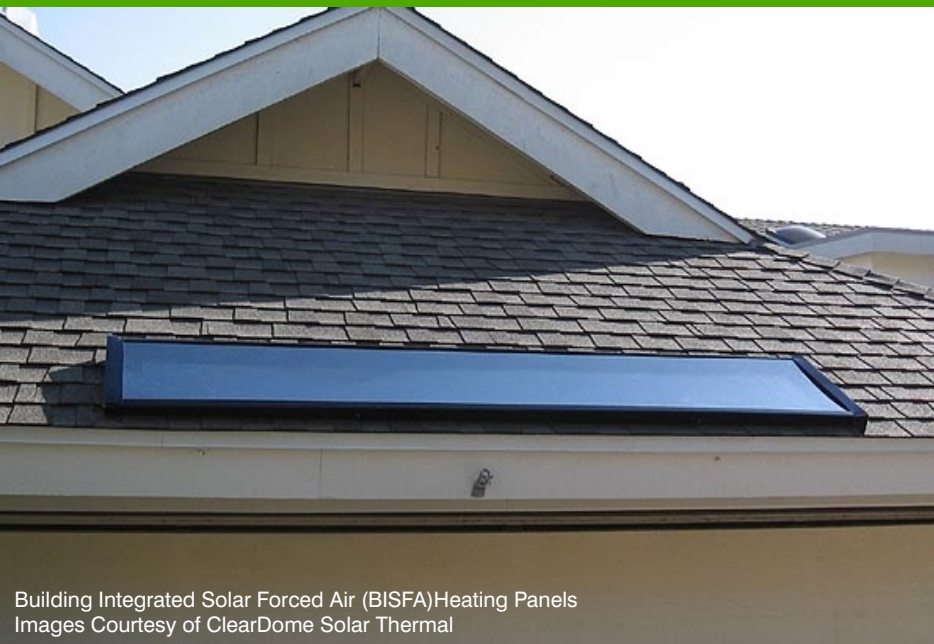


Factsheet

Solar Air Heating



Building Integrated Solar Forced Air (BISFA) Heating Panels
Images Courtesy of ClearDome Solar Thermal

Solar energy can be utilised to preheat air that is used to ventilate the home reducing the need to heat cold outdoor air using your conventional heating system.

Although slightly less efficient at collecting the sun's energy than solar water heaters solar air heaters have other advantages. As their installation does not require any plumbing work to be carried out they are well suited to retrofitting into existing buildings. Perhaps surprisingly the technology also has the potential to work particularly well in Scotland's climate.

The Scottish climate is such that a high proportion of our annual heating needs fall outside traditional winter months. The graph overleaf, shows the solar radiation levels available over a typical year in Inverness. As can be seen, in autumn and spring months, where space heating is still required there is a useful solar resource which can be harnessed. The difference between Inverness and other cities found at a lower latitude is that heating will still be

required during this period in Inverness but maybe not at all in (for example) London.

As Scotland's heating season is that much longer, there is a greater potential savings to be made using solar energy.

If you know the Latitude and Longitude of your property you can calculate the solar resource available to it by visiting:
<http://eosweb.larc.nasa.gov/sse/RETScreen>

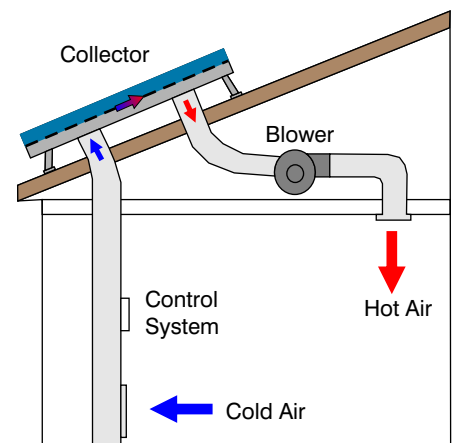
There are several different types and configurations of solar air heaters available. Most systems utilise solar collectors and can be mounted on the roof or on the wall of a property.

Some systems are simple thermosiphon collectors that rely entirely on convection to distribute hot air, but most use low energy fans or blowers controlled by simple electronics.

The components of a typical rooftop mounted installation are shown here.

As can be seen cool air is drawn through the inlet of the collector and passed under the absorber plate. The air, which is now heated, is delivered back into the home by a small blower.

A thermostatic control system automatically turns the system "on" whenever the sun shines and "off" at nighttime.



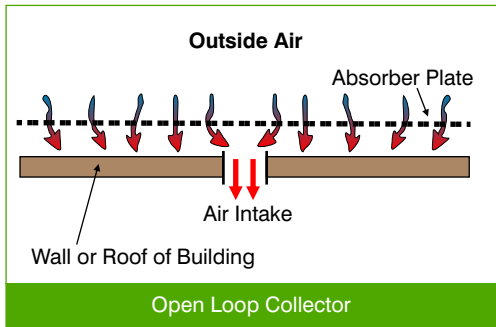
Solar Air Heating Technologies & Considerations

Solar hot air systems have been in operation since the 1950s. Modern systems tend to be classified as either open or closed-loop. The difference between the two lies in the source of air entering them.

Open Loop

In open-loop systems, collectors draw in cold outdoor air, heat it and transfer the heated air into buildings.

Collectors used in open-loop systems, known as transpired air collectors, incorporate a dark-colored, perforated metal facing, called the absorber plate. There's no glazing over the plate; the sides and back are insulated to reduce heat loss.

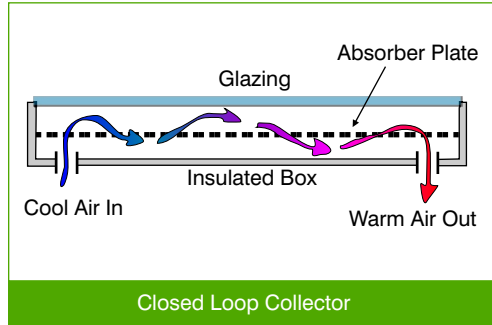


The dark outer facade absorbs solar energy and rapidly heats up in sunny conditions. A fan or blower then draws the heated air into the building through the holes in the collector where it is then distributed internally via piping.

Closed Loop

Closed-loop systems, the most popular configuration for residential applications, draw cool air from the house, heat it and return the heated air to the interior. These collectors

differ from the ones used in an open-loop system in that they are glazed. The surface of the absorber plate is also usually roughened to increase air turbulence so that air absorbs heat from it more effectively.



Costs

Costs for the installation of a solar air heating system will vary in line with the type of system installed. The simplest system will use only the slates or tiles on a roof as a solar collector therefore negating the need to purchase and install solar panels. Such a system would cost around £500 fully installed. More sophisticated systems can be combined with a building's hot water tank to also contribute to its water heating. A stand alone solar air heating unit utilising two solar collectors will cost around £5000 installed. A system combining both air and water heating will cost around £7000 installed.

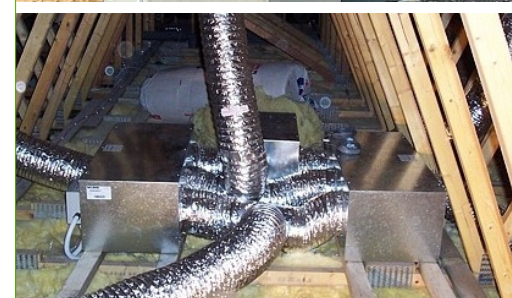
Maintenance Requirements

Although significant design variations exist all solar air heating systems are likely to require only a minimum of maintenance. The only moving component within the system will be the fan or blower which is used to

circulate the heated air. Systems incorporating air filters will need to have them changed every 5 years. Checks to the electronics should also take place at this time.

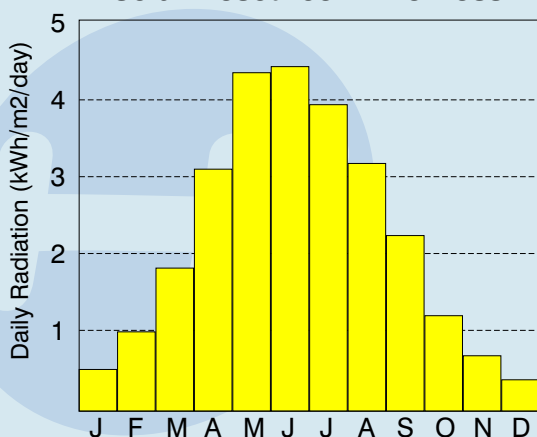
Installation

As solar air heating is not considered as mainstream as solar PV or solar water heating the technology does not currently qualify for UK wide grant assistance through the Low Carbon Buildings Programme. In Scotland it is however eligible through the SCHRI scheme. To obtain an SCHRI grant the technology must be installed by an accredited professional. A link to EST accredited installers can be found at the end of this factsheet.



The indoor and outdoor components of Nuair's Sunwarm system

Solar Resource - Inverness



Solar Resource in the Highlands and Islands

The power density of solar energy is made up of two components, the radiation in the direct beam from the sun, and diffuse radiation from the sky. Solar collectors are able to harness both components. On a clear day diffuse energy may amount to 15-20% of the global irradiance whereas on a cloudy day it will be 100%. Global irradiance varies throughout the course of the day because the path length of the solar radiation through the atmosphere changes. For the same reason, there are variations with season and latitude. The total solar energy received in a day (known as the insolation or solar irradiation) can vary in the UK from around 0.5kWh/m² in the winter to 5kWh/m² in the summer. The graph opposite shows the typical solar resource available to Inverness throughout a year. This variability is an important aspect of any solar energy project as it will influence system design and economics.

If you know the Latitude and Longitude of your property you can calculate the solar resource available to it by following the link at the end of the factsheet.

Solar Air Heating

Is My Property Suitable?

Orientation & Tilt

The installation of a solar collector used to provide space heating will have different requirements to one installed to heat water. Where as hot water is needed all year round space heating is generally only required outside of summer months.

Solar collectors work most efficiently when the sun's rays are perpendicular to its surface. In winter the sun will have a low angle relative to the horizon and it will reach a maximum angle in June. As such for space heating applications collectors should be mounted closer to vertical to maximize the winter sun angle.

Solar designers traditionally recommended that collectors be inclined at an angle equal to that of the latitude of the property, plus 10° to 15°. By having the collector at this

slope, the incident radiation is maximized during the months in which there is a space heating requirement. In countries where solar air heaters are more widely used, vertical installations on walls are also common.

In terms of orientation, panels should face as close to due south as possible. Where this is not practical panels should at least face within 45 degrees (east or west) of due south as per Figure 1.

Overshading

If the surface of the solar panel is in shadow for parts of the day, the output of the whole system will decrease. Shadows from buildings, trees or other structures can significantly reduce performance. Bearing in mind that the sun moves

throughout the day the panel should be positioned carefully so as to avoid all potential obstructions.

Planning Permission

Solar collectors used to heat water are generally integrated into the slope of a property's roof. In Scotland, such installations are usually regarded as permitted development and will not require planning permission.

Mounting your panel closer to the vertical (ie not lying flush with the roof) may mean permitted development rights do not apply. It is therefore crucial that you first consult your local planning department prior to commencing with any installation.

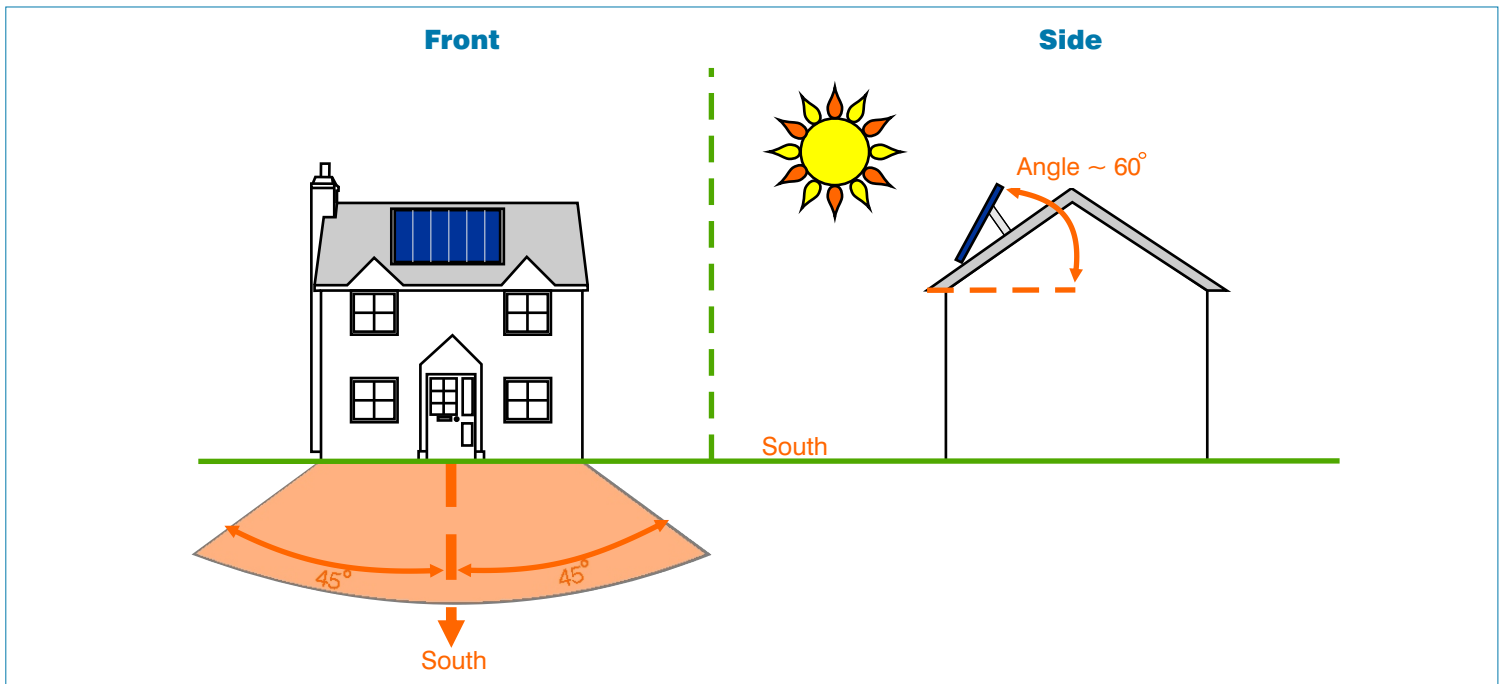


Figure 1: Optimum Orientation and Tilt of a Solar Panel

Useful Links

Solar Trade Association
www.greenenergy.org.uk/sta

Scottish Solar Energy Group
www.sseg.org.uk

NASA Surface Meteorology and Solar Energy Data - Calculate the solar resource at your property
<http://eosweb.larc.nasa.gov/sse/RETScreen>

Contact details of EST accredited manufacturers and installers of solar space heating equipment can be found here

www.energysavingtrust.org.uk/download.cfm?p=13&pid=558