Home Energy Model: Scottish Homes Standard Consultation Tool User Guide

This guide is to assist users of the consultation tool.

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Contents

1. Introduction

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Introduction

This consultation is the second of two and considers the technical, commercial and wider policy implications of improvements to energy and environmental standards set within Scottish Building Standards. This is done in the context of broader action by the Scottish Government on climate change, to further our ambition of becoming a net-zero society by out the detail of the proposed level of challenge for new homes and non-domestic buildings alongside an enhanced compliance process. 2045. The consultation documents can be found here. These set out the detail of the proposed level of challenge for new homes and non-domestic buildings alongside an enhanced compliance process.

A new home's compliance with these standards will be determined using the Home Energy Model: Scottish Homes Standard Assessment which will replace the current approved methodology SAP 10.2. The consultation tool gives you the opportunity to interact with the model and understand whether different dwelling designs are likely to comply with the proposed Scottish Homes Standard.

This consultation version of the tool is provided for the purposes of the Scottish Government's Scottish Homes Standard consultation only, and as such does not reflect any changes which may be made in the light of consultation responses. In addition, at the time of publication, the UK Government response to the Home Energy Model Consultation has not been published and the HEM may be subject to change following consideration of the responses. You can see the latest release of the Python code not linked to the consultation tool here.

The Home Energy Model represents a complete overhaul compared with SAP 10.2 and previous versions of SAP. The consultation document linked above, explains the key changes, and we would encourage you to read the consultation. However, this consultation tool looks similar to previous versions of iSAP and its user interface is basic. Please note that this is not representative of the user experience users will have when the final version is planned to be released in 2026. This tool has only been developed for the purpose of providing users with a basic working tool.

2. Navigating the Website

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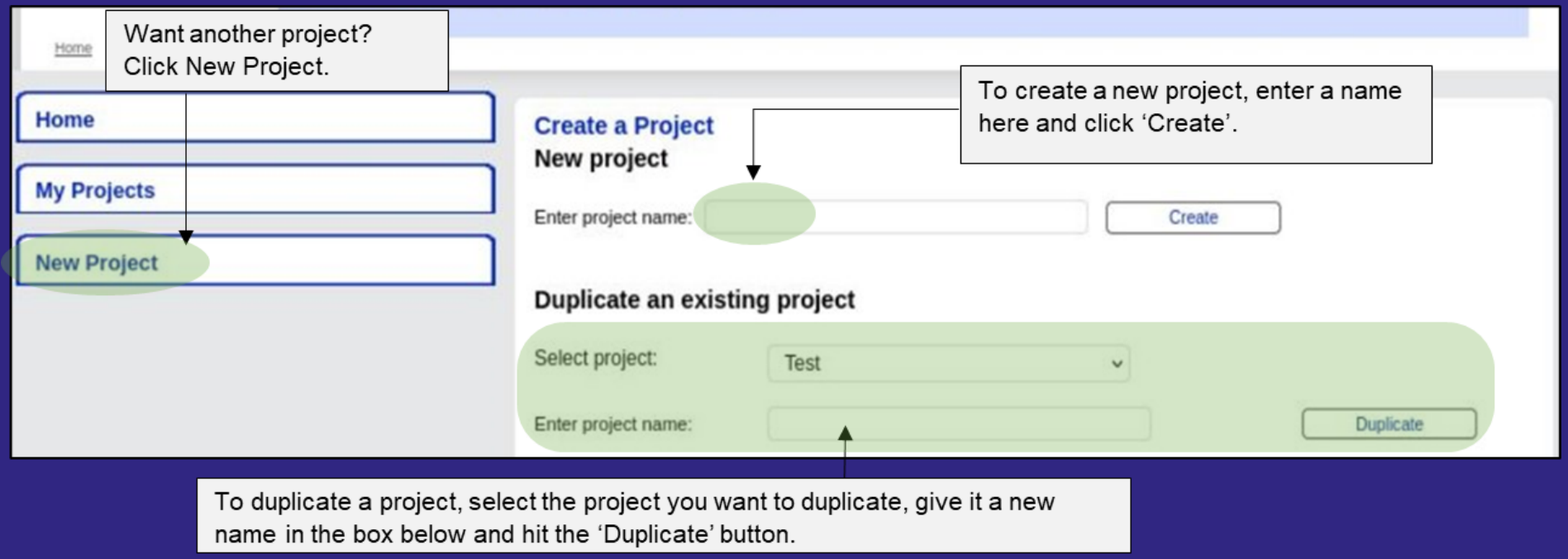
1. How to make a project and duplicate existing projects

- A project contains the information needed to define inputs for the Home Energy Model for a single dwelling.



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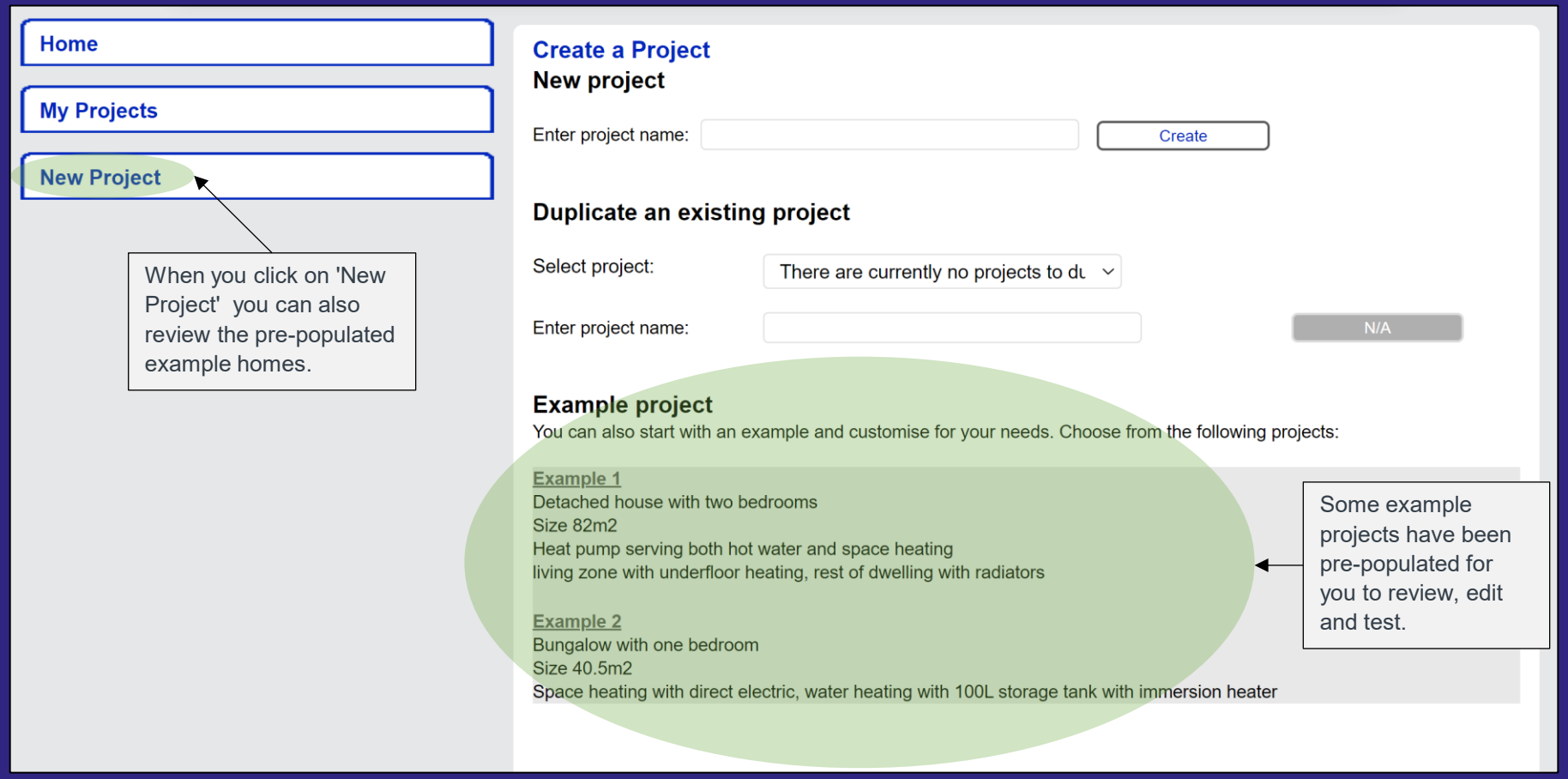
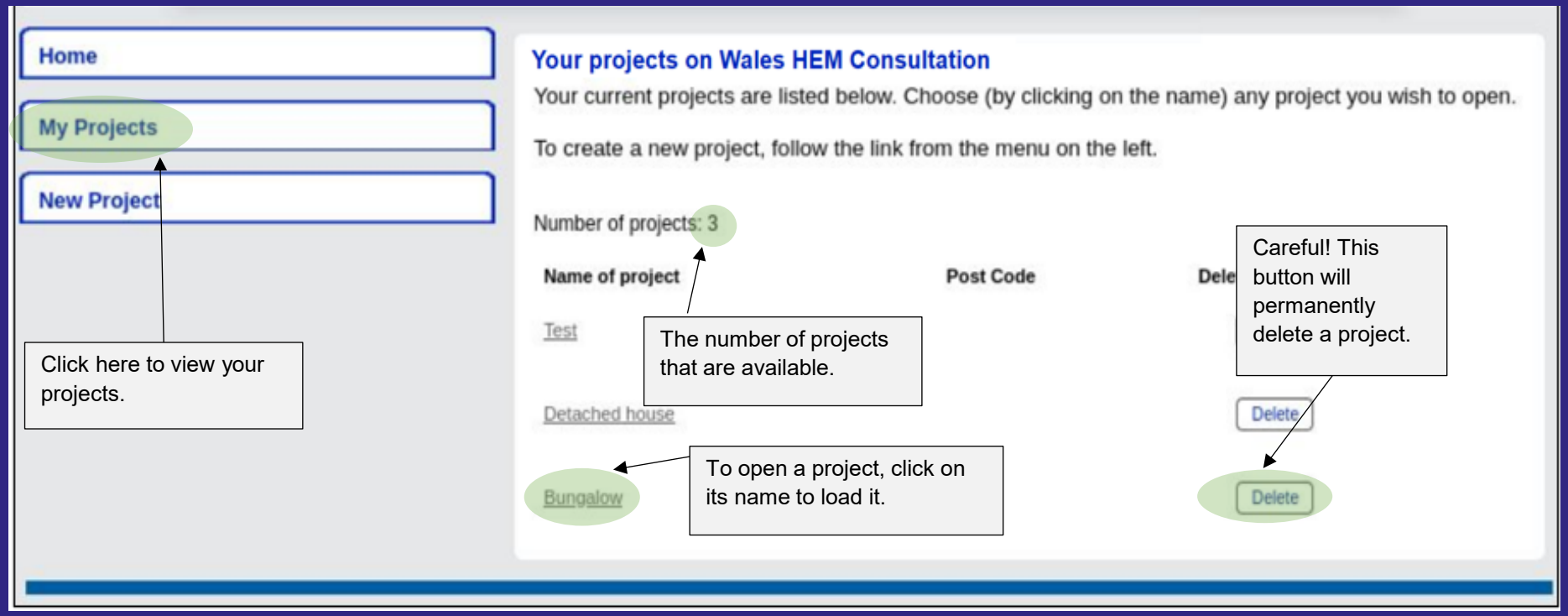
2. Pre-populated example projects



3. How to navigate the project tree



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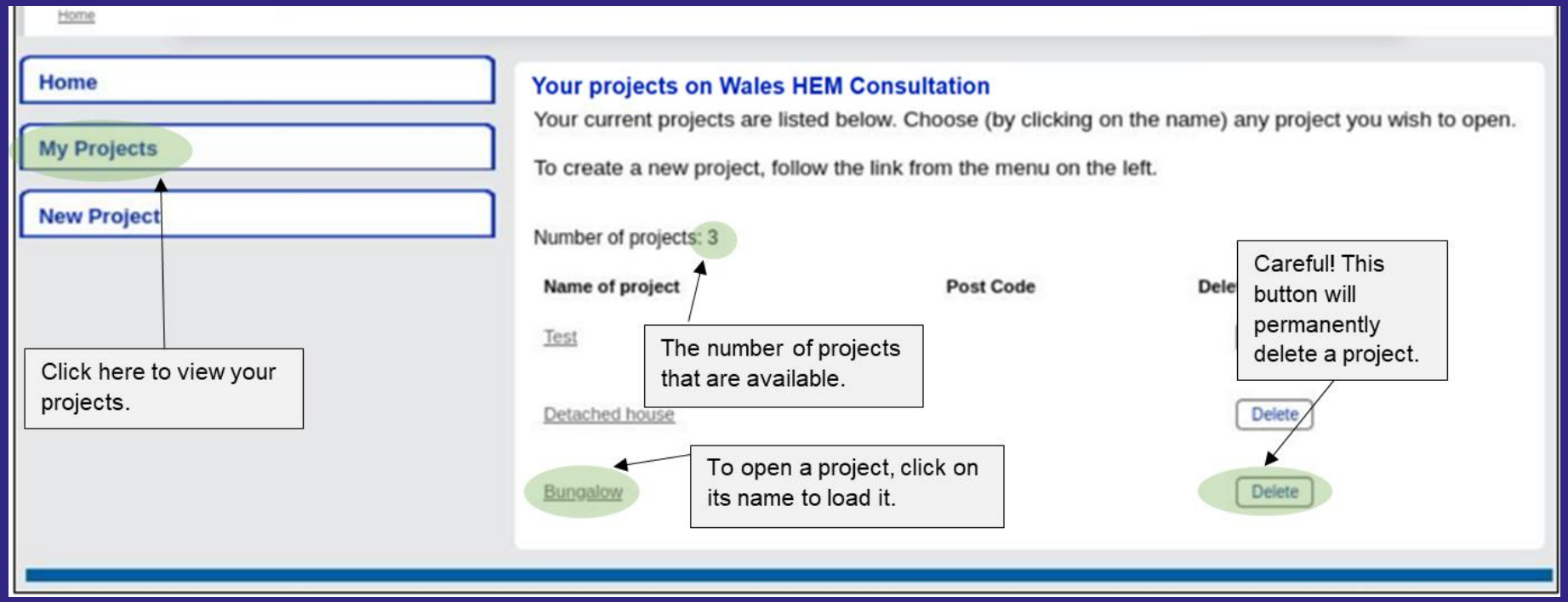
3. How to navigate the project tree- Alternative without header



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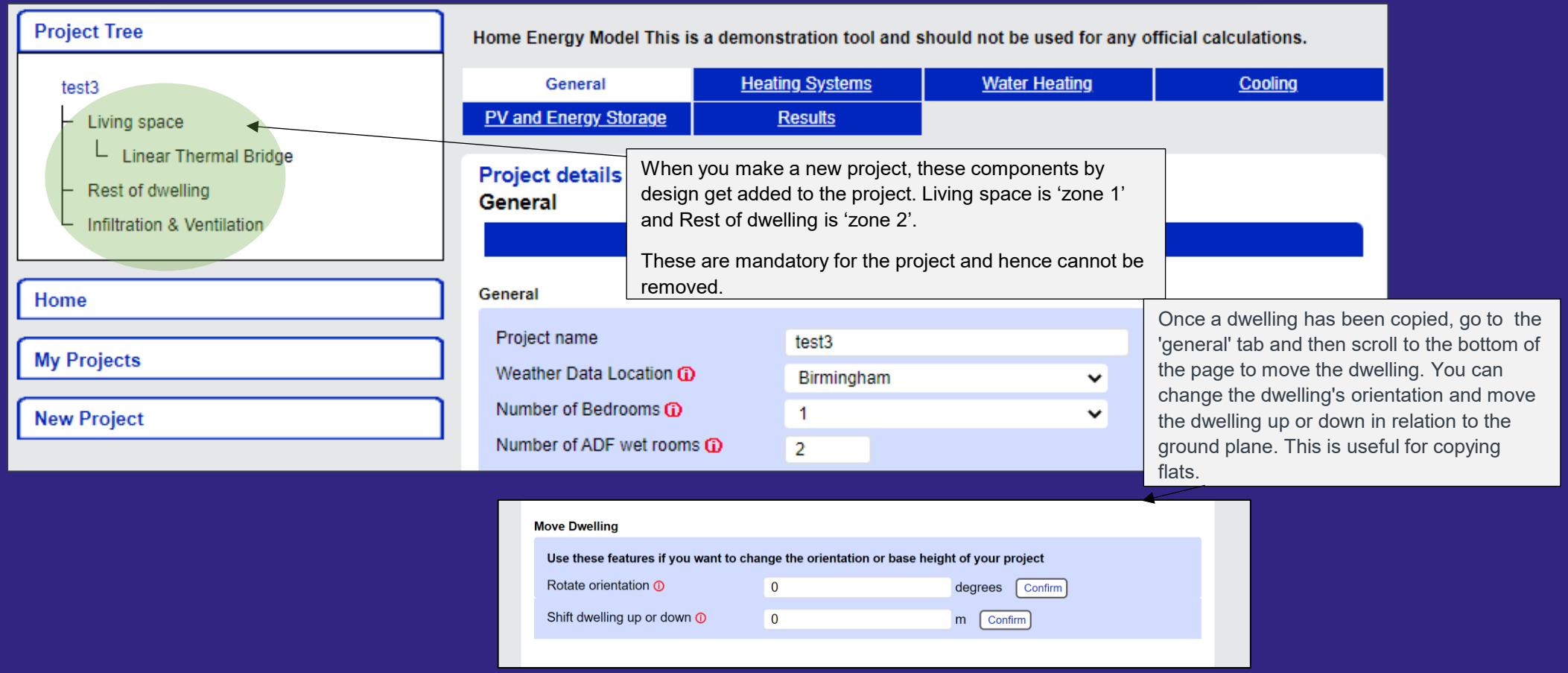
- After selecting a project, you should be able to see the interface below.



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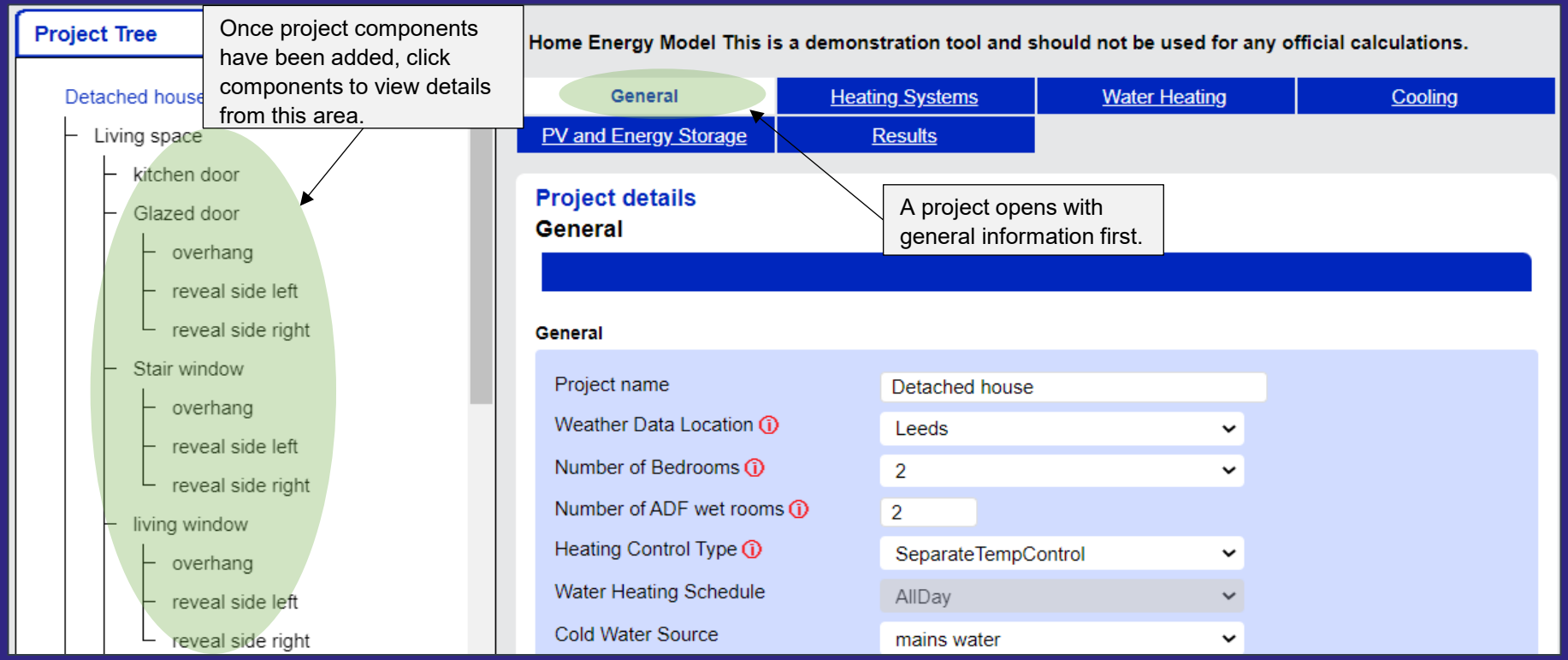
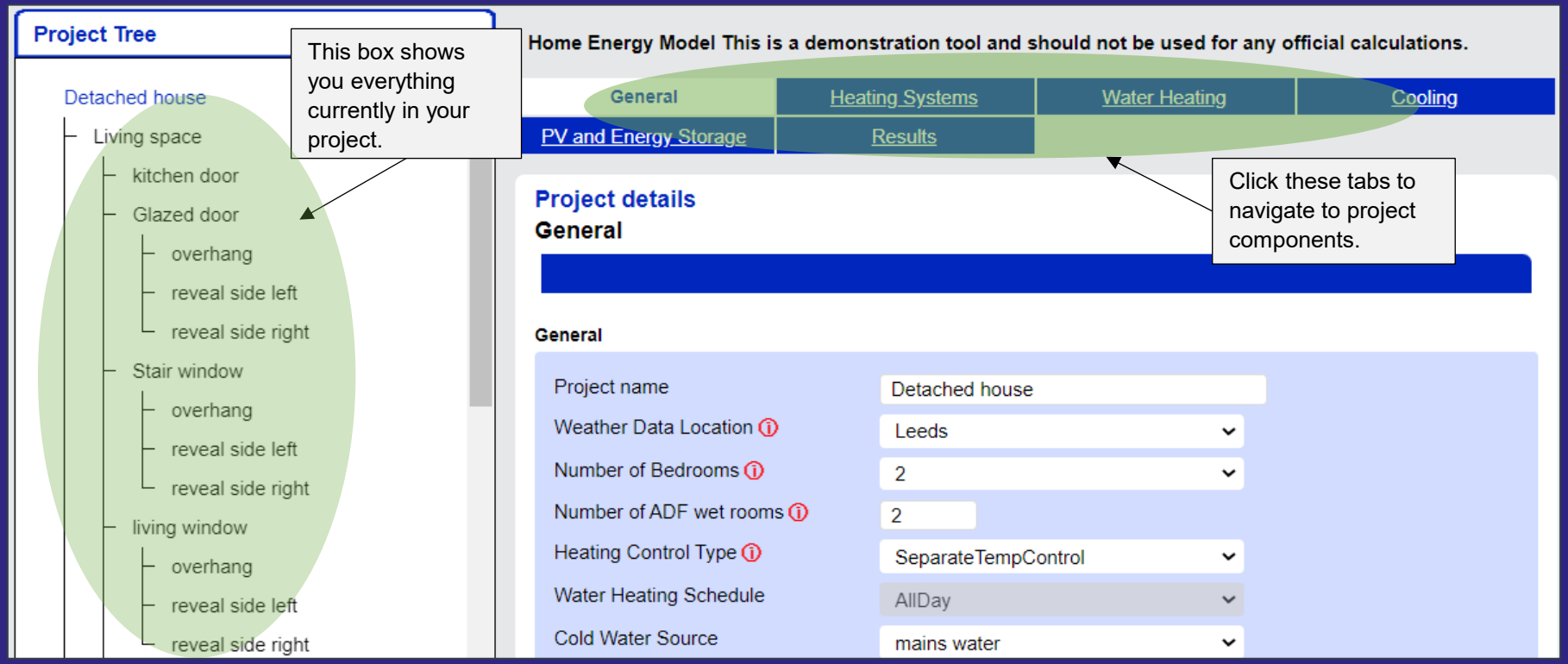
- After selecting a project with added components and their parameters, you should be able to see the interface below.



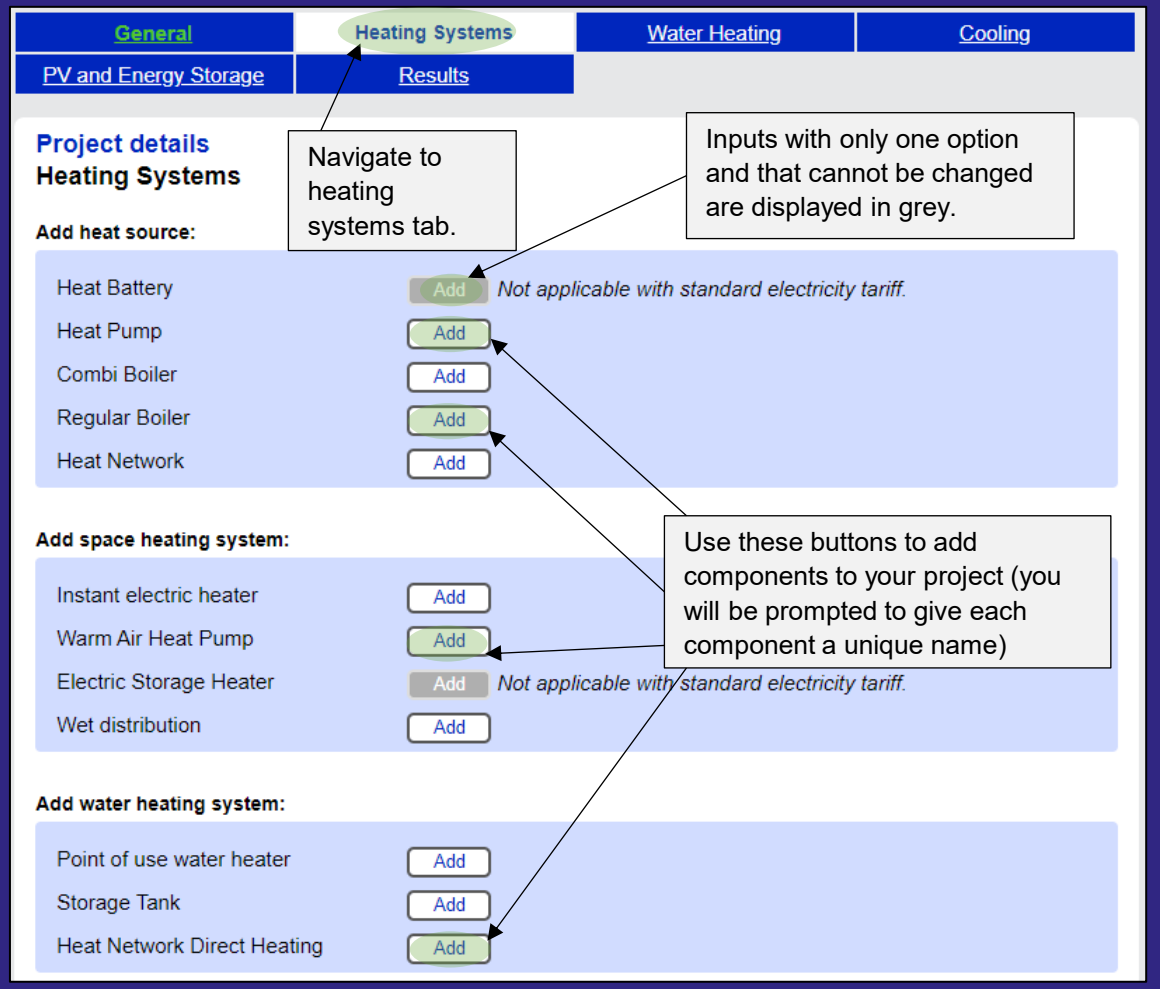
4. How to Add, delete, and copy inputs

- This section explains how to add, delete, and copy components.



i. Add components

- Example using Heating Systems.



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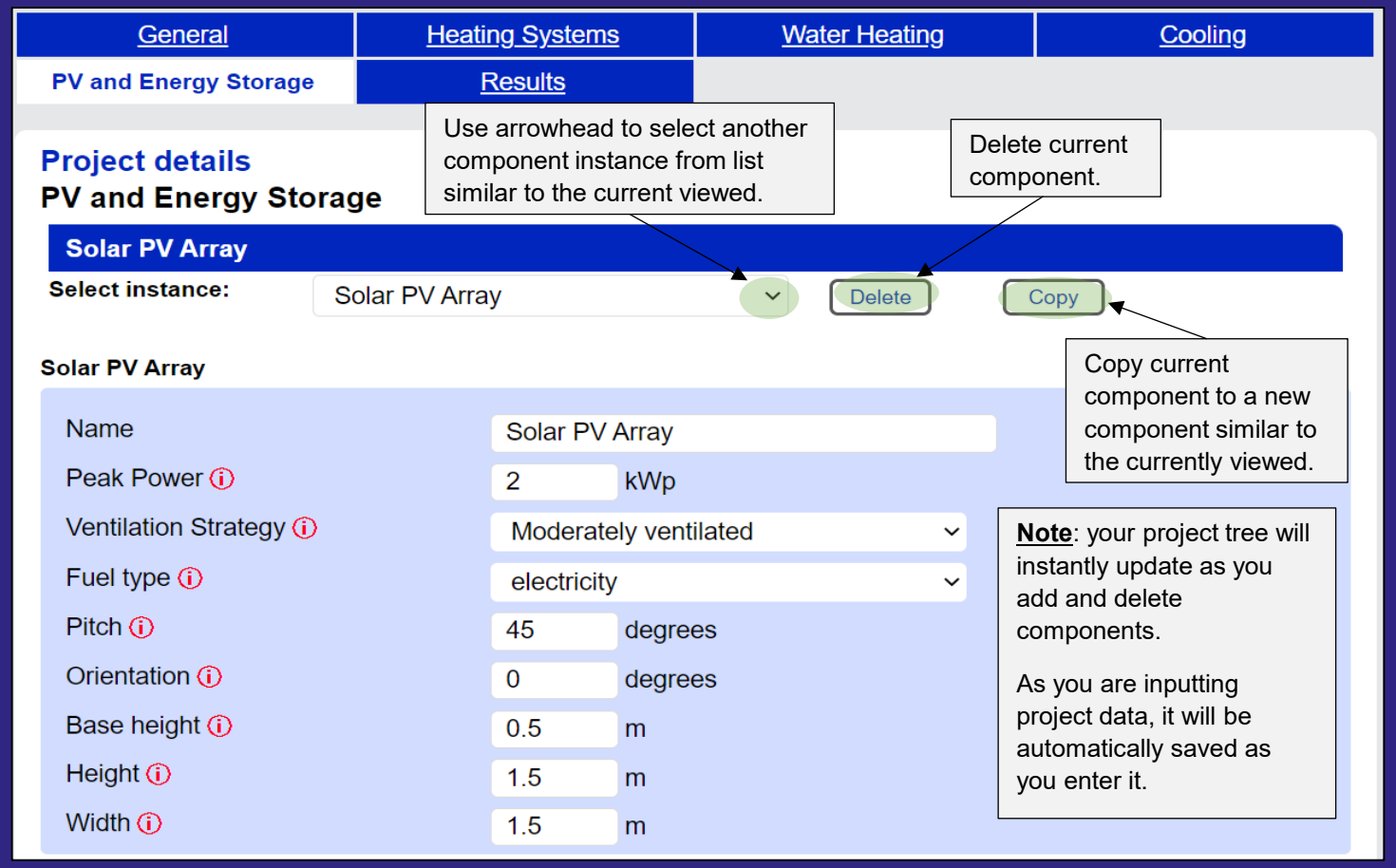
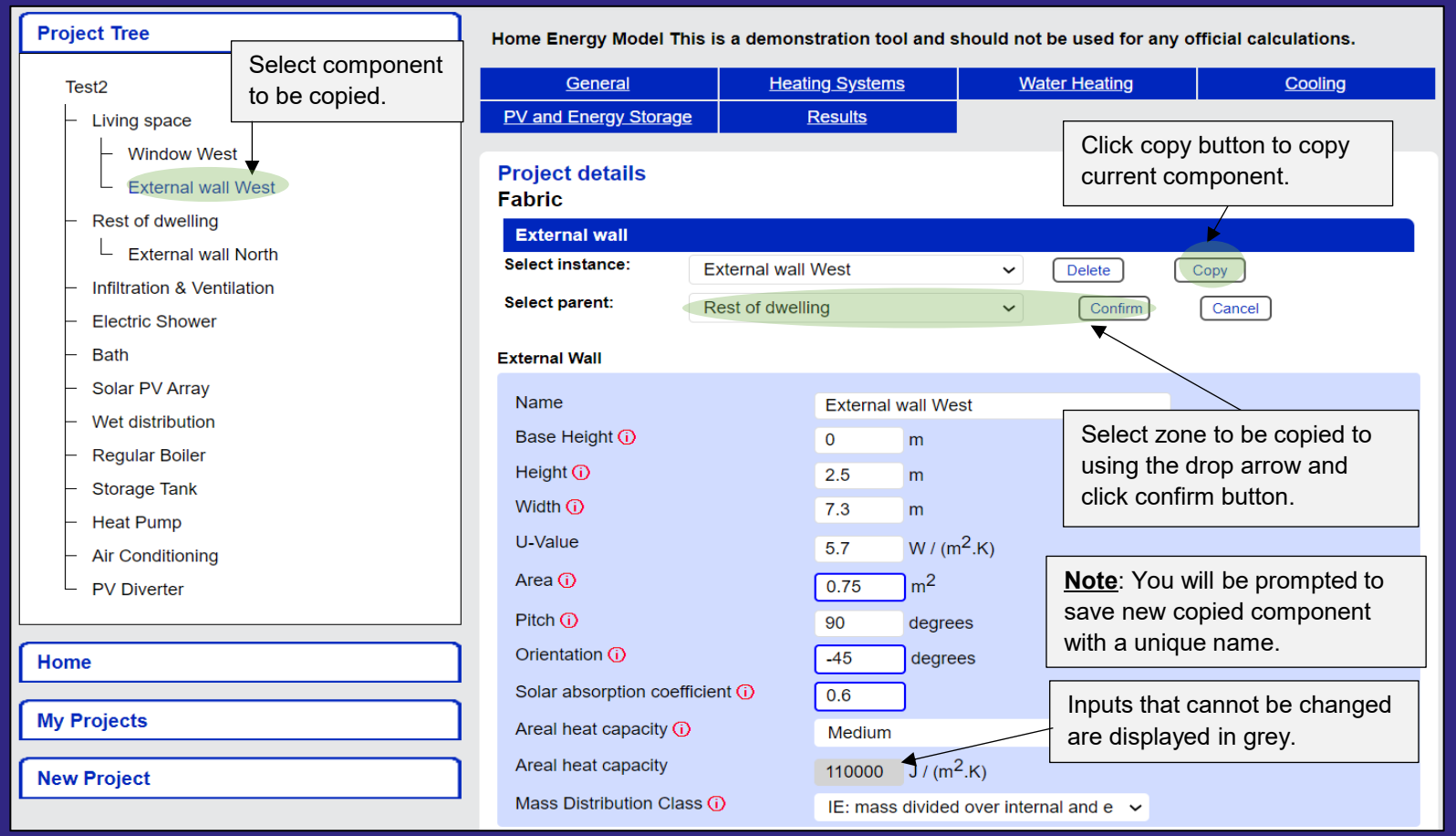
ii. Delete and Copy Component

- Example using PV and Energy Storage.



iii. Copy Components into Another Zone

- Example using Living space zone.



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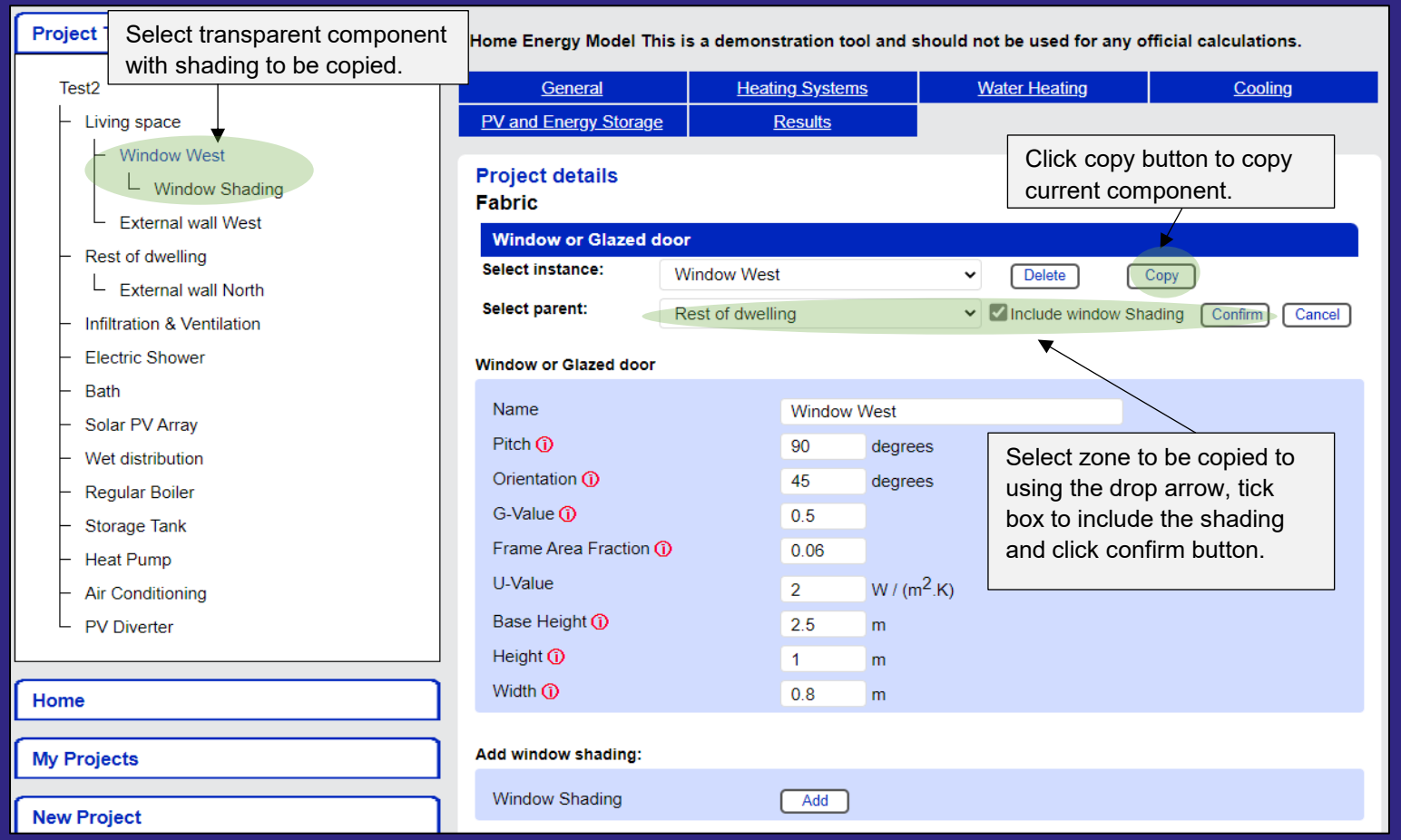
iv. Copy Transparent Component Shading into Another Zone

- Example using Living space zone. This shows how to copy transparent component shading.



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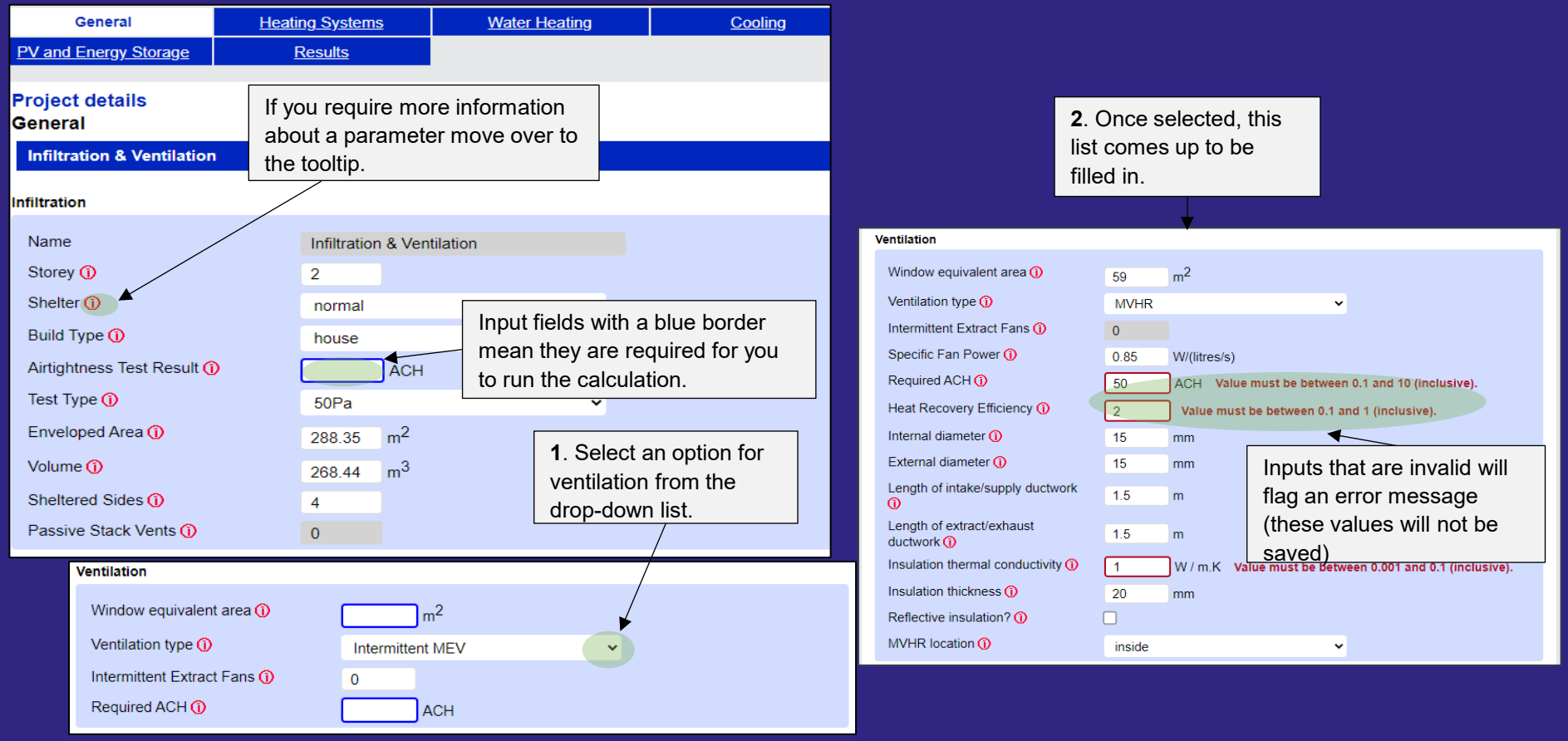
5. How to enter data

- An example of each type of data entry type (manual input, drop down list, checkbox) using infiltration and ventilation.



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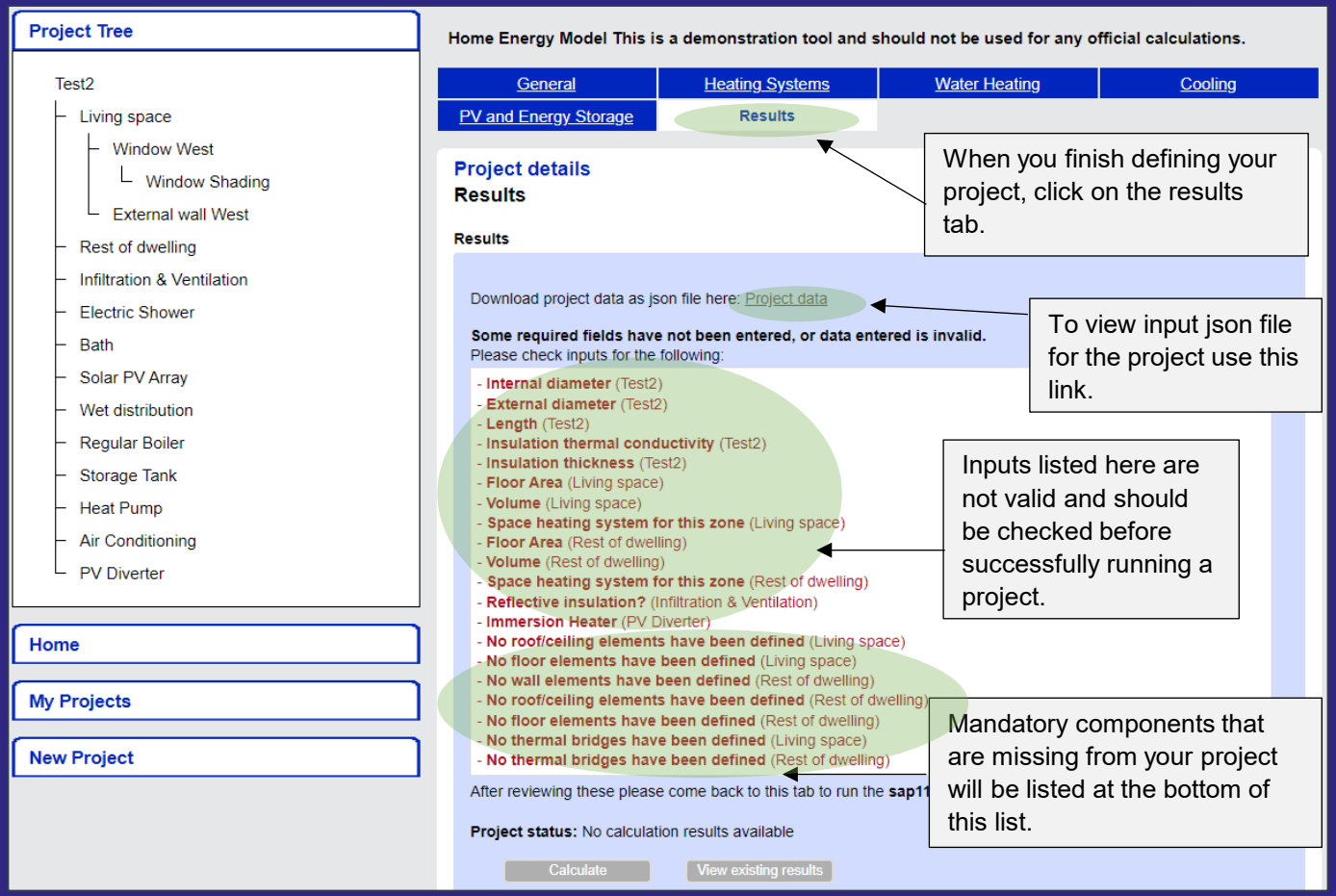
6. How to ensure your project is valid

- Error messages are displayed, this helps in final project validation.



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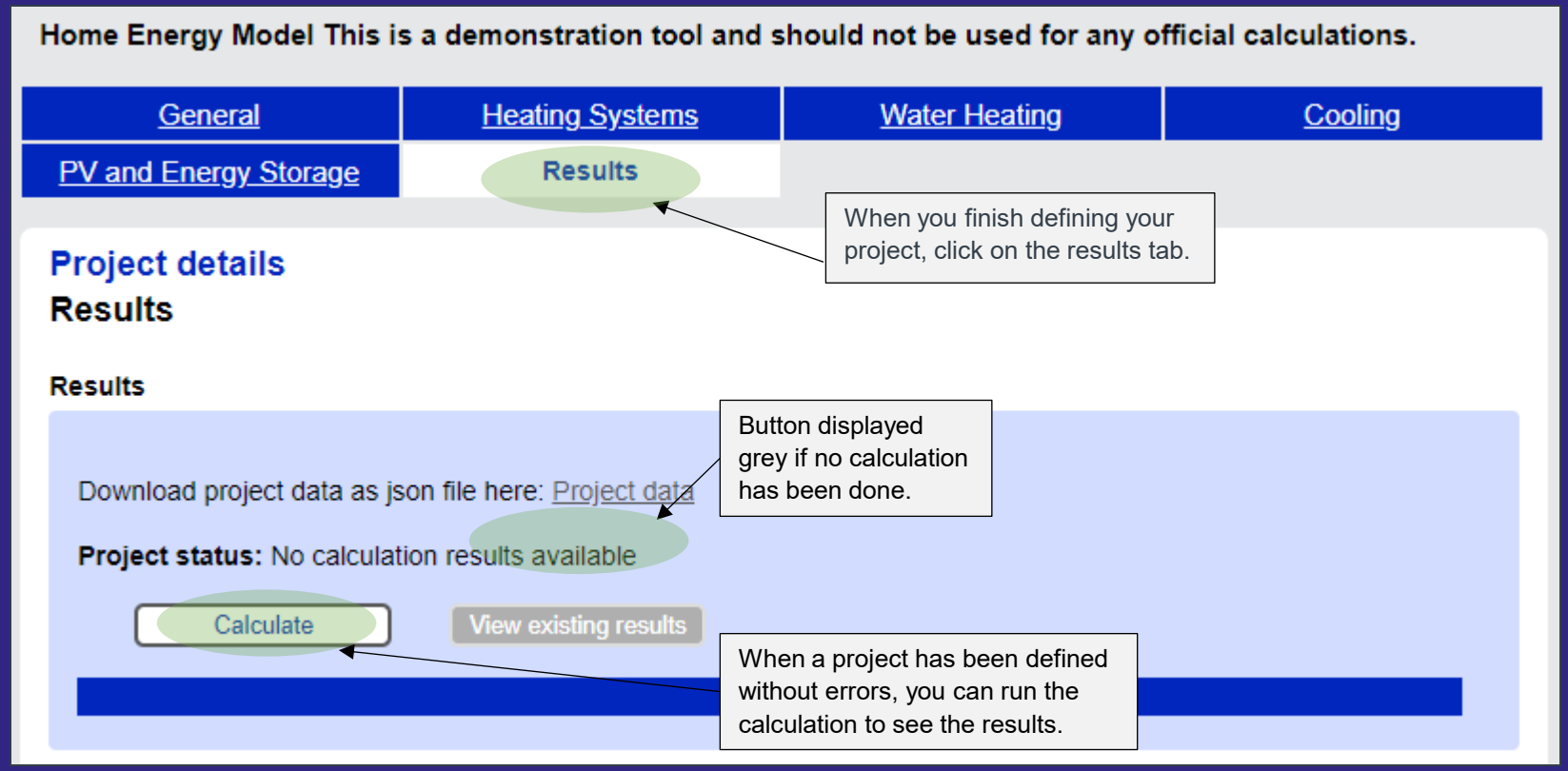
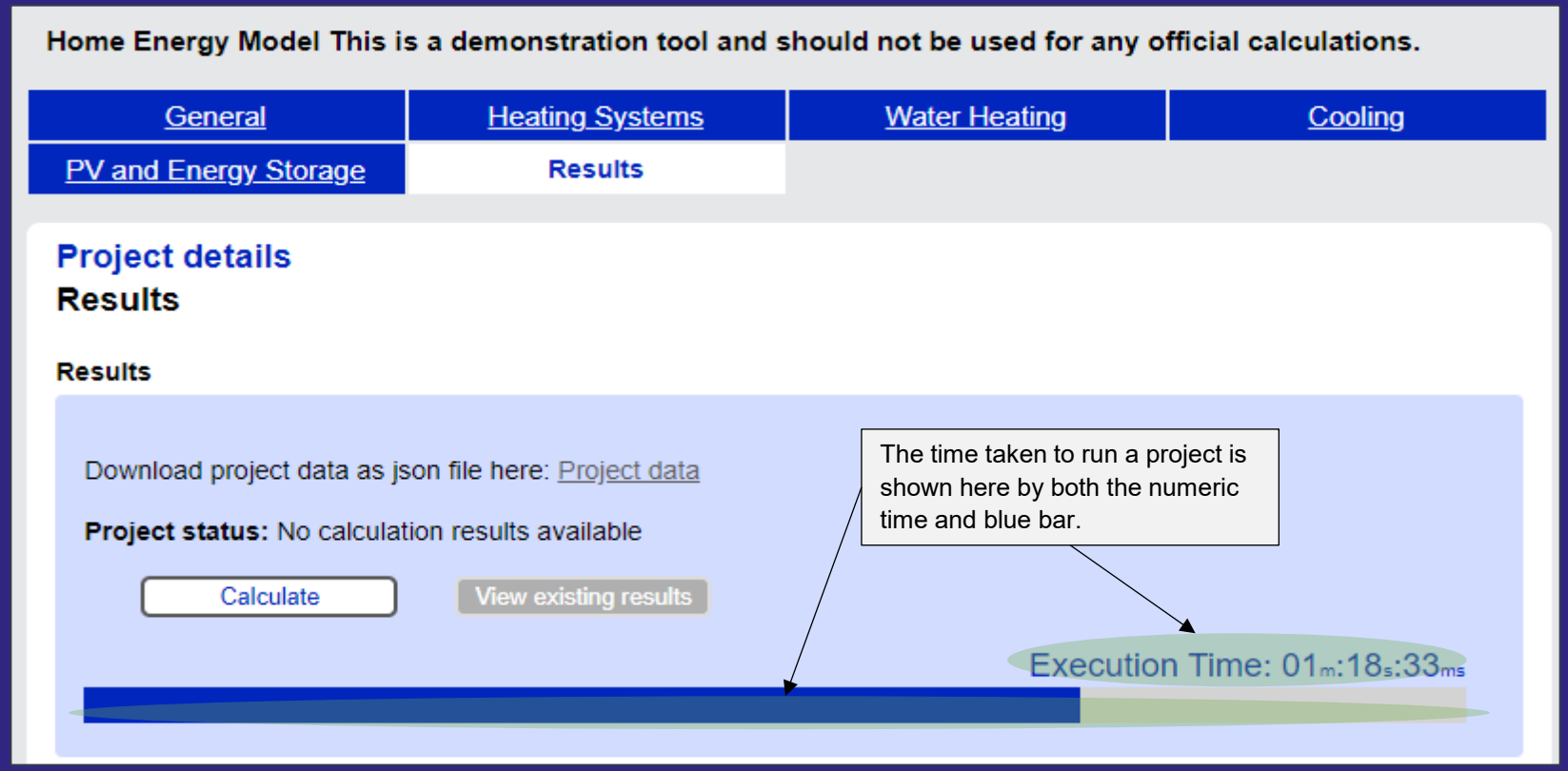
7. Understanding the calculation & results

- When you finish defining your project, click on the results tab.



i. Execution Time

- Results will take a bit longer to run and therefore display outputs will take some time to show, so make sure to come and check back on them.



ii. Project Results

- Results Summary of project will be displayed in this window.

Results Summary

Output	Units	Actual Dwelling	Notional Option 1	Notional Option 2
Delivered Energy Rate	kWh/yr			
Dwelling Space Heating Demand Rate	kWh/yr			
Delivered Energy use				
Space heating	kWh/yr			
Water heating	kWh/yr			
Cooling	kWh/yr			
Lighting (including topup)	kWh/yr			
Pumps & fans	kWh/yr			
PV generation	kWh/yr			
PV utilised	kWh/yr			
Unregulated load	kWh/yr			

3. Conventions and FAQ

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Introduction

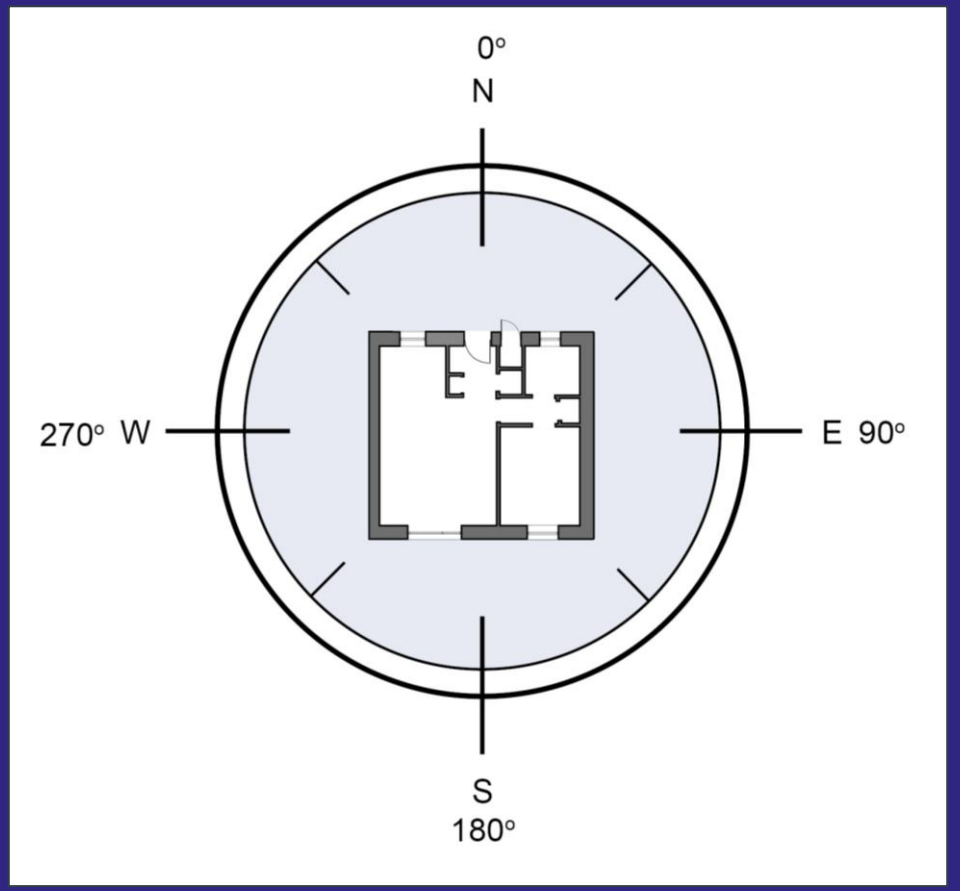
The Home Energy Model is still in development and does not yet have a comprehensive set of input conventions set out in a document, as SAP 10.2 does. To facilitate use of the new model, we highlight here some key conventions used for inputs and how they should be interpreted.

This section covers:

- Orientations
- Measuring zones (entering walls and thermal bridges between zones or fully within zones etc.)
- Perimeter and Pitch
- Distant shading
- Base heights
- Ventilation zone base heights
- Window shading
- Duct lengths
- Primary and secondary pipework
- Wet distribution
    - Eco design control class

1. Orientations

- The orientation of the outside face of an object (such as a wall) should be measured clockwise from North to the nearest degree.



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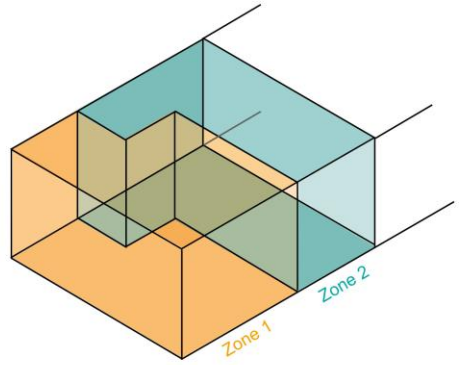
2.0. Measurement conventions - zones

- There are two zones (living and rest of dwelling). The zones are measured independently.
- External building elements such as walls, roof, floor, window are each individually defined and assigned to a zone. Window and door areas are not included in the wall areas (i.e. the user enters the net wall area, with aperture area subtracted).
- Thermal bridges are also assigned to the zone they occur in, with their length and linear thermal transmittance.
- The internal building elements are only included to account for thermal mass, and can therefore be grouped together if they have the same areal heat capacity, so internal floors, internal walls and internal ceilings only need to be defined once. For internal walls with two sides in the zone, both sides are counted as wall area. Where an internal wall is between two zones, only the area facing the zone is included.



Measure all building elements and thermal bridges separately per zone

Zone 1 - living area

- Area of floor and ceiling
- External wall associated with zone 1 (minus doors and windows from this area)
- Internal wall face associated with zone 1
- Window or solid/glazed door in wall associated with zone 1

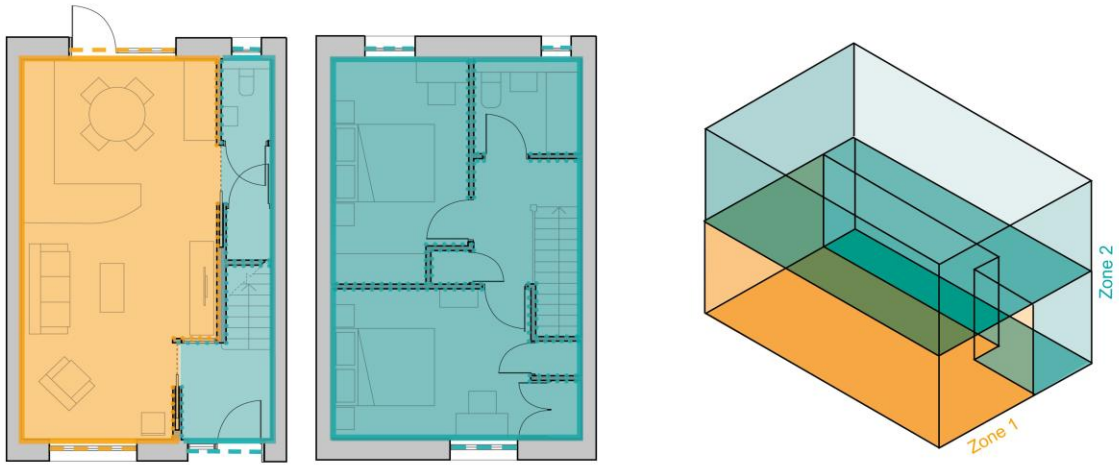
Zone 2 - rest of dwelling

- Area of floor and ceiling
- External wall associated with zone 2 (minus doors and windows from this area)
- Internal face of wall associated with zone 2 (each face entered separately)
- Window or solid/glazed door in wall associated with zone 2

Example measurement conventions for a flat

2.1. Measurement conventions - zones

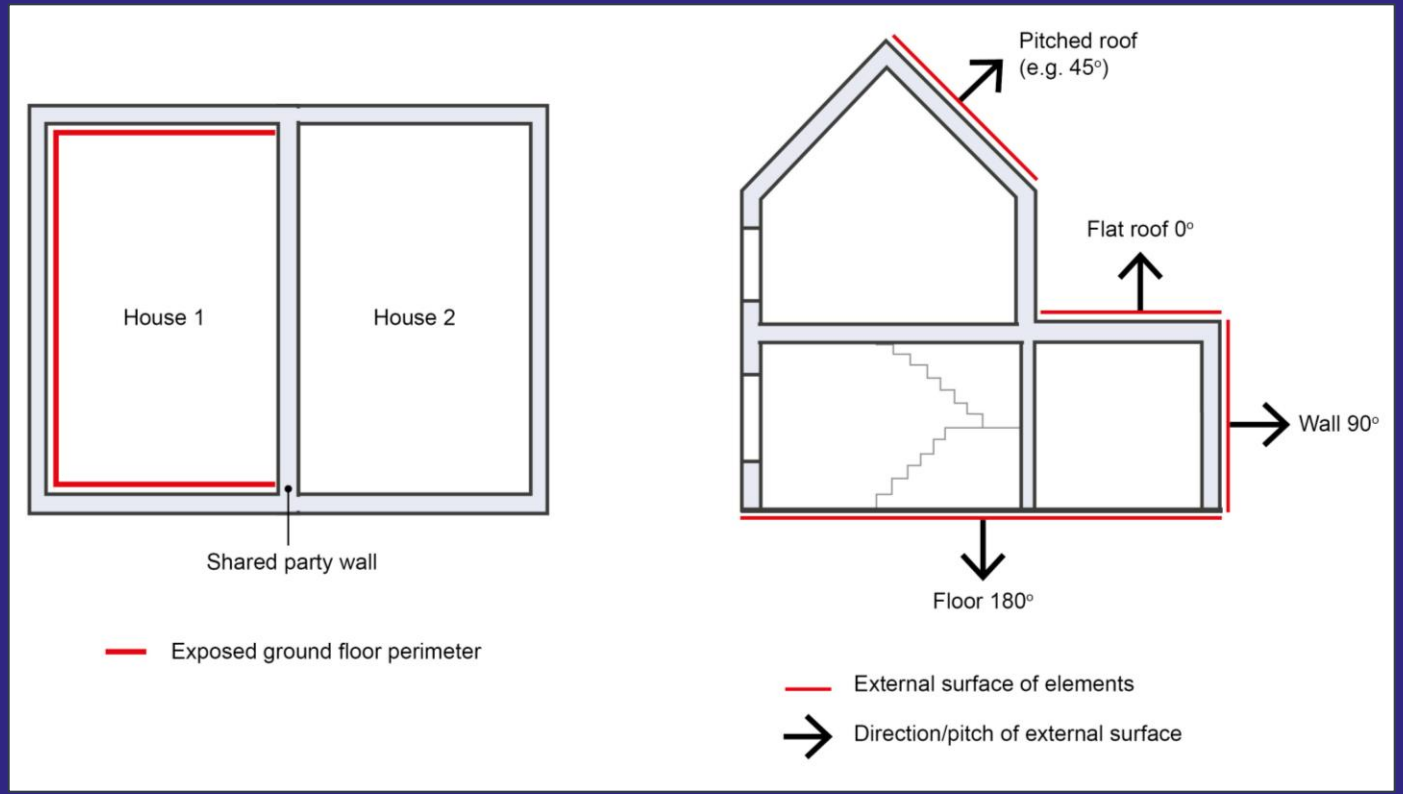
- In the context of the housing energy model (HEM): A "house" refers to a standalone residential building surrounded by open space or terraced or semi-terraced, ground floor walls are measured floor-to-ceiling, mid-floor walls are measured ceiling to ceiling
- While a "flat" denotes a self-contained unit within a multi-unit structure, sharing common walls and areas. In a single-storey flat, wall height is measured floor to ceiling. In a two-storey flat, wall height is measured lowest floor to ceiling, upper-floor walls are measured ceiling to ceiling.
- The model distinguishes between these two types based on architectural and structural differences, considering factors like insulation and heating to accurately assess their distinct energy efficiency.



Example measurement conventions for a two-storey house

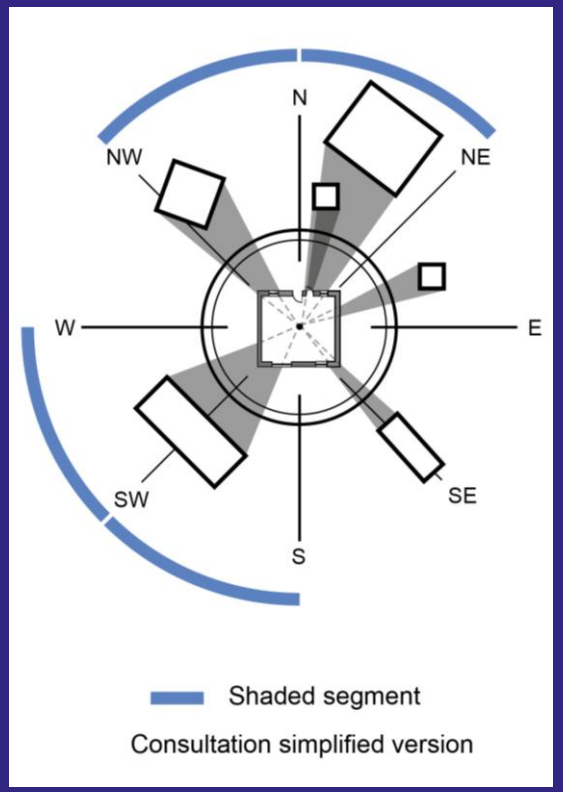
3. Perimeter and Pitch

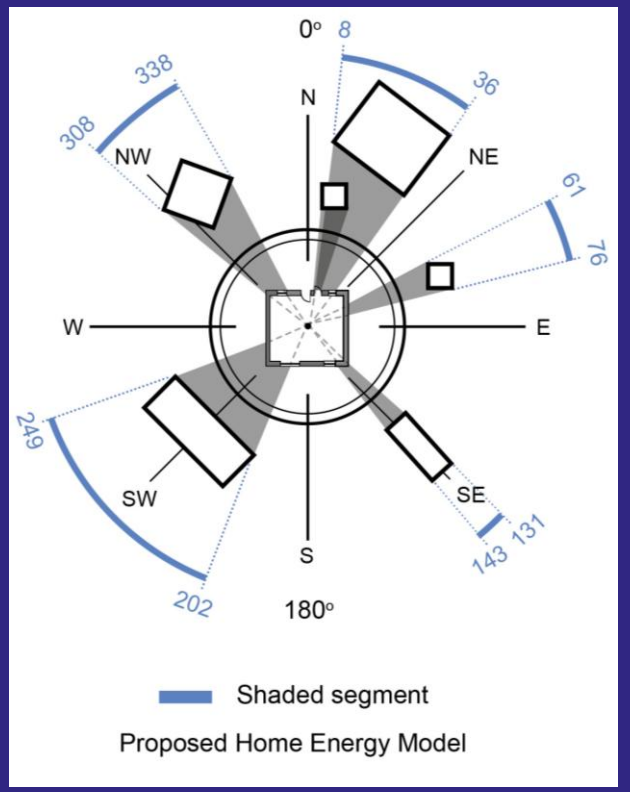
- The perimeter of a dwelling should be entered as the exposed ground floor perimeter, excluding any shared party walls.
- Where the pitch of a building element is entered, it should refer to the relevant angle of the element surface between 0-180°. Pitches should be interpreted as a rotation where a flat element facing upwards is 0° and a flat element facing downwards is 180°.



4.0. Distant shading - segments

- Distant shading has been simplified for the consultation and is considered in eight 45° segments taken from the centre of the dwelling.
- A segment should be considered shaded if an object covers over 22.5° of the segment (i.e. half a segment). If an object straddles two segments and covers over 22.5° of either or both segments, then one or both should be considered shaded.
- Where there are multiple shading objects in a segment only the most significant object should be entered.
- If other parts of a connected building (such as courtyard block of flats) shade the dwelling these should be accounted for using the above conventions. However, in the unusual case where a dwelling shades itself (such as L-shaped dwelling) this should not be included.
- The proposed Home Energy Model will later allow shaded segments to be entered in more accurate ranges, to the degree. Up to a maximum of 36 segments will be permitted (18 shaded and 18 unshaded).





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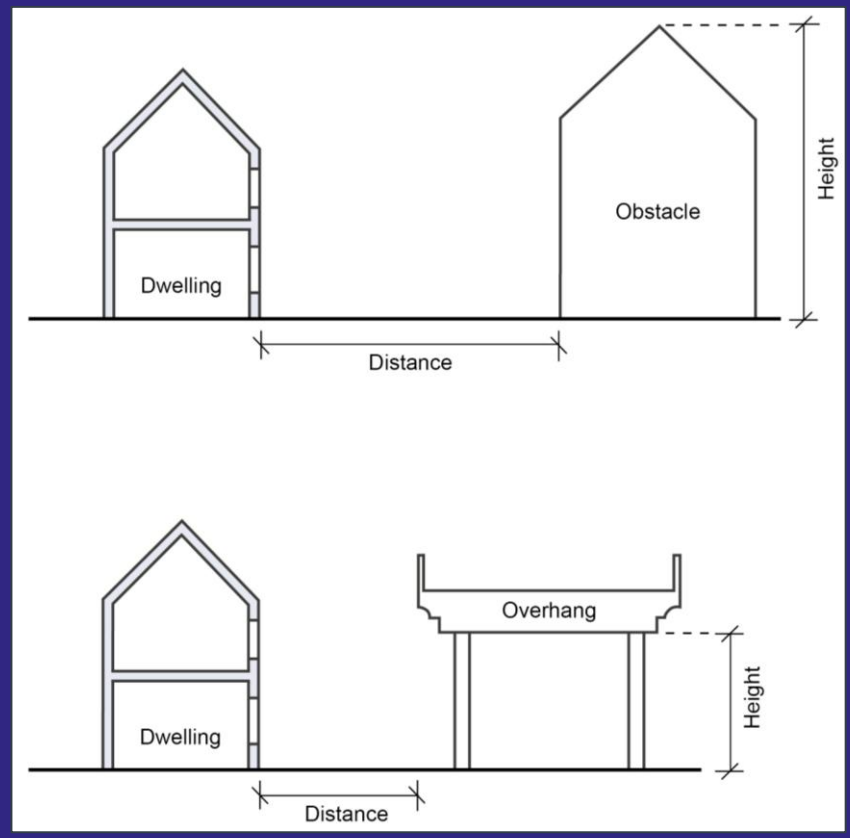
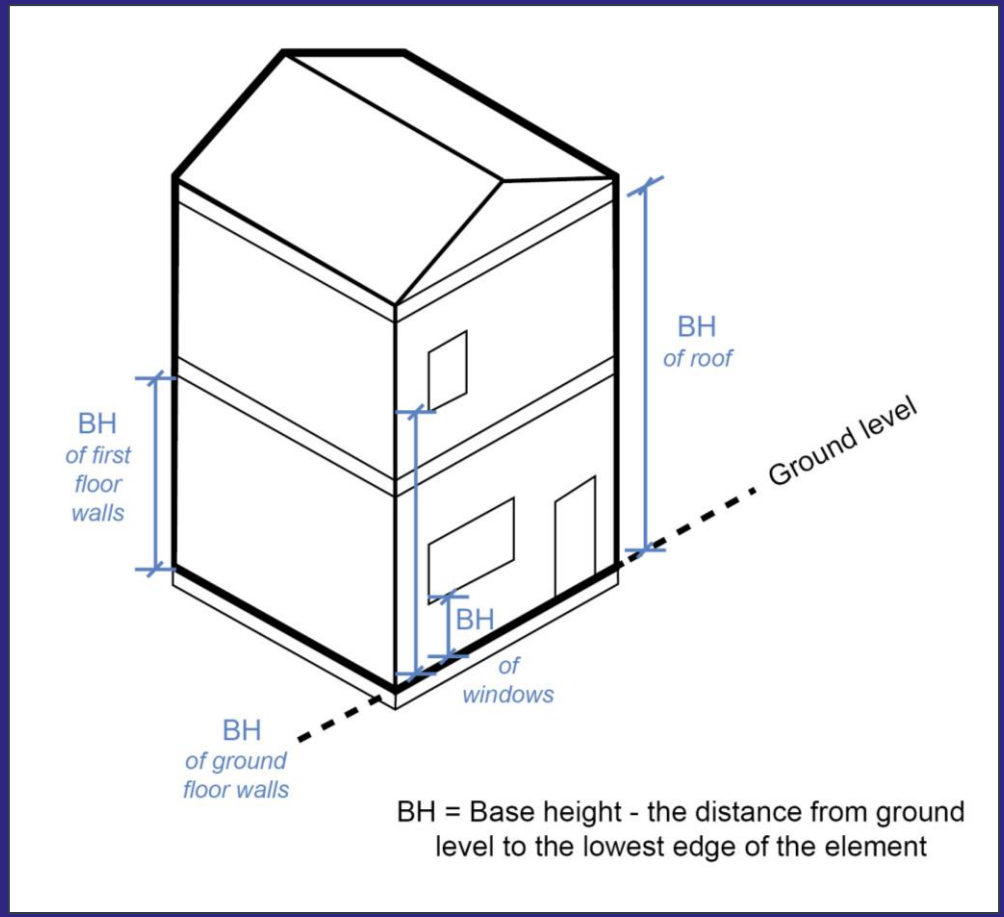
4.1. Distant shading - objects

- Where a shading segment is determined, details of the most significant shading object (obstacle or overhang) in that segment should be entered. This includes the height from the established ground and the distance between the centre of the closest external wall of the dwelling to the centre of the closest face of the shading object.
- If the vertical cross-section of the shaded object is not constant, the vertical cross-section shall be assessed in the middle of the object.
- The difference between obstacles and overhangs is that an obstacle ends at a certain height above the ground level, while an overhang starts at a certain height above the ground level.



5.0. Base heights

- The base heights of building elements are required to inform the Home Energy Model where the element is, relative to the ground, to determine if the element is shaded by a distant shading object.
- The base height of building elements should be measured from an established ground level. This is the level at which the lowest point of the building perimeter is in contact with the ground. Therefore, on a sloping site take the lowest level on the perimeter as the ground level. This same ground level should also be used when measuring the height of distant shading objects.
- In a two-storey house, the base height of the first floor is the height from ground level to the ceiling of the ground floor.
- The base height of the roof is the height from ground level to the ceiling of the highest floor.
- In a flat the base height is from the ground level to the floor level of the flat (as opposed to the ceiling level of the flat below).



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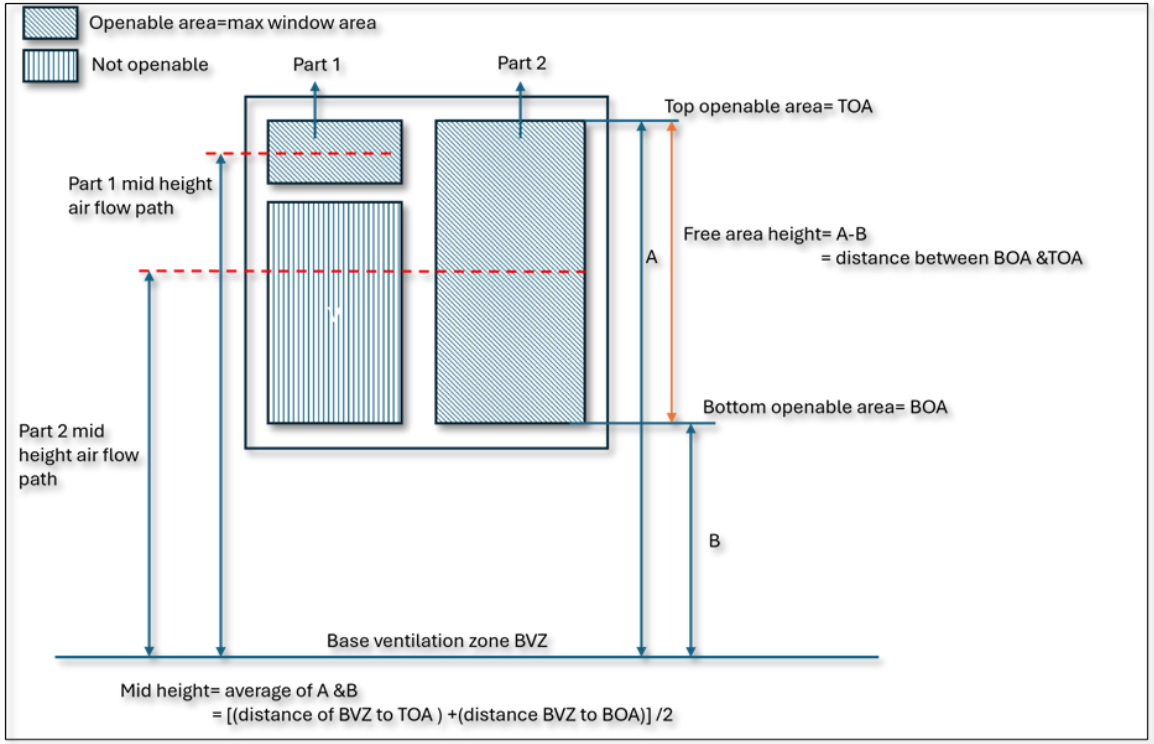
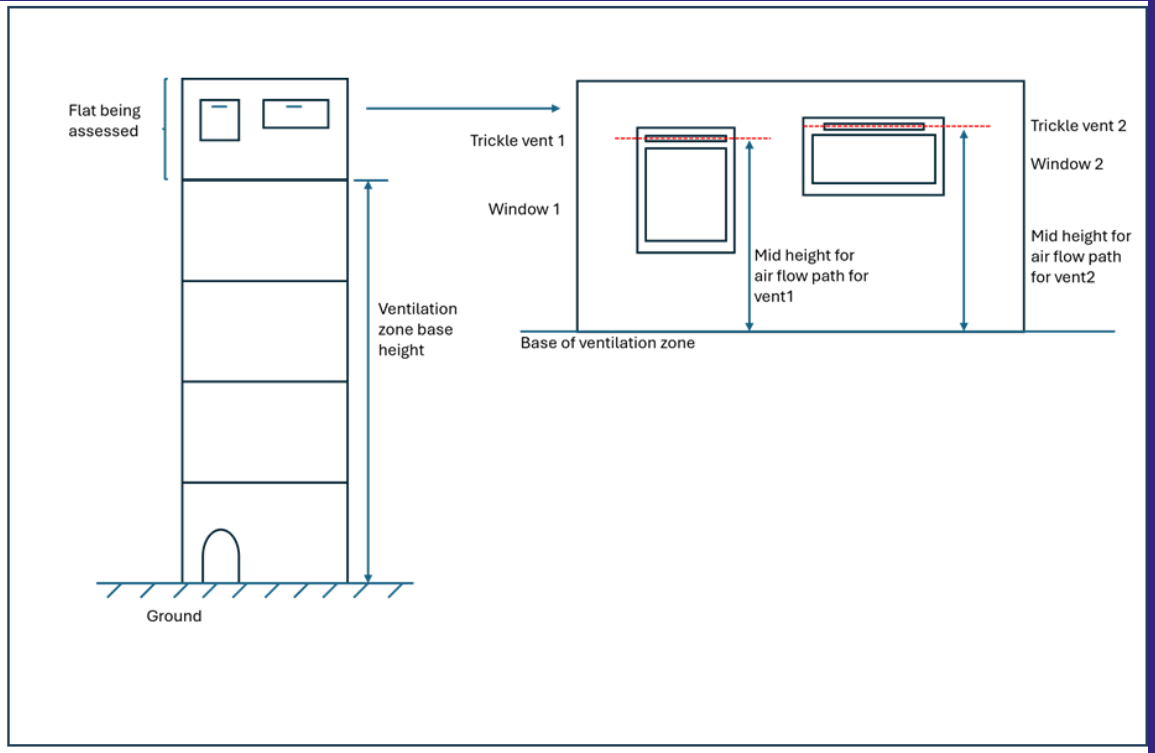
5.1. Ventilation Zone Base Height

- The ventilation zone is a space or group of spaces within a building that is served by the same ventilation strategy or system. A ventilation zone typically shares common air supply/extract conditions.
- Ventilation zone base height is the distance between the ground and the lowest edge of the lowest building element within the ventilation zone. elevational height of zone above ground datum level

5.1.0. Ventilation Zone Base Height





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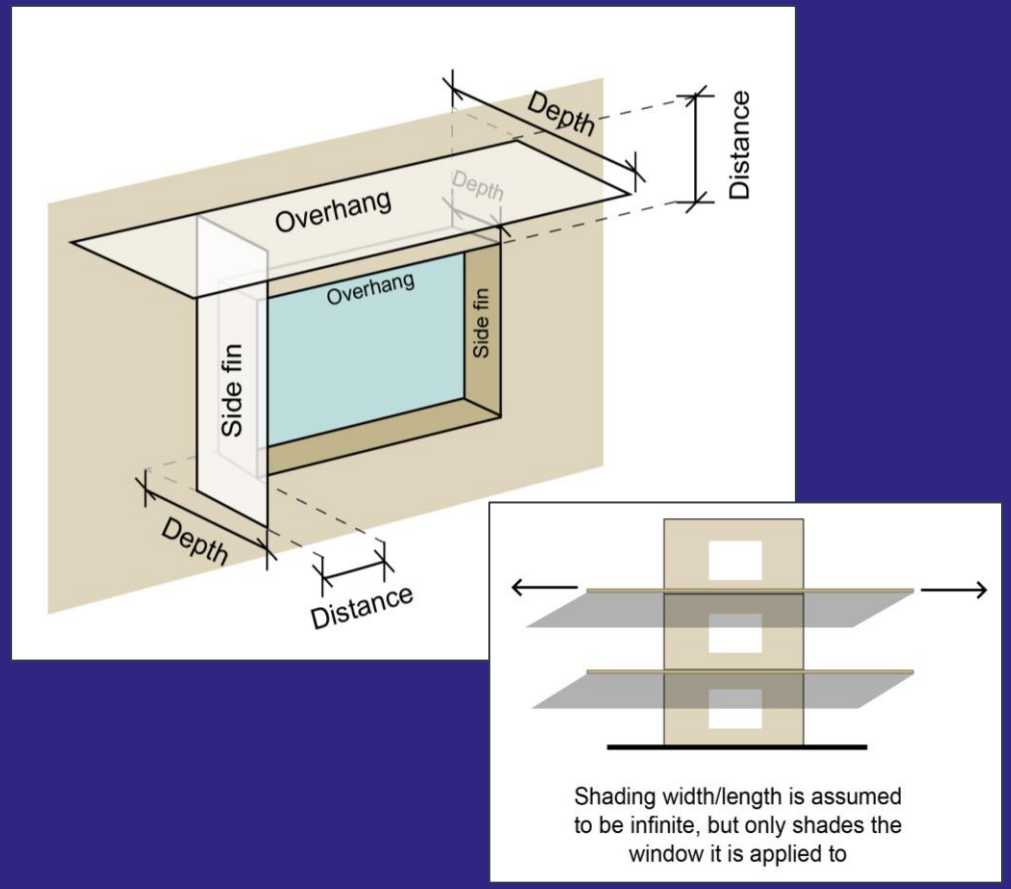
6.0. Window shading

- The shading effect of objects attached to the dwelling (including the dwelling itself) on transparent building elements (windows/glazed doors) is accounted for. To model this for each transparent building element any overhangs and side fins (including window reveals) should be added as window shading objects.
- For each window shading object the shading type (overhang, left side fin, or right side fin) should be entered. The 'depth' should be measured from the face of the glass to the furthest edge of the shading object. The 'distance' should be measured from the side or top edge of the glass to the closest edge of the shading object. This includes the window frame width, note it is not the distance to the outside edge of the window frame (hole in wall).
- Window reveals are considered as overhangs and side fins and should be entered accordingly. Where a shading device exceeds the depth of the reveal, only the shading device should be entered.
- The width of overhangs and height of side fins is not considered, they are assumed to be infinite in relation to the associated building element.
- Note: Left/right side fins should be specified from the perspective of looking out of the window.



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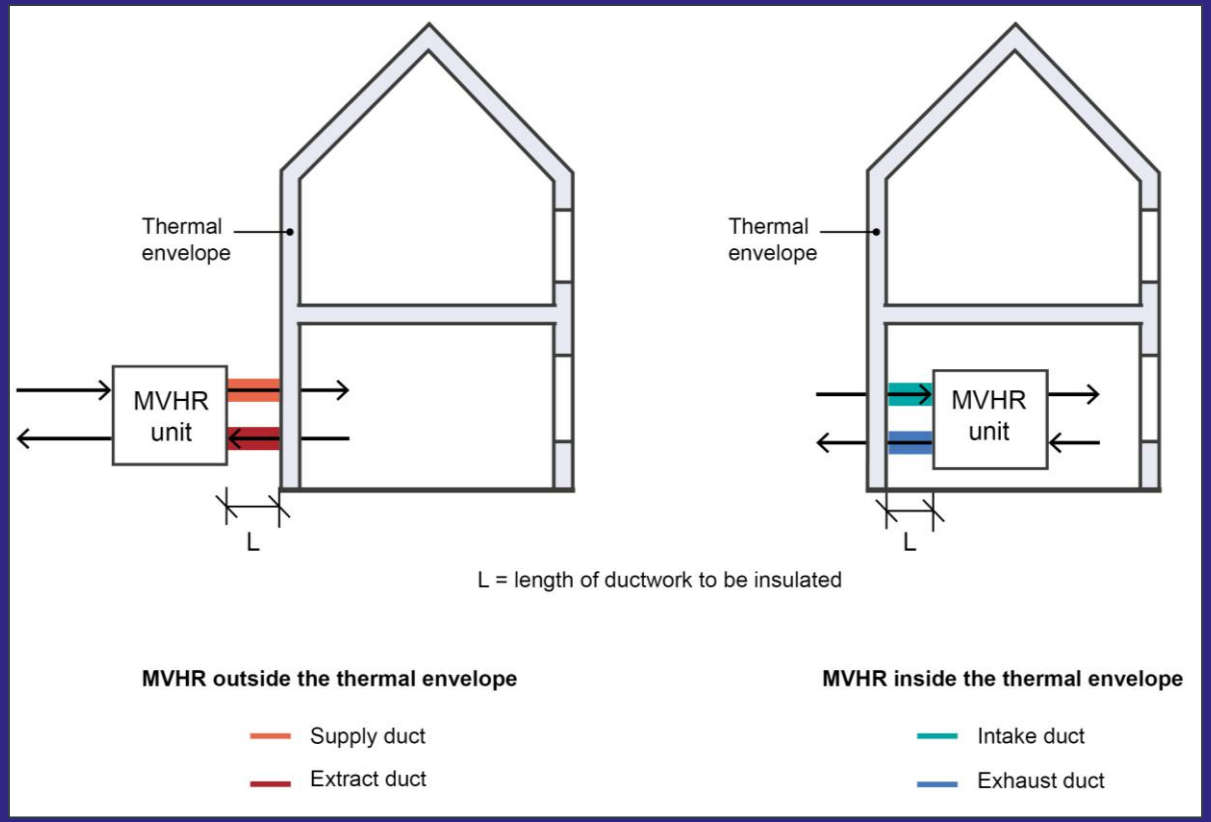
7. Duct lengths

- Duct lengths should be entered when a MVHR (Mechanical Ventilation with Heat Recovery) unit is present.
- If the MVHR unit sits outside the thermal envelope, supply and extract duct lengths should be entered measuring the distance between the unit and the exterior of the thermal envelope of the dwelling.
- If the MVHR unit sits within the thermal envelope the intake and exhaust duct lengths should be entered measuring the distance between the unit and the interior of the thermal envelope of the dwelling. In both cases the full length of the ducts given are assumed to be insulated as specified.



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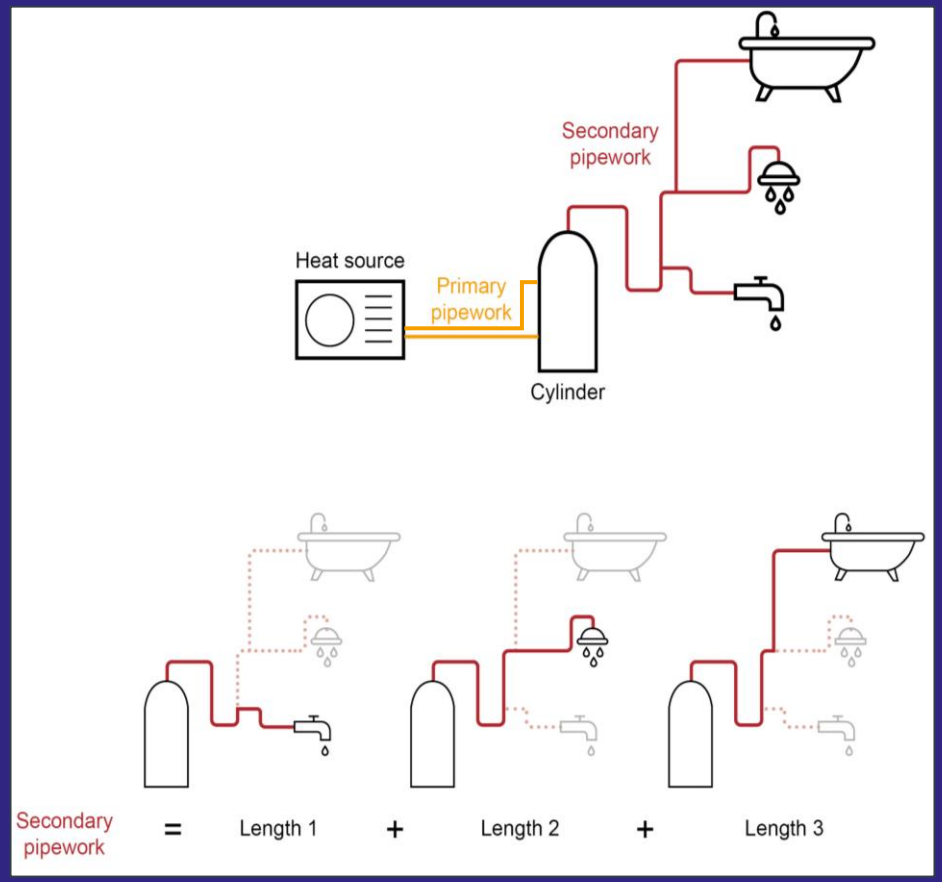
8. Primary and Secondary pipework

- The length of secondary distribution pipework is needed for modelling the hot water distribution system. (HEM does not handle secondary circulation pipework, which is secondary hot water pumped around in continuous circulation).
- The total secondary hot water distribution pipework length should be calculated as the sum of all lengths of pipework from the hot water source to a tapping point (i.e. tap, bath or shower), hence if a pipe is shared for multiple tapping points the length of shared pipe should be duplicated and added for each tapping point.
- If there is hot water distribution pipework outside the thermal envelope it should be entered in the separate pane marked ‘external’.
- ***NOTE**: Secondary distribution pipework is always needed if there are any hot water outlets in the property (hot water taps, showers).*
- If required, the length of primary pipework should be measured from the heat source to the storage tank. Both the primary flow and return lengths should be included.
- ***NOTE**: Primary pipework is required whenever there is a hot water tank or a thermal storage tank in the heating system, and it has pipework connected to a separate heat source.*



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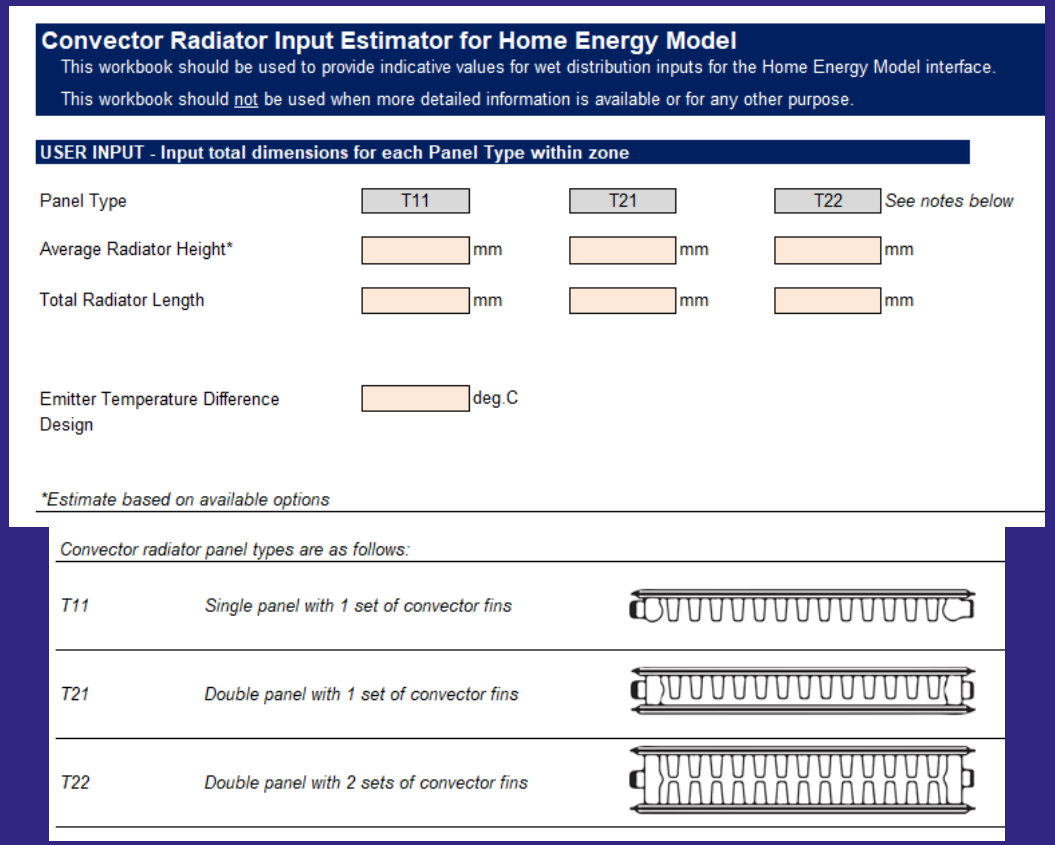
9. Wet Distribution

- When a wet distribution space heating system is included in the dwelling there are several associated inputs (Heat Emitter Constant, Heat Emitter Exponent) that need to be supplied. To help estimate what these should be, an accompanying workbook has been produced. Note this is to calculate indicative values for a given system setup and should not be used outside this tool. The workbook can be found here.
- Note the interface inputs should be for all the emitters in the given zone, hence when using the workbook, for each panel type the average radiator height should be input, along with the total radiator length and the system emitter temperature difference design. When these values are entered, a set of suggested emitter inputs for the tool will be generated.
- (Note: pipework also has some thermal mass, the workbook currently does not calculate the pipework thermal mass.)



Convector Radiator Input Estimator for Home Energy Model

This workbook should be used to provide indicative values for wet distribution inputs for the Home Energy Model interface.

This workbook should not be used when more detailed information is available or for any other purpose.

USER INPUT - Input total dimensions for each Panel Type within zone

Panel Type	T11	T21	T22	See notes below
Average Radiator Height*	mm	mm	mm	
Total Radiator Length	mm	mm	mm	
Emitter Temperature Difference Design	deg.C			

**Estimate based on available options*

Convector radiator panel types are as follows:

T11	*Single panel with 1 set of convector fins*	
T21	*Double panel with 1 set of convector fins*	
T22	*Double panel with 2 sets of convector fins*	

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10. Eco design control class

- **Class I** - On/off Room Thermostat: A room thermostat that controls the on/off operation of a heater. Performance parameters, including switching differential and room temperature control accuracy, are determined by the thermostat's mechanical construction.
- **Class II** - Weather compensator control, for use with modulating heaters: A heater flow temperature control that varies the set point of the flow temperature of water leaving the heater dependent upon prevailing outside temperature and selected weather compensation curve. Control is achieved by modulating the output of the heater.
- **Class III** - Weather compensator control, for use with on/off output heaters: A heater flow temperature control that varies the set point of the flow temperature of water leaving the heater dependent upon prevailing outside temperature and selected weather compensation curve. Heater flow temperature is varied by controlling the on/off operation of the heater.
- **Class IV** - TPI10 room thermostat, for use with on/off output heaters: An electronic room thermostat that controls both thermostat cycle rate and in-cycle on/off ratio of the heater proportional to room temperature. TPI control strategy reduces mean water temperature, improves room temperature control accuracy and enhances system efficiency.
- **Class V** - Modulating room thermostat, for use with modulating heaters: An electronic room thermostat that varies the flow temperature of the water leaving the heater dependent upon measured room temperature deviation from room thermostat set point. Control is achieved by modulating the output of the heater.
- **Class VI** - Weather compensator and room sensor, for use with modulating heaters: A heater flow temperature control that varies the flow temperature of water leaving the heater dependent upon prevailing outside temperature and selected weather compensation curve. A room temperature sensor monitors room temperature and adjusts the compensation curve parallel displacement to improve room comfort. Control is achieved by modulating the output of the heater.
- **Class VII** - Weather compensator and room sensor, for use with on/off output heaters: A heater flow temperature control that varies the flow temperature of water leaving the heater dependent upon prevailing outside temperature and selected weather compensation curve. A room temperature sensor monitors room temperature and adjusts the compensation curve parallel displacement to improve room comfort. Heater flow temperature is varied by controlling the on/off operation of the heater.
- **Class VIII** – Multi-sensor room temperature control, for use with modulating heaters: An electronic control, equipped with 3 or more room sensors that varies the flow temperature of the water leaving the heater dependent upon the aggregated measured room temperature deviation from room sensor set points. Control is achieved by modulating the output of the heater.

4. Inputs and Outputs Dictionary

Please navigate to the Inputs and outputs guides on the Documentation page.

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