

# Durable Lighting Systems for the Non-Industrial World

## Why is this project necessary?

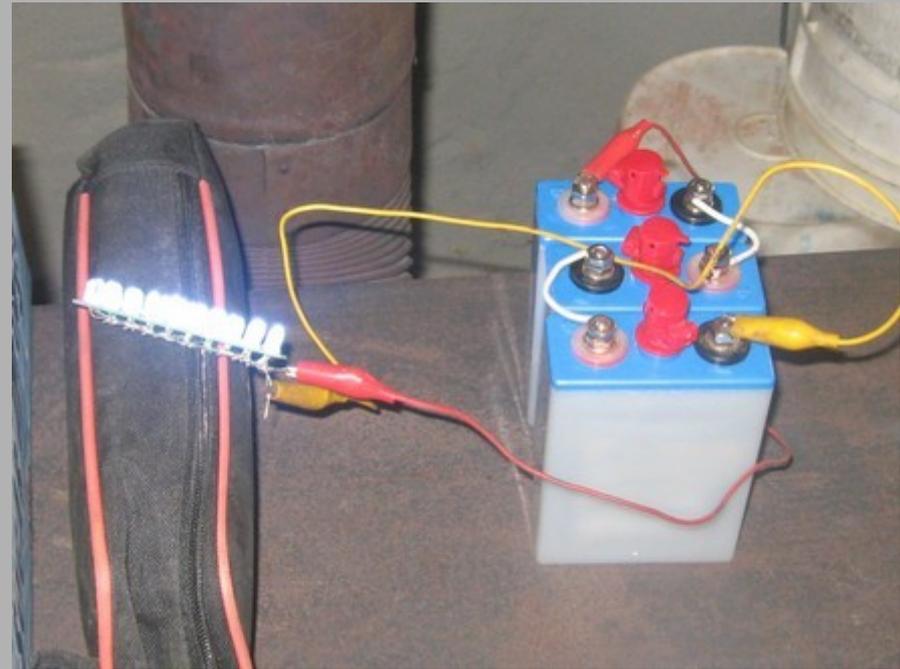
In starting Living Energy Farm, we were well aware that the American conventional off-grid model that relies on lead-acid batteries and backup generators is a very poor solution for energy self-sufficiency. We have been pleasantly surprised to realize how well our DC Microgrid works. Our LED lighting system powered by nickel iron (NiFe) batteries is part of that system. Our lights never go out (unless we turn off the switch), even in the most extended of abysmal weather. In trying to convince international charitable organizations to use our model, we have been shocked to realize that those organizations are, as far as we can tell, wedded to American consumerist, disposable technologies. Specifically, they are all using lead-acid, or sometimes lithium batteries tied to AC based power systems, even in the poorest parts of the world. That is simply tragic. Instead of giving people of modest income a reliable power supply, our charitable organizations are simply trying to provide an illusion of American middle class luxury to a chosen few.

An LED based lighting system running DC straight from NiFe batteries can produce reliable lighting for decades with a non-toxic system for people who do not have reliable grid power. Incidentally, this system is scalable, and has a much lower environmental impact. To implement that vision, a few things are needed.

**1) Smaller nickel iron batteries.** The set we have at LEF cost \$1000. That is a small cost for a community in the US to provide lighting, computers, and power tool power support for decades. But for a small house in the non-industrial world, we need something cheaper up front. To that end, we have pursued two paths;

A) We contracted with a manufacturer of NiFe batteries to produce and ship us small NiFe batteries. We have those batteries in hand and have been using them.

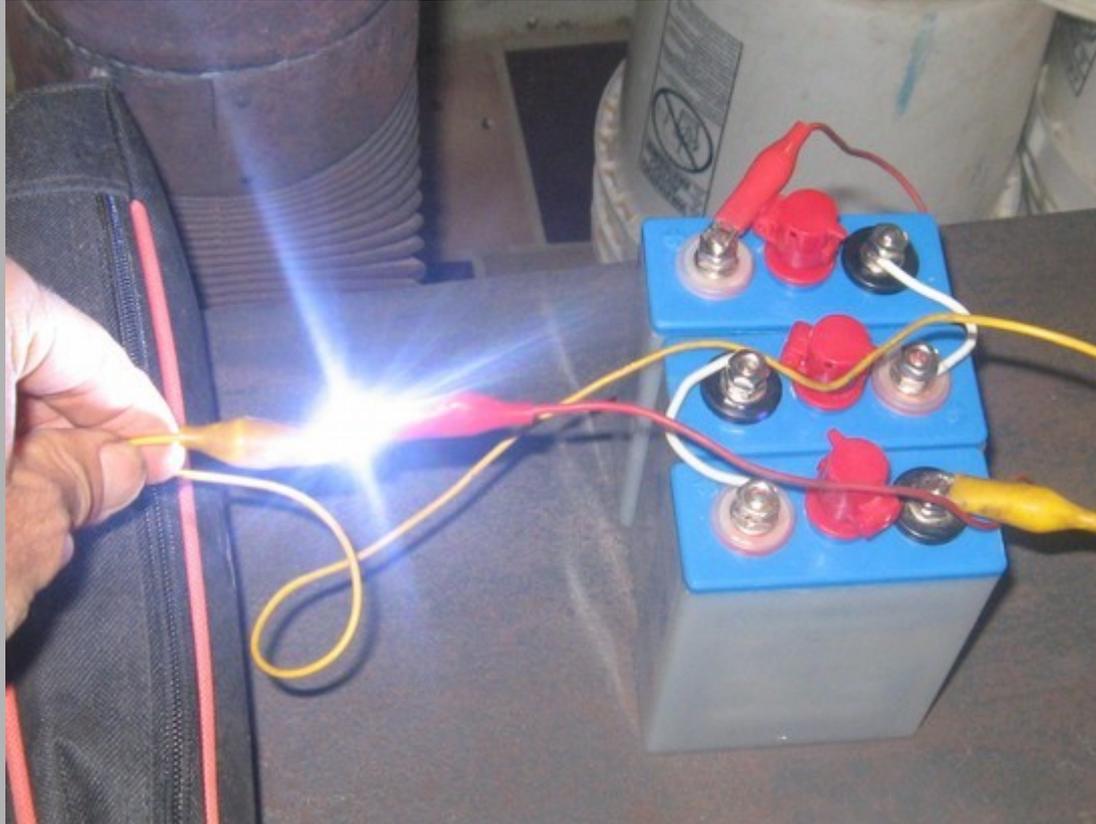
B) We are seeking to make our own NiFe batteries. Many wise people over the years have had the idea that villages could make their own NiFe batteries. Some universities and other organizations have worked on that idea, but it has not come to fruition. We have made several generations of NiFes, and are working to improve them. So far our homemade batteries are not performing well enough to take into the field.



These are small NiFe batteries connected to a homemade LED bulb. The individual LEDs are a penny each. It takes 20 – 30 of them to make much light. The NiFe cells are \$18 each. Two can make a functional set. In theory, we could make a lighting system for \$50 or so. But the quality of light of a system this small is not optimal.

## 2) Low-Voltage, Inexpensive, Durable Light Bulbs

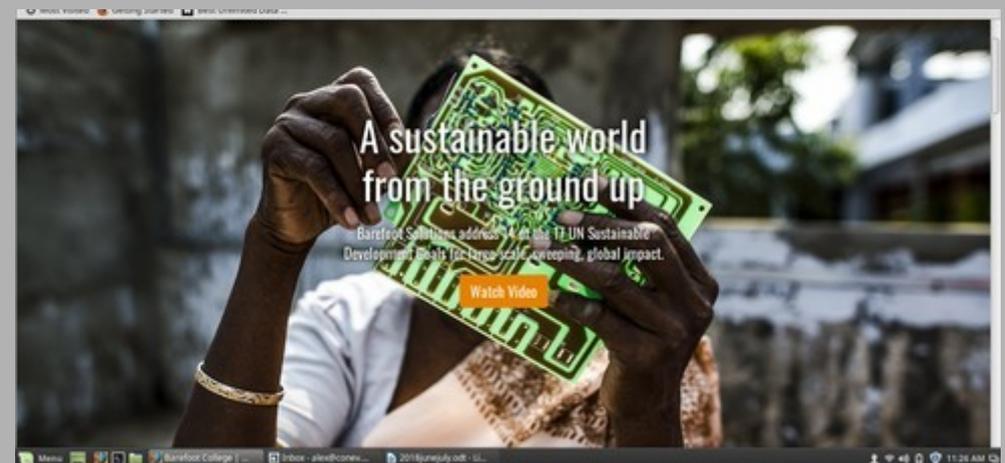
We cannot buy any good bulbs below 12 volts. To keep the price of our overall system as low as possible, we need very low voltage bulbs. We have operational bulbs at this time, and we are improving them. We are not sure if we can make good NiFe batteries on a homemade basis. Light bulbs are easier. The ones we have work fine, and we will improve them.



This is an LED chip connected to the same small NiFes. The LED chips cost .20 - .30 cents each, but make much better light, and are much faster to assemble. This is an ongoing research project, but our current plan is to deploy 6 volt NiFe systems using these small cells and LED chips. That will make a much better lighting system, but will cost \$120 - \$130 for the whole system. Such costs may seem minimal to us, but in non-industrial countries, such cost differences loom large. We can offer different, less expensive options as needed.

You should also notice what is missing from this picture. The batteries are connected straight to the LED. There's a resistor you can't see, but there are no electronics – no integrated circuit chips, no computer, no charge or discharge controllers. That's because the NiFe batteries do not need the voltage regulation that ALL other battery systems require.

Compare these two pictures. The left is a small NiFe set tied directly to a solar electric (PV) panel. No electronics of any kind are needed. The right picture is from an organization in India that teaches poor people how to make their own solar equipment. You see a woman holding a charge control circuit. That circuit is **not** needed for lighting systems based on NiFe batteries. The equipment being offered to the poorest of the poor is based on the consumerist habits of wealthy people, not the needs of the people themselves.



This is a screenshot of a charity organization asking for funding to do solar work in Haiti. Notice the solar panel field. LEF's approach is to put solar panels near the demand, and to use most of the electricity on a daylight drive basis, then to use durable (and hopefully homemade) NiFe batteries to supply lighting at night. The charity here is using this large set of PV panels to power large computerized charge control equipment, tied to industrial batteries (which will not last more than a few years), tied to inverters, tied to power lines, tied to computerized meters. The system is extremely complex and expensive compared to our model. We can provide lighting with much simpler, more durable technologies.



This is a “solar home box” designed specifically for use in Sub-Saharan Africa. It is the standard design – short lived batteries, inverter for AC power, plugs for charging phones and powering lights. The LEF model is better. We can charge phones straight from a photovoltaic panel with a car charger. DC LED lighting powered straight from durable batteries would be much simpler, cheaper, and more durable. This system is yet another system that tries to export a consumerist model of energy to people who could benefit from much simpler solar lighting/ charging systems.



The DC LED lighting system we have developed at Living Energy Farm could provide needed light to millions of people. It's time to give people what they need instead of exporting our consumerism. And, once our simplified energy systems take root abroad, perhaps the people using them will be able to teach us how to live more wisely, simply, and gracefully. We are seeking support to help make this happen.