# Tips for running the plugin

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SBED
Sustainable Building Envelope Demonstration

# Building the model

Here is some tips for using the tool to doing simulation,

- Keep the building simple not complex as far as possible, better without curves;
- Delete the layout if It has no influence to the buildings. Make sure there are no line connections between buildings;
- Building should be modelled from X-Y plane;
- Topography imported to take into account its shading influence on the buildings ( all buildings should sit on the topography, with the bottoms not higher than the topography), the topography should not be exploded;

# Building the model

Continued,

- Delete all unnecessary lines, faces and boxes;
- Make sure all spaces are closed (no face is missing);
- The plugin doesn't understand Chinese characters in the file or folder names (sorry);
- Look at the layers window, check if you have hidden layers;
- Don't use the sky view rays in the final model;

# Detailed models (surfaces, etc) can be slow

It is important to focus on the outcome of the simulation. A very detailed model will create a large number of simulation files, slowing the process and increasing the potential for confusion.

Simple mass buildings are best for modelling at a larger urban scale.

Once the overall results are known a more detailed model of a single building should be created to check the fine details of a design.

# Components and groups are ignored as a mass but not for shading (even if hidden)

Buildings or faces in components and groups format won't be output to HTB2 as spaces or masses during the conversion.

However, their shading impact to the surrounding buildings (which are exploded) will be considered through the shading masks generation for the related building.

# Energy modelling- 5 hours for a whole city.

The modelling of a building can take a few minutes in a dynamic simulation model such as HTB2 or EnergyPlus.

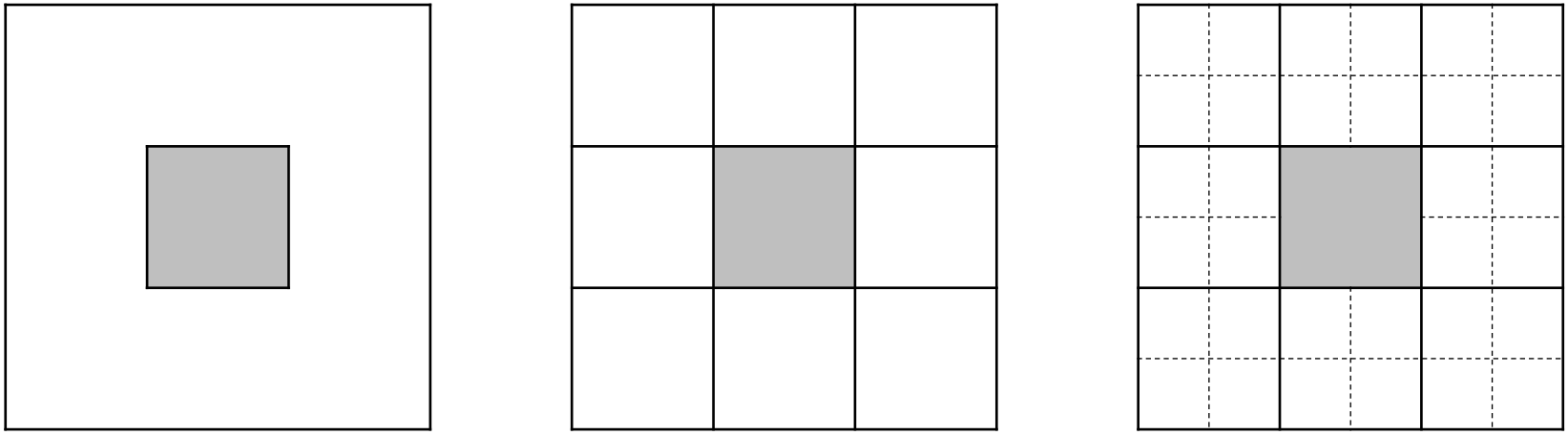
If modelling a large number of buildings, it is likely that it will take a long time to complete.

Try to model only what is really required. If considering the shading impact of surrounding buildings, created the surrounding buildings as a component, these will be ignored in the thermal simulation.

# Simple internal model

The plugin creates a thermal mass for you as an internal wall and internal floor

Modelling one floor of a tower building with a core with a representative internal mass, increasing the detail the results show



Less than 1% difference in annual energy demand

# Simple internal wall

The plugin creates a thermal mass for you as an internal wall based on the following equation:

Internal wall area = footprint area * internal wall ratio * building height

e.g.

A building

50$m^2$ footprint

6m height

internal wall ratio of 0.1

Internal wall area = 50 * .1 * 6

Internal wall area = 30$m^2$

# Simple internal floor

The plugin creates a thermal mass for you as an internal floor based on the following equation:

Internal wall area = ((building height / floor height) – 1) * footprint

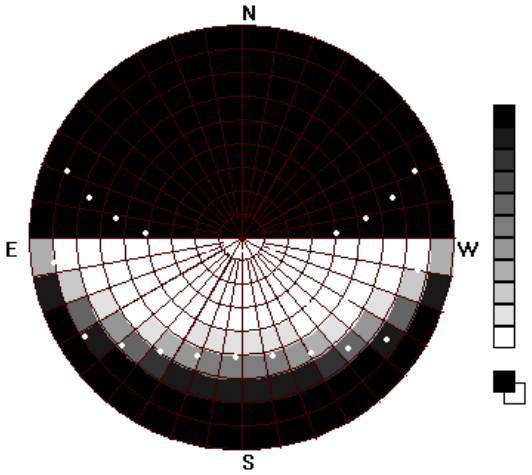
e.g.

For a 50m$^2$ building with 3m floor height and height of 9m

Internal floor area = (9 / 3) – 1) * 50

Internal floor area = 100m$^2$

# COMPARISON – Shading masks (5m high obstruction) generated from different resources



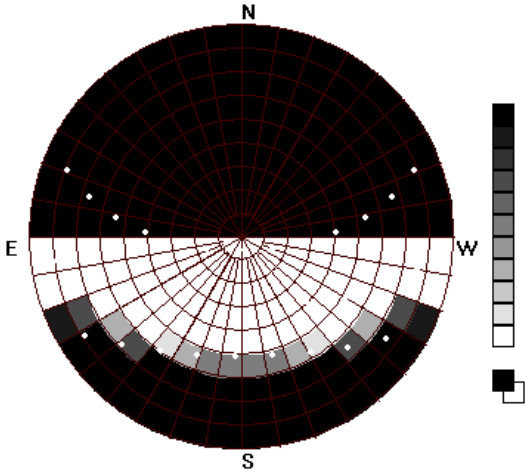

5m high obstruction generated by HTB2

Note:

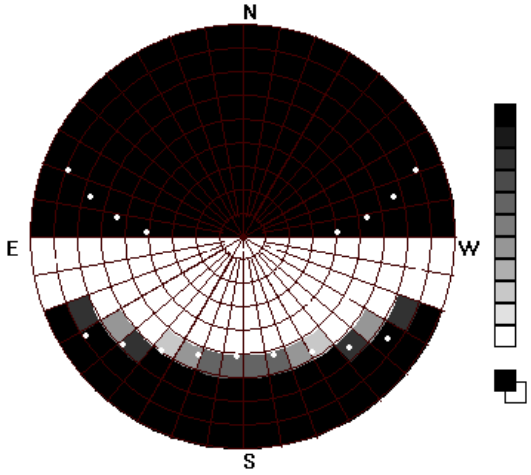
1. The sun path is set in Chongqing.

2. For shading masks stated in the following sheets, the new sketchup masks are generated directly from Mahmoud's new plugin, while the old ones come from excel calculation of data generated by old plugins.

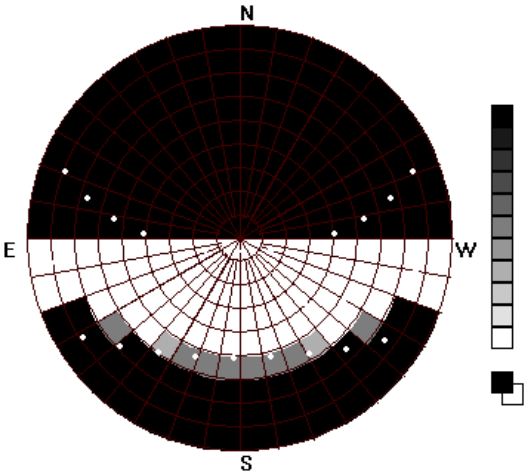
# COMPARISON – Shading masks (5m high obstruction) generated from different resources



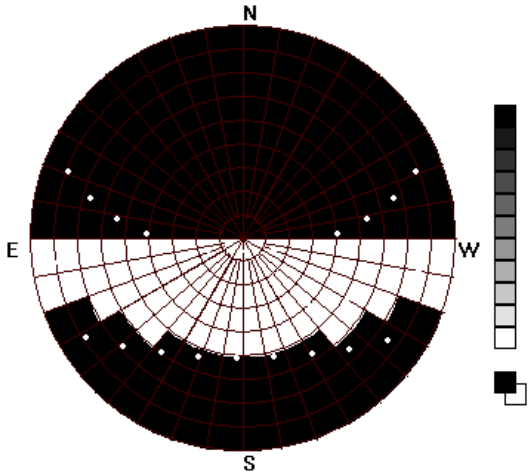

5m 1.0 degree sketchup




5m 2.0 degree sketchup



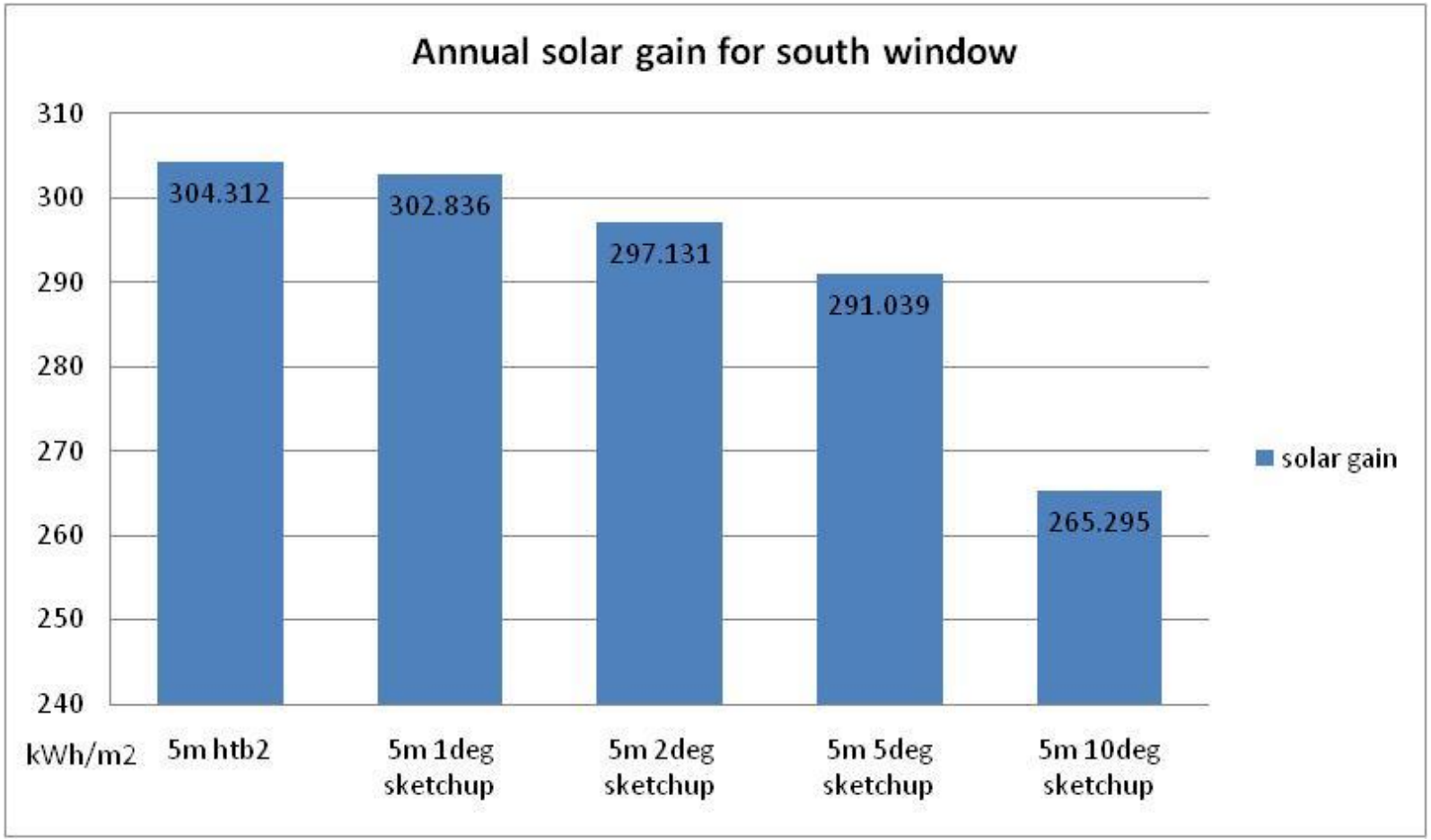

5m 5.0 degree sketchup




5m 10.0 degree sketchup

Note: the sun path is set in Chongqing

# Annual solar gain for a south window in Chongqing– Shading masks (5m high obstruction) generated from different resources



# Excel results spreadsheet

When getting the results, wait until “Got the results” appears in the Ruby console.

Seven sheets are contained in the results file:

1. Building summary
2. Face summary
3. Embodied energy
4. Embodied energy graph
5. Monthly data
6. Type summary
7. Calculation for carbon emission

# Building summary

For each building the data:

1. bld_id – SketchUp building Identifier
2. file_id - file Identifier
3. htb2_bld_id - HTB2 building Identifier
4. Volume (m3)
5. height (m)
6. Building type - Name of the SketchUp building type
7. Internal Floor to wall ratio
8. floor height (m)
9. building floor area (m2)
10. heating demand (kWh/year) – total for the building
11. cooling demand (kWh/year) – total for the building
12. embodied energy (kWh) – total for the building
13. embodied carbon (kgC) – total for the building

# Face summary

For each face the data is:

1. face_id - SketchUp face Identifier
2. bld_id – SketchUp building Identifier
3. file_id – htb2 file number
4. htb2_bld_id –htb2 building identifier
5. Zone – this is not yet working
6. build_type – Name of the SketchUp building type
7. Element - htb2 element identifier
8. face type
9. Construction – SketchUp code for the constrctuion
10. area (m2)
11. orientation (deg) – 0 is south, 180 is north
12. tilt (deg) – 0 deg is vertical, 90 deg is horizontal

# Face summary

Continued;

13. glazing ratio
14. wall area (m2)
15. window area (m2)
16. window construction
17. solar incident (kWh/m2/year) – solar radiation falling on the face
18. embodied energy code – Spreadsheet code for calculation
19. embodied energy code window – Spreadsheet code for calculation
20. embodied energy (kWh) – for the face including windows
21. embodied carbon (kgC)

# Monthly data

For each monthly data the is:

1. Heating demand for each building
2. Cooling demand for each building
3. Solar falling on each face

# Type summary

For each building type the data is:

1. Building type – the name of the SketchUp building type
2. Count – the number of each type of building
3. Volume ($m^3$) – all building of this type
4. Building floor area ($m^2$) – all building of this type
5. heating demand (kWh/year) – all building of this type
6. cooling demand (kWh/year) – all building of this type
7. Embodied energy (kwh ) – all building of this type
8. Embodied carbon (t) – all building of this type

# VIRVIL HTB2 file format

A .htb2 building type file has been created to allow the user to define building types, This file format has the basic information to a define a building in terms of

- Construction
- Materials
- Glazing type
- Heating and cooling
- Ventilation
- Internal gains
- Diary files

To add new files, use the menu item “Tools->Add HTB2 files to plugin”

# VIRVIL HTB2 file format

A typical section

## Materials

<VIRVIL_USER_MATERIALS></VIRVIL_USER_MATERIALS>

The plugin requirements for this section;

- Each user material is made of two lines of code, the first is the material number and the name, which follows a "*".
- The second line is the conductivity (W/m/°C), density (Kg/m3) and specific heat capacity (J/Kg/°C).
- The second line data should be separated by spaces not "tabs".
- The user must ensure that the material number used in this file matches the number used in the construction section (see above) and that the materials have all the required data.

For example

```
<VIRVIL_USER_MATERIALS>
1               * Standard sintering shale hollow brick
0.540     800.0     1050.0
2               * Cement mortar
0.930     1800.0     1050.0
</VIRVIL_USER_MATERIALS>
```

The plugin will merge the material files from all the building types in the sketchup model to form a new list which may have new material numbers. If two materials are exactly the same, with the same parameters and name, they will be treated as one reducing the size of the final material file.