BARILLA SOLAR

Solar Thermal Design Guide

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Incorporates Renewable Heat Incentive

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Introduction

This design guide is intended to outline the theory and considerations that should be made prior to the installation of a solar thermal system. The guide is by no means exhaustive as many of the requirements laid down by the Micro-generation Certification Scheme outline industry standard best practice. This guide does however offer the system designer an overview of how components within the solar circuit should be sized.

This guide is also intended to document the theory used when we built our free online Solar Thermal Design Assistant App.

Contents

Summary of Design Method

A. <u>Survey & Preliminary Design</u>

1. Establish customer requirements with regards to hot-water demand, draw-off profile. Check if there are any target Solar Input requirements required to meet renewable obligations such as the Code for Sustainable Homes or BREAM
2. Survey site either physically or off-plan to obtain:
    a. Details about the proposed mounting space, including available space, orientation to South, pitch and shading.
    b. If mounting on a roof, take note of the tile type and roof structure; especially if mounting a large array where supplementary design calculations may be required.
    c. The proposed route and length of the pipework
    d. Available space for water storage
    e. Available space for solar pump station, expansion vessel and if required cooling vessel
    f. Routing and location of any heat dissipation device
    g. Incoming mains water pressure
3. Establish cylinder size and arrangement based on available space, hot water demand and other renewable technologies that may need to be integrated
4. Calculate annual energy demand and decide how much of this can practically be obtained from Solar Thermal

The survey should be a thorough technical survey and the above list is by no means exhaustive.

B. Solar Circuit Design

5. Size the collector array to meet the following restraints:
    a. Physical mounting space
    b. Target energy requirement from Solar Thermal
    c. Available finance for the project
6. Size the rest of the components in the solar circuit to meet the flow rate and heat dissipation requirements of the chosen collector array. The components should be considered in the following order:
    a. Hydraulic arrangement of solar array, to minimise heat and pipe losses
    b. Practical flow-rate that can be achieved, this will be primarily affected by the collector array size and pipe-run
    c. The pipework, designed to minimise losses while remaining cost effective and able to fit in the available space
    d. The solar fluid concentration to establish a freezing point of the system
    e. The heat dissipation requirements of the system; normally only required on larger systems where there are periods of absence
    f. The expansion vessel capacity
    g. The pump sizing to meet the design flow rate and overcome the pressure drop over the entire system

C. Build a Customer Proposal

7. Check that the SAP requirements are met (if required).
8. Estimate the economic viability of the system, including payback period. You will need to revisit this section once you have established an equipment price and an estimate of installation cost.
9. Review the System Performance Report and check that all design criteria have been satisfied
10. Build a comprehensive Bill of Materials and quotation/order based on the primary components specified
11. Build a schematic diagram showing the proposed layout

D. Commissioning Details

12. Pre-charge pressure for the expansion vessel
13. Volume of concentrated solar fluid to water
14. System pre-charge pressure
15. Controller set-up

Calculating Annual Energy Demand

The annual energy demand to satisfy the water consumption including standby heat and circulation losses can be written:

$Q_{demand} = Q_{DHW} + Q_{losses}$

The energy required to raise the water temperature neglecting any losses is found by:

$Q_{DHW} = mC_p\Delta T / 3600$ kWh/day : m (kg) is mass of water to be heated

: C_p (kJ/kg.°K) specific heat capacity of water

: ΔT (°K) required temperature rise

The losses can be calculated from the manufacturer's published standby heat losses of the cylinder and estimating a circulation loss factor for the pipework:

$Qlosses = Q_{SHL} + Q_{circ}$: Q_{SHL} (kWh/day) standby heat losses

: Qcirc (kWh/day) circulation heat losses

$Q_{SHL} = \theta$ kWh / day

$Q_{circ} = k.Q_{DHW}$: k(%) is assumed loss factor

The annual demand can now be expressed as:

$Q_{demand} = [(1 + k).Q_{DHW} + Q_{SHL}] \times 365$ kWh/year

Example – Calculating annual energy demand

Calculate the annual energy demand based on a household of 4 people, with a hot water consumption of 45 litres/day/person delivered at 60°C, the incoming water temperature is an average of 10°C. The published standby heat loss for the cylinder is 2.6 kWh/day and circulation losses can be assumed to be 10%.

Q_{DHW} = $mC_p\Delta T$ /3600 kWh/day

m = number of people x personal daily demand x density of water

= 4 x 45 x 0.996

= 179 kg

Cp = 4.180 kJ / kg.K

ΔT = 60 – 10

= 50°K

Q_{DHW} = 179 x 4.180 x 50 / 3600

= 10.39 kWh/day

Calculating the annual energy demand:

Q_{demand} = $[(1 + k).Q_{DHW} + Q_{SHL}] \times 365$

= [(1 + 0.1) x 10.39 + 2.6] x 365

= 5,121 kWh / year

Sizing the Hot Water Cylinder

This will be determined by a combination of available space, daily demand, storage arrangement, draw-off profile and required refresh times.

There is reference within Part L of the Building Regulations and SAP to the required dedicated solar volume of a cylinder in relation to the installed collector area (35 litres dedicated solar volume to every m^2 of absorber area). This situation is confused by a statement in the Micro-generation Certification Scheme MIS 3001 that overrides any stipulation as to ratios of collector areas to dedicated solar volumes.

We have included the Part L regulation in the Solar Thermal Design Assistant for completeness, and like most SAP software will flag-up when the collector area is larger than the required dedicated solar volume.

Solar Storage Arrangements

The storage arrangements in common usage for integrating solar thermal systems are listed below:

- Twin Coil Cylinder. This consists of a solar coil and a coil for either a boiler or heat pump
- Single Coil Cylinder. This has a solar coil and normally has a pair of immersion heaters fitted or a single immersion heater plus direct tappings for a boiler or heat pump
- Dedicated Solar Cylinder/Heat Assist Thermal Store that pre-feeds to another store or water heater
- Multifuel Thermal Store – allows a mixture of renewable and conventional technologies.

Choosing a storage arrangement

Choosing the right storage arrangement depends upon application, best practice, heat sources and what the heat is going to be used for. Let's consider both small and large domestic properties and a large commercial application.

Small Domestic (up to 4 bedrooms/3 bathrooms)

For most domestic installations, due to system size and space constraints the twin coil cylinder is the most common. These are either unvented (pressurised) or vented (requiring a feed and expansion tank).

An alternative for properties with combi boilers, is to install a small pre-heat store with solar coil and then pre-feed a combi boiler. This arrangement normally requires a bypass valve that prevents the incoming pre-heated water exceeding the boiler manufacturer's limits on incoming water temperatures.

Large Domestic

For systems used in larger domestic properties a Multifuel thermal store is normally the preferred route. The store has a mixture of direct tappings and coils that can accept a combination of heat sources including solar thermal, wood burners and heat pumps. A thermal store is a hybrid vented and unvented cylinder, the body of water in the store is static and is vented to a normal feed and expansion tank. However the hot water is supplied at mains pressure through a high recovery coil in the store, therefore a decent incoming cold water pressure is required for this to be suitable. An advantage of the thermal store is that it can also be used to supply heating circuits (radiator and underfloor) or even a swimming pool.

Non-Domestic Applications

If the premises and hot water demand is small then a system similar to a domestic property can be used, but for larger size installations for instance in Nursing Homes or Hotels then a pre-feed cylinder will give the optimum performance. The pre-feed cylinder can be either a single coil solar cylinder or a thermal store. If using a thermal store this can either be simple heat assist unit or similar to the Multifuel format described above.

Eliminating Legionella Risk

When considering the choice of storage arrangement the provision for elimination of Legionella Bacteria needs to be addressed. Unfortunately one of the draw-backs of solar thermal is that its optimum heating range lies within that of the breeding conditions for legionella bacteria 20-50°C.

We have several choices to safely eliminate the risk:

- Use non-potable storage for the water that the solar heats. This can either be in the form of a thermal store which supplies the hot water indirectly or an external heat exchanger between a pre-feed storage cylinder and main supply cylinder. This is the most common solution for large non-domestic installations.
- Pass all solar pre-heated water through an auxiliary heat source to raise its temperature to 60°C prior to circulation to the domestic hot water system.
- Sterilise the storage vessel to a temperature of 60°C. In practice on domestic installations this means setting a boiler or immersion heater to come on and perform this task. This can either be done from the more modern solar controllers or from the heating timing circuit.

More information about this and other best practices can be found in the Energy Saving Trust's CE131 Solar Water Heating Systems – guidance for professionals, conventional indirect models found at:

http://www.energysavingtrust.org.uk/Publications2/Housing-professionals/Microgeneration-Renewables/Solar-water-heating-systems-guidance-for-professionals-conventional-indirect-models-2006-edition

Designing the Solar Circuit

Having calculated the annual energy demand, storage arrangement and target input from Solar Thermal, it is a reasonably straightforward task to size the solar array.

The annual yield required from the solar array is:

$Q_{solar} = Q_{demand} \times S_{fn}$: where S_{fn} is the design solar fraction, typically 30-60%*

The annual solar yield obtained from the solar array is:

$Q_{solar} = Q'_{solar} \times A_{apmin}$: $\dot{Q}_{solar}$ = Specific annual solar yield ($kWh/m^2/year$) adjusted for location, tilt, orientation and shading

: A_{apmin} = Minimum aperture area (m^2) of solar collector array

Rearranging the above equation gives the required aperture area to meet the solar contribution of the annual energy demand is:

$A_{apmin} = Q_{solar} / Q'_{solar}$

**Solar Fraction – This is an expression of how much of the total energy consumption is supplied by solar thermal. There is a theoretical maximum value in the UK that is limited by the effects of reduced irradiation levels received in the winter. It would not be possible to provide 100% of a system's energy demand throughout the year by solar thermal and hence the maximum value is reduced.*

Example – Determining the required Aperture Area of a Solar Thermal Array

Determine the required aperture area of a solar installation that is to provide 50% of a total energy demand of 10,000kWh/year. Assume that the collector has a specific yield of 568 $kWh/m^2/year$, based on its location, tilt, orientation and shading.

The annual yield required from the solar array is:

$$Q_{solar} = Q_{demand} \times S_{fn}$$

$$= 10{,}000 \times 50\%$$

$$\underline{= 5{,}000 \text{ kWh/year}}$$

The minimum aperture area of the solar array to meet this demand is:

$$A_{apmin} = Q_{solar} \,/\, Q'_{solar}$$

$$= 5{,}000 \,/\, 568$$

$$\underline{= 8.8 \text{ m}^2}$$

Limitations of this Design Method

Care must be taken when using this design method to determine solar yield. Avoid the temptation to oversize the system in an attempt to improve solar yield and energy savings. If a system is over-sized the specific solar yield decreases and these calculations will over-estimate annual performance.

System Oversizing

Oversizing a system will reduce the life of the components in the solar circuit due to excessive stagnation and may require more frequent service intervals. It will offer a worse return on investment, due to higher capital costs, less specific yield and cost of servicing/replacing components.

Stagnation is discussed in more detail later on in this guide.

Choice of Collector and Array

Once we have calculated the required aperture area, we need to make a decision on the collector type and model, this decision will normally be based on the following considerations:

- Mounting requirements: If the collector needs to go in-roof or in landscape then use a flat-plate
- Orientation: If the array is off south by more than 30° then use a heat-pipe evacuated tube collector
- Tilt: If the array is to be laid flat or mounted vertically (façade) then a direct flow evacuated tube collector
- Application: for low-grade heat such as pools then use a flat-plate collector; for higher grade heat such as needed for thermal stores or sterilisation applications use evacuated tubes
- The model of the collector will be influenced by its aperture area, ideally we need to get as close to the required aperture area using the least amount of collectors that will allow us to build a balanced hydraulic array

Example – Determining the Number of Collectors Required

Taking the previous collector sizing example further, we can calculate the number of collectors that we would need to meet the required aperture area.

Using Evacuated Tubes, Barilla TZ1800 25 Tube Collector (Aperture area 2.325m^2):

Number of collectors, n $\geq A_{apmin} / A_{apTZ25}$

$\geq 8.8 / 2.325$

≥ 3.79

$= 4$

Array aperture area, $A_{ap} = 4 \times 2.325$

$= 9.3m^2$

We can now calculate the annual yield from the solar array:

$Q_{solar} = Q'_{solar} \times A_{ap}$

$= 568 \times 9.3$

$=$ 5282 kWh/year

Balancing the Array

One of the design considerations that we now need to make relates to how the collectors will be hydraulically arranged, this has a direct impact on system flow rate and hence the selection of pipework and circulation pump.

In practice we need to keep the array layout simple whilst still minimising the pressure drop across the collector field. We have the added consideration that banking too many collectors together will have an effect on efficiency, particularly on the last few collectors in each series as they start to operate at a hotter temperature and their performance is affected.

As a rule of thumb, we would suggest that no single collector series should be any larger than $10m^2$. Ideally we would like an even number of collectors and a balanced pipe run. On larger systems we are aiming for a total number of collectors that can be divided by 3 or 4 to produce a sensible array.

When the array has been finalised we can apply a design flow-rate across the largest branch to give us a system flow rate to be used for the rest of the solar circuit design. Typically specific design flow rates are between 25 – 45 litres/hour/m^2.

Example – Balancing the array and calculating the system flow rate

Assume that we need to use 6 Barilla F22 AR flat-plate collectors (Aperture area = $2.01m^2$ each), and that we want to use a specific flow rate of 35 litres/hour/m2. Determine (a) the layout of the hydraulic array and (b) the system flow-rate (litres/minute) that should be observed at the flow-setter on the pump station.

Total aperture area, A_{ap} = 6 x 2.01

= $12.06m^2$

As the aperture area is greater than $10m^2$, we will divide the number of collectors giving us an array that consists of 2 branches of 3 collectors in each bank.

To achieve the design flow-rate we need to calculate the aperture area of each branch:

Aperture area of each branch, $A_{apbranch}$ = 3 x 2.01

= 6.03 m^2

System Flow Rate = 35 x A_{ap}

= 35 x 6.03

= 211 litres/hour

= 3.5 litres/minute

Sizing the Pipework

There are two choices when considering pipework for solar installations:

(a) Stainless steel pre-insulated flexible pipe
(b) Copper pipe

We recommend for domestic and small commercial installations using stainless steel flexible pipe, it is quick to fit and is relatively low cost. For larger installations you would tend to come off the collectors in stainless flexible pipe and then use copper for the main run where a larger diameter and low-loss pipe are required to minimise the pressure drop.

When sizing the pipework we are aiming to achieve the following:

- Minimise pressure drop and therefore reduce the pump size and energy consumption
- Maintain pipe velocity between 0.4 – 1.0 m/s
- Ensure that the pipe will fit in the available space
- A choice of pipework and fittings are cost effective both in terms of materials and labour

We would recommend using the Solar Design Assistant to inspect pressure drops using various pipe types and sizes, the calculations are based on published formulae for copper pipework and manufacturer's published data for stainless steel pipework.

Solar Fluid

The solar circuit requires both freeze protection and inhibitor to protect against corrosion. This is achieved by using an aqueous solution of either Propylene Glycol or Ethylene Glycol. The ratio of solar fluid to water will affect the heat transfer properties and freezing point of the solution. We recommend using a concentration of solar fluid 25%-40% by volume, this gives freeze protection in the range of -10°C to -20°C. The maximum concentration should not exceed 50%.

Expansion and Cooling

Stagnation

Solar systems are designed to cut-out once the required store temperature has been reached. The collectors are then designed to stagnate, that is boil under pressure at around 200°C and vaporise the solar fluid in the collector header. However there are several undesirable effects on the system if exposed to prolonged stagnation:

- Excess of heat energy in the system that needs to be dissipated
- Continuous temperatures are in excess of rated values for some system components e.g. Circulation Pump and the membrane of the Expansion Vessel
- Build-up of pressure that may trigger the pressure relief valve and discharge fluid from the system. Once the fluid has been discharged this introduces air, an excess of which will reduce the effective heat transfer of the system and risks damaging the bearings of the impeller on the circulation pump.
- Deteriation or total breakdown of solar fluid

Cooling and Heat Dissipation

For most domestic installations that have been sized correctly and there are only short periods of absence, stagnation does not present any real problems. An annual check of the fluid quality and levels will highlight if stagnation is a problem on a particular system. If stagnation is a problem on a smaller system a heat-dump circuit can be easily added, normally in the form of a towel radiator.

For larger systems or systems that are not in constant use a cooling vessel or fan-assisted radiator are normally used to dissipate any excess heat in the system.

The Solar Thermal Design Assistant will calculate the excess heat in the system to be dissipated. To determine if a heat sink is required we must inspect the steam length in the pipe when the collectors stagnate:

$L_{steam} = (q_{steam} \times A_{ap}) / q_{pipe}$

: L_{steam} – length of circuit (m) where fluid is displaced by steam

: q_{steam} – steam output from stagnated collector (W/m^2) [Flat-Plate=60 W/m^2; EVT=100 W/m^2]

: A_{ap} – Aperture area (m^2) of collector array

: q_{pipe} – heat dissipation property of the pipework, typically use 25 W/m

If $L_{steam} > L_{pipe}$ then a heat sink is required to dissipate the remaining heat Q_{DIS}:

$Q_{DIS} = (q_{steam} \times A_{ap})\ (q_{pipe} \times L_{steam})$ Watts

Expansion Vessel Sizing

All sealed solar circuits require a dedicated expansion vessel, the size of which can be calculated using the formulae shown below:

Total volume of fluid in system, $V_{total} = V_{pipe} + V_{coil} + V_{collector} + V_r$ [$+ V_{heatsink}$]

where V_r is residual fluid in expansion vessel to protect membrane, typically 3 litres or 10% system volume & $V_{heatsink}$ is the volume of the heat sink circuit if used.

Volume of Steam in System, $V_{steam} = V_{collector} + V_{pipesteam}$ [$+ V_{heatsink}$]

where $V_{pipesteam}$ is the volume of the steam affected pipe.

The required minimum volume of expansion vessel, V_{EV} on the solar circuit is formally expressed:

$$V_{EV} \geq (V_r + V_{steam} + \boldsymbol{\beta} V_t)(P_e + 1) \; / \; (P_e - P_{gauge})$$

Where:

β Expansion factor of fluid in system typically between 8.5 – 12%

P_e Maximum system pressure, normally PRV rating – 10% = 6 x (1 – 0.1) = 5.4 bar

P_{gauge} Gauge pressure (bar), assume 1 bar static pressure in collector manifold at rest add 0.1 bar/meter that the gauge is below the collector to obtain gauge pressure

Assuming the expansion vessel is at the same level as the pressure gauge, the expansion vessel should be set with a pre-charge pressure of 0.25 bar below the gauge pressure (to allow for the resistance on the spring-clutch).

Example – Sizing an Expansion Vessel and Calculating Pre-charge Pressures

A solar circuit consists of an array of flat-plate collectors, total aperture area $6m^2$ containing a fluid volume of 5 litres. The cylinder coil capacity is 2 litres and the residual fluid capacity of the expansion vessel is 3 litres. The pipework contains 8 litres of fluid and an intermediate cooling vessel 5 litres. The collector array is located 8m above the pump station which has a 6 bar PRV, the system pressure gauge and the expansion vessel attached.

Determine (a) the gauge pressure of the system at rest, (b) the minimum expansion vessel size required and (c) a suitable pre-charge pressure for the expansion vessel

(a) Calculate gauge pressure of the system at rest

$$P_{gauge} = 1 + 8 \times 0.1$$

$$= \underline{1.8 \text{ bar}}$$

(b) Calculate minimum expansion vessel required

$$V_{total} = V_{pipe} + V_{coil} + V_{collector} + V_r + V_{heatsink}$$

$$= 8 + 2 + 5 + 3 + 5$$

$$= \underline{23 \text{ litres}}$$

$$V_{steam} = V_{collector} + V_{pipesteam} + V_{heatsink}$$

$$= 5 + 8 + 5$$

$$= \underline{18 \text{ litres}}$$

$$V_{EV} \geq (V_r + V_{steam} + \beta V_t)(P_e + 1) \ / \ (P_e - P_{gauge})$$

$$\geq (3 + 18 + 0.085 \times 23)(5.4 + 1) / (5.4 - 1.8)$$

$$\geq \underline{41 \text{ litres}}$$

Use next available stock size, 50 litres

Pump Sizing

In order to size the circulation pump we need to calculate the system pressure drop across the entire circuit at the known design flow-rate (determined by the hydraulic layout of the collector array). Don't forget that as the system flow-rate increases the system pressure –drop will increase exponentially. It is common practice to oversize the pump by a margin of at least 15%, that is to say that the pump pressure at a given flow-rate is at least 15% higher than the system pressure drop.

The system pressure drop is expressed as follows:

$$\Delta P_{system} = \Sigma\Delta P_{collectorbranches} + \Delta P_{pipe} + \Delta P_{cylinder} + \Delta P_{pumpstation} + \Delta P_{fittings}$$

$$\Delta P_{required} = 1.15 \times \Delta P_{system}$$

The required pump pressure can be found from manufacturers' published curves at the required flow rate. The Solar Thermal Design Assistant should be used to size the pump as it not only calculates the system pressure drop at any given flow rate, it is also pre-programmed with a series of pump curves used in the pump stations that we supply.

Building a Customer Proposal

Economic Viability

As with any project your customer is going to want to know early on what the costs and benefits of their potential investment is going to be. Unfortunately this is not an exact science due to the vagaries of the British climate or indeed our economy.

In order to build a customer proposal with an indication of economic viability, and in particular an estimated payback (amortization period in accountancy jargon) we need to know or at least take an educated guess at the following parameters:

- Installed Cost. This should be straightforward as we have designed a system and will know what components we need and how much they cost. You will be able to have a good idea of your installation costs having performed a detailed survey and also based on your knowledge of performing similar installations. Remember to deduct any capital grants that the customer may be entitled to at the installation phase.
- Annual Saved Energy. This is based on an estimate of the annual solar yield and the actual efficiency of the auxiliary heating that the solar is partially replacing. If the solar yield is 10,000 kWh and this is replacing a boiler with 85% efficiency then the Annual Saved Energy will be 10,000/0.85 = 11,765 kWh
- Value of Saved Energy. This should be based on your customer's energy bills of the last year and the annual saved energy figure that has been calculated
- Annual Economic Indicators. Inflation (Consumer Price Index), Energy Inflation and Interest Rates.
- Renewable Heat Incentive. Is the installation eligible? What is the current rate per kWh and is the renewable energy production metered or deemed?

The formulae used here are complicated and best solved using computer algorithms to tackle their recursive nature. Fortunately they are included in the Solar Thermal Design Assistant.

We would suggest running various economic scenarios for your customers so that they are clear about which factors have the greatest effects on their return on investment. It is really important to be as accurate as possible with your saved energy predictions, installed price and current energy prices. You need to remember to be consistent with the use of VAT in your costing, i.e. either apply it to everything or nothing depending on the customer's VAT status.

Renewable Heat Incentive

A brief word about the Renewable Heat Incentive. This is the heating equivalent of the PV Feed-In Tariff. As of December 2011 all eligible non-domestic solar thermal installations are entitled to 8.5p/kWh of energy that they produce (for eligible use). For non-domestic applications the system are heat metered. So for example if our system generates 10,000 kWh/year then we are entitled to 10000 x 0.085 = £850 / year. The good news is that, similar to the FiT scheme, once enrolled it lasts 20 years from the date of commissioning/registration and the rate is increased annually each April in line with the Consumer Price Index. The maximum installation is currently 200kW thermal*

**interestingly enough there is no standard test condition as there is in PV for determing the instantaneous power output of a solar thermal panel. We would suggest using the power output determined at a solar irradiation level of 800W/m^2 and temperature difference of 40°C .It tends to be more accepted practice to consider the installed aperture area instead.*

A similar scheme for domestic use is in the pipeline for October 2012 to tie in with the proposed Green Deal. The draft proposals for the domestic RHI suggest that the systems will not be metered, but instead will use SAP to deem the input a solar system would have on a particular property. The tariff at the draft stage was 18p/kWh. Our experience with the introduction of the non-domestic RHI suggests that nothing is concrete with the domestic scheme and close attention ought to be paid to the DECC website (http://www.decc.gov.uk) for more up to date information.

SAP 2005 Appendix H

Appendix H of SAP 2005 deals with the solar input you can expect from a solar system on a certain property size with a given cylinder arrangement and size. It is currently recommended by the Micro-generation Certification Scheme as a suitable method to indicate to customers the potential solar yield of a system.

It is our opinion that whilst some of the theoretical basis of SAP is sound, its application provides pessimistic results. The main reasons for the poorer results than (a) we have predicted and (b) measured; is due to not taking into account the geographical location of the installation and not allowing for the optical properties of modern collectors.

We have included the SAP 2005* Appendix H calculation in the Solar Thermal Design Assistant for completeness, and we currently use the value of solar input to give an indication of the return expected from the domestic RHI. We will of course make alterations to this module if the regulations or SAP changes.

**We acknowledge that the current SAP version in use is SAP2009 and that it has updated calculations relating to hot water demand, it is not stipulated as the preferred methodology of the Micro-generation Certification Scheme (with reference to the Energy Saving Trust document that MCS recommends as a minimum standard).*

Quotations and Purchasing from Barilla

The Solar Thermal Toolbox links directly to our online store. Once you have built a system either from the Calculator or the Design Assistant you will have the option to be taken to the shop where a suggested list of the components you will require will be displayed.

You have the opportunity to save this as a quotation or to proceed and buy the equipment as required.

The shop facilitates purchases from both account customers and pro-forma customers using either BACS or card payment.

The Barilla Solar Toolbox

We appreciate that designing heating and water services in buildings is complicated especially with the wealth of renewable products and energy saving products currently available. At Barilla we have built a web-based Solar Toolbox aimed at Designers, Specifiers, Resellers and Installers to assist with the solar thermal element of your renewables projects.

This Solar Toolbox consists of two powerful Apps that allow you to design and price solar thermal systems at your own convenience.

Whilst we have access to more powerful desktop simulation and design applications such as T*Sol and Polysun for more complicated solar thermal projects, these products require a high degree of skill to operate correctly and can be expensive investments. The Barilla Solar Toolbox is designed to be straightforward to use and provide quick answers about performance and cost. The Solar Toolbox has the added benefits that it is free of charge and integrates directly with our online store.

It is our intention to continue developing the Solar Thermal Design Assistant and add more functionality e.g. Swimming Pools, Split System Arrays, and more complicated Pipework arrangements. We will also add other Barilla products to the built-in library as they become available.

<u>Solar Thermal Design Wizard</u>

- Aimed at Installer building a straightforward domestic / small commercial system and giving customer a basic performance indication as required by the Micro-generation Certification Scheme
- Web-based and accessed on the Barilla website
- Integrates with the Barilla shop and will allow you to build your own quote or orders
- Simple to use with only basic inputs required

<u>Solar Thermal Design Assistant</u>

- Aimed at more advanced users that need to check and optimise the performance of each component in the system
- Web-based and accessed on the Barilla website
- Produces a more detailed report including economic viability, component performance and SAP 2005 Appendix H calculation
- Includes the Renewable Heat Incentive for Non-Domestic applications, and provision for calculating rewards for the forthcoming Domestic programme (based on draft proposals).
- Builds Bill of Materials report
- Integrates with the Barilla shop and will allow you to build your own quote or orders
- Will allow projects to be saved and re-loaded (Account required)
- Follows the steps laid out in the Barilla Solar Thermal Design Guide

Both tools are currently restricted to Hot Water Systems and collectors facing in the same direction

Useful Solar Thermal Resources

Barilla Solar Document Library
http://www.barillasolar.co.uk

Renewable Heat Incentive
http://www.decc.gov.uk/rhi

Ofgem – administration of RHI
http://www.ofgem.gov.uk/e-serve/RHI/Pages/RHI.aspx

Energy Saving Trust – RHI Premium Payment
http://www.energysavingtrust.org.uk/Generate-your-own-energy/Financial-incentives/Renewable-Heat-Premium-Payment

Micro-generation Certification Scheme
http://www.microgenerationcertification.org

MCS Installer Certification (refer to MIS 3001 – Solar Heating)
http://www.microgenerationcertification.org/installers/installers

Energy Saving Trust CE131 Solar Water Heating System – guidance to professionals
http://www.energysavingtrust.org.uk/Publications2/Housing-professionals/Microgeneration-Renewables/Solar-water-heating-systems-guidance-for-professionals-conventional-indirect-models-2006-edition

Disclaimer

Barilla Limited or any of its subsidiaries cannot be held liable for errors or omissions contained in this document or repercussions they might have. It is the responsibility of all persons carrying out solar thermal installations to have the correct technical experience, qualifications and understanding of the legislation that affects the task they are to perform.