

DIY Green Energy-overview

For PDF copy to to: www.joyfulcatholics.com/DIY-Green-Energy-overview

Anyone anywhere can have complete energy independence by producing his/her own energy from manure and grain stems (all but the grain and the roots of wheat, rye, corn, oats, barley, etc.). A typical USA household plus two cars can be powered with manure from two typical cows and two typical horses plus grain stems from about 12 acres (about 5 Hectares).

Anyone anywhere can accomplish such energy independence using a device called an anaerobic digester. Digesters can use microbes to digest almost any organic material, producing methane (also known as CH₄) in the process. Methane is the chemical that gives natural gas its power.

PLEASE CHECK MY RESEARCH AND MY MATH

They are detailed at: www.joyfulcatholics.com/DIY-Green-Energy-math

THE NEEDS

By my calculations, fully powering a USA household requires:

- 1,032 kWh methane/week for generating 220 kWh of electricity/week
- 360 kWh/week for non-electrical household energy
- 400 kWh/week for two electric cars
- 1,792 kWh/week total

THE SOURCES

I have looked at four sources of stuff to digest; cow manure, horse manure, human feces, and enough grain stems to weigh three times the combined weight of wastes.

# of H	# of U	# of COWS and same # of HORSES							
		1		2		4		10	
		kg	kWh	kg	kWh	kg	kWh	kg	kWh
	1	764	1,000	1,520	1,991	3,032	3,974	7,568	9,923
	10	840	1,096	1,596	2,087	3,108	4,070	7,644	10,019
	50	1,176	1,522	1,932	2,512	3,444	4,495	7,980	10,445
	100	1,596	2,053	2,352	3,043	3,864	5,026	8,400	10,976

The top left corner and bottom right corner can be read as:

- One cow plus one horse plus one human plus stems will provide 764 kg of stuff to digest which can produce 1,000 kWh of energy.
- 10 cows plus 10 horses plus 100 humans plus stems will provide 8,400 kg of stuff to digest which can produce 10,976 kWh of energy.

I have some ideas to get the more energy out of the material, but those are for another day.

I think the best approach would be to:

1. Raise grain (wheat, rye, corn, oats, barley, etc.)
2. Harvest the food portion
3. Put the stems into your digester
4. Add any organic matter you want to dispose of
5. Collect the methane
6. Put the sludge as organic fertilizer on the grain field(s).
7. Repeat

ALTERNATIVE STUFF TO DIGEST

However, use any abundant and affordable organic material where ever you are. Almost any organic material can be used to make methane: food scraps, animal carcasses, grain stems, grass, straw, leaves, seeds, etc. Try whatever is available and cheap. For example, dirty bedding from cleaning out animal cages is perfect for in a digester.

If you do not have 12 acres available to you, take the effluent, (liquid leftovers) and use it to grow algae.

How much methane you actually get will vary depending on several factors like:

- The particular type of organic material you use
- Whether you had a good or a bad growing season
- How well you prepare the stuff to be digested
- The temperature during digestion
- The acidity/alkalinity during digestion

- Etc etc etc

To really know your potential, test 1kg of cow manure and 1 kg of stuff to be tested. Measure how much biogas you get. Subtract what you get from 1 kg of cow manure alone and you know how much you get from the stuff being tested.

If you cannot access cow manure, use horse manure, pig manure, etc. Relying on non-cow manure, methane production will start slowly. So, build your digester with something like 20% extra capacity. Wait until the first batch is producing lots of gas, which means it has lots of microbes. Then transfer the 20% extra into the second batch to give the second batch a faster start. Once you know how much to transfer from batch to batch, you should be able to get most batches done in four weeks even without cow manure.

If you cannot access any animal manure, use human feces alone. This will give you a very very slow start, but again, once you have a batch producing well, transfer some of the digester contents to the next digester and so on.

SAFETY FIRST

No one can generate methane with out danger. Methane is dangerous stuff. Methane has no color, no odor, no warning of its presence. So, PLEASE be very careful and build in all the safety measures you can.

If you have just a one in a thousand chance of being in danger at some time during a day, then you will be in danger once every 3 years ($365 \text{ days/year} * 3 \text{ years} = 1,095 \text{ days}$).

Methane is dangerously poisonous whenever it is more than 0.5% of the air you breath. Methane can explode whenever it is more than 5% of the air around you.

Source: <https://www.wef.org/globalassets/assets-wef/direct-download-library/public/03---resources/wsec-2017-fs-002-mrrdc-anaerobic-digestion-fundamentals-fact-sheet.pdf>

Precautions you can take include::

1. Flame trap(s) should be incorporated in pipes/hoses carrying methane
2. Keep Digester(s) outside, not enclosed in a building

3. Be sure pipes and hoses do not leak, Especially if in a building. Check them often.
4. Keep the following away from methane:
 1. naked flames
 2. anything that can create a spark
 1. mobile phones
 2. electrical equipment not specially made to not allow sparks
 3. iron or steel tools
 4. power tools
 5. normal electrical switches
 6. static electricity

My research has been done online. The sample links below can help you get started with your research.

BACKGROUND

<https://www.epa.gov/agstar/anaerobic-digesterbiogas-system-operator-guidebook>

[https://www.agmrc.org/media/cms/](https://www.agmrc.org/media/cms/FinalAnearobicDigestionFactsheet_2E11FAB524961.pdf)

[FinalAnearobicDigestionFactsheet_2E11FAB524961.pdf](https://www.agmrc.org/media/cms/FinalAnearobicDigestionFactsheet_2E11FAB524961.pdf)

<https://attra.ncat.org/wp-content/uploads/2019/05/anaerobic.pdf?>

FLAME ARRESTORS

<https://www.sciencedirect.com/topics/engineering/flame-arrestor>

DIY videos

https://www.researchgate.net/publication/345646026_Mini_Low-Cost_Bio-Gas_Digester_for_Household_Waste/link/5fa9d35aa6fdcc062420ac19/download

<https://home-biogas.blogspot.com/>

Please note that I have not personally built a digester. This info is my best knowledge and belief from my “armchair research”. I am working on my digester design and will publish it when it is done.

You do not need me. If having your own independent source of power interests you, do your own research, develop your own approach, BE CAREFUL, and make it happen! :-)

May God bless you, Phil