Thermaltricity International
(Trading arm of Solar Speedflex Co Ltd (HK))

Introducing the world's first solar thermal retrofit cooling absorber panel, that converts any brand of PV panel into PVT

http://www.youtube.com/watch?v=LekeMEl4uWs
The first PV + thermal solar cooling panels were introduced into the market in 2007 by Solar Zentrum, located in Munich.

At that time the price of a photovoltaic (PV) panel was $4.00 a watt, compared with today at $0.36 cents a watt.

While the cost of PV glass framed panels have fallen to such low levels, the cost of thermal flat plate solar panels has not.

Those companies (54) who have developed a PVT panel box which incorporates a traditional copper riser, are the companies, who now find it very difficult to sell PVT.
PVT is not just about cooling the PV panel, but also reversing the pump to Melt the Snow in Winter months.

One of the many potentials for solar PVT are the Ski areas to remote Alpine villages across the world who would not benefit due to months of snow fall. The two pictures are of a PVT/water to water heat pump system installed on the roof of a hotel in a ski lift area of Switzerland (care of Max Roth, Energie-Forschung, CH). To resolve this problem, I have added a Snow melt device into the design, so the PV panels can generated electricity all year round. The blue sky of Ski areas reflected off the snow will provide a greater increase in electrical generation than at lower levels.
• With Solar PV panel prices per watt now at rock bottom prices, the affect on Solar Thermal sales has fallen dramatically (2017)
• When all parts costs + the installation is added up + the guaranteed government tax break or subsidy, PV systems provide the greatest return on investment, while not able to resolve the increasing cost of hot water and heating.
• EXCEPT that solar PV panels loose efficiency up to 30% once the Glass/Cell temperature increases above 26c.
• Every body in the solar PV industry know this, but as yet they do not have a cost effective answer and prefer to hide this fact.
• While the PV panel itself is costing around $100.00 for a 250 watt module (certified ex China) the much higher additional cost of the copper thermal panel pre assembled together with the PV panel glass has limited the sales of PVT systems.
• A complete review of what is required to make PVT interesting to commercial companies, starting with water storage.
Existing PVT solar panels have been developed from existing flat plate solar water heating box panels.

This picture is of a typical PVT box panel design, where the thermal part is 100% the same as used in solar thermal only panels. One of two reasons why existing PVT panels are expensive, is that the companies producing and promoting PVT panels have taken an existing flat plate box panel and adapted it with a solar PV glass. The 2nd problem is those who market a PVT panel with no real installation experience of solar water heating installations. The selling of PVT panels is about the cooling of the PV panel to maintain the highest efficiency at above 15%, not the production of hot water above 30-35c, which these panels can produce up to 60c, when plumbed into the wrong size tank which is unvented.
SO WHAT IS NEW?

• With 27 yrs experience in solar thermal collector/system design + installations that started with the design of a hybrid vented thermal store water tank in 1988, the next design phase was to design a low cost water heating panel that required 50% less parts, with minimum servicing that could clip behind the back of any brand of PV panel.

• After 14 yrs of self testing a Hybrid solar central heating/hot water system using my own UK house, I set about in 2013 to design a very simple self assembly thermal cooling absorber concept that converted a 250w PV panel into PVT + snow melting for Alpine snow covered areas.

• The UK SWH industry has year on year been killed off since 2010 by the take up of solar PV systems due to government tariffs (FIT)

• Its now the time to convert millions of inefficient PV panels into more efficient panels by cooling down the back of the PV panels that delivers a pre heat water temperature up to a maximum of 35c to reduce the worlds hot water heating costs, both domestic and commercial.

• For every 1 degree rise above 26c of the PV glass panel, the efficiency drops by 0.5% , FACT.
Sample testing in the UK Sun

The sample PVT panel testing was carried out on a July day 2017, with blue skies and a air temperature of 32c. One PVT panel was a standard glass frame, with a steel water filled panel at the back, while the NEW Thermaltricity PVT panel is without glass and an aluminium backing + the thermal tube cooling panel. The results taken at 2.15pm showed the glass PVT panel reached 62.4c, while the NEW glass free PVT panels reached 65.2c
Two Solar PV panel options

The choice of two types of PV panels is available for the assembly of a PVT without any tools. Picture one and two is the glass free panels with an aluminium heat sink backing. The 3rd picture is of the mass produced glass framed panels and will always be the 1st choice where the cost per watt is the deciding factor, unless there is a weight issue and the possible breakage of the glass, then option one is highly recommended.

In 2016, an agreement was signed with an established manufacture in China who owns the patent for these panels that uses a high transmission film to encapsulate the wafers. Panel sizes from 200 to 335 watts are available with the weight of the glass free at 14.5 kg, compared to glass panels at 22.6 kg. The EVA backing of the glass panels also restricts the transfer of heat from the front of the glass panel to the thermal panel affixed to the back
Some of the comments made in an Article in the Home Building and Renovation magazine regarding PVT

• Solar thermal and photovoltaic's are both fairly old technologies. The first known solar panel design dates back to Leonardo da Vinci, who, in the late 15th century, conceived an early use of solar power by employing concave mirrors to heat water. However, the idea of bringing electricity and hot water together in a single panel has only recently occurred and like a lot of inventions, it occurred by accident.

• Using the sun's energy to produce hot water has been around as a commercial product since the 1950s, but really started to come into its own in the late 1980s, driven by rising fuel prices.

• Similarly, it was the NASA space programme that provided the funds to develop PV technology into a commercial product. PV was and still is fairly inefficient, so the industry researched improvements, thus discovering that keeping panels below 26°C kept them at optimum performance levels and improved electricity generation by as much as 30% — this was a huge step forward.

• In addition, the volume of hot water produced was useful in its own right, and so the idea of a hybrid panel was born.

• But in 2017, it's time for PVT to be recognised for its greater benefits than just the generation of grid connected electricity and the profits made from the financing companies, paid by all of us who pay for electricity.
Existing PVT panels from Europe manufactures

Solar Zentrum, Munich produced the first PVT panel back in 2007 where the water box was bonded to the back of the PV panel. Now assembled in the USA. Ideal use for heating pools.

Italian design, where the copper pipe is flattened, then insulated and offered as a completed PVT panel. Expensive at €600.00 + standard hot water tank and SWH system parts as sold still today.

Add the closed loop thermal system kit to this panel and the costs double.

These German PVT panels are now showing signs of the bonding failing.
An insight to our Thermaltricity design, developed outside of Europe/USA

This is our 3rd prototype, with a few small material changes and re-tooling, before going into production. The copper pipe has been replaced with a food grade silicone tubing that allows the forming of the U bend at the end of the aluminium absorber spreader plate. Our initial tooling design to produce the alloy absorber panel was in 2 parts, but in 2016 we invested in a new tool that pressed out a single full panel to suite the most common size of a 250 watt PV panel.
At both ends of the alloy panel, the optimal U bend of the silicone tubing is looped under the bottom and top of this 250 watt China Land manufactured PV aluminium frame panel, to provide the maximum tube length and water flows without restrictions. As the cold water flows through the tubing incorporated into the pressed out aluminium sheet, the cooling of the back of the PV panel begins. No parts of the PV panels are compromised in any way or changes made to any of the electrical box positions with pre assembled connectors.
The Aluminium absorber cooling plate with the tubing already pre assembled (exactly as we have designed) now needs 2 fixing bars of Galvanised Steel extrusion to firmly fix the absorber to the back of the PV panel for maximum contact.

We use the existing holes in the back of the PV frame to affix a screw bolt through the frame into a pre welded nut attached to the underside of the fixing bar.
Where there is a need to insulate the back of the aluminium absorber cooling panel in areas of freezing winters and snow fall, we offer a combination of Nano Aerogel insulation technology of just 6mm thickness, as the first insulation layer sealed in a plastic casing. The 6mm thickness provides the same insulation value as 25mm Rockwool insulation. The 2\textsuperscript{nd} insulated covering is a ridged proven insulated water proof board of 6-10mm in thickness. The rigid insulated board is coated with a synthetic mortar on both sides to provide strength and rigidity with the thermal/cooling panel retained tight to the back of the PV panel. An aluminium bar has been designed to fit under each side of the PV frame and using existing drilled holes in the PV frame from the manufacture to keep everything in place.
The Plumbing side of the final assembly

The flow and return silicone tube is fitted with an insert to maintain the roundness of the tube as well as produce an OD size to fit our push fit plastic plumbing fittings. From this fitting we connect to a DN20 Pex Al Pex TEE brass fitting, one line for the flow and one line for the return. With a maximum water temperature of around 30-35c, there is no need for expensive plumbing pipe and expansion valves ect.
Taken from a German manufacture of a PVT self assembly steel panel

- **Module Temperature**
  - 65°C not Cooled
  - 25°C Cooled
- **Electrical Output**
  - 1100 Wp
  - 1350 Wp Aprox 20% more
Advantage of the Thermaltricity self assemble solar thermal panel

+ upgrade of efficiency by cooling the cells
- before (65°C) -
- after (25°C) -

Taken from the German self assembly steel panel information as an example of how a PV panel being cooled down can improve efficiency.
From years of experience in solar thermal, all PVT systems need to include an open vented Thermal Store

This domestic 150 horizontal PVT loft located thermal store, provides a continued warm water flow between the PVT panels and store. The internal helical heat exchanger coil delivers pre heated water at mains pressure indirectly through to the existing home unvented hot water tank.
Selected component parts provided to the buyers of our Thermaltricity PVT KIT

Because we are not looking to heat water above 30-35c, there is no need for expensive flexible stainless steel insulated pipe, pump stations, expansion tanks and so on. Our sister company, solar speedflex has already developed all the plumbing pipe coil kits, including pre insulated Pex al Pex for the PVT installations. We recommend Sorel solar thermal controllers from Germany, while the circulation pumps can be DC 12 volt or 110-240 volts depending on the size of the PVT system. If the Snow melting sensor device is specified a 2nd circulating pump is required.
We have selected Poly PV panels with a black backing and frame.

Our current PV solar panel partners is China Land in China and China land in Wisconsin, USA. If you have a preference for your own PV brand, contact me.

During a hot day in June 2016 in the UK where the temperature was around 30c, I wanted to show how hot my shed installed PV panels were. By 4pm 50% of the egg was cooked.

To test the efficiency of your PV panels, run a cold hose pipe over the panels to cool them down.
For new house builds, we recommend the use of Pex Al Pex pipe installed like under floor heating onto the roof first, prior to laying the solar slate and slate tiles. The water filled tube circulated by a pump from the PVT thermal store takes the heat away from the back of the slate tiles so the efficiency can be maintained as per the 25c efficiency specification. The number of UFH loops in the roof can be up to six, through a manifold connected to our PVT tank range as for our single PVT panels.
A large domestic house/business layout as an example only.

To see our full range of Thermaltricity Thermal store tanks from 100 to 12,000 litres contact me direct. If the PVT panel numbers are above 6 panels switch to a AC pump.

Cold mains water passes through the stainless steel heat exchanger coil in this Horizontal loft tank.
Specifications and benefits of this innovative thermal concept

• Our food grade high quality silicone tubing incorporated into the Aluminium absorber cooling panel comes with a warranty of 20 + years due to the low temperature use, but designed to except up to 150c

• Silicone tubing has been incorporated into flat plate panels across the UK and Europe for the past 12 years under the brand name SOLAR TWIN, also THERMA TWIN located in Manchester, who later acquired the rights to the solar twin solar panel concept.

• In areas of the world where there are heavy snow falls, we can offer a Snow Melt Sensor which switches a 2\textsuperscript{nd} circulating pump installed between the PVT thermal store tank and the PVT panels. The 2\textsuperscript{nd} pump is positioned at a hotter part of the thermal store, while the 1\textsuperscript{st} pump is positioned towards the bottom of the Thermal Store tank.
A domestic PVT system requires one-two thermal store water tanks

Thermaltricity has added into the PVT system package its own range of PVT thermal store tanks, produced in stainless steel with 316L helical coils as an indirect supply of hot water at mains pressure, without having to have a pressurized unvented tank.
To boast the PVT preheated cold water, look to also include an evacuated heat pipe tube collector. As long as the solar PVT pre heat open vented tank is included in the installation, other renewable heat appliances can be added later on. I will always recommend the open vented Buffer Tank (Thermal Store) as against the hot water only unvented tank, because from the buffer tank you can also provide space heating support by adding heat pipe tube collectors/ wood burning stove, heat pump and gas boiler. No one energy source will achieve the ££$$€€ savings this does.
The DS-224C and its companion DS-824C are physically identical on the exterior. The only difference is the internal power supply, one accepting line voltage and the other accepting 24VAC/VDC. There are five leads that extend from the bottom conduit hub of the sensor. Each is 18 inches long. The Brown and Blue are input power. The Green/Yellow is optional Earth. The two Yellows are connected to the main, normally open relay. This relay can switch 30A at up to 24VAC and 20A at up to 28VDC. The relay is actually rated for up to 277VAC but the overall device is not listed for line voltage operation. Designed and Made in the USA.

The controller must be mounted outdoors in the elements in order to detect ambient temperature and precipitation. It is housed in a weatherproof NEMA 3R rated enclosure and features gaskets, seals, and glands to maintain its integrity. As the sensor provides a fully isolated dry contact output, you may switch one voltage source (12V pump power) while operating the sensor from another voltage source.
The global advantages for a snow melting PVT solar panel system.

When snow starts to lay over PV panels it is now proven that PVT panels through the snow melting sensor device and circulation pump incorporated with a PVT thermal store to extend day time electricity generation.

For example a 10-20c degree stored water temperature in a short time can free the panels of snow and ice and thereby increase the kW yield over the years.

For PVT systems being installed in Freezing/Snow fall areas of the world, the expanded polyurethane board needs to be included. Glycol also needs to be mixed with the stored water in the horizontal buffer tank and replaced every 10 years.
A PVT system is the perfect partner to operate LED Grow Lights

Hydroponics & Airoponics is a growing agricultural technology without the need for soil or land. While the PV section generates the electricity to power the pump and grow lights, while the by product of warm water at 30c maintains the fish and plant growth.
Conclusion

I am looking to ship pre assembled PVT panels out of our China facility, unless you are importing from a country inside Europe or the USA where there are restrictions or high import taxes added on imported Chinese tier one PV panels. For American and European buyers we offer ONLY the solar thermal absorber cooling panels ready to fix to your own brand of PV panels excluding the insulation.

Prior to me signing an exclusive licence agreement with an established solar energy distributor/installer company, its recommended that a small test is carried out first in your country before marketing and sales begin. Our Swiss partner Max is collecting data from a PVT system with a water to water heat pump back up installed on the roof of a hotel in a Ski lift area of Switzerland.

We are seeking established distributor/installer solar partners for each country across the world where a market for PVT systems is identified as being viable. PVT systems as I have developed is a perfect fit for hotels with roof space, as hotels require electrical power and hot water every day. There are also opportunities for the assembly to be carried out in the country of import as an alternative to being assembled in China under a licence/royalty agreement.

Other applications for PVT includes the food industry, farming, Aquaponics and hydroponics