

# SOLAR THERMAL NOW

A guide for domestic, business & public sector investors

How new energy  
labelling can help  
you decide





*Cover photo: Combined installation of Viridian Solar thermal and PV panels by AES Solar, Torridon.*

*This page: Solar thermal on a waste water treatment plant, Germany.  
Photo © Kingspan*

# INTRODUCTION

**This guide aims to inform potential investors in solar thermal, and its related technologies, of the merits of this technology and how the new LabelPackA+ label can help to inform and improve investment decisions for schemes up to 70kW in size.**

Whether you're a homeowner going green, a local authority or social housing provider looking to reduce energy bills for homes in fuel poverty, or a company that has decided to reduce the environmental impact of your production line, this guide will help you get the most out of solar thermal and modern labelling systems.

These days there are lots of opportunities to engineer solar thermal alongside other technologies, such as combi-boilers, solar power and heat pumps, to deliver maximum benefits. The LabelPackA+ label will help you to decide which solution for space and water heating is going to be the best for your needs and budget. By understanding the LabelPackA+ label you can:

- **Make better informed decisions**
- **Choose the most efficient heating solution for you within your budget**
- **Maximise reductions in your energy bills**
- **Better protect your environment**

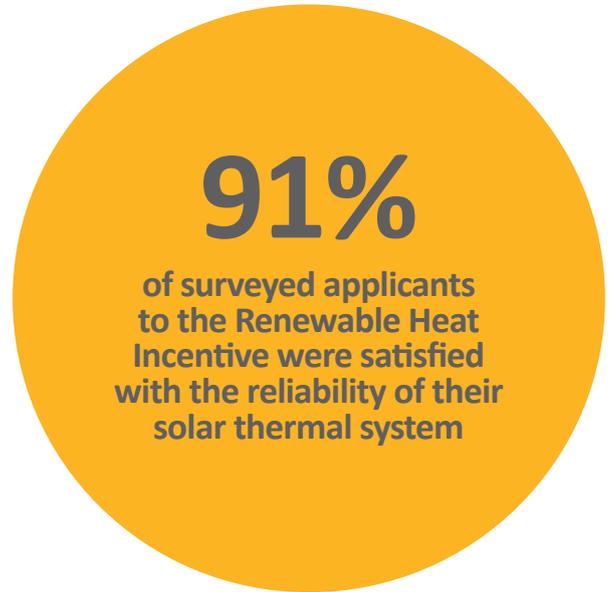


Photo © AES Solar

*AES Endurance Collectors provide hot water for this private house in the Highlands of Scotland.*



Photo © CoolSky

*The accommodation block at this Royal Airforce base features 23kW of Apricus/CoolSky Ltd evacuated tube solar collectors. It is expected to provide over 50% of the residents' hot water requirements over the year.*

# WHAT CAN SOLAR THERMAL DO FOR YOU?

Solar thermal is a mature technology which enables heat needs to be met efficiently onsite, reaching conversion efficiencies of 40-70%<sup>1</sup>. This reliable technology also safeguards air quality and produces no carbon emissions. Government research shows that solar thermal is one of the most secure renewable heat investments with an extremely high satisfaction rate among domestic customers<sup>2</sup>.

Around half of global energy is used for heating, which is vital for comfort in buildings, for sanitation and for industrial processes. Domestic homes account for just over half of UK energy demand and nearly two-thirds of this is for heating, with domestic hot water accounting for around 10-15%. Solar thermal is commonly used in the UK for meeting hot water

needs, but it is popular across Europe for space heating too. Most domestic and commercial applications of solar thermal require low to medium temperature ranges, but temperatures can reach well in excess of 200°C which enables a wide range of industrial processes.

1 [https://www.imperial.ac.uk/media/imperial-college/grantham-institute/public/publications/briefing-papers/2679\\_Briefing-P-22-Solar-heat\\_web.pdf](https://www.imperial.ac.uk/media/imperial-college/grantham-institute/public/publications/briefing-papers/2679_Briefing-P-22-Solar-heat_web.pdf)  
2 [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/642097/Domestic\\_Census\\_waves\\_1-24.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/642097/Domestic_Census_waves_1-24.pdf)



*This modern new home elegantly incorporates flat plate solar collectors in the roof.*

Photo © Viridian Solar

The new **LabelPackA+ energy label** has been compulsory since the 26th of September 2015. It now has to be issued by **all dealers and installers** of space and water heaters, combinations of both, as well as for storage tanks.

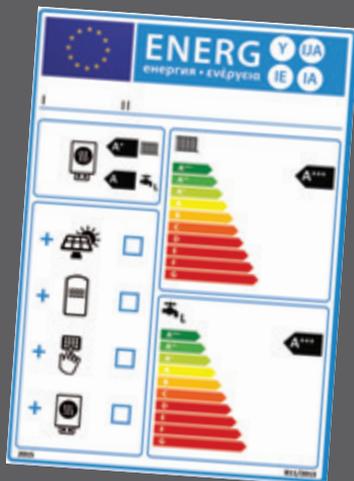
Like the existing labels for washing machines and refrigerators, the efficiency classes range from G to A+++. Most people are familiar with these labels and the benefits they provide.

The most relevant and innovative aspect introduced by the LabelPackA+ regulation is the **package label** that applies to **heating systems composed of more than one product**. The label therefore allows you to understand how your solar thermal system will work alongside other technologies, such as a combination boiler, a heat-pump, or solar PV. A bespoke **package fiche** has to be issued by your potential installer alongside the label which will contain detailed technical information on the appliances that constitute the package, such as the main heating efficiency, as well as the overall energy efficiency of the technology package.

The new label also highlights the importance of renewable energy, especially solar thermal, for heating.

## The label at a glance

- It is compulsory to label most space and water heating products, combinations and product packages up to 70 kW heating capacity!
- The energy efficiency classes ranges from G (lowest) to A+++ (highest).
- The label has to be shown to the customer together with the commercial offer!
- It offers new sales arguments for the dealer or installer for energy efficient solutions, especially those highly efficient ones including renewable energy, as it helps the customer make an informed choice and reduce energy costs!



## Which heating products have to be labelled?

### Space heaters / combination heaters for space heating and hot water

- Boiler space heaters based on gas, oil, electricity
- with cogeneration
- with heat pumps, incl. low temperature heat pumps
- Including components with packages: temperature controllers, solar system, hot water storage tanks, other devices

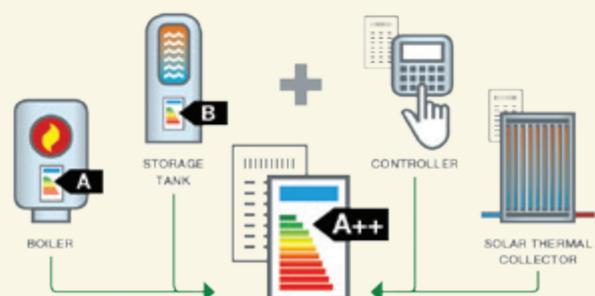
### Hot water heaters

- based on gas, electricity
- solar driven
- heat pump driven
- Including components with packages: temperature controllers, solar systems, hot water storage tanks, other devices

### Hot water storage tanks

## What is a heating package?

A “package” refers to combinations of a boiler and additional components like a storage tank, a solar thermal system, a controller or heat pumps. The package is usually more energy efficient than just a standalone boiler and this has to be reflected by the label.



# DOMESTIC HOMES

The potential contribution of solar thermal to energy savings through hot water heating becomes increasingly significant over time as our homes become better insulated. This means hot water represents an increasing share of home energy use. Today, on average, water heating makes up 20-30% of total domestic gas bills. Normally you would expect to save between 30-70% of your annual water heating costs with a solar thermal system. If you carefully follow the installer's advice, higher savings can be obtained.

Solar thermal can be used on the widest possible number of homes, including smaller, urban homes as it requires relatively little roof space and it incurs negligible on-going expenditure to operate. Solar collectors can work even if it's freezing cold. All they need is daylight and we get enough of that even on a cloudy day. An antifreeze solution circulates around the loop of an indirect solar thermal system protecting it from sub-zero temperatures.

## Key types of solar thermal collector

### Flat plate collectors

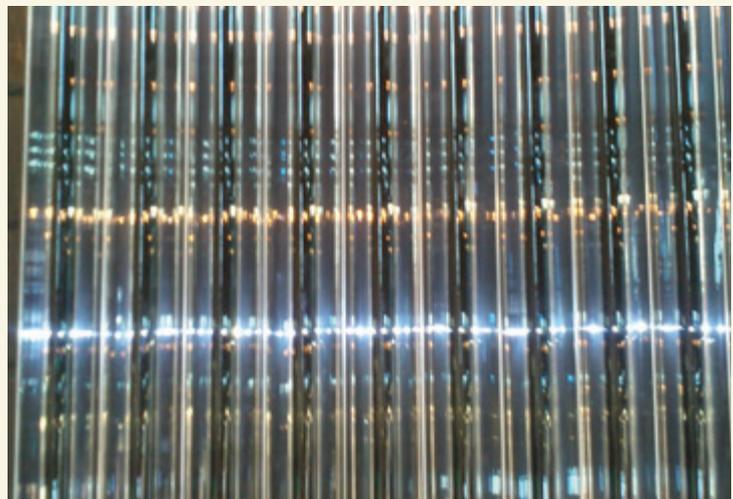
These are based on a thin heat absorber sheet, usually copper or aluminium, backed by a tubing system to carry fluids. They are relatively thin, highly insulated with a glass cover on the front. They are cost effective, with a range of mounting options and can reach efficiencies of 75-80%. They can be fitted on top of existing roof tiles, or in new-build or roof replacements where they can be integrated into roof tiles.



Flat plat solar thermal collector on a slate roof. Photo © Viridian Solar.

### Evacuated tube collectors

A vacuum between glass tubing provides extremely efficient insulation and evacuated tubes can reach very high temperatures. There are two different categories of evacuated tube (direct flow and heat pipe). Both are similar in appearance but work in different ways. Heat pipe evacuated tubes can only be installed vertically but direct flow tubes can be installed vertically or horizontally.



Caption: Evacuated tube collectors. Photo © Leonie Greene.

## The Renewable Heat Incentive (RHI)

Domestic solar thermal systems for hot water production are eligible for the Renewable Heat Incentive. This is the Government support scheme that enables home owners and landlords to invest in renewable heat technologies like solar thermal. Uniquely within the RHI solar thermal is also eligible for support as a second technology, if installed in combination with biomass or heat pumps. This means the home owner will get support for both systems.

Eligible schemes receive payments every three months for seven years. To be eligible you will need a valid Energy Performance Certificate i.e. no more than two years old, and you must have installed loft and cavity wall insulation if your EPC recommends you do this.

You will also need to purchase a system accredited by the Microgeneration Certification Scheme (MCS) or the CEN Solar Keymark Scheme, to be installed by an MCS certified installer. Payments are based on the estimated annual generation listed on your Microgeneration Certification Scheme Certificate, which will reflect household size. You can then apply for the RHI to the energy regulator, Ofgem within 12 months of your system being commissioned.

It is important to note that there are also solar thermal systems that can contribute to space heating, though unfortunately, along with PV-T (in which solar thermal and solar PV are combined), these are not eligible for Government support in the UK.

Solar thermal means an abundant supply of hot water. It can extend the life span of your boiler, because for most of the year your boiler will be used little. From March to September, solar will provide most of your water heating needs and then it will make a lower contribution during the winter months. If designed and sized accordingly, a solar thermal system can provide a contribution to your space heating (ideally through an under-floor heating system working at lower temperatures than traditional wall mounted radiators). However, you would need a hot water cylinder of around 600 litres minimum (preferably 1200-1500 litres) and a far greater collector area on your roof.

### Solar thermal works with Combi boilers!

Combination (combi) boilers that provide hot water on demand have become increasingly prevalent in the UK. 80% of all new boilers sold in the UK are combis. According to the English Housing Survey 2012, 32% of all homes now have a combi boiler<sup>3</sup>. It is a common misconception that solar thermal cannot be combined with combi boilers. Solar Trade Association manufacturer members have developed novel and unique solutions to this UK specific challenge that will allow a wider adoption of solar thermal with combi-boilers already installed throughout the UK. Major manufacturers like Worcester Bosch and Veissmann offer combi boilers that can accept preheated water from solar thermal systems.

“ Solar thermal can be used on the widest possible number of homes



3 <https://www.gov.uk/government/statistics/english-housing-survey-2012-energy-efficiency-of-english-housing-report>

# SOCIAL HOUSING

## Exceptional for tackling fuel poverty

Solar thermal is unique among renewable heating options in presenting negligible ongoing running costs – the electrical cost of running a solar thermal system is only around £7 per annum. This is a particularly important consideration for more vulnerable households. Solar thermal also has a very low risk of developing a fault over the system's lifetime. For these reasons it is a perfect match for tackling fuel poverty in social housing, where the RHI can support the cost of installation while residents benefit from much cheaper overall hot water costs.

There are further reasons why solar thermal is such a popular choice for social housing providers. Hot water use is often more significant in social housing due to high occupancy rates. Fuel poverty is concentrated in rural areas which are more likely to be off the gas grid. Solar thermal is a particularly attractive option economically when displacing oil heating in off-grid properties.

Less able-to-pay households are also more likely to live in homes with lower levels of insulation. RHI eligibility depends on meeting basic energy efficiency standards, but the performance of a solar thermal system is not dependent upon further, potentially expensive efficiency upgrades to a property. This means social landlords can use solar thermal to improve domestic comfort for vulnerable homes without major expenditure or disruption. Looking ahead, solar thermal can provide synergies with refurbishments funded under the ECO programme, which is now targeting fuel poverty.

Social landlords can apply for the RHI. Separate applications need to be made by an Authorised Representative for all properties and an EPC less than 24 months old. Authorised Representatives must be a signatory to the bank account into which the RHI payments will be made. However, after the first application, subsequent applications can be processed quickly.



Photo © Viridian Solar

*Development of 124 homes in Sunderland built to Code for Sustainable Homes Level 3 in 2009 by Gentoo, a social landlord. Panels are roof-integrated with flat concrete interlocking tile.*

# NEW BUILD

It is in the new build context that the new LabelPackA+ label comes into its own because the label shows how heating systems can be optimally designed from the outset. For the first time, the package label allows all housing developers or self-builders to understand the energy efficiency of a system combining several devices. Furthermore, this package label illustrates the overall efficiency of the system when combined with renewable energy systems, such as solar thermal.

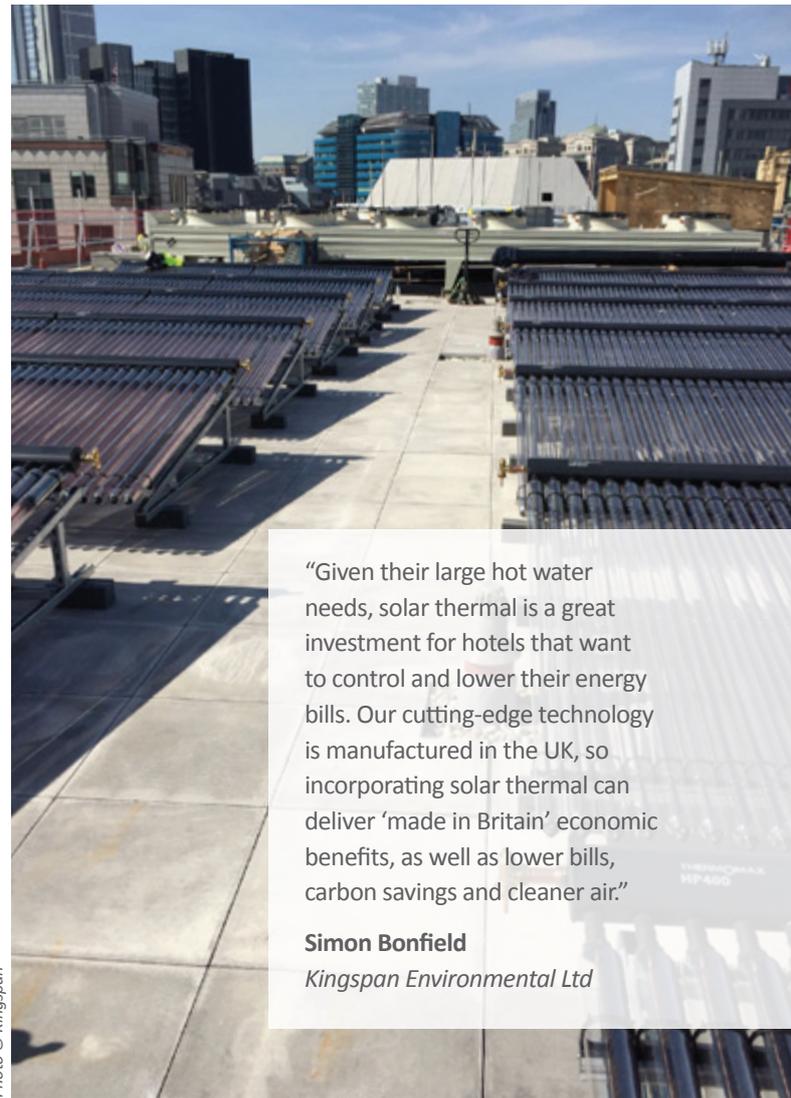
Solar thermal makes good economic sense in new buildings. While new build systems are not eligible for the RHI, solar thermal helps new properties to meet national or regional buildings performance standards cost-effectively. In the new build context scaffolding is already on site, together with skilled labour. Purchasing systems in volume can facilitate further cost reductions. For homes installing hot water cylinders, these require only an extra heating coil (at negligible cost) to be solar thermal ready.

Modern solar thermal systems take up modest roof space and can be very elegant as the examples in this guide demonstrate. Solar thermal can be successfully installed not only in individual homes, but on flats and commercial properties such as hotels.



Photo © Viridian Solar

## A modern hotel in the most prestigious location



“Given their large hot water needs, solar thermal is a great investment for hotels that want to control and lower their energy bills. Our cutting-edge technology is manufactured in the UK, so incorporating solar thermal can deliver ‘made in Britain’ economic benefits, as well as lower bills, carbon savings and cleaner air.”

**Simon Bonfield**  
*Kingspan Environmental Ltd*

Photo © Kingspan

This large solar thermal system has been installed by Kingspan on the roof of the prestigious 100 Minories Hotel, currently under construction by the Tower of London. The solar thermal system has been installed at a specific angle to ensure that it is not visible in an important viewing plane from Tower Bridge. The hotel, owned by the Grange Hotel Group, features 122m<sup>2</sup> of evacuated tube solar thermal, generating 82MWh per annum, enough to provide 9,000 litres of hot water a day which will meet half of the hot water needs of this 268 bedroom hotel. Incorporating solar thermal and other renewable technologies wherever possible will help the London Government to meet its clean energy and clean air targets.

# PUBLIC BUILDINGS, LEISURE & HEALTH CENTRES

Solar thermal is particularly well suited to public sector buildings such as leisure and health centres given their high demand for hot water, and available roof space. As well as providing hot water for cleaning, sterilising and showering, solar thermal is a particularly efficient technology for heating swimming pools.

Where solar thermal has been installed, this reliable technology reduces energy bills and helps the public sector to meet their energy efficiency and carbon objectives, such as the Energy Savings Opportunity Scheme (ESOS).

The Grade II listed Bristol Lido, the oldest lido in the country, has been transformed into a model of energy efficiency following a two-year restoration. The complex, including a 24-metre open-air swimming pool, now features Thermomax, one of the highest performing solar thermal collectors in the world, which generate up to 70% of the lido's annual hot water needs. The solar collectors allow the cost-effective heating of

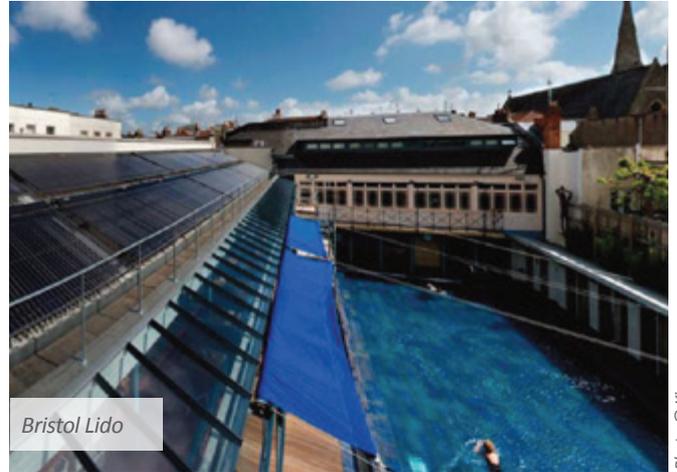


Photo © Kingspan

water, whilst helping reduce carbon emissions in the process. Its 720 solar tubes generate a massive amount of energy, heating three 500-litre cylinders, for showering, as well as the swimming pool.



South Liverpool Health Treatment Centre. 44% of the energy needs for this modern health facility are met onsite by renewable energy. Hidden on the main roof is a solar thermal system that meets much of the hot water needs of the centre. The centre also benefits from ground source heat pumps, drawing heat from six boreholes, each 150 metres deep. Demonstrating how compatible solar thermal is with other renewables, in summer the heat pumps are switched over to provide cooling while solar thermal is relied on to meet the centre's hot water needs. This striking building meets the BREEMA Healthcare Excellent rating.

Photo © Buttress Architects

# INDUSTRIAL PROCESSES AND FARMING

Solar thermal technology continues to develop and it offers tremendous potential for decarbonising industrial process heating, which accounts for over two-thirds of total energy consumption in industry. Analysis by IRENA<sup>4</sup> shows that solar thermal could technically meet half of heat demand in the industrial sector. New advanced collector designs of ultra-high vacuum flat plate and evacuated tubes with concentrators can generate temperatures up to 200°C.

Half of industrial heating requirements are for medium to low temperature processes, such as washing, drying, pasteurising and sterilising. Much of this can be met by existing solar thermal technologies. This makes solar thermal well suited to sectors where most of their heating needs are below 250°C, such as in the food and drink sectors, transport, textiles, paper, chemicals, pharmaceuticals and the tourism industries.

Dairy industries and industrial farming, in particular fruit processing, use solar thermal process steam for cleaning and solar air heating for crop drying. Active systems, which control air flow using fans, can reduce drying times by a third.

This 500-acre organic dairy farm in Wales installed 180 Kingspan solar thermal vacuum tubes, which generate enough hot water to meet the farm's demanding cleaning requirements. The system is already reporting significant savings for the farm, producing around 10,000kWh of heat per year with annual savings of around £1,500.



Welsh Dairy farm

Industrial systems up to 200kW in size are eligible for the RHI in the UK. In addition, many solar thermal systems are eligible for an Enhance Capital Allowance which enables companies to claim a capital allowance on the investment against taxable profits.

## Warming water for the Guinness Brewery and Teelings Whiskey Group



Guinness Brewery, Dundalk

The Great Northern Brewery in Dundalk, the second largest brewery in Ireland, owned by the Guinness Company, installed solar thermal technology to meet its hot water needs and reduce its running costs – as well as its carbon footprint. A solar thermal system was tailored by Kingspan to the exact requirements of the brewery, using 80 Thermomax Heat Pipe evacuated tubes to help provide hot water from dawn till dusk, all year round. The brewery has since been acquired by Teelings Whiskey Group and converted into a distillery, which retains the solar thermal within its heating system.

<sup>4</sup> [http://www.irena.org/DocumentDownloads/Publications/IRENA\\_ETSAP\\_Tech\\_Brief\\_E21\\_Solar\\_Heat\\_Industrial\\_2015.pdf](http://www.irena.org/DocumentDownloads/Publications/IRENA_ETSAP_Tech_Brief_E21_Solar_Heat_Industrial_2015.pdf)

# DISTRICT HEATING

Solar district heating plants are large-scale solar thermal systems which feed into district heating networks. In warmer periods they can totally displace other heating sources. It is also possible to store heat for winter use. The potential for community-scale solar thermal is increasingly recognised across Europe, particularly in Denmark which has well established district heating networks and where solar district heating is growing at a rapid rate.

The Department for Business, Energy and Industrial Strategy is providing funding to help extend district heating networks.

A district heating system incorporating 2,000 square metres of solar thermal has been trialled in the UK at Cranbrook, to the east of Exeter. The project will demonstrate how solar thermal technology can combine with the existing Combined Heat and Power plant to provide lower cost and low carbon space heating and hot water.

100% renewable district heating schemes are achievable today as the innovative EU SUNSTORE4 project at Marstal in Denmark demonstrates. 15,000m<sup>2</sup> of solar thermal have been combined with a wood chip boiler, a heat pump and a heat

store to provide Marstal with clean heat throughout the year. Solar thermal works in cold temperatures and starts to warm the heat store from February.

One of the world's largest solar thermal plants is in the Danish town of Silkeborg (below). This huge 110MWth solar plant, developed by Acron-Sunmark, heats 2.7 million litres of water every hour. It meets a fifth of the heating demand of the district heating network that serves this town of 43,000 people. The municipality of Silkeborg Forsyning has a goal of producing only carbon-neutral heat from 2030.

“ The potential for community-scale solar thermal is increasingly recognised across Europe



# COMBINATIONS WITH OTHER TECHNOLOGIES

There is increasing innovation through engineering renewable technologies together to improve overall outcomes in terms of energy and carbon savings. The LabelPackA+ package label enables investors to better understand how technologies can best be engineered together.

## PV-T

PV-T is an emerging energy generating technology with the ability to produce heat as well as electrical energy, combining both solar photovoltaics and solar thermal technologies in one module. Solar PV can work less efficiently at higher temperatures so wicking heat away through a combined thermal system can improve the efficiency of the solar PV. PV-T panels can be particularly useful where roof space is at a premium as the energy yield per square meter can be higher than that of installing solar PV and/or solar thermal panels separately.



Photo © NTD

PV-T installation

## Heat pumps & solar thermal

Heat pumps with high efficiencies, often described by a seasonal performance factor (SPF), work well with solar thermal. A heat pump with an SPF of 3 would use one unit of electricity to produce an average of three units of heat over the course of the year. A study by HSR Hochschule für Technik, in Switzerland<sup>5</sup> shows that solar thermal can complement a heat pump system across a variety of European climates. Interestingly, the greatest increases in heat pump efficiency, when combined with solar thermal, are in colder, northern climates.

Heat pumps work most efficiently in well-insulated homes providing lower temperature heating. They are therefore often used as part of an underfloor heating system which radiates at lower temperatures. Integrating solar thermal into the heating system to provide the higher heating requirements for hot water can ensure the heat pump can focus on lower temperatures, working at optimal efficiency. The whole heating system is therefore more efficient and lasts longer, while being cheaper to run.

## Biomass & solar thermal

Biomass boilers are often combined with large thermal stores and can be most efficient when running at high capacity for prolonged periods. In the summer months, however, the start-up energy required to get the whole boiler and flue up to temperature to provide only bursts of domestic hot water can mean costly inefficiency. This type of heating system is therefore strongly complimented by solar thermal which can easily provide hot water over the warmer months when the boiler is not required for space heating.

With most heating systems, the amount of energy used for space heating compared to domestic hot water is changing. Better building materials, technologies and regulations are leading to space heating being required for less of the spring and autumn. Solar thermal is therefore perfectly suited to provide more hot water requirements, for more of the year.



Photo © AES Solar/Viridian Solar

Integrated PV & solar thermal

5 <http://spf.hsr.ch/fileadmin/daten/publ/euro98uf.pdf>

*AES solar thermal helps to heat the water in this local authority swimming pool in Forres, Scotland. Photo © AES Solar.*





Find out more about the new LabelPackA+ energy product labelling at:

<http://www.label-pack-a-plus.eu/uk/>

**LabelPackA+**

The "package label" is the label applicable to a system, i.e., the combination of different components of a system. There can be packages of water heaters with solar; space heating equipment and of combination systems (used both for space and water heating).

**Upcoming Events**

- LabelPackA+ Vorstellung und Infostand DTU 2016
- April 20 - April 22
- Training for system designers in Lisbon - 20th of April 2016
- April 20 @ 14:00 - 17:30
- Training for system designers in Oporto - 21th of April 2016
- April 21 @ 14:00 - 17:30
- Training for installers in Lisbon - 6th of May 2016
- May 6 @ 9:00 - 13:00

[View All Events](#)



Photo © Viridian Solar/Environment Logic

The STA is a not-for-profit industry association representing a diverse membership in solar power, solar thermal and storage. Since 1978 the STA has worked to promote solar energy and to make its adoption easy and profitable for domestic, commercial and utility users.

Our mission is to empower the UK solar transformation. We are paving the way for solar to deliver the maximum possible share of UK energy by 2030 by enabling a bigger and better solar industry. We represent both solar heat and power, as well as storage, and have a proven track record of winning breakthroughs for solar PV, solar thermal and battery storage.

Find out more about solar energy and what we do at:

[www.solar-trade.org.uk](http://www.solar-trade.org.uk)

