



Professional design, installation and service of renewable energy systems

Space heating with solar hot water

ReVision Energy is often asked whether we can integrate our solar hot water systems with conventional boilers to produce energy for space heating. The question is understandable because we know that in a typical Maine home, the space heating load represents up to 80% of the annual oil or propane consumption. Minimizing this consumption and displacing as much as possible with clean, renewable solar energy is a laudable goal. Plus, sunshine is free. Here are the circumstances when active solar space heating is the best alternative.

Who should consider active solar space heating? Ask yourself the following questions. If you answer yes to all of the questions, then solar space heating might be for you.

Are you building new or do you already have a house that is super insulated? Super insulation values are generally R-30 walls & R-50 ceiling.

Do you have, or can you install, a low temperature distribution system, such as concrete slab-on-grade or a thin slab, with radiant tubing?

Do you plan to install, or do you have, a high efficiency backup heating system?

Do you have a budget of \$10,000-\$20,000 that you want to invest in a solar hot water system?

If you answer **YES** to all of the above questions, then active solar space heat might be for you!

What are the benefits of an active solar space heating system?

For those who make the investment to build an active solar space heating system, the benefits are numerous. The first thing that an active solar space heating system does is to produce over 90% of the home's domestic hot water, all year round. This is very significant because it means that the boiler doesn't have to come on during the summer months, when it runs least efficiently. Likewise, the boiler can stay off during the shoulder seasons, before it gets really cold outside. On a typical sunny winter day, the system will take care of heating the house for several hours after the sun goes down.

Why can't I retrofit solar onto my existing heating system?

The best way to understand why it's usually not practical to retrofit solar space heating onto a typical boiler and baseboard heating system is to look at the numbers:

- The Apricus evacuated tube collectors that we typically use for space heating perform relatively well in cooler weather. A single thirty tube collector produces approximately 8 Million BTUs worth of energy in a year. They produce on the high end of the range when being used to preheat hot water to a low temperature and on the low end when

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being used to heat to a high temperature. A baseboard distribution system operates at such a high temperature, that the solar becomes inefficient.

- The typical new house built in Maine using standard construction techniques requires 50,000 BTUs per square foot per year to heat. A 2,000 s.f. home would require 100 million BTUs per year.
- Roughly 1/3rd of all solar radiation to fall in Maine falls during the non-heating season. So of the 8 Million BTUs per collector per year, only about 2.5 M BTUs are available for heating. In other words, to heat your conventionally built 2000 sq ft house, you would need nearly 40 of those thirty tube evacuated tube collectors. This array would be bigger than the house itself.

Can I at least take advantage of solar energy to preheat the water going to my boiler?

- Unlike solar hot water applications, solar space heating can not be used to preheat. The water in your heating system circulates continuously in a closed loop. In order to maintain the whole house at a comfortable temperature, the water returning from the radiators is typically only 10-20 degrees less than the water being supplied from the boiler. As soon as the temperature of the solar storage tank falls below that of the return water of the heating system, it is impossible to use any more of the solar energy for space heating.
- As the temperature of the water being heated by solar goes up and as the outdoor temperature goes down, the efficiency of solar collectors goes down. Solar energy works very efficiently to heat water up to 120 degrees when it is relatively warm outside. On the other hand, trying to heat water to 170 degrees when it is cold outside, is an inefficient use of solar energy.

I am retrofitting my conventionally built house with radiant floor heat, which has a lower distribution temperature than baseboard or radiators. Does this make me a good candidate for a solar space heating system?

- While most retrofit radiant floor systems do require a somewhat lower distribution temperature than baseboard or cast iron radiators, depending on the system used, they may still require a distribution temperature that is too high to be practically addressed with solar thermal collectors.
- Additionally, just by replacing the heat distribution, you have not changed the number of BTUs that are required to heat your house, thus solar may still be impractical for you. If you are installing thin slabs with radiant, and upgrading the home's insulation to super values, then you could be in the ballpark!

If solar space heating is impractical for my house, what can I do to reduce my fossil fuel use?

- Have an energy audit, insulate wherever possible and stop air infiltration.

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- Install a solar hot water system. Because domestic hot water is a year-round load, and because the water only needs to be heated to about 120 degrees for domestic uses, solar domestic hot water systems are typically the most effective use of solar energy for Maine homes.
- Upgrade to a high efficiency low mass boiler such as the Baxi Luna (<http://www.wallhungboilers.com/products.html>).
- Install a high efficiency wood stove and plan on burning some wood (www.tarmusa.com)

More Feasible

New Construction

Super Insulated R-30 walls R50 Ceiling

Low Temperature Distribution
(100 degrees)

Heating Costs of 150 gallons of oil per
1000 square feet

High Domestic Needs in the Summer

1500 square foot house

Less Feasible

Retrofit

Conventional Construction

High Temperature Distribution
(180 degrees)

Heating costs of 400 gallons of
oil per 1000 square feet

Normal Summer Domestic Needs

3000 square foot house

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