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Honduras, air contamination

Honduras: Biodigesters for a new lifestyle

Personally I love feeling the wind on my face when traveling by car, inhaling clean air is the most pure and thrilling experience about my car trips. Sadly I can not say that clean air can be breathed everywhere because of pollution all over the world. This pollution problem is huge, I would love to solve it completely but it is too ambitious and difficult to do, that doesn't mean I am not going to help reduce pollution; at least I'd like to help in Olancho, Honduras.

Air pollution in Honduras is a problem that must have an immediate solution, since the health of people and other living beings is at risk. One of the causes of this air pollution is the use of firewood for cooking, among other activities; when burning this material toxic particles are released to the air causing an inevitable damage.

Honduras is a democratic country currently (2022) is led by President Xiomara Castro who was the candidate of a party called Partido Libertad y Refundación (Libre). According to the Honduran newspaper Voice of America committed to make a government of reconciliation and justice, indicating that she would govern through local governments, mayors and deputies. She even warned that power in her country would never be abused again, it was mentioned that she would put an end to crime and drug trafficking [Vado, 2022]. One evidence that may prove she is going to keep her promises is that recently, the so-called "first political crisis" began and ended quickly, in which the President Xiomara put an end to the congressional crisis with only two board meetings [BBC, 2022].

Honduras is the home of 10.4 million people. Within that number of people 59.6% of the population lives in urban areas while 40.4% of them live in rural areas [Kemp, 2022].

Honduras only has 9.5% of its territorial surface available for cultivation, this percentage is divided among different activities such as: agriculture that occupies 28%, permanent cultivation uses 3%, forest areas are 39% and nationally protected areas 20% [Honduras, 2018]. From the 28% that represents agriculture per hectare they get 72.5 tons of watermelon, 51.1 tons of tomato, 13.9 tons of onion, 595.5 tons of corn and 2.2 tons of mango which are the main products exported from Honduras by the agricultural sector, without mentioning other two products that are part of the main ones, these are: coffee (produced 476.3 tons per hectare) and bananas (produced 93.5 tons per hectare) [CEPAL, w.d.]. Honduras exports a few other products that are: shrimp, lobster, olive oil and clothes [Pacheco, w.d.]. So that the agriculture of Honduras gives results effectively must take into account the climate and the geographical location as in any crop; in Honduras the average temperature is 78 8° to 84 2° F (26° to 29° C) in a tropical climate, with a geographic area composed of highlands, lowlands, plains and mountains [National Geographic, 2021].

Now speaking of the cattle rising context, an average farm in Honduras measures 8 hectares that could be equated to 20 professional soccer stadiums, and a large size that can mean a large production.

An average Honduran family has 3 to 4 members, if they live in rural areas their homes meet the following characteristics: they have 1 to 2 rooms, with thatched roofs and they're built with adobe stalks or sugar cane and mud with dirt floors. Urban communities divide into two the high-class and the middle-low-class ones, high class has the possibility to acquire a decent home with all the necessary things including even luxuries, their houses are big and built with cement, but middle-low-class people live in houses with connected rooms some of them have a street view and the rooms are so small that is difficult to walk, also they are built with wood [Honduras - LIVING CONDITIONS, w.d.]. Regarding the basic services of a home, only 70% of Honduran families have access to them, such as water, electricity, bathroom, telephone and local stores (they are more common in urban areas than in rural areas) [Water for people, 2021].

In Honduras the main jobs are: Being an English teacher, administrators, merchants and vendors, farmers, laborers, service and transportation workers can also find job opportunities [Ocupaciones de Honduras, 2016]; the minimum salary they could earn in general is \$1 200 USD a month. The families can get their food from a supermarket, local stores, from their crops and fishing activities or from organizations such as the so-called World Food Program that is in charge of sending it to families with scarce food resources [WFP, 2021].

Eighty-seven percent of students are covered by the Honduran educational system and the remaining percentage remains without education; In this educational system, the first 9 years of education are free and the rest are paid. There are families that can pay and there are others that cannot, which prevents their children from finishing school properly [Borgen Project, 2019]. Every year, 100,000 Honduran families take their children out of school and put them to work because their economic situation forces them to make these decisions. It is proven that 30% of students repeat primary school, another 30% do not finish high school [UNESCO, 2020].

Air in Honduras according to the World Health Organization has a moderated quality, meaning that it is reasonably unsafe. According to the data, the ideal concentration of PM2.5 is 10 $\mu\text{g}/\text{m}^3$, but that of Honduras exceeds it, reaching 21 $\mu\text{g}/\text{m}^3$, which indicates poor air quality [IAMAT, 2020]. Air pollution seriously harms the health of people and living beings such as animals and plants, in addition to bringing environmental consequences such as acid rain or the obstruction of sight due to the density of pollution, it also damages the jobs of both farmers and ranchers [UCAR, w.d.].



(Fama team, 2022)

People's health is affected regardless of whether they live in a rural or urban area, but especially in rural areas they see themselves affected because of the damage contamination may bring to their crops, cattles and businesses that they manage in the outdoor; also marginalized populations usually are the ones that don't get much attention from government or they lack several resources such as health services. This exposes vulnerable groups to death or serious affections [WHO, 2019]. Now specifically newborns and children seem to be more affected because they breathe faster than adults causing them to absorb more pollutants and their lungs are more propense to get sick [WHO, 2018]. But all of this is about human beings' health, What about the environment? Well there are some consequences such as acid rain or the obstruction of sight due to the density of pollution, it also

damages the jobs of both farmers and ranchers, In short, air pollution may be an environmental issue, but it ends up affecting everything from health and good quality of life to the economy [UCAR, w.d.].

My proposal is to teach people how to create their own batch digester for them to use it in their crops and livestock, also get a type of biodigesters named *Polyethylene Tubular Digesters* to the people and install them in their crops and livestock too so that both vegetable and animal waste can be used to generate either electricity or biogas.; this proposal would take place in Olancho, Honduras.

The use of electrical energy is necessary for the proper operation and maintenance of crops and livestock, when generating your own source of electrical power it becomes easier because you can forget about paying for an electric service, anyway what can be better than generating sustainable energy. On the other hand, the biogas produced can be used to heat and cook without the need to use firewood, which damages the air quality and the health of each person. It is mentioned a lot about saving money because it is worth making a one-time expense rather than spending monthly.

Batch digesters are easy to use and make with a proper teaching, this makes them a perfect solution for air pollution because everyone can understand them, there is no need to be an expert. These technologies are understandable, accessible, affordable and durable, but most importantly they are appropriate for their use in Olancho, Honduras. This is important to mention because there are other types of technologies that aren't appropriate for Olancho, Honduras usage such as expensive, hard to use and get technologies which do not guarantee their durability without expert care.

The plan is to teach the population how to make a homemade and effective batch digester through classes with volunteer teachers, the materials to create the products would be purchased with money donated by the government institute SERNA (Secretariat of Environmental Resources), the environmental organization RDS (Sustainable Development Network) and volunteers from the population. Approximately the materials cost would be \$82.62 USD per digester. Now talking about the *Polyethylene Tubular Digesters* that come from Vietnam, the recommendation is to buy those already made because of the accessible price, we're talking about \$25 USD per 10.2 m approximately. The amount of digesters that will be provided to the Olancho, Honduras community will depend on every person, there is no specific data.

Batch digesters last until the biogas stops being produced, that is when the biodegradation process of animal and vegetable waste is complete, this means that it can last a long time depending on the amount of waste you have put into it. In [Figure 2](#) we may see how a batch digester works.

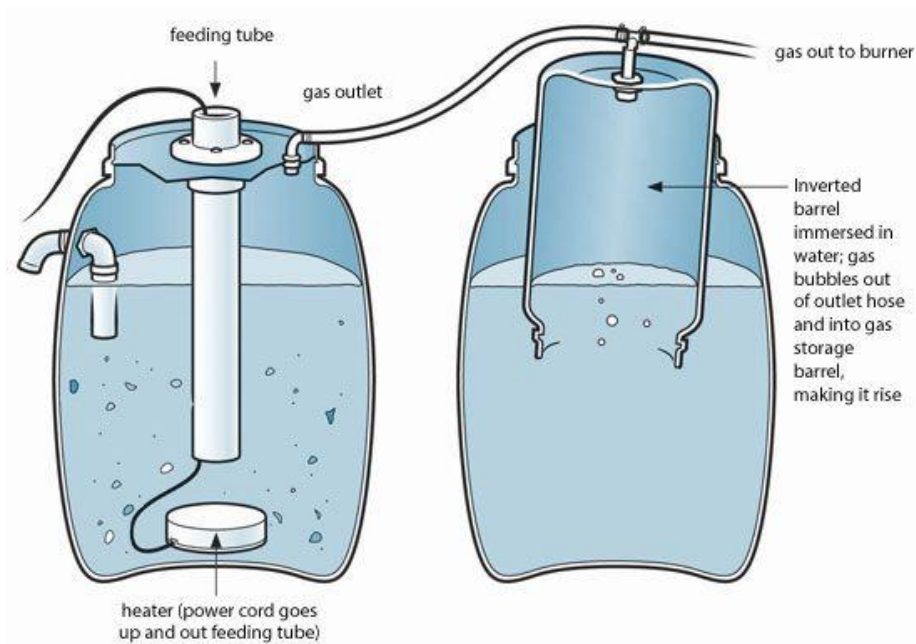


Figure 2 [Batch digester]. (2014, 12 August). Preppers101Blog
 And in [Annex 1](#) where it is explained how to make a homemade batch digester based on Avi Makes Stuff YouTube channel.

Polyethylene Tubular Digesters have to have daily maintenance by charging it with the wanted or necessary amount of waste everyday.

In order to make my project possible, it will need sponsorship and financial aid to be able to provide the following:

1. A place to set up workshops
2. Money to be able to acquire the Polyethylene Tubular Digesters
3. Publicity to spread the word and get the population to participate in this proposal
4. Economic and political stability so that the project remains standing and can be durable

But the most important thing this project needs to have is awareness about what a biodigester is and how it works in order to combat ignorance on the subject and achieve acceptance by the population, this awareness will be created through an infographic created by me that comes as [Annex 2](#). But also the population can help spread awareness by talking about this new technology and how it has helped them with their friends, neighbors, family and partners.

Olancho, Honduras population can play an important role in the dissemination of these new technologies, the way they can help is through the dissemination of the knowledge acquired about batch digesters, in this way people will find out that these technologies have come to bring them a greater benefit and will avoid creating the idea that they are not effective or do not contribute anything to their community. This role played by the community of Olancho is crucial to guarantee the effectiveness and success of this project.

The principal organization I would ask support from is the Economic and Social Council of the UN for them to take the leadership and administration of the project.

Support will be required from Honduran environmental organizations like RDS, REHDES, Ecologist Foundation "Hector Rodrigo Pastor Fasquelle", among other organizations that want to finance my project.

This project can be entrusted to the good participation of the RDS organization since it has shown itself to be committed to creating a positive impact on the environment and society. This organization has been in charge of promoting the inclusion of indigenous communities in theater workshops outside the RDS, or environmental care workshops promoted by it, they have also managed to include school and community gardens in Intibucá, Honduras, and have been in charge of teaching to the communities of Intibucá and Lempira, Honduras on Graphic Design, Hardware, Software and Office Automation. These achievements are evidence of how successful this organization is when it comes to promoting its projects and meeting its goals [Fajardo L., 2022].

This proposal will ask the participation of the governmental secretariat called SERNA not only for the project to be able to implement the proposal effectively and organizedly but also to disseminate and provide funds to this cause. This participation isn't as easy as it sounds to get because the government may not want to allocate money to the project considering it non-essential, but with the appropriate presentation and arguments, the importance and urgency of the topic that this project touches on can be demonstrated and this inconvenience can be solved.

Finally, my project would be open to receive donations from the population (any amount of money would be acceptable from the population), with this help it would guarantee the quality, effectiveness and longevity of this proposal.

That was the economic part, now let's take a look to the policies that are going to be followed in the realization of the project so that it is successful:

1. The General Law of the Environment (Decree 104 - 1993) dictates the following "the appropriate budgets for environmental management that allow the formation of a national conscience and the participation of all citizens in Honduras" [Latina y el Caribe Observatorio del Principio 10 en América, w.d.].
2. The right to information (article 103) that dictates "The right of the population to be informed about the state of the environment and of all the operations and actions that are being taken in this field, by government institutions and municipalities is established" [Latina y el Caribe Observatorio del Principio 10 en América, w.d.].
3. Right to participate (article 9) which dictates the following "promote the participation of citizens in activities related to the protection, conservation, restoration and proper management of the environment and natural resources" [Latina y el Caribe Observatorio del Principio 10 en América, w.d.].

It is important to mention that my plan is directly related to the UN's objective 7 since this objective tries to achieve sustainable energy and make it accessible to everyone, and as I have already explained, what my project wants to do is provide electricity and biogas in a totally natural, accessible and sustainable way; this relationship is relevant because it is seen how the project contributes with a proposal to the fulfillment of the 17 sustainable development goals of the UN.

“Our children won't have time to debate climate change. They'll be busy dealing with its effects” Barack Obama. This phrase implies that if we do not do something about climate change right now, we will not be able to do anything later, that is why it is necessary to take immediate action through proposals, solutions, alternatives and actions that, however small they may be, have been shown to make big changes. With this research and proposal I hope to be able to help and contribute. This action may be small but I firmly hope that it can cause that great impact that I hoped to create from the beginning. I hope that the wind that I love to feel on my face when traveling or walking carries clean air from now on.

Annex 1 How to make a batch digester.
 Infographic made based on Avi Makes Stuff's explanation.

(for best quality click the link:

https://www.canva.com/design/DAE-u8GYqYE/lJqWG0tUX71OHwy96vWuSO/view?utm_content=DAE-u8GYqYE&utm_campaign=designshare&utm_medium=link2&utm_source=sharebutton)

HOW TO MAKE A HOMEMADE *Batch Digester*

STEP 1: DRILL HOLES

We'll have to drill 7 holes 4 for the lid and 3 for the body of the barrel. The lid holes are exemplified in image 1, the inlet hole has to be 2 inches long, the outlet one has to be 1.5 inches and 1/2 inches for both gas outlets. Also the holes represented in image 2 for the body of the barrel have to measure 1/2 inches.



1



2

STEP 2: ATTACH TANK CONNECTORS

Use tank connectors according to the sizes of the previously drilled holes. Make sure that there are no leaks and are well sealed.




STEP 3: PREPARE THE BLINDS

To cap off the holes of the connectors we will need blinds, I recommend to make your own blind to save some money, for this we will need the next materials:

- 1 PVC socket
- 1 a short length of pipe
- 1 end cap
- 1 PVC glue

(Expected results in image 3)



3

↑ 😊

SHOULD LOOK LIKE THIS

STEP 4: SCREW ON THE BLINDS

We'll screw the blinds onto the tank connectors on the barrel and use PTFE tape to wind it around the thread part of the tank connector to ensure a tight fit with the blind.

This is the tape we need



STEP 5: CUT AND CONNECT PIPES INSIDE THE BARREL

Use the right sized pipe to attach it to the tank connector, so if we are using a two inch connector, use a two inch pipe. The inlet pipe should go about 80 - 90% and the outlet pipe should go about 50 - 60% into the barrel. Cut the end of the pipe to a 45 degree angle, then immerse them in the barrel and paste them to the tank connector's on the other side of the lid.



INLET PIPE

30CM VERTICAL



😊 →

SHOULD LOOK LIKE THIS

HOW TO MAKE A HOMEMADE *Batch Digester*

STEP 6: CONSTRUCTING THE PIPES THAT CONNECT ABOVE THE LIDE

In this step we will build the pieces of the diagram below



INLET

For the inlet we will connect a funnel, a ball valve and the socket that connects to the tank connector.

For the funnel glue a 4 inch to 2 inch reducing fitting to a piece of 2 inch PVC pipe.



Result



For the socket glue a piece of PVC pipe to one end of the socket.

Like this



OUTLET

For the outlet we need to build an elbow part

All we need is 2 90 degree elbow tee's and length of pipe (long enough so that one end reaches out of the perimeter of the barrel).

Cut a short length of pipe that will eventually connect to one end as a guide pipe for the slurry to flow down into a canister.



Results of Step 6



Add a small canister for the outlet slurry to flow into.

HOW TO MAKE A HOMEMADE *Batch Digester*

STEP 7: GAS STORAGE

To store gas we need something that can hold gas in a place, we can use a tyre tube with the valve removed for it to inflate as a ballon.

Just make a little bit higher the gas outlet with a sucket glued to a length of pipe and a tank connector glued to the other end of the PVC pipe.

Should look something like this



Prepare 2 meters of flexible hosing and cut it in half, at one end connect it to the pipe elevation, at the high way point connect a gas valve and at the end connect the tyre tube; attach the whole thing to the biogas digester.



Like this



STEP 8: FINAL ASSAMBLY

First test that there are no leaks, if there are, use silicone glue and that's it. Put the gas bag above the digester level and put everything together and we are good to go!

Final Result



et to place an old
the slurry outlet pi

BIODIGESTERS

A GOOD THING?

WHAT IS A BIODIGESTER

"A biodigester is a system that biologically digests organic material, either anaerobic (without oxygen) or aerobically (with oxygen). Microbes and other bacteria break down organic materials in a biodigester. Most food, including fat, greases, and even animal manure, can be processed in a biodigester. Biodigesters are a closed system; therefore, it gives off no odor from food waste; this will eliminate flies and rodents from the facility, increasing hygiene. Also, eliminating food waste on-site saves money by reducing hauling costs. The capacity of food a biodigester can process depends on the size; larger the digester more food it can handle. Biodigesters are a living system and do require maintenance. However, they are easy to use and maintain" [Mallikarachi, 2021].

BENEFITS **ECO-FRIENDLY**

"Of course, one of the great benefits of biodigesters is they are eco-friendly and will reduce a facility's carbon footprint significantly. Food scraps and other organic materials decaying in landfills release methane and carbon dioxide contributing to climate change. Food waste is estimated to be 30-40 percent in the United States and represents the largest category of materials in landfills. Diverting food scraps and other organic materials from landfills, methane, and carbon dioxide can be captured and used efficiently" [Mallikarachi, 2021].

IF I USE A BIODIGESTER, AM I BREATHING ANIMAL WASTE?

NO Absolutely NO! Using animal and vegetable waste for creating biogas doesn't mean that you are cooking and breathing waste, when you put the waste in the container, it decomposes and the gas it releases is called biogas, that is what is used, even though it comes from that waste, it is not cooking or breathing with waste.

WHAT IS BIOGAS ANYWAY?

"Biogas is a renewable gas composed mainly of methane and carbon dioxide obtained from the anaerobic degradation - without oxygen - of organic waste. It is, according to the Institute for the Diversification and Saving of Energy of Spain, "the only renewable energy that can be used for any of the major energy applications: electrical, thermal or as fuel" [Romero, 2022].

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Regina Beltrán Herrera, 2022

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