quickSAP
Home Energy Modelling

SKETCHUP EXTENSION TOOL FOR INDICATIVE ENERGY USE CALCULATIONS, SAP RATINGS AND EPC BANDING AT THE OUTLINE DESIGN STAGE AND PLANNING STAGE

quickSAP has been created to allow simple block models to be interpreted for energy efficiency at an early project stage and to look at different options for insulation, glazing, heating systems and PV generation assessing how they will impact on CO_2 emissions and provide detailed calculations of:

- heat losses through the fabric, thermal-bridging and ventilation;
- heat gains through solar gains, internal gains and heating / water gains;
- energy requirements for heating, hot water, cooling, lighting, auxiliary electricity;
- assess the impact of PV, battery storage and air-tightness;
- differing fuel types, heating and ventilation systems;
- approximate SAP Ratings and EPC Bands.

quickSAP is designed primarily for UK single new build dwellings but can be used on existing dwellings as well (a version for RdSAP for existing dwellings will be available early 2026).

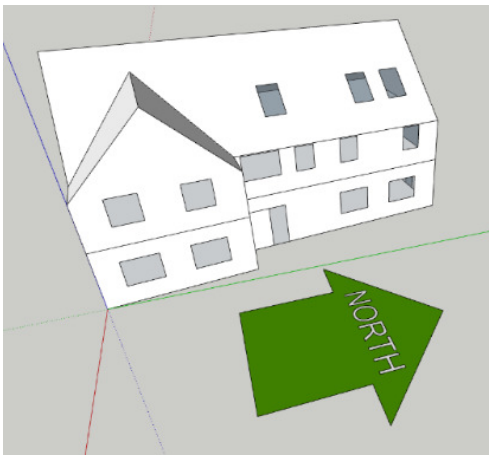
While providing clear breakdowns of the detailed calculations in easy to follow tabulated and graphical format, **quickSAP** is not intended to replace a formal SAP Assessment by a qualified assessor for Building Regulations purposes.

The suite of tools within **quickSAP** are design to follow of a set of clear steps:

1. Build a simple outline model of the dwelling **insulation envelope** (i.e. for pitched roofs over cold loft spaces where the insulation line is the ceiling below the model should stop at the ceiling). Finished ground floor to be set at model ground level.

   North for the purposes of solar gains for the windows is along the green axis!

Remember to use the internal face of external walls and roofs not the external face, otherwise your floor areas and volumes will be too large!



Build the model entirely on the "untagged" layer and use simple rectangles or polygons to show window and rooflight sizes and positions. Likewise external doors. Use any generic transparent material to colour the windows and rooflights.

If you want to add (single face thickness) for internal walls and manually tag them to **epc-int-walls** you can do but it's not necessary – you could just enter the approximate length of the internal walls; the Tool will then use that information together with the default Heat Capacity settings. If you don't want to bother with that, the tool will assume that that the internal walls have an area of 2.5 x the external walls (it counts both sides!).

2. With the model geometry complete, select the **Tag Faces** tool. This will automatically create a series of Sketchup tags and apply them to each face (epc-walls-1, epc-windows-1, epc-pitched-roof-1, epc-ground-floor etc.) based on the geometry of the model and the orientation / transparency of the faces.

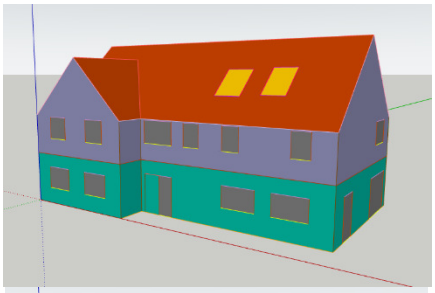
   All faces +/- 30 deg of vertical will initially be sets as "walls" and +/- 10deg of horizontal will initially be set as "floors" or "flat roofs" depending on adjacent geometry.

   Note: quickSAP will see solid, vertical faces as "epc-walls-1" so for your external doors, select the face and manually change it to "epc-doors"!

   If you have more than one wall construction type or glazing type, simply select the faces you wish to change and use the Sketchup tag menu to swap to the relevant tag, e.g. epc-walls-2 or epc-windows-2 etc. Remember to check the Model Data tab below for the different values.

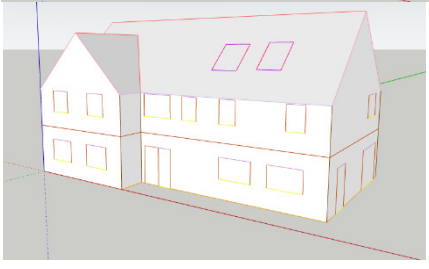
3. After tagging the faces, select the **Tag Edges** tool. Based on the adjacent faces and the orientation / position of the edges this will automatically tag each edge according to the relevant thermal bridge value (tb-E3-sill, tb-E16-external-corner, tb-E5-ground-floor etc.).

   Note: Due to the vagries of how Sketchup handles adjacent faces, internal corners and roof valleys (inverted ridges) will automatically be assigned to external corners and ridges and will need to be manually corrected. If you have "odd" shaped windows you might also want to double check the heads, jambs and sills are correctly identified too!

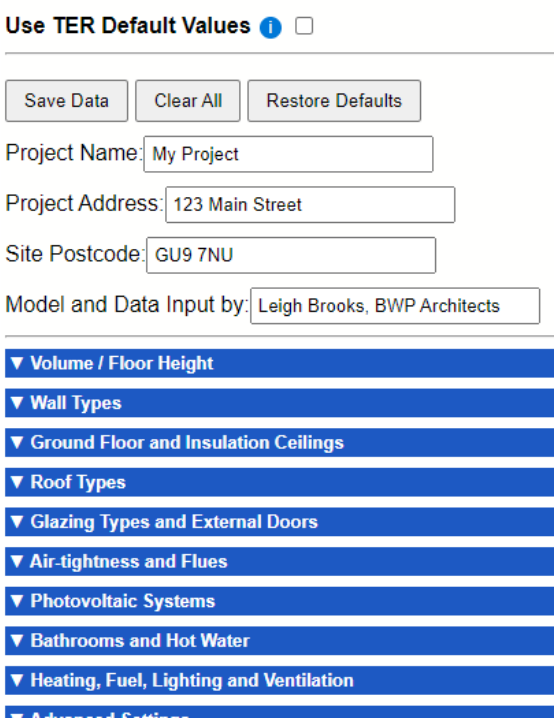


4. Select the **Colour by Tag** Tool for a quick visual check that faces are as expected. This toggles 'on' and 'off' with repeated clicks.

   Switching Sketchup to "Display Shaded by all the same" from the Sketchup toolbars makes the Thermal Bridge colouring a little easier to see if you wish.



5. Select the **Model Data** tool and start to populate some key information regarding the project. Don't forget the postcode! Without it, the calculations will default to SAP Region 0, average values.



a. Open up the Volume and Floor Height tab and add the volume, if you know it, or the average floor to ceiling height if you don't.

b. Expand the tabs for wall types, ground floors, ceilings and glazing types.

c. Wall types: Four options for different wall type U-values to allow for different wall constructions within the same model. Just ignore the types you don't need and use wall type 1 only if you only have one type.

d. Ground floor and insulated ceilings: Complete your U-value or use the defaults.

e. Roof types: Three pitched roof and two flat roof U-value options to fill in to allow for up to five different roof construction U-values within the same model. Ignore the ones you don't need.

f. Glazing types and eternal doors: Let's you input U-values and g-values for up to three different types of window, two pitched rooflights options and a flat roof light option. Again, just ignore the ones you don't need.

g. Air-tightness and flues and PV generation: Complete the design air-permeability value and add in any flues, stoves etc if necessary.

h. PV Generation: Add in any details for PV panel arrays and a battery, if included.

i. Bathrooms and hot water: Complete the number of bathrooms, baths and showers. Add in the hot water system and the cylinder size.

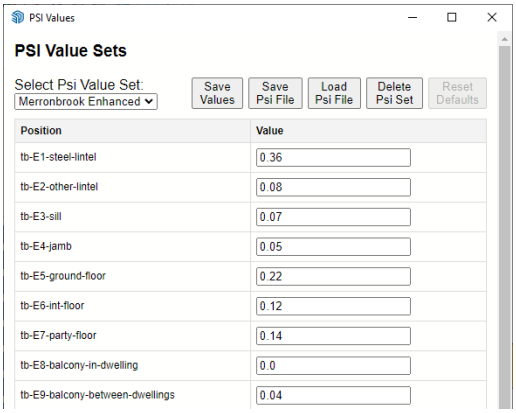
j. Heating, fuel, low-energy lighting and ventilation: Use the defaults or select the appropriate system from the pull-down choices.

k. The Advanced Settings options gives you a bit more control over some of the minutia if you wish, such as overall site shading, window frame factors, heating controls, pipework insulation, heat capacity of internal walls etc. but you can just use the defaults of course but the more information you add the closer the result will be to the final SAP!

Select "Save Data" to ensure that all your changes are saved!

You can always go back and edit and adjust these – in fact, that's the whole point; you can make quick design and value changes and get instant comparative results!

6. Finally, select the Thermal Bridge **Psi Values** tool and choose a set of default Psi values, load a previously saved set that have been made or create a new set from manufacturer's data (and save them to an external file for use in the future for different projects if you wish).



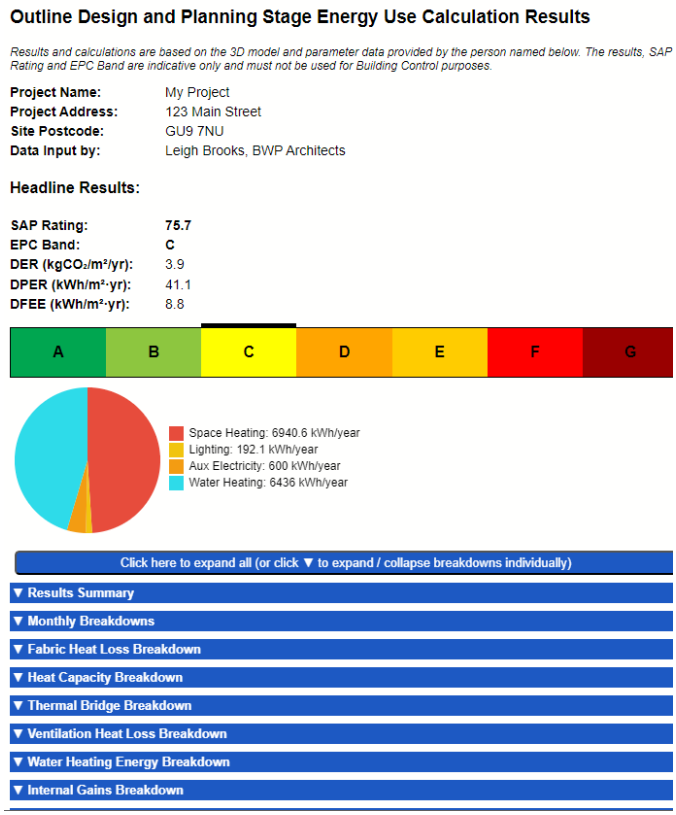
7. Happy with the values, geometry and assigned tags? Click the **QUICKSAP Sketchup Tool** to run the calculations within Sketchup and instantly see how the U-values, heating systems, PV generation, air-permeability etc. comparatively impact on the approximate SAP / EPC Rating and the CO^2 emissions.

   Make any changes to the model needed or improve / adjust any of the values using:

   the EPC Model Data tab, and / or,

   select a different set of Psi values, then

   Hit the QUICKSAP Sketchup Tool again to rerun the calculations instantly with the new data and see instantly what difference your changes have made.



As well as the EPC and SAP Rating the report gives the DER, DPER and DFEE results and includes lots of additional data and calculation results such as Fabric Heat Loss, Thermal Bridge Heat Loss, Ventilation Heat Loss, Solar Gains, Primary Energy etc.

Detailed breakdowns are also available at the bottom of the report to provide all the backup information and values.

Use the "**Print PDF**" button at the top of the page to export the full results as a PDF report including, if you wish, the backup detailed breakdowns.

8. Export key data to a CSV file if required. This can be sent to your SAP Assessor for instance.

9. Check how long is left on your licence.

TARGET EMISSION RATES:

We see a number of local Planning Authorities asking for CO_2 Emissions data at the planning stage, often way before it would be appropriate to have full SAP Calculations carried out. We have used the detailed calculations produced by this tool to demonstrate how the design CO_2 emissions compare to the Target Emission Rates (TER, TPER and TFEE). To do this is simply a matter of selecting the "**Use TER Default Value**" checkbox at the top of the **Model Data** tab:

On the Model Data Tab click the "Use TER Default Values" check box at the top of the form and this will automatically adjust the necessary settings (unchecking it will restore your previous saved values).

quickSAP will automatically default to the SAP Table K1 values for the Notional Dwelling TER.

Planning Stage EPC / SAP Results

Project Name	My Project
Project Address	123 Main Street

Headline Results

TER ($kgCO_2/m^2/yr$)	10.4
TPER (kWh/m^2yr)	58.1
TFEE (kWh/m^2yr)	39.3

Run the **quickSAP Sketchup** calculations again to see the TER / TPER Results (please note that no EPC band will be shown).

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WHAT CALCULATIONS AND DATA ARE CONSIDERED IN quickSAP?

The calculations are not intended as replacement for fully detailed SAP calculations by a qualified SAP assessor. As with most things, the accuracy of the output is reliant on the accuracy of the input but at least you'll know that the assessment is based on the right floor area and window sizes!

The detailed calculations with the coding take into account, amongst other things, the following:

- Area and U-value of external faces for fabric heat losses including monthly temperature weighting;
- Lengths and Psi values for thermal bridge heat losses including monthly temperature weighting;
- Ventilation heat losses based on volume, flues, mechanical ventilation system type including default efficiencies, average UK monthly wind speeds;
- Solar gains based on glazing areas, orientation, frame factors and g-values, overall window shading factor and monthly irradiance factors;
- Internal gains based on default W/m^2 value, and monthly day / night occupancy factors;
- Heating demand based on losses and gains including seasonal factors;
- Space cooling demand for June, July, August;
- Hot water demand based on default values per bathroom, bath and shower; the hot water system type, and standing heat losses based on hot water cylinder size and default "warm plant room" location;
- Auxiliary electrical demand based on number of fans (based on ventilation system type) and pumps with default power requirements, usage and efficiencies;
- Fuel type efficiencies based on default efficiencies for different types;
- Lighting load based on percentage of low energy lighting;
- Offsets of delivered electricity for PV generation;
- CO2 emissions based on delivered energy and fuel types with default primary energy factors;
- Annual fuel costs based on default SAP10.2 tariffs, SAP 10.2 cost deflators and factors

INSTALLATION AND LOGIN

Ideally the extension should be purchased, downloaded and installed from the Sketchup Extension Warehouse!

If you have purchased the extension from a reseller or direct from BWP Architects:

1. Expand the **quicksap□zip** file and save the **quicksap□rbz** file in your Downloads, Desktop or other suitable location
2. Open Sketchup (2020 onwards currently supported)
3. Open the **Extension Manager** from the pull-down menus (it will be under the Window or Extensions tab depending on your Sketchup version)
4. Click **Install Extension** and navigate to the **quicksap□rbz** file and select it
5. Enter your licence log-in details the first time of using
6. **RESTART** Sketchup to complete the installation and remember to show the **quickSAP** toolbar from either the View / Toolbars pulldown menu or right-click on a blank toolbar area to call up the list of toolbars (checked are already showing).

ADDITIONAL DEFAULT VALUES USED IN quickSAP CALCULATIONS

(not including SAP 10.2 standard default values also incorporated)

Monthly Internal Gains:

Water heating gains:	0.45W / sqm
Lighting gains:	0.7W / sqm
Appliance gains:	1.2W / sqm
Pump gains:	7W
Metabolic gains:	60W / occupant

Ventilation defaults:

open_flues:	20 m^3 / hour
intermittent fans:	10 m^3 / hour
boiler flues:	35 m^3 / hour

Auxiliary Electricity:

Fan power:	30 *(based on SAP 10.2 continuous operation)*
Fan hours per year:	365 * 2 *(based on two hours a day for each intermittent fan)*
MHVR / WHMV:	360 *(typical MV fan annual electricity)*
ASHP:	250 *(typical ASHP annual electricity)*
GSHP:	550 *(typical GSHP annual electricity)*

Lighting:

Base lighting: 66.9 lumens / watt *(as SAP 10.2 Table L1 for LED lighting)*

Hot Water System Efficiencies:

Hot water controls assumed to include 3hrs winter and summer (h value)

Distribution losses assumed same for combi / instant water heaters as others

Instant:	0.95
Direct:	0.90
Indirect:	0.85

Water Heating:

Cold water temperature assumes from incoming mains and not header tank

Bathrooms:	600
Baths:	500
Showers Flow Rate:	8 l/m
Shower duration:	6 min
Electric shower:	9.3kW *(as SAP 10.2 Table J4)*

Cooling System Efficiency:

SEER: 6.10 *(typical air-conditioning / ASHP cooling COP)*

Future versions of quickSAP may include advanced options to adjust these defaults as well to fine tune the results even further.