

Northeast Biogas Initiative Small Farm Biogas

Northeast Biogas Initiative • Hampshire County, MA • northeastbiogas.com
submitted by Elyssa Serrilli • northeastbiogasinitiative@gmail.com



FOLLOW:
[@northeastbiogas](https://www.instagram.com/northeastbiogas)

Farming through floods, droughts, rising fuel and fertilizer costs, and disruptions to supply chains are all unpredictable factors we cannot control, especially amidst mounting climate change. A product that is controllable and reaps great rewards on small farms are small-scale biogas.

A small farm can make all the gas you will need for cooking and food processing using organic 'wastes' with gas left over for electricity generation in the case of an emergency. Digesters also produce a nutrient-rich liquid fertilizer, which is often times referred to as "liquid gold" by growers who use it.

Project Drawdown, one of the most important sources of climate hope and guidance to emerge in the past decade, notes that small farm biogas production through anaerobic digestion of on-site feedstocks and manures has as much potential CO₂ sequestration (4.65–9.7 GT) as industrial-scale biodigesters (6–7 GT). It also requires 72–82% less initial investment at \$24.70–51.60 USD for small-scale biogas, as opposed to \$138–182 USD for industrial-scale projects.



Commercial Biogas Bag System, small farm digester, 2.5 cubic meters

BENEFITS:

- Processes organic 'wastes' easily and cleanly into biogas and liquid fertilizer
- Helps save money on fertilizer costs if using the "liquid gold" bio-fertilizer on crops, woody debris, and new beds
- Saves money on gas for cooking, heating, and more
- Be more resilient to power outages and disruptions in the supply chain
- Lowers your carbon footprint

DRAWBACKS:

Biodigesters are easy to use but do require some training for effective daily use and occasional troubleshooting.

FINE TUNING:

We may put a greenhouse around the digester for season extension.

YEARS IN SERVICE: 1

YEAR DEVELOPED: 2023

SUPPLY LIST:

- Commercial Biogas Bag System
- Gravel pad with rigid foam board insulation on top
- 2-burner cookstove
- DIY 5-gallon bucket water drain
- PVC gas line and fittings

ESTIMATED COST: \$1600

NOTES:

Our small-scale pilot biodigester is located at Ancient Ponies Farm, a BIPOC-led, woman-run, multi-use farm in Amherst, Massachusetts. The digestion is used to supply fuel to an outdoor kitchen, and the fertilizer is used to accelerate humanure decomposition.

We're very excited for more farmers to learn how easy, safe, and affordable it is to run small-scale biogas on their farms. Most farmers have heard of large-scale biogas, but very few are familiar with small-scale and even fewer are running it.



Volunteers add sandbags to push the gas to the stove



Looking into the mouth of a "dragon"



Side view of full Commercial Biogas Bag System



Outside the outdoor biogas kitchen

Second Spring Farm Landscape Fabric Roller/Unroller

Second Spring Farm • Loudoun County, VA • secondspringcsa.com • submitted by David Giusti

We have started using a 4' lightweight landscape fabric for our aisles between bio-plastic mulch rows that are 220–280' long. In the fall, we roll up each piece of fabric tightly. Then to unroll them in the spring, we push the balls down the roll and they will spread out to cover the aisle. We discovered that it was much easier to pull the new fabric from the roll than to push the ball of re-used fabric down the aisle. It is also much easier to install the fabric when it comes flat off the roll and is already spread out. We built this roller/unroller out of old parts in a day. This will improve the speed and ease of rolling and unrolling the landscape fabric and is an easy alternative to hay-bale mulching.



It works!

BENEFITS:

- Roll and unroll 900' of 2.2 oz, 4' landscape fabric onto spools (in any number of pieces of fabric) quickly and easily, all while standing up
- Much faster and easier laying of landscape fabric in the spring
- Much more pleasant roll-up of landscape fabric in the fall
- Fabric can now be stored by hanging the spools from the metal deer fence, rather than leaving the balls of fabric on the ground or piled in a shed or pallet bin
- Very happy workers

DRAWBACKS:

It requires three people at once to roll and unroll the fabric. To roll, one person will have to turn the crank and two people will have to hold the fabric taught from side-to-side. Unrolling the fabric will require two people to load a spool and one person to pull out the fabric to unroll.

YEARS IN SERVICE: 1

YEAR DEVELOPED: 2023

PRO TIP:

This roller is mounted to a golf cart, but a tractor or saw horses could also be used.

FINE TUNING:

We added a guide bar so that the fabric goes up over a roller and then down around the spool–this gave it a slightly easier, slightly more taught roll.

It is possible to install guide wheels and rollers to replace the two people holding the fabric, but it would be a non-trivial build for a relatively minor time-saving. We are happy to use two people for a short time to help roll up fabric at the end of the season.

Similarly, a motor/PTO seems like an obvious improvement for the person cranking, but as the roll gets larger, the RPM must change so that the feet-per-minute getting rolled up remains constant. Cranking is a small and easy enough job, and I did not find that it is worth mechanizing.

SUPPLY LIST:

- Four pillow-block bearings
- One axle for each side, with a slot/flange to hold the wooden tab that protrudes from the spools
- A crank to turn one of the axles
- Wooden frame with stand to set on the ground, or mounting brackets to any vehicle or object (I put it on a golf cart)
- Two 5' 2x4 spools with a piece of furring strip in between to serve as a spacer to make a 4" square spool and to create the tab held pinned/bolted through the slot in the axle



Nice taught fabric



Last piece of fabric on a spool–guide roller shown here



First piece of fabric on a spool

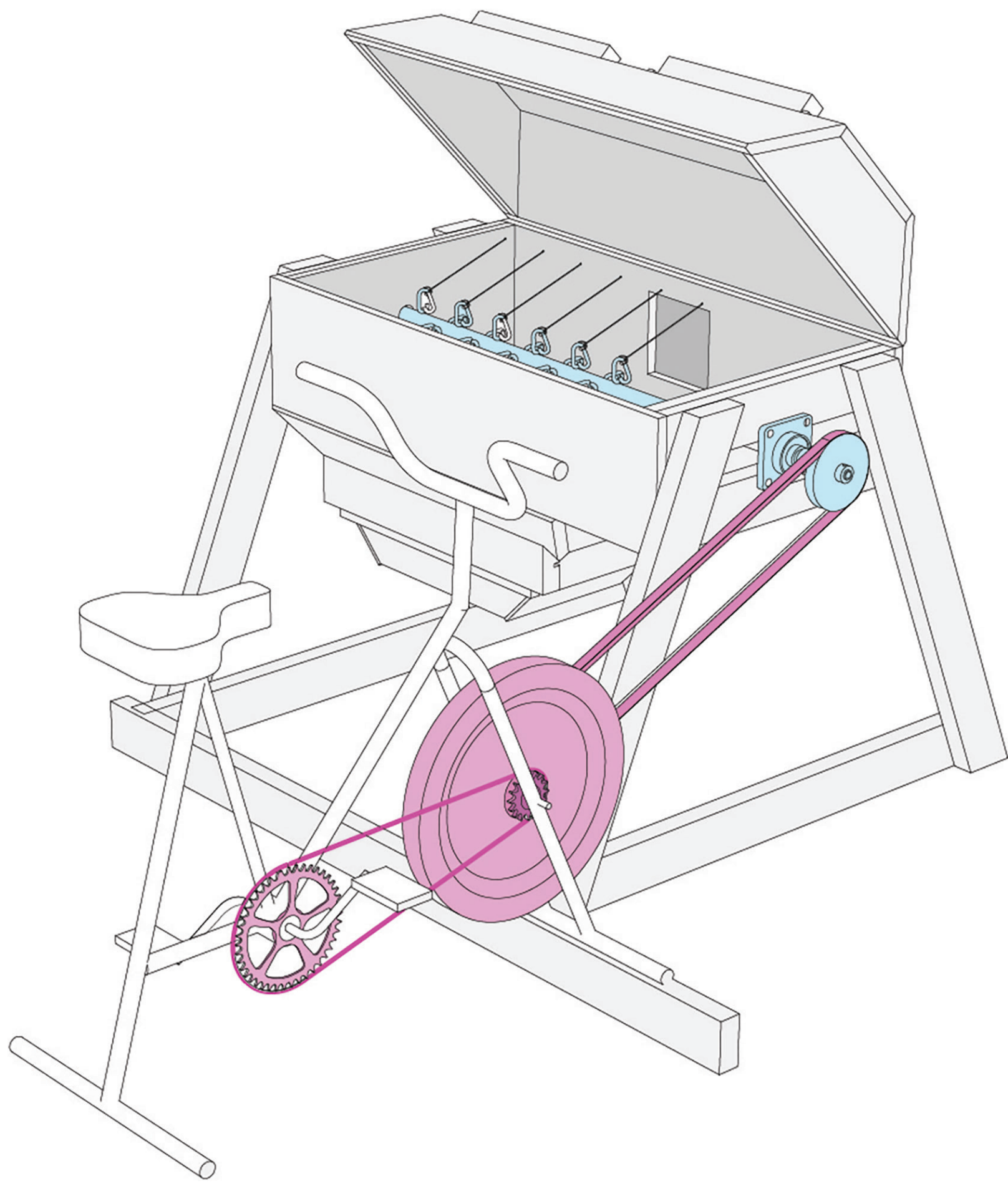
Brave Little Ship Bike-Powered Thresher

Brave Little Ship • Bristol County, VA • submitted by Lu Yoder

3–10 acre vegetable farms have the equipment to plant grains and dry beans, but not the equipment to harvest and process them for markets, seed saving, or selling seeds. Available commercial equipment is designed for large farms and either costs too much and/or only works on one crop. Many motorized options are difficult to use, adjust, and tune for different crops and lack customer support.

THE THRESHER CAN BE USED IN THREE WAYS:

- **As a batch process**, where the whole drum is filled with plant material and then processed—after which, the fibrous remains are removed
- **As a pass-through process**, where the seed heads are fed through the top right window and then processed as they move to the left—the empty seed heads are tossed out on the left side of the window
- **As a sheaf process**, where sheaves of cut and aligned grain are held by their stalks, and the heads are thrust through a window on the side of the drum to be processed—after which, the straw bundle is withdrawn and a new sheaf is introduced



Thresher plan

BENEFITS:

- Appropriate for small-scale grain and seed production
- Low-cost, do-it-yourself option for grain and seed processing, using open-source plans
- Materials and parts are readily available at hardware stores and through material salvage

DRAWBACKS:

- Can be time-intensive to build, depending on available tools and parts
- The thresher was developed along with several other related tools, including the fanning mill, dehuller, and seed cleaner-fractioner, that may also need to be built to maximize the efficiency of each individual unit

FINE TUNING:

Future versions of the thresher will look to reduce the materials needed, reduce the costs to build, improve performance, and simplify the design to make it as accessible for others to build, as possible.

SUPPLY LIST:

- Stationary bicycle with flywheel
- Various dimensional lumber for the thresher drum, frame, screen track, and funnel
- Drive shaft and associated hardware
- Various materials for swipples (wire, bike spokes, wood, and plastic or metal chain)

ESTIMATED COST:

\$150–200

PRO TIP:

Other grain/seed processing equipment may be necessary, depending on the user’s processing needs.

YEARS IN SERVICE: 6

YEAR DEVELOPED: 2016–2017



Thresher profile view



Thresher overhead view

SEE THIS INNOVATION IN ACTION!



Scan this code to see more information and watch videos on their website.

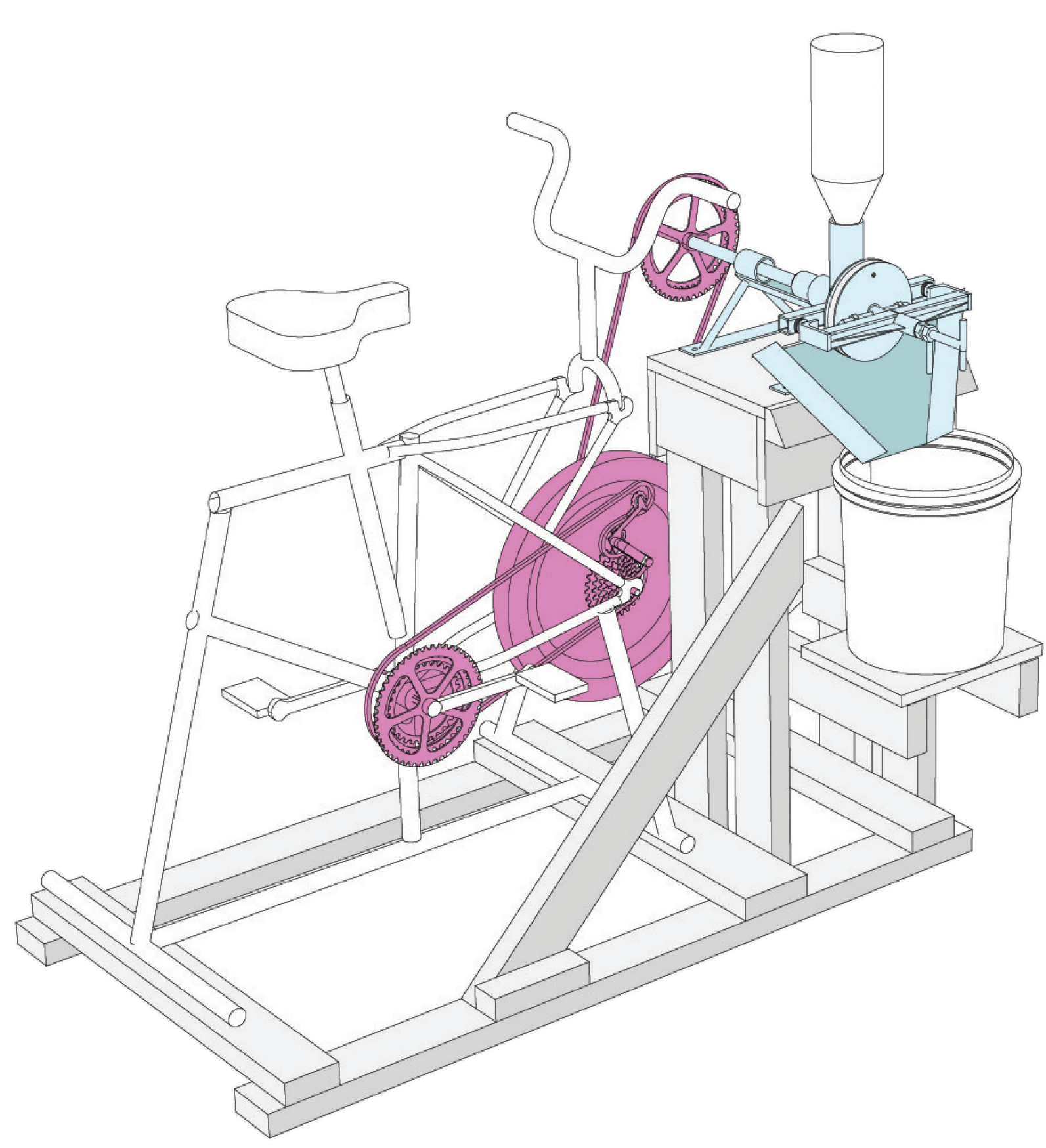
Brave Little Ship Bike-Powered Dehuller/Mill

Brave Little Ship • Bristol County, VA • submitted by Lu Yoder

3–10 acre vegetable farms have the equipment to plant grains and dry beans, but not the equipment to harvest and process them for markets, seed saving, or selling seeds. Available commercial equipment is designed for large farms and either costs too much and/or only works on one crop. Many motorized options are difficult to use, adjust, and tune for different crops and lack customer support.

The Bike-Powered Dehuller/Mill is a human-scale tool to address these challenges. This horizontal shaft mill is intended for dehulling grains and can easily be converted to a flour grinding mill. This tool can be used for wheat, rice, einkorn, or emmer. Other grains can be milled but may require additional parts and adjustments to adequately work.

Building this mill is not difficult. The fabricator must be equipped to make square cuts in metal tubing and the welding technique should minimize distortion. All parts should be cut out first and then fabricated, which should take approximately five hours.



Dehuller/Mill plans

BENEFITS:

- Appropriate for small-scale grain and seed production
- Low-cost, do-it-yourself option for grain and seed processing, using open-source plans
- Materials and parts are readily available at hardware stores and through material salvage
- Faster and more robust than other small-scale, manually-powered mills

DRAWBACKS:

The dehuller/mill was developed along with several other related tools, such as the fanning thresher and the seed cleaner-fractioner, that may also need to be built to maximize the efficiency of each individual unit.

FINE TUNING:

Throughput capacity could be improved for this design.

YEARS IN SERVICE: 7

YEAR DEVELOPED: 2016

SUPPLY LIST:

- Stationary bicycle with flywheel
- Various dimensional lumber for the frame
- Steel tubing and parts for auger housing, bed plate, runner plate, and yoke
- Drive shaft assembly
- Chute and cowling covers

ESTIMATED COST:

\$125

PRO TIP:

Other grain/seed processing equipment may be necessary, depending on the user’s processing needs.



Flour Mill profile view



Flour Mill diagonal view

SEE THIS INNOVATION IN ACTION!



Scan this code to see more information and watch videos on their website.

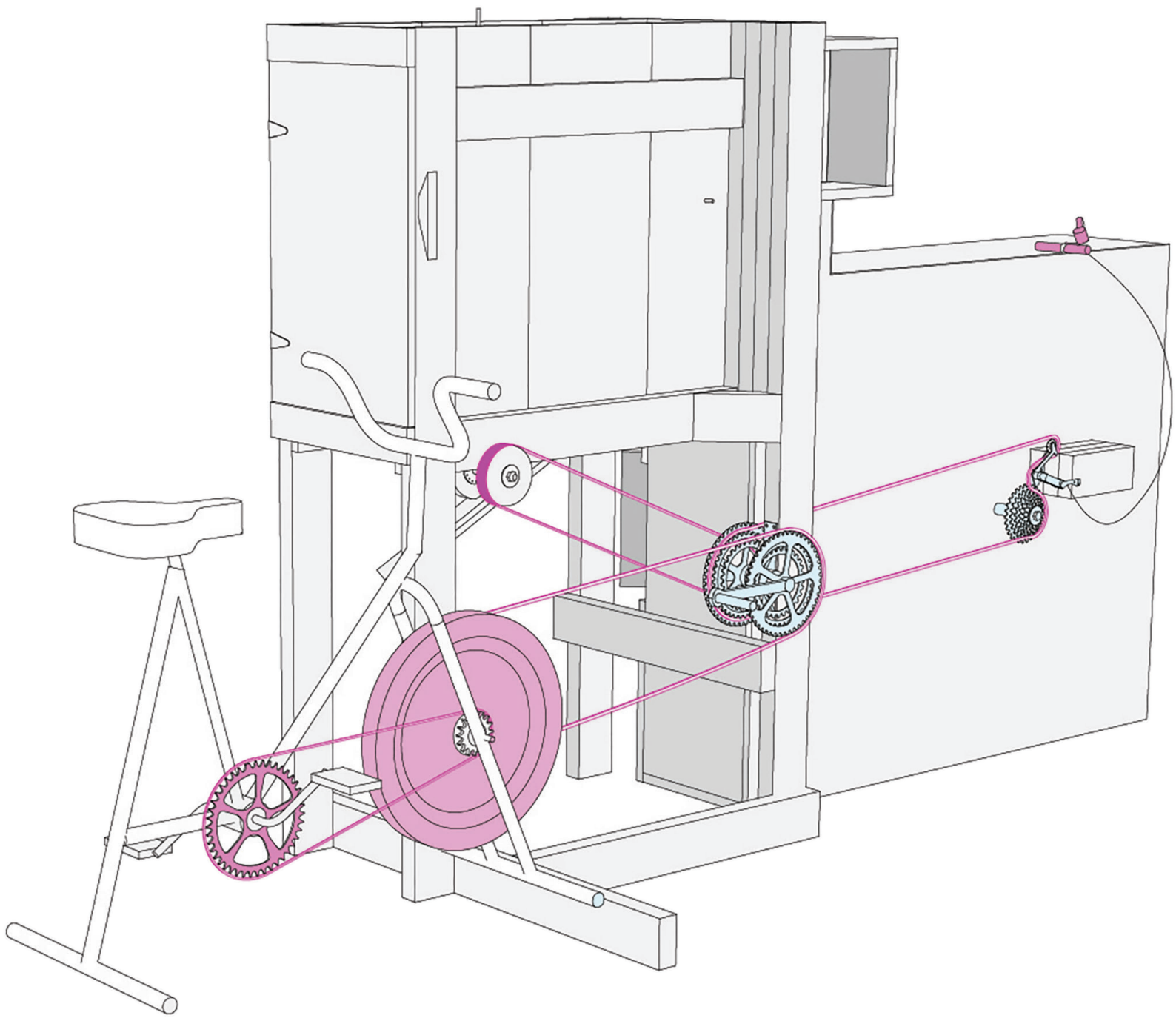
Brave Little Ship Bike-Powered Fanning Mill

Brave Little Ship • Bristol County, VA • submitted by Lu Yoder

3–10 acre vegetable farms have the equipment to plant grains and dry beans, but not the equipment to harvest and process them for markets, seed saving, or selling seeds. Available commercial equipment is designed for large farms and either costs too much and/or only works on one crop. Many motorized options are difficult to use, adjust, and tune for different crops and lack customer support.

The Bike-Powered Fanning Mill is a human-scale tool to sort and clean seeds. It first grades material by size with two screens and then winnows the remaining material in a vertical winnowing tower. The screen size is selected for the crop or operation. The tilt angle of the screens is adjustable, as is the rate and amplitude of the screen shaker. The speed of the blower is also adjustable.

The fanning mill is designed to be highly adaptable to different uses. It easily exceeds 1 lb/min for all crops tested and 5 or 10 lbs/min for most beans. Some crops will require multiple passes—for example, rice usually takes one pass before dehulling and a second pass after dehulling. In a test of rye, processing just about 10 lbs took less than 10 minutes, even including set-up time.



Fanning Mill Plan

BENEFITS:

- Appropriate for small-scale grain and seed production
- Low-cost, do-it-yourself option for grain and seed processing, using open-source plans
- Materials and parts are readily available at hardware stores and through material salvage

DRAWBACKS:

- The fanning mill was developed along with several other related tools, such as the fanning thresher and dehuller/mill, that may also need to be built to maximize the efficiency of each individual unit
- Some advanced fabrication, assembly, and gearing skills are needed

YEARS IN SERVICE: 7

YEAR DEVELOPED: 2016

FINE TUNING:

The fanning mill could be tweaked so that less back blow occurs between the winnowing tower and the bottom screen.

SUPPLY LIST:

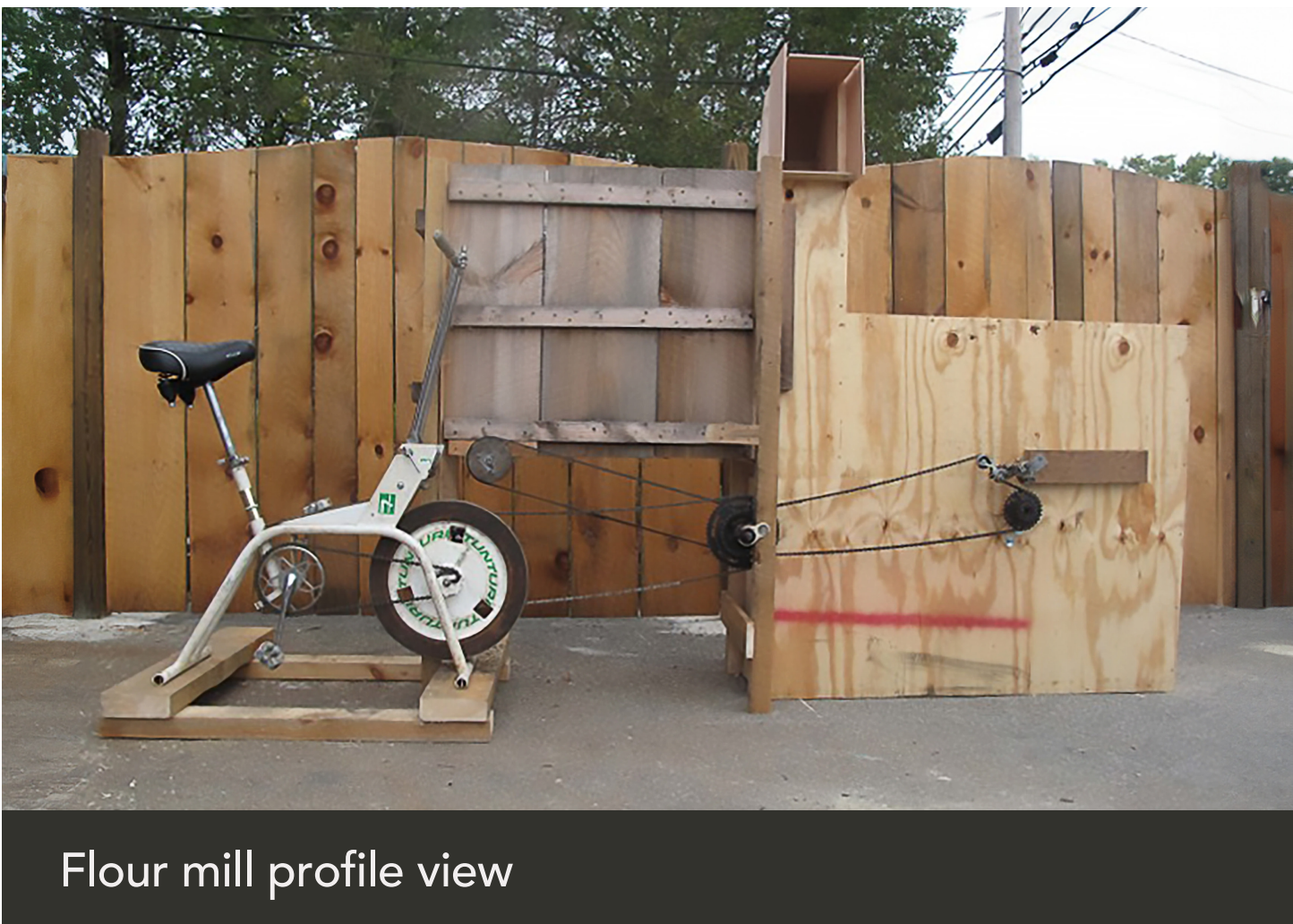
- Stationary bicycle with flywheel
- Various dimensional lumber for the frame, screen box, and screen frames
- Stock metal plate and tubing
- Various bike gears

ESTIMATED COST:

\$150

PRO TIP:

Other grain/seed processing equipment may be necessary, depending on the user’s processing needs.



Flour mill profile view



Flour mill front flow view

SEE THIS INNOVATION IN ACTION!



Scan this code to see more information and watch videos on their website.

Hilltop Urban Farm Off-Grid Solar Powered Walk-In Cooler

Hilltop Urban Farm • Allegheny County, PA • hilltopurbanfarm.org • submitted by John Bixler

Hilltop Urban Farm (HUF) converted a used 8'x9'x40' insulated shipping container into a solar-powered walk-in cooler. As part of the farm's lease agreement, HUF is not permitted to tap into the electric grid, so we had to come up with an alternative source to power the cooler. Along the exterior of each of the 9'x40' walls of the container, we mounted a two-bowl, stainless steel sink as the main fixed component for wash and pack stations.

BENEFITS:

- Well-insulated and the entire space is cooled by two standard window air conditioners controlled by Cool-Bot systems
- Runs on two independent (identical) circuits—if one circuit goes down, there is still power
- Large enough to hold at least 24 three-foot-wide shelving units
- Contains three distinct cooling zones
- It is wired, so a generator can be plugged in to power the air-conditioners in extended periods of overcast or if the system is otherwise not charging

FINE TUNING:

We want to install solar-powered, motion-activated interior lighting since users of the cooler often forget to turn off our rechargeable, non-solar battery-operated lights. Having the lights turn on automatically when entering would allow the doors to open and close more quickly and prevent cool air from escaping. Currently, those entering the cooler must spend additional time turning the battery-operated lights on, letting cool air escape.

YEARS IN SERVICE: 4

YEAR DEVELOPED: 2020

DRAWBACKS:

- Initial setup is expensive
- Compatible replacement parts can be difficult to locate
- Requires specialized installation and finding technicians can be difficult
- System requires maintenance to extend the life of the batteries
- Need to drain freon/refrigerants from old/non-functioning refrigeration unit
- Positioning of cooler and solar panels may not be the most practical or efficient
- Might require usage of non-petroleum-based lubricated seal around the door to ensure they can easily be opened—otherwise, might require cutting off tops of exterior latches

SUPPLY LIST:

- 11.2 kW Solar Array (modules, inverter, charge controller)
- 44.2 kWh Battery Storage system
- Racking

ESTIMATED COST:

\$30,000



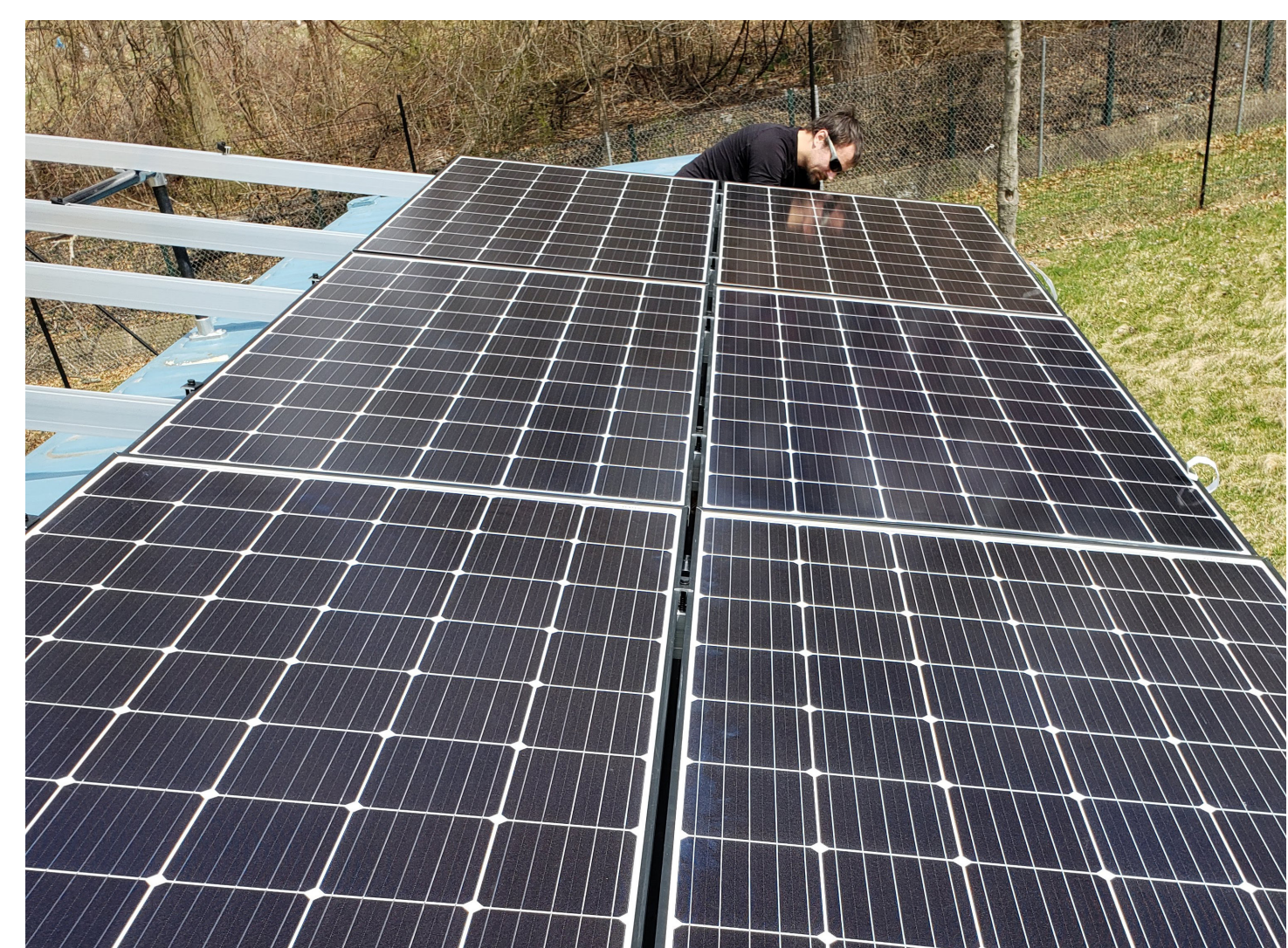
Contractor working on installation

PRO TIP:

You will need a separate shed or shelter with heavy-duty shelving for solar batteries and to mount inverters and control panels.



Battery room



View of panels being installed on cooler



Solar Powered Coolers