# biogas digester

by **whatisthisidontunderst** on October 2, 2016

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## Intro: Biogas digester

Part of the purpose of building the mobile food and apple grinder cart was to grind up kitchen scraps, garden leftovers, and even weeds for use in a biogas digester. I've been composting these things for years, but as I've read more about greenhouse gases and realized that methane is many times worse for the atmosphere than CO2, I began to think about capturing the methane that my household creates and doing something with it. I could just throw a tarp over the compost pile and light a match to the built-up gases every now and then, but a biogas digester would more efficiently convert the organic waste to methane, collect the methane, and provide a nutrient-rich compost liquid that I can use to water the garden.

Plus, I can use the methane to blow stuff up.

Part of the goal here too is to reuse materials I had cluttering up my garage and basement. Some I'd held on to with this project in mind, some I just happened to come across. Doing so probably wasn't cost-effective, given the number of plumbing adapters I had to buy to make X work with Y, but at least I cleared out some of the clutter. I won't get into too many specifics on dimensions for that reason - use your best judgment regarding materials if you plan on building your own digester.

## Step 1: Prepare the containers

I bought three different containers for this project: one with a removable lid, a 30-gallon drum, and a 50-gallon drum. All three are plastic (HDPE), and all three were sourced from a neighbor who specializes in second-hand barrels.

The removable lid container will be used for the digester itself, so it needs a feed pipe, a gas outlet, a drain, and an overflow provision. Both the 30- and 50-gallon drums will get their tops removed, and the smaller will fit inside the larger to trap the biogas.

**Image Notes**
1. fire roasted green chile puree. and it sure smelled good.

## Step 2: Add a feed tube to the digester

I measured how far in from the edge of the lid to drill the hole to account for the gradual decrease in diameter toward the bottom of the barrel. I also eyeballed the depth so I could cut some 2-inch PVC to length - the bottom of the feed tube doesn't need to extend all the way down, just far enough to keep the end submerged and just short enough to allow whatever you dump down the tube to spread throughout the rest of the digester. I then fit a coupler to the top of the PVC and inserted a threaded adapter through the hole and into the coupler. PVC cement to keep it all together and some clear silicone to seal up the gaps (PVC cement does not work on HDPE, so it's not an option to simply glue the fill tube to the lid). A threaded male plug is easy enough to unscrew by hand when it comes time to fill.

I found a drum funnel that happened to have the same thread diameter and pitch as the PVC. Filling is much less messy with it, highly recommended.

Also, I built a stuffer using the cut-out round from the hole saw (ground down a bit on the edges) and an old broomstick. Whatever goes down the feed tube should be ground up finely enough not to get stuck in the tube, but this will help encourage what isn't. If the stuffer doesn't get the job done, a big long section of metal pipe will.


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PURPO
100% Silic
WATERPR
NEVER
WEATHER


FUNNEL KING
3 – QT DRUM FUNNEL
Tough Industrial Quality
2" Threaded Adapter
Chemically Resistant Polyethylene
Made in USA

## Step 3: Add the drain valve and overflow tube to the digester

To prevent damage from freezing over during the winter, I want to be able to drain it, so I adde another hole toward the bottom for a garden hose-style drain. I entertained the idea of heating it throughout the winter using the heating element from an old dishwasher, but the ultimate goal here is to produce energy, not consume it.

The overflow tube goes toward the top using 3/4-inch PVC pipe and fittings. To keep the digester sealed, I added a valve (for when the fluid level hasn't yet reached the overflow tube) and a J-bend (for when it has). This will just dump out to a 5-gallon bucket for now, but I may add an overflow tank later on.

Note the upturned entrance to the overflow tube inside the digester. This ensures that only fluid will enter the tube and that the system doesn't airlock. Also note the multiple adapters it took to get from 3/4-inch PVC to 1-1/2-inch sink drain piping.



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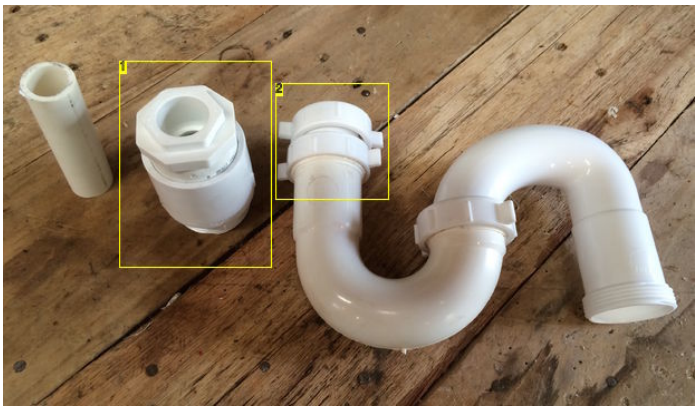



**Image Notes**
1. Two reducer bushings, a coupler, and a threaded adapter.
2. And then a short female to female threaded adapter before the J-bend.

## Step 4: Add the biogas outlet

I disassembled an old water softener system I got for free and ended up with a good amount of semi-rigid plastic tubing, fittings, and a valve that I figured would be perfect for the biogas outlet. Drilled another hole for the valve and threaded the adapter into it, then ran the line to another valve that will then connect to the collector.

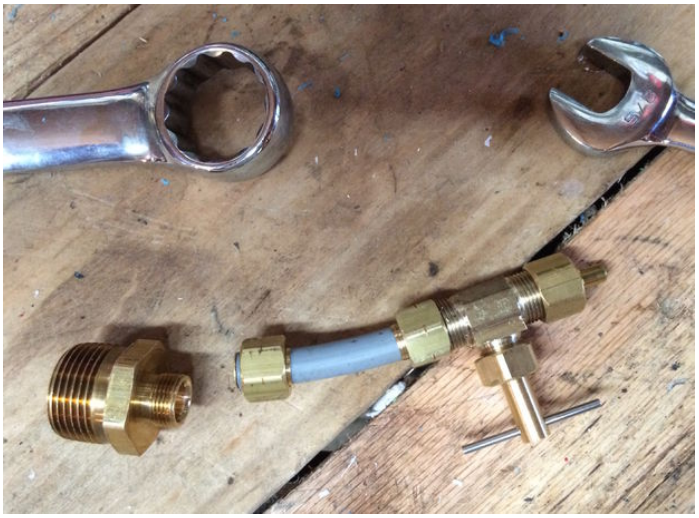
Note the three-way adapter in the middle. That's acting as a placeholder for a sulfur scrubber that I intend to build later down the line. Biogas digesters produce plenty of methane, some CO2, and enough hydrogen sulfide to make the biogas stink. The sulfur isn't all that useful for us, so it'll be worth scrubbing out of the end product. Which my neighbors should appreciate.

As for the different-sized tubing, that's just a result of using what I had on hand. The larger tubing measures 3/8 inch and fits perfectly into compression fittings.

**Image Notes**
1. Connections for later addition of a sulfur scrubber.

## Step 5: Build the biogas collector

Cut the top off the 30-gallon and 55-gallon drums, add another drain toward the bottom of the latter, and add another gas outlet to the bottom of the former. Invert the smaller drum and stick it in the larger. Fill the 55-gallon drum about half full with water.



## Step 6: Add the biogas inlet to the collector

More 3/4-inch PVC. Starting with a 3/8-inch copper pipe and fitting salvaged from the used sink that formed the basis for the mobile grinder cart project, I then adapted that to a 90-degree elbow and then a pipe that extended to the bottom of the collector. Another 90-degree elbow takes it underneath the rim of the 30-gallon drum and toward the middle of the collector, then a third elbow directs the gas upward to bubble through the water.

Before I cemented it all together, I added a couple 1-inch T-fittings to the long pipe. As it fills with biogas, the 30-gallon drum will rise, but I wanted it to rise evenly and not wobble like a buoy, so I figured the biogas inlet pipe would also make for a good guide pole if I secured the drum to a couple T-fittings that would ride the inlet pipe up and down.

To secure the drum to the T-fittings without drilling into the drum (and thus creating potential gas leaks), I cut a couple sections of plastic-coated wire to about the circumference of the drum, looped the ends, and cinched the ends to the fittings via zip-ties routed through holes drilled in the T-fittings. With the wires as tight as possible, I then lowered the entire assembly into the 55-gallon drum. Another zip-tie through a couple holes drilled toward the top of the larger drum keeps the inlet pipe from flopping around.

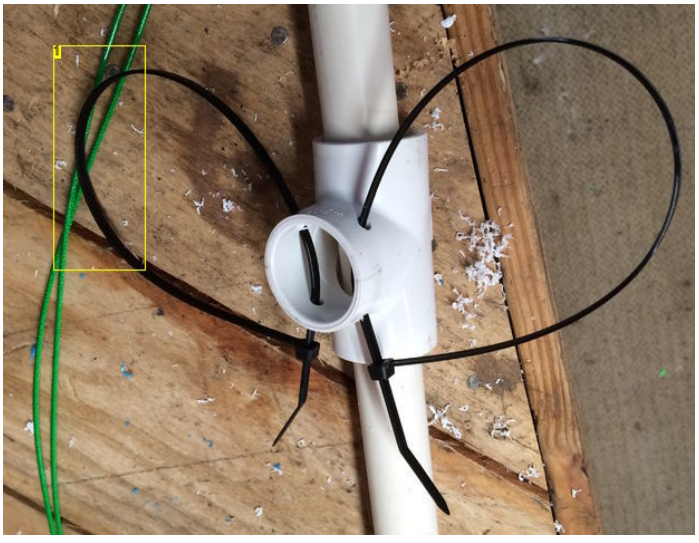
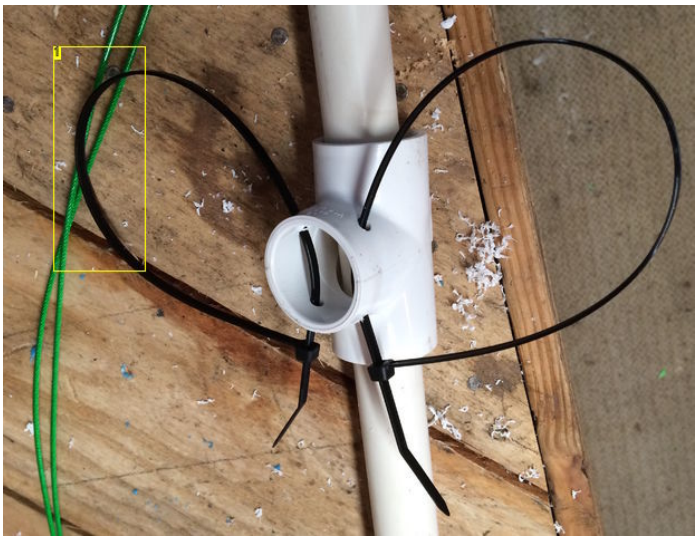
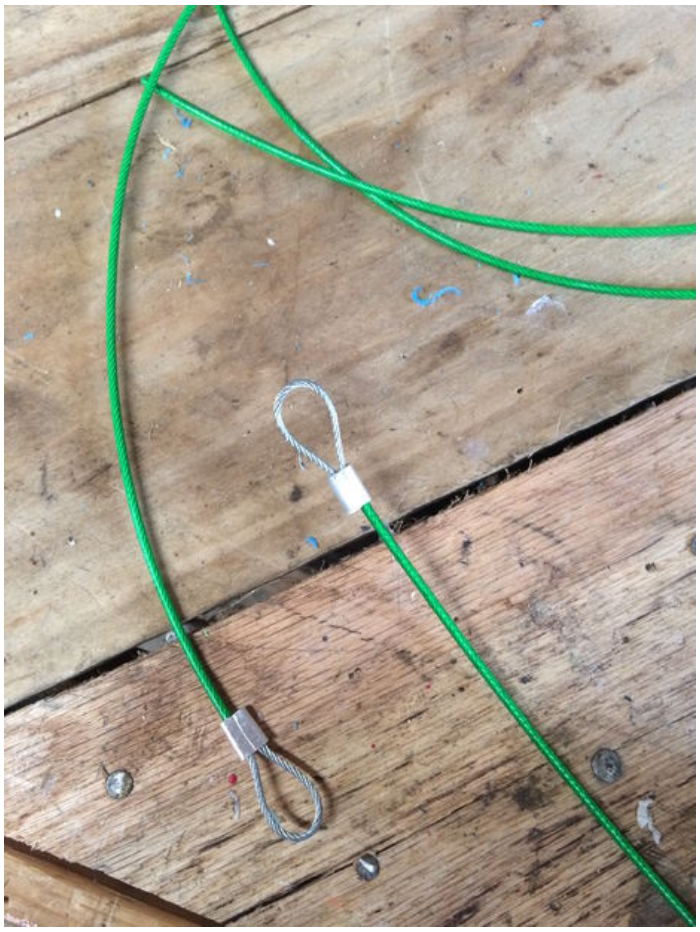


**Image Notes**
1. Note that I went ahead and closed the zip ties before inserting the wire loops. Derp.





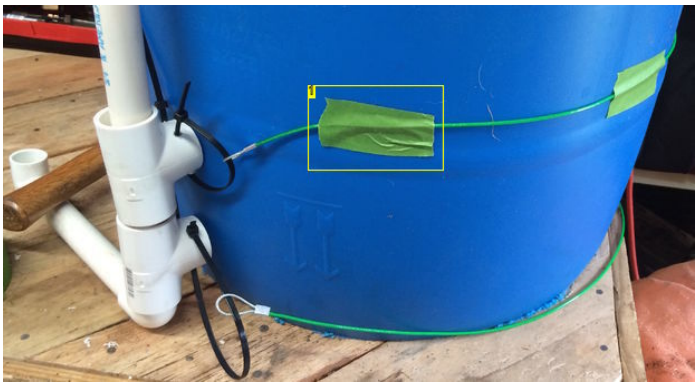


**Image Notes**
1. A little tape helps keep the wires in place when you don't have a helper.

## Step 7: Connect the digester to the collector and feed the digester

Before moving the whole assembly into place, I made a nice little patio for it from old bricks. I then connected the line from the digester to the collector, opened the collector outlet valve, pushed as much trapped air as possible out from the collector, and then closed that valve before opening the two valves between the digester and collector.

As mentioned before, I intend to feed the digester with kitchen scraps and some weeds processed through the mobile grinder cart. Tap water typically contains enough chlorine to negate the bugs doing the digesting, so I'm feeding it with water from my basement dehumidifier. Eventually, I'll add some cow dung to really jumpstart the reaction.

Then, once I get the digester up to speed and the whole system purged of anything but biogas, the sky's the limit for what I can do with it. I'll likely run a small compressor to feed empty propane tanks for use in my barbecue, but I'm also considering buying a secondhand generator to convert to natural gas. Or, if anybody has experience building methane fuel cells, I'd love to hear from you!

## Related Instructables

**How to Build a Medium Sized Biogas Plant** by antoniraj

**Make Energy From Weeds** by antoniraj

**biogas from leftovers** by Venkat Jayanth

**Mini Bio-gas plant using food waste, decomposable organic material and kitchen waste** by antoniraj

**biogas generator** by kartikaa23

**Intel Edison Gas Sensor System to Detect Biogas / LPG Leakage** by antoniraj

## Comments

**1 comments** **Add Comment**

**DaveS4** says: Oct 4, 2016. 6:27 PM **REPLY**

This is a great and simple way of doing it. I have done lots of research and there's a guy in BC that uses a food waste disposal unit and is much more complex. The only thing I can see as a precaution is where you build it as for us in the frozen north you would have to build a Something to keep the heat in so it won't freeze