SOLAR THERMAL TECHNOLOGY

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SOLAR UK

SINCE 2000

THE PRINCIPALS OF SOLAR THERMAL VACUUM TECHNOLOGY

Light energy delivered from the sun in the form of radiation, passes through the cold environment of space, through our atmosphere, and onto the objects in our built environment here on earth's surface.

On its way here through space the only form of energy transfer possible is radiation (direct transfer through waves) because there are not enough particles (solids) or gasses (fluids) for this energy to be conveyed by, either; conduction (transfer between two objects of different temperature touching together), or convection (the transfer of heat through a fluid via movement or current).

Once this energy enters Earth's atmosphere it begins to be affected by the environment. Some of the energy is reflected and some is absorbed. The temperature of objects and particles the radiation lands on is raised by this energy input. This heat, being energy, can be conducted through contacting materials and moved around by convection through air and liquids in our environment.

In order to understand how a solar thermal collector works we need to consider some of the physics which apply and the nature of energy transfer. On an average day with typically low ambient air temperatures, caused by our geography and maritime climate, cool air flow takes away the energy that is delivered by radiation from the sun, faster than it is absorbed (delivered and collected in the form of heat or temperature rise).

In the past before collectors incorporated vacuum technology (and still with some flat plate collectors today) good performance from a solar collector was only possible on fair days similar, due to the same influencing factors and lack in application of vacuum technology.

LaZer2 solar thermal

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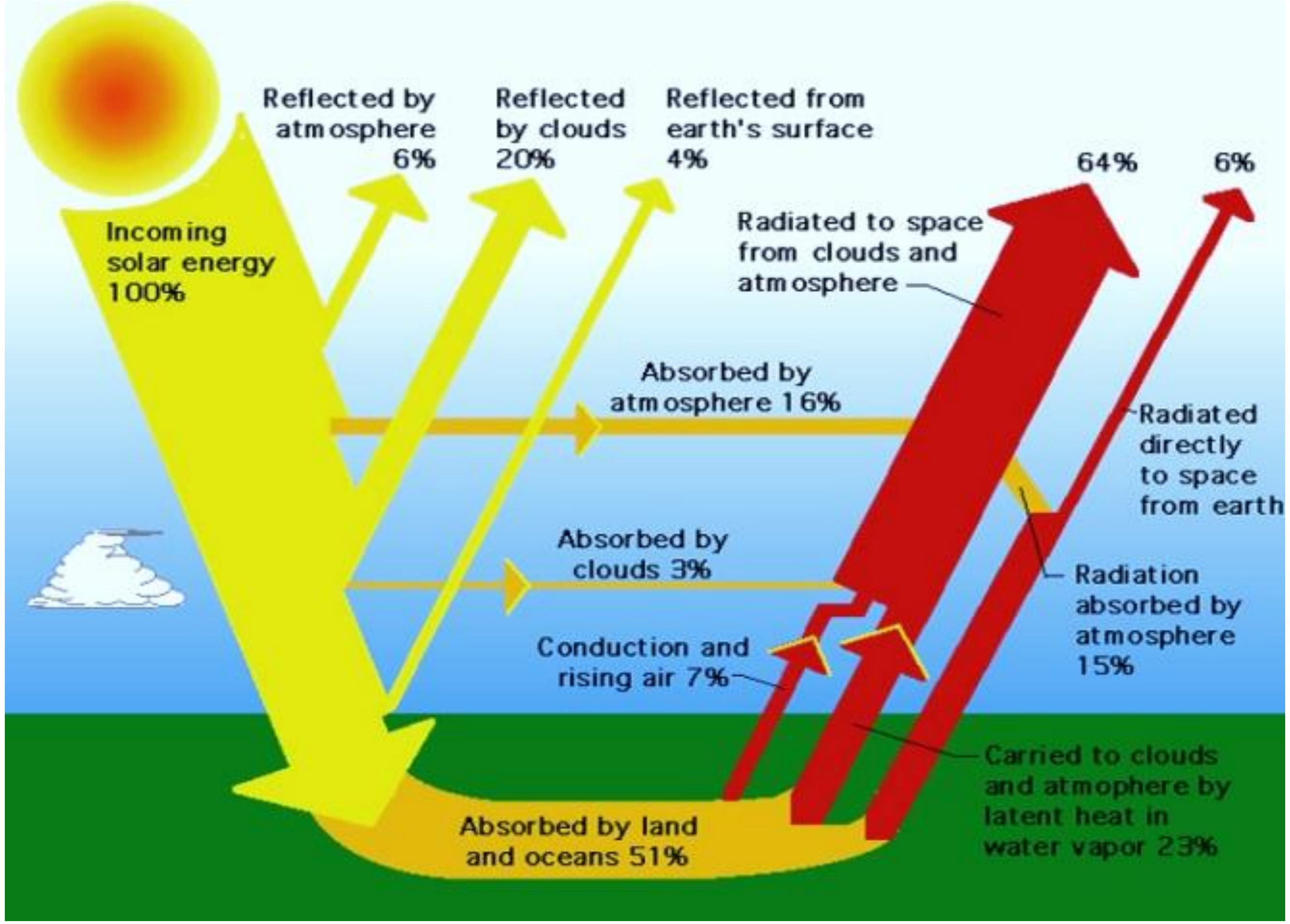


The diagram above depicts how much of the energy coming from the sun is ‘lost’ in various ways before we have the opportunity to harvest what is left. The LaZer2 solar thermal collector has been developed to the point where it can convert around 93% of radiation that is available at the earth’s surface, in the location and surface area that the collector is positioned, to usable retained heat energy. This product is at the forefront of this technology, as extensive research and development has discovered we are at the point of diminishing returns in collector performance.

THE PHYSICS

To start off, heat is energy and is measured by temperature changes occurring as a result of, or in order for, an action (work) to occur. Temperature change (energy transfer) only flows one way and heat travels invariably from hot to cold. Some forms of energy transfer result in energy being converted into heat as a by product, or sometimes this conversion into heat is caused intentionally in order to serve a purpose. A good example of this is where fuel is burned to release heat energy which is then transferred to water for the purpose of providing usable hot water. Another example is where a high resistance is applied to the current of an electrical circuit resulting in the intended element of the equipment becoming very hot and so transferring heat to serve a purpose such as for heating or cooking.

Energy comes in many forms and is inbuilt into everything around us. The sun is probably the most relevant energy source present in our environment, it has been around since long before our technological advancement and understanding, and the energy it transfers' to earth is both considerable and renewable. The energy the sun imparts to our environment is prevalent in several forms including light as well as heat, as has been touched on earlier. However, the way that the energy which originates from the extreme combustion and chemical reactions occurring on the suns surface, transferred to us here on earth, is often misunderstood and can sometimes appear misleading.

In simplistic terms there are only three ways in which heat energy can be transferred, and often the energy we refer to as heat has arrived via a combination of the three.

Conduction: ‘The heat energy moves through the material. A good thermal conductor such as most metal alloys allow heat energy to pass quickly and easily through it. For example place one end of an iron bar in a fire and the other end (the bit you’re holding!) will get hot quite quickly because metal is a good conductor of heat. The end of a wooden pole in the same situation can be held for a considerable period of time usually until long after it catches light without the heat conduction through the wood to the hand end of the pole.

All materials conduct heat in varying degrees and although water has the capacity to store a large amount of heat energy, water is a surprisingly poor conductor of heat, which allows hot water in the top of a hot water cylinder to stay hot, even with cold water below it.’

Convection; ‘The heat energy is carried by moving the material with its heat energy retained, around to somewhere else. For example, a radiator in a room will heat the air next to it, that air then rises and swirls in eddies and carries its heat with it around the room as it mixes with the remaining air, warming the whole room. This is referred to as natural convection where the current or movement of particles in the fluid occurs on its own due to differences in temperature and density.

Forced convection is where a pump or fan is used to move the particles/fluid and an example of this is the water in a heating system. The boiler puts heat into the water which is physically moved by the pump to the radiators where the heat is delivered resulting in the radiator getting hot. Because of its high heat capacity water is a very good medium for transporting heat from one place to another.’

Radiation: ‘The direct transfer of energy by the electromagnetic spectrum (Solar radiation). You can feel radiated heat coming off a fire in addition to the heated air moving around and the surrounding materials conducting heat through them as they are heated. The direct nature of radiation amounts to the movement of energy in waves or energetic particles through a vacuum or matter containing medium which is not required for its propagation.’

Our environment on earth has the effect of cooling materials by the conduction and convection of heat energy away, causing any temperature increase resulting from solar gain to be dissipated to the surrounding environment.

In the case of a solar thermal collector, we are trying to heat material above the ambient temperature so conduction and convection will work against us by taking heat from the panel to the outside world. In a vacuum there is no material so no conduction and no convection can occur! The inside (collector surface) of a vacuum tube has no physical connection to the ambient air temperature outside and therefore cannot be affected by it. This allows the collector to continue to increase in temperature proportionally to the solar radiation which lands on it and limits the effect that conditions in the surrounding environment have on collector performance.

As the collectors can reach higher temperatures than the ambient surroundings, they are able to work well even in very cold climates providing solar radiation is available

The northern European climate still receives a fair amount of energy delivered from the suns rays as direct radiation and so by using vacuum technology in the design and construction of our solar collectors, we are able to utilise this energy with little variation in performance on colder days or high winds. In addition, due to the higher efficiencies that are available by using vacuum technology, our systems are also capable of utilising defused or secondary radiation energy, allowing the system to harvest solar energy even during overcast or cloudy conditions.

The ambient air temperature is negligible due the vacuum space created in the collector tube construction, both isolating and insulating the absorber area from the climatic environment. In the same way that radiation from the sun passes through the vacuum of space, it passes through the artificial vacuum between the layers in the tube and is captured by the absorbers selective coating. This energy is trapped in the collector and so increases its absorber surface temperature significantly. This trapped energy is conducted to the panel's internal manifold arrangement and transported away to be deposited elsewhere by forced convection, through our insulated and sealed circuit pipe work. This capture of light energy (radiation from the sun) is proportional to the light quality the panel is exposed to and can work with virtually no loss in efficiency to the collector in cold weather conditions.

Whilst being a top ten contender in the collector performance table, the LaZer2 collector also has additional technological advancements which set it apart from its competitors. Specifically addressing all areas of the system which contribute to combined system performance, and not just focusing on collector performance alone.

The LaZer2 collector's internal manifold has been developed to maximise efficiency when extracting the energy from the collectors with the minimum of losses. It incorporates among other things, a direct series manifold arrangement whereby each panel, comprising of 9 vacuum collector tubes, designed such that the heat transfer fluid passes through the length of each collector tube twice and all 9 tubes in turn, before it joins the flow pipe work stretch. This enables an enhanced temperature change in each circulation of the system. This also increases turbulence and surface area the fluid comes into contact with, within the collector's manifold and so enhances the efficiency of temperature exchange between the conducting profile, manifold U-tube and heat transfer fluid. This design enables the system to focus the energy towards the desired heat destination and reduce the retention of usable energy in the panel material mass, making the LaZer2 panel more thermally responsive.

APPLICATION & UTILITY

There are lots of ways that solar thermal energy can be used. The most common application is to heat water for washing and cleaning. This can be on domestic, commercial and industrial scales, with public buildings, businesses and homeowners cited as being in the best position to maximise the opportunities available. Hotels, hospitals, educational buildings, offices and factories are all typically looking to make savings to their running costs and often have very large demands for hot water provision.

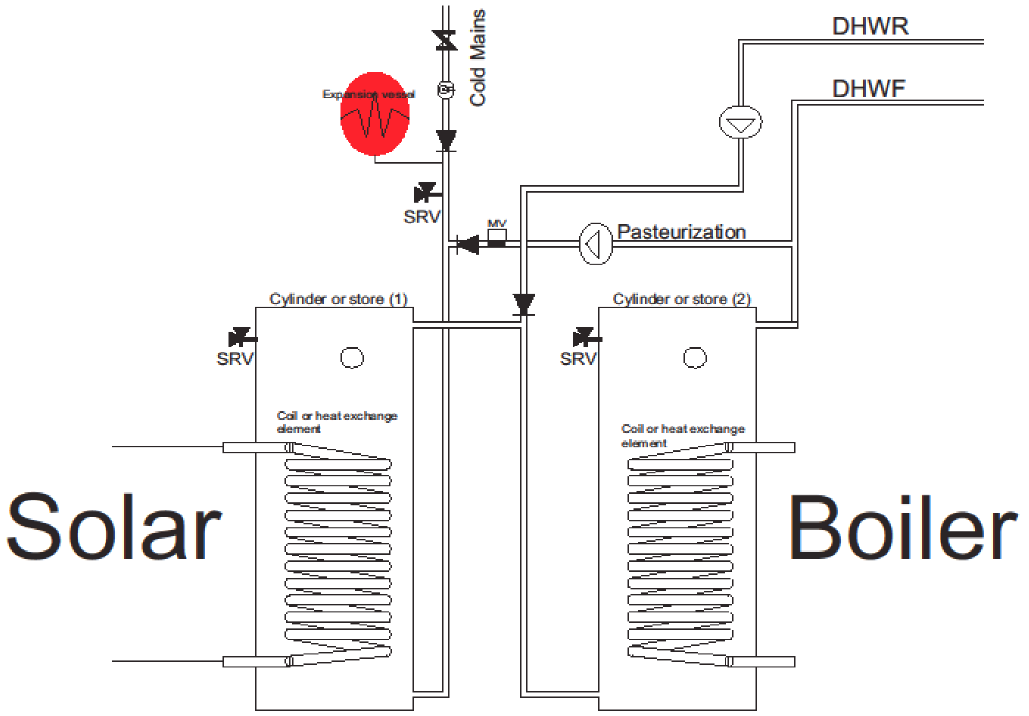
We have extensive experience in providing solutions for projects of this kind and due to the modular way in which the LaZer2 collector can be increased in number to suit energy demand characteristics; it is ideally suited to cater for both the smaller domestic installations as well as large scale commercial projects.

Other suitable applications include heating swimming pools and other large volumes of water such as for industrial processes.

The LaZer2 collector can be utilised in many ways. Typically, it is used to indirectly heat a stored water volume in a vessel via an internal coil, or it is used to heat the secondary water volume via a heat exchanger. In some instances, it is used to heat a heat storage medium/volume which in turn has further exchanges to either heat exchangers or extraction coils. Phase heating of different volumes of water is also possible depending on the application priorities and this is often referred to as pre-heating or buffering.

A typical solar hot water heating system consists of an indirect hot water cylinder, with internal heat exchange coils fitted for each of the heating circuits.

An alternative is to have a pre-heating/pre-feeding arrangement, whereby two vessels are installed in tandem. In this arrangement the flow of water passes through both cylinders, with heat input occurring in each in turn before going to the outlets (taps/showers). An example of how this can be achieved is shown here.



Pre-heat hot water heating

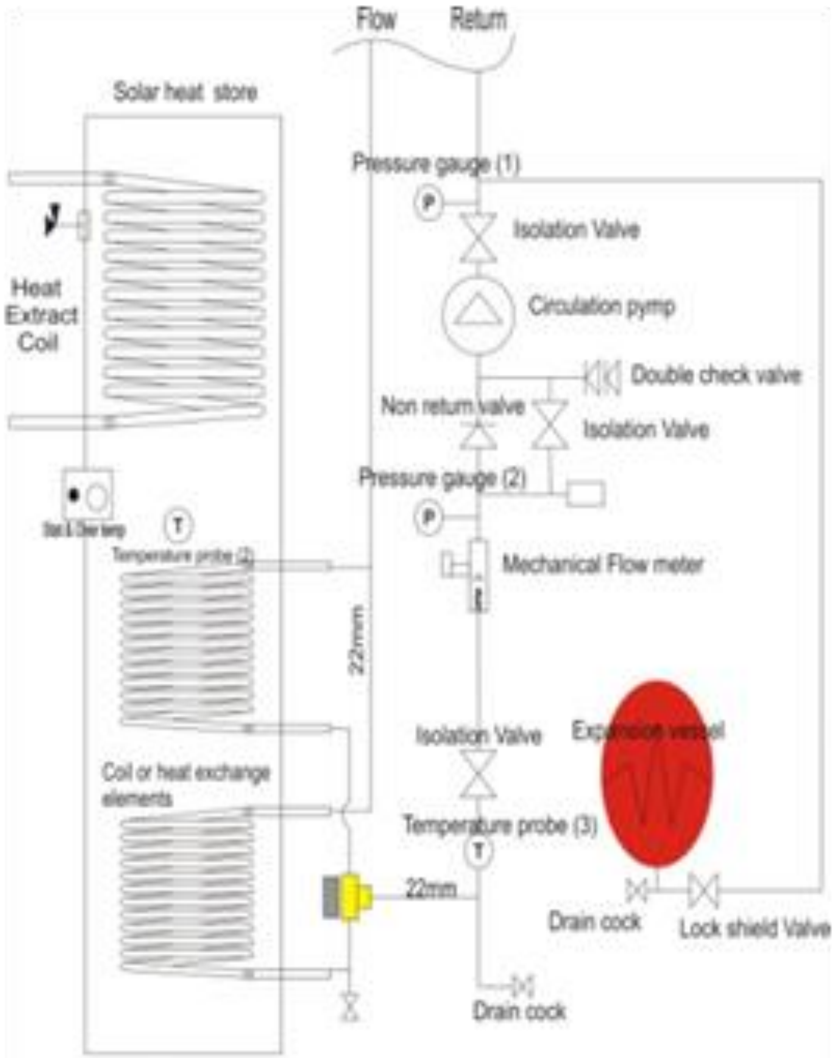
Heating swimming pools with the LaZer2 solar thermal system offers huge savings on energy costs compared with conventional fuels used to do this, and so these systems can achieve very short payback periods. The typically seasonal use of swimming pools in northern Europe makes pool heating with relatively few panels a very suitable application for this technology. A design with pool pumping and filtration equipment required for all swimming pools, coupled with an inline solar heat exchanger and a conventional inline boiler heat exchanger can be utilised.

The setting on the boiler system in this example would ensure the desired comfort level is reached whenever owner/user wishes to take a swim. The LaZer2 solar thermal system is able to utilise all available solar yield to heat the pool water and satisfy the boiler temperature control thermostat. This set up allows the heat input from the sun to be used to off-load the work otherwise done by the boiler, and to prevent additional heat from the boiler from being required for the majority of the time.

The LaZer2 system is versatile and can be used for all sorts of purposes. Heat stored for other purposes is common and bespoke service systems can be designed to lower running costs and offset CO^2 for many different client demands and objectives. Heat stores are popular for many reasons, but they are not ideally suited for providing the best performance for a standard domestic hot water system. Advantages they do have include hydraulic separation and multi utility flexibility.

Although some clients wish to use solar thermal technology to provide space heating, this application is not well suited to the characteristics of solar thermal technology. This is partly due to the nature of solar gains being most abundant during the low demand periods for space heating. The ability to achieve some benefit by contribution towards space heating is easily achievable, however as a viable space heating energy source, any solar thermal system would have to be dramatically over sized to satisfy demand during the coldest and darkest winter months and would therefore be in a constant state of over production during the bright summer and shoulder months.

This strategy of over sizing a system does not make financial sense, and so unless sufficient demand exists to constructively utilise or otherwise dump the energy available from the system during overproduction, the additional outlay required for the purchase, installation and maintenance of an oversized, un-proportionate system is not advocated.



Phase heated heat store

Where a logical sizing justification exists, it may then, in addition create opportunity to utilise the energy available in alternative but similarly effective ways. For example; we often encourage our clients to incorporate the capacity to heat domestic hot water when designing a system for heating a swimming pool, as this is a very sensible additional utilisation for the energy that will be available from the solar system.

Typically, we look to allocate between 55-85 litres of dedicated stored water to be heated by each m^2 of LaZer2 collector aperture, each day in an indirect hot water cylinder. This ratio is capable of producing between 55-85% of the HW demand anticipated in a domestic dwelling, depending on the inhabitant's usage patterns. Although variations in usage and weather conditions will account for variations in system performance, the LaZer2 Collector and system is capable of making the most effective use of the solar energy available at any given time. Many other system designs require a greater area of collector to stored water volume ratio to achieve similar results.

It is important to appreciate the capabilities and limitations of a well-designed solar system. Due to our modern expectations and the level of comfort we have become used to, the majority of solar thermal systems are connected to heat water with all available solar energy, whilst a secondary energy source is incorporated to ensure the desired temperature and recovery well-designed we have become used to are maintained. Solar thermal systems are designed to be super efficient, whilst traditional heat sources generally prioritise effectiveness over efficiency. As these traditional water heating systems are capable of heating water in a very short period of time and on demand, the heating characteristics of a well designed solar system is sometimes miss perceived as ineffective, immediately following a peak demand period or over night when solar gain is not available. Many traditional water heating systems have raised expectations by the almost instant release of energy from primarily nuclear power or fossil fuels allowing water to be heated instantly on demand. Quality solar thermal systems take into to account the duration of light energy available and the demand for hot water throughout the year and so are sized to achieve the desired heat input with the minimal of equipment outlay. Should an increase or decrease in the hot water demand occur the perceived effectiveness of the solar system can often be affected.

Depending on the priorities set by the client, and using the LaZer2 collector, we can tailor a system to best suit the needs of the buildings end users. And by working closely with mechanical and electrical consultants we regularly find the right balance between ensuring a building service provision is achieved with the minimal use of conventional fuel sources. Maximising the utility of free, environmentally friendly solar energy is of course advantageous to us all, but to what effect is still yet to be fully appreciated.

MOUNTING OPTIONS

The wide range of conditions presented by the projects encountered can be reduced to several types of mounting system by familiar characteristics.

Pitched roofs

Here is a sample of the typical pitched roof fixings available for the LaZer2 collector.

- Truss Straps for tiles
- Wood to metal dowels
- Seam Clamps for seam roofs
- Top hat profile for composite sheet roofs

Due to the vast diversity of pitched roofing materials and systems, we employ various methods of securing equipment in place. It is of course paramount that we transfer loads safely to the structure without compromising the integrity of the construction envelope. This is why we invariably attempt to pass through the tile courses, fixing directly to the load bearing structure without impeding the tiles' function. Due to the wide range of tile types that we encounter, we have several profiles of fixing brackets in our arsenal. Typically, they will be made from either; stainless steel, or aluminium, this is for strength and longevity and in each case will be tested to be fit for purpose. Due to the nature of certain roof coverings, it is necessary in some instances to penetrate roofing materials. This can be done carefully following our tried and tested methods to ensure the resulting integration of materials, continues to perform as well as it did prior to the penetration being undertaken.

Flat roof, Free standing or ground mounted

The LaZer2 collectors can be mounted in many ways. The modular design makes them very versatile and system sizing is increased in multiples of panel units. The panel units can be arranged in numerous ways, as can be seen in the photographs on the next page.

Flat roof options

There are two options available when planning to install collectors to a flat roof top. These are either; to fix them to the construction in some way, Or, to use an arrangement of carefully calculated ballast material, positioned to resist the wind loading conditions possible in the installation location. We have had extensive experience is providing solutions that work well in both situations. The loading of a structure and the feasibility of achieving a suitable fixing are the main influences effecting which option is most suitable for the project in hand.

The additional ballast loading is not extreme due to the tubular nature of the collectors allowing wind to pass between them, however it can be an issue for close consideration, particularly if being implemented on a retrofit/refurbishment of an existing building or applying this technology to a building in the late stages of design/construction. Fixed flat roof arrays require physical connection to the building by high tensile bolts or other positive secured fixings such as clamps. Examples are shown on the next page of some previously completed installations.

Ballasted arrays

These are popular because they don't require any fixings to be passed through the finished roof materials. Providing the structure and roof covering material is suitable, this tends to be the favoured method of ensuring collectors can resist wind loading and so remain in the position intended. It is common to use sacrificial layers of material to separate the ballast blocks from the roof coverings, in order to avoid wear and tear otherwise caused through different rates of thermal expansion.

Ground mounting options

These can include ballast but more commonly incorporate ground mounting posts which are driven into the ground like piles. The benefits of this system are that it can be used on land with no permanent environmental effects. Options extras include a terram and shingle covered area below the panels to ensure low maintenance by removing the need to trim weeds and grasses under and around the ground mounted panel arrays.

Tracked Arrays

The LaZer2 collectors can be supplied along with a bespoke solar tracking system which can achieve unparalleled performance when compared with alternative arrangements. These systems are suited to overcome space limitations by maximising the yield from fewer panels. This system is expensive due to the equipment required and additional maintenance involved, but may be the only option in certain circumstances where the requirement to achieve a given yield from renewable sources is paramount to a projects viability. Here are some example photographs of systems we have installed in the past.

General

We have extensive experience with various building types, materials and fixing systems. We are able to engineer bespoke options for unique projects as well as share the benefit of this experience with any designers or specifies at the

earliest stages of a new project or retrofit. We are also keen to keep our eyes open to new and improved technology, and so will often work closely with designers and roofing specialists to make sure where possible that we use brand compatible materials and systems to maintain existing warrantees and ensure compatibility.

We can provide structural loading calculations if the client is not cost-effective to undertake these checks. We are insured to carry out design work, however we are happy to provide product specific design input and support to an overall building/project design, as this can sometimes be the most cost-effective option for our clients representative, depending on the structure of the project or contract. LaZer2 collectors can be hung vertically from a wall or laid flat with a lower reduction in performance than would result from doing this with alternative designs of collector.

DESIGN & INSTALLATION

The LaZer2 thermal collector is often selected by clients and architects because the aesthetic appearance compliments its performance. This visual aspect greatly enhances the products appeal to project planners of all types.

- Neutral black and navy-blue finish of all externally visible components
- Horizontal tube arrangement - often more in keeping with traditional/ existing roof materials and building lines
- Concealed through roof penetration system
- No exposed connection pipe work for a very tidy appearance

The ease of installation is always an influential factor for suppliers and installers, as this leads directly towards consistency of performance between systems, and a reduction of variables which could otherwise detriment the successful completion of a project. Some of the main attractions of the LaZer2 collector which enhance the flexibility are as follows

- Straightforward and robust mounting systems
- Simple, durable, tried & tested, single through roof penetration system
- Can be mounted flat on a roof, through to vertically on a wall, with very little reduction in performance
- Unique butterfly arrangement enables installation of collectors in narrow roof areas
- Can be installed in spaces where other collectors cannot
- Roof mounting and panel manifold kits available with the collectors.
- Complete system supplied as a package if desired, containing all essential components.
- Modular, 9 tube collector design is intended to be manageable in transit and installation. It can be safely handled by two healthy individuals. System sizes are increased by multiples of this modular unit size.

SIZING A SYSTEM

To specify the size of a system we use the results from extensive testing, and the experience gained through the review of previously installed systems, to apply understanding to various system designs. Some general rules of thumb can be seen at the bottom of this section. Please be aware that these may not be ideally suited to all scenarios, and so it is important to understand the demands and usage patterns of the building and its occupants before committing to specifying volumes and quantities of equipment.

Assistance to do this can be sought from our specification engineers and technical review staff who are available for consultation on such matters to the benefit of project planners of all types. It is advised that the details of any project enquiries be sent to our team, who will offer the best product specific solution based on the information available at the time.

As with all projects, success often relies on the priorities of the intended design being clearly defined in order that these can be married with the operational characteristics of solar thermal technology, to achieve the best performance from the resulting integration of systems we can help with establishing clarity of design objectives if this is something which is not already clear.

Factors that often influence the sizing of a system, which are often divisive to the performance targets of a text book system include; space limitations of plant areas, planning and building regulations targets which stipulate a percentage/quantity of energy to be achieved from renewable sources, and the peak demand and recovery target rates required of conventional fossil fuel fired systems which can remain un exercised compared with the sporadic and cyclical solar yield characteristics which can reach and exceed their design capabilities on a regular basis in correlation with the weather conditions.

A typical LaZer2 system is capable of producing somewhere between 55-65% of the energy required for heating hot water each year in domestic buildings and typically achieve a payback period through energy savings alone of between 8-12 years. With a design life which well exceeds 25 years, this makes for a very viable addition to any building regardless of additional; moral, environmental and financial motives which may effect someone’s discussion. Some customers who are more aware of the system characteristics and can be more flexible with their water usage patterns are able to avoid using any other heat source for the majority of the year.

In buildings where the demand requirements are prioritised over the availability of free renewable energy, such as hospitals and commercial food preparation facilities, it is common that the supply of hot water on demand is ensured by conventional means whilst the solar is set up as a supplementary system to offset the maximum amount of fuel it can for the initial investment.

The first item to tackle when sizing a system for domestic premises is what the stored hot water volume should be. This will typically be 180ltrs<250ltrs in most 2-4 bed homes in the UK. It would be recommended that any replacement cylinder be sized in accordance with this convention. For this size range of hot water system it would be recommended that 2<3 LaZer2 collectors be installed to heat the stored volume via an internal lower coil and the conventional heat source (boiler) be connected to provide supplementary/backup heating via a second internal upper coil. This format is most appropriate for homes and assumes that the cylinder volume will be drawn off and refilled for the most part on a daily basis. This approach can be scaled up for larger buildings such as university halls of residence, hotels or apartment blocks with centralised plant, as the typical volumes and usage patterns are comparable with self contained domestic properties, although being generally, slightly higher in hotels than homes.

In offices and educational buildings, the use of hot water is likely to be slightly different and for the most part will be during normal working hours. The volumes used for cleaning and in catering facilities will become the peak demands and had washing facilities will make up the remaining demands. The size of the solar system will revolve around the realistic daily quantity of hot water used by the building, and the number of collectors will be chosen in order that this volume is heated to the desired temperature on a daily basis for the majority of the year.

Because the design of the LaZer2 collector is such that the variation in performance throughout the year is due to the number of daylight hours and the clarity of light available, there are inevitably differences between the winter months and the rest of the year. The sizing of the system must take into account this and accept that in the winter months there may be a need to supplement solar heat with a conventional heat source, and in the summer the yield may exceed the demand on occasion.

It is important to get the balance right so as to provide as much of the hot water possible without losing efficiency through the system preventing the use of available solar energy because the stored hot water is too hot to apply further heating to it.

There is a balance between efficiency and effectiveness that needs to be evaluated and targeted when considering the number of panels and volume of water to be heated.

Effectiveness = the volume of water achieving or exceeding the desired minimum temperature in line with the demands of the occupants of the building.

Efficiency = putting to best effect, all the energy available from the sun in order to offset the maximum amount of energy otherwise obtained from conventional fuel sources, for the minimum of equipment cost.

Where the maximum amount of energy available from the varying environmental conditions is utilised with no excessive outlay on solar equipment which would otherwise provide excess energy unused when it exceeds demand. Alternative models can be achieved depending on design priorities and the cost and practicality of alternative energy sources to supplement and ensure the typical usage demand is satisfied.

Where the balance between the number of collectors (which equate to approx 1m² each) and the stored water volume falls below 65ltrs/m² there is a likelihood of an unusable surplus of solar energy, produced from the equipment during the summer months. This problem can be overcome if the design takes into account that the volume used each day is greater than 65ltrs/day resulting in a larger volume to be heated by solar each day. On the other hand if the stored volume exceeds 85ltrs/day/m² of collector, then the system is less likely to achieve the required usable temperature other than in idyllic conditions during the summer months.

The angle and elevation of panels will have an effect on the yield achievable from any collector when generally speaking. Here we have a good depiction of how the angle and azimuth of a typical collector might be effected. The LaZer2 collector with its horizontal tubular collector surface is able to be installed with more flexibility than many other collectors, with less reduction in performance, as the collectors are positioned further away from the typically accepted ideal of due south and elevated to between 25 degrees and 45 degrees.

In buildings where the temperature of a volume of water is required to be constant for the hot water system to work effectively, such as in some systems which incorporate heat stores or where legionella threats are considered very high. It is not very effective to incorporate solar thermal technology without having a rethink of the existing system design. This is because the capacity for solar to add heat to water is not available if the water is already at the maximum safe temperature allowed by the system.

The efficiency of the solar system is enhanced by a daily draw off and replacement of the cylinder volume with cooler water. In hospitals and other types of public service buildings which have this scenario, the LaZer2 system can be configured to pre-heat water which enters the primary calorifier, allowing the primary calorifier and secondary return circuits to operate at higher temperatures between peak demand periods. Due to the slower temperature recovery rate of solar heated water compared with other heat sources, and the lower differential temperature between the primary and secondary sides of the solar heat input exchanger, stratification is often utilised to allow the hottest water to be available to the outlets whilst the coolest water to be introduced and remain near the heat input location for longer. Many industrial or commercial hot water systems incorporate de-stratification in order to enhance the volume of water available for use and reduce the potential for bacterial hazards. The LaZer2 system can be configured to achieve these priorities whilst also enabling the solar to work effectively providing some basic changes are made to the conventional hot water systems operation philosophy, and the volumetric demands of the property are attainable within the confines of the plant location.

When designing a system for heating a swimming pool it is again important to consider the intended result related to the achievable performance of different sizes of system. Here in the UK, for a typical below ground swimming pool of modern construction, average depth 1.5m, 30% of the pool surface area would be sufficient to provide a suitable level of heat input to reach desirable temperatures (26<30°C) for what is considered to be the average British swimming season (May to September). For pools with no other heat source, or pools with constructed such that greater than average temperature losses will be experienced, it is recommended that the percentage be increased to 50% or the surface area. Indoor pools which are well insulated (modern) it can be sufficient to reduce the area of solar collectors to as low as 15<25% of the surface area. Often budget will affect the size of system chosen, but heating swimming pools can often be the most efficient use of solar thermal technology due to the relatively large, costly, energy losses they experience and large volume of water they contain. This makes the thermal characteristics of the solar thermal system perfect for swimming pool heating and will enable very good efficiency to be achieved.

Solar UK, established 2000, brings a breadth of knowledge and experience to help deliver your new energy project.

We are CHAS Elite, MCS, Trustmark and NICEIC-accredited suppliers and installers, with in-house R&D, design, and technical support.

We employ our own installations team, working with trusted sub-contracted labour when there is a need, ensuring that they always work to our standards and under our management.

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