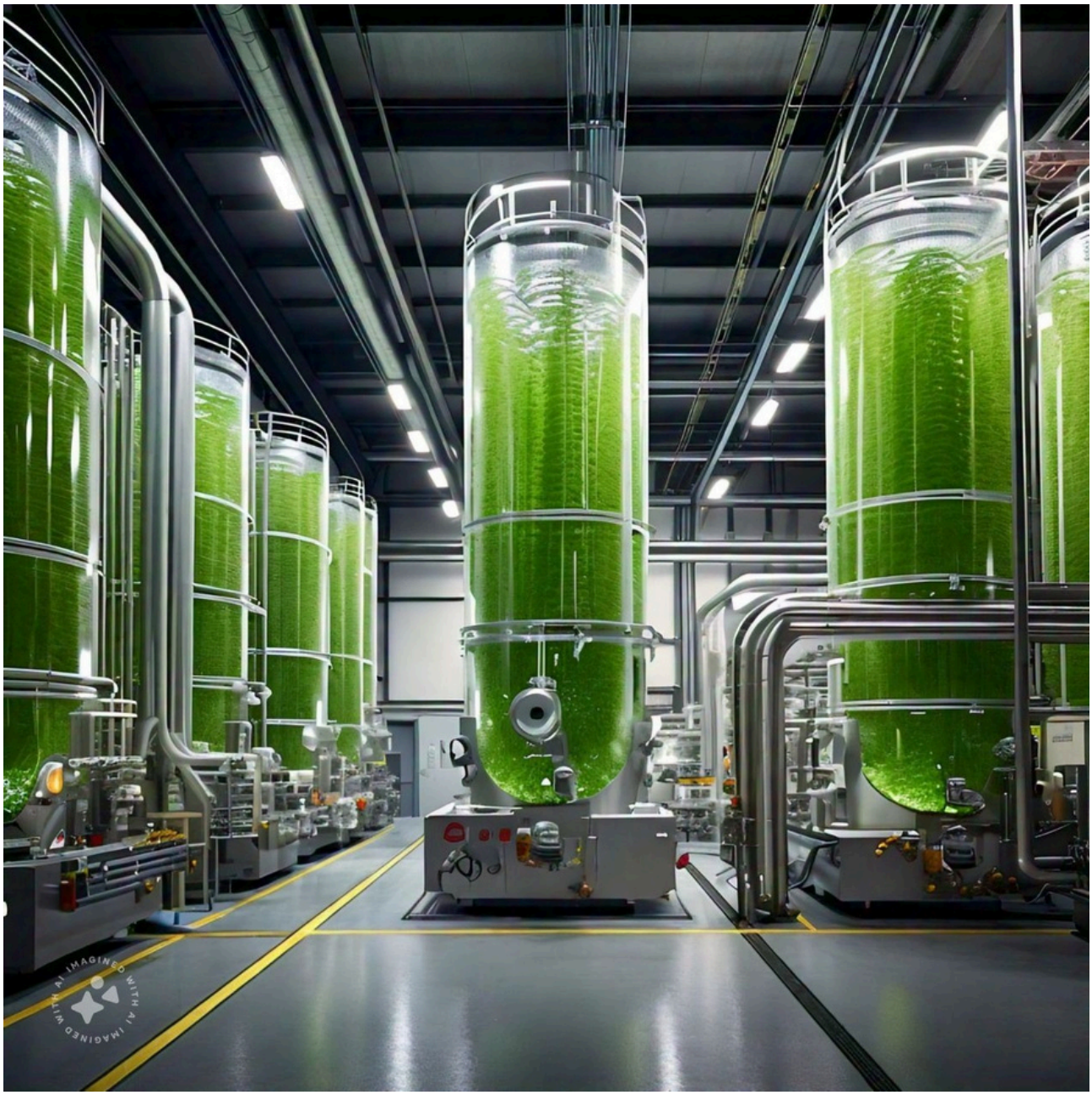
MEDIGREEN
ENERGY

DETAILED PROJECT PROPOSAL

CO_2 Utilization via Hybrid Algae Photobioreactor

Integrated with BioCNG Plant



1. Executive Summary

This project proposes the installation of a ***Hybrid Algae Photobioreactor (PBR)*** system to utilize ***CO_2 generated from a BioCNG plant (4,000 Nm^3/day biogas)*** and convert it into ***high-value algae biomass***.

- ***CO_2 available:*** 2.7 TPD
- ***Algae production:*** 1.5 TPD (dry)
- ***Selling price:*** ₹80/kg
- ***CAPEX:*** ₹14 Crores ***(excluding civil, land, CO_2 capture) Taxes extra***
- ***OPEX:*** ₹1 Crore/year

👉 The project converts ***waste CO_2 into ₹4.38 Cr annual revenue***, delivering ***25% ROI***.

2. Project Objectives

- Capture andutilize CO_2 emissions from Bio CNG plant
- Produce high-value algae biomass
- Improve overall project IRR and sustainability
- Enable carbon-negative operations
- Create scalable module for multipleplants

3. Technical Configuration

3.1 Input Streams

Parameter	*Value*
Raw Biogas	4,000 Nm^3/day
CO_2 Content	35%
CO_2 Available	2.7 TPD

3.2 Output

Parameter	*Value*
Dry Algae	1.5 TPD
Annual Production	547.5 TPA

3.3 Utilities

Utility	*Requirement*
Power	1,300 kWh/day
Water	1,000 KLD (initial, recycled thereafter)
Land	1 acre

4. Process Description

Step-wise Process Flow

1. CO_2 Capture & Conditioning (Client scope)

- CO_2 separated from biogas upgrading system
- Moisture removal and pressure stabilization

2. Hybrid Cultivation System

- ***Closed Photobioreactor(PBR)***
  - High efficiency, contamination control
- ***Open RacewayPond***
  - Cost-effective scale-up

3. Algae Growth

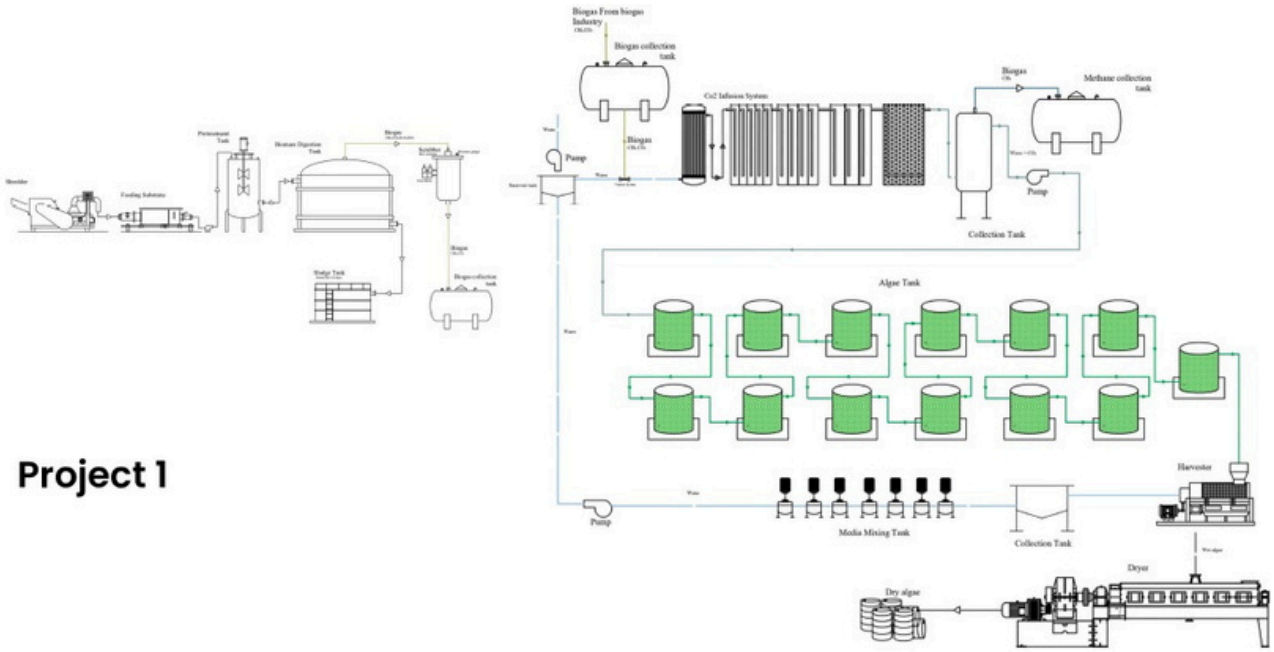
- Inputs:
  - CO_2
  - Sunlight
  - Nutrients (can use digestate)

4. Harvesting

- Flocculation / membrane / centrifuge

5. Dewatering & Drying

- Slurry → cake → dry powder



5. Mass Balance

Parameter	*Value*
CO_2 Input	2.7 TPD
Conversion Efficiency	55–65%
Algae Output	1.5 TPD
CO_2 Fixation Rate	~1.8 kg CO_2/kg algae

5.1 Operating Cost

Component	*Cost (₹ Cr/year)*
Power	0.40
Labor & Maintenance	0.25
Nutrients	0.20
Miscellaneous	0.15
Total OPEX	***1.00***

5.2 ROI & IRR

Parameter	*Value*
CAPEX	₹14 Cr
Payback Period	*~4years 3 months*
ROI	*~25%*

6. Strategic Benefits

🌱 *1. Carbon Capture & ESG Compliance*

- ~1,000 TPA CO_2 mitigation
- Eligible for ***carbon credits***

💰 *2. High-Value Product*

- ₹80/kg pricing enables strong margins
- Potential markets:
  - Animal feed
  - Aquaculture
  - Biofertilizer
  - Protein applications

🔄 *3. Circular Economy Integration*

- CO_2 → algae
- Digestate → nutrients
- Algae → fuel/feed/fertilizer

👉 Fully aligned with your ***M2R framework***

⚡ *4. Revenue Diversification*

- Adds ***non-energy income stream***
- Reduces dependency on gas pricing

📈 5. Scalability

- Modular expansion
- Replicable across:
  - BioCNG plants
  - Industrial CO_2 sources

7. CAPEX Scope

Included (₹14 Cr)

- Photobioreactor system
- Pumps, piping, instrumentation
- Harvesting & dewatering system
- Drying system
- Electrical & automation

Excluded

- Land cost
- Civil works
- CO_2 separation & compression
- Incoming power infrastructure

8. Implementation Timeline

Phase	Duration
Engineering	2 months
Procurement	2 months
Installation	3 months
Commissioning	1 month

👉 ***Total: ~8 months***

9. Conclusion

This project is a ***high-impact, high-return module*** that:

- Converts CO_2 into revenue
- Enhances BioCNG project IRR significantly
- Aligns with global sustainability goals
- Provides scalable, replicable business model

🔥 *Strategic Positioning*

"CO_2 to Value Platform for Waste-to-Energy Ecosystems"

Date of Proposal: 15-4-2026