Living Energy Farm
January - February 2026 Newsletter

Simple, Durable Solar in Jamaica

Last month long time friend and more recent LEF collaborator Tim SanJule traveled to Jamaica to lend a hand at Soladarity Yaad, a permaculture farm in St Ann's Parish. Solidarity Yaad's mission is to uplift women and QTGNC while building a community-based agroeconomy that values shared equity through collective labor.

In 2024 an LEF supported crew from Puerto Rico installed a daylight drive refrigerator, oven and water pump system. This visit was focused on repairing damage done to them by the two hurricanes that have passed overhead since installation and planning for a future workshop, battery based lighting and charging and additional daylight drive capacity.

Tim SanJule in Jamaica, helping repair hurricane damage and prepare for more direct drive solar equipment at Solidairty Yaad.

We were able to successfully repair damage and restore functionality as well as plan for upgrades to add functionality via reduced shading and more robust installation. Discussions about the next stage revolved around a solar water pump for the main house, solar charged battery powered lighting and device charging stations for the main house and two smaller adjacent buildings. This included needed load calculations, panel placement and wire routing considerations. We also pondered additional daylight drive needs such as a mill grinder.

Hurricane Melissa did significant damage to the main house/building on the farm. This damage included the complete loss of the roof and precipitated our planning session and visit. At times of great loss there can also be opportunities and this is one of them. Many of the details of a return visit with an LEL crew need to be fleshed out but we have the outline and the enthusiasm. Stay tuned!

LEF's Energy Model In Sierra Leone

We have been working on a project in Sierra Leone called Project Peanut Butter (PPB) that makes nutritional supplements for malnourished children. Our friend Ryan from Cal Poly went there twice and has helped them upgrade their systems, and part of it is now running on solar. Ryan has moral dedication and an excellent understanding of electricity and direct drive solar. We have a strong mechanical background. Together, we put together plans for a full conversion of the facility. Unfortunately, some of the original information we had been given about current and future production plans has proven to be inaccurate. We mentioned in the last newsletter than we felt like PPB was the "home run" for direct drive solar. But we now find that we have to accept that we made some modest improvements, but the full conversion we had hoped for is not in the cards.

Future Direction and Projects for Living Energy Lights

For years, we have been looking for projects that would increase the notoriety of Direct Drive DC Microgrids (D3M) such as we have at LEF. If we could gain legitimacy in the public eye, D3M could make grid power obsolete, at least in the tropics, and possibly far beyond. The environmental benefits could be huge. But there are many frustrations along the way. Having to scale back the PPB project is one of them. But we also have no shortage of future opportunities to look forward to. Deb has been managing Living Energy Lights (LEL), the LEF affiliated nonprofit that works to expand D3M. She has upgraded our current stock of nickel iron batteries, solar refrigerators, and other useful items for durable solar systems (see livingenergylights.com).

Our relationship with the projects in the Caribbean is ongoing. As we reported in this and the last newsletter, we are continuing to support the various organizations installing durable solar in Puerto Rico and Jamaica. We are making progress in educating people about direct drive solar, even if it feels like a a slow process at times.

For now at least, the phone has gone silent with Cuba, and they need our technology more than anyone. They are, as you may know, in a severe energy crunch caused by actions of the U.S. government. They are burning about 90% of their liquid oil to make electricity. And they already have about 50 watts of solar photovoltaic capacity installed. By comparison, LEF has about 300 watts per capita, and we run large and diversified array of equipment. Cuba could benefit enormously from D3M. They don't know that. Anybody know any Cubans? Feel free to send them our way.

Projects in Sub-Saharan Africa

One hopeful development concerns other people who are working on these same issues. Pete Schwartz is the professor from Cal Poly who developed the Insulated Solar Electric Cookers (ISECs), and also connected us with Ryan. He is now a Fulbright Scholar at Mzuzu University, Malawi, Africa. He will be there for a year. Pete uses the term Direct Drive Solar (DDS), and he understands it well. He is also a bundle of energy in terms of his relentless pursuit of DDS. (His blog is here https://sharedcurriculum.peteschwartz.net/global-engagement/) Pete has put together an enthusiastic team of people at Mzuzu who want to see DDS spread. They are pursuing grants, and seem optimistic that they will get support. We are part of the grant process, and will be part of implementing it if it comes through. We will keep you posted as the project evolves.

Here is the reason 'solar mills' are so expensive. This is a full-speed hammermill driven by a conventional battery-inverter setup proposed for widespread us in Africa. That approach is both costly and not durable.

Grain Mills in Malawi and Beyond?

A big issue is that the cost effectiveness of D3M only works when energy use patterns can match solar output. If you build a fancy solar rack and then don't do something useful with the energy, the payback is poor. The integrated system we have at LEF is ideal in that we use it heavily. Village scale energy systems like we have at LEF seem to be hard to find. Short of an LEF-style village, the easiest payback would come when we can shut down stationary diesel or gasoline engines that are running long hours.

Going forward, our thinking at this point is that grain grinding in Sub-Saharan Africa might be a niche where direct drive solar can prove itself. To that end, we are looking toward setting up solar powered grain mills, probably in Malawi, possibly in Ghana and other locations. Grain mills in Sub-Saharan Africa often run long hours and are powered by diesel engines or unreliable grid power. The first mill we help set up is likely to be at Kindle. That is an organization in Malawi originally set up as an orphanage for children whose parents died of AIDS. They now run a school and other facilities. Pete has been working with them for several years. We have raised the idea of putting in a grain grinding mill there in late summer or early fall. They are enthusiastic about the idea. Ryan has already done some work there in setting up some DC equipment at Kindle, and he can go back there later in the year.

There are other organizations that have, for some time, tried to solarize grain grinding in Africa. Their failure is that they try to use hammermills at full speed from battery-based solar kits. Taking that approach results in a grain grinder that cost *more* to run than a diesel powered one.

A 2020 study by Energy4Impact and the Efficiency for Access Coalition Co-Secretariat, CLASP, found that solar mills cost twice as much as diesel mills to purchase... The monthly energy spend to power an electric mill is also twice as much as that for a diesel mill. From https://nextbillion.net/milling-on-mini-grids-africa-maize/

The reality is that there are many different kinds of grain mills. Burr mills are the standard for animal feed, and run with no problem at variable speed. Most fancy fine flour mills are either stone mills or have machined plates as opposed to the rough plates of burr mills, and they also work fine running variable speed.

Hammermills are very common, from garden shredders to big industrial grinders. Hammermills shatter the material being ground with high speed flails. They have to spin fast or they don't work at all. *Any other kind of grain mill* can be run variable speed. There are literally thousands of different models of grain grinders -- burr mills, different variations of plate mills -- on the market. Like solar water pumps, there is a huge variety of price, quality, and capacity options. In short, hammermills are not well suited to direct drive solar, all other mills work fine with direct drive. Surely, the professionals trying solarize grain in Sub-Saharan Africa know all this, don't they? They don't. The cost of setting up a direct drive grain mill is quite modest. We are hoping to start installing them later this year.

This simple burr mill, with stainless hopper and stand, cost a whopping $70, delivered. Larger versions of this mill would make for very inexpensive direct drive solar grain mills.

Pete and Ryan's Optimizer Circuit

Direct drive solar works at peak efficiency if the machines are optimally sized to the power supply. Pete and Ryan have been trying for the last few years to develop and build inexpensive optimizers that make a solar direct drive circuit run at peak efficiency even if the varying solar supply is not optimally matched with the load created by the machines. Ryan came by LEF on his way home from Africa and installed their new optimizer at LEF. We like cheap and simple, but in this case, we also like this circuit. First of all, the failure mode of the circuit is that it simply disappears electrically, and things go back to what they were like without the circuit. Second of all, the circuit cost only about $20 in parts and adds 30 - 40% power capacity on our 1.4 KW high voltage power supply. (Smaller circuits can use cheaper optimizers.) Third, the circuit is relatively simple and can be assembled on site (from a pre-built board with a couple of integrated circuits on it). And forth, at 4 PM on a winter day, our shop shuts down without the optimizer. We can run shop tools quite a bit later, and in cloudier weather. We like that. Our contribution to the project has been to take their somewhat frail laboratory model and upgrade the wiring techniques to something more suitable for general, in-the-field application.

The Next Generation Simplified Combine Harvester -- The Grain Goblin

As we have discussed in previous newsletters, we created a simplified combine harvester (Easy Reaper). It is a good machine in that it is much simpler than normal combine harvesters. As with any machine, it has its strengths and weaknesses. We have not found anyone to make them in the U.S.. A project was initiated and a couple were made in Zambia. We sent detailed plans, but there were some issues with the ability of the builders to interpret our plans. The machines they built were not the same as what we had built in the U.S. They may build more of them, they may not.

The Grain Goblin, the next generation simplified combine harvester, being assembled in our shop with our direct drive shop tools and solar powered welder.

The Easy Reaper is a useful machine, but it is still complex enough to be challenging to build without proper knowledge and equipment. The Easy Reaper was actually harvester number four. Number one was much simpler, but fell apart quickly when we tried to use it. The Grain Goblin is harvester number five. It is much simpler than the Easy Reaper, and hearkens back to number one; the original, very simple design, but this time made with sturdier components. Hopefully, we can put the Grain Goblin into operation this year. It would be quite a bit easier to build in remote locations than the Easy Reaper. If we do succeed with the Grain Goblin, instead of creating detailed plans with lots of small numbers on them (which is no small task in itself), we may make more copies of the machine itself, and try to send those abroad. In the small shops outside of the industrial world, material things carry meaning in a way that paper plans do not. Either that or we will create plans with a very large number of very close-up photos. Wish us luck.

Solar Direct Drive for AC Motors?

We are testing a new-ish technology that is likely to have a very large impact on the future of D3M. The technology consists new motor drivers that allow us to run AC motors directly from solar photovoltaic panels.

The discovery of solar direct drive -- running equipment without batteries -- came as a huge surprise to us at LEF. We have developed the technology over the last 15 years to include high and low voltage circuits, thermal storage and small amount of battery support. In terms of electric motors, we mostly rely on permanent magnet DC (PMDC) motors, as well as an occasional brushless DC motor. PMDC motors are rugged, super flexible in their ability to use varying voltage, and the small ones are about the same price as AC motors.

In considering how to convert PPB, as well as other potential larger scale conversions in Cuba or Sub-Saharan Africa, we have started to realize that the LEF model faces a big supply chain problem. PMDC motors are used in many industrial machines that need speed control in industrial countries. We can get them easily. Used ones are as good as new, and very cheap.

We have come to realize that PMDC motors are extremely rare in non-industrialized countries. If we ever get to the point (we hope) of large scale D3M conversions, we would be swapping a lot of AC electrical motor for PMDC motors, and all of the PMDC motors would have to be imported. Cheap used ones are not available in non-industrial countries. There are other issues as well. Large PMDC motors are expensive, and they are not manufactured above five horsepower (HP). The largest motors we have at LEF are 1.5 HP, so it's not an issue for us. But looking at ten or twenty HP motors, the cost of these big industrial AC motors is high, and the cost of big industrial DC motors is astronomical.

It seems we have found a fairly cheap solution to this problem, and it originated in the water pump market. That market has for decades been the primary driver of direct drive solar technologies. Middle class consumers may be finicky about their appliances and turn up their nose at intermittent solar power. But farmers are not so picky, and all over the world they are happy to pump water (cheaply) when the sun shines.

For many years, large industrial plants have been using Variable Frequency Drives (VFDs) to power their motors. The VFDs allow an AC motor to act a more like the DC motors in terms of varying speed, as well as slower starts and stops, which helps prevent damage in the machines being powered by those big motors.

The solar pump market took the idea and is now making solar VFDs in sizes from small and cheap to hundreds of horsepower that can power AC motors directly with sunshine, no batteries. That is a big deal for us. Old fashioned VFDs are really complex and expensive, AC powered, and do not have anything resembling the flexibility of direct drive solar. The solar VFDs are an improvement on the technology.

The core of modern solar VFDs is something called a mosfet driver. Bottom line, they are somewhat complex, but not incomprehensibly so. We can, if need be, build them from scratch. We have begun experiments with inexpensive solar VFDs to see how they work with our D3M systems. It seems very likely that in the future we will be able to walk into a factory like PPB, add some solar panels, add some fairly inexpensive VFDs, and run the plant on solar without swapping out the motors. That could make the spread of industrial D3M much cheaper and easier. We will likely also be able to set up grain mills with locally available AC motors if we choose. It seems like the solar VFDs may expand the applicability and lower the cost of what we are trying to do in a big way. We will keep you posted.

Nika learning how to MIG weld.

Off Grid Through a Cold Winter at LEF

It has been a cold winter at LEF, with 'snowcrete' that covered the ground for weeks. The weather has been cloudy. Some winters we make it through with no firewood at all. This winter, we burned some wood. Still, good insulation is a huge benefit either way. We have burned about a half cord, and that for the whole community. Even when we burn wood, the efficiency of our systems means we need much less than would be true in more conventional buildings. It is quite remarkable, and tragic in the extreme, that standard construction models in the western world largely ignore cheap, thick walled construction like straw bale. Passive solar solar and straw bale construction cost about the same as ordinary housing, and use 70 - 80% less energy. But an energy consumptive society is actually a more powerful society in economic and military terms. So rich and poor alike build houses that are leaky and poorly insulated. It doesn't have to be that way.

We are preparing for spring. We know it's coming! We have lots of little plants in trays growing strong roots, waiting for the last frost to pass. We are planning a normal seed year. We have a sizable wheat patch this year, ready for more harvester testing when the time comes.

Steel cat pondering the heavens, Rosa's first MIG welded sculpture.

We would like to try some experiments with strip tillage in winter cover crop, but the deer are populous and trim the cover crop so severely that it limits our ability to engage such experiments. We are modifying our farming techniques to minimize energy use in preparation for converting the farm equipment to biogas. There will not be a full conversion this year, but energy efficient farming is worthwhile, just like energy efficient buildings, because it just makes life easier.

Please support us if you can.

Living Energy Farm is a project to build a demonstration farm, community, and education center in Louisa County that uses no fossil fuels. For more information see our website www.livingenergyfarm.org, or contact us at livingenergyfarm@gmail.com or Living Energy Farm, 1022 Bibb Store Rd, Louisa VA, 23093.
Living Energy Lights is the nonprofit outreach arm of our project. Donations to LEL are tax deductible.
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