ft)	1	90	0.179	0.2	100	85	330.4	517.2	481.4	737.5
VC.19: WINDOW - CASEMENT: West (A268.7°, 17.25 ft², width 2.875 ft)	1	90	0.179	0.2	100	85	330.4	517.2	481.4	737.5
VC.19: WINDOW - CASEMENT: West (A268.7°, 17.25 ft², width 2.875 ft)	1	90	0.179	0.2	100	85	330.4	517.2	481.4	737.5
VC.19: WINDOW - CASEMENT: West (A268.7°, 17.25 ft², width 2.875 ft)	1	90	0.179	0.2	100	85	330.4	517.2	481.4	737.5
VC.19: WINDOW - CASEMENT: East (A94.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	91.1	83.8	301.7	486	477.7	732
VC.19: WINDOW - CASEMENT: East (A94.5°, 18 ft², width 3 ft)	1	90	0.176	0.2	100	85	367.1	560	495.5	759.2
VC.19: WINDOW - CASEMENT: East (A94.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	349.6	533.2	477.7	732
VC.19: WINDOW - CASEMENT: East (A94.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	349.6	533.2	477.7	732
VC.19: WINDOW - CASEMENT: East (A94.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	349.6	533.2	477.7	732
VC.19: WINDOW - CASEMENT: East (A94.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	349.6	533.2	477.7	732
VC.19: WINDOW - CASEMENT: East (A94.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	349.6	533.2	477.7	732
VC.19: WINDOW - CASEMENT: East (A94.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	349.6	533.2	477.7	732
VC.19: WINDOW - CASEMENT: East (A94.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	349.6	533.2	477.7	732
VC.19: WINDOW - CASEMENT: East (A94.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	349.6	533.2	477.7	732
VC.19: WINDOW - CASEMENT: East (A94.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	349.6	533.2	477.7	732
VC.19: WINDOW - CASEMENT: East (A94.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	349.6	533.2	477.7	732
VC.19: WINDOW - CASEMENT: East (A94.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	349.6	533.2	477.7	732
VC.19: WINDOW - CASEMENT: East (A94.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	349.6	533.2	477.7	732
VC.19: WINDOW - CASEMENT: East (A94.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	349.6	533.2	477.7	732
VC.19: WINDOW - CASEMENT: East (A94.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	349.6	533.2	477.7	732
VC.19: WINDOW - CASEMENT: East (A94.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	349.6	533.2	477.7	732
VC.19: WINDOW - CASEMENT: East (A94.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	349.6	533.2	477.7	732
VC.19: WINDOW - CASEMENT: East (A94.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	349.6	533.2	477.7	732
VC.19: WINDOW - CASEMENT: East (A94.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	349.6	533.2	477.7	732
VC.19: WINDOW - CASEMENT: East (A94.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	99.6	85	347	531	477.7	732

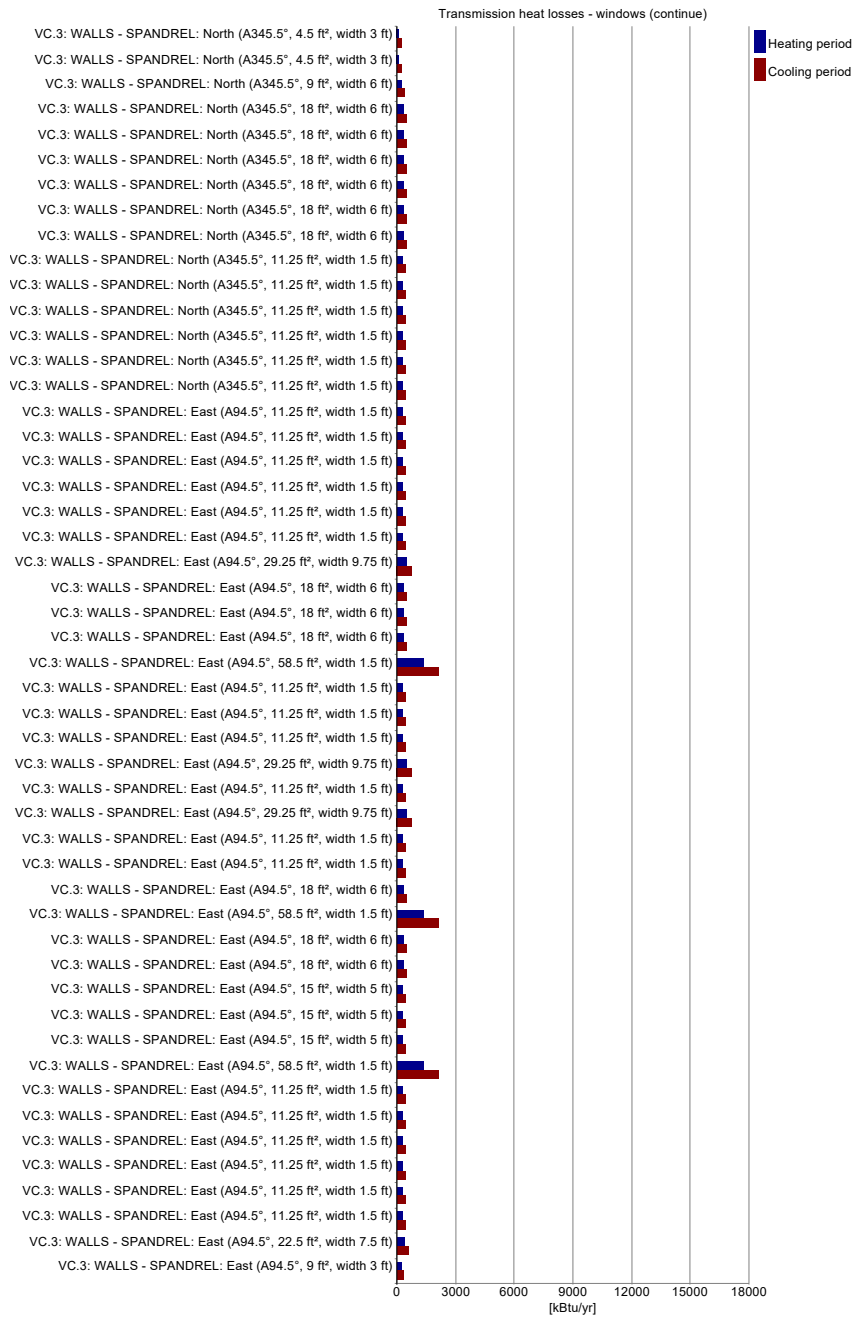
Transmission heat losses - windows (continue)

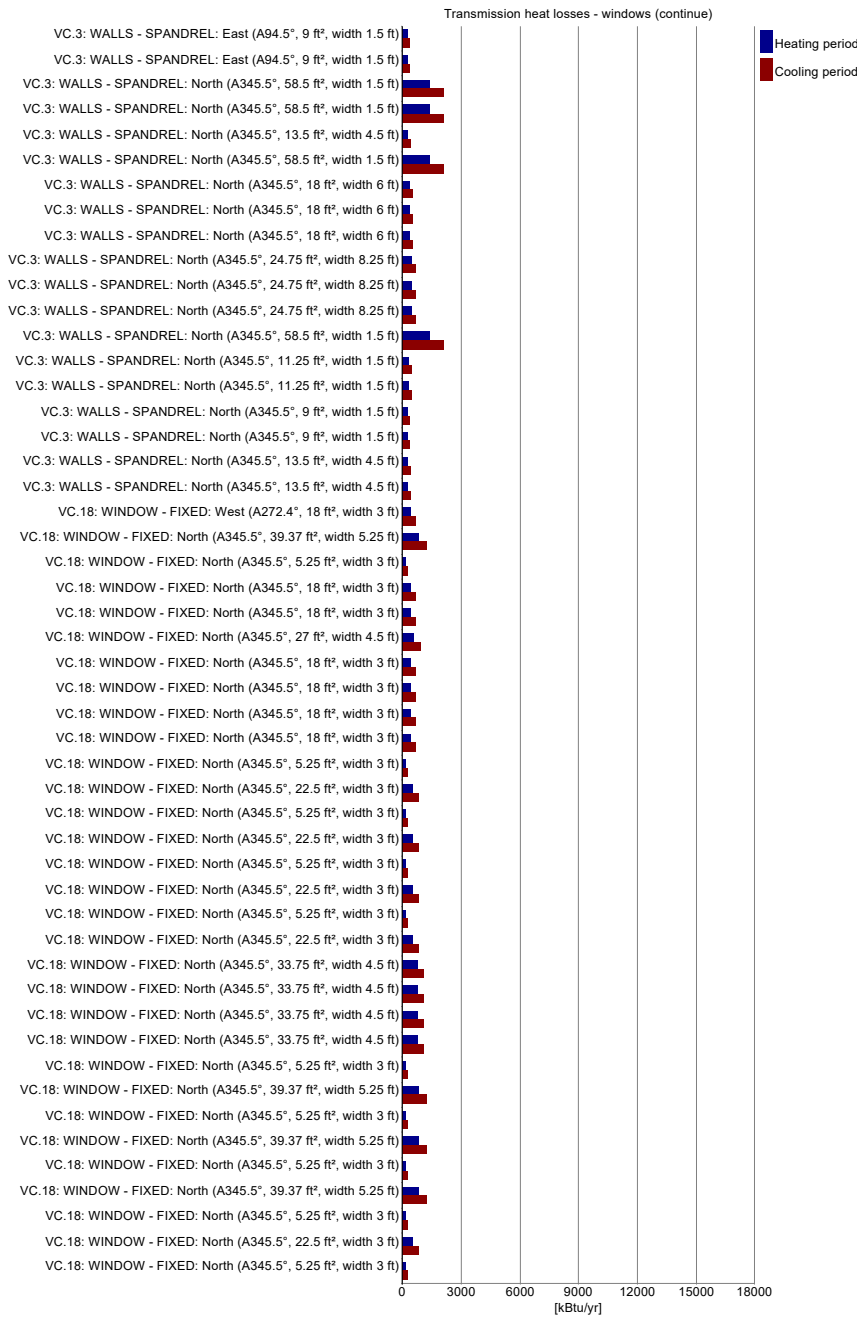
Name	Quantity	Inclination [°]	U-value total [Btu/hr ft² °F]	SHGC (perpendicular)	Reduction factor shading [%]	Reduction factor shading summer [%]	Solar gain heating [kBtu/yr]	Solar gain cooling [kBtu/yr]	Transmission losses heating [kBtu/yr]	Transmission losses cooling [kBtu/yr]
VC.19: WINDOW - CASEMENT: East (A94.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	349.6	533.2	477.7	732
VC.19: WINDOW - CASEMENT: East (A94.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	349.6	533.2	477.7	732
VC.19: WINDOW - CASEMENT: East (A94.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	349.6	533.2	477.7	732
VC.19: WINDOW - CASEMENT: East (A94.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	349.6	533.2	477.7	732
VC.19: WINDOW - CASEMENT: East (A94.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	349.6	533.2	477.7	732
VC.19: WINDOW - CASEMENT: East (A94.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	349.6	533.2	477.7	732
VC.19: WINDOW - CASEMENT: East (A94.5°, 18 ft², width 3 ft)	1	90	0.176	0.2	100	85	367.1	560	495.5	759.2
VC.19: WINDOW - CASEMENT: East (A94.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	349.6	533.2	477.7	732
VC.19: WINDOW - CASEMENT: East (A94.5°, 18 ft², width 3 ft)	1	90	0.176	0.2	100	85	367.1	560	495.5	759.2
VC.19: WINDOW - CASEMENT: East (A94.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	349.6	533.2	477.7	732
VC.19: WINDOW - CASEMENT: East (A94.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	349.6	533.2	477.7	732
VC.19: WINDOW - CASEMENT: East (A94.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	349.6	533.2	477.7	732
VC.19: WINDOW - CASEMENT: East (A94.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	349.6	533.2	477.7	732
VC.19: WINDOW - CASEMENT: East (A94.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	349.6	533.2	477.7	732
VC.19: WINDOW - CASEMENT: East (A94.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	90.8	83.6	300.8	484.4	477.7	732
VC.19: WINDOW - CASEMENT: East (A94.5°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	90.8	83.6	300.8	484.4	477.7	732
VC.19: WINDOW - CASEMENT: South (A182.4°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	80.4	57.7	459.9	563.9	477.7	732
VC.19: WINDOW - CASEMENT: South (A182.4°, 18 ft², width 3 ft)	1	90	0.176	0.2	100	85	561.2	736.8	495.5	759.2
VC.19: WINDOW - CASEMENT: South (A182.4°, 18 ft², width 3 ft)	1	90	0.176	0.2	81.4	58	490.7	599.8	495.5	759.2
VC.19: WINDOW - CASEMENT: South (A182.4°, 18 ft², width 3 ft)	1	90	0.176	0.2	100	85	561.2	736.8	495.5	759.2
VC.19: WINDOW - CASEMENT: South (A182.4°, 18 ft², width 3 ft)	1	90	0.176	0.2	81.4	58	490.7	599.7	495.5	759.2
VC.19: WINDOW - CASEMENT: South (A182.4°, 18 ft², width 3 ft)	1	90	0.176	0.2	100	85	561.2	736.8	495.5	759.2
VC.19: WINDOW - CASEMENT: South (A182.4°, 18 ft², width 3 ft)	1	90	0.176	0.2	87.2	71.4	496.9	642.2	495.5	759.2
VC.19: WINDOW - CASEMENT: South (A182.4°, 18 ft², width 3 ft)	1	90	0.176	0.2	81.4	58	490.7	599.8	495.5	759.2
VC.19: WINDOW - CASEMENT: South (A182.4°, 18 ft², width 3 ft)	1	90	0.176	0.2	100	85	561.2	736.8	495.5	759.2
VC.19: WINDOW - CASEMENT: South (A182.4°, 18 ft², width 3 ft)	1	90	0.176	0.2	100	85	561.2	736.8	495.5	759.2
VC.19: WINDOW - CASEMENT: South (A182.4°, 18 ft², width 3 ft)	1	90	0.176	0.2	100	85	561.2	736.8	495.5	759.2
VC.19: WINDOW - CASEMENT: South (A182.4°, 18 ft², width 3 ft)	1	90	0.176	0.2	100	85	561.2	736.8	495.5	759.2
VC.19: WINDOW - CASEMENT: South (A182.4°, 18 ft², width 3 ft)	1	90	0.176	0.2	100	85	561.2	736.8	495.5	759.2
VC.19: WINDOW - CASEMENT: South (A182.4°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	534.4	701.6	477.7	732
VC.19: WINDOW - CASEMENT: South (A182.4°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	534.4	701.6	477.7	732
VC.19: WINDOW - CASEMENT: South (A182.4°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	80.4	57.7	459.9	563.9	477.7	732
VC.19: WINDOW - CASEMENT: South (A182.4°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	534.4	701.6	477.7	732
VC.19: WINDOW - CASEMENT: South (A182.4°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	534.4	701.6	477.7	732
VC.19: WINDOW - CASEMENT: South (A182.4°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	80.3	57.6	459.7	563.4	477.8	732
VC.19: WINDOW - CASEMENT: South (A182.4°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	534.4	701.6	477.8	732
VC.19: WINDOW - CASEMENT: South (A182.4°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	534.4	701.6	477.8	732
VC.19: WINDOW - CASEMENT: South (A182.4°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	534.4	701.6	477.7	732
VC.19: WINDOW - CASEMENT: South (A182.4°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	534.4	701.6	477.7	732
VC.19: WINDOW - CASEMENT: South (A182.4°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	534.4	701.6	477.8	732
VC.19: WINDOW - CASEMENT: South (A182.4°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	534.4	701.6	477.8	732
VC.19: WINDOW - CASEMENT: South (A182.4°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	534.4	701.6	477.7	732
VC.19: WINDOW - CASEMENT: South (A182.4°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	534.4	701.6	477.7	732
VC.19: WINDOW - CASEMENT: South (A182.4°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	534.4	701.6	477.7	732
VC.19: WINDOW - CASEMENT: South (A182.4°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	534.4	701.6	477.8	732
VC.19: WINDOW - CASEMENT: South (A182.4°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	534.4	701.6	477.7	732
VC.19: WINDOW - CASEMENT: South (A182.4°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	534.4	701.6	477.7	732
VC.19: WINDOW - CASEMENT: South (A182.4°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	80.3	57.6	459.8	563.7	477.7	732
VC.19: WINDOW - CASEMENT: South (A182.4°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	534.4	701.6	477.7	732
VC.19: WINDOW - CASEMENT: South (A182.4°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	96.7	78.8	524.6	678.1	477.7	732
VC.19: WINDOW - CASEMENT: South (A182.4°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	80	57.1	458.9	561.3	477.7	732

Transmission heat losses - windows (continue)

Name	Quantity	Inclination [°]	U-value total [Btu/hr ft² °F]	SHGC (perpendicular)	Reduction factor shading [%]	Reduction factor shading summer [%]	Solar gain heating [kBtu/yr]	Solar gain cooling [kBtu/yr]	Transmission losses heating [kBtu/yr]	Transmission losses cooling [kBtu/yr]
VC.19: WINDOW - CASEMENT: South (A182.4°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	534.4	701.6	477.7	732
VC.19: WINDOW - CASEMENT: South (A182.4°, 17.25 ft², width 3 ft)	1	90	0.177	0.2	100	85	534.4	701.6	477.7	732
VC.19: WINDOW - CASEMENT: South (A182.4°, 18 ft², width 3 ft)	1	90	0.176	0.2	100	85	561.2	736.8	495.5	759.2
VC.20: WINDOW - STOREFRONT (FIRST FLOOR): North (A345.5°, 38.06 ft², width 5.25 ft)	1	90	0.334	0.3	54.4	55.3	356.4	676.2	1,987.5	3,045.3
VC.20: WINDOW - STOREFRONT (FIRST FLOOR): North (A345.5°, 38.06 ft², width 5.25 ft)	1	90	0.334	0.3	61.2	62.2	401.6	761.2	1,987.5	3,045.3
VC.20: WINDOW - STOREFRONT (FIRST FLOOR): North (A345.5°, 38.06 ft², width 5.25 ft)	1	90	0.334	0.3	60.3	61.3	396.1	750.3	1,987.5	3,045.3
VC.20: WINDOW - STOREFRONT (FIRST FLOOR): North (A345.5°, 17.06 ft², width 5.25 ft)	1	90	0.356	0.3	43.5	43.3	121.9	226.6	950	1,455.6
VC.20: WINDOW - STOREFRONT (FIRST FLOOR): North (A345.5°, 17.06 ft², width 5.25 ft)	1	90	0.356	0.3	40.1	40.4	110.8	208.8	950	1,455.6
VC.20: WINDOW - STOREFRONT (FIRST FLOOR): North (A345.5°, 17.06 ft², width 5.25 ft)	1	90	0.356	0.3	43.7	43.9	121.1	227.3	950	1,455.6
VC.20: WINDOW - STOREFRONT (FIRST FLOOR): North (A345.5°, 7.25 ft², width 1 ft)	1	90	0.442	0.3	73.2	73.6	62.2	116.7	501.2	767.9
VC.20: WINDOW - STOREFRONT (FIRST FLOOR): North (A345.5°, 7.25 ft², width 1 ft)	1	90	0.442	0.3	77.2	77.5	65.9	123.1	501.2	767.9
VC.20: WINDOW - STOREFRONT (FIRST FLOOR): North (A345.5°, 27.08 ft², width 8.333 ft)	1	90	0.348	0.3	45.9	45.8	208.7	389.8	1,471.2	2,254.1
VC.20: WINDOW - STOREFRONT (FIRST FLOOR): North (A345.5°, 18.69 ft², width 5.75 ft)	1	90	0.354	0.3	51.9	51	161.7	297.7	1,034.5	1,585.1
VC.20: WINDOW - STOREFRONT (FIRST FLOOR): North (A345.5°, 18.69 ft², width 5.75 ft)	1	90	0.354	0.3	53.7	52.8	167.7	308.2	1,034.5	1,585.1
VC.20: WINDOW - STOREFRONT (FIRST FLOOR): North (A345.5°, 41.69 ft², width 5.75 ft)	1	90	0.332	0.3	69.5	70.2	509.7	954.1	2,162.4	3,313.2
VC.20: WINDOW - STOREFRONT (FIRST FLOOR): North (A345.5°, 41.69 ft², width 5.75 ft)	1	90	0.332	0.3	71.5	73.2	518.3	980.6	2,162.4	3,313.2
VC.20: WINDOW - STOREFRONT (FIRST FLOOR): North (A345.5°, 24 ft², width 4 ft)	1	90	0.346	0.3	71.7	74.6	282.2	542.8	1,296.7	1,986.8
VC.20: WINDOW - STOREFRONT (FIRST FLOOR): East (A94.5°, 21 ft², width 6 ft)	1	90	0.35	0.3	100	100	708.5	1,271.6	1,150.1	1,762.2
VC.20: WINDOW - STOREFRONT (FIRST FLOOR): East (A94.5°, 42 ft², width 6 ft)	1	90	0.332	0.3	100	100	1,502.1	2,695.9	2,176.5	3,334.8
VC.20: WINDOW - STOREFRONT (FIRST FLOOR): NE (A46.6°, 31.5 ft², width 4.5 ft)	1	90	0.339	0.3	83.4	88	545.9	1,632.1	1,668.9	2,557
VC.20: WINDOW - STOREFRONT (FIRST FLOOR): NE (A46.6°, 15.75 ft², width 4.5 ft)	1	90	0.357	0.3	73.7	77.2	229.5	681.6	879.6	1,347.7
VC.20: WINDOW - STOREFRONT (FIRST FLOOR): East (A94.5°, 8.75 ft², width 1.25 ft)	1	90	0.416	0.3	77.4	82.1	173.3	324.8	568.9	871.7
VC.21: WINDOW - STOREFRONT (AMENITY DECK): North (A2.4°, 60.75 ft², width 9 ft)	1	90	0.325	0.3	100	100	1,069.7	2,041.4	3,084.6	4,726.2
VC.21: WINDOW - STOREFRONT (AMENITY DECK): North (A2.4°, 52.31 ft², width 7.75 ft)	1	90	0.327	0.3	100	100	914.7	1,745.5	2,675.7	4,099.7
VC.21: WINDOW - STOREFRONT (AMENITY DECK): North (A2.4°, 20.25 ft², width 3 ft)	1	90	0.354	0.3	100	100	325.6	621.3	1,121.8	1,718.8
VC.21: WINDOW - STOREFRONT (AMENITY DECK): East (A92.4°, 60.75 ft², width 9 ft)	1	90	0.325	0.3	100	100	2,171.8	3,977.7	3,084.6	4,726.2
VC.22: WINDOW - BALCONY DOOR: North (A345.5°, 22.5 ft², width 3 ft)	1	90	0.634	0.4	96.4	99	384.8	730.7	2,228.5	3,414.4
VC.22: WINDOW - BALCONY DOOR: North (A345.5°, 22.5 ft², width 3 ft)	1	90	0.634	0.4	100	100	405.7	758	2,228.5	3,414.4
VC.22: WINDOW - BALCONY DOOR: North (A345.5°, 22.5 ft², width 3 ft)	1	90	0.634	0.4	100	100	405.7	758	2,228.5	3,414.4
VC.22: WINDOW - BALCONY DOOR: North (A345.5°, 22.5 ft², width 3 ft)	1	90	0.634	0.4	100	100	405.7	758	2,228.5	3,414.4
VC.22: WINDOW - BALCONY DOOR: North (A345.5°, 22.5 ft², width 3 ft)	1	90	0.634	0.4	100	100	405.7	758	2,228.5	3,414.4
VC.22: WINDOW - BALCONY DOOR: North (A345.5°, 22.5 ft², width 3 ft)	1	90	0.634	0.4	89.1	90.4	357.8	675.3	2,228.5	3,414.4
VC.22: WINDOW - BALCONY DOOR: North (A345.5°, 22.5 ft², width 3 ft)	1	90	0.634	0.4	94.6	97.5	372.8	716.7	2,228.5	3,414.4
VC.22: WINDOW - BALCONY DOOR: North (A345.5°, 22.5 ft², width 3 ft)	1	90	0.634	0.4	93.2	96	370.1	706.5	2,228.5	3,414.4
VC.23: GLAZED ENTRYWAY: East (A94.5°, 24 ft², width 3 ft)	1	90	0.633	0.4	71.8	72.2	635.4	1,136.8	2,373.1	3,636
VC.23: GLAZED ENTRYWAY: North (A345.5°, 26.13 ft², width 3.167 ft)	1	90	0.63	0.4	67.2	68.1	319.6	601.7	2,570.9	3,939.1
VC.23: GLAZED ENTRYWAY: North (A345.5°, 26.12 ft², width 3.167 ft)	1	90	0.63	0.4	65	65.7	309.9	581.9	2,570.9	3,939.1











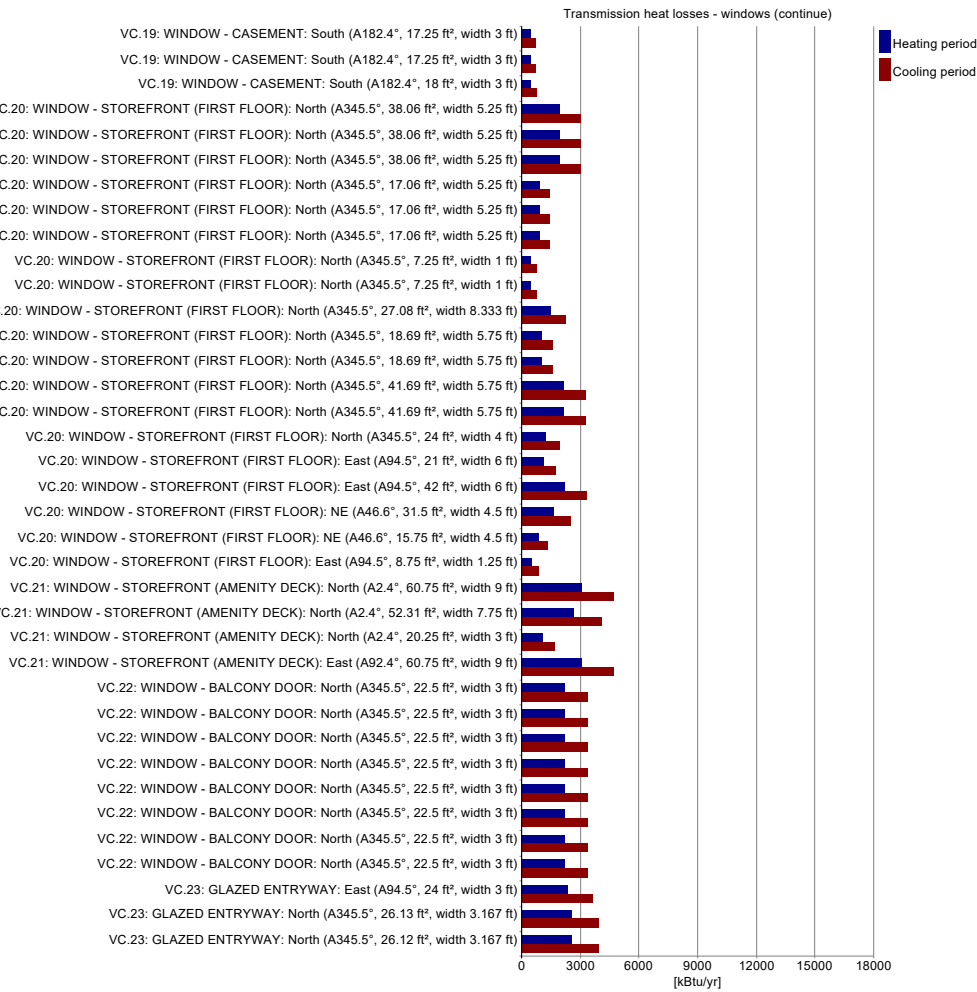






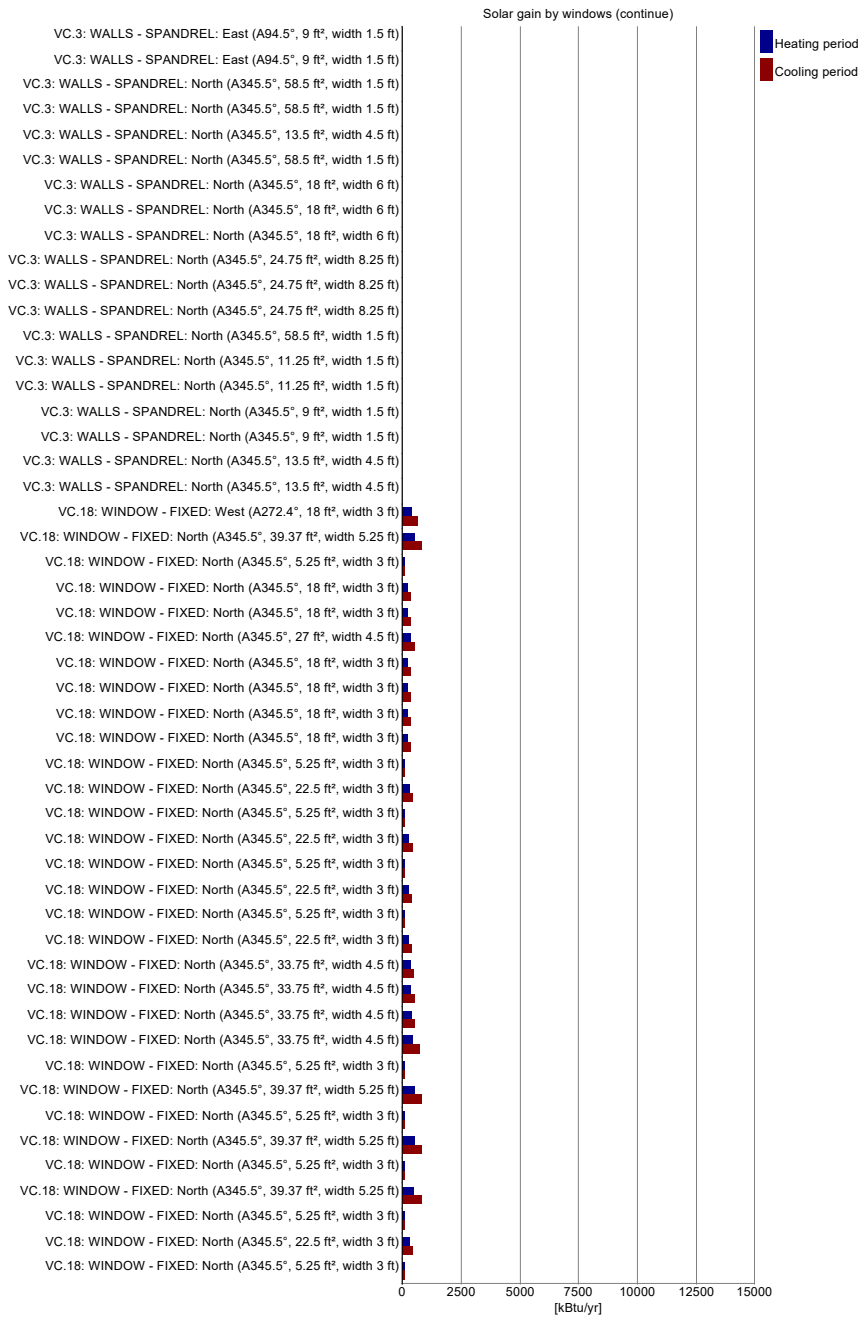




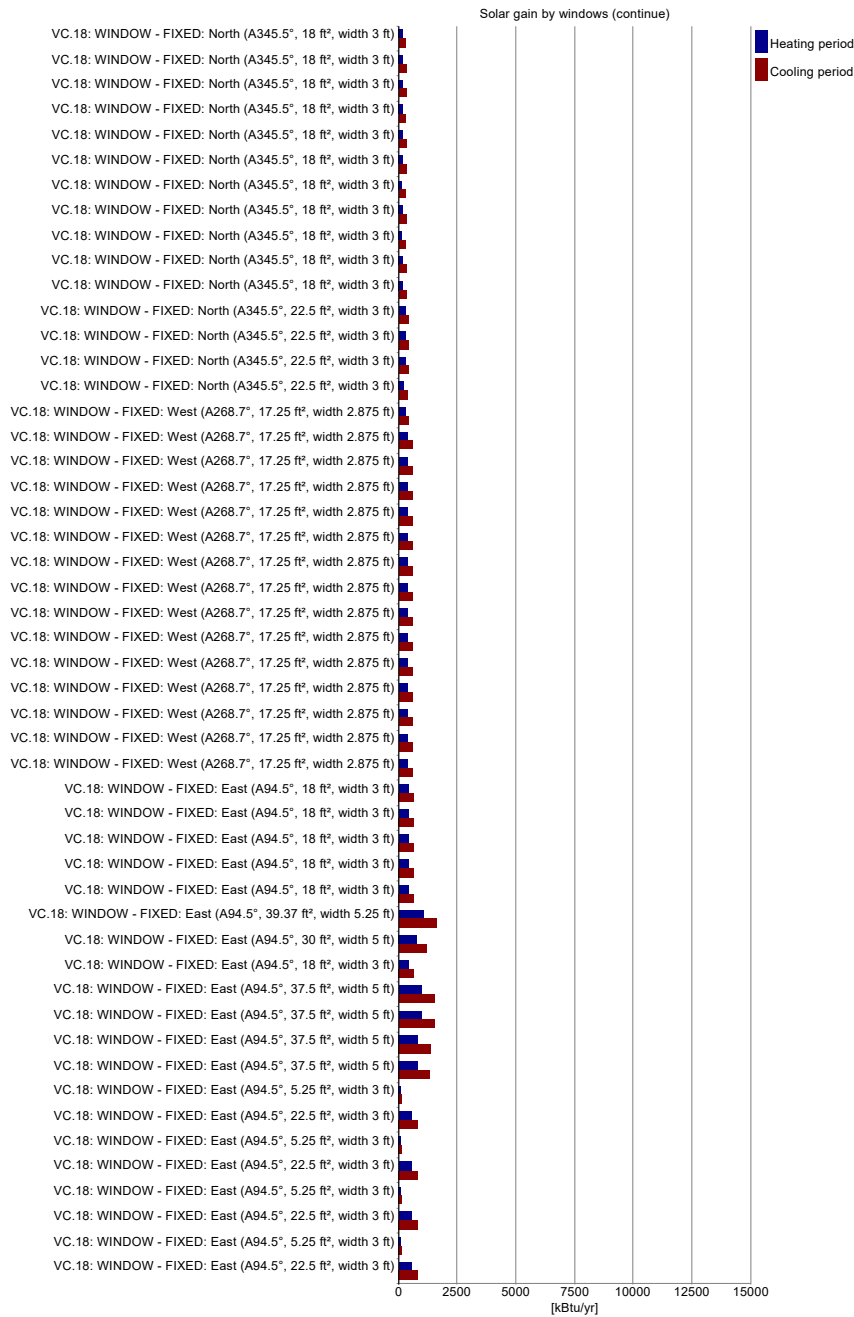












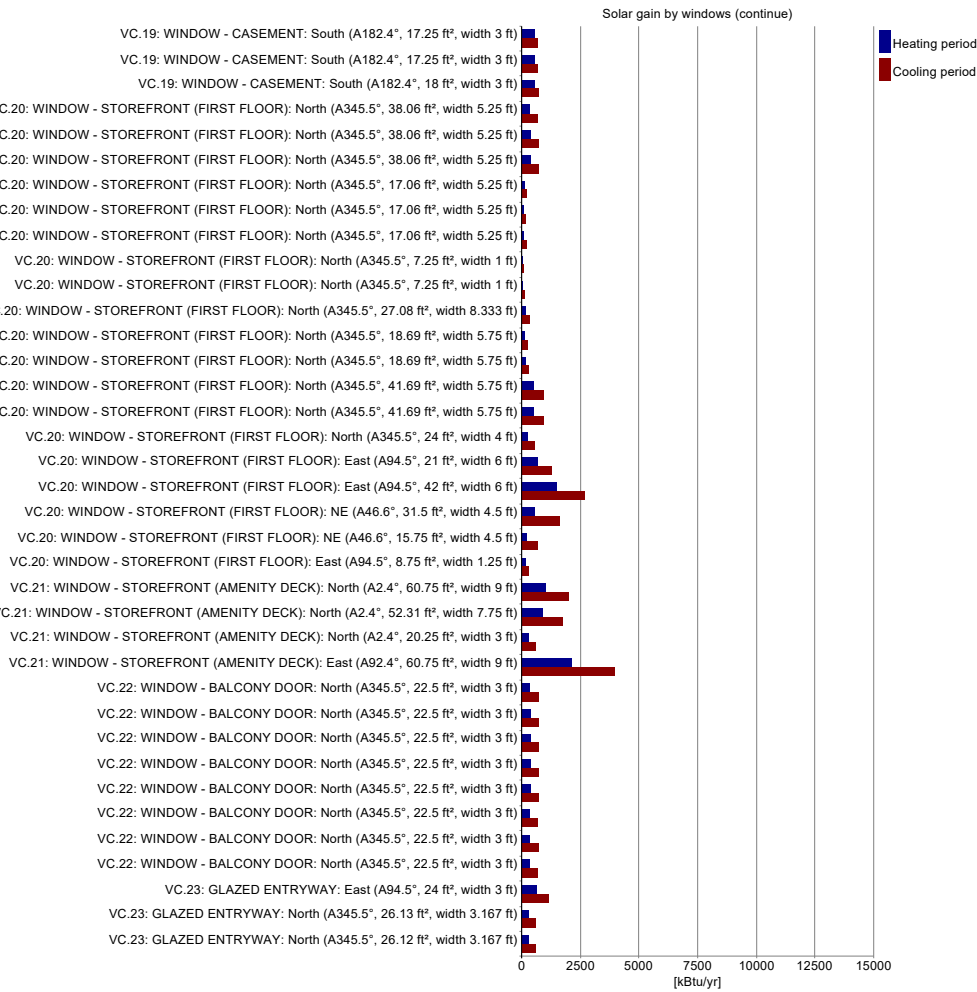












## Summary building envelope

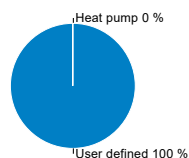
	Total area / length	Average U-value / Psi value	Transmission losses
Exterior wall ambient:	<b>20,400.6</b> ft <sup>2</sup>	<b>0.037</b> Btu/hr ft <sup>2</sup> °F	<b>118,548.7</b> kBtu/yr
Exterior wall ground:	<b>2,147</b> ft <sup>2</sup>	<b>0.11</b> Btu/hr ft <sup>2</sup> °F	<b>9,019.5</b> kBtu/yr
Basement:	<b>5,520</b> ft <sup>2</sup>	<b>0.147</b> Btu/hr ft <sup>2</sup> °F	<b>30,934.4</b> kBtu/yr
Roof:	<b>11,138.8</b> ft <sup>2</sup>	<b>0.033</b> Btu/hr ft <sup>2</sup> °F	<b>57,617.9</b> kBtu/yr
Windows:	<b>9,513.6</b> ft <sup>2</sup>	<b>0.182</b> Btu/hr ft <sup>2</sup> °F	<b>270,877.7</b> kBtu/yr
Doors:	<b>43.1</b> ft <sup>2</sup>	<b>0.168</b> Btu/hr ft <sup>2</sup> °F	<b>1,128.4</b> kBtu/yr
Thermal bridge ambient:	<b>0</b> ft	<b>0</b> Btu/hr ft °F	<b>0</b> kBtu/yr
Thermal bridge perimeter:	<b>0</b> ft	<b>0</b> Btu/hr ft °F	<b>0</b> kBtu/yr
Thermal bridge floor slab:	<b>0</b> ft	<b>0</b> Btu/hr ft °F	<b>0</b> kBtu/yr

## Shading

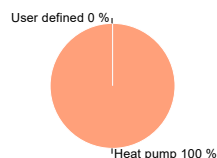
	Heating	Cooling
Reduction factor North:	<b>90.6</b> %	<b>80.7</b> %
Reduction factor East:	<b>98.5</b> %	<b>85.8</b> %
Reduction factor South:	<b>95.9</b> %	<b>79.2</b> %
Reduction factor West:	<b>97.9</b> %	<b>83.5</b> %
Reduction factor Horizontal:	<b>100</b> %	<b>100</b> %

System	DHW			Heating			Total		
	Covered DHW demand [%]	Estimated solar fraction [%]	Final energy demand [kBtu/yr]	Covered heating demand [%]	Estimated solar fraction [%]	Final energy demand [kBtu/yr]	Performance ratio	CO2 equivalent emissions [lb/yr]	Source energy demand [kBtu/yr]
Heat pump, EPHOCA + DAIKIN MINI-SPLITS	0	0	0	100	0	120,685.6	0	53,029,666.5	241,371.3
User defined, RHEEM PROPE50 M2 RH92 4.5 kW EWH	100	0	327,781.7	0	0	0	1.1	20,097,827	655,563.4
Σ	100	0	327,781.7	100	0	120,685.6		73,127,493.5	896,934.6

DHW - final energy



Heating - final energy



## COOLING UNITS

	sensible	latent
Air cooling:	<b>0</b> kBtu/ft <sup>2</sup> yr	<b>0</b> kBtu/ft <sup>2</sup> yr
Recirculation cooling:	<b>5.2</b> kBtu/ft <sup>2</sup> yr	<b>0</b> kBtu/ft <sup>2</sup> yr
Additional dehumidification:		<b>0.5</b> kBtu/ft <sup>2</sup> yr
Panel cooling:	<b>0</b> kBtu/ft <sup>2</sup> yr	
<b>Sum:</b>	<b>5.2</b> kBtu/ft <sup>2</sup> yr	<b>0.5</b> kBtu/ft <sup>2</sup> yr

## VENTILATION

### Energy transportable by supply air

#### Heating energy

transportable: **2.72 W/ft<sup>2</sup>**  
 load: **1.21 W/ft<sup>2</sup>**



#### Cooling energy

transportable: **1.62 W/ft<sup>2</sup>**  
 load: **0.89 W/ft<sup>2</sup>**



Infiltration pressure test ACH50: **0.55 1/hr**  
 Total extract air demand: **7,605 cfm**  
 Supply air per person: **18 cfm**  
 Occupancy: **121**

Average air flow rate: **7,605 cfm**  
 Average air change rate: **0.84 1/hr**  
 Effective ACH ambient: **0.22 1/hr**  
 Effective ACH ground: **0 1/hr**  
 Energetically effective air exchange: **0.22 1/hr**  
 Infiltration air change rate: **0.04 1/hr**  
 Infiltration air change rate (heating load): **0.1 1/hr**

Type of ventilation system: **Balanced PH ventilation**  
 Wind screening coefficient (e): **0.07**  
 Wind exposure factor: **15**  
 Wind shield factor: **0.05**

Ventilation heat losses: **301,287.19 kBtu/yr**

#### Devices

Name	Sensible recovery efficiency [-]	Electric efficiency [W/cfm]	Heat recovery efficiency SHX [-]	Effective recovery efficiency [-]
RESIDENTIAL: EPHOCA (100 CFM)	0.8	0.02	0	0.8
RESIDENTIAL: PANASONIC - 2 BED (110 CFM)	0.8	0.03	0	0.8
RESIDENTIAL: PANASONIC - 3 BED (135 CFM)	0.8	0.04	0	0.8
COMMON: CENTRAL ERV	0.7	0.07	0	0.7
Altogether	0.8	0.03	0	0.8

#### Ducts

Name	Length (total) [ft]	Clear cross-section [ft <sup>2</sup> ]	U-value [Btu/hr ft <sup>2</sup> °F]	Assigned ventilation units
ERV Supply	10	0.25	1.52	RESIDENTIAL: EPHOCA (100 CFM), COMMON: CENTRAL ERV
ERV Exhaust	10	0.25	1.52	RESIDENTIAL: EPHOCA (100 CFM), COMMON: CENTRAL ERV
Σ	20			

\*length \* quantity

\*\* thermal conductivity / thickness

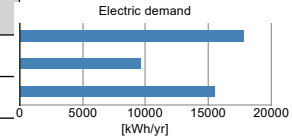
### SUMMER VENTILATION

Overheating temperature:

77 °F

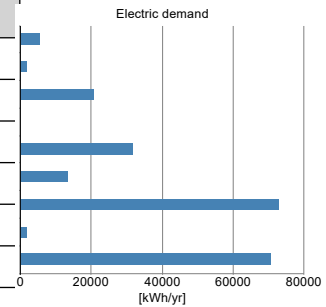
## ELECTRICITY DEMAND - AUXILIARY ELECTRICITY

Type	Quantity	Indoor	Norm demand	Electric demand [kWh/yr]	Source energy [kBtu/yr]
Ventilation winter	1	yes	0.5 W/cfm	17804.6	121491.9
Ventilation Defrost	1	yes	40,618 W	9583.8	65396.3
Ventilation summer	1	yes	0.5 W/cfm	15482.4	105645.8
Σ				42870.9	292534.1



## ELECTRICITY DEMAND RESIDENTIAL BUILDING

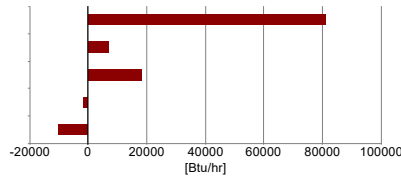
Type	Quantity	Indoor	Norm demand	Electric demand [kWh/yr]	Non-electric demand [kWh/yr]	Source energy [kBtu/yr]
Kitchen dishwasher	1	yes	1.3	5447.8	0	37173.4
Laundry - washer	1	yes	0.3	1840.5	0	12559
Laundry - dryer	1	yes	3.3	20661.3	0	140984.7
Energy consumed by evaporation	0	yes	3.1	0	1588.5	10839.1
Kitchen fridge/freeze combo	1	yes	1.2	31595	0	215591.9
Kitchen cooking	1	yes	0.2	13310	0	90822.2
User defined lighting	1	yes	73,193	73193	0	499440.5
User defined lighting	1	yes	1,856	1856	0	12664.6
User defined MELs	1	yes	70,554	70554	0	481433
Σ	8			218457.6	1588.5	1501508.4



## INTERNAL HEAT GAINS

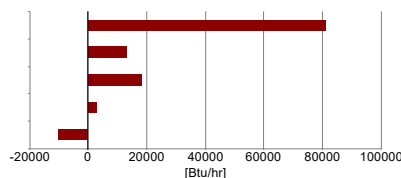
### Heating season

Electricity total: **81,149.4** Btu/hr  
 Auxiliary electricity: **6,979.2** Btu/hr  
 People: **18,166.2** Btu/hr  
 Cold water: **-1,688.5** Btu/hr  
 Evaporation: **-10,321.7** Btu/hr  
 Σ: **94,284.5** Btu/hr  
 Specific internal heat gains: **1.6** Btu/hr ft<sup>2</sup>



### Cooling season

Electricity total: **81,149.4** Btu/hr  
 Auxiliary electricity: **12,965.8** Btu/hr  
 People: **18,166.2** Btu/hr  
 Cold and hot water: **2,832.7** Btu/hr  
 Evaporation: **-10,321.7** Btu/hr  
 Σ: **94,284.5** Btu/hr



## DHW AND DISTRIBUTION

DHW consumption per person per day:	<b>6.6</b> gal/Person/day
Average cold water temperature supply:	<b>50</b> °F
Useful heat DHW:	<b>278,530.9</b> kBtu/yr
Specific useful heat DHW:	<b>4,645.6</b> Btu/ft <sup>2</sup> yr
Total heat losses of the DHW system:	<b>25,083.1</b> kBtu/yr
Specific losses of the DHW system:	<b>418.4</b> Btu/ft <sup>2</sup> yr
Performance ratio DHW distribution system and storage:	<b>1.1</b>
Utilization ratio DHW distribution system and storage:	<b>0.9</b>
Total heat demand of DHW system:	<b>303,614</b> kBtu/yr
Total specific heat demand of DHW system:	<b>5,063.9</b> Btu/ft <sup>2</sup> yr
Total heat losses of the hydronic heating distribution:	<b>0</b> kBtu/yr
Specific losses of the hydronic heating distribution:	<b>0</b> Btu/ft <sup>2</sup> yr
Performance ratio of heat distribution:	<b>100</b> %

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