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Larry Sagers Greenhouse

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Perhaps it is the cold weather, perhaps it is environmental concern or perhaps it is skyrocketing heating bills. Maybe it is also a time for introspection and New Years Resolutions. Maybe it is just because I like growing plants. Whatever the reason, I would like to share a little experience that I have gleaned about greenhouses for the home and how to build and use them.

For almost the last twenty years teaching about hobby greenhouses has been part of my life. Each spring I have taught workshops on how to build and operate a home greenhouse (see garden tips for this year’s class). I have shared my experience with people from most of the counties in Northern Utah and several surrounding states. Yet I think there is much more that people could learn to help them harvest solar energy and increase their enjoyment of gardening.

For these reasons I am sharing what I learned about building and operating a solar greenhouse. Future columns will cover other aspects of greenhouse growing. I started the class and realized that there were many myths and many misunderstandings about solar energy, greenhouses and growing and I needed to find out what would work and what would not. The best way to do that was to build my own and see for myself how and why they would work.

Plants are nothing more than solar collectors. If you could not design a collector to grow a solar collecting plant inside there was something wrong. The goals I laid out were simple. It had to be useable, and it had to be affordable, efficient and functional without inputs from me in terms of time and money.

I did not want this greenhouse to cost me money to heat it. In fact I wanted just the opposite. I wanted it to put money in my pocket by saving me on energy costs. This includes both heating costs in the winter and cooling costs in the summer.

Many homeowners have the misconception that a greenhouse will collect tremendous amounts of solar heat that will heat other areas of the home. While this is partially true, there is a contradiction between using a greenhouse to grow plants and using it as a solar collector for heating the house.

Solar heat collectors operate best if temperatures inside rise to well above 120 degrees. Such temperatures collect more heat but would quickly cook the plants. If you are not a gardener and do not want to raise plants, your solar collector would be designed much differently than mine.

Heat builds up on sunny days and in most greenhouses would build to a temperature high enough to cook the plants if the house is not vented. Mine is designed to vent additional heat into the
main building and warm up the adjacent rooms.

When the sun is not out, the greenhouse is not collecting much solar heat and most designs would need supplemental heat although I designed mine to overcome such possibilities. Additional heat can be added, but that would have defeated my goal of energy self sufficiency in the greenhouse. Adding a greenhouse heater or piping in warm air from my house would cost additional money. Therefore, it has to collect and conserve heat during the day. This is released at night to keep the temperatures above critical levels.

I also wanted a passive solar system. A passive solar system is where the greenhouse is the collector of solar heat and the heat is then stored in water or rock storage. By contrast, an active solar heating system has external solar collectors with fans or pumps that circulate the warmed air or water into the greenhouse or into a storage material. I did not want or need expensive, complicated and hard to maintain pumps and collectors or other equipment.

A passive solar greenhouse had several advantages for me. The construction is relatively simple, it is lower in maintenance and the cost of building the system was much lower initially.

Solar greenhouses depend on some material to store heat energy during warm periods and to release that energy at night. Each material, including air has a specific heat capacity. Generally, gases have low values and solids have the highest values with liquids in between.

Air normally fills the greenhouse but it has very poor thermal mass, which is why additional thermal mass must be added. I chose the front of my house because it has dark double brick walls, sidewalks and a basement staircase that would absorb the heat during the day and release it at night. I could have added other materials but for my purpose that has never been necessary.

My greenhouse thermal mass absorbs heat and subsequently releases it back into the surrounding atmosphere. The masonry materials have a high thermal mass so they absorb and release heat more slowly than water but they are much easier to deal with and were already a part of the structure. Water storage also works well but it is difficult to compare the two materials quantitatively because absorption and heat release rates depend on the material configuration.

I also did not need a greenhouse that needed a lot of attention. Because I am teaching classes and involved in other activities, I do not have time to constantly change and fiddle with a lot of controls and other changes.

When I built my greenhouse, it was a no brainer. The government would give you a 50 percent tax credit to build it. That program is no longer available but even so I consider solar to be the best renewable resource and would recommend everyone look at some solar heating aspect.

What have I learned? It is possible to build and operate a solar greenhouse without any other heat if it is designed and operated correctly. It has withstood temperatures of -28 degrees without freezing inside. In fact the only disaster as far as cold temperatures are concerned occurred on one very cold winter night when teenagers came home very late and left the door open. Because of the
design, there are no backup heaters or other devices to compensate and many of the plants froze.

I also learned that leakproof skylights were not, that hermetically sealed windows were not and that no greenhouse is totally without problems. I also learned that it is impossible to grow tomatoes and other warm season crops without adding considerable amounts of supplemental heat.

In spite of this, the greenhouse is filled to capacity each winter with a variety of plants including a few tough “tropicals” that protest but manage to stay alive. It preserves many plants including tender outdoor planters that go out in the landscape each summer.

I learned that the greenhouse holds its own but does not collect large amounts of excess heat. I still pay for gas and electricity to heat the home, but it does contribute some to reducing reliance on fossil fuels. The best of all reasons. It lifts my spirits to see green growing each and every morning no matter how dark, cold or stormy the weather is outside. That is reason enough for any gardener to have a greenhouse.

Most successful solar greenhouses including mine are not fully glazed, as the heat loss through glazing is too great. Fully glazed designs also collect too much heat during the summer. This can be just as expensive to deal with as heating in the winter. Solar overhangs and other designs need to be carefully constructed to alleviate the problem.

For a solar greenhouse to be successful, it must face south or nearly so. My construction is wood frame on a concrete foundation with a shed style roof that slopes to the south and a vertical south wall. The glazing is primarily double pane sliding glass door panels.