*energy*designtools

User Guide Energy Design Tools SAP 2005 Calculator v3.1 The Energy Design Tools SAP Calculator is a web-based tool used for calculating SAP energy assessments for new build dwellings.

Main Menu

Edit/view projects

The Edit/View projects" screen is the default screen that you are taken to on accessing the SAP calculator. This screen lists all of your projects, by default ordered by ascending date (although you can switch to alphabetical by clicking the "project name" heading). There is a key at the top, which explains the attributes for each of the projects: country, whether the dwelling contains an individual or a community heating scheme, and whether the dwelling is "as designed" or "as constructed". For each project there is an "Actions" dropdown which allows you to manipulate the project. Select the chosen action and click the "Go" button corresponding to the project to activate it.

Edit/view project

Clicking this option takes you into the project screen, and allows you to edit the information and generate reports.

Edit initial details

This screen allows you to change the details of your project that were specified when you created it. This includes editing the project name (although you will not be able to change it to a name that already exists), address, built form, detachment, country, and whether the project is "as designed" or "as constructed". Click the "submit" button at the bottom of the screen when you are happy with the new information (or just close the window if you change your mind).

Save project as

This function allows you to duplicate this project under a different name and address. You will not be able to enter a project name that already exists. Click the "submit" button to create the new project. Clicking "close window" will refresh the project list, including the newly created project.

Archive project

This function allows you to archive an old project so that it will not appear in your current list, the aim being that searching for projects will be easier and much faster to achieve. To action this, just click "archive project", and then confirm that you wish the archive to occur. You can retrieve archived projects at any point by clicking the checkbox "Display archived data" at the top of the Edit/view projects screen.

Delete project

Use this function to remove any project from your list permanently. On clicking you will be asked to confirm that you want to delete the project. Click "OK" to proceed, "cancel" to cancel. If you click OK the project list will automatically refresh, removing the project.

Lock project

Use this function to protect your project from accidental deletion or editing. When you lock a project you will only be able the view the information and generate reports.

Unlock project

This function will only be available once a project has been locked. Use it to unlock a project. The project will subsequently be editable and deletable.

Groups

(feature available with multi-user license only)

This feature allows you to share your projects with other users of the calculator. You can either create a new group or accept an invitation from a group owner who has invited you.

Accessing group member's projects

To access group member's projects, click on the name of the group member whose projects you wish to view. The page will expand to accommodate a list of the projects. From here you can either edit the project by clicking on the "edit" link, or save it into your own list of projects by selecting the "save as" link. Remember that if you click the "edit" button, any changes you make to the calculation will be reflected in the user's project.

Add a new project

This page allows you to create a new project in the SAP calculator. To create a new project, enter a name, address, built form and detachment, select the location and (England and Wales/Northern Ireland only) specify whether the dwelling is "as designed" or "as constructed". Click the "submit" button at the bottom of the page to create the project. If there are problems with any of the fields an alert box will explain what information is invalid or missing. On successful submission, the calculator will automatically transfer you to the main calculation page. The created project will immediately appear in your project list in the Edit/View projects tab.

Create as package (Dwellings for Scotland only)

This page allows you to create a project according to a Scottish "fuel package", which populates the information for heating systems, u values etc according to the primary fuel selected (see Scottish building regulations for further details), the result being that the DER will be the same as the TER. To use this function, assign a name and address to the project, select the built form and detachment, and choose the primary fuel. You also need to enter the dimensions of the designed dwelling, including, floor area, dwelling volume, storeys, exposed floor area, exposed wall area, exposed roof area and living room area. Once these have been completed, click the "submit" button to create the project. The calculator will fill in all of the specifics as determined by the Scottish building regulations. You will automatically be taken to the "Results and Lodgement" page where you can view and print out the summary reports. If you choose, you can also go into the project and amend the data in this way. This project will appear immediately in your "Edit/view projects" list.

Calculation

The main calculation page opens when you create a new project or choose to edit or view a project. The top of the page gives details of the current project: name, country, as designed / as constructed, individual or community heating, and creation date. The tabs separate the data input into the different components of the dwelling.

Dwelling details

The information in here is used to complete the Energy Performance Certificates. After entering the information, click the submit button at the bottom to save the details.

Client

Enter the name of the client you are producing the calcualtion on behalf of

Address

Enter the address of the dwelling. If you are transferring from Architectural-EPC this will be automatically completed.

Year completed

Enter the year of completion here

Built form and detachment

These are selected as specified when creating the project; however this section allows you to amend the selection.

Terrain type

Select the most appropriate selection from the list. This information is also used when calculating the energy generated from micro wind turbines

Dwelling faces

Select the orientation of the dwelling

Overshading

Select the most suitable overshading factor (select average/ unknown if you are not sure)

Fixed air conditioning

Check if applicable

Heated conservatory

Check if applicable

Smoke control area

Check if applicable, this will produce a warning if an unsuitable primary or secondary fuel is used.

Heating, water & ventilation

This section allows you to enter the information for space heating, water heating and ventilation systems. There are 4 tabs, each of which must be completed:

- Space heating
- Water heating
- Pumps and Fans
- Ventilation

Space heating

This section allows you to specify the primary heating system, fuel and controls and, if applicable, the secondary heating system, fuel and controls.

Primary heating system

There are 3 sources of information for obtaining the information for the primary heating system. In order of preference, these are:

- The SEDBUK Boiler Database
- · Manufacturer's information from a datasheet
- SAP Table 4

The SEDBUK Boiler Database contains the most up to date source of information for boilers and, where applicable, the water

systems they supply the heat to. Information about pumps and fans may also be specified if using the database. The database is split into 4 types of boiler:

- Gas, LPG and Oil
- Solid Fuel
- Cooker
- Cogen

Select the appropriate link on the left hand side of the page to open a page containing all of the relevant boilers in the database. The Gas, LPG and Oil boiler list contains a search facility to search for boilers according to main type, fuel etc, but the others do not provide this functionality as the database is not big enough to need this function. Select the boiler by clicking on the link or radio button, and choose the control system in the same way. Until you have selected both a system and controls you will not be able to submit.

Alternatively, you can choose to select a boiler from SAP table 4. To do this, click on the link "Select from SAP tables" in the space heating tab. If you select this option you will have the option of overriding the default efficiency with manufacturer's data. If you are specifying a community scheme, you can also use this screen to specify the efficiencies and the fraction of heat provided by two boilers if required.

After selecting a boiler, the page will close and the space heating screen will refresh to display the selected options. A drop down list will also be presented with the options for primary heating fuel.

To select a different boiler, simply go through the above process again and your current selection will be removed (remember, you will have to reselect your primary fuel as well).

Secondary heating system

The secondary heating can be selected in exactly the same way; however, only secondary systems from the SAP table 4 can be specified (although you can override these with manufacturer's data). After selecting your system, choose the secondary heating fuel from the drop down box.

To remove the secondary heating system, click the "delete secondary heating system" link.

Community heating schemes

If you are specifying a community scheme, then you will be prompted to select the distribution loss factors for the scheme.

If you have specified a community scheme with CHP, the screen will ask you to enter the fraction of heat provided by CHP, the fuel used for CHP, plus the heat and electrical efficiency.

If you have specified a community scheme with geothermal or waste heat, the fraction of heat provided from these sources needs to be entered.

Load compensation / delayed start room thermostat

If applicable, options to select load compensation or a delayed start room thermostat will appear. Check these if they are applicable.

Heat emitters

Where applicable, you will be asked to specify the emitter used in the dwelling. Select from radiators or underfloor heating.

Range cookers

If a range cooker is selected, the case loss and full output power need to be entered into the calculation.

Once you are happy with the data entered, click the "submit" button to save your information and progress to the water heating stage.

Water heating

This section allows you to specify the source of the water heating for the dwelling. You must complete each of the boxes available. Depending upon previous options, new information may be required or may not be applicable so it is important to enter this information in order. When you have entered the details, click the "submit" button to save. If there is any missing information, the system will prompt you to complete this before you can save.

Domestic Hot Water (DHW) only community scheme

If the water heating is supplied by a DHW-only community scheme, check this box. You will then be asked to select the type of DHW-only community heating scheme: boilers, CHP or community heat pump, and the fuel used. For boilers and heat pumps you will also be required to enter the efficiency, and for CHP the overall efficiency and heat to power ratio. Finally, select the distribution losses for this system.

If there is a cylinder in the dwelling, then enter these details into the relevant fields, including cylinder volume, insulation type and thickness / manufacturer's declared loss factor. Alternatively, leave the "Is there a cylinder in the dwelling" checkbox unchecked, and the calculator will assume a 110 litre cylinder with 50mm factory insulation (as per the SAP specification).

Method of water heating

The method of water heating can be specified from this drop down box. To specify the primary heating system as the source of hot water, select "Main system" from the drop down box. If the main system is a community scheme then you will be asked whether there is a cylinder in the dwelling or whether to assume 110I (as for the DHW-only community scheme). If you have an individually heated dwelling, then all of the options for type of water heating are available to you.

Other options that are available include:

• Instantaneous (gas or electric). On selection the "type of water storage box" will immediately switch to "no water storage".

• Immersion (select the electricity tariff and dual or single immersion)

- · Back boiler
- Circulator
- Range cooker boiler
- Solid fuel boiler

Select fuel

In some water heating options, different fuels are available. If this is the case, this drop down list will become enabled and you can select the fuel from those available in the drop down box.

Type of water storage

Select the type of water storage from this list. In many cases, for example instantaneous systems, this will default to "no water

storage" automatically. When selecting combi boilers from the boiler database, the information specified in the database will automatically be selected.

If any option other than "no water storage" is selected, then the following fields will become available:

Volume:

Enter the volume of the cylinder in litres (if selecting a combi from the database this will automatically be completed)

Known manufacturer's loss factor/manufacturers' loss factor

If known, check the box and enter the loss factor.

Unknown manufacturers' loss factor and cylinder insulation

If the details of the loss factor are unknown, leave this box unchecked. Select the type of insulation from the drop down list, and enter the thickness of insulation (in mm) in the relevant box.

Water heating separately timed (only applicable for some systems)

Check this box if there is a separate timer for the hot water

Boiler interlock (only applicable for some systems)

Select yes or no from the drop down menu if there is boiler interlock

Thermal store or CPSU stored in airing cupboard / Cylinder inside the dwelling

Select yes or no depending upon your arrangement

Select primary circuit losses

The options in this box will depend upon previous selections (cylinder, thermal store or instantaneous combi boiler). Select the appropriate configuration from the list.

Cylinderstat

This will only appear if an electric immersion is specified (as the primary circuit losses cover this otherwise). Select yes or no from the drop down box.

Winter operating temperature

This will only appear if a CPSU is specified as the main heating system and the main heating system is used for the hot water. Enter the winter operating temperature in this box.

Pumps and Fans

On submission of the water heating section, the calculator will move onto the "Pumps and Fans" section. If you have selected a boiler from the SEDBUK boiler database, the number of central heating pumps and number of fan-assisted flues will already be entered for you.

Number of central heating pumps

Enter the number in the box. Enter 0 if not applicable

Are the pumps inside the dwelling

Select if the pumps are inside the dwelling (information used for calculating internal gains)

Number of boilers with fan-assisted flue

If the boiler has a fan assisted flue, enter the number here (enter 0 if not applicable)

Number of warm air heating fans

Enter the number here (enter 0 if not applicable)

Click the "submit" button at the bottom of the screen to save the information and proceed to the Ventilation section.

Ventilation

On submission of the pumps and fans section, the calculator will move onto the ventilation section. Once you have completed all of the details, click the "submit" button to proceed to the windows section. If information is missing or invalid, an alert box will explain where the problems are.

Chimneys/Open flues/Fans and vents/Flueless gas fires

Enter the number of each in the applicable box.

Pressure test

For new build SAP assessments, a pressure test must either be entered or assumed.

1. If assuming this value

Click the radio button that says "Yes (assume)". For England and wales this will assume a value of 15. For Scotland it will assume a value of 10 if you have accredited thermal bridging details, 15 if you do not.

2. Enter design/tested value

Click the radio button "(yes)", and enter the value in the box to the right of this. You will also be asked to state whether this is "As tested" or "As designed" by selecting the correct radio button.

Sheltered sides

Enter the number of sheltered sides in the box

Ventilation type

Use the drop down to select the type of ventilation in the dwelling:

- Natural ventilation with intermittent extract fans
- Natural ventilation with passive stack ventilators
- Positive input ventilation (from loft)
- Positive input ventilation (from outside)
- Mechanical extract ventilation centralised *
- Mechanical extract ventilation decentralised *
- Balanced mechanical ventilation (no heat recovery) *
- Balanced mechanical ventilation with heat recovery *

For those not marked with an *, no further information is needed, click the "submit" button to proceed to the windows section.

Those marked with a * require further information about the ventilation system. There are 3 sources of information for this:

- Data sheet
- Default values (from the SAP specification)

• Ventilation database (similar to the Boiler Database, updated with accurate values of the systems on a monthly basis – this is the preferred option)

Data sheet

Enter the information from the datasheet into the boxes that become available when you select the type of system.

Default values

These will automatically populate with the values from the sap specification.

Ventilation Database (when selecting Centralised MEV, Balanced Mech Vent w/ Heat Recovery and Balanced Mech Vent w/out Heat Recovery)

Click the link to open up the database in a new window. Select the type of ventilation system and enter a keyword if known. The search pane shows the information from the database for each of the systems. Check the radio button to the left of these systems to select it, and click "select system", to close the window and save the details.

Ventilation Database (when selecting decentralised MEV)

Decentralised MEV requires detailed information about the number of fans in each configuration. Open the database in the same way and select the ventilation system by clicking the radio button to the left of the name. You also need to enter the number of fans in each location. Once you have done this, click "select system" to save the details.

Once you have entered the details, click "Submit" to proceed to the windows section.

Windows

This section allows you to enter the information for the windows and rooflights in the dwelling.

Window information

At the top of the screen there is a row each for Windows (type 1), Windows (type 2, and Rooflights. Using this section you can enter the U value, select the type of frame, and glazing transmittance. If you have information from the BFRC, you can enter the Gwindow value, by selecting the box "BFRC data?", and entering it into the "Gwindow" text box that becomes available.

Towards the bottom of the screen you can assign these windows to the different sides of the dwelling. The areas and overshading factors for the Type 1 windows are entered into the left hand column, those for type 2 windows into the right hand column. Enter the area and overshading for rooflights in the bottom row (labelled rooflights).

When the information has been entered, click "submit" to proceed to the SAP worksheet, or "reset" to return to the original values. If any information is missing or invalid, an alert will inform you of the problem which must be corrected before you are allowed to submit.

SAP/DER/TER worksheet

These pages display the entered information as they would appear in the different worksheets. A small amount of information needs to be entered into the SAP worksheet. The other 2 worksheets are read-only, so you will not be able to edit them (they are for information only). To switch between the views, simply click on the heading and this will toggle the display appropriately.

Overall dwelling dimensions

Enter the area and average height for each storey in the dwelling. This information is used to calculate total floor area and dwelling volume. Click submit to proceed – if any information is missing or invalid an alert box will highlight the problem which must be changed before you can proceed.

Appendix K: Thermal bridging

This section allows you to set the thermal bridging (y value).

If you know the individual bridges in the dwelling, select the box "Are thermal bridging details known". The table at the bottom of the screen will become enabled to allow you to enter the lengths and if applicable override the y value for each of these (although this is optional).

If they are not know, you have three options – select if they do or do not conform with accredited details, or enter a user-defined value.

Click "submit" to save the details.

Ventilation rate

For information only, displays the ventilation calculations as they appear in the SAP worksheet.

Heat Losses and HLP

This section allows you to enter areas and u values of the exposed elements of the dwelling, in order to calculate heat loss. The windows and rooflights sections will already be prepopulated with the information entered into the windows section previously.

Doors

Enter the area and the u value of the doors, if applicable in this section. If not applicable, leave blank.

Ground floor

This will be entered by default as the value entered into the "overall dwelling dimensions" section. If there is more than one type of ground floor, you can enter this information by clicking the link "Show ground floor list". In here you can enter information for the area and u value of the different ground floors in the dwelling. The areas entered here will be subtracted from the originally specified area of the ground floor.

Exposed floors

These are entered by clicking the link "Show exposed floor list", which opens in a smaller popup window. In this window, enter a floor description, area and u value, and click submit to add. You can add, delete or modify these at any time. For information, the total area and area-weighted average u value of all the exposed floors added will display on the main page.

Walls type 1

Enter the largest wall area and u value into this box

Walls type 2

As for exposed floors, you can add as many additional types of wall as you require.

Roof type 1

Enter the largest roof area and u value into this box

Roof type 2

As for exposed floors, you can add as many additional types of roof as you require.

As the data is entered, the HLP is automatically updated. You must click the "submit" button at the bottom of this page to save the information and proceed. If any information is missing or invalid, you will be alerted before you are able to submit.

Appendix H: Solar water heating

This section allows you to specify any solar water heating in the dwelling. If there is no solar water heating, just leave the radio button checked as "No", and click "submit" at the bottom of the screen to proceed.

If there is solar water heating, click "yes". You must then enter the details about the system.

Solar pump is powered by:

Select whether the pump is electrically or solar powered

Aperture area of collector

Enter the area (m²) here

Solar collector type

Select the type of collector from the list. If you wish to enter your own collector efficiency and heat loss coefficienct, select "enter test data (below)" from the drop down list.

Zero loss collector efficiency ($_{0}$)/ Collector heat loss coefficient (a_{1})/ Collector performance ratio ($a_{1}/_{0}$)

These will automatically be populated unless "enter test data" has been selected. In which case, it is up to you to complete these details.

Orientation and Tilt of collector

Select the appropriate values from the drop down lists: the annual solar radiation will automatically be calculated from all of the preceeding information.

Overshading factor

Select the level of overshading from the list. From this and the annual solar radiation figure, the "solar energy available", "solar to load ratio", "utilisation factor", and "collector performance factor" will be calculated.

Dedicated solar storage

Enter the volume of the dedicated solar store (in litres)

Is the cylinder a combi?

Click "yes" if the solar hot water cylinder is part of the main water cylinder, and enter the total volume of the cylinder. If it is a standalone cylinder, click "no".

The "effective solar volume", "volume ratio", "solar storage volume factor", and "solar input" will be calculated from this information as it is entered.

Click "submit" to save this input (if there are any problems with the information you will be alerted before you can submit).

Water heating energy

This is for information purposes only and displays the results of

the water heating section entered earlier, with allowances for the solar input.

Appendix L: Energy for lighting

This page displays the calculation for the savings made from low energy lighting. Enter the ratio (between 0 and 1) of low energy lighting into the box. Click "submit" to save this information.

Internal Gains

For information only, displays the internal gains calculations as they appear in the SAP worksheet.

Solar Gains

For information only, displays the solar calculations as they appear in the SAP worksheet.

Mean Internal Temperature

This page displays the calculation for the mean internal temperature. You need to enter the living area fraction (a value of between 0 and 1) to complete this calculation. Click "submit" to save the information.

Degree Days

For information only, displays the degree days calculations as they appear in the SAP worksheet.

Appendix M: Photovoltaics

This section allows you to specify a photovoltaic system in the dwelling. If the system does not contain a PV system, check "no" and press submit.

If there is a PV system, check "yes", and enter the peak power, and select the orientation, tilt, and overshading factor. The calculator will automatically calculate the energy generated.

Click "submit" to save the information.

Appendix M: Wind turbines

This section allows you to enter wind turbines in a dwelling. If there are no wind turbines, click the "no" radio button and submit to save.

If a turbine is in the dwelling, enter the number, the rotor diameter, terrain type and the hub height. Click "submit" to save the details.

Other energy saving technologies

This section allows you t specify other new technologies that may not be part of the SAP specification. If no technologies exist, click "Next" to skip through the section. To add a new technology, click the link: "Add new technology" in the top right hand corner.

This will open a new window: Give a name to the technology and enter the types of fuel used and saved, and the amount of energy generated and saved. Click "submit" to save the details.

You can enter as many new technologies as required and at any point delete or modify existing technologies.

Appendix P: Summer Overheating (Part a)

This section provides the information for the overheating assessment.

Select the location of the dwelling:

Select the location from the drop down list. This is used to determine average temperatures for the assessment.

Air change rates

You can either enter the known air change rate, or select the most suitable description from the drop down list.

Shading factors

Select the most accurate description from the drop down list

Fraction of daylight hours closed

Enter a value of between 0 and 1 in the box provided

Width:Height ratio and overhang (completed for each window)

Enter the width:height ratio for each window and whether the window has a large overhang in the boxes provided.

Click "submit" to save these details.

Appendix P: Summer Overheating (Part b)

This section allows the system to calculate the thermal mass parameter. There are three methods for this:

- Enter the TMP (if known)
- Select an indicative construction to provide an estimate
- Calculate if details of the construction are known

Enter the TMP

Click the appropriate radio button and enter the value in the box provided.

Select an indicative construction to provide an estimate

Click the appropriate radio button at the top and select the radio button corresponding to the most accurate description of the construction.

Calculate if details of the construction are known

Click the appropriate radio button at the top and click the checkbox corresponding to each element, and enter the area, to allow the system to calculate the TMP.

In all cases, click "submit" at the bottom of the page to save the details.

Space Heating Requirements (licensed users of the website only)

For information only, displays the space hetaing calculations. The values calculated will depend on whether the SAP, DER or Notional worksheet has been selected.

Fuel Costs (licensed users of the website only)

For information only, displays the fuel cost calculations. The values calculated will depend on whether the SAP, DER or Notional worksheet has been selected.

SAP Rating (licensed users of the website only)

For information only, displays the sap rating calculations. The values calculated will depend on whether the SAP, DER or Notional worksheet has been selected.

Carbon dioxide Emission Rate (licensed users of the website only)

For information only, displays the emission rate calculations. The values calculated will depend on whether the SAP, DER or Notional worksheet has been selected.

Primary energy (licensed users of the website only)

For information only, displays the primary energy calculations. The values calculated will depend on whether the SAP, DER or Notional worksheet has been selected.

Results and Lodgement

This page displays a summary of the results of the calculation, including:

- SAP Rating
- SAP Band

Licensed users of the website will also see the following information:

- Environmental impact rating
- · Environmental impact band
- Primary energy kWh/yr
- Primary energy kWh/yr/m2
- Dwelling Carbon Emission Rate (DER) kgCO2/m2
- Target Carbon Emission Rate (TER) kgCO2/m2

At the bottom of the screen, the option to generate the output documents (in PDF format) will appear. Just select the reports that you require and click "Generate" to open these.

Coversheet:

This contains an overview of you and your project and specifies the documents that are included in the report

Licensed users of the website will also be able to view and downloads PDFs of the following information:

Input data:

A list of the input data for the project

Worksheets

A report containing the completed SAP, DER and Notional worksheets

Compliance checklist (England and Wales, Northern Ireland only)

A compliance report for Part L / Technical Booklet F1 sheet.

Energy performance certificate

An EPC report for the dwelling. For Scottish dwellings you can additionally specify whether you want a single page report and whether you wish the report to contain the cost graphs in addition to the emissions graphs).