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BATTERY MAINTENANCE

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H ave you ever flushed the toilet and had the lights go out. An off-grid friend of mine had this happen to her. And the problem is simple and easily cured. Basically with larger solar power systems, people are throwing more and more equipment on, but failing to keep their batteries in top condition. I handle maintenance at another off-grid friend's house, checking his system, every time I go off-grid for vacation. A year ago I had to pull two batteries, because I simply could not get the system to equalize. One battery was shot and the other was the weakest I could find in the system, because it is wired with 12 volt deep-cycle batteries for a 24 volt system.

Deep cycle lead acid batteries are designed for a life from 5 to 10 years, depending on how they are used. These are the most commonly used batteries used in alternative energy systems, because they are inexpensive (especially if you shop around), and easy to maintain. And their life can be extended if they are properly cared for, but greatly shortened, if not.

The great enemy of the lead acid battery is a failure to bring them back to full charge on a regular basis. When a lead acid battery is not fully charge sulfate begins to form on the plate, reducing the amount of plate available for charging and discharging. The main method of removing this sulfate is to equalize, that is over charge the batteries and blast the sulfate off. The best way, though is to prevent sulfate from forming in the first place. Ideally batteries would be kept at full charge, but this is not possible, except in utility intertie systems where the batteries serve in a backup roll in case of failure of the utility grid. (Notice that batteries in this capacity have twice the warranty.) We shall begin by discussing how to maintain the batteries to reduce the need for equalization.

Most systems have a volt meter on the charge controller, and the volt meter is the main thing we need to check on how well our system is doing. After several sunny days, the system should be reaching full charge (28.7 volts on a 24 volt system; 14.4 on 12 volt; 57.4 on 48 volt). If not, then it is time to check things out. There are several possible problems.

The first is that the battery bank is simply too large for the panels. In fact one book I read advises putting in an extra large battery bank, but does not warn that you will have to run the generator more. The only real solution is to add more panels. (I am presuming solar power, because most people have solar, some with wind backup.) The only other solution is to plan on running the generator more often, which I will discuss in a moment.

The second possible problem is using more electricity than you produce. Without an amp hour meter, it is hard to measure, but obviously if you are not reaching full charge after several sunny days, something

is definitely wrong. The solutions are either to cut the load or add more panels to produce more electricity. There are simple ways to reduce the load. Put all phantom loads on switches. There are many phantom loads, such as the TV, VCR and Satellite receiver. Anything with a clock is always consuming power. And sometimes it is something strange, such as an old big dish satellite receiver that buzzes away from the modified sine-wave power, and I can't figure out why, but it does. Also switch off the computer, when not in use. This is simple, simply exit from Windows and shut off, when the compute says you may. The only downside is waiting five minutes to fire up, which gives me time to go get a cup of coffee or a snack.

There is another problem to check for, a bad connection from the panels, coming in. The Trace C-40 tells you how many amps you are producing. Simply check at noon on a sunny day several times a year and be sure you are getting what you are supposed to get. If the amperage is too low, then start checking for a lose connection.

There are some basic rules to batteries. Rule number one is to be sure they are well vented. The second rule is to never enter the battery box, when the voltage is over 26.4 volts (24 volt; 13.2 - 12 volt; 52.8 - 48 volt), because this is the voltage the Powervent is set to kick on, although gassing does not start until a higher voltage. It is always better to be safe than sorry. If you take a tool in, be sure the handle is insulted. If you use a wrench, cover most of it with tape, just in case it falls across two terminals. Once installed, there is little reason to enter the battery box, except to check water once a month and when you add water.

I recommend getting to know your system. To do this get a calendar and track your voltage at noon and at the end of the day. Battery voltage is the main thing we have to tell us how things are going. I can walk down to my charge controller and tell where I am at by simply looking at the voltage and how much sun there is. If you have an amp hour meter, which measures amps in and out, remember that you don't get everything back you put in. Batteries are like a leaky water tank, they lose a little power just sitting there. Also write down when you check and add water and how much. I add less than some recommend, but in a larger battery bank, water consumption will be less per cell.

And to the secret. Once a month we want to see full voltage, whether we use the generator or whether the sun does it for us. Full voltage is 28.7 volts on a 24 volt system. (57.4 -48 volt; 14.4 - 12 volt) It is cheaper to buy a little more gas for the generator, than to replace the battery bank in five years, instead of 10 or possibly even 15. Do the Math and this should become obvious. It doesn't matter is you have to run the generator all day, make sure you reach full voltage once a month. I also charge to full voltage after watering the batteries. Full voltage stirs up the electrolyte in the batteries. In fact, I have read where it is a good idea to get to full voltage weakly in the sunnier part of the year and this is a good idea.

In watching the system, it becomes obvious that there is a voltage you should not get below. On my system it is the nominal volts of 24 volts. If I see anything below this, then it is time to charge. A little extra effort will pay off in the long run. Alternative power is not like utility power. Alternative energy takes a little work to maintain, since we are not only the consumer, but the producer and the distributor. Of course, alternative power is more reliable that utility power, and is worth the effort, even in on-grid applications, such as mine. In the last year, I have relied on my system for power through several overnight outages. Several years ago, I went to purchase a new computer. The salesman tried to sell me a UPS (Uninterruptible Power Supply) for my computer. I told him that I have one of the largest in the country. (The only problem I have in a major power outage is that my ISP is also down.) I no longer worry about staring at a blank screen, having lost an hour's worth of work to a blip on the grid!

There are three accessories that should be purchased to go along with an alternative power system. The first item is a battery waterer. This can be purchased on-line and at auto-parts stores. This little device

makes watering a breeze and insures all cells are brought to the same level. Mine cost about $15 a few years ago, but is an investment that is well worth it.

The second is a hygrometer. This is a simple device, which extracts water from the cells and tests the specific gravity. This is needed to determine full charge, since battery voltage or an amp hour meter do not guarantee that the batteries are full. Also, if battery performance has dropped off, it will be necessary to equalize, that is a controlled overcharging of the batteries until all cells test the same. The reason they appear unbalanced is that sulfate has built up reducing the capacity of the batteries. One can then push the voltage to 30 volts (15 for 12 volt; 60 for 48 volt). To do this, reset the inverter to its equalize setting. Also reset the charge controller to a similar setting. Before equalizing, water the batteries. Although it is not a good idea to be in the battery box at these voltages, there is no choice in equalizing, so be very careful. It is definitely a good time to put up the No Smoking sign! Test several cells and track their progress hourly throughout the charge. When they all test good and close to each other, then the charge can be stopped. On larger systems, batteries may equalize at less than 30 volts, so high voltage is not essential. On older and abused systems, one may find that some batteries have dead or have dying cells and must be removed. When I ran across this in a heavily used system, it took an hour to check every cell. Get out a piece of paper and note which batteries have weak cells. In a 20 battery system, I found one bad battery, which was pulling the whole system down. This being removed, the system is working much better today and last time I was there needed no maintenance!

Last but not least are PowerPulse units. (www.pulsetech.net) When I installed my system, I had read of the existence of units that eliminated the need for equalization, but it took me 15 months to locate and get the units installed. As a novice I had overused my batteries and it took several equalizations to bring performance up, but it still was unacceptable. These units pull a small amount of power for the battery and then pulse it back in. One unit is required for each string, although on larger banks the units can be rotated. (In designing a system I would go for larger capacity batteries with less strings and put a unit on each string, but hind-sight is 20/20) After installing my units, I noticed improved performance almost immediately. Their claim of increased battery life in my opinion is substantiated. They claim that this eliminate the need for equalization. I haven't equalized my system since, but maintain performance by following the other advice above. These units may appear a little expensive, but in the long run improved performance and substantial increase in battery life makes the investment worth it. It is my opinion that these units with proper care and maintenance makes batteries far less of a weak link in an alternative energy system.

And so, remember to keep your batteries full and happy to improve the performance of your alternative energy system. Since alternative energy is the wave of the future let us pioneers learn how to operate them properly today!

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