

Affordable Renewable Energy Systems

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Living Energy Farm is a community renewable energy development center in Virginia, USA. Our mission is to develop renewable energy systems that are affordable and durable to be installed homes and communities around the world. We have developed a compact solar electric kits that we call Living Energy Lighting and Charging Systems, or LELCS. The purpose of LELCS are to:

- 1) To bring solar electric lighting and charging services to people in low income communities who need and want them.
- 2) To establish and encourage the use of renewable energy in a manner that enhances the self-determination and sustainability of the communities where they are installed.
- 3) To train skilled installers and establish a supply chain such that the project may continue in the future without ongoing charitable donations.

What Are LELCS?

LELCS are durable solar energy systems that can provide lighting for a small home, and charging services to charge cell phones, smart phones, and other devices. LELCS are built around core components that perform for decades. We have been using LELCS systems at Living Energy Farm for 10 years. We have been very pleased with the performance of these systems, and see it as our mission to provide them to communities around the world that do not have reliable electrical services.

Core components of LELCS

- 1) Each system has a PV panel, and these degrade slowly over decades.
- 2) LELCS use nickel-iron (NiFe) batteries. NiFes last much, much longer than any other battery. We have a 72 year old NiFe that is still in use. NiFes are much more robust than every other battery technology. They can tolerate voltage swings and deep discharge better than every other battery technology. Lead acid and lithium batteries are fragile compared to NiFe batteries. NiFes are less profitable for the battery companies, but they are much better suited to stationary solar electric installations.
- 3) We use DC LED lighting in LELCS. The DC LEDs are highly efficient and tolerate varying conditions.
- 4) Charging station -- Anything that can be charged from an automotive cigarette lighter plug or USB cable charger can be charged from a LELCS. All small electronics, including smart phones and laptops, can be charged from a LELCS. All LELCS have a nominal 12 volt DC output, and come with 12 volt charge plugs, light sockets, and light bulbs.



LELCS are enclosed in a custom made, durable metal box.



LELCS use highly durable nickel-iron batteries, and can be installed with 10 cells as a 10 amp-hour system, or with 20 cells as a 20 amp-hour system.



Each LELCS has two cigarette lighter plugs that can be used to power DC LED lighting for a small home, or to charge phones, computers, and other devices.



Each LELCS can power 3 - 4 lamps or overhead lights, enough to light a small home, as well as charging computers, phones, etc.



This is the LELCS kit. Overhead lights and lamps are provided on an as-needed basis.

has pioneered the use of "daylight drive" equipment that uses thermal storage instead of electrical storage. As a result of this, our LELCS system runs only lighting and electronics, not appliances or tools. Given this, we are able to use much smaller, much more durable battery systems. The overall result is that LEF is energy and economically self-sufficient, and our annual cost for replacing worn-out batteries and other electrical equipment is about \$25. We can design custom sized LELCS systems for other communities. These systems are flexible in configuration. Any moderate sized solar PV panel, 100 – 300 watt, can be used. At LEF, we have found that a 100 amp-hour battery set can easily support a community of a dozen people. Cost of materials is about \$1500



Larger LELCS can be supported with a single PV panel.

LELCS Cost and Implementation

In April 2019, LEF installed 7 LELCS systems on the Navajo Nation in Arizona. These systems each contained \$350 worth of parts. In the fall of 2019, we intend to install more LELCS systems in more homes in Arizona. We have found several local civic and government organizations in Arizona that are excited about the project and can help us on the ground. The new LELCS systems we are building have a much better enclosure. We have also found a cheaper source of both batteries and charge controllers, thus allowing us to build the LELCS boxes for about \$170 in parts (not including labor). We are raising funds to install 100 LELCS systems in Arizona in the coming year.

Custom LELCS Systems

At LEF, we have been living off-grid with a LELCS electrical system for the last 10 years. It provides lighting and charging services for several buildings and about a dozen people. This system sails through extended cloudy periods with no disruption of lighting or charging services. Laptops and other electronic devices can be charged any time of day or night. Living Energy Farm



This is a \$350 MPPT controller at LEF. One can also use a \$90 controller if nominal 12 volt panels are used.



100 AH NiFe battery set.

Implementation

Many organizations and individuals have attempted to deploy solar lighting systems to people who do not have grid power around the world. Sadly, the model of off-grid technology that relies on short-lived batteries has prevailed, and disposable lead batteries and derelict solar systems are now scattered far and wide. The core components of LELCS systems are highly durable, and the overall complexity is minimal. The outreach component of Living Energy Farm is the Living Energy Global Initiative, or LEGI. Through LEGI, we are setting up small shops in areas that need LELCS systems. These shops will have the tools and

training to repair LELCS systems. Though NiFe batteries are very sturdy compared to other batteries, they are not indestructible. If a NiFe cell fails in a LELCS system, they can easily be replaced. With these village repair shops in place, LELCS can be maintained indefinitely. Our first deployments of LELCS will be in rural areas in the U.S. that do not have grid power. This will allow us to refine our equipment and our approach. We hope to have a pilot project in Ghana in 2020. We are also seeking people with experience and contacts abroad who might benefit from LELCS. We are seeking support in this undertaking. Donations can be made at <https://donatenow.networkforgood.org/1388125>
Designate Living Energy Farm Education Fund.