AUSTRALIAN PV INSTITUTE

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PVT - the solar technology that you've never heard of

With solar PV - now the lowest cost form of new energy generation, opportunities for adding value to solar PV are becoming increasingly competitive. Imagine if you could take the heat away from a solar panel – making it more efficient – and divert that heat for a useful purpose! And since thermal processes consume around 50% of the worlds' final energy demand, there is a huge market for lower cost and improve efficiency in heating.

That's where PVT (Photovoltaic Thermal) comes in. PVT combines two well-known technologies into one hybrid technology; Solar photovoltaics (PV) and solar thermal (T). By day PV converts sunlight into electricity. With PVT, a solar thermal collector is added to solar PV, which transfers the otherwise unused excess heat from the PV module to a heat transfer fluid. By combining electricity and heat generation within the same component, these technologies can reach a higher overall seasonal efficiency than PV or solar thermal alone. By night, the technology transforms into a large heat radiative surface that can provide renewable cooling, harnessing the night sky radiation effect.

The APVI is pleased to share a Technology Position Paper on Solar PV-Thermal (PVT), prepared by the IEA Solar Heating and Cooling Program that describes the growing market opportunity for the hybrid technology, and strategies to accelerate uptake. Australia is represented on this activity by Glen Ryan, Co-Founder of Sunovate, a manufacturer of innovative PVT products.

The PVT market is emerging – with over 2 million square metres of technology deployed worldwide and payback times reported to be as short as 4 years.

Benefits

The combination of production electricity from the PV and production of energy from the heat transfer, provides an increased yield per square metre.

The heat exchanged from PV modules can be used to provide various forms of heating including process heat (e.g. pasteurisation, car washing, bottle washing), domestic hot water heating, space heating, swimming pool heating and as a source for heat pumps.

PVT manufacturers in Europe and Australia, including testing by West Australian manufacturer Sunovate, have tested this efficiency and found that yields can more than double compared to PV or solar thermal alone. This efficiency is dependent on

the temperature of the heating application, with pool heating more efficient than space heating, and both are more efficient that hot water heating.

PVT also offers benefits for the increased efficiency and use of solar radiation including:

1. Spatial efficiency - uses the same area as a PV array or a solar thermal system to provide both electricity and heat
2. PV electrical efficiency - increased due to removal of heat from the modules
3. Cooling opportunity – using night radiation phenomena conditions
4. Improved PV cell lifetime - through lower thermally induced degradation and with potential PVT lifetime of between 20-40 years
5. Excellent return on investment – dependant on maximum electricity self-consumption and local grid electricity prices. Payback times as low as four years have been observed in hotel case studies in Spanish conditions.
6. Very low social impact – no noticeable noise, no detrimental visual impact

The potential for PVT is particularly strong for commercial businesses where heating requirements are elevated during the day, such as agro-industrial processes (greenhouses, dairies) and solar water desalination and stills.

Ryan says of the technology, “Globally, heating typically accounts for more than 50% of final energy consumption, very little of which is powered by renewable energy. PVT allows us to harness clean solar energy, improve PV panel output, and convert the heat removed for application directly such as space heating or enhancing it by combining it with heating appliances such as heat pumps. It’s a remarkable combination of technologies that is improving efficiency, output and longevity of PV modules and allowing more applications to access clean energy.”

Challenges

So with the benefits of combined PV and solar thermal, why isn’t PVT more well-known?

The IEA report identifies the primary challenge as the lack of mandated renewable targets for heating/cooling and molecular fuels, compared with the electricity targets that drive PV sales.

Secondly, the combination of the two technologies makes return on investment modelling more complex. This, and the lack of adequate case studies for PVT, makes the technology more difficult to sell for solar retailers. Additional installation and sales training is required in order for solar retailers to offer PVT alongside standalone PV and solar thermal options. This, coupled with a lack of appetite for adoption of emerging technology, is a barrier for PVT options in the market.

Additionally, the lack of visibility of PVT amongst governments, architects, planners, educators and industry associations means a lack of awareness for potential solar retailers and installers.

These challenges are directly contrasted with broader government renewable target incentives, particularly where there are physical spatial constraints, such as in European cities, that make the high energy yield per m2 of PVT very attractive.

PVT in Australia

There are a number of Australian PVT technology manufacturers, as well as international distributors, however in 2019, Australia had only 547 m2 of installed PVT – a dramatically smaller installed capacity than France (485,000 m2), South Korea (281,000 m2), China (133,000 m2) and Germany 112,000 m2).

With 2 million m2 of PVT installed worldwide over the past 5 years (representing 270 MW PV and 1,400 MW solar thermal), Australia has some catching up to do to see the benefits of PVT.

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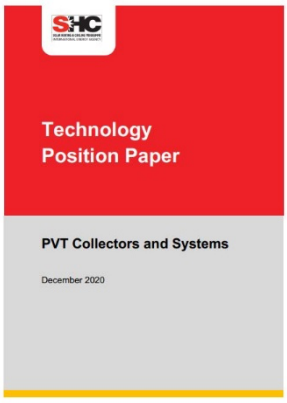
IEA Reports and References:

Dec 2020: **"**Technology Position Paper: PVT Collectors and Systems**"**

May 2020: "Basic concepts of PVT collector technologies, applications and markets".

Ongoing Wiki article Task60 output: "Photovoltaic thermal hybrid solar collector"



The IEA's Technology Collaboration Programme was created with a belief that the future of energy security and sustainability starts with global collaboration. The Australian PV Institute, with support from ARENA, leads Australia's engagement in the IEA Solar Heating and Cooling (SHC) program and works with its members to increase the uptake of PV through quality research, data and analysis.

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About the APVI

The Australian PV Institute is a not-for-profit, member based organisation which focuses on data analysis, independent and balanced information, and collaborative research. Our objective is to *support the increased development and use of PV via research, analysis and information.* The APVI promotes solar through its live solar mapping platform [http://pv-map.apvi.org.au], the national solar research conference and Australia's participation in two International Energy Agency (IEA) programs – PVPS (Photovoltaic Power Systems) for solar photovoltaics and SHC (Solar Heating and Cooling), concerned with new solar thermal products and services.

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