

# *The Quest for Carbon Neutrality*

One of my guiding objectives, before I even knew of the 1000 Home Challenge, was to greatly reduce the Cabilow's carbon footprint both by bringing down energy consumption and by shifting our remaining energy use to renewables. During Year 1, the baseline year (June '11-May '12), we used the propane furnace and bought all our electricity from Xcel Energy. According to the EPA's 2012 numbers, in Colorado the source mix for electricity averaged 86% fossil fuel (mostly coal) and 14% renewables (mostly hydro and wind). Thus, the only renewable energy we used during our first year was ~14% of our 11,627 kWh of electricity ( $.14 \times 39.7 \text{ MMBtu}$ ) = 5.55 MMBtu, or 6.2% of our total of 90 MMBtu (electricity + propane). The other 93.8% all came from fossil fuels.

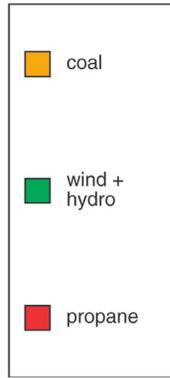
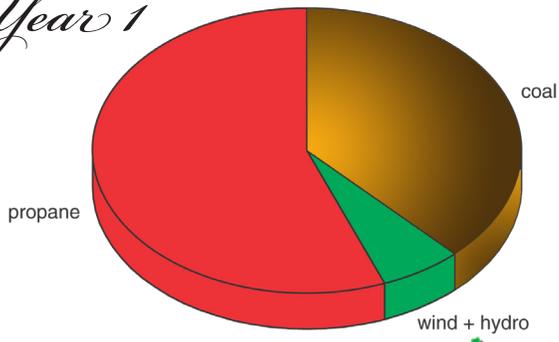
The changes we made going into Year 2 (June '12-May '13) in terms of renewable energy were to install solar PV panels on the roof, which came online in mid-December; to sign up for Xcel Energy's WindSource program, whereby the power company buys enough wind energy to cover all the electricity that we get from them (the portion the solar panels do not produce); and to switch to a new wood pellet stove for space heating. Wood is considered a renewable energy source by most pertinent organizations such as the IPCC, IEA and EPA, so long as it's harvested sustainably. We buy our pellets from a mill (New Earth) that uses only Colorado beetle-kill pine. These trees need to be culled to improve the health of the forest and lessen the severity of the pine beetle epidemic that is sweeping through the Rockies. We are actually helping the forest by using this wood, and our EPA-certified stove meets Colorado air-quality standards — the strictest in the nation — so air pollution is not a concern.

Implementing these measures resulted in a vast drop in the amount of our energy that came from fossil fuels. Our overall consumption was down about 19%, to 72.6 MMBtu, and all of our electricity was from renewable sources, either solar or wind. Net electric usage was down from 39.7 MMBtu to 20.6, a drop of 48%. All of our heat was supplied by renewable biomass (3 tons of pellets). Wood is not only a renewable fuel but a carbon-neutral one, as the same amount of CO<sub>2</sub> is released upon combustion or decay as the tree assimilated during growth. Solar panels and windmills, of course, produce no CO<sub>2</sub> at all while they're generating electricity.

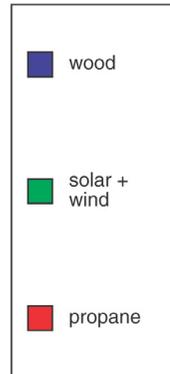
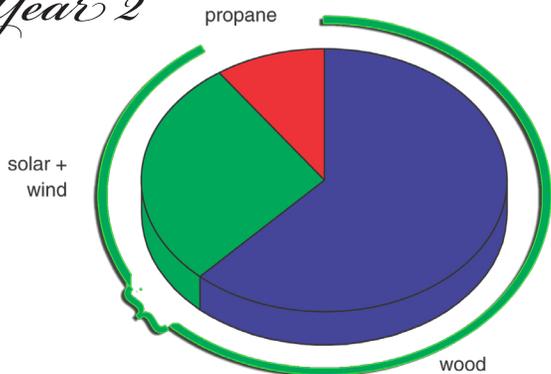
Our only remaining propane usage, after we abandoned the furnace, was for cooking and hot water. We only had propane for 8 months out of Year 2, because we had to have the tank hauled away while we put in a new septic system. During that time we had no hot water, and could only cook in the microwave; the 77 gallons of propane we used represents 8 months @ 9.6 gals/mo. This 77 gallons (7.045 MMBtu) of propane was our only fossil fuel, representing 9.7% of our energy use. The other 90.3% was all renewable (solar, biomass, wind). Almost a total flip!

During Year 3, we kept working on efficiency, like turning down the water heater temperature, and the ongoing insulation work. Our propane usage for the year was about the same, at 80 gallons, but this actually represents a substantial improvement, because it is 12 months' usage rather than 8; we were thus down to using only 6.7 gallons/month rather than 9.6. The solar panels, now online for the full year, brought our net electric usage down to 4114 kWh (14.04 MMBtu). And even though only certain rooms were insulated by year 3 (Allison's bedroom, laundry room, most of living room), this made such a difference that we used only 2 tons of pellets rather than 3, for a total heating energy of 30 MMBtu. The change was clearly noticeable, because during the first winter that we used the pellet stove, there were many times that we had to run it on high; by the second winter, even though we had several subzero spells ("polar vortex" intrusions), we almost never had to run it above medium. I was just pleased as punch at this, because I really didn't realize that insulating only a few rooms would make such a difference. Total energy for Year 3 was significantly less than for Year 2, at 50.2 MMBtu (down 43% from year 1). From a carbon standpoint, the most

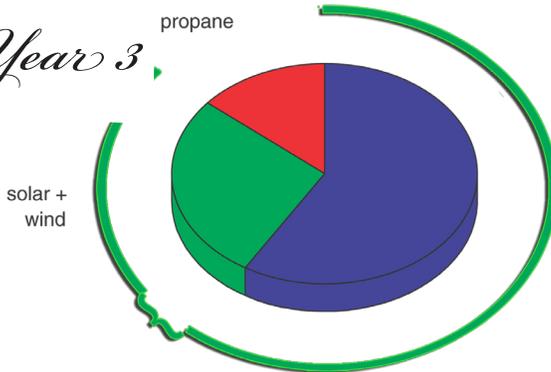
*Year 1*



*Year 2*

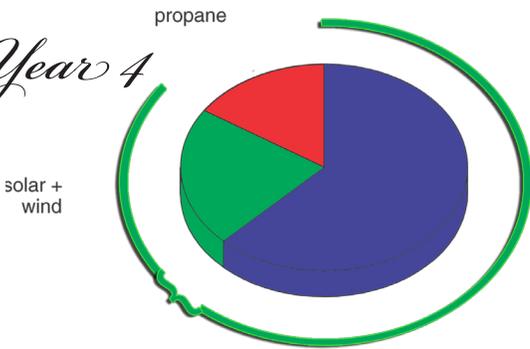


*Year 3*



renewable

*Year 4*



renewable

important thing for us to work on now is minimizing propane, since this is our sole remaining fossil fuel.

I was out of commission or running at half-mast for much of last year, so I only managed an 8% further energy reduction, to 51% overall, for Year 4. Propane barely budged at 75 gallons. Pellets came down about 10%. Much of the savings was in electricity, due to several factors, a large one being the conquering of the well pit heater problem. We finally got the culvert well enough insulated that the heater hardly came on at all (less than 3 kWh all winter), vs. the 400 kWh/month it racked up in the beginning. Hallelujah!

We're struggling with cutting our propane much further during Year 5. We use the induction burner and microwave for all our cooking other than baking an occasional meatloaf or birthday cake. We sterilize pet laundry with bleach rather than hot water, so now we use hot water only for showers and

the dishwasher. Preliminary data suggests we're using about 5 gallons of propane/mo, projecting ~60 for Year 5. With a standard tank-type water heater, we're bumping up against the minimum required just to keep the pilot light running.

We may get the chance to replace this ol' dog with a new water heater in the next few years. I wish we could do solar, but we lack both roof space for panels and inside room for a storage tank. Careful consideration of all the remaining options points to a pilot-free tankless as the best solution for us. Manufacturers don't tell you how much propane those will take, but since we know our approximate hot water usage plus summer and winter cold tapwater temps, we can reasonably estimate the energy required to attain a given hot water temperature. Such an exercise leads me to believe we might get by on around half as much propane with a tankless as with the current heater — definitely something to put on the wish list.

If we reach that point, where we're only using ~33 gallons of propane/year, that'll be 3.6% of the fossil fuel we used during Year 1. While that's not quite carbon-neutral, it's only 1/5 of what we'd be allowed while still meeting

President Obama's 80%-by-2050 emissions-reduction pledge, leaving the other 4/5 to offset some of the embodied energy in the solar panels. That'll be close enough for me.

