

The Oak Tree Low Carbon Farm

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Care and Feeding of Lead-Acid Leisure Batteries for Island Sites

The Oak Tree Low-Carbon Farm doesn't have a mains power connection at this time, so things like electric fences to keep the rabbits out and the pigs in, and lighting and incidental power needs to be provided by 12V batteries, charged up at home during wintertime and from solar panels in the Spring, Summer and Autumn.

Powering an off-grid island site like this isn't the typical use of lead-acid batteries. You need to treat your batteries with loving care and an understanding of their needs if you want them to last any reasonable time. Fail to do that and you will need to replace them more often, and more importantly, you may lose crops if your electric fence fails. This is what works for me. You have to get a routine if you're aiming for a continually powered site, and there are a few wrinkles that are worth knowing about before you start. I've written this up as it can be generalised to any smallholding not on mains power.

First, the battery. Lead-Acid batteries are unlike most other rechargeable batteries in that the rule of thumb is to use as little of the battery capacity between charges as you can, and never use more than about 50% of its capacity on a regular basis. Note you have to calculate this from your load – the voltage of a lead acid battery changes very little from 100% charged to 90% discharged. Do not let the voltage of the battery fall below about 11.5V, but you can't rely on voltage to give you the state of charge.



this battery was discharged to 4.83V open circuit, way too low below 11.5V

I had to learn all this the hard way, even though I knew the principles. After the ouch of trashing one battery by over-discharging (and recharging using a basic charger) I sucked it up and got two replacement batteries and an intelligent charger. My batteries are still in fine form after two years, swapped out over the winter and charged using solar panels and a charge controller the rest of the time. I store the unused battery fully charged and charge it again after six months, if not charged after use at an event in the meantime.

Some fence energisers cut off if the battery voltage falls below about 11V, and one of ours warns of low power by changing

the LED colour. That saves the battery, whether you feel good about pushing things that far depends on what the fence is keeping in, or out.

Use a simple process of weekly swapping of batteries

You need a simple process, so you can establish a routine. Anything too clever like measuring the state of charge in the field *is* too clever and will catch you out in the end, routine is the key to success here.

Swapping between two batteries, one in the field and one on charge is a tried and tested process used in industry for critical battery powered items. It is guaranteed to work as long as you both adhere to the process and you have done the load estimation right. You can expect at least 200 cycles from a decent battery at less than 50% capacity discharge, more typically 500. Because each battery is being used for only half the time, this corresponds to a service life of about five years or more. Unfortunately, Sod's Law being what it is, you will probably over-discharge a battery at some point, greatly reducing its lifetime, so a service life of four years is more likely.

Choosing a 12V Lead Acid Battery

You need a leisure battery for this sort of usage, not a car battery. This is because the load is spread out over time, unlike the load of starting a car. A leisure battery is designed for this sort of usage, and will last a lot longer. A car battery is designed to supply an extremely heavy load for a short period of time, then be immediately recharged in the vehicle as you are driving. Some people will remember when cars had dynamos rather than alternators, and the grief car batteries gave in winter. These problems were because the dynamo did not recharge the battery fully between starts. If you absolutely must use a regular car battery keep the total discharge low, less than 10% of total battery capacity. For an electric fence you'll be swapping that battery every couple of days to meet that requirement!

Lead Acid batteries come in wet-cell types which look like typical car batteries and must be kept vertical otherwise the acid will slosh out. You can get sealed lead acid types which are a lot more expensive for the same capacity; these can be used any way up. Most people will use wet cells for farm use because of cost. The battery will be used in a fixed place where keeping it upright is no big deal. Sealed lead acid batteries are very finicky on charging, you'd be unwise to use a typical car battery charger with a sealed lead acid battery

Maintenance-free or not?

Wet cells come in no-maintenance and low-maintenance types. Purchasers think maintenance-free is good, but you can make anything maintenance-free if you are prepared to scrap it when it needs servicing 😊

No maintenance is worse than low maintenance for farm use as all it means is there is no means of replacing the water in the battery if it is overcharged. Particularly if you are going to use a non-intelligent charger you will probably overcharge often, which turns some of the water in the battery to gases.

With a low-maintenance battery you can get to replace that. Use deionised water, I got mine from the BP garage near the Golden Key but any auto parts store should carry it. With no maintenance you get to throw the battery out. Since lead is a poisonous metal and the acid isn't friendly either, you should take the battery to a recycling facility. Foxhall Road household waste dump accepts these for recycling, and the store you buy the replacement may accept your old one for recycling.

Where no-maintenance batteries score is that it's harder for inquisitive prying fingers to meet the battery acid, so if you're going to charge with a intelligent charger somewhere kids might be then no-maintenance is okay. If you look after it

no-maintenance can last reasonably long. Use a grotty cheapo charger which doesn't sense the state of charge and you'll get to scrap the battery more frequently than if you properly kept a low-maintenance type topped up with distilled water. I like having the maintenance option, because people and chargers are fallible and screw up every so often. Even intelligent chargers have to slightly overcharge to know when the battery is done.

Leisure batteries are heavy, so worth getting locally. I got the ones used at The Oak Tree at [Barry Sharman's](#) at Colchester Road. [Motormania](#) in Woodbridge Road also carry some leisure batteries as well as car batteries. I use the Platinum 80Ah type.

Choosing a battery charger

All the power in your battery will come from the charger, unlike the situation in a car or in a caravan, so you really need to get this right for the sake of decent battery life. Use an intelligent charger that senses the battery condition. I use a [Ring RSC516](#) charger. You don't need a 16A capacity charger for leisure batteries, these typically settle to 4-6A for most of the charge cycle if you don't over-discharge them.

Using a Leisure Battery to power an electric fence

For a typical electric fence charger, drawing 150-300mA average, you can simply use a pair of 80Ah leisure batteries. Have one in the field, and swap them over every week. Bring the used battery home and charge it as soon as possible, preferably with an intelligent charger. If you have to use a simple charger of the sort sold for car batteries, your battery won't last as long because you will need to overcharge it to be sure of getting enough charge in, an intelligent charger senses this and stops once the battery is fully charged.

Swapping the batteries over in the field means your fence is energised all the time and you have enough time to recharge the used battery. It is easier to maintain the process if two identical batteries rather than mucking around with different sizes or types of battery.

You want to keep water off the battery to minimise leakage and corrosion. A plastic trug placed upside down over the battery and weighted or tied down does this job well.

Calculating Capacity

You can calculate the battery capacity needed from the current drain. A typical small electric fence energiser uses 150mA, which is 0.15A. If you swap every week, there are $24 \times 7 = 168$ hours of running time, so the Ah used is $0.15 \times 168 = 25.2$ Ah. You should try not to use more than half the capacity of a lead acid battery [1] so you need at least a 50Ah unit, and 60-80Ah will be a better choice. There is such a thing as too large a battery, you should use at least 10% of the battery capacity per cycle, we are running about 30% capacity.

If you want to save money and use a 40Ah battery, then you'll need to swap batteries every three or four days ($0.15 \times 4 \times 24 = 14$ Ah, less than half the 40Ah capacity)

Lead Acid Battery Dos and Dont's

- Never charge a battery indoors. Explosive gases can be released on charging, maintain good ventilation at all times.
- Never let the voltage of the battery fall below 11.5V off load. You will probably have permanently damaged a battery

that measures less than 10V off load.

- Ensure the + terminal is connected to the + terminal of the load and the charger. If you have ever seen the results of someone getting this wrong on jump starting a car you will never forget it.
- Remove rings, watches, jewellery before handling batteries, the short-circuit current is huge. Don't give the short a chance...
- Recharge the battery as soon as possible. Lead acid batteries want to be a close to fully charged all the time, unlike other types of batteries like NiCads. Lead acid batteries do not really like being used at all, and the less of the capacity you use between charges, the longer they will last.
- When connecting to a charger, connect the charger to the battery before switching the mains on. This is to reduce the chance of sparks at the terminals
- When charging has finished, switch the mains off before disconnecting the charger from the battery. This is again to reduce the chance of sparks at the battery terminals, which can ignite the explosive gases released on charging.

References

[1] best lifecycle cost at < 50% discharge [Wind and Sun](#) Battery FAQ

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