

Renewable energy options and compatibility, for your Rockville home

Before considering renewable energy options for your home, you should know that the best initial investment you can make, with regard to the energy performance of your home, is to tighten up the “envelope” of your home. By this, I mean ensuring you have proper weather stripping in the seals of your doors and windows, replacing your old single pane windows with double pane, and adding insulation to your attic space. There is much more you can do to operate your home efficiently, but eliminating pathways for the leakage of conditioned air (either warmed or cooled, depending on the season) goes a long way to reducing your energy costs.

With respect to solar power, net metering is the right way to go, as long as our distribution grid remains reliable. Net metering is an automated process by which a solar electric generating system either delivers power to the homeowner when needed, or sells it back to your local utility when not needed by the homeowner. The only "catch" that I see with net metering with most utilities is that, when there is a regional outage, most local utilities require your system to instantly disengage from the grid, so as not to feed electrical power back into a downed grid and possibly injure utility workers. This means that on those occasions when you can use your own generation the most, you won't have that option to use your own electrical generation.

As an alternative to net metering, you could have a standalone solar-battery system (probably costing an additional \$10K up front), and then you could run your system independent of the grid, similar to having a small diesel generator, as well as store your own electricity, to be used while the grid is down for any extended period of time. Does this scenario happen often enough to make a solar-battery system worth it? Not these days, but it's conceivable, if electrical demand continues to grow, without corresponding generation capacity, thereby creating reliability issues with the grid. It has become really hard to build large new power generating stations of any kind (coal or nuclear), so most new demand is now being met by "found" capacity, i.e. all the energy efficiency measures going into effect, as well as all types of distributed generation (such as solar, geothermal, wind, diesel, and gas turbine) in homes and businesses.

Solar hot water heating is another good option, if used on its own for hot water heating, and if there is enough of an end use for the heat energy - but in terms of compatibility with a potential / future ground source (geothermal) heat pump (ideal for our region, as well drillers love solid rock), solar hot water heating would not be advisable. Since geothermal heat pumps include a water pre-heat capability (a waste heat recovery feature) during either season, in addition to the main space heating and cooling functions, solar hot water heating and geothermal water pre-heat combined could deliver excess heat energy to the same end use, while not being able to use it all to bring the water up to full temperature, especially in the warmer months. The geothermal waste heat recovery feature (for water pre-heat) would also significantly reduce your natural gas or electric consumption, since your water heater (either type) would work much less to bring pre-heated (80 - 110° F) water up to 125° or more, than if it has to bring 55° (well or ground temperature) all the way up to 125°.

Looking at the big picture of "greening" an existing home in our area to the fullest extent, here is something to consider, in addition to a net metered solar power system. When it is time to replace your existing air source heat pump (which loses efficiency rapidly as the outside air temperature falls below 40° F), or your natural gas furnace, you might consider installing a geothermal heat pump system (taking advantage of all available rebates for your location, as listed in the web site below). Energy system engineers consider this form of renewable energy to be the "big one" - simply because of the following numbers:

- In terms of energy equivalence, 1 ton of heat exchange capacity (heating or cooling) = about 3.5 kW
- Most homes of our average size can install up to 6 kW of solar panels on the roof, before running out of space on the most southern exposed side of the roof, and these systems typically cost about \$6,000 per kW to install.
- The same size house usually requires about 4 tons of heating / cooling capacity, or an equivalent 14 kW
- A geothermal system costs about \$7,000 per ton to install, assuming solid rock to drill through (can cost more, if not solid rock, due to the need to case more of the hole length).
- Even with a Coefficient of Performance (COP) of about 4:1 (typical of geothermal heat pump systems - COP is the ratio of heat energy removed (in cooling mode) or heat generated (in heating mode) to the required energy input (to run the compressor and fan in either mode) - you are still generating (or rejecting) heat at a rate of 2.6 kW / ton of system capacity.
- With a 4 ton system, this means you are generating an equivalence of 10.4 kW by renewable means, in the form of heat exchange capacity (not electrical generation), and this heat exchange is needed in most months of the year, and useful to pre-heat water.
- One other advantage (non-monetary) - there are no noisy outdoor condensing units, since all equipment for a geothermal system is either in your mechanical room or underground (the ground loops), and it all runs quietly.

In light of this, and running the math with the cost comparisons mentioned above, you'll see that you get a good bit more output per dollar spent on a geothermal heat pump system than from a solar power system. This also means that the payback period on your renewable energy investment is quicker with a geothermal heat pump, than from a solar system - typically between 8 - 12 years with geothermal, whereas a solar system takes between 20 - 25 years to pay for itself, under current utility rates. Of course, if those rates go up, the payback will be quicker for either system.

Keep in mind that heating and cooling accounts for about 50% of a home's total energy consumption, and a geothermal system will deliver to you about half of that for free, thereby reducing your total energy bill by about 25%. A solar system also does a good job, but will typically reduce your total energy bill by about 10 - 15%, under average patterns of home energy consumption.

Here are some links that may be useful and informative:

<http://www.findsolar.com/> - for identifying and locating solar system integrators / contractors in your region.

www.youtube.com/watch?v=ybfVoiN14HE - to understand how a geothermal heat pump works. For the average consumer, this is the most poorly understood of any renewable energy system, and this video does a good job of explaining how this technology works in any building.

<http://www.dsireusa.org/> - an up-to-date listing of all incentives / rebates available from all government levels, federal, state, and local, and links for how to apply for those rebates. This is a very valuable web site, and should be reviewed thoroughly for your location, to make sure you are taking advantage of all financial assistance you may be eligible for on your renewable energy project.

To summarize, the ideal retrofit with renewable energy systems, on an existing home in our region, would include both solar electrical generation and geothermal heat pump technology. The only time geothermal systems do not deliver anything for you is when the weather is mild and comfortable, when a solar system can still operate (at least during the day, and if the sky is relatively clear). On the other hand, a geothermal system delivers heat or cooling, as well as pre-heated water, whenever your thermostat calls for it, regardless of the time of day or the availability of clear skies. If the homeowner can only afford one of these options, geothermal is the more cost effective choice. But, if you can do both of these renewable energy systems, you can become a net producer of energy on more occasions of a given year, than if you choose a solar electric system alone.

Submitted by Bret Lyhus, Manor Lake resident and former officer and board member of the MLCA. Bret has worked in the energy industry for 20 years, including years working with various means of power generation, as well as in energy efficiency consulting. Bret managed the project to install solar lighting at the Manor Lake entranceways. He also has a geothermal system operating in his home, and looks forward to adding a solar electric system in the future.