

Emergency Cooling Preparedness

Larry and Judith Watson © 2009

Everyone who lives in the South Skyline area lives “off-the-grid” at least part of the time. Most of us grid-connected types who have lived here for a while have developed means for dealing with grid-loss, which, for us, occurs about a dozen times a year. This article explains why we love our new high-efficiency SunFrost refrigerator both on or off-the-grid. We have an all-electric late 1970’s house with solar assisted hot water and a newly installed grid-tied solar electric system.

Refrigeration is perhaps the most beneficial use of limited available electricity. In addition to food preservation, ice can be valuable for first aid, expanding cold storage, or cocktails.



Our most recent **long** outage was January 2008 for 8 days, and there was not one hour of sunny skies for the entire period. This was our first grid-outage without some solar hot water. We have enough battery power to run the essentials for the first 24 hours, but

we're on fossil fuel after that. With our vehicles' average fuel content and 2 gas cans, we generally have enough gasoline and propane bottles to last about a week. After that we must go get provisions, or be limited to eating yard animals cooked over a wood fire.

But when we think about the "big one" or some other disaster that might occur that would take out the grid and also the roads, we're in trouble. If we reserved all our electricity production to refrigeration, our SunFrost will run 6 times as long as the refrigerator we replaced it with. The now-dead and gone Jenn-Air, side-by-side, with icemaker in the door, consumed 2.8 kWh per day. Our 20-year old Amana, freezer on the bottom and no ice maker, uses 2.4 kWh per day. After the death of the Jenn-Air, we purchased a SunFrost, with similar capacity but which uses only 400 Watts per day. Pictured above is our RF-19, the largest SunFrost: 19 cubic feet, ½ refrigerator, ½ freezer (on the bottom), sitting atop a matching 13" 2 drawer cabinet.

SunFrost has been hand-making refrigerators, freezers, combinations, and portable solar-powered vaccine coolers in Arcata since 1978. Originally created for the back-to-the-land, off the grid types of Northern California, over half of their production now goes to hospitals in rural Africa and other developing countries. SunFrost provided an off-the-grid alternative to propane-powered refrigeration.



Perhaps the greatest benefit is the extended storage life for fruits and vegetables compared to the traditional refrigerator/freezer. But to understand this benefit, we

want to first discuss the incredible efficiency inherent in SunFrost products available in many voltages, AC or DC.

You cannot put anything on top of this unit – the “works” are on top for freer heat dissipation, rather than having the works underneath warming the cabinet being cooled above. Notice in the photo above, there are two optimized complete “works” – one for the refrigerator and one for the freezer. The built-in brackets are tied to the stud wall for stability.

To explain the SunFrost’s efficiency, one needs to understand alternative technologies. Nearly all refrigerator/freezer combinations have only one set of works which cools the freezer down to 0 to 10 degrees F, and then circulates this cold (now almost zero relative humidity) air into the refrigerator compartment through a hole or tube. This eliminates the cost of a second works, but creates serious problems:

1. The introduced very dry cold air will dehydrate any exposed food, especially fruits and vegetables. Hence, the need for crispers, containers, or drawers to slow this dehydration and (and as a result) obscure the visibility of the contents.
2. The water vapor extracted from the produce re-enters the freezer where it is converted to ice (frost). Hence the need for frequent defrosting by heating the freezer compartment to maintain “efficiency”.
3. Due to automatic defrosting and circulating air, Ice cubes are continuously evaporated necessitating replacement. It takes a lot of electricity to make ice (typical commercial ice makers use 4 to 22 KWh per 100 pounds of ice).



You can note in the photo above, we use the top for drinks and produce. Visibility is great and the storage time of produce is at least doubled which is also of benefit in an emergency situation. We first defrosted the freezer after 6 months use. Freezer contents were transferred to efficient camping coolers and then the freezer independently turned off. After about 30 minutes the ½" of ice on top and rear easily comes off in a dozen or so large pieces.

But, what is the cost? If you need a new refrigerator and also plan to install solar electric, the SunFrost is almost free when compared to the cost of the incremental solar equipment needed to provide the additional 800 kWh per year for a typical refrigerator/freezer. Our SunFrost RF-19 cost \$3,800 delivered and required an 8 week lead time. Based on the first-year cost and estimated annual production of our solar electric system, we would have needed an additional \$3,600 for the extra capacity in addition to the cost of the typical unit.

Regarding our battery backup for 24 hours, we have batteries on wheels in the form of a 1980's golf "pickup" and an 1800w inverter that we bought on eBay. The inverter and 6 Trojan T105 batteries can provide approximately 3 to 4 kWh's before recharging. I do most of the maintenance on this Yamaha, but there is at-home service if you desire it.



Typically, for approximately 16 hours we can run 2 refrigerators (1 SunFrost), entertainment (TV, satellite, DVD.), small appliances (toaster, microwave....), 4 or 5 cf lights, water pressurization pump, and the solar hot water pump. On the 2nd and subsequent days, we run our Honda 3000w generator for 8 hours (2.5 gallons of gas) powering the essentials while recharging the batteries. Thus, we only have to listen to the generator for 1/3 of the time. An unfortunate consequence is that it is necessary to use 3.5 kWh to recharge the batteries for every 1 kWh extracted from the inverter/batteries. We are still investigating how to improve this charging efficiency to extend our gasoline supply for more days.

All these usage measurements came from using a kilowatt hour meter. That is the only way you can know the actual accumulated consumption for appliances. Meters are available for purchase or can be built using reconditioned meters purchased from <http://www.hialeahmeter.com/>.