Introduction:

In the United Arab Emirates, approximately 224 kg of food is wasted per average person per year. Considering the global population, not only does this imply unsustainable consumption of food, but it also affects the environment in terms of pollution from landfills. This is a world crisis that needs to be urgently controlled and reduced. Therefore, the Sustainable Soldiers hereby introduce our project, Syntirogenesis.

Meet the team!


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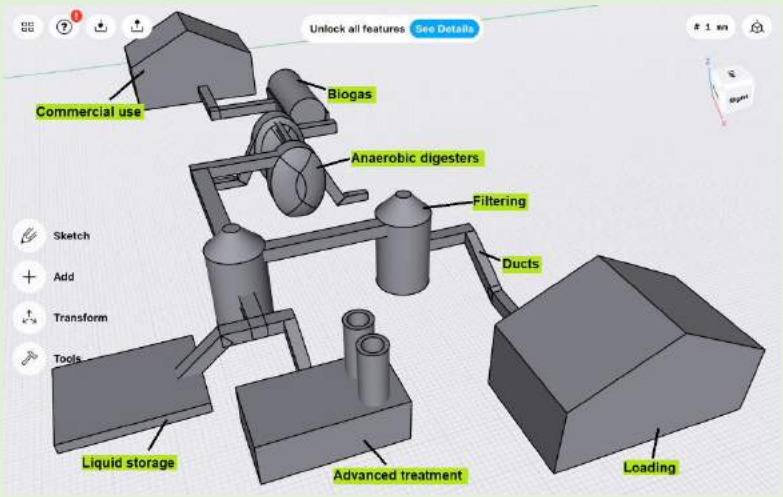
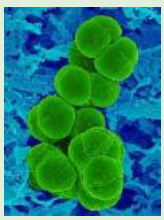
Objectives:

Our Project, Syntirogenesis, aims to reduce food wastage by having it incorporated into other processes that could, in return, provide the population with something beneficial. In this case, we have decided to use food waste as the source of energy in anaerobic digesters. Food waste collected from factories and neighbourhoods is first filtered through screens, then fed into digesters through ducts. These digesters contain Lactobacillus (LAB), that feed on the biowaste to release biogas (mainly methane, with traces of hydrogen sulphide that can be neutralised). The biogas collected through ducts is then combusted to boil water, and the steam released turns a turbine/rotor shaft, which turns a generator to produce electricity.



A single 4,600 m^3 digester produces about 6,800 MWh of energy per year. Manufacturing a few of these in heavily populated areas in the country can therefore be beneficial as this can be very lucrative, considering the greater amount of food waste that would be obtained. This system also saves spaces in landfills, and ultimately promotes the use of a potentially renewable source of energy that is readily available.

We also considered additional features to this project:


Methanosarcina barkeri

1. Methanogens, such as Methanosarcina barkeri, can be added into the digesters. These bacteria can work at a low pH (4.0 to 6.5), which is a consequence of the acetic acid released by the lactic acid bacteria. Methanogens can return the pH to an optimum level, allowing the digestion process to continue at a steady rate.
2. The residue from the digestors is collected to be manufactured into fertiliser pellets with the help of recaptured heat from the initial generation of electricity. These fertilisers can be used in hydroponic farms, which is a common practice in the UAE.
3. Carbon dioxide from the biogas can be liquefied by the traditional method of pressurised compressors, then collected to be used in greenhouses, fire extinguisher factories, etc. based on demands.
4. An alternative solution could be the use of zeolite sorbents in landfills that release methane upon digestion by LABs. The high concentration of methane in landfills makes this a profitable route.

All these enhancements are supported by reports and data that we have seen in published documents by various national-based industries, such as Masdar Institute and Xylem UAE; this helped us take into consideration the demands of the country and allowed us to think of innovative improvements to existing models.

Our second initiative is the designing of an app's layout that aims to promote sustainability through small tasks and activities. The app, SyntiroWorld, would consist of updates on upcoming cleanup campaigns and volunteering programmes. Upon participation, the user can scan QR codes at the designated area (beaches, parks, festival sites, etc.) to retrieve vouchers/coupons. There would also be daily tasks to complete around the neighbourhood. Not only does this encourage individuals to act, but it also creates a platform to discuss such crucial matters.

Progress:

So far, we have collected survey results from a population sample of around 100 people. The survey was shared through social media to gather as many responses as possible. All the responses indicate that the selected sample, ranging between teenagers and young adults, are aware of the world's issues and are onboard the idea of such anaerobic digesters and environmental apps to be used.

We have also interviewed Ms. Gishy Koshy, the Head of Year 12 at Cambridge International School, Dubai. As she is also a biology teacher, she seemed to be the perfect candidate to be interviewed. We had a very knowledgeable talk on the importance of sustainability and the role of an individual in a society in terms of climate change. She was very impressed with our suggested solution and even shared a few pieces of advice and ideas.

IN: Well, apart from that, It has been reported that approximately 224 kg of food is wasted per average person per year in the UAE. What can you say about this?

TR: I think that's true but at the same time, the UAE government has taken some steps to ensure that this number is reduced. But I feel again that it is up to individual households to decide how much to purchase on a weekly basis and how much waste is created. Because if you are conscious, you cannot talk about the entire nation making a change, but you can make a change in your household and ensure that you have less wastage coming out of your house. And if there is any wastage, make sure it isn't going to any landfills but rather composted to make things such as fertilisers.

IN: So, like in our communities?

TR: Yes, like in our communities.

IN: So, our other component of the project is to design a 3D model of anaerobic digesters. The main process is to collect food waste and use them as bio-waste for the anaerobic bacteria to digest, and the biogas released would be used to generate electricity.

We have also collaborated with GSL Unify on Instagram – it helped us promote our ideas and helped us engage in informative discussions about various world matters, ultimately creating a diverse and constructive platform for us, as well as other participating teams, to engage in.

Aims: The targeted download number of the app is roughly 200 downloads initially based on the small sample size, and as the programme expands to different communities, we want to achieve around 350-400 downloads.

Difficulties/Challenges:

Initially, due to the consequences of the pandemic, working together in-person proved difficult unless at school. However, as restrictions were gradually retracted, we were able to meet up and work effectively. We also faced the difficulty of creating a working mobile app and resorted to designing the layout instead with sufficient details. To support this, we took feedback from students at our school to obtain data on the likeliness of the app potentially being used.

Conclusion: Working together on this project for approximately seven months has helped each of our team members collaborate and share our creative ideas on how we can bring a reformative change to the world, based on the SDGs. It was a very mind-engaging experience, and it encouraged us to take initiative of spreading awareness and getting our community involved. We strongly believe that Syntirogenesis is one of many great suggestions to solving some of the world's problems, and we shall continue participating in such activities to protect our planet.