Using Solar to Heat – Net Metering Makes a Difference

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Vaughan Woodruff, Expert Instructor, Solar Approaches to Radiant Heating, outlines a response to a student who recently asked a question regarding the use of solar electricity for heating and how advances in battery storage might impact the suitability of using solar electricity to provide heating. The student asks:

"Even though grid-tied electric battery storage is less efficient, is it gaining momentum because of things like net metering and the fact that it is intuitive?"

While a solar electric system has fewer losses between collection and storage than a typical solar combisystem, it is reasonable to assume that the energy collection from the solar combisystem will be 3 times more efficient per square foot of roof space.

One hundred gallons of water storage can reasonably provide about 75,000BTU of heat storage for a radiant system. This is the equivalent of 22kWh of electrical storage.

Two key things must be present to make the use of solar electricity more economical than solar heating – using electricity to move heat (via a heat pump) rather than as resistance heat and utilizing favorable net metering laws to eliminate the cost restrictions of electrical storage.

In places where net metering is favorable, traditional solar combisystems may be less attractive. Where net metering laws are weak or could be subject to significant modification, solar combisystems have an advantage.

Using solar electricity for heat encounters two practical challenges relative to solar heating – the efficiency of collecting energy via solar photovoltaics and the cost of electrical storage. As discussed in the free lecture, current solar photovoltaic modules used in residential installations typically have a maximum efficiency of 15-18%. In contrast, a medium-temperature solar heating collector has a peak efficiency of 70-75%. While a solar electric system has fewer losses between collection and storage than a typical solar combisystem, it is reasonable to assume that the energy collection from the solar combisystem will be 3 times more efficient per square foot of roof space.

Disregarding net metering for the moment (more to come on that topic), let's look at storage. One hundred gallons of water storage can reasonably provide about 75,000BTU of heat storage for a radiant system. This is the equivalent of 22kWh of electrical storage. This is roughly the equivalent of three of the new smaller models of the Tesla Powerwall. I can currently buy a 100 gallon indirect water heater for roughly $1,500, while the list price for three Tesla Powerwalls is $9,000. As electrical storage gets larger, the price increases in a fairly linear manner (twice as much storage costs twice as much). Heat storage provides an economy of scale – the more volume that is stored, the lower the unit cost.

While this is a simplistic analysis, it illustrates that there are two key things that can be leveraged to make the use of solar electricity more economical than solar heating – using electricity to move heat (via a heat pump) rather than as resistance heat and utilizing favorable net metering laws to eliminate the cost restrictions of electrical storage.

The approach of using solar photovoltaics (PV) to offset the electrical use of a heat pump is becoming increasingly popular. This approach is only practical when strong net metering policies are present. Net metering allows solar PV owners to receive credit for excess energy they supply to the grid. Often these systems do not use batteries. Instead the utility becomes the storage mechanism through an administrative procedure that can credit the customer for excess generation in the summer and then pay on that credit in the winter when heating loads are higher and there is less available solar energy. In essence, strong net metering laws provide 100% efficient storage. Adding a heat pump can get three to five times the benefit from the accrued energy credits, often making the economics favorable in comparison to a solar combisystem.

While this approach provides significant return, it is wholly dependent upon consistent net metering laws. Many states are seeing their net metering policies under attack. In Wisconsin, for instance, regulators modified their net metering policy to allow monthly net metering rather than annual net metering. This means that any extra credits must be used in the month they are generated. This eliminates the opportunity to accrue net energy credits in July to power a heating system in February.

Currently, PV policy is being examined in a number of states across the country. In places where net metering is favorable, traditional solar combisystems may be less attractive. Where net metering laws are weak or could be subject to significant modification, solar combisystems have an advantage.

AC Panels Provide Outstanding Advantages

by Robert Onofrey, Vice President Sales, Phono Solar North America

DC solar panels have dominated the solar market since the discovery of functional terrestrial solar panels in 1953. Now the old technology is being replaced in the market by the next evolution of the solar panel: the integrated AC solar module.

The greatest advantage of AC modules is that they don't require high-voltage DC wiring, which make them safer to install than traditional models. This ensures that there will be a lower risk that an installer will be hurt through an accidental encounter with a DC wire, the potential for fires will also plummet — giving installers, inspectors and end users confidence in array's safety.

As a self-contained power source, AC modules ensure the maximum amount of power from each module and, unlike traditional DC modules, AC modules monitor themselves. Armed with real-time production data, consumers and installers can ensure the array is actually producing the amount of power it promises.

Operators can also determine if specific AC modules are struggling and deal only with them, allowing the rest of the array to keep producing power. DC modules are incapable of providing precise monitoring because their central/string inverter connections only collect information about the entire array.

AC modules are gaining traction as a popular panel solution. According to Solar Server, IHS predicts that in 2017 AC modules will reach 32% of all microinverter shipments, becoming the fastest growing microinverter type to reach 800MW in 2018.

Combined with the explosive growth of the solar industry, AC modules are replacing outdated technology with better technology that serves the installers and end users with more effective electricity generation. This is why AC modules are rapidly replacing DC modules in the market — and will continue to do so for the foreseeable future.