SUSTAINABILITY STARTATHON

COUNTRY NAME - MYANMAR

TEAM - ECOVATION CREW

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From Myanmar Noble University

Team Ecovation Crew

from **Myanmar Noble University**

Ms. Eaint Phoo May

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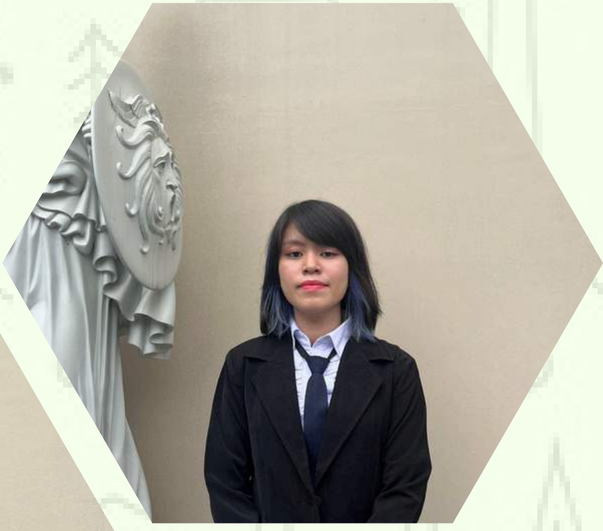

Ms. Shin Thant Shwe Eain

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Problem Statement

Access Disparity

Lack of electricity in 29,604 villages in Myanmar hinders education and business opportunities.

Environmental impact

Reliance on diesel generators in rural and remote areas leads to high carbon emissions and environmental damage.

Economic Viability

Existing energy solutions like hydropower, solar power, and diesel generator power are not affordable or sustainable for underserved communities in Myanmar.

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OUR

PROJECT

How is our ‘അഃ (Arr) project’ gonna solve this problem?

SMART Objectives

Specific

Provide off-grid electricity to 1,000 households in a village in the Ayeyarwaddy region of Myanmar.

Measurable

Achieve 100% renewable and clean energy generation for these households through a hybrid system including a biomass incinerator and biogas digester.

Attainable

Implement the hybrid energy system within 2 years and a budget of 800,000,000 MMK leveraging local agricultural waste for biomass and biogas production.

Relevant

Directly contribute to the seventh Sustainable Development Goal by ensuring access to affordable, reliable, and sustainable energy for the target communities.

Time Bound

Complete the installation and operationalization of the hybrid energy systems in all targeted villages within 2 years.

Targeted Market

Location

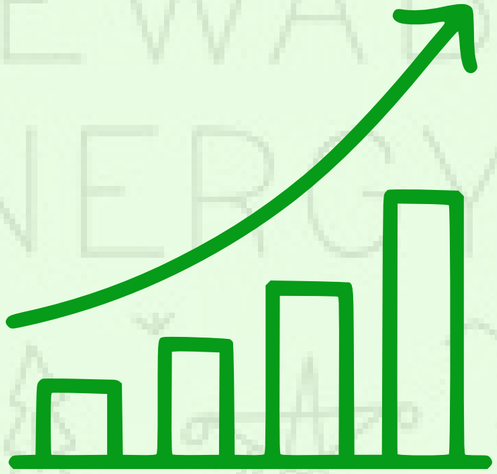
A village of 1000 households in the Ayeyarwady Region

Source

A great source of agricultural waste like rice husk for biomass

Electricity Demand

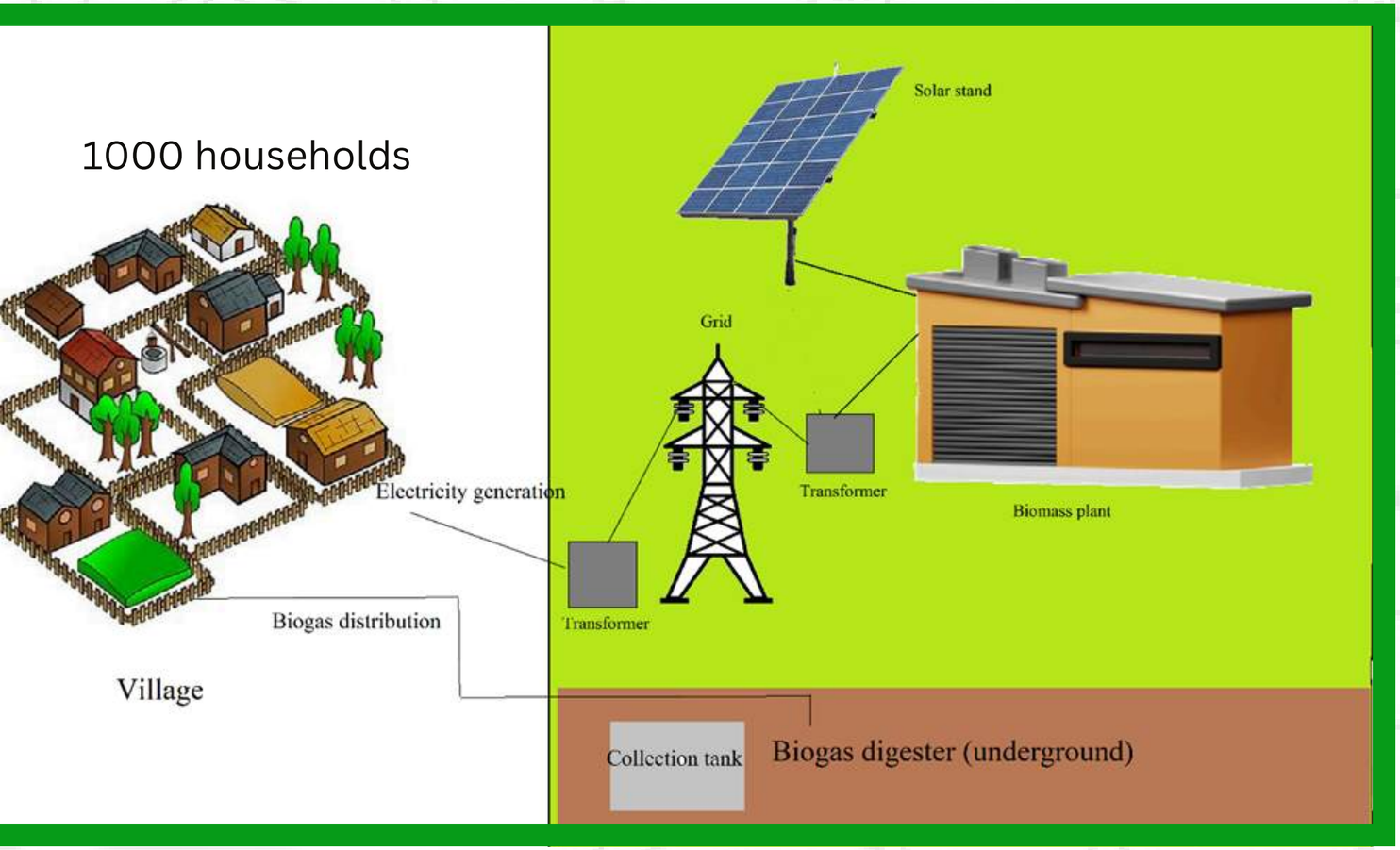
High



Profitability

Can provide revenue to break even in a year and sustainable profitability

Project Deliverable



Hybrid Project

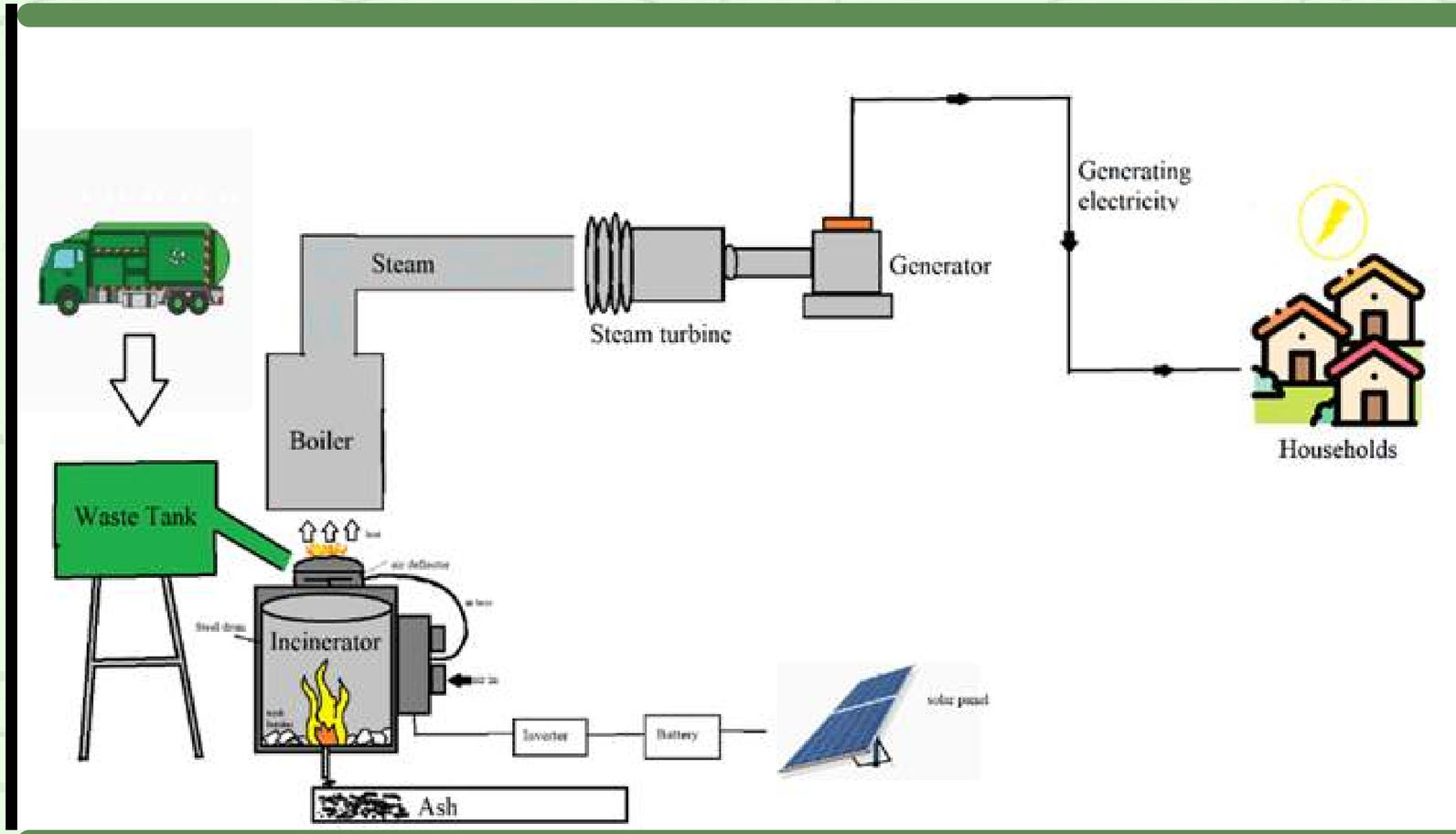
- A hybrid electricity generation consisting of a biomass incinerator and a biogas digester in an open field
- Provide a sustainable and reliable source of energy to rural villages by integrating biomass and solar power technologies
- Leverage abundant local resources such as agricultural waste and human waste to generate electricity and energy for cooking

Biomass incinerator

- The biomass component involves the installation of a central incinerator that burns organic waste to produce steam, which then drives a turbine connected to a generator, converting thermal energy into electricity. The incinerator's design was inspired by the SMART ASH incinerator by Elastec.

- No smoke, no smell, no pollutant emitted

- To generate 1500 kWh per day for 1000 households, about 360 kg of agricultural waste will be burnt in the incinerator each day.



Inspired technology by Elastec

- This is the portable SMART ASH Incinerator.
- For our project, the incinerator will be medium-sized.
- The function and the technology are inspired for less damage on the environment.

Process flow of biomass incinerator

Solar panels

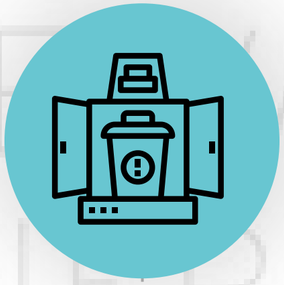
- Function: Generates electricity from solar energy.
- Output: Electricity at 480 volts for the incinerator

Battery

- Function: Stores electricity generated from solar panels.
- Inverter: Converts DC from the battery to AC

Biomass incinerator

- Function: Burns trash (biomass) to generate heat.
- Air Inlet: Supplies air to support combustion.
- Output: Produces heat used to generate steam.



Boiler

- Function: Uses heat from the incinerator to produce steam.
- Output: Steam is directed to the turbine.

Steam turbine

- Function: Uses heat from the incinerator to produce steam.
- Output: Steam is directed to the turbine.

Sufficient electricity generation

Waste Production

- 1000 households produce approximately 2500 kg of waste per day

Electricity Generation

- To generate 1500 kWh per day for 1000 households, about 360 kg of agricultural waste needs to be burnt each day

Surplus Waste

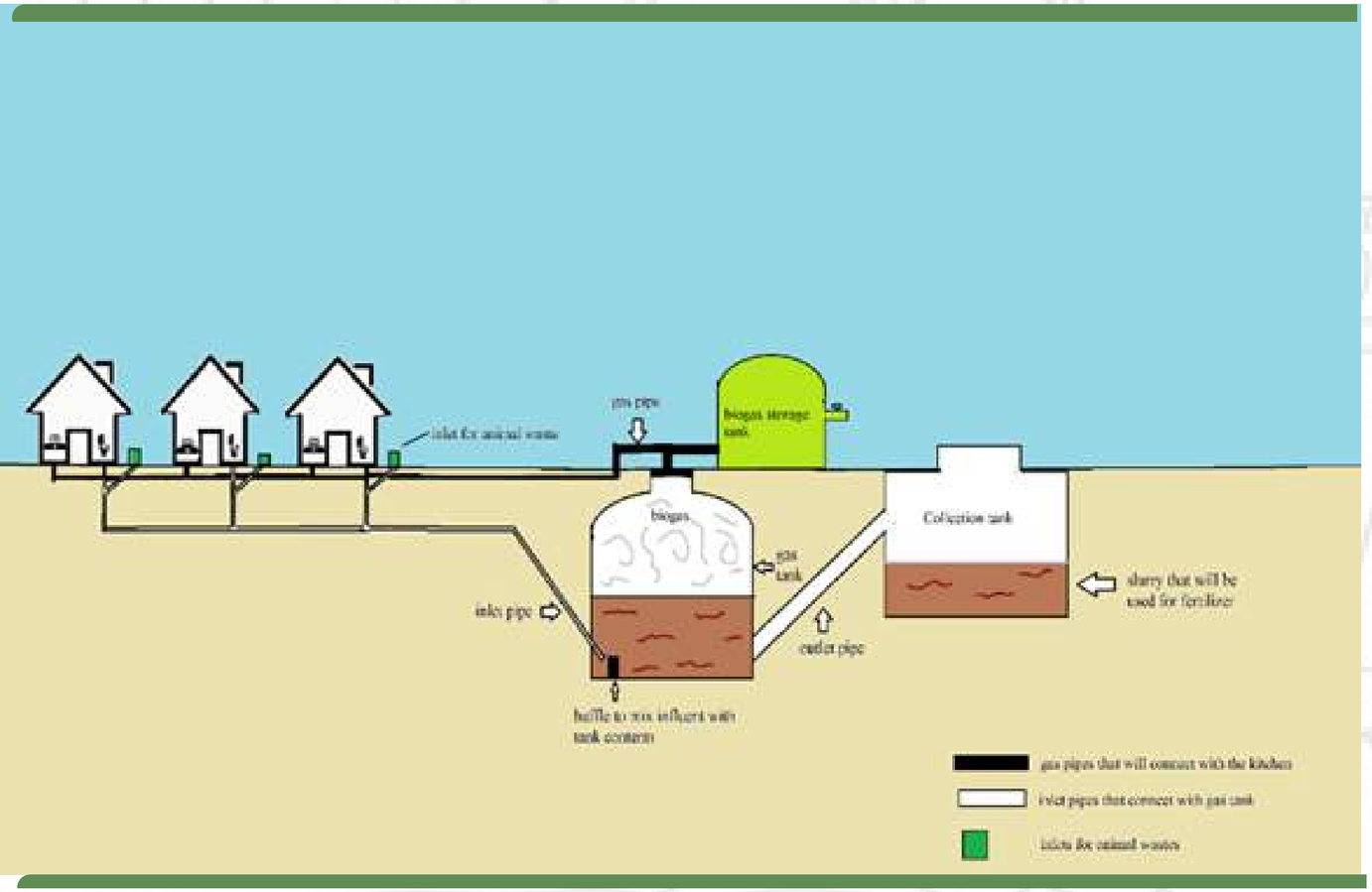
- With 2500 kg of waste produced and only 360 kg needed for electricity. It will be used for additional electricity generation

Agricultural waste

Approximate agricultural waste from fields in the Ayeyarwaddy region is mentioned below. It would be used for burning to generate electricity if the waste from households could not be collected for several reasons.

- **Rice fields: 5-10 tons per day.**
- **Wheat fields: 3-6 tons per day.**
- **Sugarcane fields: 1-2 tons per day.**
- **Maize fields: 2-4 tons per day.**

Biogas Digester



- The biogas digester converts human waste from the toilets in the villages and animal manure into biogas
- Can be used for cooking and heating. According to the statistics, the average amount of biogas a household requires is 0.3 cubic metres.
- For 1000 households, it would be 300 cubic metres (0.3 cubic metre*1000 households).

Process flow of biogas digester

Waste collection for households

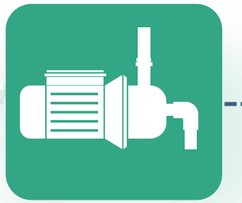
- Pipelines: Gravity-based or pump-assisted pipelines are used to transport waste from the sanitary systems to a local collection tank.

Local collection tanks

- Intermediate Tanks: These tanks collect waste from nearby households before being pumped to the central mixing tank. These tanks help manage waste flow and reduce the burden on the main pipeline.

Pumping system

- Pumps: Submersible or surface pumps are installed in the local collection tanks to move the waste through pipelines to the central mixing tank. Pumps are chosen based on the distance and elevation differences between collection tanks and the central digester.



Baffle to mix

- Effluent Treatment: The liquid effluent from the digester is treated to remove pathogens before being released into the environment or used for irrigation.

Biogas digester

- Anaerobic Digestion: Waste from the mixing tank enters the biogas digester, where anaerobic bacteria break down the organic material, producing biogas (methane) and digestate (liquid fertilizer).
- Gas Collection: The produced biogas is collected at the top of the digester and transported via gas pipes for storage or direct use.
- Digestate Outlet: The digestate is periodically removed and can be used as a fertilizer for agriculture.

Wastewater and efflument management

- Effluent Treatment: The liquid effluent from the digester is treated to remove pathogens before being released into the environment or used for irrigation.

Biogas storage tank

- Energy Use and storage: The biogas can be used for various purposes such as cooking and heating. The excess gas can be stored in the storage tank.

Calculation for biogas production from human waste

Average Human Waste Production:

- o Each person produces approximately 2 litres of human waste per day.
- o Assume an average household size of 5 people.
- o Daily waste per household: 5 people×2 litres/day=10 litres/day
- o For 1000 households: 1000 households×10 liters/day=10000 liters /day

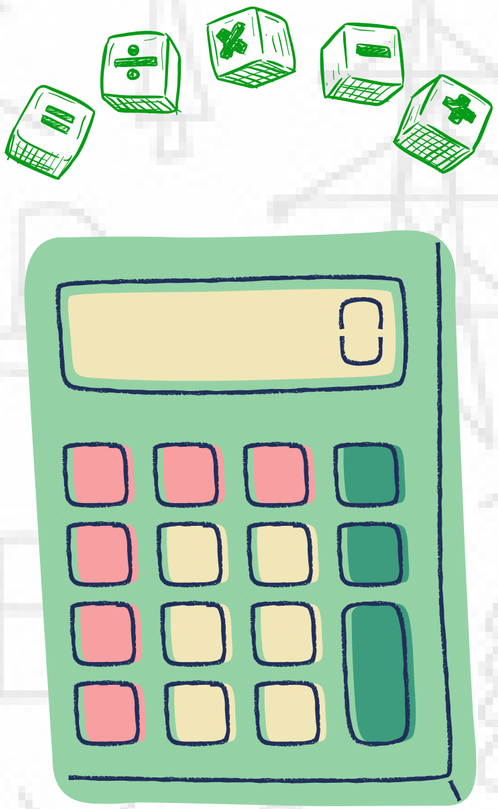
Calculating Biogas Production

Biogas Yield from Human Waste:

- o On average, 1 cubic metre (m^3) of biogas can be produced from 25-30 litres of human waste.
- o Using the average value of 27.5 litres per 1 cubic metre of biogas

Daily Biogas Production:

- o When waste for 1000 households of 10000 litres/day is divided by 27.5 litres per 1 cubic metre, 363.63 cubic metres of biogas will be produced in 1 day.



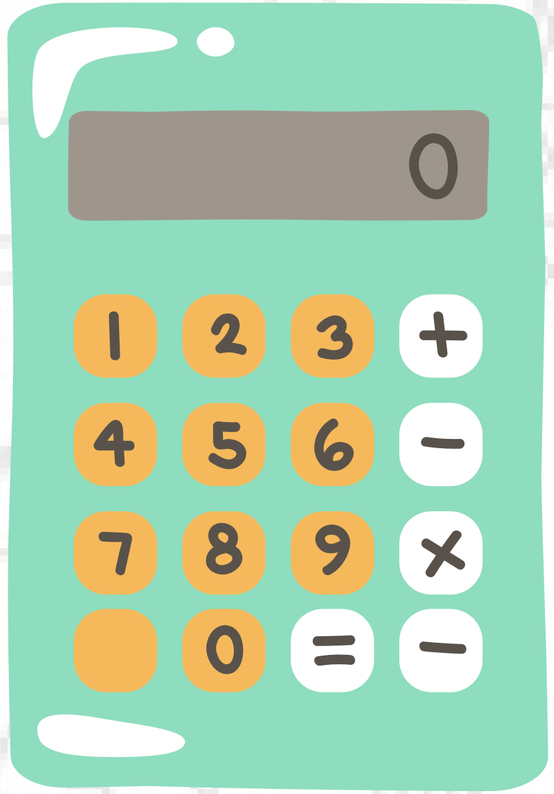
Calculation for biogas production from animal waste

Biogas production from animal waste

On average, a medium-sized animal like cows produces 10 kg of dung per day—enough to produce 0.5 cubic meters (m3) of biogas.

Estimation

Supposing there are 100 cows in the village
Biogas production from animal waste would be 50 cubic meters
(number of cows 100* 0.5 cubic metres of biogas)



Total biogas production

Human waste = 363.63 cubic metres
Animal waste = 50 cubic metres
Total biogas production = 413.63 cubic metres

Providing biogas for households

According to the statistics, the average amount of biogas a household requires is 0.3 cubic metres. For 1000 households, it would be 300 cubic metres (0.3 cubic metre*1000 households).

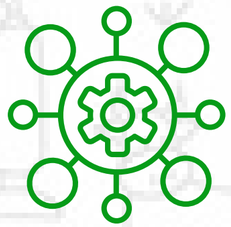
Adequate biogas production

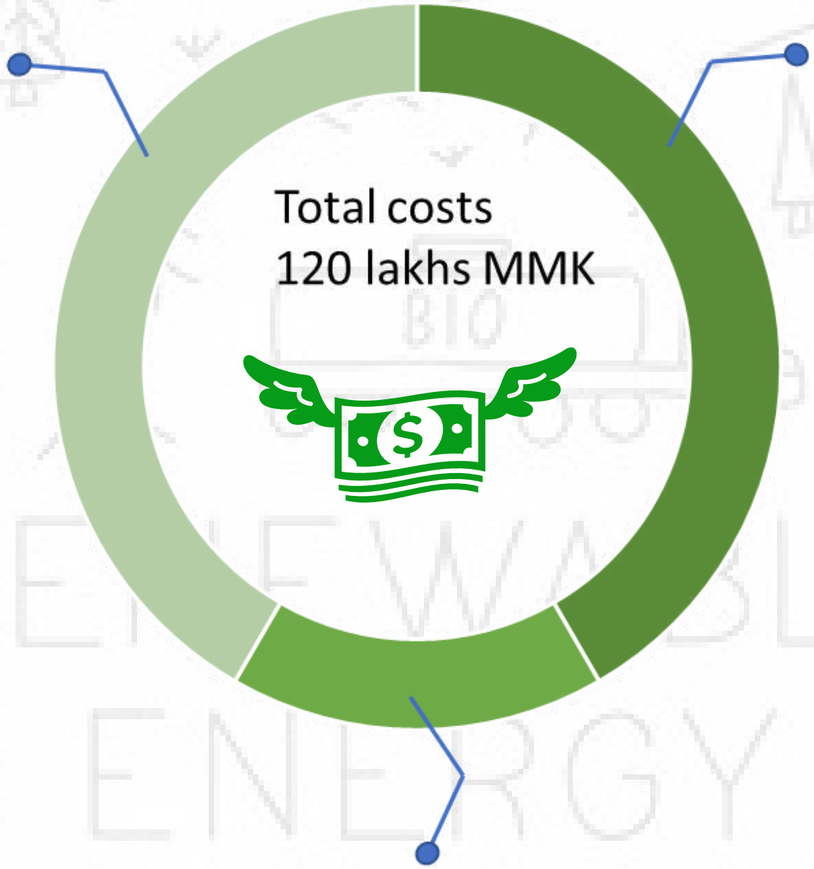
Financial Plan (Initial Installation Costs)

Biomass incinerator and boiler	2500 lakh MMK
Stream turbine and generator	400 lakh MMK
solar panels, battery storage, and inverters	1000 lakh MMK
Biogas digester and piping	2000 lakh MMK
Civil works and electrical infrastructure	1000 lakh MMK
Engineering and design services	200 lakh MMK
Installing and regulatory compliances	900 lakh MMK
Total	8000 lakh MMK

Monthly Costs

Miscellaneous
50 lakhs MMK
41.7%



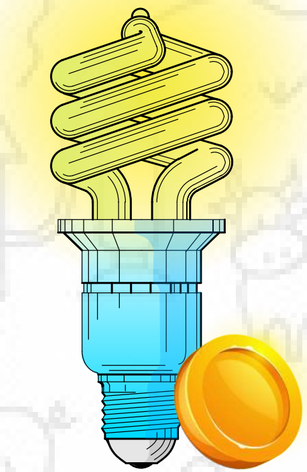


Labour
50 lakhs MMK
41.7%

Maintenance
20 lakhs MMK
16.6%

Revenue Streams

Electricity bill



A household uses 45 kWh in a month. Therefore, each household has to pay 1755 MMK per month. The revenue for 1000 households would be 1,755,000 per month.

Calculation	
Operational Cost	20 MMK/ kWh
Profit Margin	19 MMK/ kWh
Total Price	39 MMK/ kWh

Biogas sales

1 cubic meter of biogas - 600 MMK

Since a household uses 0.3 cubic meters daily, it will be 180 MMK daily.

For a month, a household will pay 5400 MMK.

For 1000 households, revenue generation will be 5,400,000 MMK.

Fertilizer sales

The slurry from the biogas digester produces 6490 kg per day, which can be used as fertilizer.

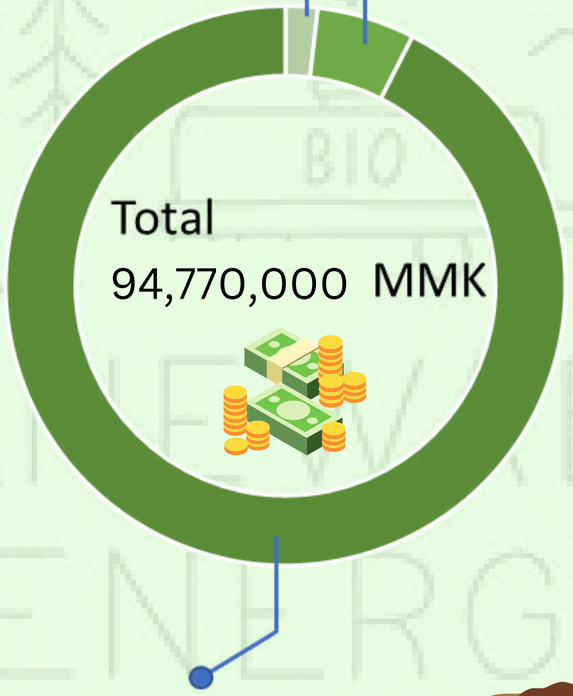
1 kg of fertilizer will be sold at 450 MMK.

Thus, revenue for 1 month will be 87,615,000 MMK.

Monthly Revenues

Electricity
1,755,000 MMK
1.85%

Biogas
5,400,000 MMK
5.65%



Fertilizer
87,615,000 MMK
92.5%

Monthly Profit

Revenue	99,477,000 MMK
Cost	12,000,000 MMK
Profit	87,477,000 MMK

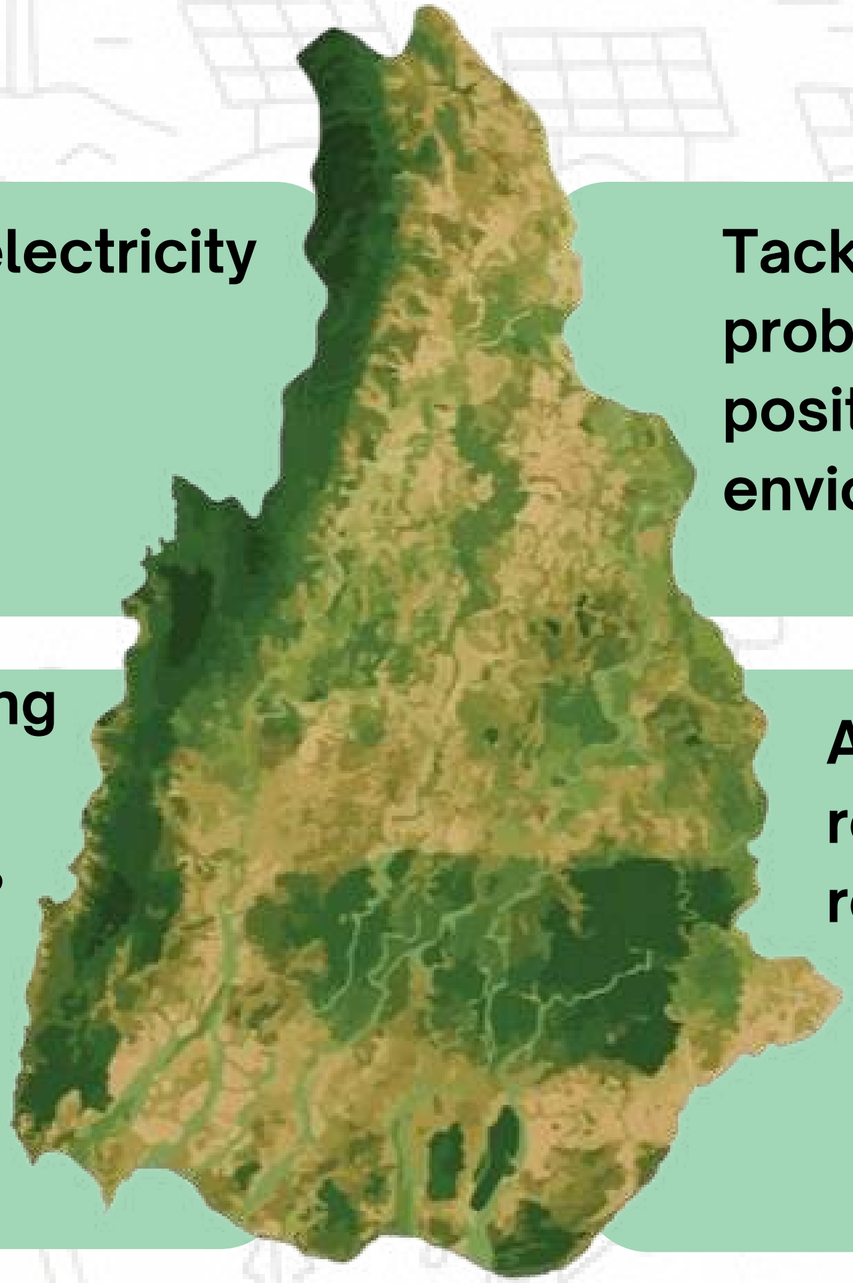
Break even the installation costs within over a year

Reinvest the profit in future projects in other regions of Myanmar

Benefits

Providing 24/7 electricity

Tackling the waste problem, having a positive impact on enviornment



Enhancing the living standards, economic growth, and education

Affordable, clean, renewable, and reliable energy

Risks

Solutions

High initiation costs

Different financing strategies
Collaborations with governments, NGOs like WBA and GGGI

Regular maintenance

Having a local service centre

Policy associated with energy generation

Engaging with government boides
Following safety regulations

Lack of knowledge

Collaborations with universities to hold campaigns and knowledge sharing sessions

How do we distinguish ourselves from others?

If others choose SDG 7, we share the same goal, but what sets us apart is our innovative fusion of biogas and biomass.

The top players in the bioenergy sector

These companies are from India, the UK, and the USA leading in the bioenergy sector. However, there are very few bioenergy initiatives in Myanmar.

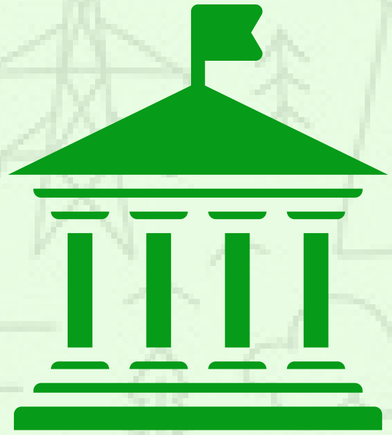
Affordability

Our ‘Arr’ Project

Every 1 unit is 39 kyats

Price does not increase per unit.

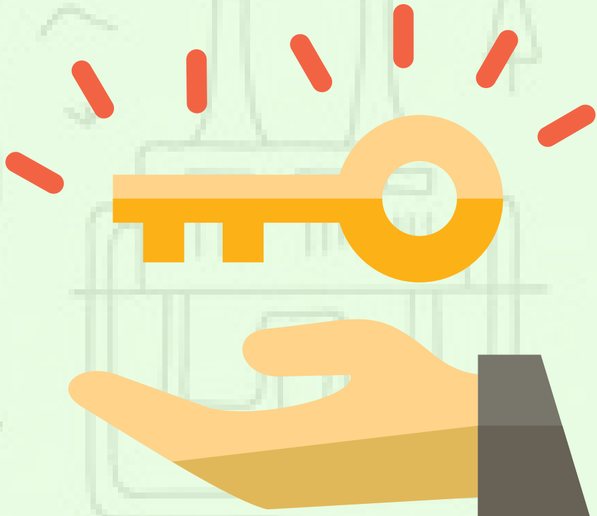
Government



The first 30 kWh - 35 kyats

Price increases per unit afterwards

Feasibility and opportunity for future projects



Abundant sources of biomass

Biomass energy is predominantly derived from wood fuel and agricultural wastes, such as cotton and pigeon pea stalks, sugarcane, rice straws, rice husks, sesame stalks, and palm leaves.

Potential for biomass energy market

Table 13: Actual and Projected Energy Production by Source of Energy
(ktoe)

Year	Coal		Crude Oil		Natural Gas		Hydro		Biomass		Total	
	Base Case	High Case	Base Case	High Case	Base Case	High Case	Base Case	High Case	Base Case	High Case	Base Case	High Case
1980	136	136	368	1,368	286	286	30	30	7,572	7,572	9,392	9,392
1990	49	49	762	762	659	659	103	103	9,021	9,021	10,594	10,594
2000	72	72	1,055	1,055	1,068	1,068	163	163	9,175	9,175	11,533	11,533
2010	446	312	2,852	2,870	960	982	1,281	1,570	10,069	10,099	15,618	15,583
2020	491	363	4,150	4,372	1,054	1,133	2,184	3,217	11,122	11,198	19,011	20,283
2030	551	512	5,871	6,603	1,244	1,899	3,192	6,364	12,286	12,420	23,144	27,798

ktoe = thousand tons of oil equivalent.

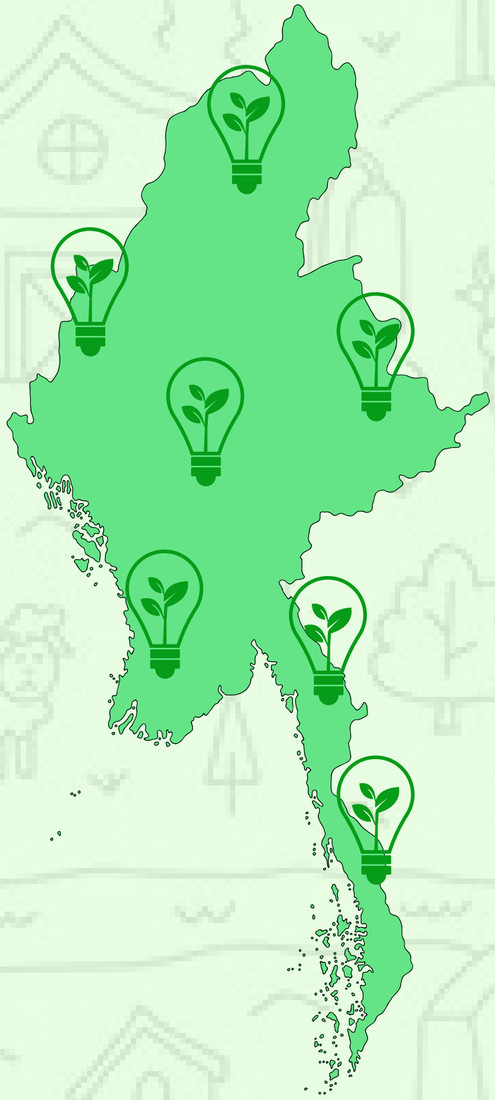
Source: Ministry of Energy.

Myanmar biofuel market sees potential growth in the future.

The demand for biofuel - 12,286 ktoe for the base case
12,420 ktoe for the high case in 2030.

Reason - the rural population cannot afford fuels, such as kerosene, because of the rising domestic oil prices caused by the fluctuating prices of crude oil in world markets

Conclusion



“Myanmar has the potential of better and brighter future with equal distribution of affordable, clean, renewable, and reliable electricity.”

‘အား (Arr) project’

Thank you very much!

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