



March Webinar: Feasibility Study Checklist

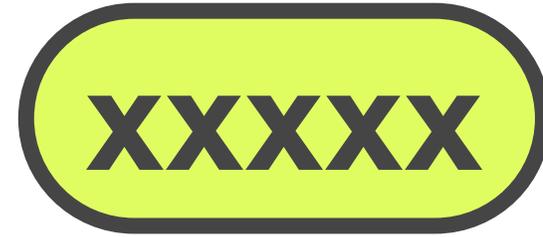
March 10, 2026



Event Approved for
Phius CEUs

Mar. Webinar: Feasibility Study Checklist

Earn 1.0 CEU



Self Report Code
Coming Later

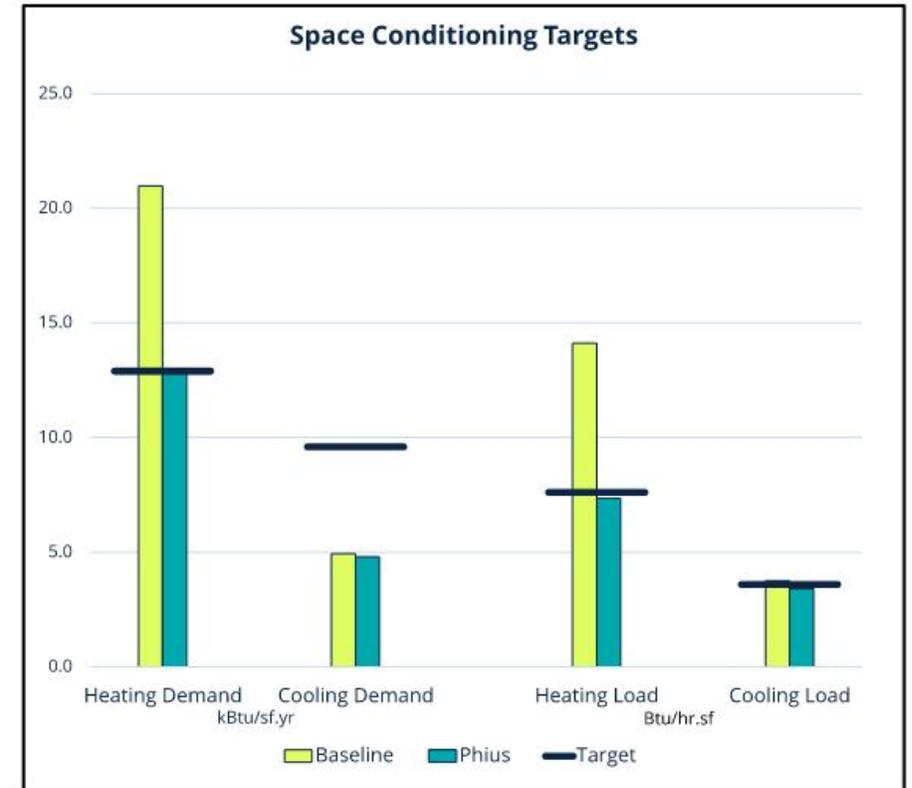
Self Report @

[www.phius.org/certifications/
professionals/maintain-credentials](http://www.phius.org/certifications/professionals/maintain-credentials)



1. Getting Started
2. General Process
3. Pre-modeling documentation
4. Takeoffs & Calculators
5. Geometry
6. Calculate targets
7. WUFI Passive / METr Modeling
 - a. Orientation
 - b. Opaque assemblies & Fenestration
 - c. Thermal bridges
 - d. Internal Loads & Occupancy
 - e. Ventilation/Rooms
 - f. Systems
 - i. Devices
 - ii. Distribution
8. Informing the Design with WUFI Passive / METr Reports

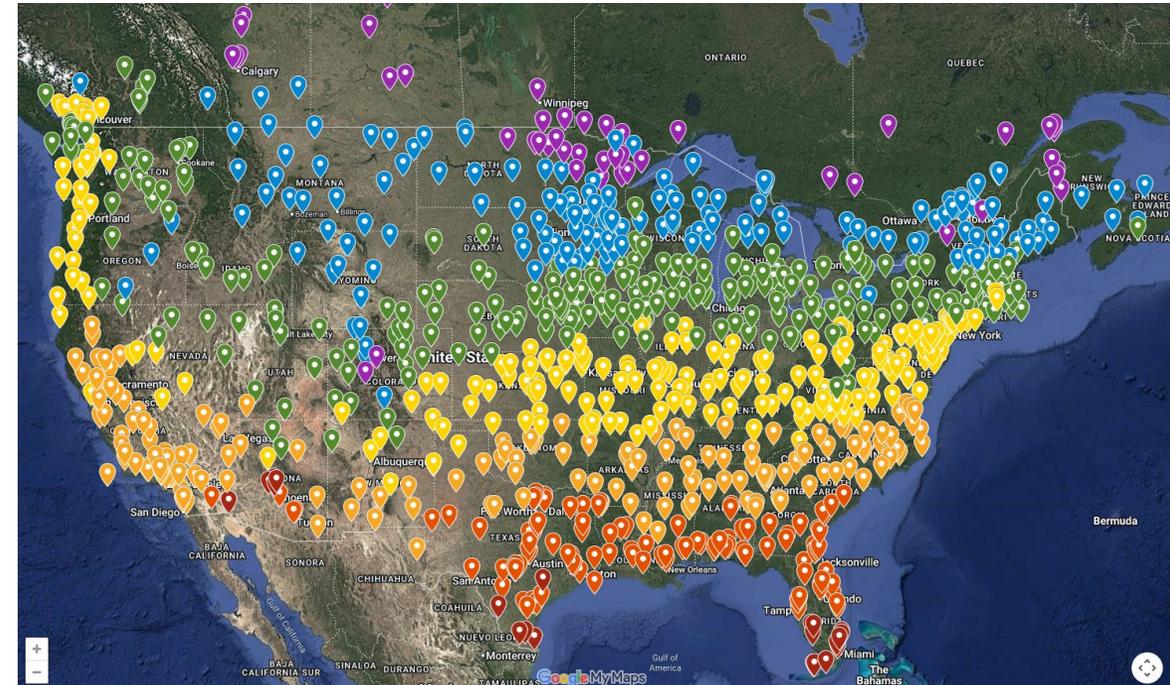
- Establish the intent of the feasibility study
 - Check design for compliance with Phius targets?
 - Convincing a client?
 - i.e. Code comparison / utility savings
 - Other?



	General Process	Complete
Step 1	Collect necessary documentation	<input type="checkbox"/>
Step 2	Complete takeoffs & preliminary calculations (i.e. occupancy)	<input type="checkbox"/>
Step 3	Model the SketchUp geometry & import to WUFI/METr	<input type="checkbox"/>
Step 4	Complete the WUFI/METr model for the <i>Baseline Case</i>	<input type="checkbox"/>
Step 5	Review the <i>Baseline Case</i> for accuracy	<input type="checkbox"/>
Step 6	Duplicate the <i>Baseline Case</i> , rename it " <i>Proposed Phius Case</i> "	<input type="checkbox"/>
Step 7	Revise air-tightness in the <i>Proposed Phius Case</i> to the Phius limit 0.06 or 0.08 cfm50/sf _{env}	<input type="checkbox"/>
Step 8	Review WUFI reports to identify most cost-effective energy conservation measures (ECMs)	<input type="checkbox"/>
Step 9	Upgrade the <i>Proposed Phius Case</i> model until Phius targets are met	<input type="checkbox"/>
Step 10	Create a comparison report <i>Ideally, this report should demonstrate the most relevant technical changes between cases, as well as results of each case</i>	<input type="checkbox"/>

1. Pre-Modeling Documentation

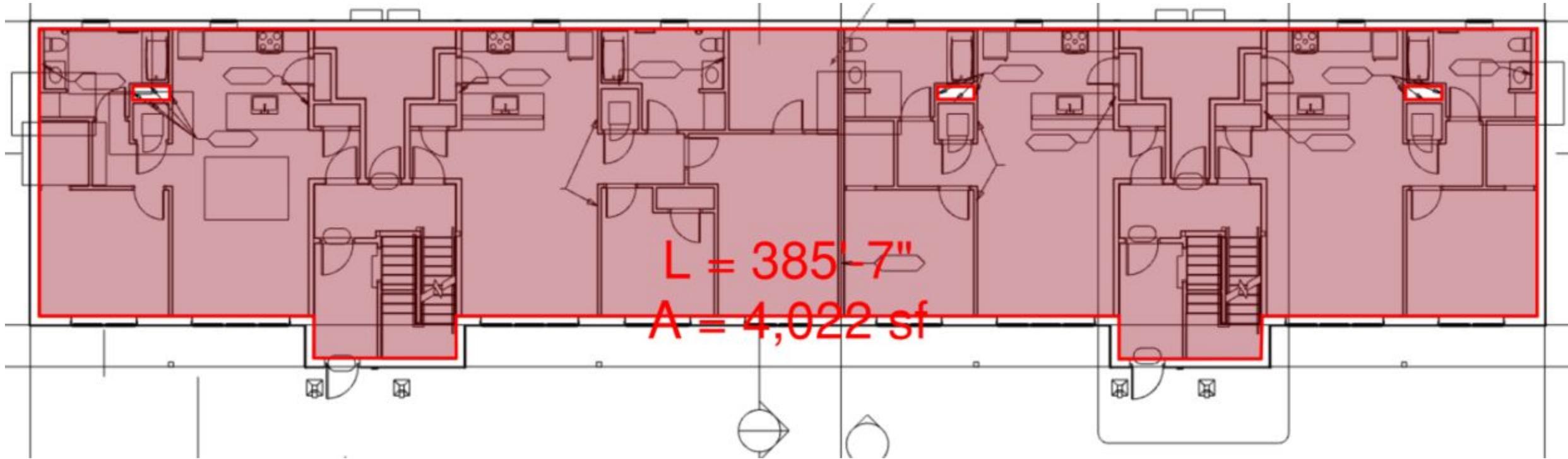
1.0	Drawings, Takeoffs, & Geometry	
1.1	Pre-Modeling Documentation	Complete
Floor Plans		<input type="checkbox"/>
Elevations		<input type="checkbox"/>
Building Section		<input type="checkbox"/>
Site Plan / Project address (or locality if not available)		<input type="checkbox"/>
<p><i>Floor plans, elevations, and building sections are critical for geometry modeling to determine the envelope area. A building section, for example, should clearly show the intended extent of the thermal boundary (i.e. sloped compact roof vs. vented attic). If the thickness of exterior continuous insulation is unknown, over-estimate the dimensions in plan and in section to remain conservative in regard to envelope area.</i></p> <p><i>A site plan is ideal in order to model site obstructions, shading elements, and establish the orientation of the building. A feasibility study can still be performed without this document, but the results may not be as reliable as a project with a pre-determined site & all landscape obstructions modeled (i.e. trees, adjacent buildings/structures, etc.).</i></p>		
Select Climate Data Refer to section 1.4.4.2 of the Guidebook for how to obtain the climate data set for use in WUFI Passive. If you have a METR subscription, you can select the climate data set directly from the map! The selected dataset must meet the following criteria: <ul style="list-style-type: none"> • ≤50 linear miles from the project location • ≤400' difference in elevation from the project location <p><i>If there are no climate data sets available that meet these criteria, custom climate data should be requested from Phius.</i></p>		<input type="checkbox"/>
Project Narrative <ul style="list-style-type: none"> • Proposed assembly/fenestration performance values • Basis of design for mechanical systems (heating/cooling, ventilation, DHW system types) • Notes on special considerations & project goals (i.e. foam free, net zero, etc.) 		<input type="checkbox"/>
Other / Misc <ul style="list-style-type: none"> • Non-residential projects <ul style="list-style-type: none"> ○ Occupancy / program use schedule (utilization narrative) ○ Planned equipment schedule (i.e. plug loads, process loads, etc.) 		<input type="checkbox"/>



1.2	Takeoffs & Calculators	Complete
	All Projects <ul style="list-style-type: none">• <i>Overall iCFA Takeoff</i>	<input type="checkbox"/>
	Single Family <ul style="list-style-type: none">• <i># Bedrooms</i>• <i># Bathrooms</i>• <i># Occupants (= # bedrooms + 1)</i>	<input type="checkbox"/>
	Multifamily <ul style="list-style-type: none">• <i>Individual space takeoffs (Common areas & Dwelling units)</i>• <i>Multifamily MELs, Lighting & Occupancy Calculator</i>	<input type="checkbox"/>
	Non-Residential <ul style="list-style-type: none">• <i>Non-res Occupancy & Utilization Pattern Calculator</i>	<input type="checkbox"/>

2. Takeoffs & Calculators

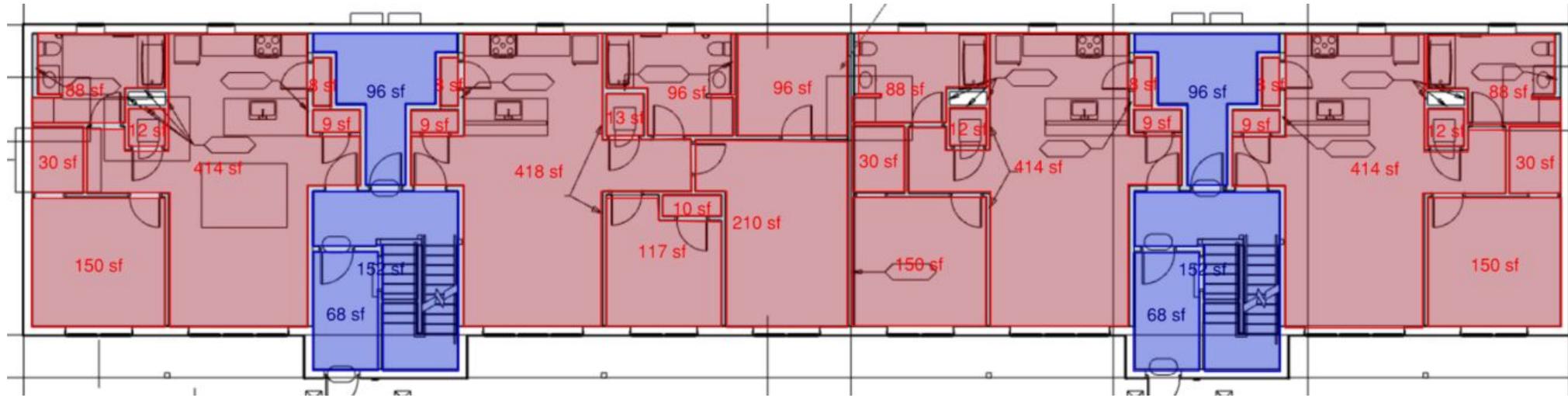
1.2	Takeoffs & Calculators	Complete
All Projects <ul style="list-style-type: none">• Overall iCFA Takeoff		<input type="checkbox"/>



2. Takeoffs & Calculators

Multifamily

- Individual space takeoffs (Common areas & Dwelling units)
- Multifamily MELs, Lighting & Occupancy Calculator



Dwelling Unit
Common Area

Dwelling Unit - Information						Planned Design E/HRV Airflows (cfm)		Phius Minimum Design E/HRV Airflows (cfm)		Common Area Information						
UNIT TYPE	iCFA _{DWELL} (sf)	Total # Units	# Bedrooms / Unit	# Bathrooms / Unit	# Recirculating Range Hoods / Unit	Supply / Unit	Exhaust / Unit	Supply / Unit	Exhaust / Unit	Space Type (Default)	Room		Occ. Sensor	Input unique room entries in yellow cells below.		
											Number	Name		Multiplier	iCFA _{comm} (sf)	Misc Plug Loads (kWh/year)
A	718	5	1	1	1	55	55	45	45	Indoor Corridor	101	Entry Hallway, L1	N	2	89	
B	784	4	1	1	1	55	55	45	45	Indoor Corridor	102	Stair Hallway, L1	N	2	98	
C	991	3	2	1	1	55	55	54	54	Indoor Corridor	202	Stair Hallway, L2-L3	N	4	67	

1.3.0	Geometry	Complete
<p>SketchUp Model</p> <p><i>It's recommended to use underlays in SketchUp to easily 'trace' the geometry as you build the model. If the building is at an angle, model it orthogonally in SketchUp to ensure lines are straight – the orientation can be defined in WUFI later! This leads to fewer import errors overall.</i></p>		<input type="checkbox"/>
<p>Assign WUFI Properties</p> <p><i>Use the tables below to track geometry property assignments. To force WUFI to separate similar components when importing geometry (i.e. fixed vs operable windows), assign unique properties. This will save time over using the grouping & ungrouping function in WUFI Passive. If you run out of assignments (spaces in the tables), increase the quantity of zones (Extensions > WUFI > Zones). Note that the quantity of zones needs to be re-input every time the SketchUp file is reopened.</i></p> <p><i>Components with an inside attachment of outer air or ground will appear under 'Remaining elements' in the model. Components may be assigned the same properties but will still be imported separately if they have different inclinations/orientations (i.e. vertical vs horizontal upwards vs horizontal downwards). For example, a roof and overhang floor could both be assigned to 'Outer air' and 'Zone 1' but will import ungrouped because the outer sides of these components face opposite directions. Similarly, pitched roofs with different slopes will also import ungrouped.</i></p> <p><i>For example, assign fixed windows as follows:</i></p> <ul style="list-style-type: none"> • <i>Type: Transparent</i> • <i>Inner Side: Zone 1</i> • <i>Outer Side: Outer Air</i> <p><i>Then, assign operable windows as follows:</i></p> <ul style="list-style-type: none"> • <i>Type: Transparent</i> • <i>Inner Side: Zone 1</i> • <i>Outer Side: Ground</i> <p>Remember to assign the correct properties in WUFI after importing!</p>		<input type="checkbox"/>

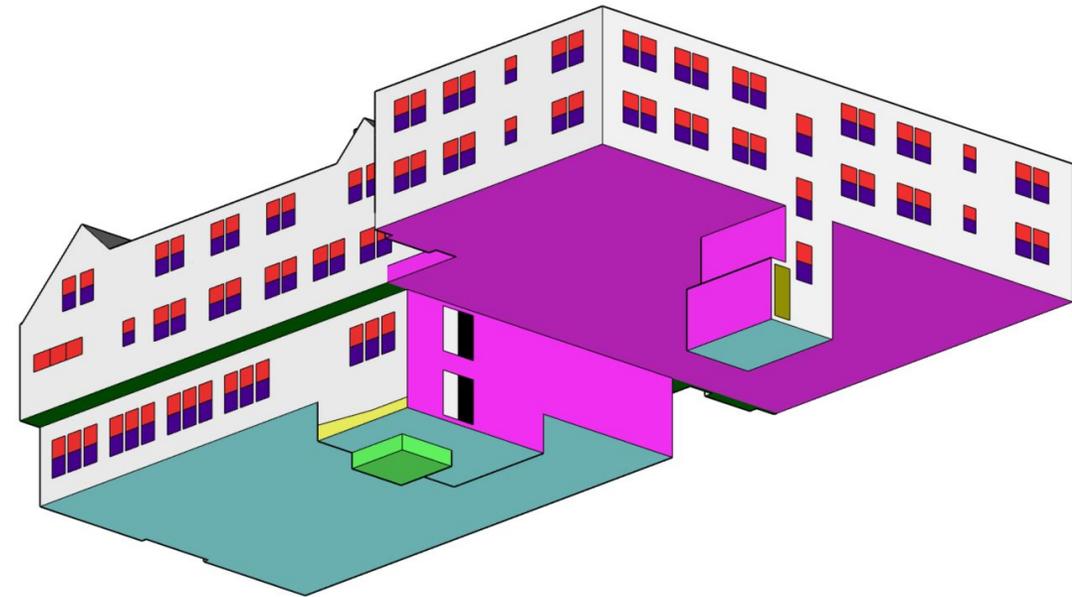
3. Geometry - Assigning Properties

Type: Opaque				
Outer/Inner Side Attachment	O: Outer Air	O: Ground	O: Adiabate	O: Zone 1
I: Outer Air	<i>Site Context / Full-year Shading</i>			
I: Ground				
I: Zone 1				
Type: Transparent				
Outer/Inner Side Attachment	O: Outer Air	O: Ground	O: Adiabate	O: Zone 1
I: Outer Air	<i>Seasonal shading (summer)</i>			
I: Ground				
I: Zone 1				
Type: Opening				
Outer/Inner Side Attachment	O: Outer Air	O: Ground	O: Adiabate	O: Zone 1
I: Outer Air	<i>Centering Circles</i>			
I: Ground				
I: Zone 1				

Remember to assign the correct properties in WUFI after importing!

3. Geometry - Assigning Properties

Type: Opaque				
Outer/Inner Side Attachment	O: Outer Air	O: Ground	O: Adiabate	O: Zone 1
I: Outer Air	<i>Site Context / Full-year Shading</i>			
I: Ground				
I: Zone 1	Above grade walls, roof overhang floor	Slab on grade, BG walls	Walls/Floor to Garage	Elevator pit wall/slab
Type: Transparent				
Outer/Inner Side Attachment	O: Outer Air	O: Ground	O: Adiabate	O: Zone 1
I: Outer Air	<i>Seasonal shading (summer)</i>			
I: Ground				
I: Zone 1	Fixed windows	Operable windows	Glazed doors	Windows to garage
Type: Opening				
Outer/Inner Side Attachment	O: Outer Air	O: Ground	O: Adiabate	O: Zone 1
I: Outer Air	<i>Centering Circles</i>			
I: Ground				
I: Zone 1	Opaque Doors to Garage			





4. Calculate Targets

1.4.0	Targets Checkpoint	Complete
Import Climate Data <i>Import climate data collected in Step 1</i>		<input type="checkbox"/>
Calculate Targets <i>Now that the geometry & takeoffs are complete, you should now have all the information you need to calculate the project-specific Performance Criteria Targets! For envelope area, use the sum found at the bottom of the table within the 'Visualized components' branch of the WUFI tree. Make sure the climate data location matches the set imported to WUFI!</i>		<input type="checkbox"/>

Phius 2024

New Construction*
Performance Criteria Calculator v24.1

UNITS: IMPERIAL (IP) ▾
BUILDING FUNCTION: RESIDENTIAL ▾

STATE / PROVINCE: MASSACHUSETTS ▾
CITY: BARNSTABLE MUNI BOA ▾
ASHRAE 169 Climate Zone: 5A

Envelope Area (ft²) 58,368.2
iCFA (ft²) 44,647.4
Dwelling Units (Count) 36
Total Bedrooms (Count) 56

Space Conditioning Criteria

Annual Heating Demand	5.7	kBtu/ft ² yr
Annual Cooling Demand	6.1	kBtu/ft ² yr
Peak Heating Load	4.6	Btu/ft ² hr
Peak Cooling Load	2.0	Btu/ft ² hr

Source Energy Criteria

Phius CORE	5700	kWh/person.yr
Phius ZERO	0	kWh/person.yr

Phius 2024 PASSIVE BUILDING STANDARDS CERTIFICATION GUIDEBOOK



1.4.4 Phius Energy Modeling Protocol for WUFI Passive

Table 1.4.4.0 Modeling Protocol Table of Contents

1.4.4.1 Cases	General
	Reports
1.4.4.2 Localization / Climate	Localization
	Climate
	Source Energy / CO ₂ -Factors
1.4.4.3 Building	Building Wizard
	Orientation
	3-D Editor
	SketchUp Import
	gbXML Import
1.4.4.4 PH Case	General
	Additional Data
1.4.4.5 Zone 1	Foundation Interface
	Interior Conditioned Floor Area (ICFA)
1.4.4.6 Visualized Components	Specific Heat Capacity / Thermal Mass
	Type / Attachment
	Opaque Assemblies
	Transparent Assemblies
	Window Parameters
1.4.4.7 Thermal Bridges	Solar Protection
	Positive vs Negative

Table 1.4.4.1 Modeling Protocol TOC (continued)

1.4.4.8 Residential Internal Loads / Occupancy	Occupancy Quantity
	Number of Bedrooms
	Device List (appliance, lighting and miscellaneous load tables)
1.4.4.9 Non-Residential Interior Loads / Occupancy	Utilization Patterns
	Occupancy
	Office Equipment
	Kitchen Equipment
	Lighting
1.4.4.10 Ventilation / Rooms	Process Loads
	Utilization Pattern
	Rooms Ventilation
	Summer Ventilation
1.4.4.11 Attached Zones	Exhaust Ventilation
	General
1.4.4.12 Remaining Elements	General
	Distribution: Hydronic Heating
1.4.4.13 Systems	Distribution: Domestic Hot Water
	Distribution: Cooling
	Distribution: Ventilation
	Distribution: Auxiliary Energy
	Distribution: Heating Devices
1.4.4.14 Devices	Domestic Hot Water Devices
	Mechanical Ventilation Devices
	Renewable Energy Systems

4. Calculate Targets

Phius Performance Criteria Calculator

Phius Performance Criteria Calculator

phius 2021
Custom Performance Criteria Calculator v3.3

BUILDING FUNCTION RESIDENTIAL

Climate Location

Envelope Area (sf)	14,895
iCFA (sf)	5,251
Dwelling Units (Count)	1
Total Bedrooms (Count)	4

Space Conditioning Criteria

Annual Heating Demand	7.8	kBTU/sf.yr
Annual Cooling Demand	5.7	kBTU/sf.yr
Peak Heating Load	4.8	BTU/sf.hr
Peak Cooling Load	2.6	BTU/sf.hr

Source Energy Criteria

phius CORE	5,600.0	kWh/person.yr
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Design Temperatures

99% Design Temp	25.3	°F
99.6% Design Temp	25.0	°F

Envelope Area

Id	Name	Type	Attachment	Area [ft²]
1	AD Wall	Opaque	Outer air	4375.99
2	Slab	Opaque	Ground	4192.4
3	Roof main level	Opaque	Outer air	1539.56
4	Roof upper level	Opaque	Outer air	1892
5	Roof main level	Opaque	Outer air	1036
6	Door to garage	Opaque	Attached zone 1: Garage	20.83
7	Wall to garage	Opaque	Attached zone 1: Garage	451.71
8	Entry door	Transparent	Outer air	21.6
9	Entry eadles	Transparent	Outer air	18.72
10	Operable windows	Transparent	Outer air	291.88
11	Fixed windows	Transparent	Outer air	523.61
12	Glazed doors	Transparent	Outer air	67
13	Lift slide door	Transparent	Outer air	90
14	Fixed window walls	Transparent	Outer air	348.67

Total area of envelope components (interior components excluded): 14,823.61

Phius Comments: Please use the envelope area from the 'Visualized Components' list. Be sure to set any 'openings' to 'outer air' as the 'inner side' and if there are any 'non-visualized components', those areas should be added to the total envelope area for the performance criteria calculator.

WUFI Passive - Passive House Verification Report

BUILDING INFORMATION

Category: Residential
Status: In planning
Building type: New construction
Year of construction: [redacted]
Units: 1
Number of occupants: 5 (Design)
Occupant density: 1,050.2 ft²/Person

Boundary conditions

Climate: CAMAS, WA
Internal heat gains: 0.6 Btu/hr ft²
Interior temperature: 68 °F
Overheat temperature: 77 °F

Building geometry

Enclosed volume: 67,162.2 ft³
Net-volume: 51,043.3 ft³
Total area envelope: 14,824 ft²
Area/Volume Ratio: 0.2 1/ft
Floor area: 5,251 ft²
Envelope area/iCFA: 2.823

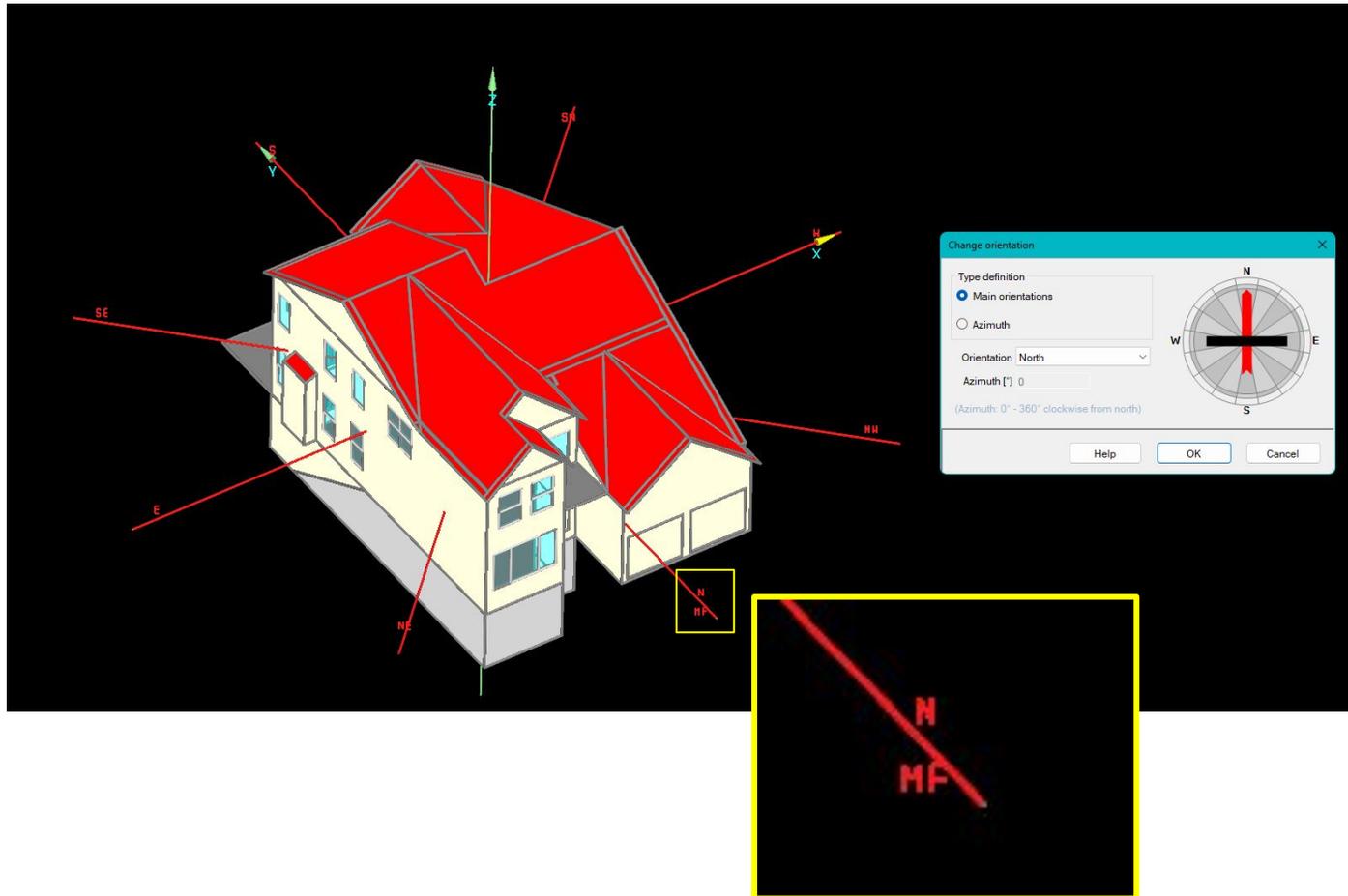
Phius Comments: Please use the number of units and floor area from the screenshot above.

Number of Bedrooms

Occupant quantity [-]: 5
Number of bedrooms [-]: 4
Humidity sources [lb/(R*hr)]: 4.096E-4

Phius Comments: Please use the number of bedrooms from the screenshot above.

Tutorial: [Setting Orientation in WUFI Passive](#)



WUFI Passive Tutorials (#23-29)

2.2	Opaque Assemblies & Fenestration							Complete
<p>Refer to section 1.4.4.6 of the Guidebook for nuanced guidance on how to account for fasteners & framing in the modeled assemblies – it's important to capture the effective assembly performance as this will be required for Phius Certification. See example on p71 of the Guidebook for guidance on how to model whole-window performance if detailed information is not known (typical at this stage). </p>								
<p>Baseline Case (IECC 2024 or local adopted version) R- and U-values It is recommended to use IECC values for the "Baseline Case" in lieu of the as-designed assemblies, as this will result in a more impactful comparison between cases.</p>								<input type="checkbox"/>
IECC 2024 Prescriptive Assembly Requirements by Climate Zone								
Climate Zone	0	1	2	3	4A/B	5 & 4C	6	7 & 8
Vertical Fenestration U-factor / SHGC (max)	0.5 / 0.25		0.4 / 0.25	0.3 / 0.25	0.3 / 0.4	0.28 / NR		0.27 / NR
Skylight U-factor / SHGC (max)	0.6 / 0.28			0.53 / 0.28	0.5 / NR ⁵	0.5 / NR ⁵		
Ceiling R-value	30		38		49			
Insulation entirely above roof deck	25ci				30ci		35ci	
Wood/steel-framed wall R-value ^{1,2}	13 or 0+10ci			20 or 13+5ci or 0+15ci	30 or 20+5ci or 13+10ci or 0+20ci			
Mass wall R-value ³	3 / 4	3 / 4	4 / 6	8 / 13		13 / 17	15 / 20	19 / 21
Floor R-value ¹	13 or 7+5ci or 10ci			19 or 13+5ci or 15ci		30 or 19+7.5ci or 20ci		38 or 19+10ci or 25ci
Basement/ Crawlspace wall R-value ¹	0			13 or 5ci	13 or 10ci	19 or 13+5ci or 15ci		
Heated slab R-value ⁴	R-5 full slab							
<p>¹ (X or X + Yci or Yci) X = cavity insulation R-value & Y = continuous insulation R-value ² Cavity insulation in steel framed assemblies should be derated 69% in the WUFI/METr model ³ Second R-value applies when >1/2 of insulation is located on the interior side of mass walls ⁴ Perimeter/edge insulation omitted from this table. Perimeter insulation should not be modeled in WUFI/METr until details are completed and the condition is deemed a negative or neutral thermal bridge ⁵ While there is no SHGC limit for these climate zones, it is recommended to assume 0.3</p>								

Proposed (Phius ranges or as-designed) R- and U-values

Phius R- and U-value ranges below are based on the prescriptive path and are likely conservative for the performance path. These values can still a good starting point when modeling for a feasibility study and can be "backed off" in the energy model as long as the space conditioning targets are still met. Assemblies as designed by the project team may also be used.



Climate Zone	0 & 1	2	3A/B	3C	4A/B	4C	5A/B	5C	6	7	8
Fenestration U-value	0.5 - 0.29	0.5 - 0.23	0.47 - 0.19	0.39 - 0.25	0.25 - 0.15	0.37 - 0.18	0.23 - 0.13	0.27 - 0.2	0.19 - 0.11	0.22 - 0.09	0.19 - 0.08
Roof R-value	40 - 52	52 - 60	52 - 68	56 - 60	60 - 76	56 - 72	60 - 80	64 - 76	72 - 96	76 - 120	76 - 172
Above Grade Walls & Overhang Floors	20 - 24	20 - 28	24 - 40	28 - 32	28 - 48	28 - 44	32 - 48	36 - 46	40 - 68	44 - 92	52 - 160
Below Grade Wall & Floor R-value	1 - 16	8 - 16	8 - 20	12 - 16	16 - 28	12 - 28	16 - 32	16 - 28	20 - 48	24 - 60	32 - 100

Solar protection / Shading

Don't forget to account for reveal depths & shading devices! It is best practice to model shading objects, such as canopies or overhangs, in the SketchUp geometry. However, for the feasibility study stage, overhangs and interior/exterior shades may be unknown, but could be considered as a means to meet the space conditioning targets and can be entered numerically in WUFI.

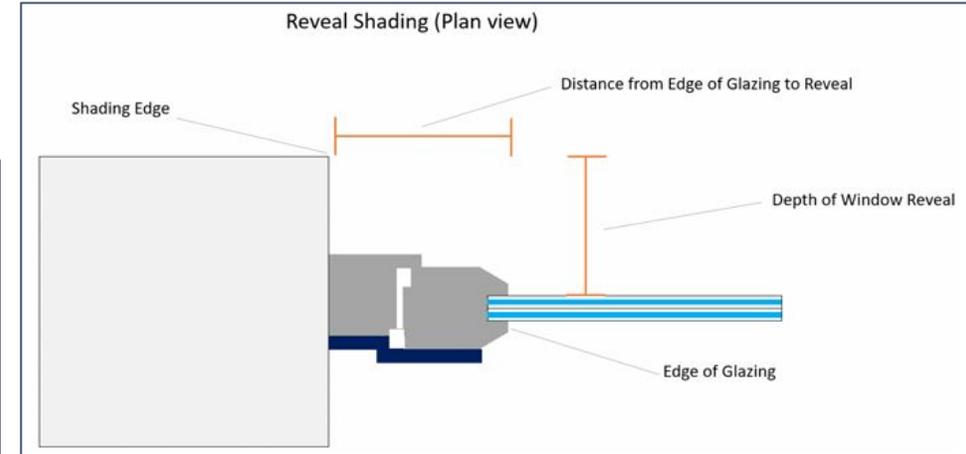
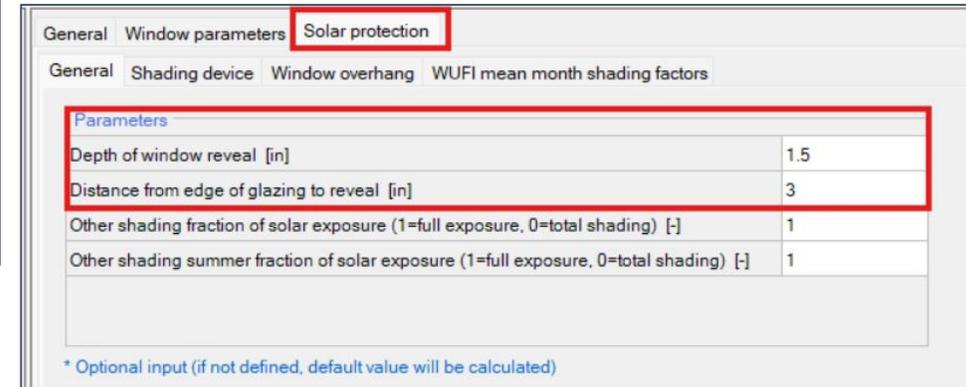
All fenestration elements require completion of the 'Depth of window reveal' and 'Distance from edge of glazing to reveal' inputs under the 'Solar protection' > 'General' tab (when window is selected). Refer to Guidebook section XX for how these measurements should be taken. Because the frame widths may not be known at this stage, use an average of 3" for the 'Distance from edge...' input. More specifically:

- Fixed Windows: 2"
- Operable Windows: 4"
- Glazed Doors: 6"

Interior or exterior manually operated shades can be added on the 'Shading Device' tab under 'Solar protection'. Use the following reduction factors in the model:

- Interior - 0.85
- Exterior - 0.65

Overhangs can be added on the 'Window overhang' tab under 'Solar protection'. This input is only for horizontal overhangs. Keep in mind that any canopy / overhang attachment details typically require careful detailing to avoid thermal bridging!

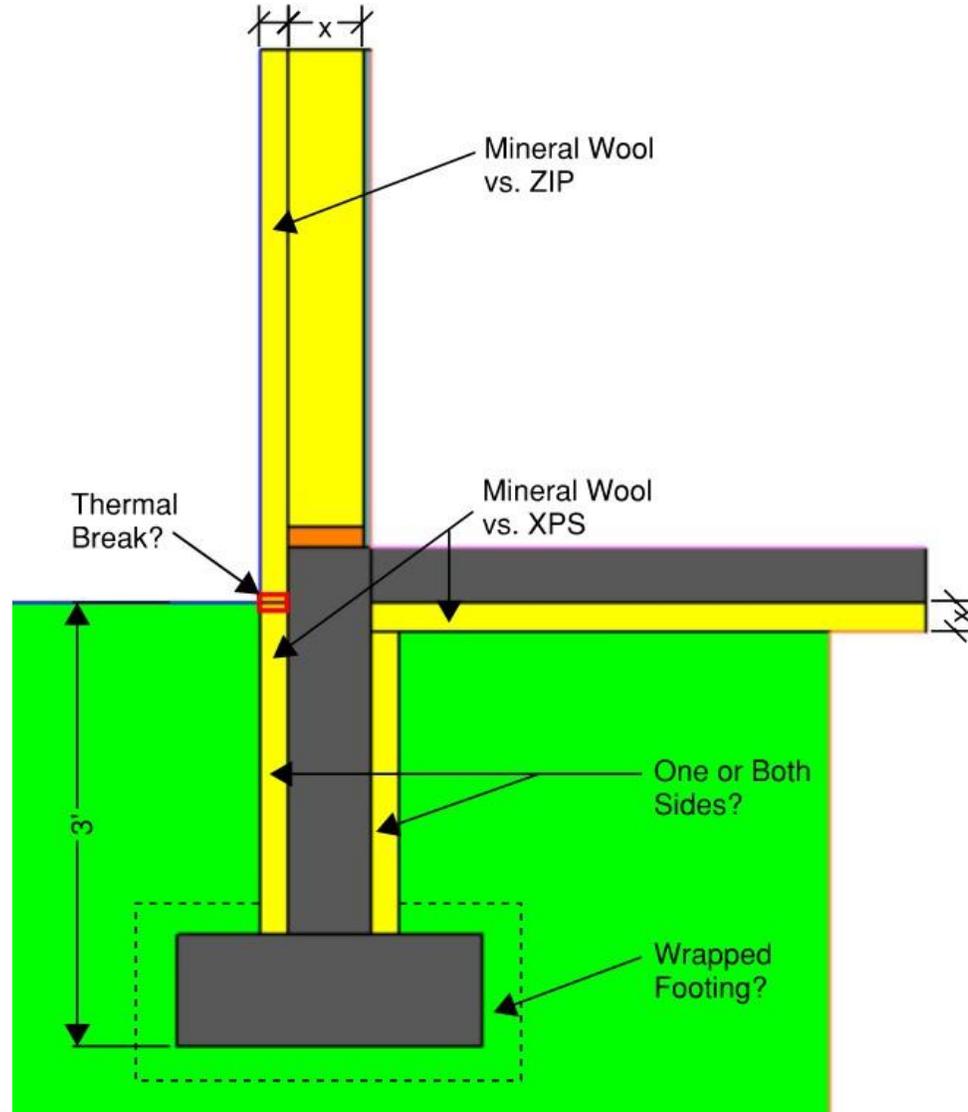



The screenshot shows the 'Solar protection' tab in the WUFI software interface. The 'Parameters' table is highlighted with a red border. The table contains the following data:

Parameters	
Depth of window reveal [in]	1.5
Distance from edge of glazing to reveal [in]	3
Other shading fraction of solar exposure (1=full exposure, 0=total shading) [-]	1
Other shading summer fraction of solar exposure (1=full exposure, 0=total shading) [-]	1

* Optional input (if not defined, default value will be calculated)

2.3	Thermal Bridges	Complete
<p>Account for potential thermal bridges</p> <p><i>It is best practice to design details that don't result in thermal bridges, but sometimes they are unavoidable. It is recommended to conservatively account for potential common thermal bridges, such as perimeter conditions at the wall-to-slab connection. Refer to the table below for placeholder perimeter psi-values to use in the model, dependent on the modeled assemblies. Note that project-specific calculations are required for Certification (if applicable).</i></p> <p><i>(PENDING PERIMETER STUDY)</i></p> <p><i>Other common thermal bridges that should be considered for large multifamily projects include:</i></p> <ul style="list-style-type: none"> • <i>Wall-to-floor transition in podium-style construction</i> • <i>Rim joist / slab edge conditions</i> • <i>Balcony attachments</i> • <i>(PENDING PHIUS DEFAULTS)</i> 		<input type="checkbox"/>



2.4	Internal Loads & Occupancy (Residential)	Complete
<p>Input Occupancy & Bedroom Quantity <i>From the results of the takeoffs completed earlier.</i></p>		<input type="checkbox"/>
<p>Add typical appliances <i>Use the 'Set Standard Dataset' button to auto-populate typical appliances. Eliminate or add line items as needed.</i></p> <p><i>Since appliance models have not likely been chosen at this stage, refer to the Guidebook (section 1.4.4.8) for Energy Star median values that are acceptable to use for Design Certification. Appendix I-3.15 includes non-Energy Star values that could be used for the "Baseline Case". However, keeping these internal loads the same across both cases could be considered if the intent of the study is more focused on envelope / HVAC design (i.e. less variability between cases).</i></p>		<input type="checkbox"/>
<p>Add lighting & miscellaneous electric loads (MELs) <i>Line items for lighting & MELs will automatically be added if using the 'Set Standard Dataset' button noted above. For single family projects, the only inputs needed will be the fraction of high efficacy lighting (below the device table). For multi-family projects, set the device types to 'User defined - lighting' or 'User defined - MELs'. Input the results of the Multifamily Calculator completed earlier.</i></p> <p><i>Garage lighting should be accounted for in single family projects. This is not needed for multifamily projects for Phius Certification.</i></p>		<input type="checkbox"/>

2.5	Internal Loads & Occupancy (Non-Residential)	Complete
	<p>Define Utilization Patterns</p> <p><i>This should be driven by the occupancy/space-use narrative collected in Section 1 (if available). If general space types are known, but no detailed information on actual utilization, refer to Appendix N-8 of the Guidebook for typical utilization pattern inputs for common space types. Utilization patterns for transient spaces (i.e. bathrooms, corridors, etc.) should not have unique utilization patterns.</i></p>	<input type="checkbox"/>
	<p>Define Occupancy</p> <p><i>This should be driven by the occupancy narrative collected in Section 1 and/or the non-residential occupancy calculation completed earlier. If this is not yet determined, refer to Guidebook Section 1.4.4.9 for information on how to estimate the maximum & average occupancies. Be realistic when estimating the occupancy – avoid using fire-code maximums as these are likely too conservative.</i></p>	<input type="checkbox"/>
	<p>Define plug loads, lighting, & other equipment</p> <p><i>At the feasibility study stage, information on equipment may not be known. To simplify, include only one ‘User defined’ line item under ‘Office Equipment’. Then, estimate the annual energy consumption (kWh/yr) of all planned equipment using the following formula, and enter the resulting value as the ‘Power rating (W)’ in WUFI. Below this table, enter 1 hrs/yr.</i></p> <ul style="list-style-type: none"> • $kWh/yr = EPD * iCFA * EFLH$ <ul style="list-style-type: none"> ○ <i>EFLH (equivalent full load hours) = operating hours/day * operating days/yr</i> ○ <i>EPD (equipment power density) = W / sf</i> <p><i>For EPDs & LPDs (lighting power density), many resources are available online if unknown (typical for the feasibility study stage), like BEMcyclopedia, which summarizes typical values for multiple building use types per ASHRAE 90.1 – 2019.</i></p> <p><i>For lighting, refer to the Guidebook 1.4.4.9 for information on how to set up this section (WUFI daylighting inputs). Add one line item to the table. Simply enter the estimated whole-building LPD and input value in the corresponding cell below the table. Then, input the EFLH calculated for equipment power previously.</i></p>	<input type="checkbox"/>

Occupant quantity [-]	5
Number of bedrooms [-]	4
Humidity sources [lb/(ft²hr)]	4.096E-4

Device list Set standard dataset

Device/end use	Reference quantity	Quantity	In conditioned space	
Kitchen dishwasher	PH case occupants		<input checked="" type="checkbox"/>	New
Laundry - washer	PH case occupants		<input checked="" type="checkbox"/>	Delete
Laundry - dryer	PH case occupants		<input checked="" type="checkbox"/>	Copy
Kitchen fridge/freeze combo	PH case Units	1	<input checked="" type="checkbox"/>	Insert
Kitchen cooking	PH case occupants		<input checked="" type="checkbox"/>	New/Insert:
PHIUS+ MELS	Bedrooms	4	<input checked="" type="checkbox"/>	after
PHIUS+ Interior lighting	PH case floor area	5251	<input checked="" type="checkbox"/>	
PHIUS+ Exterior lighting	PH case floor area	5251	<input type="checkbox"/>	
PHIUS+ Garage lighting	None		<input type="checkbox"/>	

Additional data: Kitchen dishwasher

Energy demand (norm) reference	Year
Annual energy use rating [kWh/Year]	225
Dishwasher capacity, preselection	Standard
Dishwasher capacity, in place settings [-]	12
Comment	Cove DW2451

Single Family

Occupant quantity [-]	111
Number of bedrooms [-]	74
Humidity sources [lb/(ft²hr)]	0.00041

Device list Set standard dataset

Device/end use	Reference quantity	Quantity	In conditioned space	
Kitchen dishwasher	PH case occupants		<input checked="" type="checkbox"/>	New
Laundry - washer	PH case occupants		<input checked="" type="checkbox"/>	Delete
Laundry - dryer	PH case occupants		<input checked="" type="checkbox"/>	Copy
Kitchen fridge/freeze combo	PH case Units	37	<input checked="" type="checkbox"/>	Insert
Kitchen cooking	PH case occupants		<input checked="" type="checkbox"/>	New/Insert:
User defined - lighting	User defined	1	<input checked="" type="checkbox"/>	after
User defined - lighting	User defined	1	<input type="checkbox"/>	
User defined - Misc electric loads	User defined	1	<input checked="" type="checkbox"/>	

Additional data: Kitchen dishwasher

Energy demand (norm) reference	Year
Annual energy use rating [kWh/Year]	240
Dishwasher capacity, preselection	Standard
Dishwasher capacity, in place settings [-]	12
Comment	DW-1: GE GDT225SSLSS

Multi-family



Internal Loads & Occupancy

Phius Multi-Family Calculator		v4.2	Navigate to Definitions
Lighting & Plug Loads for WUFI Passive			
Number of Units	12	1	
Design Occupancy	27	2	
Number of Bedrooms	15	3	
MEL _{DWELL} (kWh/yr)	11,854	4	
Interior MEL _{YARD} (kWh/yr)	0	5	
MEL _{COMM} (kWh/yr)	0	6	
Total MEL (kWh/yr)	11,854	7	
LIGHTS _{INT,DWELL} (kWh/yr)	4,402	8	
LIGHTS _{INT,COMM} (kWh/yr)	4,707	9	
Total LIGHTS_{INT} (kWh/yr)	9,108	10	
LIGHTS _{EXT,DWELL} (kWh/yr)	337	11	
LIGHTS _{EXT,COMM} (kWh/yr)	2,373	12	
LIGHTS _{GAR} (kWh/yr)	5,941	13	
Total LIGHTS_{EXT} (kWh/yr)	8,651	14	
Exterior MEL _{YARD} (kWh/yr)	0	15	
iCFA _{DWELL} (sf)	9,699	16	
iCFA _{COMM} (sf)	1,765	17	
iCFA_{REF} (sf)	11,464	18	

Phius Non-Residential Occupancy Calculator	Required Input cells.	Required dropdown menu inputs.
	Constants & Instructions	Calculated for WUFI or METr

WUFI Passive / METr: Internal Loads/Occupancy > Utilization Pattern							
Name (Utilization Pattern)	Begin Utilization [hr]	End Utilization [hr]	Annual Utilization Days [days/yr]	Illumination Level [lux]	Height of Utilization Level	Relative Absence	Part use factor of operating period for
Tour	16.0	16.8	14	Varies per Appendix N-8 of Phius 2024 Guidebook		0.10	Varies per Appendix N-8 of Phius 2024 Guidebook
Summer Schedule	12.0	16.0	40			0.10	
Costume Shop Typical	10.0	15.0	124			0.10	
Design Shop Typical	10.0	15.0	60			0.10	
Community Art Nights	18.0	20.0	44			0.10	
	0.0	0.0				0.00	
	0.0	0.0				0.00	
	0.0	0.0				0.00	

2.6	Ventilation/Rooms	Complete
<p>Define Utilization Pattern <i>Typically, this should be set to 7d/52w, and 24h at a design airflow fraction of 1 (100%). Non-residential projects may have unique ventilation utilization patterns if the system will spool-down or shut off during non-occupied hours (i.e. demand-controlled ventilation).</i></p>		<input type="checkbox"/>
<p>Define Ventilation Rates <i>For single family projects:</i></p> <ul style="list-style-type: none"> • <i>Use the table as a tool to determine the minimum required balanced ventilation rate for the project</i> • <i>First, input exhaust rooms (only if ventilated through the E/HRV)</i> <ul style="list-style-type: none"> ○ <i>Bathrooms = 20 cfm</i> ○ <i>Kitchens = 25 cfm</i> • <i>Then, add a line for supply air, with a flow rate of 15 cfm per occupant (minimum required for Certification)</i> <ul style="list-style-type: none"> ○ <i>If the supply rate is less than the exhaust rate (>10%), add additional supply air to balance the system</i> • <i>If the exhaust flow rate is less than the supply (>10%), increase the exhaust flow rates, or add exhaust from additional spaces to balance the system</i> <p><i>For multi-family projects:</i></p> <ul style="list-style-type: none"> • <i>For dwelling units, refer to the calculated minimum ventilation rates on the corresponding tab of the Multifamily Calculator</i> • <i>For common areas, the balanced airflow rate can be estimated using:</i> <ul style="list-style-type: none"> ○ <i>0.06 cfm * iCFA (comm.)</i> <p><i>For non-residential projects, use the same formula as residential common areas to estimate the balanced airflow rates.</i></p>		<input type="checkbox"/>

Dwelling Units:

Total # of Units	12
Design Occupancy	27
Total # of Bedrooms	15
Total # of Bathrooms	12
Total Supply _{DWELL} (cfm)	660
Total Exhaust _{DWELL} (cfm)	660

Utilization pattern Rooms ventilation Summer ventilation Exhaust ventilation					
Rooms					
Name	Room type	Quantity	Utilization pattern	Design volume flow rate [cfm]	
				Supply Air	Exhaust Air
Dwelling Units	User defined	1	Pattern 1: Typ Day	660	660
Common Areas	User defined	1	Pattern 1: Typ Day	106	106

Common areas (or non-res):

iCFA _{DWELL} (sf)	9,699
iCFA _{COMM} (sf)	1,765
iCFA _{REF} (sf)	11,464

$*0.06 = 105.9 \rightarrow 106$

<p>Define Summer Ventilation Mode</p> <p><i>'Always' is the most conservative option and recommended for the feasibility study stage. If the Phius-compliant case is having difficulty meeting the cooling demand target, consider specifying a mechanical ventilation with bypass mode available, and use either 'Temperature-' or 'Enthalpy-' (less common) controlled bypass in the model.</i></p> <p><i>"Bypass Mode", also known as "Economizer Mode" or "Free Cooling", is referring to the ventilation device's sequence of operations. In the summer, when outdoor conditions are ideal, the air bypasses the wheel and is distributed indoors without passing through heat recovery. A device with temperature-controlled bypass mode is triggered by temperature conditions alone. A device with enthalpy-controlled bypass is triggered by both temperature and humidity.</i></p>	<input type="checkbox"/>
<p>Define Direct Exhaust devices</p> <p><i>For the code "Baseline Case", review the requirements of your local codes, and consider what is "normal" for other similar buildings in your vicinity. If direct-exhaust bathroom fans, laundry appliances, and/or kitchen range hoods are typical and permitted, model to reflect this. When modeling this approach, these spaces should not be included under 'Rooms ventilation'. Use the following inputs for these typical exhaust devices:</i></p> <ul style="list-style-type: none"> • Exhaust Dryer <ul style="list-style-type: none"> ○ Residential (typ. for single family & in-unit) – 125 cfm ○ Commercial (typ. for shared laundry rooms) – 220 cfm ○ Select 'Exhaust dryer'. Make sure the right setting is selected under 'Internal loads & Occupancy' • Kitchen Range Hood – 100 cfm <ul style="list-style-type: none"> ○ Select 'Kitchen range hood' • Bathrooms – 50 cfm (each; enter total sum if multiple bathrooms) <ul style="list-style-type: none"> ○ Select 'Other exhaust appliances' ○ Enter runtime of 21,900 min/yr (60 min/day * 365 days) <p><i>Other exhaust devices that are common in multifamily projects (trash chutes / compactor rooms)</i></p>	<input type="checkbox"/>

Utilization pattern	Rooms ventilation	Summer ventilation	Exhaust ventilation
Summer ventilation			
Optional data			
Average mechanical ventilation air change rate [1/hr]			
Summer HRV/ERV recovery mode		Temperature controlled bypass	
ACH via natural ventilation (day) [1/hr]		<div style="border: 1px solid red; padding: 2px;"> Note Temperature controlled bypass Enthalpy controlled bypass Always </div>	
ACH via natural ventilation (night) [1/hr]			
Additional automatic controll ventilation [1/hr]			
Specific power consumption cooling [W/cfm]			
Automatic control system via		Temperature difference	
Additional mechanical ventilation exhaust air [1/hr]			
Specific power consumption [W/cfm]			

Utilization pattern					
Rooms ventilation		Summer ventilation		Exhaust ventilation	
Name	Type	Exhaust volume flow rate [cfm]	Run time per year [min]	Run time per day [min]	
	Exhaust dryer	125	11286	30.92	 New  Delete  Copy  Insert New/Insert: after <input type="text"/>
	Exhaust range hood	300	10000	27.4	

6. Systems: Distribution

2.7	Systems: Distribution	Complete
<p>Define Hydronic Heating System (atypical) Refer to Section 1.4.4.13 of the Phius Certification Guidebook for more information on modeling this system.</p>		<input type="checkbox"/>
<p>Define DHW (Domestic Hot Water) Piping First, define the design flow temperature - 120-140°F is typical. The 'Circulation Pipes' section should only be completed if there is a continuous- or time-based recirculation system (only acceptable in multifamily projects >5 stories & non-residential projects). Skip this section if this does not apply.</p> <p>For residential projects, set the calculation method to <u>either</u> 'Hot water piping calculator (unit method)'. Then, complete the 'Hot water piping' tab. Simplification is key when modeling DHW piping. Refer to section 1.4.4.13 of the Guidebook for detailed instructions on how to model DHW piping. The tips below are how Phius generally models DHW piping for feasibility studies:</p> <ul style="list-style-type: none"> • Single-family projects <ul style="list-style-type: none"> ○ If no recirculation system is planned, input one trunk & branch with a length of 0'. Uncheck the box for 'Demand recirculation'. Input one twig for each hot water fixture (do not include dishwashers or clothes washers). For the twig lengths, enter a conservative value - 20-30' ○ If an on-demand recirculation system is planned, follow the same steps above, but leave the 'Demand recirculation' box checked. For the trunk length, estimate the length of the supply side of the recirculation loop. For the twig lengths, input a conservative length from the recirc loop to the fixture - 10'-15' • Multifamily projects <ul style="list-style-type: none"> ○ If unitary hot water heaters are planned (with or without demand recirculation), follow the steps for single-family projects above ○ If a centralized DHW system is planned, a recirculation system is likely necessary to meet the hot water distribution requirements for Certification. The length of recirculation piping can be estimated using the following formula: (length of corridor * # of floors) + (height of building * # of risers) <ul style="list-style-type: none"> ▪ If a continuous- or time-based recirculation loop is planned, complete the inputs on the 'General' tab - in the table below the input for design flow temperature. ▪ If a demand recirculation loop is planned, create one trunk to account for all recirculation piping, with the box checked. Then, create one trunk for each unit type with the box unchecked - 'unit type' being defined by quantity of DHW fixtures (i.e. 1-bath, 2-bath, etc) or unit type (i.e. 1-bed, 2-bed, etc). Follow the steps for single-family projects w/ demand recirculation above but input a length of 0' for the trunks and branches. • Non-residential projects <ul style="list-style-type: none"> ○ TBD 		<input type="checkbox"/>



Domestic Hot Water (DHW) Piping

General Distribution

Hydronic heating DHW Cooling Ventilation Supportive device / auxiliary energy

General Hot water piping

Preselection effectiveness	Standard flow
Hot water fixture effectiveness [-]	1
All pipes are insulated	<input checked="" type="checkbox"/>
Count of units or floors	PH case setting

Trunk

Nr.	Name	Demand recirculation	Pipe material	Piping diameter [in]	Piping length [ft]	Heat capacity [Btu/°F]	Count units or floors	Volume [oz]	Cumulative volume [oz]	
1		<input checked="" type="checkbox"/>	PEX-AL-PEX	1	26.16	12.78	1/3	145.45	0	New Delete

Branch: Trunk 1

Nr.	Label	Pipe material	Piping diameter [in]	Piping length [ft]	Heat capacity [Btu/°F]	Volume [oz]	Upstream volume [oz]	Branch cumulative volume [oz]	Cumulative volume [oz]	
1	Lav	PEX-AL-PEX	3/4	10.25	3.11	34.75	0	34.75	34.75	New
2	Lav	PEX-AL-PEX	3/4	3	0.91	10.17	0	10.17	10.17	Delete
3	Kitchen	PEX-AL-PEX	1/2	0	0	0	0	0	0	
4	Lav	PEX-AL-PEX	3/4	23	6.98	77.97	0	77.97	77.97	

Twig: Branch 1, Lav

Nr.	Fixture label	Pipe material	Piping diameter [in]	Piping length [ft]	Heat capacity [Btu/°F]	Volume [oz]	Upstream volume [oz]	Cumulative volume [oz]	Watersense met?	Time to "hot" @1gpm [s]
1	To Lav	PEX-AL-PEX	1/2	6	0.74	7.86	34.75	42.61	True	40
2	To Lav	PEX-AL-PEX	1/2	6	0.74	7.86	34.75	42.61	True	40
3	To Shower	PEX-AL-PEX	3/4	7.5	2.28	25.43	34.75	60.17	True	56

Single-family project w/ on-demand recirc system

General Distribution

Hydronic heating DHW Cooling **Ventilation** Supportive device / auxiliary energy

Ducts

Name	Duct type	Duct shape	Quantity	Duct length [ft]	
ERU-1	Supply / outdoor air duct	Rectangular	1	3.67	New
ERU-1	Extract / Exhaust air duct	Rectangular	1	3.67	Delete
ERU-2	Supply / outdoor air duct	Rectangular	1	40.38	Copy
ERU-2	Extract / Exhaust air duct	Rectangular	1	28.94	Insert

New/Insert:
after

Additional data, Duct 1: ERU-1

Duct width/height [in]	16
Ductshape height [in]	14
Insulation thickness [in]	3
Thermal conductivity [Btu/hr ft °F]	0.03121
Is reflective	<input type="checkbox"/>

Assigned ventilation units, Duct 1: ERU-1

V.1. : ERU-1 Greenheck ERV-20-15L	<input checked="" type="checkbox"/>
V.2. : ERU-2 Greenheck ERV-20-15L	<input type="checkbox"/>

General | Distribution

Hydronic heating | DHW | Cooling | Ventilation | Supportive device / auxiliary energy

Use default values

Name	Device type	Quantity	In conditioned space	Energy demand (rated) [W]	Additional info	
Booster Pump	Other	1	<input checked="" type="checkbox"/>	367	Period of operation 1 khr/yr	 New
Recirc	DHW circulating pump	1	<input checked="" type="checkbox"/>	50		 Delete

[Devices in the system](#)

1	Heat pump: Heating, Cooling: Heat Pump - Carrier 37MAHAQ18AA3 (outdoor) & 45MBAAQ18X
2	User defined: DHW: Richmond 6ES30-D
3	Electric resistance space heat / DHW: Heating: EUH-1 and EUH-2
4	Mechanical ventilation: Ventilation: ERU-1 Greenheck ERV-20-15L
5	Mechanical ventilation: Ventilation: ERU-2 Greenheck ERV-20-15L
6	Photovoltaic / renewable energy: Off-Site PV

[Additional data: Other](#)

Period of operation [khr/yr]	1
------------------------------	---

2.8	Systems: Devices	Complete
<p>Define Ventilation System</p> <p><i>Consider what type of ventilation device makes sense for your project and climate zone. Use the following defaults in the model, or obtain performance data for the basis-of-design device (if available):</i></p> <ul style="list-style-type: none"> • <i>ERV Recovery Efficiencies:</i> <ul style="list-style-type: none"> ○ <i>Sensible: 0.75</i> ○ <i>Humidity (aka latent, or net moisture transfer): 0.4</i> • <i>HRV Recovery Efficiencies</i> <ul style="list-style-type: none"> ○ <i>Sensible: 0.8</i> ○ <i>Humidity: 0</i> • <i>Fan power (W/cfm)</i> <ul style="list-style-type: none"> ○ <i>0.75-1 (small units)</i> ○ <i>1.5 (DOAS mid-rise)</i> ○ <i>2+ (DOAS high rise)</i> <p><i>Exhaust only system protocol: TBD</i></p>		<input type="checkbox"/>

7. Systems: Devices > Heating/Cooling

Define Heating/Cooling System

Consider what type of heating system is typical and permitted in your location. If gas systems or electric resistance heating systems are the typical and permitted in your location, model to reflect this in the "Baseline Case".

For Phius Certification, electrification infrastructure is required for any combustion equipment present (except backup generators). This could add significant cost to a project, and gas systems are generally more demanding from a source energy perspective, and less ideal from an air quality & general safety perspective. So, it is recommended to propose all-electric systems for the "Phius-compliant" case.

Refer to the table below for default efficiencies to use for feasibility study modeling based on Phius' observations of Certified projects. For Certification, device datasheets and external calculators may be needed to confirm these inputs.



Default Heating/Cooling System Efficiencies					
System Type	WUFI Type	Coverage (%)	Heating Type	Heating Performance	Cooling COP
Split Heat Pumps / VRF	Heat pump	100%	Heat pump	COP: 3	4
		100%	Heat pump (rated monthly COP)	COP: 2.4 @ 17F COP: 3.5 @ 47F	
Ground Source Heat Pump (WSHP)	Heat pump	100%	Heat pump	COP: 3	4
Heat Pumps in Series (WSHP)	Heat pump	100%	Heat pump	COP: 2.1 ¹	3.1 ¹
WSHP w/ Boiler & Cooling Tower	Heat pump	80%	Heat pump	COP: 2.1 ²	2.9 ²
	User defined (gas) or Electric resistance	20%	-	Efficiency ³ (gas): 96%	-
ASHP w/ Hydronic Fan Coils	Heat pump	100%	Heat pump	2.25 ¹	3.1 ¹
Combustion + DX Cooling	User defined	100%	-	Efficiency ³ (boiler): 96% Efficiency ³ (furnace): 90%	-
	Heat pump		-	-	3.5

¹ De-rated 5% for pumps

² De-rated 10% for pumps

³ Refer to Guidebook section 1.4.4.14 for how to implement this efficiency in WUFI

Name	
Type	
Heat pump ▼	
Parameters	
Required data	
Annual heating coefficient of performance (COP) [-]	2.4
Total system performance ratio of heat generator [-]	0.4166

Name	
Mitsubishi MXZ3C24NA3/SUZKA24NA2	
Type	
Heat pump - rated monthly COP ▼	
Parameters	
Required data	
Rated COP 1 [-]	2.32
Ambient Temperature 1 [°F]	17
Rated COP 2 [-]	3.67
Ambient Temperature 2 [°F]	47

Name	
Fireplace	
Parameters	
Required data	
Performance ratio of heat generator [-]	.85
Source energy factor [Btu/Btu]	1
CO2 emissions factor [g/kBtu]	1
Within thermal envelope	<input checked="" type="checkbox"/>
Optional data (if not defined default value will be calculated)	
Auxiliary energy (electric power) [Btu/hr]	

User defined

General Distribution

Hydronic heating DHW Cooling Ventilation Supportive device / auxiliary energy

Cooling distribution

Cooling via ventilation air	<input type="checkbox"/>
Cooling via air recirculation	<input checked="" type="checkbox"/>
Dehumidification	<input checked="" type="checkbox"/>
Panel cooling	<input type="checkbox"/>

Additional data

Recirculation air cooling is single-speed	<input type="checkbox"/>
Minimum temperature of cooling coil (for recirculation air) [°F]	45
Recirculation air flow rate [cfm]	1750
Recirculation air flow is variable	<input checked="" type="checkbox"/>
Recirculation air cooling capacity [kBtu/hr]	70
Recirculation cooling COP [-]	4.43
Useful dehumidification heat loss	<input type="checkbox"/>
Dehumidification COP [-]	1.2

7. Systems: Devices > DHW

Define Domestic Hot Water (DHW) System

Consider what type of DHW system is typical and permitted in your location. If gas systems or electric resistance heating systems are typical and permitted in your location, model to reflect this in the "Baseline Case".



Refer to the table below for default efficiencies to use for feasibility study modeling based on Phius' observations of Certified projects. For Certification, device datasheets and external calculators may be needed to confirm these inputs.

Default DHW (Domestic Hot Water) System Efficiencies			
System Type	WUFI Type	Coverage (%)	Heating Performance / Storage Losses
Gas Water Heater	User defined	100%	Efficiency ³ : 90-95%
	Water storage	-	Specific total losses: 8 Btu/hr °F
Electric Water Heater	Electric resistance space heat	100%	-
	Water storage	-	Specific total losses: 8 Btu/hr °F
Heat Pump Water Heater (unitary)	Heat pump water heater (inside)	100%	COP: Match heating system EF (Energy Factor): 2.35
Split Heat Pump Water Heater (CO ₂ or split)	Heat pump	100% or 75% (if swing tank present)	COP: 3 (CO ₂) COP: 2 (R-410A / 32)
	Electric resistance (if swing tank present)	25%	-
	Water storage (if inside)	-	Specific total losses: 8 Btu/hr °F

³ Refer to Guidebook section 1.4.4.14 for how to implement this efficiency in WUFI

Name
INN 1350N Gas Fired Boiler 96% Efficiency

Parameters

Required data

Performance ratio of heat generator [-]	1.0417
Source energy factor [Btu/Btu]	1.1
CO2 emissions factor [g/kBtu]	73.28
Within thermal envelope	<input checked="" type="checkbox"/>

Optional data (if not defined default value will be calculated)

Auxiliary energy (electric power) [Btu/hr]	
--	--

Gas

Name
LAARS Model SHVDI54113MHSXXX R16

Input options
Specific total losses

Database relevant data

Assign from database

Required data

Storage capacity [gal]	1000
Specific total thermal storage losses [Btu/hr F]	17.9

Connected solar collector

Water Storage

Remaining parameters

Required data

Within thermal envelope	<input checked="" type="checkbox"/>
Quantity	3

Optional data (if not defined default value will be calculated)

Typical storage water temperature [°F]	140
--	-----

Name
Rennai REHP80

Type
Heat Pump water heater (HPWH) inside

Parameters

Required data

Annual heating coefficient of performance (COP) [-]	2.9
Total system performance ratio of heat generator [-]	0.35
HPWH EF [-]	4.24

HPWH

General Distribution

Name
System 1

Device/Equipment

Nr.	Type	Used for				
		Space heating	DHW	Space cooling	Space ventilation	
1	Heat pump	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<ul style="list-style-type: none"> New Delete Copy Insert New/Insert: after
2	Electric resistance space heat / DHW	<input type="checkbox"/>	<input checked="" type="checkbox"/>			
3	Electric resistance space heat / DHW	<input checked="" type="checkbox"/>	<input type="checkbox"/>			
4	Mechanical ventilation				<input checked="" type="checkbox"/>	
5	Heat pump	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
6	Water storage		<input checked="" type="checkbox"/>			

Coverage

	From other systems			
1	Heat pump, Mitsubishi Hyper-Heat ASHPs	0.95		.5
2	Electric resistance space heat / DHW, Swi		.2	
3	Electric resistance space heat / DHW	0.05		
4	Heat pump, HPWH-1 & 2		.8	
5	Photovoltaic / renewable energy, PV Array			



On-Site Renewable Energy

Phius typically does not rely upon renewable energy to meet the Phius CORE targets during the feasibility study stage unless either of the following is true:

1. The client has confirmed renewable energy is planned **OR**
2. The source energy target is unreachable even with significant upgrades to the envelope or systems past the point of what the team is comfortable with.

Phius typically uses PV Watts to estimate renewable energy production.

The screenshot displays the PV Watts calculator interface. The 'Name' field is 'PV Watts Estimate', 'Location' is 'On-site', and 'Onsite utilization' is 'PV utilization calculator'. Under 'Parameters', 'Required data' includes: Photovoltaic / renewable energy [kWh/yr] (5228), Array size [kW] (4), and Utilization factor [-] (1). The 'RESULTS' section shows a total of 5,228 kWh/Year* and a monthly breakdown table.

Month	Solar Radiation (kWh / m ² / day)	AC Energy (kWh)
January	2.42	261
February	3.48	334
March	4.20	435
April	5.22	508
May	5.74	557
June	6.26	581
July	6.72	634
August	5.87	555
September	5.11	482
October	3.73	374
November	2.75	278
December	2.15	228
Annual	4.47	5,227

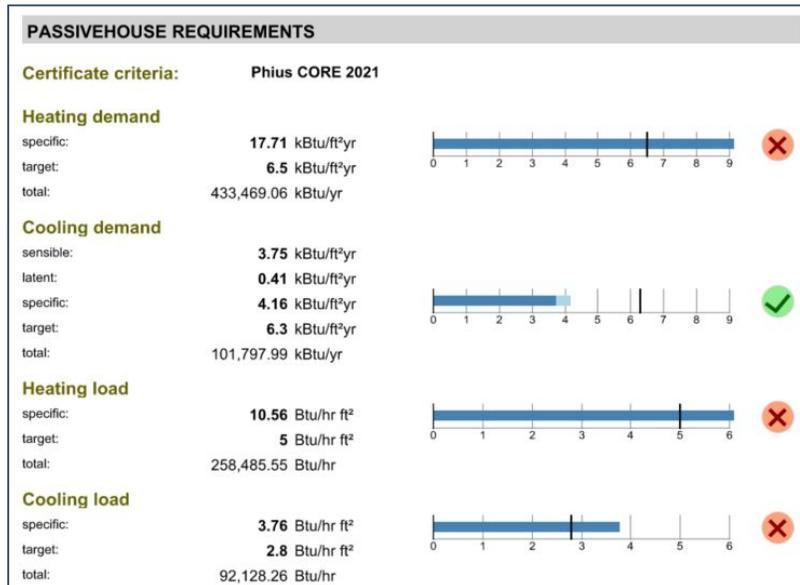


Inform the Design with Reports

Example: A Baseline Model is struggling to meet the Heating Demand & Load. Reviewing the PH Verification Report shows that Ventilation is the largest single 'loss'.

Energy Conservative Measures (ECMs) to review first:

1. Envelope Airtightness
2. Ventilation System Efficiency
3. Mechanical Airflow Rates



Passive House Verification Report

ANNUAL HEAT DEMAND

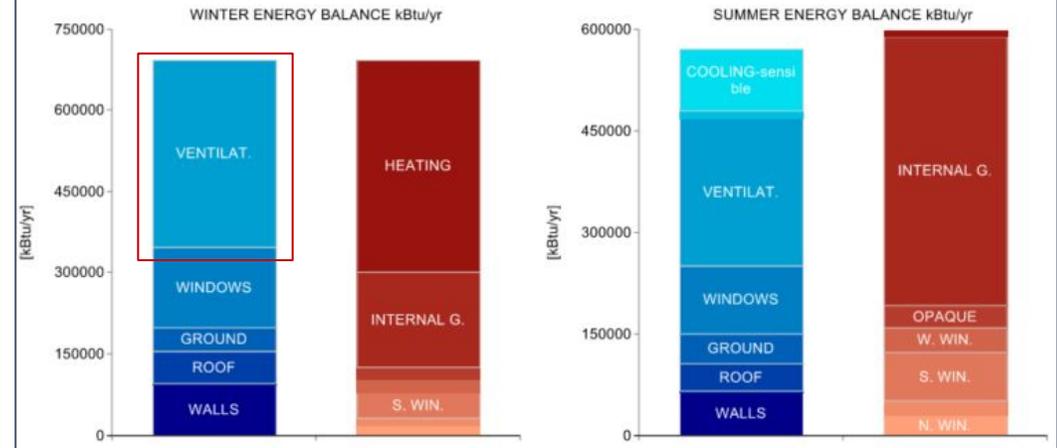
Transmission losses :	389,491 kBtu/yr
Ventilation losses:	344,321 kBtu/yr
Total heat losses:	733,812 kBtu/yr
Solar heat gains:	147,973 kBtu/yr
Internal heat gains:	211,255 kBtu/yr
Total heat gains:	359,228 kBtu/yr
Utilization factor:	83.6 %
Useful heat gains:	300,343 kBtu/yr

Annual heat demand:	433,469 kBtu/yr
Specific annual heat demand:	17,712.1 Btu/ft ² yr

ANNUAL COOLING DEMAND

Solar heat gains:	191,547 kBtu/yr
Internal heat gains:	396,811 kBtu/yr
Total heat gains:	588,358 kBtu/yr
Transmission losses :	618,803 kBtu/yr
Ventilation losses:	483,285 kBtu/yr
Total heat losses:	1,102,088 kBtu/yr
Utilization factor:	45.1 %
Useful heat losses:	496,512 kBtu/yr

Cooling demand - sensible:	91,846 kBtu/yr
Cooling demand - latent:	9,952 kBtu/yr
Annual cooling demand:	101,798 kBtu/yr
Specific annual cooling demand:	4.2 kBtu/ft ² yr





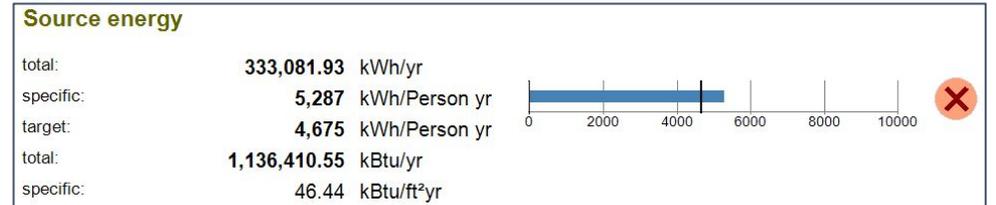
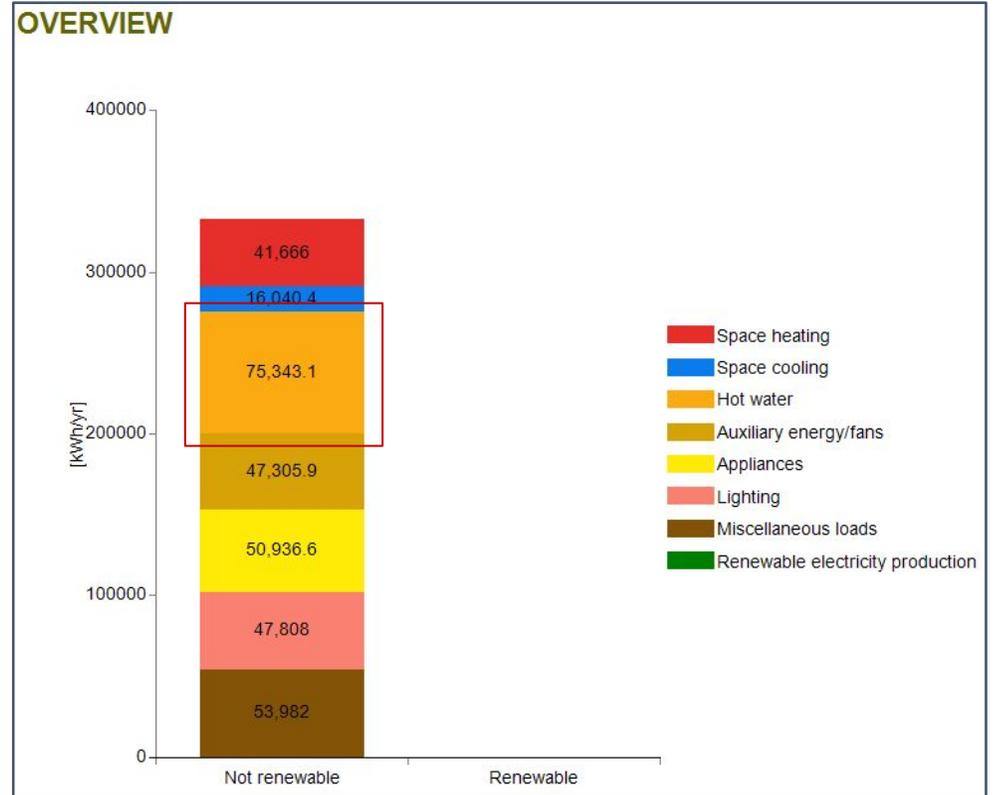
Inform the Design with Reports

Example: A Proposed Model is struggling to meet the Source Energy Target. Reviewing the PH Source Energy Report shows that Hot Water is the largest energy use.

Energy Conservative Measures (ECMs) to review first:

1. Distribution Pipe Lengths
 - a. Confirm multipliers are entered correctly
2. DHW System Efficiency
3. Look into Renewable Energy Systems

Passive House Source Energy Report





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