Judith Fisher Centre Battery Report by Daniel Jacobs, January 16, 2020

Battery is rated 2200 amp hours at 48 volts for approximately 100 kWH energy storage. Optimum cycle life and utilization is 50% of rated capacity or 50 kWH. Load at the Last Resort is 25 kWH per day in the winter. Sixty percent goes to the service building (15 kWH) to run the heating system. The battery is sized appropriately for the load. Replacement cost for the existing battery is around $35k, installed. If the battery is cycled every other day, and is good for 3000 cycles, it will last 16 years in laboratory conditions. This being the real world if we get 10 years we will be doing well. In that case the battery costs about $10 per day. The cells are 4.5 years old now.

When I came on site the battery was somewhat discharged. The data log showed that the generator was shutting down frequently, and was unable to complete the charge cycle. Specific gravity readings showed a 25 point spread between the highest and lowest cells. Ten points is considered acceptable, therefore equalization was called for. I adjusted the system to equalize according to the Rolls battery manual at 2.67 VPC. Charging at this voltage caused the cells to overheat. The power system shut down due to high battery temperature a couple times. Ventilation is not adequate for a battery that size. The battery vent fan is meant for a battery ¼ the size, and the vent pipe is necked down as well. Inadequate ventilation increases the risk of explosion. It's important to research the ventilation needs for this size of battery and follow the recommendations.

I reduced the charging voltage to the lowest "equalization" setting (2.58 VPC) and there have been no more shutdowns due to high battery temperature. At last SG test there was still a 20 point spread high to low, so not much progress has been made. It may not be possible to equalize effectively without a way to keep the cells cooler. Their current condition is not terrible, if the SG difference does not increase they may be usable for many years yet. I would certainly try to perform another aggressive equalization in the spring, as soon as there is any "free" solar energy to do it with. Also when the service building is not heated the cells will be less likely to overheat.

There are some issues with the SMA generator control algorithm, and also the battery monitoring algorithm which lead me to wish for a third party product to take over those functions. This will not be possible due to the need for generator reverse power protection. The data log shows system shut-down events that usually relate to a sustained load of 3500 watts for several hours. The battery is designed to run such loads, but the operating voltage eventually falls below 46.0 volts. When it has stayed there for a time the Sunny Island inverter abandons it's battery SOC information and "recalibrates" to "dead". The inverter shuts off without issuing a generator run command and the lights are out. Not good. After restarting the SMA inverter the next generator run cycle must be controlled manually. Very inconvenient. Specific gravity tests at the time the error occurred show that the SOC is around 65%. Therefore the inverter is "panicking" without due cause. SMA tech support should be made aware of these issues in case they have a fix for them. Ironically, if the load were higher (5kW) the generator would be triggered to run, thus averting the shutdown.

Conclusion:

1. There is some sulphation, but it is not catastrophic
2. Battery specific gravity should be checked monthly
3. The weak cell should be checked weekly
4. Ventilation in the battery enclosure needs to be improved
5. System should be programmed to equalize every two weeks
6. Charge setpoints should be set according to the Rolls battery manual