PVT ROADMAP

The 6th Framework Programme

A EUROPEAN GUIDE FOR THE DEVELOPMENT AND MARKET INTRODUCTION OF PVT TECHNOLOGY

Combined solar heat and electricity

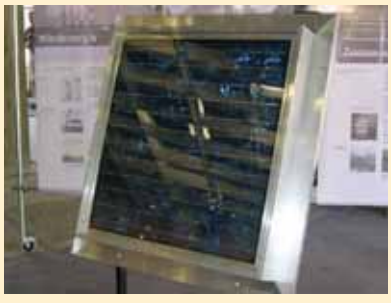
A photovoltaic/thermal module, or PVT module, is a combination of photovoltaic cells with a solar thermal collector, forming one device that converts solar radiation into electricity and heat simultaneously.

The excess heat that is generated in the PV cells is removed and converted into useful thermal energy. As a result, PVT modules convert more solar energy per area than a corresponding combination of separate photovoltaic panels and solar thermal collectors. Moreover, this results in reduced manufacturing and installation costs.

Strong growth

The European Union is aiming at 3 GWp of PV and 100 million m^2 (70 GWth) of solar thermal collectors installed in Europe in 2010. With the two-for-one approach of PVT, these targets can be reached much more cost effectively.

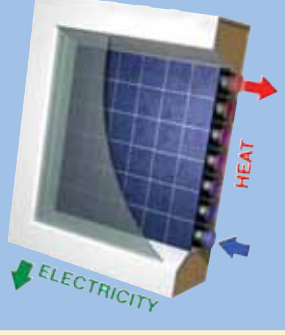
The European market for solar energy is growing rapidly. Presently, only a select number of manufacturers are producing PVT products. However, given the strong growth in the European solar energy market, a similar growth is expected for the PVT market in the near future.



With PVT, solar energy is converted to heat and power simultaneously in one device. (Photographs: ECN, Vattenfall, ECN)

Unique selling points of PVT

- ✓ higher energy yield per surface area
- ✓ reduced manufacturing and installation costs
- ✓ reduced payback time compared to PV
- ✓ homogeneous appearance of roof and façade
- ✓ aesthetics of PV
- ✓ one solar product for all of the consumer's energy needs



How does PVT work?

In a PVT module, PV cells are fixed to a heat exchanger with either air or water as a heat transport medium. In a typical PV panel, only 10% of the incident sunlight is converted into electricity, while over 70% is converted into heat and thrown away. In a PVT module, this heat can be used effectively.

Challenges

For PVT to mature from a niche to a mainstream product, several challenges have to be overcome in a joint effort between PVT manufacturers, building industry, policy makers, installers, architects, engineering consultants and researchers. Each of these actors has specific challenges to face, but each will also profit from specific benefits of PVT.

Manufacturers

Benefits of PVT

- ✓ new and/or enlarged markets

Challenges

- ✓ how can the production technologies of PV and solar thermal be integrated cost-effectively?
- ✓ how can plug-and-play integration of PVT into heating and electrical systems be accomplished?
- ✓ how can PVT modules be produced with sufficient variety in colour and shape?

Certification, integration in building logistics, and training of installers are essential to the commercialisation of PVT.

Policy makers

Benefits of PVT

- ✓ renewable energy targets are reached more efficiently and at an earlier time

Challenges

- ✓ which market support mechanisms are most effective for PVT?
- ✓ how should PVT be included in the new energy efficient building regulations?
- ✓ how can research, development and demonstration of PVT be supported most effectively?

R&D and test institutes

Benefits of PVT

- ✓ development requires innovative technological solutions

Challenges

- ✓ what should the performance and reliability standards for PVT look like?
- ✓ which technological solutions can be found to increase the optical and thermal efficiency and the reliability of PVT?

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Architects

Benefits of PVT

- ✓ new ways to integrate renewables into buildings
- ✓ less aesthetic problems with integration into the building envelope, since only one device needs to be integrated

Challenges

- ✓ how can PVT (and other solar technologies) become an integral part of the building design?
- ✓ which new building concepts are now possible because of PVT?

Installers

Benefits of PVT

- ✓ reduced installation effort
- ✓ new or enlarged market

Challenges

- ✓ how can plug-and-play integration of PVT into heating and electrical systems be accomplished?
- ✓ how can the three specialisms (roofing, heating and electrical installation) be combined?
- ✓ which targeted solar campaigns are necessary for PVT?

Engineering consultants

Benefits of PVT

- ✓ innovative and high profile technology for demonstration projects

Challenges

- ✓ what sort of design tools are needed by architects, installers and engineers?
- ✓ which new system concepts are now possible because of PVT?

The seamless integration of PVT in buildings is an important challenge for the commercial breakthrough of PVT.

Building industry

Benefits of PVT

- ✓ increased energy performance of buildings
- ✓ reduced payback time compared to PV and solar thermal

Challenges

- ✓ how can plug-and-play integration of PVT into the building construction be accomplished?
- ✓ how can prefab building elements be realised that facilitate installation of PVT?

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PVT combines heat and power generation in one device. Hence, PVT devices can be very different in design, ranging from domestic hot water systems to ventilated PV façades and actively cooled PV concentrators.(Photographs: ECN, Atlantis, Australian National University).

Wide product range

The term “PVT” covers a wide range of concepts, varying from domestic hot water systems to ventilated PV façades. Some of these are aimed at limited niche markets, while others have the potential to become mainstream products with a very large market.

The various PVT concepts differ in the remaining development effort that is required for commercialisation. Although there already is a long history of research and development in co-operation between manufacturers and research institutes, it is only now that PVT is beginning to enter the market as a commercial product.

Promising markets

The largest market potential for PVT lies in the residential sector, particularly in domestic hot water heating. Particularly promising markets are (1) low-energy high solar fraction houses, where PVT can be combined with a heat pump, and (2) multi-family buildings, that typically have a very limited available roof area.

Promising niche markets that already exist today are collective tap water heating systems, swimming pool heating and autonomous applications such as solar desalination. In the future, space heating and solar cooling in the commercial sector may become an important niche market, as well as industrial and agricultural applications.

This document is part of the PVT Roadmap, one of the main deliverables of the European Co-ordination Action PV Catapult. This project aims to support the large-scale introduction of PVT in Europe, and is funded by the European Commission under contract SES6-502775. The PVT Roadmap is based on the input of experts in solar thermal, PV, installations, buildings, and marketing.

For more information, see www.pvtforum.org.

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