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How the Weatherization Assistant
MulTEA Tool Works to Implement
Multifamily Retrofits



"Amplifying Our Impact"

PRESENTERS



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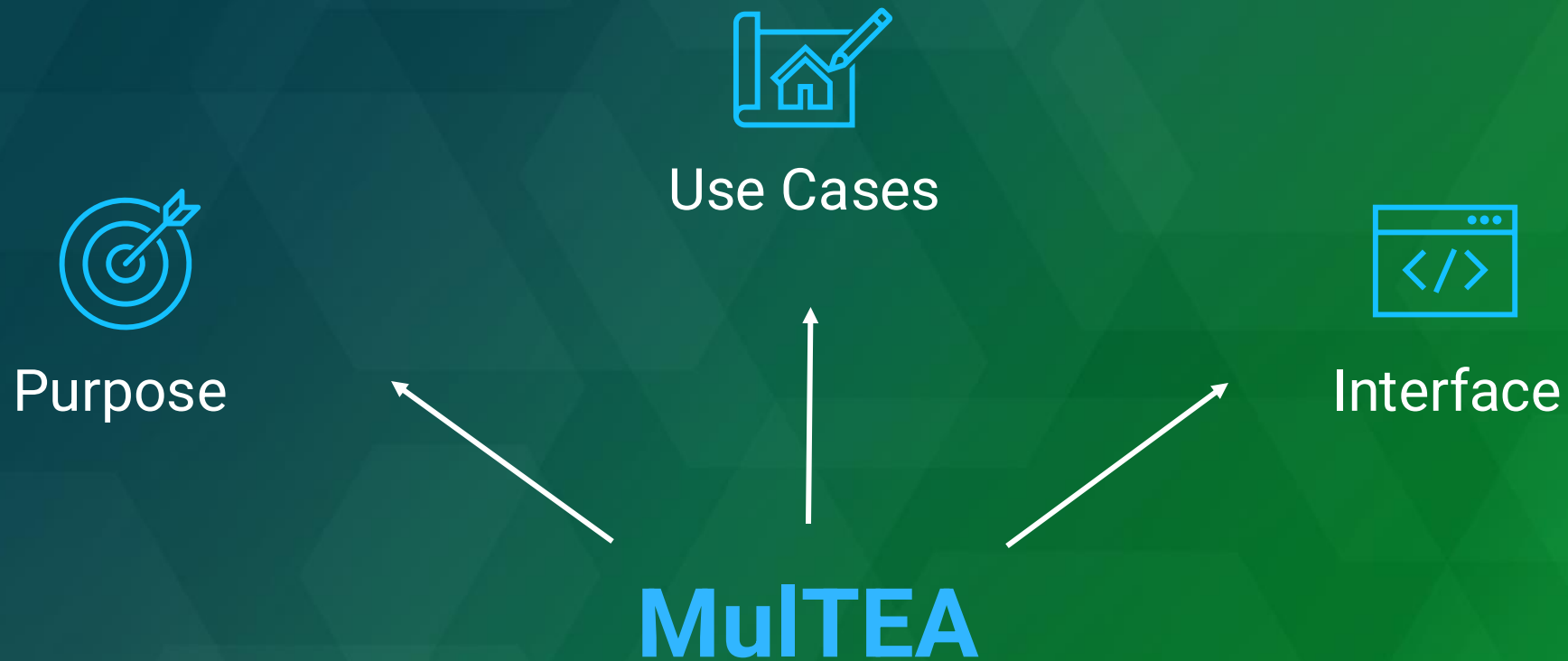
ORNL Integrated Building
Deployment and Analysis Group

ACKNOWLEDGMENTS

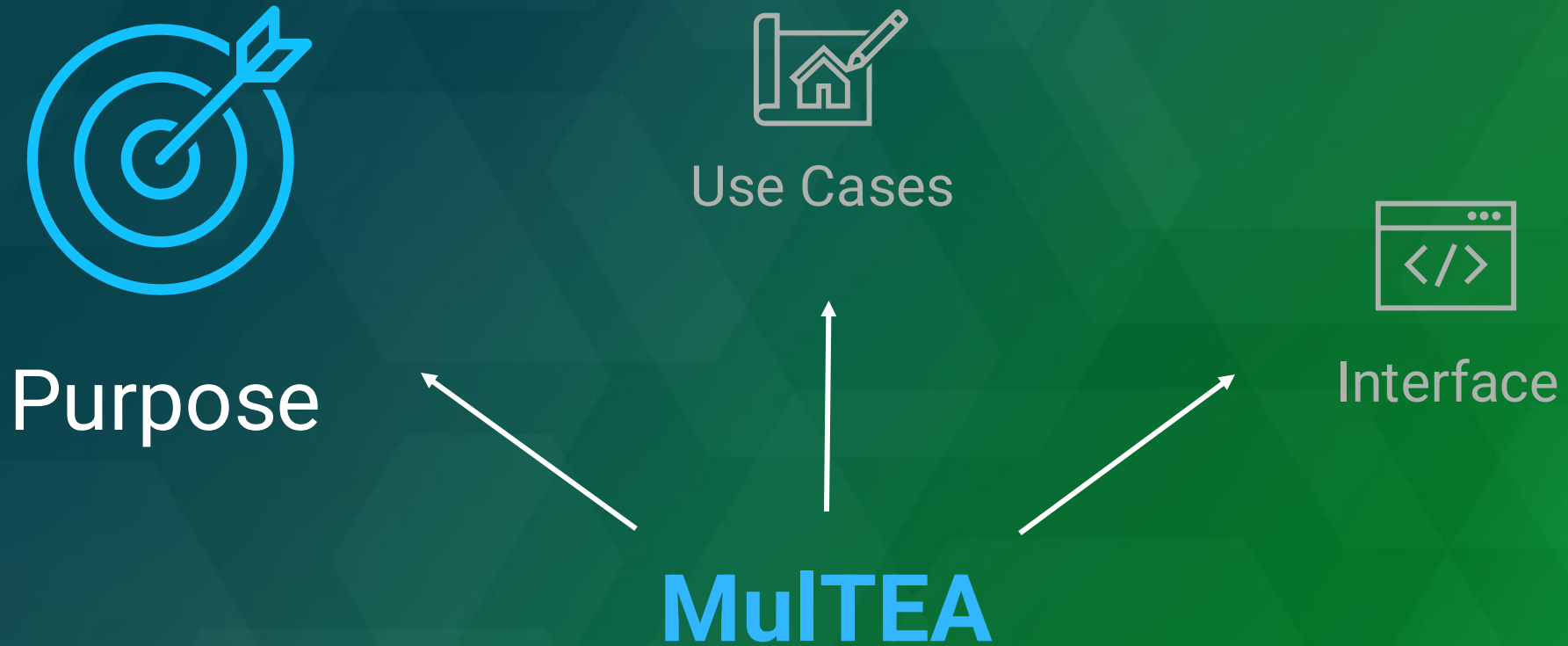
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This presentation introduces MuTEA as a WAP energy audit tool, outlining its **purpose**, highlighting common **use cases**, and providing an overview of its **user interface**.



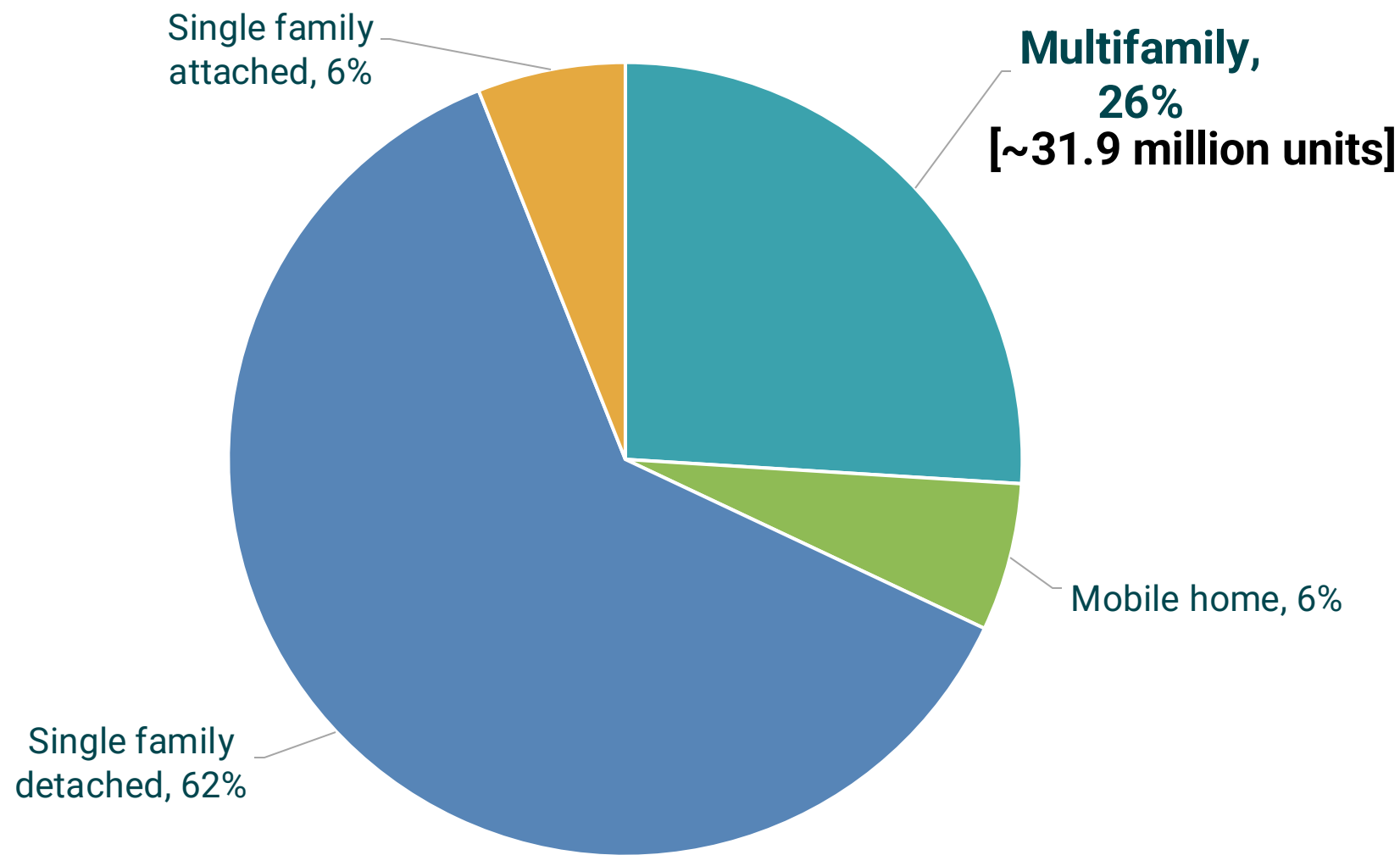
The Purpose of MuTEA



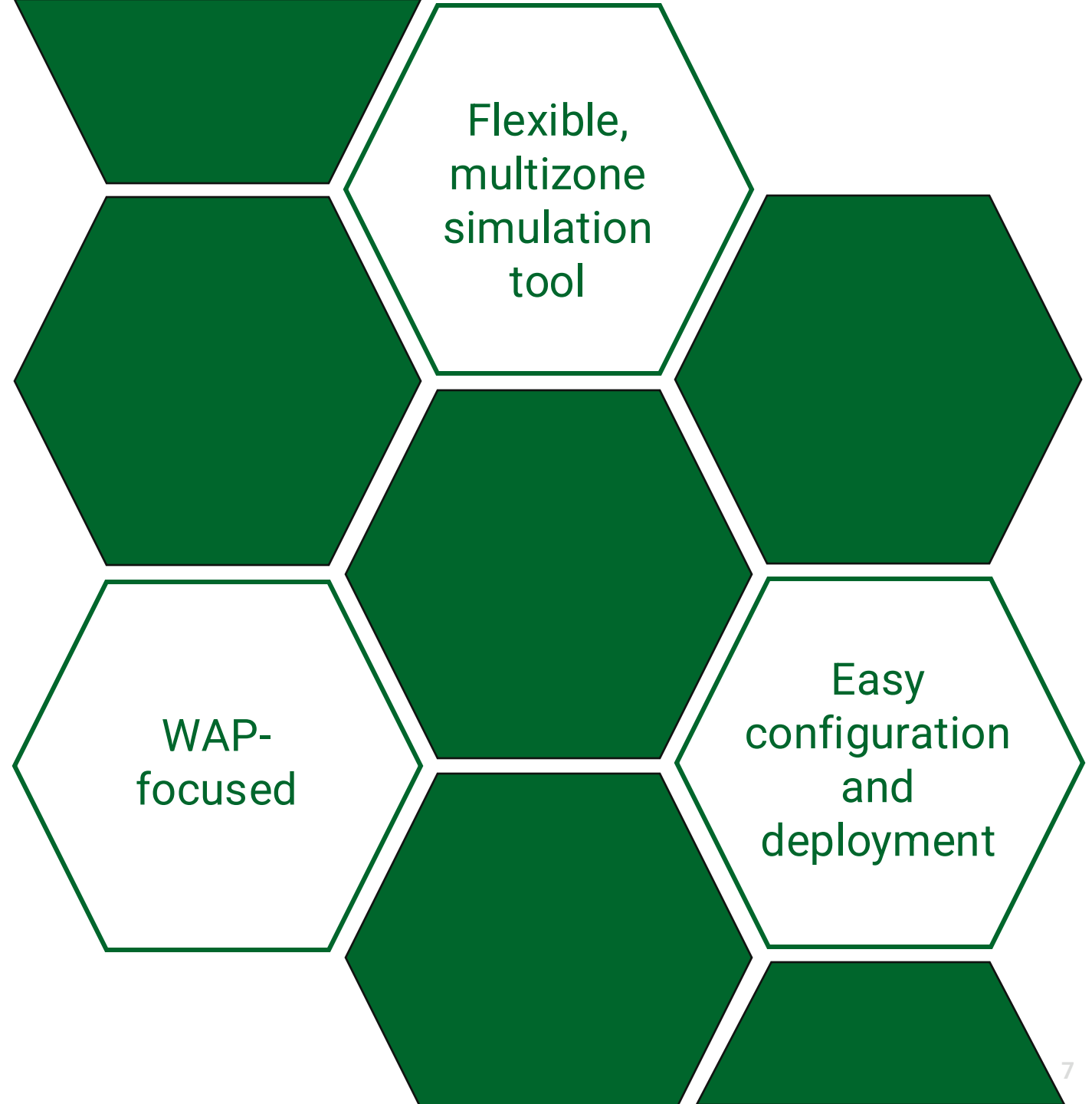
Multifamily audit tools are needed to meet the retrofit needs of US housing stock.

122.8 million
housing units

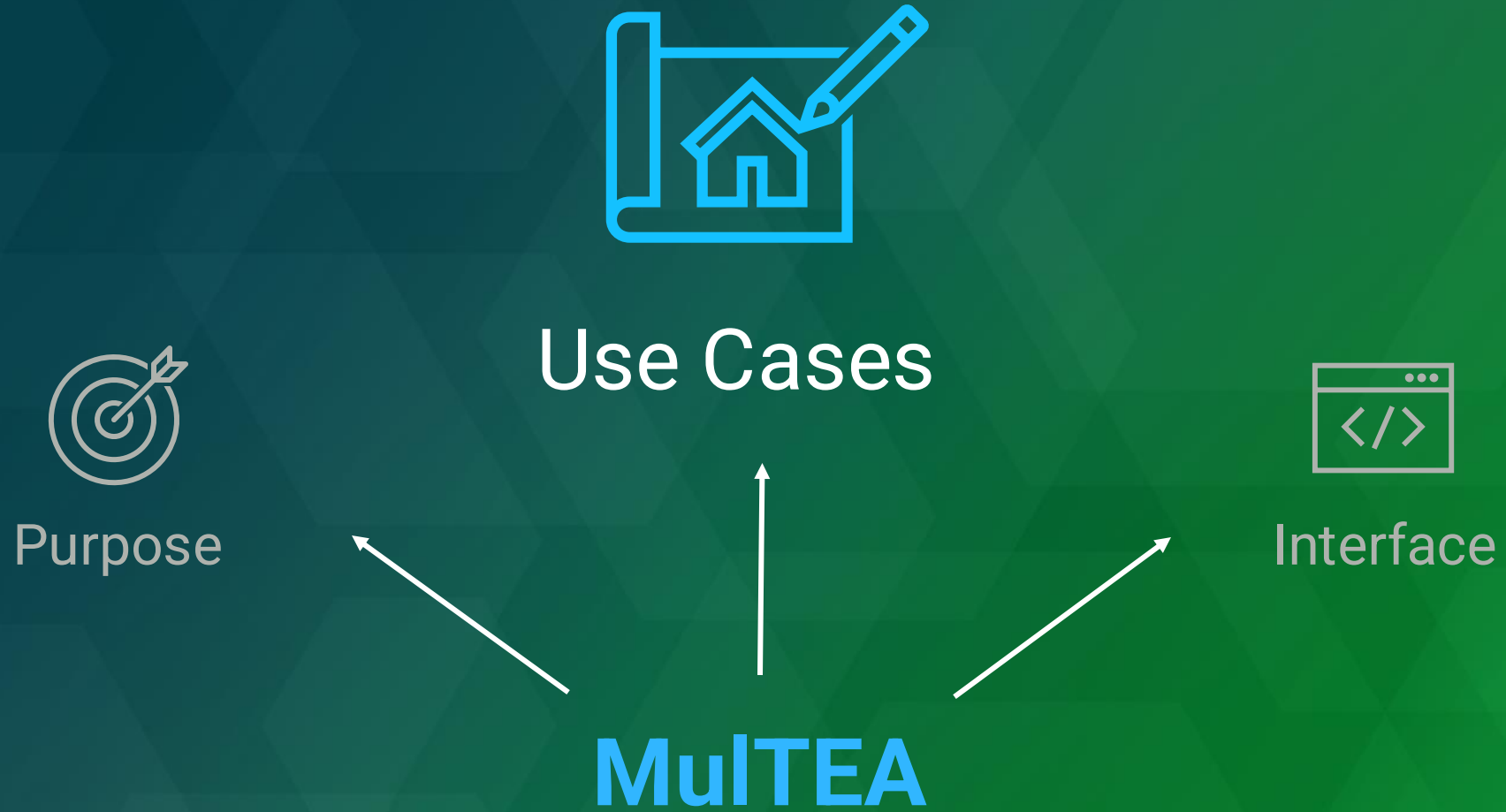
75% of multifamily
dwellings units
have simpler
systems



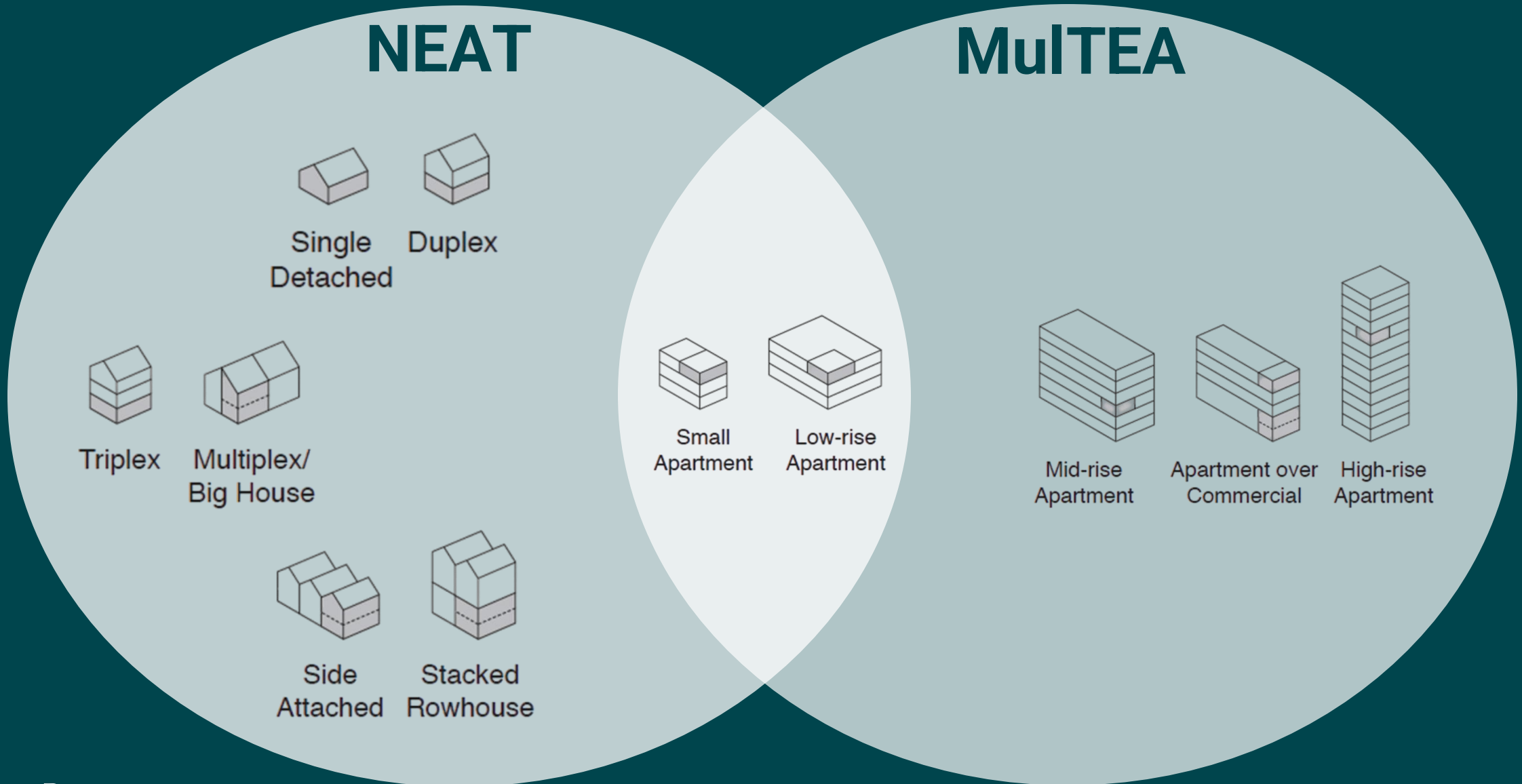
**MulTEA allows WAP
implementation on
common multifamily
building types.**



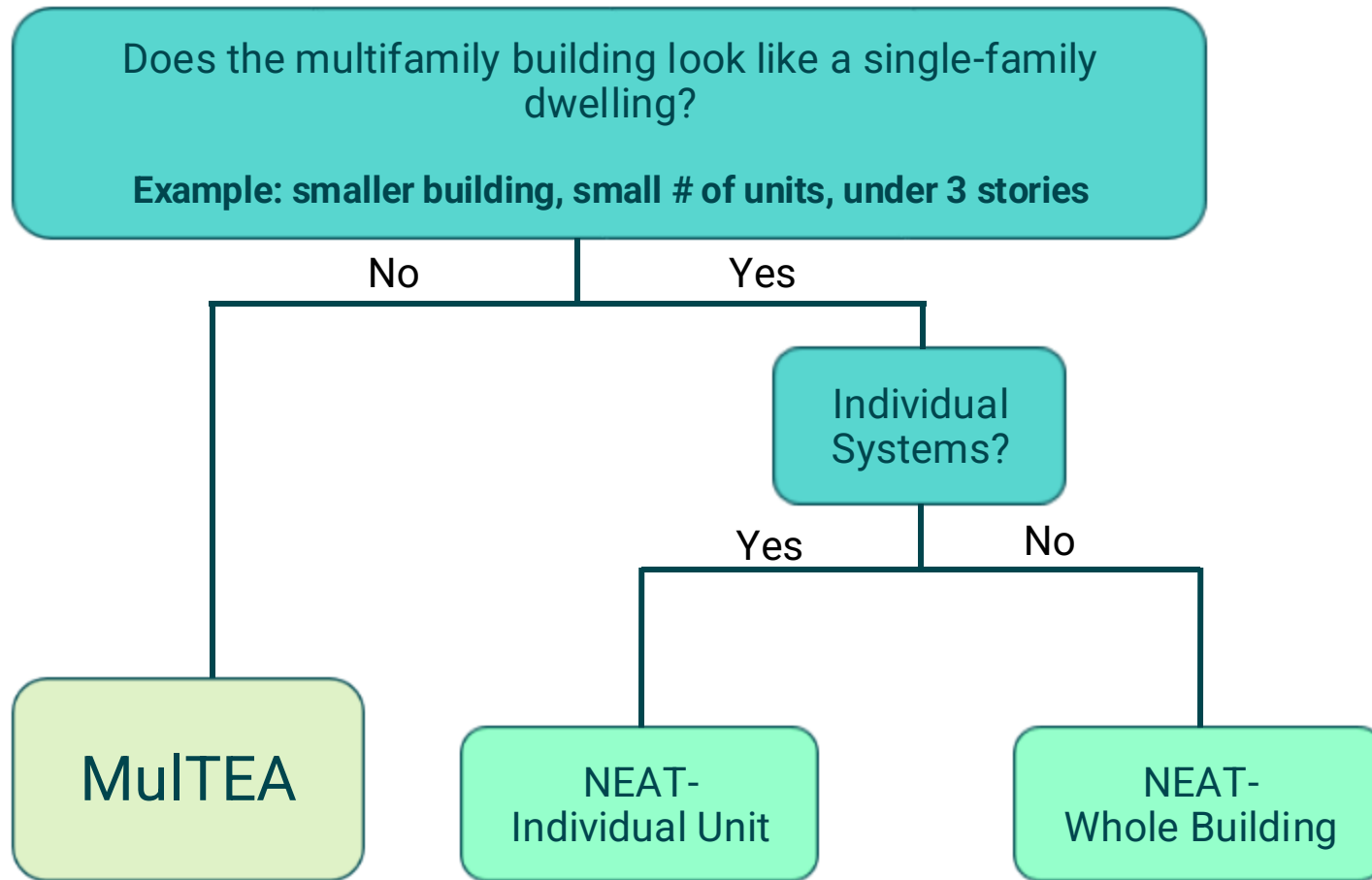
MuTEA Use Cases



Both NEAT and MuTEA can model multifamily buildings.



While nuanced, what is the basic decision-making process for determining when to use NEAT vs. MuTEA?



When considering whether to use NEAT or MuTEA, refer to the key **modeling differences** between NEAT and MuTEA.

MuTEA

Multi-zone, flexible
model

ONLY
Whole Building

NEAT









Single-zone Model

Whole Building
OR
Individual Units

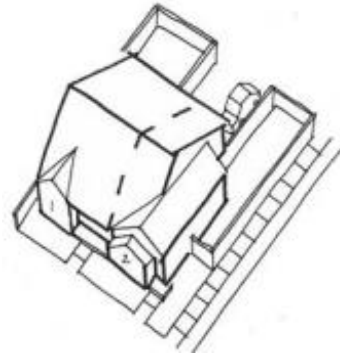
Selecting NEAT vs. MulTEA for multifamily buildings requires a case-specific approach.

MulTEA	NEAT- Individual Unit	NEAT- Whole Building
Larger building / large # of units	Smaller building	Smaller building with complex unit configuration
Individual HVAC/DHW and replacements likely	Individual HVAC/DHW replacement likely	HVAC/DHW replacement unlikely
Central HVAC	Varied HVAC/DHW equipment	

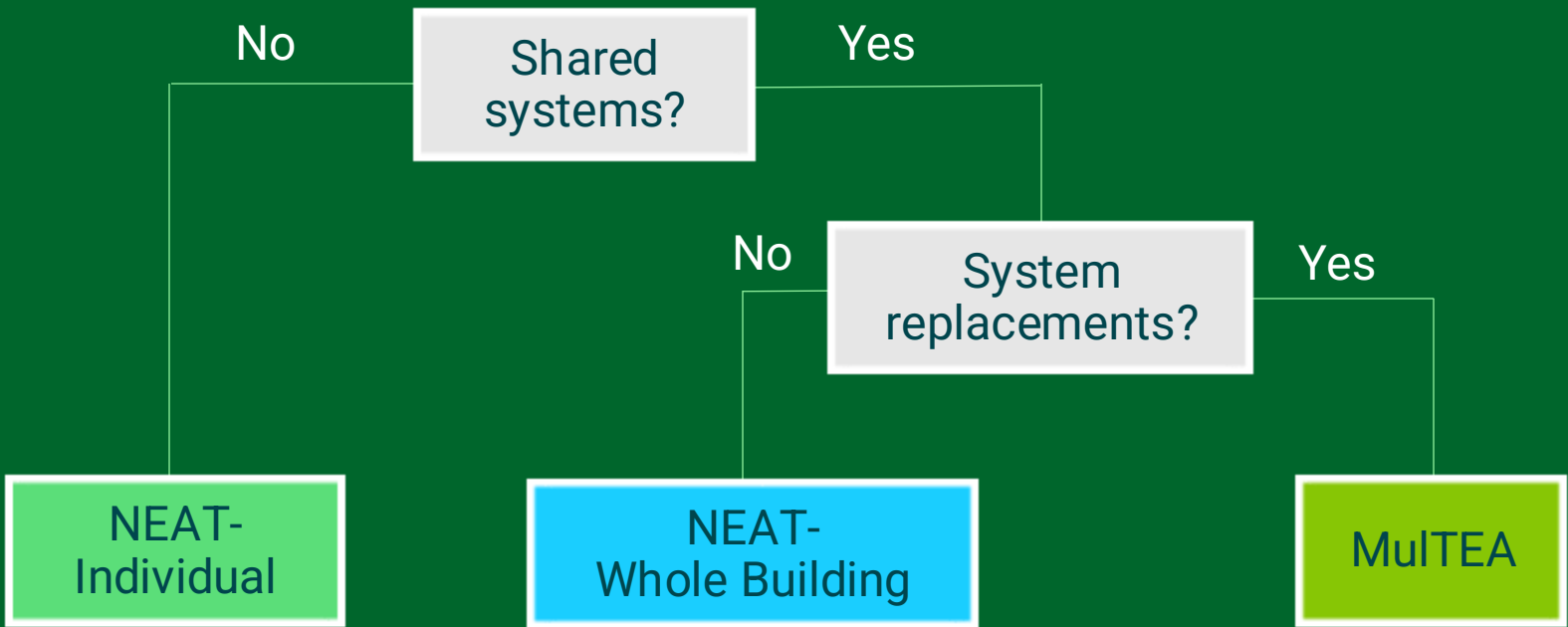
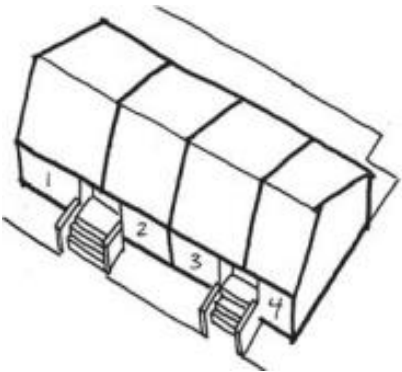
NEAT vs. MuTEA systems and equipment modeling differences influence audit tool selection for multifamily buildings.

	NEAT	MuTEA
HVAC		
Ducts		
Water Heater		
Fridge		

Duplexes/Triplexes should typically be modeled in NEAT.



Town Houses/Row Homes could be modeled in NEAT or MuTEA.



“Mansion” Apartments are best modeled in NEAT.

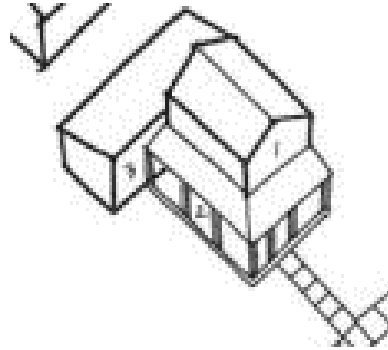
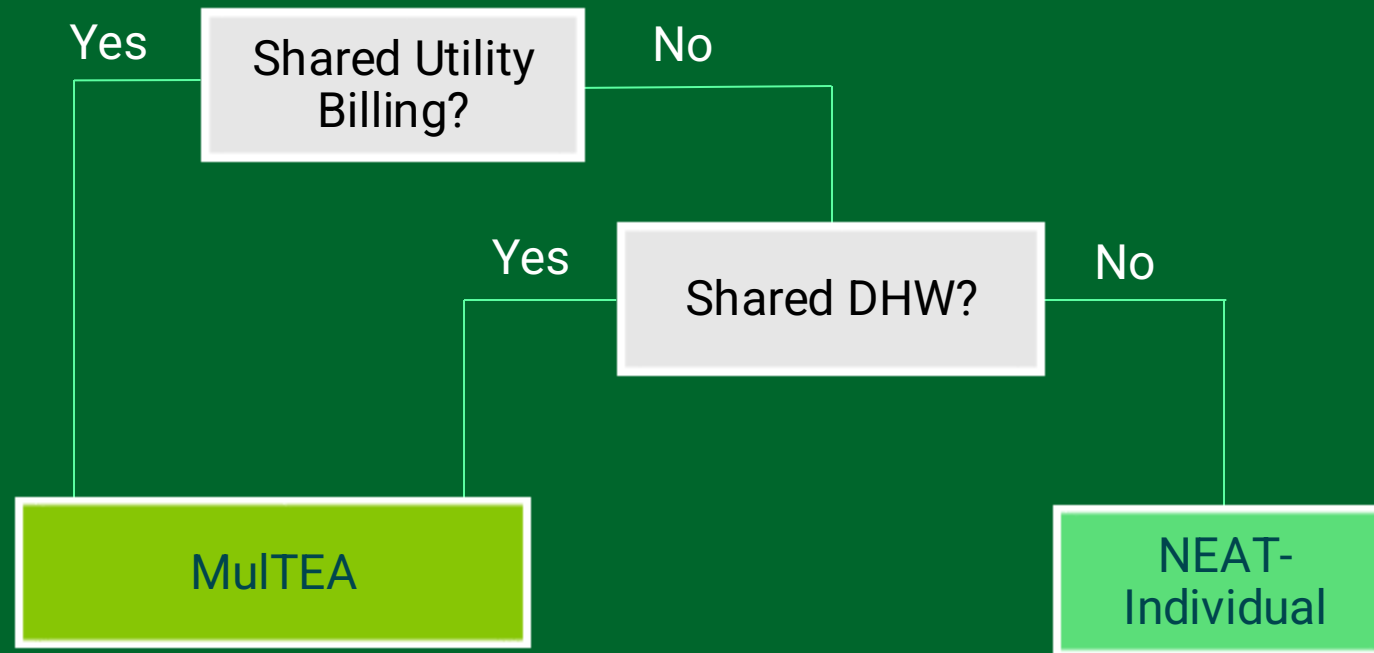
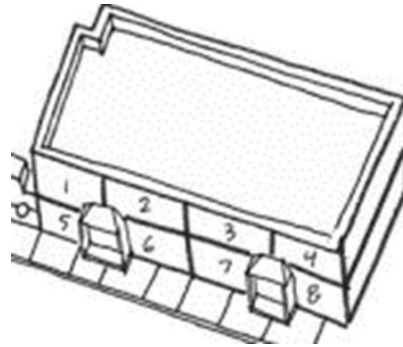


Image sources: The Metropolitan Design Center (University of Minnesota) and Thurston Regional Planning Council

Garden Apartments could be modeled in NEAT or MulTEA.



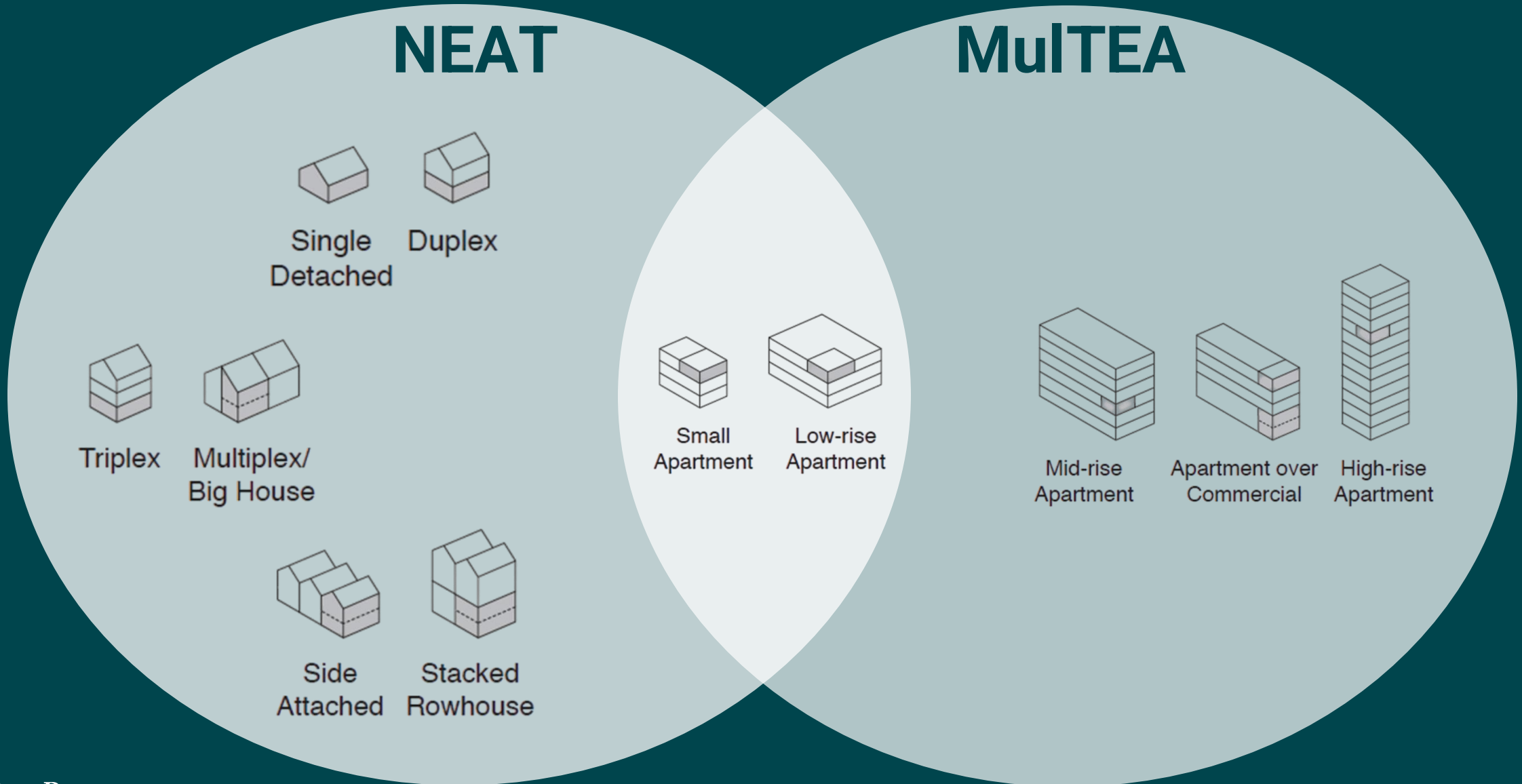
Midrise Apartment Buildings are best modeled in MulTEA.



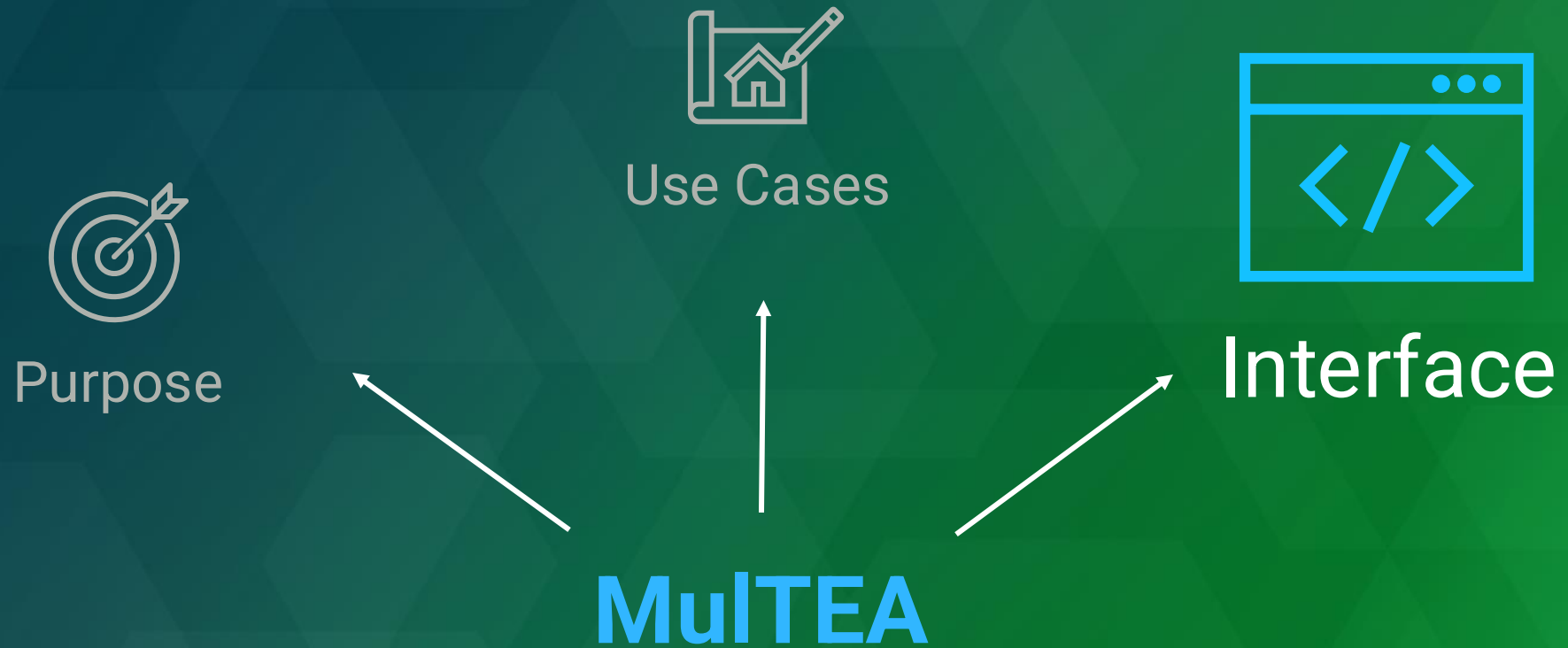
>25 units!

**Multiple thermal
zones**

Both NEAT and MuTEA can model multifamily buildings.



MuTEA User Interface



The Weatherization Assistant (WA) interface provides access to all audit tools in one location. Existing WA users can access MulTEA by using the same dropdown menu used to access NEAT, MHEA, and the Health & Safety Audit.

Weatherization Assistant

Agency

Account

Audit (MulTEA)

Libraries

Work Orders

User

Release Notes

Options

Admin Tools

Help

MulTEA

Agency:

Acct.:

Acct. #:

Audit:

Audit #:

Multifamily Tool

Agency:

Account Name

Account Numb

Audit Name:

NEAT – National Energy Audit Tool

MHEA – Manufactured Home Energy Audit

MulTEA – Multifamily Tool for Energy Audits

Health and Safety Audit

View Audit

Audit Date:

Auditor:

City:

State:

Audit Number:

-1

General

Audit

Building

Shell

Walls

Windows

Doors

Roofs

Floors

Systems

HVAC

Infiltration/Vent.

Water Heating

Lighting & Appliances

Lighting

Appliances/Eqpt.

Refrigerators

Other

Itemized Costs

Utility Bills

Calibration

Measures

Libraries

Weather State:

Weather Station:

Economic Parameters:

Measure Costs:

Key Parameters:

Fuel Cost Details

Electricity:

Natural Gas:

Propane/LPG:

Fuel Oil:

Kerosene:

Cost:

per

Cost:

per

Cost:

per

Cost:

per

Cost:

per

Comments

New

Copy

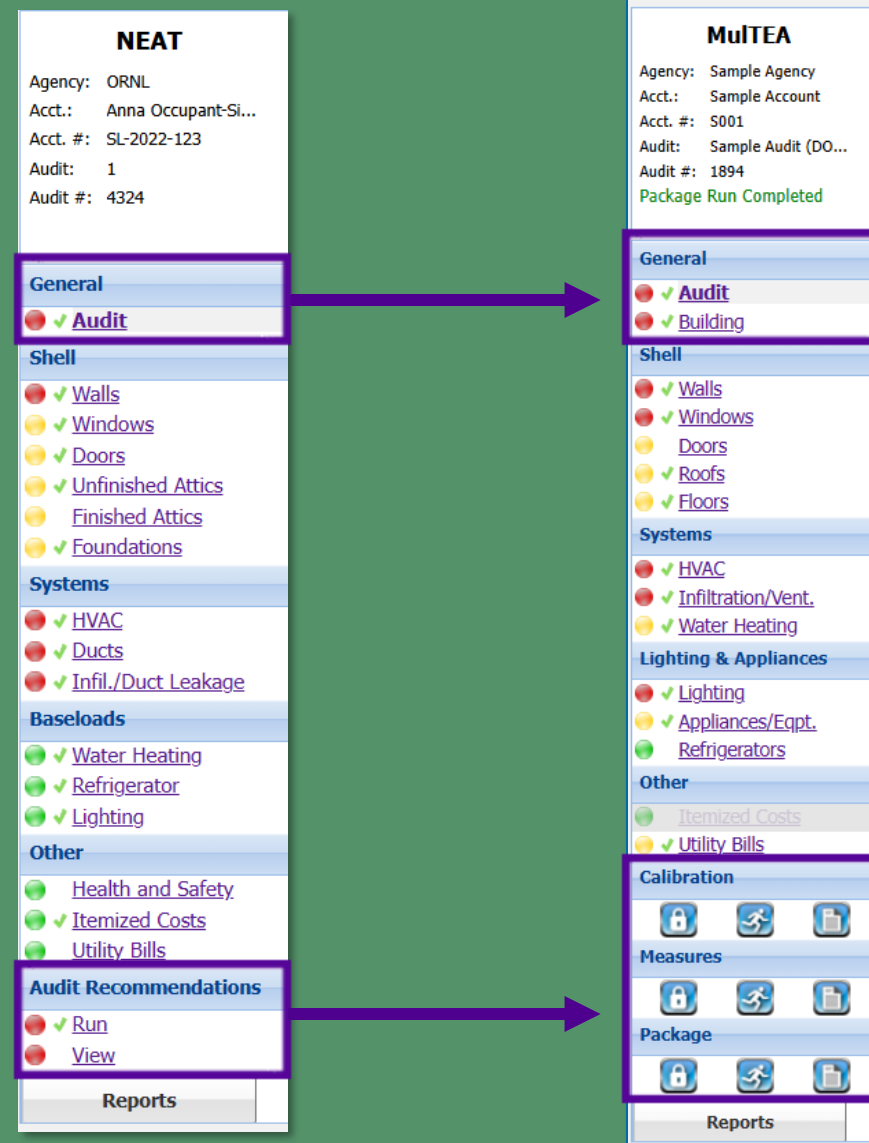
Delete

OK

Apply

Cancel

The primary differences between the MulTEA and NEAT audit docks are MulTEA's **building form** and **iterative audit run process**.



Images sourced from the Web-based Weatherization Assistant (ORNL)

MulTEA's Building Form sets key features of the shell forms.

Define dwelling units and orientations

General Building Details

Building Configuration

Define Areas of Building Spaces

MulTEA
Agency: Sample Agency
Acct.: Sample Account
Acct. #: S001
Audit: Sample Audit (DO...
Audit #: 1894
Package Run Completed

General
Audit
Building
Shell
Walls
Windows
Doors
Roofs
Floors
Systems
HVAC
Infiltration/Vent.
Water Heating
Lighting & Appliances
Lighting
Appliances/Eqpt.
Refrigerators
Other
Itemized Costs
Utility Bills
Calibration
Measures
Package
Reports

Building

Building Size and Occupancy
Number of Dwelling Units: 6
Gross Floor Area of Building (sq ft): 7800
Number of Floors Above Grade: 1
Number of Floors Below Grade: 0
Average Floor Height (ft): 10
Number of Occupants:
During Daytime: 12
During Nighttime: 24
Site Grade Changes:
With Reference to the Highest Grade:
Elevation of First Floor Above Grade (ft): 0
Total Height of Building Below Grade (ft): 0
Depth of Ground Below Grade:
On the Back (ft):
On the Right (ft):
On the Front (ft):
On the Left (ft):

Site Definition
Site Shielding: Moderate
Site Terrain: Suburban

Building Layout
Building Shape: Linear/Box
Hallway Configuration: Double-Loaded
Hallways Are Conditioned:
Orientation of Building (deg): 0
Number of Dwelling Units by Floor:
Top Floor: 0
Intermediate Floor: 0
First Floor: 6
Below Grade Floor: 0

Area of Spaces
Area of Spaces by Floor

Floor	Area of Enclosed Spaces (sq ft)				Floor Sum
	Units	Hallways	Other Conditioned Spaces	Other Unconditioned Spaces	
A3	0	0	0	0	0
A2	0	0	0	0	0
A1	7200	600	0	0	7800
B1	0	0	0	0	0
B2	NA	0	0	0	0
Totals:	7200.0	600.0	0.0	0.0	7800.0

Number of Dwelling Units
Below Grade Floor First Floor Intermediate Floor Top Floor
☒ Exposed Walls in one orientation
☒ Exposed Walls in two adjacent orientations
☐ Exposed Walls in two opposite orientations
☐ Exposed Walls in three orientations
☐ Exposed Walls in all orientations

MulTEA's tabbed interface streamlines data entry while preserving user flexibility.

Exterior

Underground

Interior

MulTEA

Agency:
Acct.:
Acct. #:
Audit:
Audit #:

General

Audit

Building

Shell

Walls

Windows

Doors

Roofs

Floors

Systems

HVAC

Infiltration/Vent.

Water Heating

Lighting & Appliances

Lighting

Appliances/Eqpt.

Refrigerators

Other

Itemized Costs

Utility Bills

Calibration

Exterior 1Exterior 2Exterior 3Exterior 4Underground 1Underground 2Interior 1Interior 2

Wall Code:

Construction

Wall Construction:

Construction Material:

Stud Dimensions:

Size:

Spacing (in):

Wall Insulation:

Cavity Insulation:

Type:

Thickness (in):

Exterior Insulation:

Type:

Thickness (in):

Interior Insulation:

Type:

Thickness (in):

Wall Exterior:

Exterior Finish:

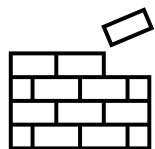
Exterior Color:

Configuration

Gross Area of Wall

Space	Gross Area (sq ft)				
	Back	Right	Front	Left	Sum
Totals:	0.0	0.0	0.0	0.0	0.0

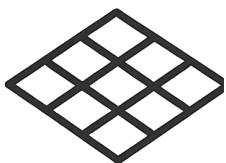
In MulTEA, the Shell, Systems, and Appliances forms use the **tabbed interface** similar to the Walls form.



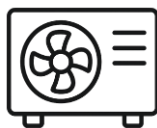
Walls



Windows



Floors



HVAC

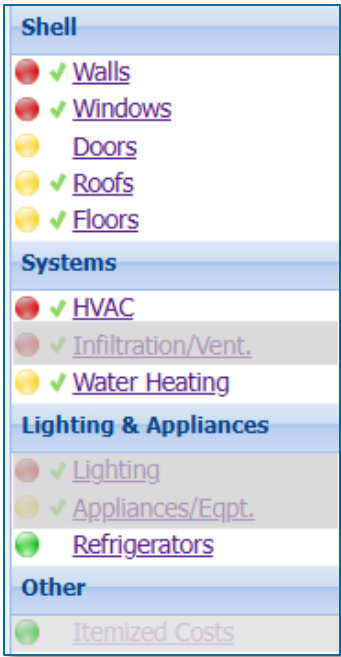


Image source:
Web-based Weatherization Assistant
(ORNL)



Doors



Attic/Roof



Water Heating



Refrigerators

Shell forms in MuTEA, NEAT, and MHEA share similar structure and inputs.

Components

Exterior 1 Exterior 2 Exterior 3 Exterior 4 Underground 1 Underground 2 Interior 1 Interior 2

Wall Code: Wall1 - brick siding

Construction

Construction Material Type: Wood

Stud Dimensions: Size: 2x4 Spacing: 16

Wall Insulation:

Cavity Insulation: Type: Fiberglass Batt - Normal Density Thickness (in): 3.5 R-value: 0

Exterior Insulation: Type: None Thickness (in): R-value:

Interior Insulation: Type: None Thickness (in): R-value:

Wall Exterior:

Exterior Finish: Brick Veneer

Exterior Color: Medium-Dark

Zone Assignment

Area by Zones

Location	Gross Area (sq ft) (Optional)				Sum
	Back	Right	Front	Left	
Units	1800	1200	1800	1200	6000
Hallways	150	0	150	0	300
Other Conditioned Spaces	0	0	0	0	0
Other Unconditioned Spaces	0	0	0	0	0
Crawlspace	0	0	0	0	0
Totals:	1950.0	1200.0	1950.0	1200.0	6300.0

Retrofit Measures

Active: ☐ Add Cavity Insulation: Type: None Thickness (in): R-value:

Active: ☐ Add Exterior Insulation: Type: None Thickness (in): R-value:

Active: ☐ Add Interior Insulation: Type: None Thickness (in): R-value:

Delete OK Apply Cancel

Systems forms in MulTEA, NEAT, and MHEA share similar structure and inputs.

General Operation

Type and Configuration

Zone Assignment

Equipment

Retrofit Measures

MulTEA

Central Boiler **System 1** System 2 System 3 System 4 System 5 System 6 Units Thermostat Hallways Thermostat Other Conditioned Spaces Thermostat

HVAC System Code: SysUNIT

System Configuration: Heating Only - Individual Units

Outside Air Ventilation Rate (cfm): 0

Location Served: Units

Number of Same Systems: B2: B1: A1: 1 A2: A3:

Heating Equipment

System Type: Individual

Equipment: Central Furnace

Fuel: Electricity

Efficiency Input Method: Year Manufactured

Year Manufactured: 2020

Steady State Efficiency % (Site Measured):

Efficiency (Nameplate/Rated): 98 %

Capacity: 50 kBtu/hr

Pilot Light/IID:

Cooling Equipment

System Type:

Equipment:

Efficiency Input Method:

Year Manufactured:

Efficiency:

Capacity:

Retrofit Measures

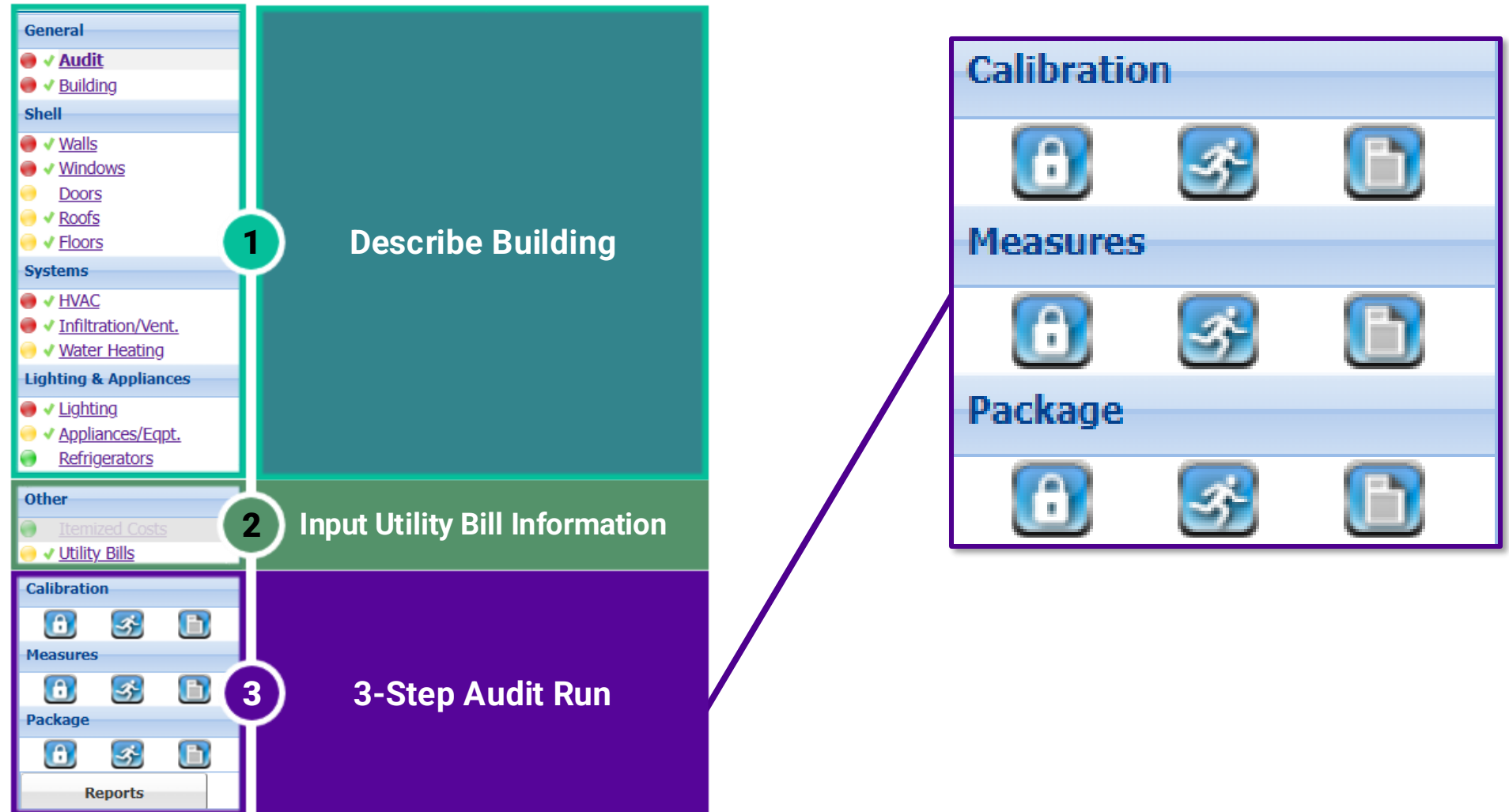
Active: ☐ Change Ventilation Rate: Outside Air Ventilation Rate (cfm):

Active: ☐ Replace the System: System Configuration: Heating Equipment: Heating Fuel: Heating Efficiency: Heating Capacity: Cooling Equipment: Cooling Efficiency: Cooling Capacity:

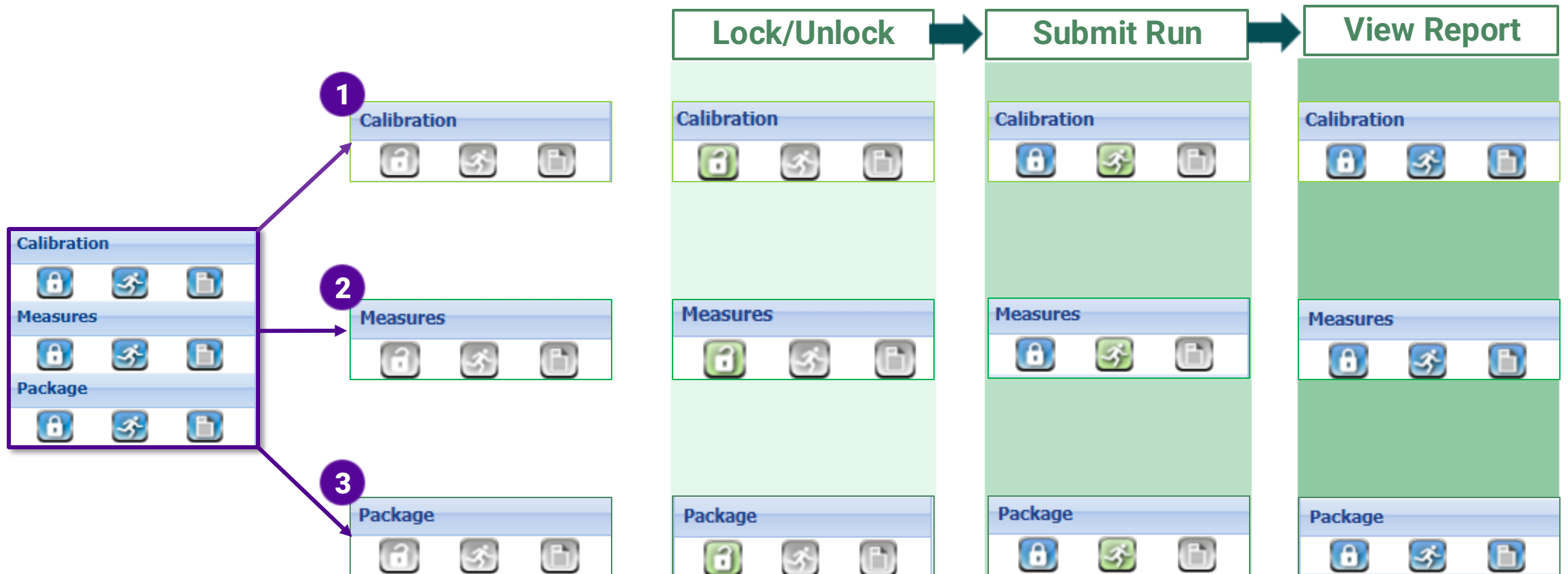
Active: ☐ Tune Up: Heating Efficiency Improvement (%): Cooling Efficiency Improvement (%):

Delete OK Apply Cancel

Three-step MulTEA audit run provides improved input and control for auditors.



MulTEA's iterative run process allows fine tuning of the model, measure modification, and package customization.



Calibration run report shows utility bill comparison and acceptance criteria.

MuTEA

Agency: Sample Agency
Acct.: Sample Account
Acct. #: S001
Audit: Sample Audit (DO...
Audit #: 1894
Package Run Completed

General

Audit

Building

Shell

Walls

Windows

Doors

Roofs

Floors

Systems

HVAC

Infiltration/Vent.

Water Heating

Lighting & Appliances

Lighting

Appliances/Eqpt.

Refrigerators

Other

Itemized Costs

Utility Bills

Calibration

Measures

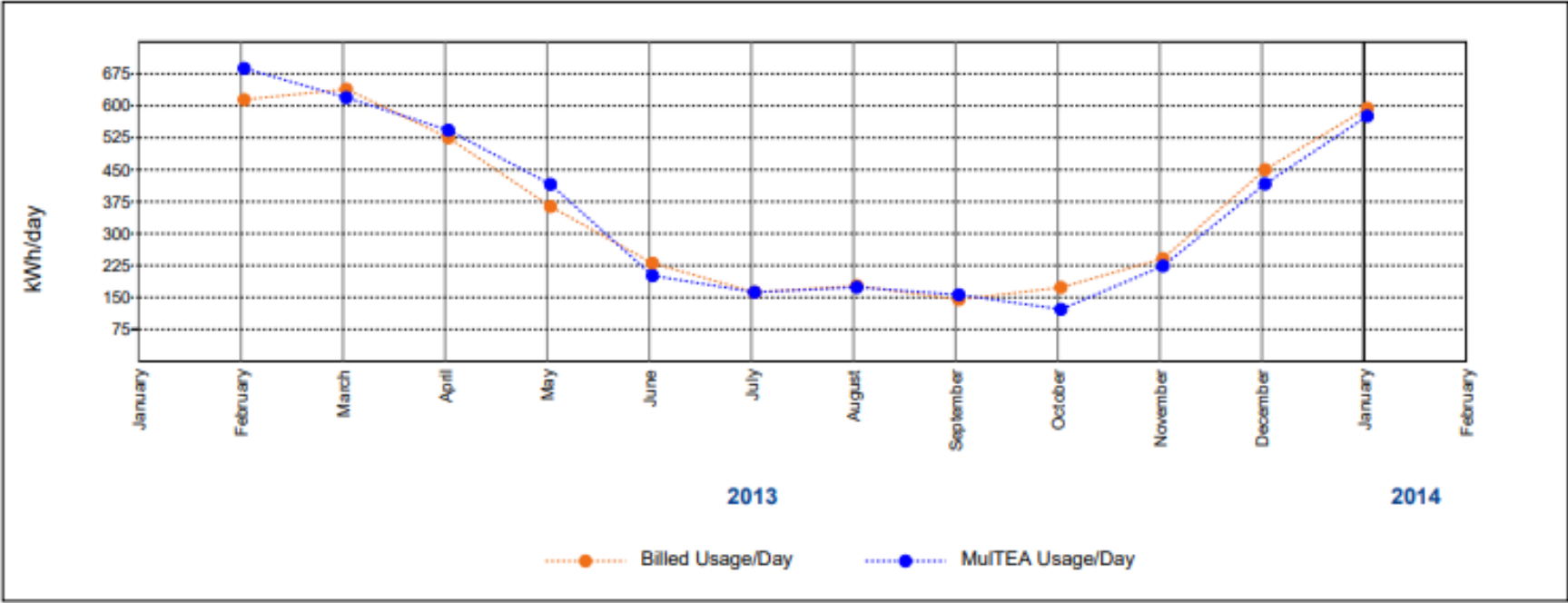
Package

Reports

Metrics for Calibration			
Statistical Index	Calculated Value	Acceptance Criteria	
		BPI ¹	ASHRAE ²
Normalized Mean Bias Error (NMBE)	0.4%	Within +/- 5%	Within +/- 5%
Coefficient of Variation of the Root Mean Square Error (CVRMSE)	10.1%	<=20%	<=15%

¹BPI-2400-S-2015 v.2, Standard Practice for Standardized Qualification of Whole-House Energy Savings Predictions by Calibration to Energy Use History.
²ASHRAE Guideline 14-2023, Measurement of Energy, Demand, and Water Savings.

Meets acceptance criteria



Utility bill comparison with model

The Economics tab within the Measures Run report allows auditors to select appropriate measures, including potential buy down measures.

MulTEA

Agency: Sample Agency
Acct.: Sample Account
Acct. #: S001
Audit: Sample Audit (DO...
Audit #: 1894
Package Run Completed

General

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Refrigerators

Other

Itemized Costs

Utility Bills

Calibration

Measures

Package

Reports

Weatherization Assistant Agency Account Audit (MulTEA) Libraries Work Orders User Release Notes Options Admin Tools Help

Energy Savings Cost Savings Installation Costs Economics

Agency: ORNL
Account Name: MulTEA Examples - TtT
Account Number: none provided
Audit Name: Sample Bldg 0 - Calibrated
Audit Number: 6175

Retrofit Measure Economics (No Interaction Among Measures)

Include in Package	#	Retrofit Measure	Component	Tab	Code	Predicted Annual Cost Savings (\$)	Estimated Installation Cost (\$)	Lifetime (years)	Savings-to-Investment Ratio (SIR)	Simple Payback Period (years)
<input checked="" type="checkbox"/>	1	Replace Window	Windows	Window 1	W1	\$524	\$6,000	20.0	1.35	11.4
<input checked="" type="checkbox"/>	2	Replace Window	Windows	Window 2	W2	\$362	\$4,500	20.0	1.24	12.4
<input type="checkbox"/>	3	Replace Door	Doors	Door 1	Building entrance	\$10	\$500	20.0	0.29	52.4
<input checked="" type="checkbox"/>	4	Add Ceiling Insulation	Roofs	Attic 1	Roof 1	\$489	\$3,000	20.0	2.51	6.1
<input checked="" type="checkbox"/>	5	Air Sealing	Infiltration/Ventilati...	Infiltration	Infiltration	\$484	\$2,500	10.0	1.70	5.2
<input checked="" type="checkbox"/>	6	Replace Lamps	Lighting	System	L1_units	\$232	\$1,000	6.8	1.44	4.3
<input checked="" type="checkbox"/>	7	Install Motion Sensors	Lighting	System	L2_hallways	\$101	\$500	12.0	2.08	4.9
<input checked="" type="checkbox"/>	8	Replace the Refrigerator	Refrigerator	Refrigerator 1	R1	\$180	\$3,600	15.0	0.92	13.4

Auditor selects measures...

...based on SIR, buydown potential

Package run shows opportunity for measure buydown.

MulTEA
Agency: Sample Agency
Acct.: Sample Account
Acct. #: S001
Audit: Sample Audit (DO...
Audit #: 1894
Package Run Completed

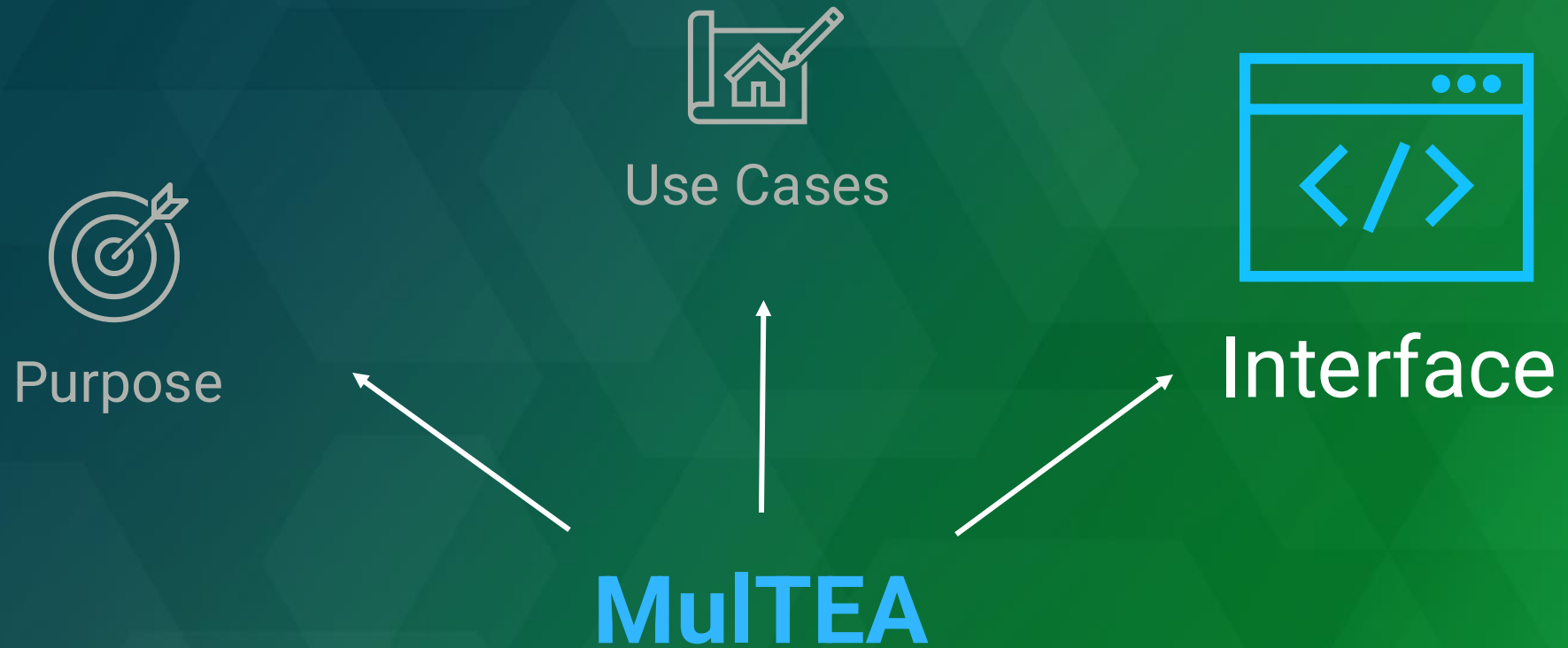
General
✔ **Audit**
✔ **Building**
Shell
✔ **Walls**
✔ **Windows**
Doors
✔ **Roofs**
✔ **Floors**
Systems
✔ **HVAC**
✔ **Infiltration/Vent.**
✔ **Water Heating**
Lighting & Appliances
✔ **Lighting**
✔ **Appliances/Eqpt.**
Refrigerators
Other
Itemized Costs
✔ **Utility Bills**
Calibration
Measures
Package
Reports

Energy Savings Cost Savings Economics Leveraging										
Agency: ORNL Account Name: MulTEA Examples - TtT Account Number: none provided Audit Name: Sample Bldg 0 - Calibrated Audit Number: 6175										
Retrofit Package Leveraging (Includes Interaction Among Measures)										
#	Retrofit Measure	Component	Tab	Code	Estimated Installation Costs (\$)	Savings-to-Investment Ratio (SIR)	Leveraging			
							Buydown for SIR = 1.0 (\$)	Actual Buydown (\$)	Estimated Program Installation Cost (\$)	Program SIR
1	Add Ceiling Insulation	Roofs	Attic 1	Roof 1	\$3,000	2.51	\$0	\$0	\$3,000	2.51
2	Install Motion Sensors	Lighting	System	L2_hallways	\$500	1.75	\$0	\$0	\$500	1.75
3	Air Sealing	Infiltration/Ventilation	Infiltration	Infiltration	\$2,500	1.96	\$0	\$0	\$2,500	1.96
4	Replace Lamps	Lighting	System	L1_units	\$1,000	1.71	\$0	\$0	\$1,000	1.71
5	Replace Window	Windows	Window 1	W1	\$6,000	1.18	\$0	\$0	\$6,000	1.18
6	Replace Window	Windows	Window 2	W2	\$4,500	1.03	\$0	\$0	\$4,500	1.03
7	Replace the Refrigerator	Refrigerator	Refrigerator 1	R1	\$3,600	0.75	\$916	\$950	\$2,650	1.01
Package					\$21,100	1.39		\$950	\$20,150	1.46

Buydown opportunity

SIR > 1

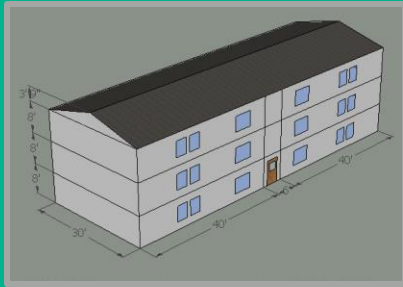
MuTEA User Interface



• Questions?

These sample buildings represent the 5 typical buildings commonly used in testing and training for MuTEA.

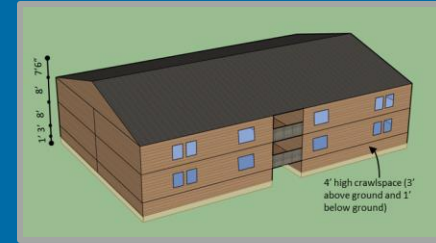
Walkup- Slab



Basement



Garden with crawlspace



Open parking ground floor



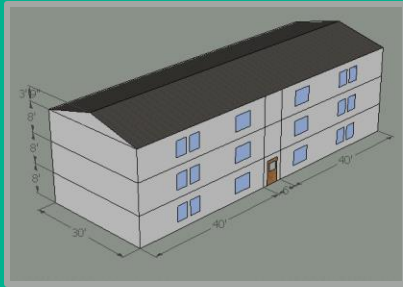
Row housing- slab floor



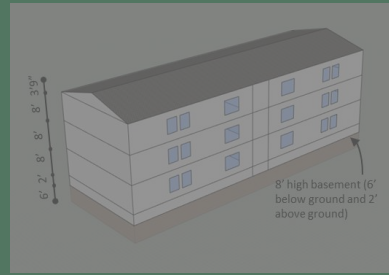
Images sourced from the 1) Web-based Weatherization Assistant Getting Started Guideline (ORNL) and the 2) Manuals and Training Material page on weatherization.ornl.gov

We will walk through how to input a three-story walkup with slab-on-grade floor in MulTEA.

Walkup- Slab



Basement



Garden with crawlspace



Open parking ground floor

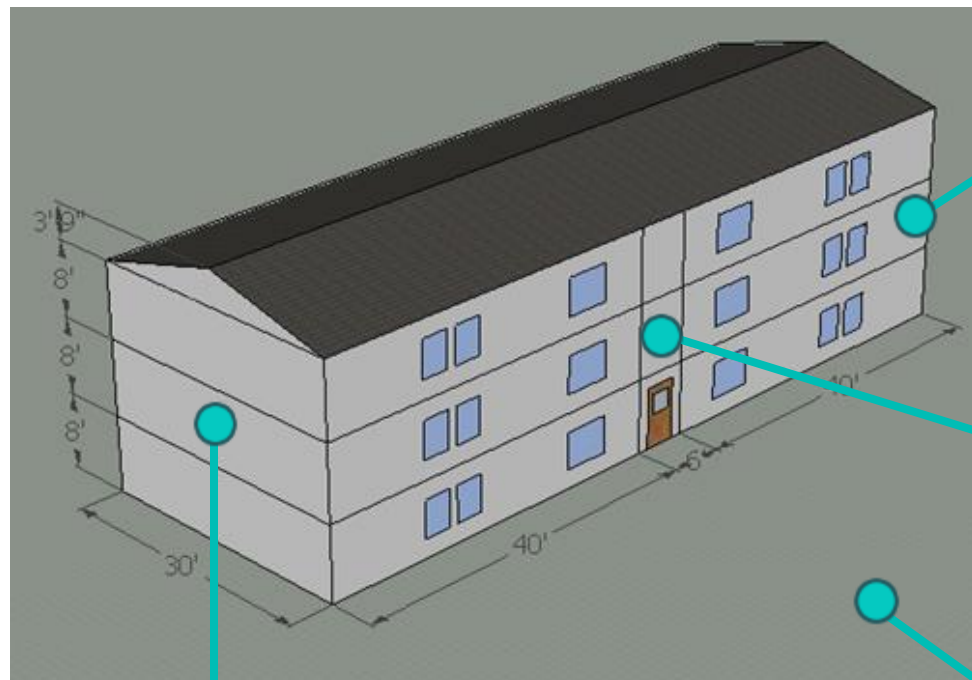


Row housing- slab floor



Images sourced from the 1) Web-based Weatherization Assistant Getting Started Guideline (ORNL) and the 2) Manuals and Training Material page on weatherization.ornl.gov

Our sample building is a three-story walkup with slab-on-grade floor



3-stories
(2 units per floor)

**Double-loaded,
enclosed,
unconditioned hallways
& stairwells**

**Old asphalt ground
surface lot**

Walls

8" hollow concrete blocks (exterior and partition)

Stucco finish with medium-dark color (exterior)

This represents the sample building's completed **Building Form**, and we will cover each field in detail.

General Building Details

MuTEA

Agency: Sample Agency
Acct.: Sample Account
Acct. #: S001
Audit: Sample Audit (DO...
Audit #: 1894
Package Run Completed

General

✓ Audit
✓ Building

Shell

✓ Walls
✓ Windows
Doors
✓ Roofs
✓ Floors

Systems

✓ HVAC
✓ Infiltration/Vent.
✓ Water Heating

Lighting & Appliances

✓ Lighting
✓ Appliances/Eqpt.
✓ Refrigerators

Other

Itemized Costs
✓ Utility Bills

Calibration

Measures

Package

Reports

Building Configuration

Building

Building Size and Occupancy

Number of Dwelling Units: 6
Gross Floor Area of Building (sq ft): 7740
Number of Floors Above Grade: 3
Number of Floors Below Grade: 0
Average Floor Height (ft): 8
Number of Occupants:
During Daytime: 3
During Nighttime: 12

Elevation of First Floor Above Grade (ft): 0
Site Grade Changes: ☐
Depth of Building Below Grade:
All Sides (ft): 0
On the Back (ft):
On the Right (ft):
On the Front (ft):
On the Left (ft):

Site Definition

Site Shielding and Terrain: Heavy (Urban, Suburban, Forest Area)
Ground Surface: Old Asphalt (Light Color)

Building Layout

Building Shape: Linear/Box
Hallway Configuration: Double-Loaded
Hallways Are Conditioned: ☐
Orientation of Building (deg): 0

Total Number of Dwelling Units:
Top Floor: 2
Intermediate Floor(s): 2
First Floor Above Grade: 2
First Floor Below Grade: 0

Floor Area of Enclosed Spaces

Floor	Area (sq ft)				Floor Sum
	Units	Hallways	Other Conditioned Spaces	Other Unconditioned Spaces	
A3	2400	180	0	0	2580
A2	2400	180	0	0	2580
A1	2400	180	0	0	2580
B1	0	0	0	0	0
B2	NA	0	0	0	0
Bldg Totals:	7200	540	0	0	7740

Bldg totals include no floor multipliers.

Define Areas of Building Spaces

Number of Dwelling Units by Orientation

First Floor Below Grade	First Floor Above Grade	Intermediate Floor(s)	Top Floor
<input type="checkbox"/> Exposed Walls in one orientation			
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Exposed Walls in two adjacent orientations			
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Exposed Walls in two opposite orientations			
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/> Exposed Walls in three orientations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Exposed Walls in all orientations			
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Define dwelling units and orientations

First, **general building details** are entered about its size, occupancy, and layout, as well as site information.

2 units per floor
3-stories

Old asphalt ground surface lot

Double-loaded,
enclosed,
unconditioned hallways

Building

Building Size and Occupancy

Number of Dwelling Units:

6

Elevation of First Floor Above Grade (ft):

0

Gross Floor Area of Building (sq ft):

7740

Site Grade Changes:

☐

Number of Floors Above Grade:

3

Depth of Building Below Grade:

Number of Floors Below Grade:

0

All Sides (ft):

0

Average Floor Height (ft):

8

On the Back (ft):

Number of Occupants:

On the Right (ft):

During Daytime:

3

On the Front (ft):

During Nighttime:

12

On the Left (ft):

Site Definition

Site Shielding and Terrain:

Heavy (Urban, Suburban, Forest Area)

Ground Surface:

Old Asphalt (Light Color)

Building Layout

Building Shape:

Linear/Box

Hallway Configuration:

Double-Loaded

Hallways Are Conditioned:

☐

Orientation of Building (deg):

0

Total Number of Dwelling Units:

Top Floor:

2

Intermediate Floor(s):

2

First Floor Above Grade:

2

First Floor Below Grade:

0

To input the **number of dwelling units by orientation** on the Building Form, we will determine the configuration of walls exposed to ambient conditions for the top floor of the building.

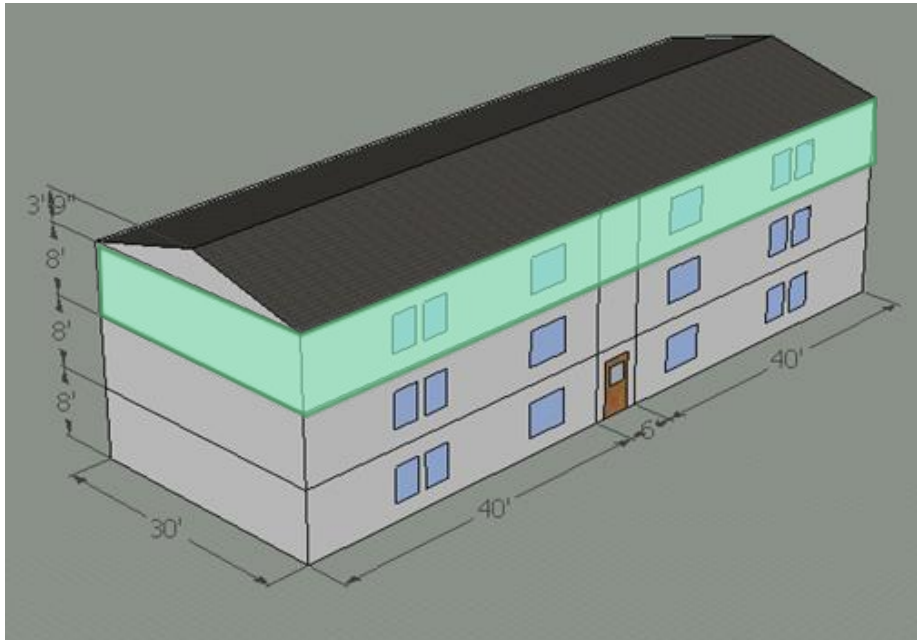


Image source: Manuals and Training Material page on weatherization.ornl.gov

Number of Dwelling Units by Orientation

First Floor Below Grade	First Floor Above Grade	Intermediate Floor(s)	Top Floor
<input type="checkbox"/> Exposed Walls in one orientation			
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Exposed Walls in two adjacent orientations			
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Exposed Walls in two opposite orientations			
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/> Exposed Walls in three orientations			
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Exposed Walls in all orientations			
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Image source: Web-based Weatherization Assistant (ORNL)

The top-floor units are separated by an enclosed hallway.

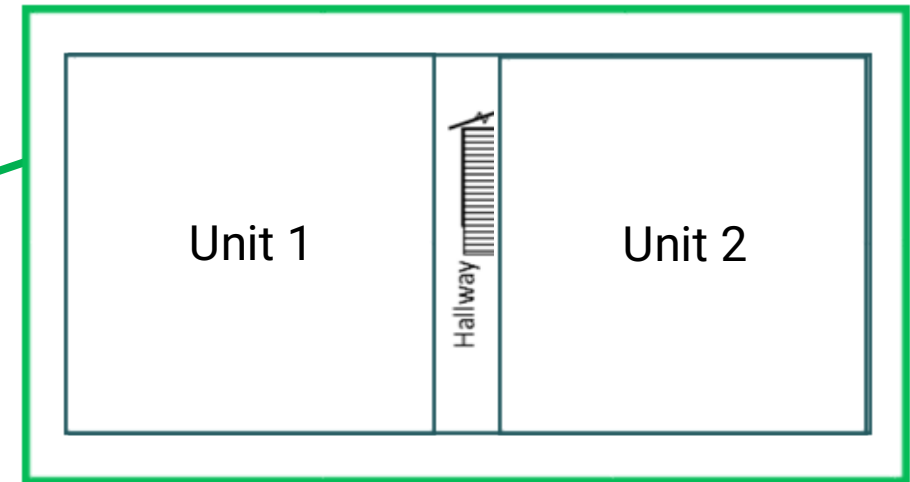
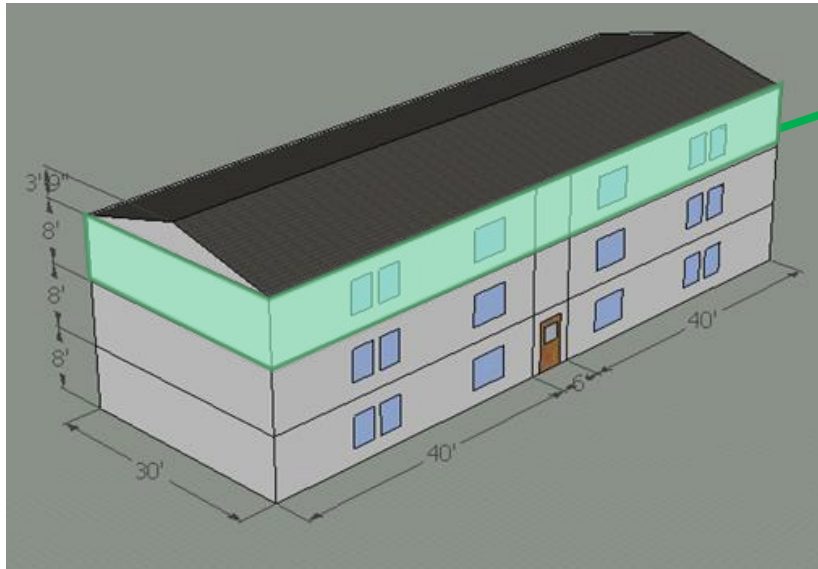


Image source: Manuals and Training Material page on weatherization.ornl.gov

Due to the enclosed hallway, **three walls** are exposed to ambient conditions in **two different orientations**.

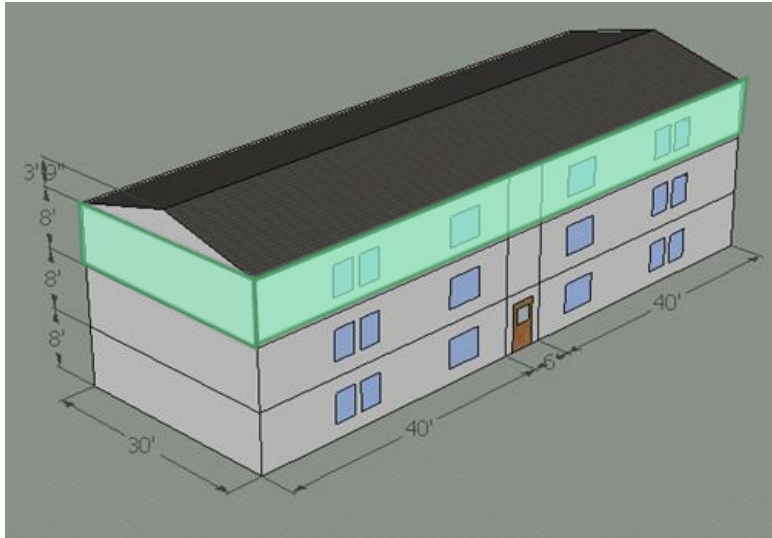
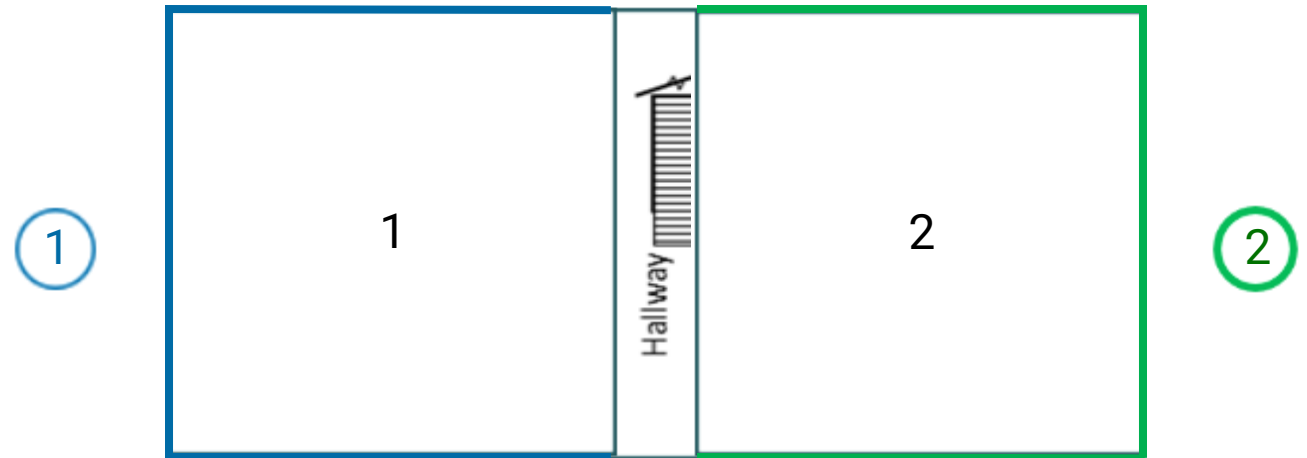
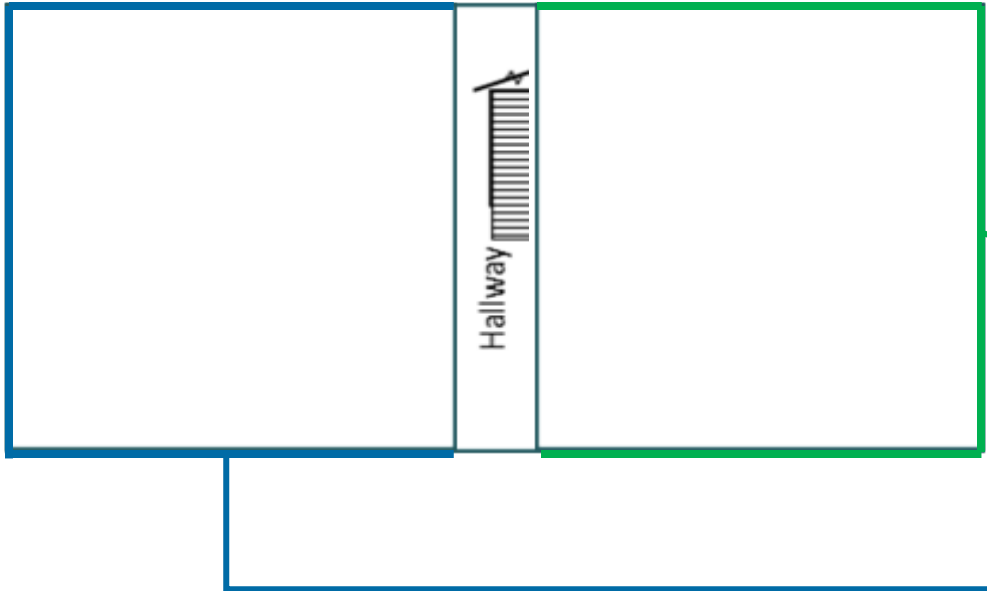


Image source: Manuals and Training Material page on weatherization.ornl.gov



We input the number of units using each wall orientation in the Building Form.



Number of Dwelling Units by Orientation			
First Floor Below Grade	First Floor Above Grade	Intermediate Floor(s)	Top Floor
<input type="checkbox"/> Exposed Walls in one orientation			
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="checkbox"/> Exposed Walls in two adjacent orientation			
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="checkbox"/> Exposed Walls in two opposite orientations			
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="checkbox"/> Exposed Walls in three orientations			
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text" value="1"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text" value="1"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="checkbox"/> Exposed Walls in all orientations			
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

We repeat this process for all three building floors.

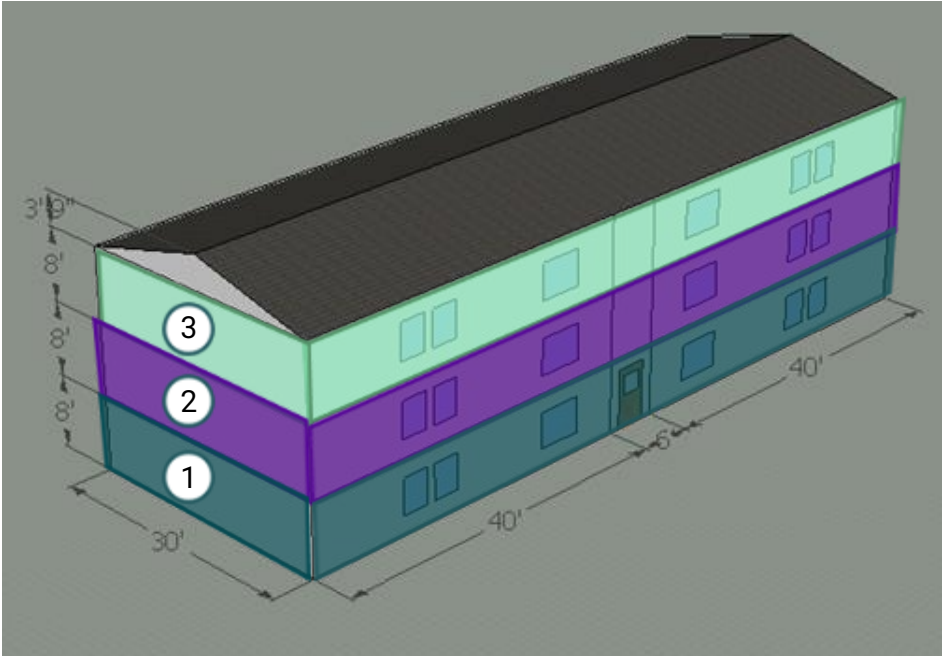


Image source: Manuals and Training Material page on weatherization.ornl.gov

Number of Dwelling Units by Orientation

First Floor Below Grade	First Floor Above Grade	Intermediate Floor(s)	Top Floor
<input type="checkbox"/> Exposed Walls in one orientation			
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Exposed Walls in two adjacent orientations			
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Exposed Walls in two opposite orientations			
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/> Exposed Walls in three orientations			
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/> Exposed Walls in 1 orientation			
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Image source: Web-based Weatherization Assistant (ORNL)

To complete the Configuration table in MuTEA's Building Form, **calculate and enter the area (sq ft)** of all enclosed space types for each above and below ground floor.

Floors
A: above ground
B: below ground

Configuration

Floor Area of Enclosed Spaces					
Floor	Area (sq ft)				Floor Sum
	Units	Hallways	Other Conditioned Spaces	Other Unconditioned Spaces	
A3	0	0	0	0	0
A2	0	0	0	0	0
A1	0	0	0	0	0
B1	0	0	0	0	0
B2	NA	0	0	0	0
Bldg Totals:	0	0	0	0	0

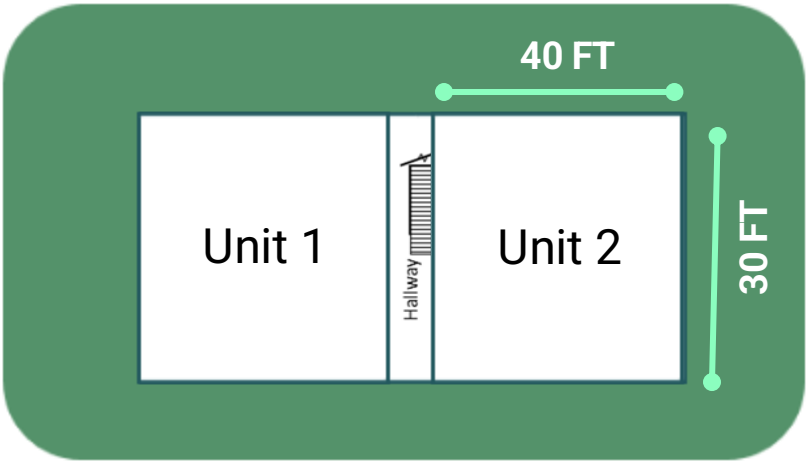
Bldg totals include no floor multipliers.

Type of Enclosed Space

Maximum of 4 space types per floor

Image source: Web-based Weatherization Assistant (ORNL)

Use provided dimensions to calculate and enter the floor area of units on each floor.



$$(40\text{ft} \times 30\text{ft}) \times 2 \text{ units} = 2,400\text{FT}$$

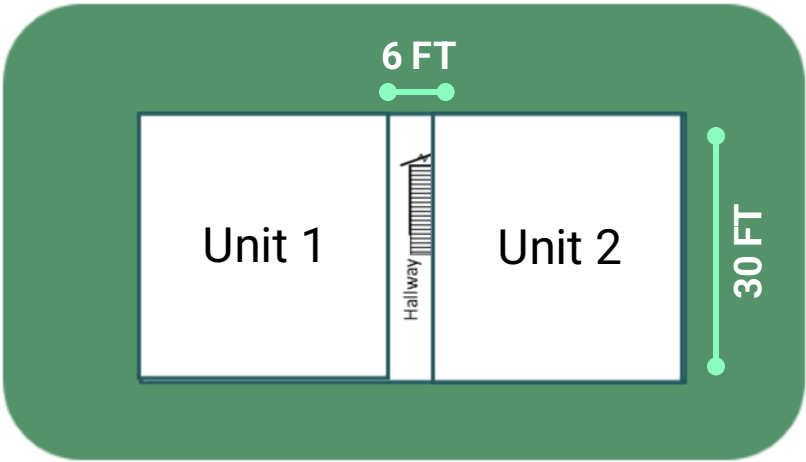
Configuration

Floor Area of Enclosed Spaces					
Floor	Area (sq ft)				
	Units	Hallways	Other Conditioned Spaces	Other Unconditioned Spaces	Floor Sum
A3	2400	0	0	0	2400
A2	2400	0	0	0	2400
A1	2400	0	0	0	2400
B1	0	0	0	0	0
B2	NA	0	0	0	0
Bldg Totals:	7200	0	0	0	7200

Bldg totals include no floor multipliers.

Image source: Web-based Weatherization Assistant (ORNL)

Use provided dimensions to calculate and enter the floor area of the hallway on each floor.



$(6\text{ft} \times 30\text{ft}) \times 1 \text{ hallway}$
 $= 180\text{FT}$

Configuration

Floor Area of Enclosed Spaces					
Floor	Area (sq ft)				
	Units	Hallways	Other Conditioned Spaces	Other Unconditioned Spaces	Floor Sum
A3	2400	180	0	0	2580
A2	2400	180	0	0	2580
A1	2400	180	0	0	2580
B1	0	0	0	0	0
B2	NA	0	0	0	0
Bldg Totals:	7200	540	0	0	7740

Bldg totals include no floor multipliers.

Image source: Web-based Weatherization Assistant (ORNL)

We have now completed MulTEA's Building Form for the sample building.

General Building Details

Building Configuration

Define Areas of Building Spaces

MulTEA

Agency: Sample Agency
Acct.: Sample Account
Acct. #: S001
Audit: Sample Audit (DO...
Audit #: 1894
Package Run Completed

General

Audit

Building

Shell

Walls

Windows

Doors

Roofs

Floors

Systems

HVAC

Infiltration/Vent.

Water Heating

Lighting & Appliances

Lighting

Appliances/Eqpt.

Refrigerators

Other

Itemized Costs

Utility Bills

Calibration

Measures

Package

Reports

Building

Building Size and Occupancy

Number of Dwelling Units: 6
Gross Floor Area of Building (sq ft): 7200
Number of Floors Above Grade: 3
Number of Floors Below Grade: 0
Average Floor Height (ft): 8
Number of Units: 6
Duration: 3
During Nighttime: 12

Elevation of First Floor Above Grade (ft): 0
Site Grade Changes:
Depth of Building Below Grade:
All Sides (ft): 0
On the Back (ft):
On the Right (ft):
On the Front (ft):
On the Left (ft):

Site Definition

Site Shielding and Terrain: Heavy (Urban, Suburban, Forest Area)
Ground Surface: Old Asphalt (Light Color)

Building Layout

Building Shape: Linear/Box
Hallway Configuration: D...
Hallways Are Conditioned:
Orientation of Building (deg): 0
Number of Dwelling Units: 6
Intermediate Floor(s): 2
First Floor Above Grade: 2
First Floor Below Grade: 0

Floor Area of Enclosed Spaces

Floor	Area (sq ft)				Floor Sum
	Units	Hallways	Other Conditioned Spaces	Other Unconditioned Spaces	
A3	2400	0	0	0	2580
B1	2400	0	0	0	2580
B2	2400	180	0	0	2580
Bldg Totals:	7200	540	0	0	7740

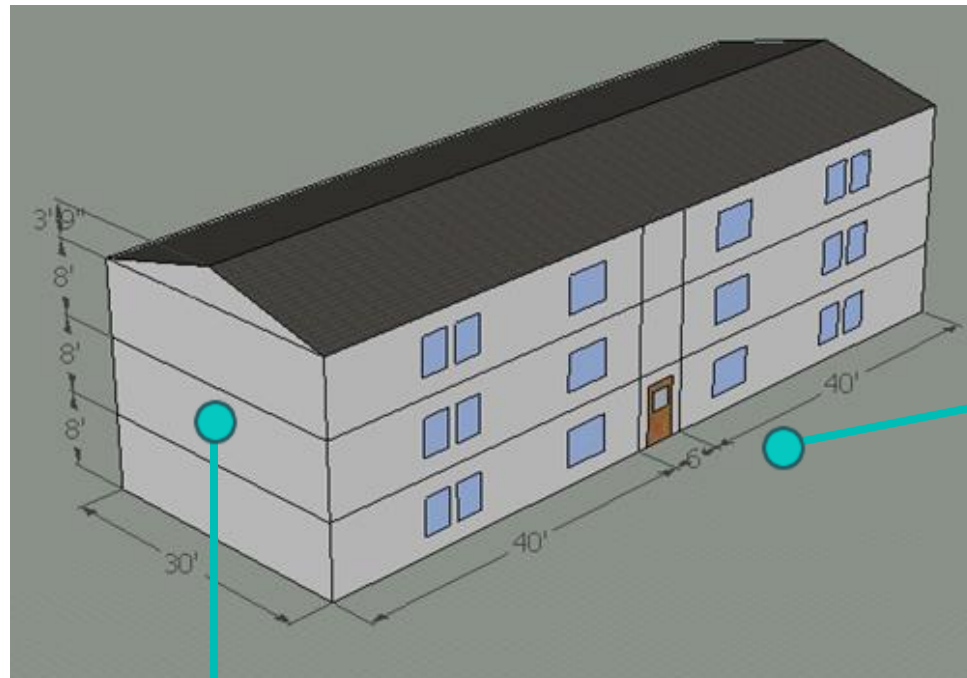
Bldg totals include no floor multipliers.

Define dwelling units and orientations

Number of Dwelling Units by Orientation

First Floor Below Grade	First Floor Above Grade	Intermediate Floor(s)	Top Floor
<input type="checkbox"/> Exposed Walls in one orientation			
<input type="checkbox"/> Exposed Walls in two adjacent orientation			
<input type="checkbox"/> Exposed Walls in two opposite orientations			
<input checked="" type="checkbox"/> Exposed Walls in three orientations	1	1	1
<input type="checkbox"/> Exposed Walls in all orientations			

Our sample building is a three-story walkup with slab-on-grade floor.



Dimensions

40' x 30' x 8' units
6' hallway

Walls

8" hollow concrete blocks (exterior and partition)

Stucco finish with medium-dark color (exterior)

This represents the sample building's completed **Walls Form** for its **exterior walls**. The configuration table will be covered in detail next.

MulTEA

Agency: Sample Agency
Acct.: Sample Account
Acct. #: S001
Audit: Sample Audit (DO...
Audit #: 1894
Package Run Completed

General

Audit

Building

Shell

Walls

Windows

Doors

Roofs

Floors

Systems

HVAC

Infiltration/Vent.

Water Heating

Lighting & Appliances

Lighting

Appliances/Eqpt.

Refrigerators

Other

Itemized Costs

Utility Bills

Calibration

Measures

Exterior 1

Exterior 2

Exterior 3

Exterior 4

Underground 1

Underground 2

Interior 1

Interior 2

Wall Code:

exterior walls

Construction

Wall Construction:

Construction Material:

8" Concrete Block, Hollow

Stud Dimensions:

Size:

Spacing (in):

Wall Insulation:

Cavity Insulation:

Type:

Exterior Insulation:

Type:

None

Interior Insulation:

Type:

None

Wall Exterior:

Exterior Finish:

Stucco

Exterior Color:

Medium-Dark

Configuration

Gross Area of Wall

Space	Gross Area (sq ft)				
	Back	Right	Front	Left	Sum
Units	1920	720	1920	720	5280
Hallways	144	0	144	0	288
Crawlspace	0	0	0	0	0
Totals:	2064.0	720.0	2064.0	720.0	5568.0

Components / Wall Type
Type: Exterior

Construction
8" hollow concrete block
Stucco finish - medium dark color

Configuration

To complete the exterior wall's Configuration table in MulTEA's Walls Form, **calculate and enter the area (sq ft)** of each exterior wall type by orientation.

Wall Type

Configuration					
Gross Area of Wall					
Space	Gross Area (sq ft)				Sum
	Back	Right	Front	Left	
Units	1920	720	1920	720	5280
Hallways	144	0	144	0	288
Crawlspace	0	0	0	0	0
Totals:	2064.0	720.0	2064.0	720.0	5568.0

Orientation

Image source: Web-based Weatherization Assistant (ORNL)

Use provided dimensions to calculate and enter the exterior wall area of the front and back of the building.

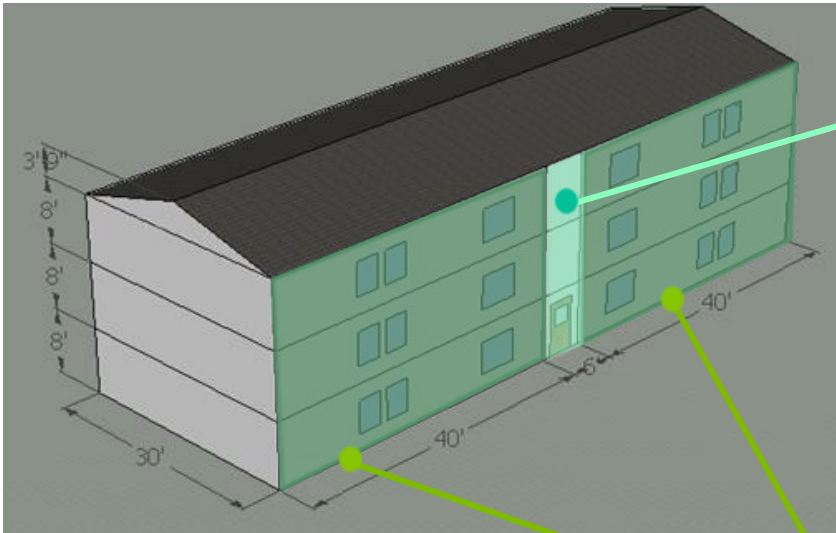


Image source: Manuals and Training Material page on weatherization.oml.gov

Hallways:
8ft ceiling x 3 floors x
6ft long = 144 sq ft

Units:
8ft ceiling x 3 floors x 2
units x 40ft long = 1,920
sq ft

Configuration

Gross Area of Wall				
Space	Back	Right	Front	Left
Units	1920	720	1920	720
Hallways	144	0	144	0
Crawlspace	0	0	0	0
Totals:	2064.0	720.0	2064.0	720.0

Image source: Web-based Weatherization Assistant (ORNL)

Use provided dimensions to calculate and enter the exterior wall area of the right and left of the building.

Units:
8ft ceiling x 3 floors x
30ft long = 720 sq ft

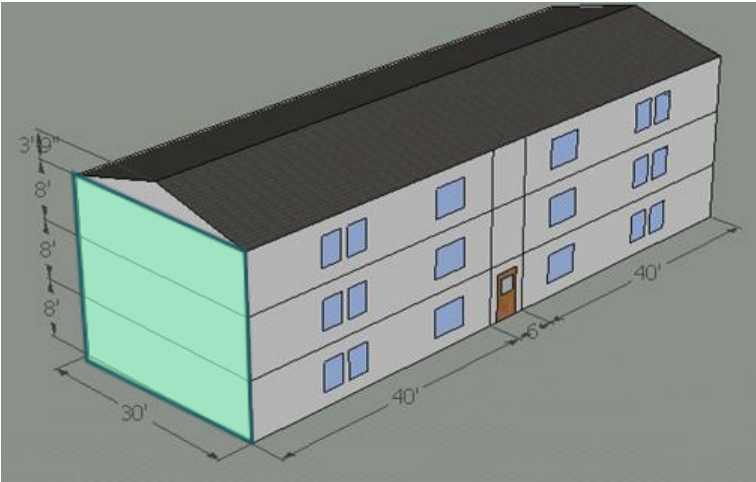


Image source: Manuals and Training Material page on weatherization.ornl.gov

Configuration				
Gross Area of Wall				
Space	Gross Area (sq ft)			
	Back	Right	Front	Left
Units	1920	720	1920	720
Hallways	144	0	144	0
Crawlspace	0	0	0	0
Totals:	2064.0	720.0	2064.0	720.0

Image source: Web-based Weatherization Assistant (ORNL)

We have now completed the **Walls Form** for the sample building's **exterior walls**. The process would be repeated for interior walls.

MulTEA

Agency: Sample Agency
Acct.: Sample Account
Acct. #: S001
Audit: Sample Audit (DO...
Audit #: 1894
Package Run Completed

General

Audit

Building

Shell

Walls

Windows

Doors

Roofs

Floors

Systems

HVAC

Infiltration/Vent.

Water Heating

Lighting & Appliances

Lighting

Appliances/Eqpt.

Refrigerators

Other

Itemized Costs

Utility Bills

Calibration

Measures

Exterior 1

Exterior 2

Exterior 3

Exterior 4

Underground 1

Underground 2

Interior 1

Interior 2

Wall Code:

exterior walls

Construction

Wall Construction:

Construction Material:

8" Concrete Block, Hollow

Stud Dimensions:

Size:

Spacing (in):

Wall Insulation:

Cavity Insulation:

Type:

Exterior Insulation:

None

Interior Insulation:

Type:

None

Wall Exterior:

Exterior Finish:

Stucco

Exterior Color:

Medium-Dark

Configuration

Gross Area of Wall

Space	Gross Area (sq ft)				
	Back	Right	Front	Left	Sum
Units	1920	720	1920	720	5280
Hallways	144	0	144	0	288
Crawlspace		0	0	0	0
Totals:	2064.0	720.0	2064.0	720.0	5568.0

Components / Wall Type
Type: Exterior

Construction
8" hollow concrete block
Stucco finish - medium dark color

Configuration

This represents the sample building's completed **Floors Form** for its **first floor**. The configuration table will be covered in detail next.

MuTEA

Agency: Sample Agency
Acct.: Sample Account
Acct. #: S001
Audit: Sample Audit (DO...
Audit #: 1894
Package Run Completed

General

Audit

Building

Shell

Walls

Windows

Doors

Roofs

Floors

Systems

HVAC

Infiltration/Vent.

Water Heating

Lighting & Appliances

Lighting

Appliances/Eqpt.

Refrigerators

Other

Itemized Costs

Utility Bills

Calibration

Measures

Underground 1

Underground 2

Exposed 1

Exposed 2

Interior 1

Interior 2

Above Crawlpace 1

Above Crawlpace 2

Floor Code:

slab on grade

Construction

Floor Construction:

Construction Material:

Concrete

Truss / Joist:

Depth (in):

Spacing (in):

Floor Insulation:

Slab Insulation:

Location:

None

Thickness (in):

1

Width/Depth (ft):

Exterior Insulation:

Type:

Thickness (in):

R-value:

Interior Insulation:

Type:

Thickness (in):

R-value:

Sill Box Insulation:

Type:

Thickness (in):

R-value:

Floor Covering:

Carpet Area (%):

80

Show Slab Insulation Diagram

Configuration

Area and Exposed Perimeter of Floor

Floor	Space	Area (sq ft)	Exposed Perimeter (ft)
A1	Units	2400	220
A1	Hallways	180	12
Totals:		2580.0	232.0

Retrofit Measures

Active:

Add Slab Insulation:

Location:

Thickness (in):

1

Width/Depth (ft):

Active:

Add Exterior Insulation:

Type:

Thickness (in):

R-value:

Active:

Add Sill Box Insulation:

Type:

Thickness (in):

R-value:

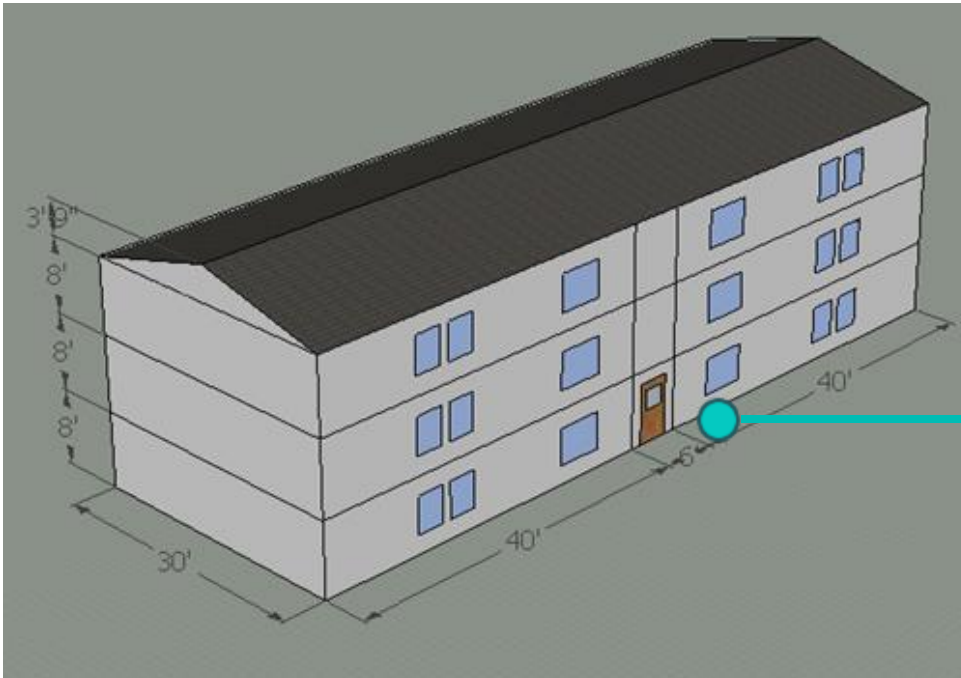
Floor Type

Construction

Configuration

Retrofit Measures

Provided specifications of the sample building foundation and floors.



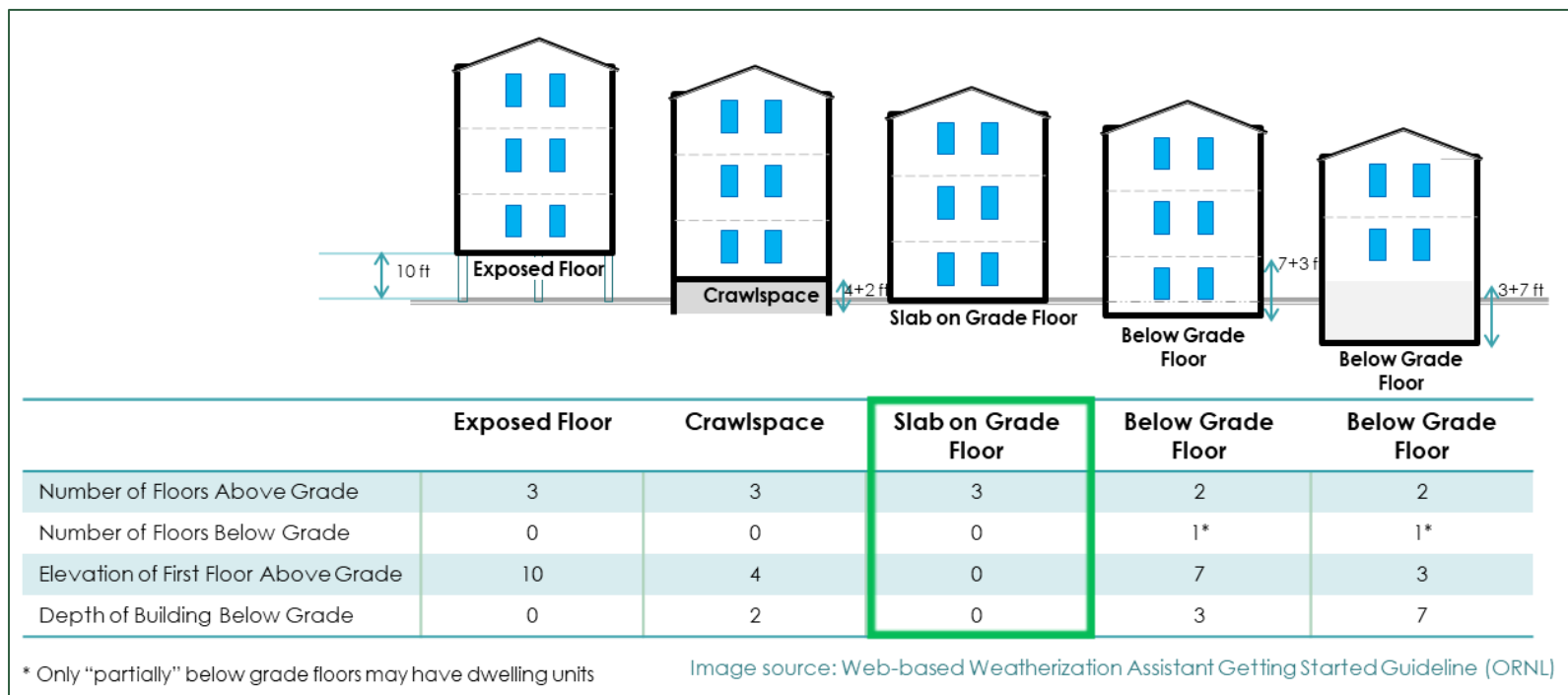
Slab-on-grade

Uninsulated concrete

80% carpet

Image source: Manuals and Training Material page on weatherization.ornl.gov

Reminder- our sample building is slab on grade, but other building types can be reflected on the Building Form.



Entries in the Building Form determine the layout of the Floors form.

Building

Building Size and Occupancy

Number of Dwelling Units:

Gross Floor Area of Building (sq ft):

Number of Floors Above Grade:

Number of Floors Below Grade:

Average Floor Height (ft):

Number of Occupants:

During Daytime:

During Nighttime:

Elevation of First Floor Above Grade (ft):

Site Grade Changes: ☐

Depth of Building Below Grade:

All Sides (ft):

On the Back (ft):

On the Right (ft):

On the Front (ft):

On the Left (ft):

Site Definition

Site Shielding and Terrain:

Ground Surface:

Building Layout

Building Shape:

Hallway Configuration:

Hallways Are Conditioned: ☐

Orientation of Building (deg):

Total Number of Dwelling Units:

Top Floor:

Intermediate Floor(s):

First Floor Above Grade:

First Floor Below Grade:

Configuration

Floor Area of Enclosed Spaces

Floor	Area (sq ft)				Floor Sum
	Units	Hallways	Other Conditioned Spaces	Other Unconditioned Spaces	
A3	2400	180	0	0	2580
A2	2400	180	0	0	2580
A1	2400	180	0	0	2580
B1	0	0	0	0	0



Floors Form

Configuration

Area and Exposed Perimeter of Floor

Floor	Space	Area (sq ft)	Exposed Perimeter (ft)
A1	Units	2400	220
A1	Hallways	180	12
Totals:		2580.0	232.0

This represents the sample building's completed Floors Form for its first floor.

MuTEA

Agency: Sample Agency
Acct.: Sample Account
Acct. #: S001
Audit: Sample Audit (DO...
Audit #: 1894
Package Run Completed

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Lighting

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Refrigerators

Other

Itemized Costs

Utility Bills

Calibration

Measures

Underground 1Underground 2Exposed 1Exposed 2Interior 1Interior 2Above Crawspace 1Above Crawspace 2

Floor Code:slab on grade

Construction

Floor Construction:

Construction Material:Concrete

Truss / Joist:Depth (in):Spacing (in):

Floor Insulation:

Slab Insulation:Location:NoneThickness (in):1Width/Depth (ft):

Exterior Insulation:Type:Thickness (in):R-value:

Interior Insulation:Type:Thickness (in):R-value:

Sill Box Insulation:Type:Thickness (in):R-value:

Floor Covering:

Carpet Area (%):80

Configuration

Area and Exposed Perimeter of Floor

Floor	Space	Area (sq ft)	Exposed Perimeter (ft)
A1	Units	2400	220
A1	Hallways	180	12
Totals:		2580.0	232.0

Retrofit Measures

Active: Add Slab Insulation:Location:Thickness (in):1Width/Depth (ft):

Active: Add Exterior Insulation:Type:Thickness (in):R-value:

Active: Add Sill Box Insulation:Type:Thickness (in):R-value:

Floor Type

Construction

Configuration

Retrofit Measures

We have now completed the sample building's Floors Form for its first floor.

MuTEA

Agency: Sample Agency
Acct.: Sample Account
Acct. #: S001
Audit: Sample Audit (DO...
Audit #: 1894
Package Run Completed

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Itemized Costs

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Measures

Underground 1 | Underground 2 | Exposed 1 | Exposed 2 | Interior 1 | Interior 2 | Above Crawspace 1 | Above Crawspace 2

Floor Code: slab on grade

Construction

Floor Construction:
Construction Material: Concrete
Truss / Joist: (in): Spacing (in):

Floor Insulation:
Slab Insulation: Location: Thickness (in): 1 Width/Depth (ft):
Exterior Insulation: Thickness (in): R-value:
Interior Insulation: Type: Thickness (in): R-value:
Sill Box Insulation: Type: Thickness (in): R-value:

Floor Covering:
Carpet Area (%): 80

Show Slab Insulation Diagram

Configuration

Area and Exposed Perimeter of Floor

Floor	Space	Area (sq ft)	Exposed Perimeter (ft)
A1	Units	2400	220
A1	Entrances	180	12
Totals:		2580.0	232.0

Retrofit Measures
Active: Slab Insulation Location: Thickness (in): 1 Width/Depth (ft):
Active: Add Exterior Insulation: Type: Thickness (in): R-value:
Active: Add Sill Box Insulation: Type: Thickness (in): R-value:

Floor Type

Construction

Configuration

Retrofit Measures

This represents the sample building's completed HVAC Form for its baseboard heaters.

Agency: Sample Agency
Acct.: Sample Account
Acct. #: S001
Audit: Sample Audit (DO...
Audit #: 1894
Package Run Completed

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Refrigerators

Other

Itemized Costs

Utility Bills

Central BoilerSystem 1System 2System 3System 4System 5System 6Units ThermostatHallways ThermostatOther Conditioned Spaces Thermostat

HVAC System Code:base board heater

System Configuration:Heating Only - Individual Units

Outside Air Ventilation Rate (cfm):0

Location Served:Units

Number of Same Systems: B2: B1: A1: 2 A2: 2 A3: 2

Heating Equipment

System Type:Individual

Equipment:Electric Baseboard Heater

Fuel:Electricity

Efficiency Input Method:Year Manufactured

Year Manufactured:1998

Steady State Efficiency % (Site Measured):

Efficiency (Nameplate/Rated):98 %

Capacity:5 kW

Pilot Light/IID:

Cooling Equipment

System Type:

Equipment:

Efficiency Input Method:

Year Manufactured:

Efficiency:

Capacity:

Retrofit Measures

Active: Change Ventilation Rate: Outside Air Ventilation Rate (cfm):

Active: Replace the System: System Configuration: Heating Equipment: Heating Fuel: Heating Efficiency: Heating Capacity: Cooling Equipment: Cooling Efficiency: Cooling Capacity:

Active: Tune Up: Heating Efficiency Improvement (%): Cooling Efficiency Improvement (%):

Active: Pilot Light: Replace Pilot Light with IID

Type and Configuration

General Operation

Zone Assignment

Equipment

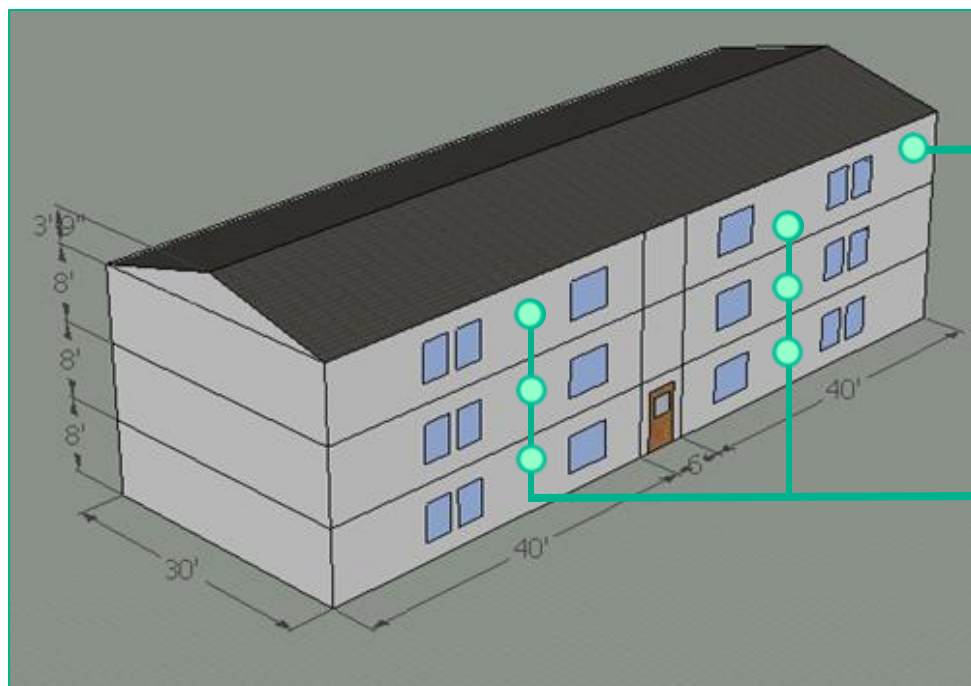
Retrofit Measures

OAK RIDGE
National Laboratory

Image source: Web-based Weatherization Assistant (ORNL)

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Provided specifications of the sample building HVAC systems.



No outside air ventilation

5-kW electric baseboard heater

1.5-ton room AC in each unit

1-ton room AC in each unit

**All systems manufactured and
installed in 1998**

Image source: Manuals and Training Material page on weatherization.ornl.gov

Image source: Web-based Weatherization Assistant Getting Started Guideline (ORNL)

We utilize one of the System tabs to input the 5-kW electric baseboard heaters.

MuTEA

Agency: Sample Agency
Acct.: Sample Account
Acct. #: S001
Audit: Sample Audit (DO...
Audit #: 1894
Package Run Completed

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Central Boiler

System 1

System 2

System 3

System 4

System 5

System 6

Units Thermostat

Hallways Thermostat

Other Conditioned Spaces Thermostat

HVAC System Code:
base board heater

Location Served:
Units

System Configuration:
Heating Only - Individual Units

Number of Same Systems:
B2: B1: A1: 2 A2: 2 A3: 2

Outside Air Ventilation Rate (cfm):
0

Heating Equipment
System Type:
Individual

Cooling Equipment
System Type:

Equipment:
Electric Baseboard Heater

Efficiency Input Method:
Electricity

Year Manufactured:
1998

Steady State Efficiency % (Site Measured):
98 %

Efficiency (Nameplate/Rated):
5 kW

Capacity:
5 kW

Pilot Light/IID:

Retrofit Measures
Active: Change Ventilation Rate: Outside Air Ventilation Rate (cfm):

Active: Replace the System: System Configuration:
Heating Equipment:
Heating Fuel:
Heating Efficiency:
Heating Capacity:
Heating Efficiency Improvement (%):

Active: Tune Up: Heating Efficiency Improvement (%):

Active: Pilot Light: Replace Pilot Light with IID

All HVAC Systems (3)

HVAC System Code	HVAC Tab	Location Served	System Configuration	Heating Equipment	Heating Fuel	Cooling Equipment	Last Edited
base board heater	System 1	Units	Heating Only - Individ...	Electric Baseboard Heater	Electricity		04-24-2025 9:00 AM
1 ton units	System 2	Units	Cooling Only - Individ...			Room (Wall) Air Conditioner	04-24-2025 9:01 AM
1.5 ton units	System 3	Units	Cooling Only - Individ...			Room (Wall) Air Conditioner	04-24-2025 9:02 AM

No outside air ventilation

Electric baseboard heaters in each unit

All systems manufactured and installed in 1998

We utilize a second System tab to input the 1-ton room air conditioners.

MuTEA

Agency: Sample Agency
Acct.: Sample Account
Acct. #: S001
Audit: Sample Audit (DO...
Audit #: 1894
Package Run Completed

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Reports

Central Boiler System 1 **System 2** System 3 System 4 System 5 System 6 Units Thermostat Hallways Thermostat Other Conditioned Spaces Thermostat

HVAC System Code: 1 ton units Location Served: Units
System Configuration: Cooling Only - Individual Units Number of Same Systems: B2: B1: A1: 2 A2: 2 A3: 2
Outside Air Ventilation Rate (cfm): 0

Heating Equipment
System Type:
Equipment:
Fuel:
Efficiency Input Method:
Year Manufactured:
Steady State Efficiency % (Site Measured):
Efficiency (Nameplate/Rated):
Capacity:
Pilot Light/IID:

Cooling Equipment
System Type: Individual
Equipment: Room (Wall) Air Conditioner
Efficiency Input Method: Year Manufactured
Year Manufactured: 1998
Efficiency: 9.08 EER
Capacity: 1 Tons

Retrofit Measures
Active: ☐ Change Ventilation Rate: Outside Air Ventilation Rate (cfm):
Active: ☐ Replace the System: System Configuration: Heating Equipment: Heating Fuel: Heating Efficiency: Heating Capacity: Cooling Equipment: Cooling Efficiency: Cooling Capacity: Cooling Efficiency Improvement (%):
Active: ☐ Tune Up: Heating Efficiency Improvement (%):
Active: ☐ Pilot Light: Replace Pilot Light with IID

All HVAC Systems (3)

HVAC System Code	HVAC Tab	Location Served	System Configuration	Heating Equipment	Heating Fuel	Cooling Equipment	Last Edited
base board heater	System 1	Units	Heating Only - Indiv...	Electric Baseboard Heater	Electricity		04-24-2025 9:00 AM
1 ton units	System 2	Units	Cooling Only - Indivi...			Room (Wall) Air Conditioner	04-24-2025 9:01 AM
1.5 ton units	System 3	Units	Cooling Only - Indivi...			Room (Wall) Air Conditioner	04-24-2025 9:02 AM

No outside air ventilation

1-ton room air conditioner in each unit

All systems manufactured and installed in 1998

We utilize a third System tab to input the 1.5-ton room air conditioners.

MuTEA

Agency: Sample Agency
Acct.: Sample Account
Acct. #: S001
Audit: Sample Audit (DO...
Audit #: 1894
Package Run Completed

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Other

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Reports

Central Boiler

System 1

System 2

System 3

System 4

System 5

System 6

Units Thermostat

Hallways Thermostat

Other Conditioned Spaces Thermostat

HVAC System Code:1.5 ton units

System Configuration:Cooling Only - Individual Units

Outside Air Ventilation Rate (cfm):0

Location Served:Units

Number of Same Systems: B2: B1: A1: 2 A2: 2 A3: 2

Heating Equipment

System Type:

Equipment:

Fuel:

Efficiency Input Method:

Year Manufactured:

Steady State Efficiency % (Site Measured):

Efficiency (Nameplate/Rated):

Capacity:

Pilot Light/IID:

Cooling Equipment

System Type:Individual

Equipment:Room (Wall) Air Conditioner

Efficiency Input Method:Year Manufactured

Year Manufactured:1998

Efficiency:9.08 EER

Capacity:1.5 Tons

Retrofit Measures

Active: ☐ Change Ventilation Rate: Outside Air Ventilation Rate (cfm):

Active: ☐ Replace the System: System Configuration: Heating Equipment: Heating Fuel: Heating Efficiency: Heating Capacity: Heating Efficiency Improvement (%):

Active: ☐ Tune Up: Heating Efficiency Improvement (%):

Active: ☐ Pilot Light: Replace Pilot Light with IID

All HVAC Systems (3)

HVAC System Code	HVAC Tab	Location Served	System Configuration	Heating Equipment	Heating Fuel	Cooling Equipment	Last Edited
base board heater	System 1	Units	Heating Only - Indiv...	Electric Baseboard Heater	Electricity		04-24-2025 9:00 AM
1 ton units	System 2	Units	Cooling Only - Indivi...			Room (Wall) Air Conditioner	04-24-2025 9:01 AM
1.5 ton units	System 3	Units	Cooling Only - Indivi...			Room (Wall) Air Conditioner	04-24-2025 9:02 AM

No outside air ventilation

1.5-ton room air conditioner in each unit

All systems manufactured and installed in 1998

We have now completed the sample building's HVAC Form for all heating and cooling systems.

Type and Configuration

General Operation

MulTEA

Agency: Sample Agency
Acct.: Sample Account
Acct. #: S001
Audit: Sample Audit (DO...
Audit #: 1894
Package Run Completed

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Water Heating

Lighting & Appliances

Lighting

Appliances/Eqpt.

Refrigerators

Other

Itemized Costs

Utility Bills

System 1

System 2

System 3

System 4

System 5

System 6

Units Thermostat

Walkways Thermostat

Other Conditioned Spaces Thermostat

HVAC System: base board heater

System Configuration: Heating Only - Individual Units

Outside Air Ventilation Rate (cfm): 0

Heating Equipment

System Type: Individual

Equipment: Electric Baseboard Heater

Fuel: Electricity

Efficiency Input Method: Year Manufactured

Year Manufactured: 1998

Steady State Efficiency (% (Site Measured):

Efficiency (Nameplate/Rated): 98 %

Capacity: 5 kW

Pilot Light/IID:

Cooling Equipment

System Type:

Equipment:

Efficiency Input Method:

Year Manufactured:

Efficiency:

Capacity:

Zone Assignment

Equipment

Retrofit Measures

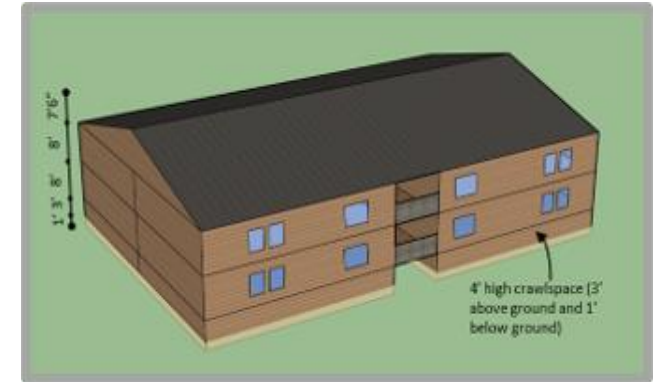
MuTEA allows WAP implementation on common multifamily building types.

WAP-
focused

Flexible,
multizone
simulation
tool

Easy
configuration
and
deployment

Questions?



Need Assistance?

Contact our Weatherization Assistant Helpdesk at:

<https://weatherization.ornl.gov/contact-us/>

or

wahelpdesk@ornl.gov



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