Living Energy Farm

July - August 2019 Newsletter

News

Charming video trailer created by our interns at https://youtu.be/srSGw6dKu-I

Press Conference and public demonstration of LEF's lighting kits, **Wednesday, September 11, 1 - 3 PM,** McIntire Room, JMRL Library, Central Branch, 201 E. Market Street, Charlottesville, VA 22902. **Second public presentation, 5:30 - 6:30 PM**, same location. Want to know how LEF's systems can be more broadly applied? Come see and ask questions.

Support our Climate Justice Campaign to take Solar Lighting to Arizona and Ghana

https://www.gofundme.com/climate-justice-now

Tax deductible donations can go to https://donatenow.networkforgood.org/1388125 Designate Living Energy Farm

Biogas at LEF

We installed a biogas system a couple months ago. And it's working well. What a blessing to cook breakfast every morning with no smoky fire! Or warm up some toast with just the turn of a knob. It's great! Biogas is homemade natural gas, aka methane. It can be made in any airtight/ watertight container from decaying organic matter. We got a home biogas kit. The idea was that the we could use the expertise of the kit makers to help us understand biogas in preparation for installing a community-sized system. The system has a tank (really a big bag) full of water and decomposing organic matter. Gas output has climbed slowly but steadily since it started producing gas a few weeks ago. At this point, we are getting more than an hour a day of gas through the gas burner.

Our original plan was to use human waste and sawdust as fuel. Turns out this time of year we have enough food and agricultural by-products (from seed and food processing) to feed the digester. The good side of the kit we got is: the burner is great, it tolerates variations in gas quality and pressure while putting out fantastic heat, and the very low-flow toilet that came with the kit works well, much better than any RV toilet I have ever seen. The disappointments with this kit are: technical support has been weak, and the main digester is pretty expensive for what it is. This digester is also poorly designed for handling human waste. The intake for human waste is much too close to the effluent output. So when we put together a larger community system, we will have to take that into account. A well-designed biogas system breaks down human wastes well. This one does not. (The kit is from homebiogas.com.)

Biogas burner, excellent heat output, tolerates variations in gas quality and pressure very well.

The digester we have has a 4 inch intake pipe, which seems large, until you start trying to push a bunch of agricultural waste down it. We had an old garden "shredder" (aka hammermill) laying around. We put an electric motor on it, and now it turns

piles of organic material into homogeneous slop -- perfect gasifier food. We call it the explozerator. It makes getting our volumes of food and agricultural wastes into the digester really easy. Also the anaerobic bacteria in the digester that make the methane can access their food (and make gas) much faster when their food is chopped into small bits. This combined with a solar heating coil under the gasifier and an insulation jacket over it (bacteria are heat sensitive), and we can get large amounts of gas within hours of feeding the gasifier. We are very much appreciating the convenience of gas cooking. It's a huge improvement over cooking most of our meals on rocket stoves.

A Whole New Kind of Solar Cooking

There are a lot of solar cookers on the market. We have both a parabolic cooker (looks like a small satellite dish) as well as a solar oven. In optimal weather, they work well. We spent years of work and sums of money trying to create a solar high temperature solar storage system. We couldn't get that to work.

The daylight drive economy we have at LEF is unique. Ninety percent of our electricity never goes through a battery. That makes a huge difference in how our systems work. Solar electric panels put out DC power, and the grid runs on AC power. There are a number of devices that can run on AC or DC, including most portable household appliances, and any device that just makes heat. We have known for a while that on many days, our daylight drive system (high voltage DC) was not fully utilized. We had a fair amount of available electricity that we just weren't using. I knew that any electric cooker (hot plate, toaster) could run on DC as easily as on AC, but I always assumed it wouldn't work all that well -- that any heating device would just swallow all our precious watts and nothing else could run.

Well, guess what? I was wrong. We put in a hot plate some weeks ago. If you were running sets of 3 photovoltaic panels at 90 volts (most panels these days are around 30 volts), you could use 120 volt American appliances. In our case, we standardized to 6 PV panels and 180 volts, which means we can use the 220 volt AC appliances used in Europe and Asia. We have now installed both hot

220 volt AC hotplate running 180 volt DC daylight drive power. We bypass internal switches and use external butterfly switches.

220 volt AC oven with hotplates running off of 180 volt DC daylight drive power. Bakes great! Again, internal switches bypassed.

plates and a small, well built electric oven. On a sunny day we can do half of our cooking with electricity -- daylight drive, straight off the PV panels. A couple days ago, we had good sun, and we were running 4 motors and the electric cooking system at the same time. That's a 300% load on our system. Everything in my electrical experience prior to LEF would have lead me to believe that such a thing would have been completely, utterly impossible. But it works. So much for electrical self-assuredness.

This isn't perpetual motion or pulling magic energy out of the cosmic ether. It's just DC systems floating as the power input floats. Things just speed up and slow down. Sometimes we turn one thing off so something else can run, especially on cloudy days. The remarkable thing about this new revelation in solar cooking is that daylight drive electric cooking actually works better than concentrating parabolas in partially cloudy conditions. The biogas and the daylight drive cooking compliment each other well. The biogas builds up over time, and you can use it anytime, day or night. The daylight drive cooking needs sunshine, and reduces the demand on the biogas. We will need a bigger biogas system in the long run, or more storage, and we will need to look at the most cost-effective means of putting together these tools. But for us, the daylight drive cooking and biogas together resulted in an overnight reduction in firewood (and smoke and soot) by about 90%. Nice!

Daylight drive cooking begs a terribly big question -- does it makes sense to try to deploy solar electric panels all over the world just for cooking? Well, maybe not, at least not if you ask the question that way. But we have been saying all along that a DC Microgrid can do many, many things. The list of devices we run off of DC power straight from our PV panels would be too long to list here. Just in the last few weeks, we have added a blender for the kitchen, and the explozerator for the biogas system (which is hefty machine).

So, yes electric cooking from a daylight drive PV totally makes sense, and while you are at it, why don't we do everything else with it as well? It really would be remarkable if we could get these systems established in those parts of the world where people need and expect basic services (instead of heat pumps and big screen TVs), which brings us to our next subject....

The explozerator -- yard shredder equipped with nice, heavy duty industrial DC motor. A little spooky how quickly this thing obliterates organic material.

Expanding the LEF Model to Arizona and Beyond

We put small solar electric systems in 7 homes in the Navajo Nation in April, and have been raising funds to try to do 100 more this winter. One of the headaches in the spring project was not having small parts when we needed them. That lead to some last minute purchasing of parts at much higher prices. This time, we have been diligently searching out suppliers for all the small parts

we need well in advance. For better or worse, all the small parts we need are being sourced from China. We have almost everything we need, except the most important part -- the nickel-iron batteries. We have been negotiating and acquiring samples from a bunch of battery companies (Changhong, Henan Troily, Seawill, ADS, Henan Hengming, Henan Xintainhang, and Ciyi). ADS is in Ukraine, the rest are in China. We are hoping to establish a pilot project in Ghana next year, so it seems to make sense to get a firm grip on the nickel-iron battery market before we make larger commitments.

We brought Manuel Clark (Manny), a Navajo friend, to LEF learn how to build and install our systems. He will be with us through most of September. He's been great to work with. It is sobering to talk to him about life on the reservation. There are many, many things we take for granted that are just not available for thousands of people who live there, electricity being one of them.

We have also made some good contacts that we are now working with to pull the project together in Arizona, including a Hopi permaculture center, the solar program at the Navajo Tribal Utility Authority, and the Hopi community development department. This gives us a very good mix of resources on the ground to make the project happen and expand. Our hope in working with Manny (and others in Arizona) is to set them up to buy parts, and build systems in the future without charitable support. It's great to give help to folks who need it, and even better to leave them in a position to help themselves. It is painful indeed to hear over and over again how folks who live involuntarily off-grid are sold crappy batteries and bad solar systems. Manny has talked to us about the numerous iterations of lead-acid and AGM (another version of lead-acid) batteries they have tried to use. Many only last a few months. That's what's happening all over the world. Our systems are small, but they are durable. And the financial costs of using nickel iron batteries to make larger systems is not that huge either. In the process of talking to battery suppliers, we are learning about opportunities for bringing in nickel-iron battery sets larger than the ones we use in the LELCS systems at much more moderate costs than what is available on the retail market.

Design Change for the Living Energy Lighting and Charging Systems (LELCS)

We have improved our previous LELCS system. The ones we took to Arizona in April had $350 in parts in them, and were in plastic tool boxes. They work, but now we are making custom, more durable metal enclosures. We have also swapped out a $90 charge controller for an integrated $2 charge control circuit. Owing to sourcing of better materials and bulk purchasing, the new LELCS design is both cheaper and better. We also swapped around components so that they are all fit standardized "knock out" hole sizes. This allows for faster assembly. The new custom LELCS enclosure is sized to allow us to install the LELCS system as a 10 amp-hour system with about $150 in parts (to maximize reach in low-income communities) or as a 20 amp-hour system with $250 in parts (where resources allow and a bigger system is desired).

New LELCS metal enclosure. Takes some time to build the box, but it's better than the plastic toolboxes. Round meters and switches can be installed quickly using standardized punches.

Homemade Nickel-Iron Batteries

We mentioned in the last newsletter that we had pulled together an excellent crew of people from various

locales to try to build nickel-iron batteries. The point is not (necessarily) to beat the Chinese mass producers in price, but rather to take more control of the process to improve the self-determination of communities. Particularly in Africa, this model will spread, and not everyone will be pleased about that. The more we can empower ourselves and the communities we are trying to help with hands-on access to the sustainable tools we need, the better. That's the idea anyway. In practice, it all gets a bit sticky. Nickel iron batteries are, at least in relative terms, simpler than other batteries. Figuring out production can be divided into two primary areas; figuring out the chemistry of the metal powders used (mostly nickel and iron oxides, but the details matter), and then the mechanical part of putting it all together. After negotiating with various chemical test labs, we figured out we could probably do the tests we need for about $5000 to nail down the chemical composition. Not nothing, but a comprehensible sum.

On the mechanical side, we have talked to many machine and tool shops, and have had trouble finding one who wanted to work on it. We finally found one, a professional tool engineer who responded with confidence that he could do it. We sent him the parts, and he sent us a bid at $165,000. Wow.

To quote one of my fellow volunteer battery designers, "I guess we aren't going down that road." So, we are still in the market for a tool engineer who might help us make the tools to make the batteries. In the meantime, we are working on it ourselves. That will, no doubt, involve a lot of mistakes, and some months or years (we hope not too many) of time, but that's where we are going for now. It will also take a few thousand dollars worth of tools that are used to make tools. We already have a very nice daylight-drive powered lathe. We will likely invest in a milling machine, and some attachments for both of those. That and a few sundry other tools, and we will give it a try.

New LELCS kit running 3 lamps, a laptop, and a smart phone.

Battery Magic?

The defining feature of LEF is that we are trying to build sustainable systems that are durable, simple, and inexpensive so that they are accessible to as many people as possible. Part of the standard tour of LEF is a reminder that 75% of humanity lives on less than $5 a day, and 25% who have a lot more money pretty much pretend the majority of humanity does not exist. It is heartbreaking to realize that American environmentalism is highly focused on trying to convince people that an industrial, consumer society can be maintained with renewable energy while ignoring the greater number of people who can't afford consumerism. (Ted Trainer and Ozzie Zehner have written excellent books on the subject. And now there is a new documentary is coming out called *Planet of the Human*s. It's the result of a collaborative project with Michael Moore, Ozzie Zehner, and Jeff Gibbs, the director who created some of Michael Moore's films. The film documents how renewable energy has been re-directed to maximize corporate profit while sacrificing environmental protection.)

If it's problematic to sell the idea of downscaling to Americans, trying to change the laws of physics with political will power is all the more so. That's what's happening with renewable energy. We are trying to pretend that huge, centralized grids and the consumer economy are absolutely necessary and can be made sustainable. They are not and cannot. At the end of the day, those big environmental groups are big. For LEF and our "down-

scale and live well" message, we have gotten a lot of support (thank you!), but we are still small. It's clear we are casting our seeds on dry ground in terms of trying to get larger numbers of Americans to adopt community lifestyles, conservation, and DC Miocrogrids. The irony is that we could have most of the comforts and conveniences we currently have with about 1% of the energy demand, if only this model were widely adopted. But the thunderous voices advocating renewable energy magic drowns us out pretty effectively, at least in the terms of mainstream appeal. That's why we are taking this model to other locales. The only widely used luxury our DC Microgrid cannot support is air conditioning, though that's a big one for many Americans. The U.S. is the only country in the world that is so thoroughly dependent on air conditioning.

Industrial battery storage is the magic solution being put forward by mainstream environmentalism to support the consumer society. Apart from the fact that it won't work mechanically or financially, it's foolish to try. To power the fridge at LEF, the DC motor in that fridge is designed to run 10 - 45 volts, which means most any solar electric panel will power it. It has 6 inches of foam insulation. It runs during the day, and stays cold overnight, and through cloudy weather. Using such a fridge is little different than using a "normal" one. The mainstream environmental approach to powering a fridge is to keep the massive AC grid in place, powered as it is by coal, nuclear power, and increasingly, fracked natural gas. To that is added fields of industrial solar electric panels (being built on destroyed hardwood forests around us, what's the carbon footprint of that?), massive windmill farms that don't turn when there's no wind, and massive battery storage facilities. All so we can power poorly insulated refrigerators instead of insulating them.

Dominion Power (our local electric company) has a proposal out now to build another pumped storage facility in southwest Virginia. That's a lake built in the mountains. They pump it full of water, then drain the water during periods of peak demand to generate hydropower. Naturally, we don't support such a thing, and if we could only get people to live a conservationist lifestyle using systems like we have at LEF, we certainly wouldn't need it. That said, hydropower equipment is pretty heavy duty stuff. Big steel turbines and industrial generators last a long time with only routine maintenance. We are on numerous local environmental email lists, and the local push now is not to demand real conservation, but rather to demand Dominion Power consider battery storage instead. If they install a hydropower system, the same hardware will be there 50 years from now. If they install a massive battery farm, it will have to be completely rebuilt at least 5 times over the next 50 years. It's magical thinking to imagine that "renewable" energy and batteries can somehow make up for the complete lack of self-restraint in American consumption.

In recent months, we have been talking a lot about nickel-iron batteries. That has caused some confusion. The magic of nickel-iron batteries is that they sustain an incredibly long discharge curve at *low draw rates.* When used in conjunction with a daylight drive system, very small nickel iron battery set mean the lights never go out. If you look at our April newsletter, you will see a photo of the largest off-grid solar system we found in Arizona. That was the only working off-grid system we saw on the Navajo Nation. It supplies energy for one person, and it has a 4000 amp-hour battery set. The battery set we have at LEF -- the one that powers the lights and all the relentless use of electronic gizmos by a dozen people, with never a failure in nearly 10 years -- is 100 amp hours, or 1/40th the size of a "nice" solar setup. That works because 90% of our electricity is used daylight drive. Only 10% actually goes through the batteries.

So no, we are not trying to join the battery magic parade. But how can we tell people to stop using fossil fuel if we don't offer them a coherent alternative? At the end of the day, we need to pump water, grow food, and live. There is a lot magical thinking about how all of our needs are going to be met in a future, sustainable economy. There's nothing magic about the technology at LEF, just good design and good tools. We need an alternative, we need to keep working on it, and we need to keep putting it out there in front of people. Perhaps the day will come when some rain will fall on that dry soil.

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. Donations to the Living Energy Farm Education Fund are tax deductible.

Articles and videos about LEF:

How to Live Without Fossil Fuel (Introductory Video) https://www.youtube.com/watch?v=Ri2U6u8p65E
Powering a Community with Solar Electricity (LEF has the only DC powered community that we know of, here's how it works) https://www.youtube.com/watch?v=FvdExgvHnRI&t=23s
The Best Way to Store Off-Grid Energy https://www.youtube.com/watch?v=2wOxQ3sL9zc
Batteries that Last (almost) Forever https://www.youtube.com/watch?v=dfrgLsyFs0E

Virginia Homegrown created a program at LEF (the LEF part starts at the 29 minute mark in the program)
https://www.youtube.com/watch?v=MDGP0C9MIzU

International Permaculture has done 2 articles on LEF. One is in issue #93, Autumn 2017, and the second is in issue #94, Winter 2017. See https://www.permaculture.co.uk/
Article about LEF at the Atlantic Online Magazine
https://www.theatlantic.com/politics/archive/2017/01/anarchism-intentional-communities-trump/513086/
Article about LEF in The Central Virginian
http://www.livingenergyfarm.org/cvarticle.pdf
LEF on CNN
http://www.cnn.com/interactive/2015/09/us/communes-american-story/
Cville weekly in Charlottesville VA
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Video on vimeo
https://vimeo.com/128744981
Slideshow produced by Alexis a while ago
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