

HyWynds Farm Sustainability Open House*

Sunday June 24th 1-3PM

2317 North Road Barnard VT: HyWynds@aol.com

A Sustainable Woodstock Event Sponsored by Eric Johnston – Four Seasons Sotheby's

For the last 9 years Janet and Stephen Andersen have done all they can to make their farm in Barnard carbon neutral. They have done it all; from installing solar, to weatherizing their home, to changing their lifestyles and they have been meticulously tracking their energy usage. We are so excited that they have opened their farm to the public for a tour, light snacks and beverages, and presentations from the Janet & Stephen Andersen about why they took on this effort and how others might do the same.

*Janet and Stephen Andersen formerly worked for the Environmental Protection Agency where Janet managed the registration and promotion of natural pesticides and Stephen managed stratospheric ozone and climate protection programs and at the same time managed the United Nations Montreal Protocol technology assessment.



The Andersen Sustainability Ambition at HyWynds Farm

Janet and Stephen Andersen's Dream Retirement after decades of professional employment was to live on a beautiful small farm in a creative community. Search criteria included:

Landscape view without powerlines and other visual insults and protected against unwanted future development by neighbors

Quality design and construction of existing buildings with room for fiber studio and small animals (sheep and goats; chickens and turkeys)

Excellent soil naturally enhanced over many years with composted animal manure and plant material and wood ash

Mature landscape plants, and particularly orchard trees, berry patches and flowers in every growing season

On the advice of friends living in Woodstock, the search was concentrated on Barnard, Pomfret, and Tunbridge. Andersens fell instantly in love with HyWynds Farm when they drove by at sunset and saw the 'for sale' sign on the lawn.

HyWynds had only a handful of owners since its construction in 1850. Sellers Chris Wuttke & Kerry Beverstock had refurbished house, restored the gardens, and added the red barn as pottery studio and shop.

HyWynds Farm House Carbon Footprint and Sustainability Efforts

Comprehensive Energy Audit Guided Investment

Trusted Partner: Brent Mellen, Building Energy, White River Junction, 802-359-3384;
bmellen@buildingenergy.us.com

Including:

- Blower door testing of infiltration
- Smoke pencil and digital thermometer sleuthing
- Furnace efficiency testing
- Appliance appraisal

Identified the best steps in improving energy efficiency

Created a list of high priority / high payoff measures requiring contracting

Also pinpointed areas easily improved over time do-it-yourself (DIY)

~5.88 KW Solar Collectors (see elaboration later in this handout)

Andersens chose to be on the grid for both reliability, low carbon and no batteries
Opting for continuous power and the ability to not waste surplus electric generation
Collectors supply all the electricity to farm with surplus sold to neighbors via GMP
The solar investment qualified for both US Federal and Vermont tax credits
The tax credits plus the “buy-back” of surplus electricity and increasing electricity cost resulted in cost pay back in just 10 years

Solar Lessons:

Choose size based on incremental cost and output; adding capacity to a basic solar system is often very inexpensive per added kWh

Be mindful of wind loads of wing-shaped collectors on the roof and always mount over roofing that will last longer than the collectors

Trusted Partner: Real Goods Solar: 888-567-6527, www.realgoods.com,

Energy Efficient Space and Water Heating (see heat pump water heating elaboration, below)

Three wood pellet stoves; stairway stove supplies hot air throughout the house
High efficiency condensing propane furnace backup with two heating zones controlled by separate thermostats and door between great room and kitchen

Propane space heater preheats studio; pellet stove maintains comfort

Less carbon than slow warm up with heat from pellets alone

Heat pump water heater also dehumidifies basement at no extra cost

For special occasions we compromise energy efficiency with classic stone fireplace

Energy Efficient Appliances

Best-in-class refrigerator with ventilation from cool basement for increased efficiency

A hole cut in the floor feeds colder basement air to the refrigerator condenser

The refrigerator is raised $\frac{3}{4}$ " above the floor with space behind and above

Food freezer in cool basement for fruits and vegetables harvested in summer

Inverter well pump uses drastically less energy, particularly when garden needs water

Light-emitting diode (LED) and compact fluorescent lighting (CFL)

High efficiency washing machine and full loads using cold water

Clothesline drying most of the year; indoor winter clothes drying near pellet stove

humidifies house when added moisture to the air is welcome

Sensible Clothing, Ventilation, and Outside Living in Summer

Sweaters and warm pants in winter

Shorts and cotton shirts in summer

Cross ventilation in summer using windows

East covered porch is cool on hot summer nights

Reversible fans move hot air from ceiling in winter, cool air in summer

Osmotic Water Filter Minimizes Bottled Water

The osmotic filter polishes water for point-of-use purity

No risk of mistakes in bottled water processing and packaging in plastic

HyWynds Farm Animal Sustainability Efforts

Animal Barn has Dual Use for Solar Collectors

Purposely built with true south barn orientation and slope and sized to collector array
Roof strong enough for wind load on solar collectors
New roof under collectors has longer expected life than collectors
Proven plumbing boots on collector brackets avoid faulty fastening through shingles

Barn Interior Tailored for Sheep, Goats, and Poultry

Sub-divided for animals, farm machinery and hay storage
Flexible for poultry and medium-sized animals (alpaca, goats, lama or sheep)
Animal smell down-wind and away from house

Poultry Coop is Convenient and Versatile

Chicken-wire encloses poultry against vermin
Insulated poultry box can be opened for ventilation
Poultry door and ramp directly into fenced free-range

Sheep and Goat Pens

Rubberized floor protects hoofs
Raised interior gate contains straw bedding
Hay loaded from hallway into feed trough for interior pen
Hay loaded from stairway into feed trough in lean-to pen
Hay stored in loft

Electric Fence Fully Successful

Two separate corrals divided by gates surround the barn
Adjacent 1.5+ acre pasture with barbed wire at soil level avoids burrowing under
Top electrified wire seems to keep deer and coyotes out

Animal Care Advice and Trusted Advisors

Animal personality might be more important than breed

Vermont Sheep and Goat Association
<http://vtsheepandgoat.org>

University of Vermont Cooperative Agricultural Extension:
<https://www.uvm.edu/extension>

Murray McMurray Hatchery, mcmurrayhatchery.com, 515.832.3280
Totally amazing heritage and rare juvenile poultry, advice and supplies

Fred DePaul for sheering and complementary story telling! 802-672-4113

HyWynds Vegetable and Fruit Sustainability Efforts

Garden Scientifically Improved

Periodic soil testing
Annual organic lime and wood ash as needed
Composted animal manure, bedding and vegetative compost tilled into the garden soil
Selective application of organic pest control methods
Weeding and manual pest harvest and disposal

Pasture Rehabilitation from 50-years Fallow

“Drop-in-place” sheep and goat manure supplies plenty of nitrogen
Hand removal of invasive or toxic plants
Rotational grazing to improve native meadow species composition
Three applications of 5-6 tons of limestone spaced two years apart

Orchards and Berries

Heritage apple of unknown species harvested for cider by Fable Farm
Young plum orchard just reaching first harvest
Pie cherry with satisfying yield
Abundant gooseberries, raspberries, strawberries, and a few blueberries
Currants (black, red, and pink) and rhubarb
Fruits and berries eaten fresh, frozen and in preserves and homemade wine

Perennial Vegetables and Herbs

Three rows of highly productive asparagus plus horseradish
Wide assortment of perennial herbs

Annual Vegetables, herbs, dye plants and flowers

Rotated crops of cucumbers, garlic, sweet and hot peppers, summer and winter squash, tomatoes, tomatillos, kale, broccoli, cilantro, parsley, dill, and more
Indigo, sunflower, zinnias, marigolds, cosmos, ... dye plants and cut flowers

Trusted Advisors

University of Vermont Cooperative Agricultural Extension:
<https://www.uvm.edu/extension>

Books by Eliot Coleman, Helen & Scott Nearing, and numerous others who publish details on anything you think you might need to do

Kathy Voth, Educated Cows Eat Weeds!
<https://www.livestockforlandscapes.com/cowseatweedsbook.htm>

HyWynds Farm Carbon Neutrality? Good Question and Food-for-Thought!

“Carbon neutrality,” or having a “net zero carbon footprint,” is achieved for a farm when the energy collected from the sun via photovoltaic systems or photosynthesis is equal to or greater to carbon released from the farm ecosystem. Keep in mind that such a calculation requires choosing a boundary and making assumptions.

- ✓ HyWynds Farm over-produces electricity that is sold to a neighbor who buys less electricity from the grid, which allows Green Mountain Power to avoid a portion of their most carbon intensive and expensive electricity generation.
- ✓ HyWynds Farm over-produces renewable firewood from its boundary woodlot that is donated to the community fuel program, but at the same time purchases renewable wood pellets made in Maine but with carbon emissions from harvest, processing, and shipping.
- ✓ HyWynds Farm over-produces fresh food in the growing season that is given to friends who avoid the carbon emissions from production elsewhere or is dried, frozen or canned for off-season consumption.
- ✓ HyWynds Farm, when at full capacity, over-produces sheep and heritage turkeys that are gifted to friends and neighbors (who avoided buying some of their protein elsewhere).
- ✓ In fact, a considerable challenge of a small farm is to balance farm production with demand. In Barnard, it is claimed, local residents lock their cars in late summer to make sure no one leaves bags of zucchini on the back seat.

The term "climate neutral" reflects the broader inclusiveness of taking into account all greenhouse gases as well as black and brown carbon particulate emissions from fossil fuel and biomass burning. Non-CO₂ greenhouse gases include: carbon dioxide (CO₂) methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFC), perfluorocarbons (PFC), and sulphur hexafluoride (SF₆).

So the answer is: 1) YES, HyWynds Farm carbon neutral in electricity; 2) YES, HyWynds is carbon reduced in food production; but 3) NO, HyWynds Farm is not yet carbon or climate neutral overall. The Andersen's are still buying gasoline, propane, and diesel fuel and every purchase of anything embodies greenhouse gas emissions used in production, distribution, use and recycle. Much accomplished; more to be done.

Andersen Solar PV System Elaborated Experience

5.88 kW DC, Grid-Connected, Non-Battery Solar System, Installed in fall 2009 by Real Goods Solar in 2012 <https://rgsenergy.com/vermont/>

Full Cost:	\$34,700
Minus Vermont Credit:	\$ 8,800
Minus Federal Credit:	\$10,400
Cost after Credits:	\$15,600

Total savings to June 2018 \$13,200 (value of electricity used plus feed-in bonus and sales)

Generated since October 2009 over 64,000 kWh

Breakeven by 2019 then annual savings of about \$1100/year for life of system

Savings increase as electricity price escalates

Huge carbon savings and great satisfaction in contribution to sustainability

Since 2009 the price of solar collectors has fallen substantially, but in January 2018 Donald Trump imposed a tariff on imported solar modules and cells that starts at 30 percent in the first year, declines to 25 percent in the second, 20 percent in the third and ends at 15 percent in the fourth. For the first ten years, Andersens qualified for a “feed-in tariff” that pays \$.06/kWh for power generation that may not be available in the future. Excess kWhs were paid to the Andersens at current charge for a kWh (about 13 to 15 cents per kWh). Federal and State tax investment credits are determined at the time of investment.

Andersens fully satisfied with installation, reliability, carbon emission reduction, & payback (Desire to be self-sufficient in electricity motivated energy efficiency improvements, which saved more money and carbon emissions).

Solar Lessons and Advice:

Think through off-grid vs on-grid; battery or no battery

- ✓ On-grid allows sale of surplus power to neighbors, has higher reliability and may have a greater value when the home is sold
- ✓ Adding modern lithium batteries to an on-grid system is even greater power reliability and will be an asset if Vermont abandons net metering; Tesla and LG offer similar high-capacity batteries for about \$7000+, which can be compared to the install cost of automatic propane backup power systems but avoiding annual fuel cost and expensive annual maintenance
- ✓ If you choose not to add battery backup now, insist that the system be designed for simple upgrade to battery later (wiring in place for a location where the battery can be located)
- ✓ Off-grid has the satisfaction of independence and greater personal and family involvement in synchronizing electrically-powered activities with the weather

Orient for maximum solar output; confirm no avoidable seasonal shading

Be sure the installation will be wind-safe, water-tight, and ventilated

- ✓ Ask an independent expert if the roof and mounts are strong enough
- ✓ Absolutely avoid any screw penetration of shingles or other roofing!
- ✓ Consider re-roofing prior to installation on an existing structure
- ✓ Allow air circulation below panels to avoid overheating that reduces output

Get several bids and understand any differences in performance, cost and warrantee

Watch the details and deadlines for discounts, net metering and tax credits

Calculate and negotiate upgrades

Stronger collector mounts

Larger system (selling surplus to neighbors or anticipating a plug-in electric or plug-in hybrid car)

Larger cable gauge connecting collectors to inverter

DC current has high transmission losses mitigated by larger cable

Insist on a warrantee and scrutinize the details

What is covered and who pays the insurance claim?

Is the insurance transferable if you sell your home?

How much output loss triggers panel replacement?

Who determines if output is below annual thresholds?

Is labor included?

Trusted Partner: Green Mountain Power resource for net metering and other questions:
<https://greenmountainpower.com/help/>

Andersen Heat Pump Water Heater Elaborated Experience

Trusted Ed Jodice, (retired) AHT Plumbing & Heating

The heat pump water heater is considered one of Andersens best energy-efficiency investments.

In 2014, Andersens shifted from a traditional electric resistance water heater on a separate utility meter billed at a reduced price per kWh averaging \$25 to \$30/month to the heat pump water heater at no reduced rate (eliminating the utility water heating meter and rate). Stephen installed a meter on the water heater, to compare before and after investment. We reduce the kWh used by about two-thirds and the cost about one-half since we pay more per kWh. Savings of \$12 to \$15/month. If GMP had implemented "smart" nighttime electric rate, it is likely the savings would be higher (depending on the rate savings and the adequacy of water heating just at night).

A rebate from Vermont Efficiency resulted in a net water heater cost of \$540 from Sears and had it installed for about \$550. Payback of \$1090 in about 6 to 7 years, not counting dehumidification value.

Andersens eliminated the use of a dehumidifier operated for about 6 months a year at a cost of about \$25-\$35/month (we never timed or metered dehumidifier use so this is a rough estimate). Dehumidifier savings of \$150 to \$210/year, which reduced payback to 2 to 3 years.

The water temperature is set at 125° F and it is set to operate in the heat-pump mode without electric backup. With just two people, most of the time, and washing clothes with cold water, most of the time, we never run out of hot water.

A larger family might need to schedule showers morning and night to have enough hot water. The higher the water heater set temperature, the lower the efficiency of heat pump operation.

From Efficiency Vermont:

“Electric heat pump water heaters typically offer the best balance of up-front cost, ease of installation, and savings over time.”

“Lower your water heating expenses by up to 50% or more”

“Models with a high energy factor save the most over time”

“Factor in installation costs when comparing systems”

<https://www.encyvermont.com/products-technologies/heating-cooling-ventilation/water-heating>

Here is the best online calculator. Use your electric rate and the price you pay for propane and oil.

<https://www.encymaine.com/at-home/home-energy-savings-program/water-heating-cost-comparison/>

However, in winter the heat pump draws heat from the surrounding air and thus requires that you make that up that heat from the source of space heating.

Consider also that a tankless propane heater might yield some heat to air, which has a value in winter. Or maybe the vent actually lets cold in when the blower is off?

Furthermore, consider that the heat pump has higher coefficient of performance at high ambient (heat source) temperature and thus may have lower efficiency in winter if located in an unheated space.

https://aceee.org/sites/default/files/pdf/conferences/hwf/2017/Delforge_Session4B_HWF17_2.28.17.pdf

https://www1.eere.energy.gov/buildings/publications/pdfs/building_america/64904.pdf

Finally,

Consider that it accomplishes a substantial amount of dehumidification, which saves more energy:

<https://docs.lib.purdue.edu/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=2818&context=iracc>