

Solar Industry®

EVACUATED TUBES

Holding Back A Product's Potential

For the evacuated tube market to flourish, solar thermal professionals must take advantage of the many suitable applications for this product.

■ Michael Humphreys

In the North American marketplace, solar thermal - especially evacuated tube technology - is currently facing an uphill battle for adoption and recognition.



Michael Humphreys

Consumers in the market have embraced photovoltaic technologies, but most have overlooked the many factors that make evacuated tube systems a suitable choice for the moderate-climate areas of North America and the many emerging applications of solar thermal energy.

This is not to say that evacuated tubes are the perfect option in every situation. Warmer summer climates and arid conditions have favored flat-plate collector technology in North America due to the lower risk

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3 ■ NEW & NOTEWORTHY

The election of Barack Obama as the nation's 44th president, coupled with a new, reconfigured Congress that strengthens the Democratic Party's control of the House of Representatives and the Senate, is being seen as a positive development for solar's future in the U.S.

18 ■ THIN-FILM MODULES

With the enormous supply of low-cost thin-film modules coming to market over the next few years, now is the time to learn techniques to effectively integrate these modules into solar power projects to provide the best energy yield.

34 ■ CRYSTALLINE PV

In the past, PV products and components - particularly crystalline PV - have practically sold themselves because of robust subsidies and incentives and a level of demand far above the available supply. However, many experts agree that the challenges and competition in the market will increase significantly in the future.

of overheating and sometimes lower cost of system installation. In many situations, flat-plate collectors can provide an effective solution for hot water needs - and sometimes other residual heating needs as well.

With solar thermal dehumidification and absorption cooling on the horizon - among a number of other potential functions - the increased operating temperatures created by evacuated tubes will make the tubes the technology of choice for these new applications. Evacuated tube collectors are designed to satisfy the additional demand for heat that these loads require.

These applications for solar thermal energy are creating greater overall demand for thermal energy, and common commercial-scale and industrial-scale applications often require very high heat capacities to satisfy their needs.

In California, for example, industrial heat made up 47% of the state's natural gas consumption, and almost 80% of that heat was required for the food-processing sector of the economy. These demands for heat present an opportunity for the use of evacuated tubes to fulfill high energy requirements.

With all of these trends in mind, it is even more perplexing that consumers and businesses have generally shied away from investing in evacuated tube technology. Evacuated tubes take up only about one-tenth of the space of a comparable PV system and cost about a quarter of the price in the majority of cases. Finally, an evacuated tube system can reach efficiency levels of up to 75%, because its tube design creates excellent passive tracking. PV systems, even at peak performance, often fall short of 20%.

So, what has been holding evacuated tubes back? The answers are prominence, policy and production.

Marketing shift

First, the popular media have been quick to embrace photovoltaic technology and its vast potential, and there is little argument against the fact that PV technology will be an integral part of the world's renewable energy mix in the future.

But the mainstream media, policymakers and even those in the industry have let evacuated tubes languish. On the international level, solar thermal was omitted from the In-



Evacuated tubes atop the Hilltop Lodge at OceanView, Falmouth, Maine.

Photo courtesy of Apricus.

ternational Energy Agency report to the G8 group of countries published about renewable energy in June 2008.

This trend occurs in part because electricity is easy for people to understand and easy to measure. However, electricity consumption - depending on whom you ask - only accounts for 20% to 30% of our energy requirements, and heating and cooling make up almost double that percentage. It is clear that more emphasis needs to be placed on the thermal requirements of the market.

But perhaps the simpler explanation is that consumers are fascinated with novelty. For instance, people will queue up for hours to have a new iPhone, but they would never do the same thing for a proven and reliable device of the same type. Solar thermal is tried and tested - a hurdle in a market of consumers entranced by the newest shiny things.

There are attainable solutions to this visibility problem, and the burden - fortunately or unfortunately - falls on those who manufacture and install these systems. While the marketplace evolves as solar technology as a whole sees a spike in adoption, evacuated tube professionals must shift the messages that are being delivered to the public.

The days of marketing on marvel are behind us. The next frontier in promoting evacuated systems will turn away from system photographs and statistics of the total square footage installed nationwide to the innovative applications and the benefits the system provides the consumer: guilt-free showers and baths, radiant floor and wall heating, and the immense savings and quick payback period.

Alongside these benefits, however, will be increased inter-competition - something that has been on the horizon but not fully realized in North America. As demand increases and evacuated tubes become a technology of choice for innovative applications, competition will no longer be about evacuated tubes vs. flat plate or thermal vs. electric.

Instead, the battle will be among evacuated tube systems - how systems stand up to one another side by side. A new market will require greater differentiation of product benefits and system design and, inevitably, further exploration of complete packaged systems to ease adoption.

This new market will be affected greatly by the legislative environment that is available, particularly in the U.S. Due to the immense efforts of the solar thermal policy team at the Solar Energy Industries Association, led by Scott Hennessy and others, the tax credits for solar thermal have been extended along with the photovoltaic credit extension for the next eight years. This victory will help adoption of evacuated tubes and encourage more homeowners and businesses to consider evacuated tubes' benefits as a part of their energy mix.

Standards

However, other policies and provisions are lacking in the marketplace. The absence of universal standards for installation - such as OG300 system design and installation guidelines, which are often not enforced by code inspectors at the local level - in part prevents consistency throughout the market.

Sanctioning bodies like Solar Rating and Certification Corporation are understaffed and undersupported by the government, and they have burdensome application processes. An especially perplexing problem is that products certified through Solar Keymark, the European solar standard or other comparable standards have no fast-track process in these national sanctioning organizations.

The majority of policies in place currently favor PV technology, including the removal of the cap from the investment tax credit, coupled with the inclusion of utility-scale installations as eligible for those resources.

A signal of hope for future expansion in the market, however, is that many jurisdictions across the country are adopting new standards and regulations that favor and sometimes even require the use of solar thermal. For instance, Washington, D.C., has made solar thermal renewable energy credits (RECs) valid to help utilities meet the renewable portfolio standard (RPS) goals.

Washington, D.C., though, is a unique situation, as a number of factors prevent widespread adoption of other technologies within the dis-

trict's limits, and thermal may very well be necessary for the district to meet its RPS. Evacuated tubes produce immense amounts of energy, making them ideal for producing these RECs and optimizing the value of an installed system.

Some localities are taking standards one step further. From states like Hawaii, which is mandating that new homes include solar thermal, to local jurisdictions that require traditional pool heaters to be replaced, governments have become more apt to implement solar thermal requirements, as these mandates are less burdensome financially on businesses and homeowners than comparable requirements would be for wind, geothermal or PV.

But as more jurisdictions adopt similar measures and encourage the use of thermal energy, the last hurdle for evacuated tubes - monitoring production - becomes apparent.

Solar thermal, unlike PV, is not easy to quantify, and this characteristic has traditionally made it harder to meter. Whereas photovoltaic production is measured simply in kilowatt hours, heat is measured in British thermal units (Btus) and sometimes square meters of installation.

The result of these measurement methods is that these systems are often regarded - at least at the policy level and regulation level - as energy-saving or energy-efficiency systems rather than actual power production.

This lack of metering has been a major hurdle to the inclusion of solar thermal as a source of RECs and has limited its inclusion in other legislation. In addition, when thermal is lumped in with efficiency measures, its price comparison is off the charts and seems unapproachably expensive when compared to double-pane windows and spray-on insulation.

The first utility to adopt metering for solar heating in the U.S. marketplace was Lakeland Electric in Florida. The utility established a unique program in which Lakeland purchases and installs the thermal systems so that the power provider can generate and collect the RECs produced to sell on the open market, while the consumer benefits from reduced heating bills and the ability to purchase the system over time. The operation was small at first, but it has continued to grow over time.

Industry responsibilities

These types of programs have demonstrated that the ability to

properly quantify and standardize reporting for the output of systems is an important factor in the continued growth of the industry.

However, many older installations do not feature metering systems. Thus, new regulations should serve as encouragement for customers to invest in monitoring, so they can take advantage of the additional benefit of REC generation, especially as RPS requirements continue to become more stringent for utilities.

Until recently, the most reliable measure for performance has simply been comparing utility bills month-to-month, year-by-year. This method falls way short of the ideal and makes it nearly impossible for legislators to create programs and incentives that help promote the energy produced by evacuated



Workers installing solar thermal technology at the Cadigan Lodge in Topsham, Maine. Photo courtesy of Apricus.

tubes, because they are not being provided with easy-to-understand metrics by which solar thermal can be rewarded.

Those of us in the business have not yet provided the model of measurement required, but calculations can be done simply by measuring the incoming water temperature, measuring the outflow from the water heater to the home and measuring volume consumed.

These measurements provide a clear conclusion about the amount of natural gas or electricity that is being offset for domestic hot water, and meters should be encouraged and installed in as many systems as possible to demonstrate the amount of energy produced. The difference is simply the measurement unit used, and Btus of energy are easily translated into kilowatt hours for the general public's and policy-makers' consumption.

The responsibility falls on all of us in the evacuated tube industry to spur the change we want to see in the market. We have a number of responsibilities ahead of us:

- Define output and capacity. Without doing so, thermal will languish on the fence between an efficiency measure and production.

- Get involved in policy and legislation at the local level. In many regards, successes in the PV industry have occurred because PV leaders made a seat for themselves at the table. Those in the solar thermal industry must do the same.

- Raise the profile of evacuated tubes. Every positive article, advertisement and Web site helps to propel the technology forward and increase prominence.

Increased adoption of standards in installation and monitoring will pave the way for further advancement in legislation and incentives for thermal technologies and encourage further development of in-

novative applications for thermal energy - propelling evacuated tubes forward in the market. ☞

Michael Humphreys is CEO of Apricus, a company that specializes in the development and manufacturing of evacuated tube solar thermal collectors. He can be reached at mick@apricus.com. For more information on the company and its products, visit www.apricus.com.



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