DISEDIAKAN OLEH:

NAMA:
Mohd Tajul Izrin Bin
Mohd Tajul Hasnan

TEL :
019-3965334

E-MEL :
tajulizrin@uitm.edu.my /
bios.built@gmail.com

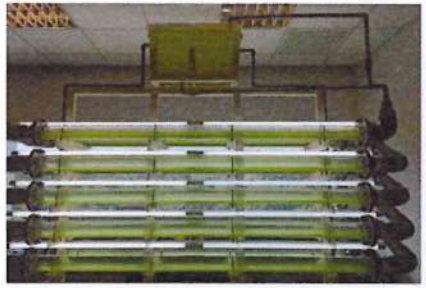
B.I.O.S BUILT Special Interest Group

[Bio. Initiative. Oriented. Solution] B.I.O.S Built is a community of researchers with different expertise from various backgrounds who **share common research interests** and come together to **collaborate, explore and discover new ideas and advanced knowledge in a multidisciplinary platform.** With inspiration and integration of natural elements at the very core, We'll be working together to build and apply interdisciplinary knowledge and develop complex ideas, prototypes, projects and plans, which integrate various studies and methods in a new way. This includes Environmental Design, Strategic Planning, Digital Computation, Material Fabrication & Product Commercialization to create a radically new & innovative solution for more sustainable development of urban growth and built environment

Fac	Team Members
KAB	1. Mohd Tajul Izrin Mohd Tajul HasnanTs.
FSG	2. Prof. Madya Dr. Khairul Adzfa Radzun
KAB	3. Dr. Julitta Yunus
KAB	4. Dr. Nuril Izzeaty Ishak
KAB	5. Ts. Noor Sahidah Samsudin
KGC	6. Patrick Tan Sang Hup
ITB	7. Dr. Eng. Mochamad Donny Koerniawan

Email : **bios.built@gmail.com**

Universiti Teknologi MARA | Kolej Pengajian Alam Bina Fakulti Sains Gunaan | MRL | KGC RESOURCES








OUR ACHIEVEMENT

INNOVATIONS AND PUBLICATIONS

2023

bios

2025

FRGS2023- Funding from Fundamental Research Grant Scheme 2023

Establishment of Special Interest Group **B.I.O.S Built**, a Multidiciplinary Team of Expertise

- Presentation at AMER/ABRA2020
- Exhibition at BIOS Mini Seminar 2023
- Exhibition at Nexus NBio Showcase at PWTC
- Presentation at ICONBEE2024
- Exhibition and Presentataion at IIDEX2024
- Exhibition at Auckland Study Visit to KAB Puncak Alam

Won BRONZE Award for BIOS facade in IAM2023

Won SILVER Award for BIOS facade in ICON2020

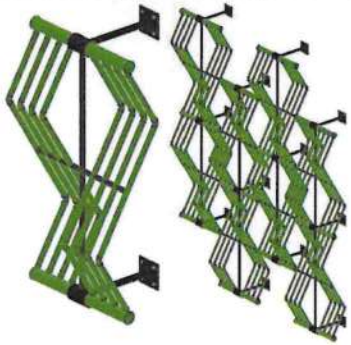
Won GOLD Award for BIOS facade in IAM2024

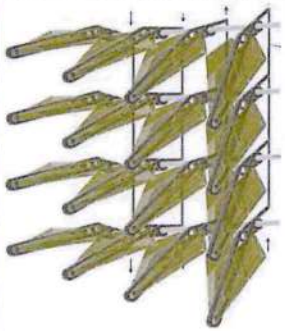
Won GOLD Award for BIOS Shade in IIDEX2024

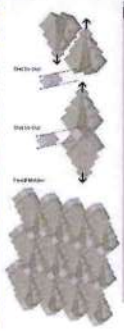
Won Diamond Award for BIOS Shade in IIDEX2024

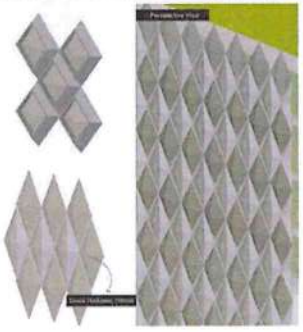
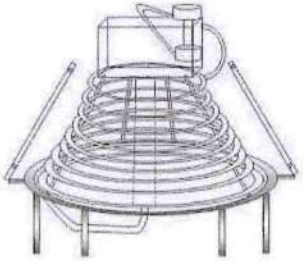
Won BIMB Grand Award for BIOS Shade in IIDEX2024

- Environment-Behaviour Proceedings Journal Volume 5 Issue 14 - AIVCE-BS-1 | July 2020 Exploration of Microalgae Photobioreactor (PBR) Tropical Climate Building Envelope.
- RISE Magazine Issue 2 | October 2022. Title: Green Retrofit Framework for Sustainable Residential Refurbishment Project
- Malaysian Journal of Social Sciences and Humanities (MJSSH) Volume 7 Issue 12 December 2022. Title: The Need for Sustainability Improvements in Residential Building Stock
- AIP Conference Proceedings 2881, 020002 - 3rd International Conference on Built Environment and Engineering 2022 | October 2023. Title: Observational Data on the Refurbishment Behaviour of Two-Storey Terrace Houses in PJ
- PLANNING MALAYSIA: Journal of the Malaysian Institute of Planners - Volume 21 Issue 2 | October 2023 Title: Auspicious Green Retrofit Strategies in Two-Story Terrace Houses: Case Study of Petaling Jaya Selangor Malaysia
- Journal of Design and Built Environment (JDBE) Special Issue IV | October 2024. Title: Unveiling the Potential of Green Facade Retrofit for Commercial Shopping Malls in Kuala Lumpur, Malaysia







POTENTIAL FUTURE OUTCOME

FUTURE DEVELOPMENT

BIOS Facade Retrofit

POTENTIAL FUTURE OUTCOME

FUTURE DEVELOPMENT

Beyond Green Initiative
An Urban Algae Follies

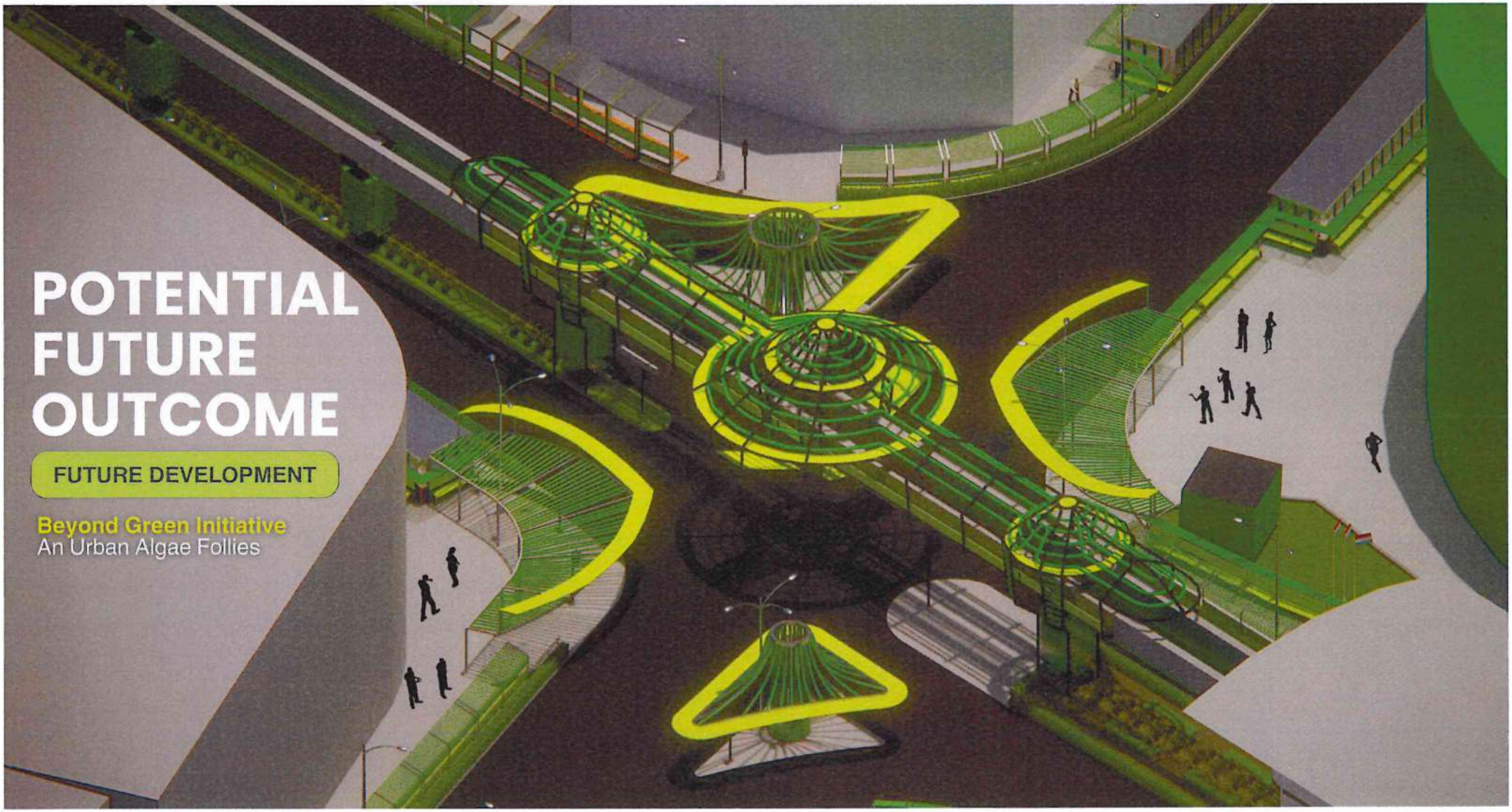
Shaded waiting area

Safe pedestrian Crossing

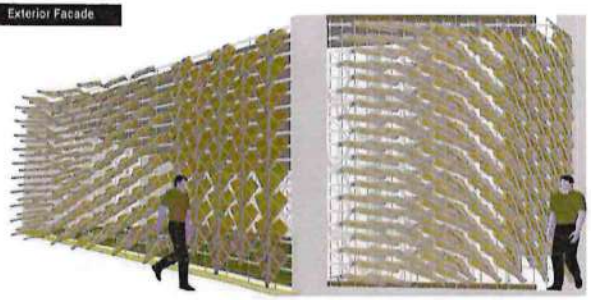
POTENTIAL FUTURE OUTCOME

FUTURE DEVELOPMENT

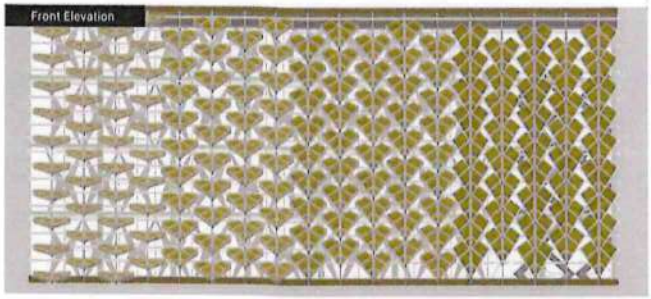
Beyond Green Initiative
An Urban Algae Follies

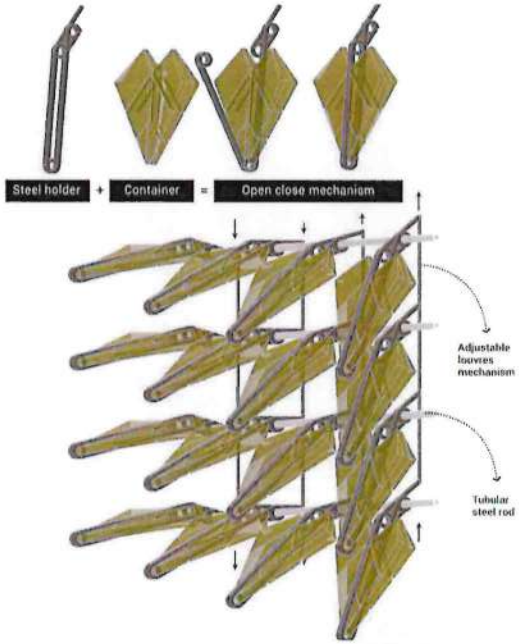

POTENTIAL
FUTURE
OUTCOME
FUTURE DEVELOPMENT
Beyond Green Initiative
An Urban Algae Follies

Exterior Facade



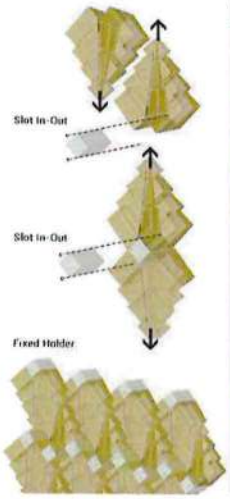
Front Elevation



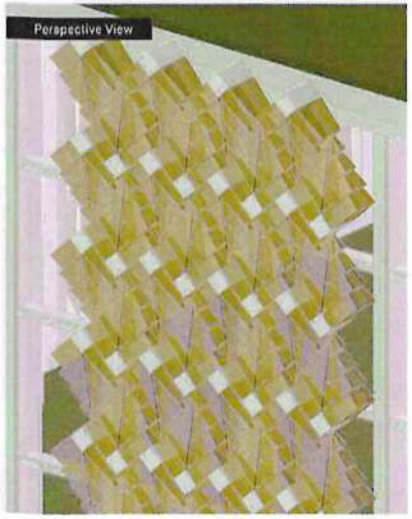


POTENTIAL FUTURE OUTCOME

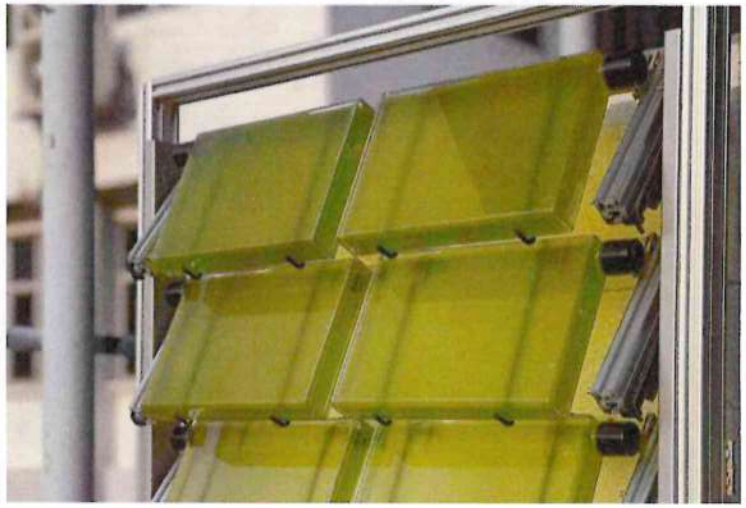
- The modular approach take into consideration the ability for it to grow into larger parts by extension according to the proposed location

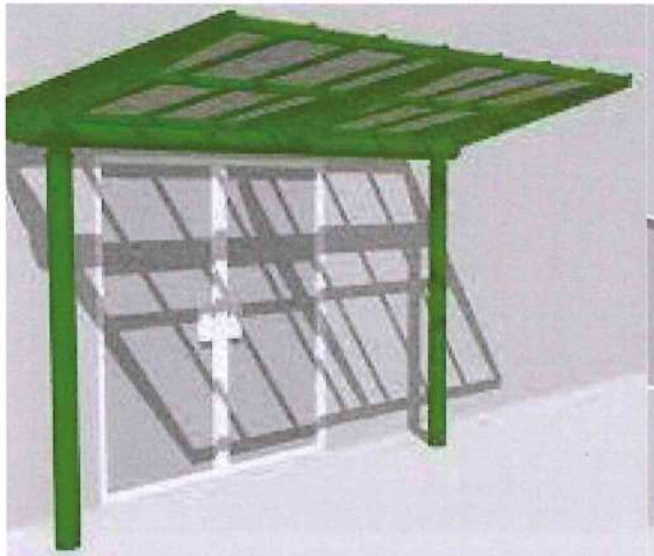


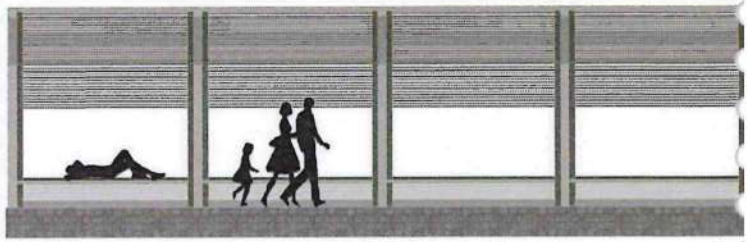
Perspective View



Perspective View







POTENTIAL MODULAR OUTCOME

- The modular approach take into consideration the ability for it to grow into larger parts by extension according to the proposed location

bios

CONCLUSION

There are needs to initiate **BIOS Station** among the Malaysian community. Microalgae's undemanding nature can easily become part of the bus stop in area of an urban development and has the potential to be utilized at a larger scale.

SUSTAINABLE DEVELOPMENT GOALS

SDG 7

Affordable and Clean Energy

BIOS Station increases potential investments in renewable energy through production of microalgae buofuel and biomass

SDG 9

Industry, Innovation and Infrastructure

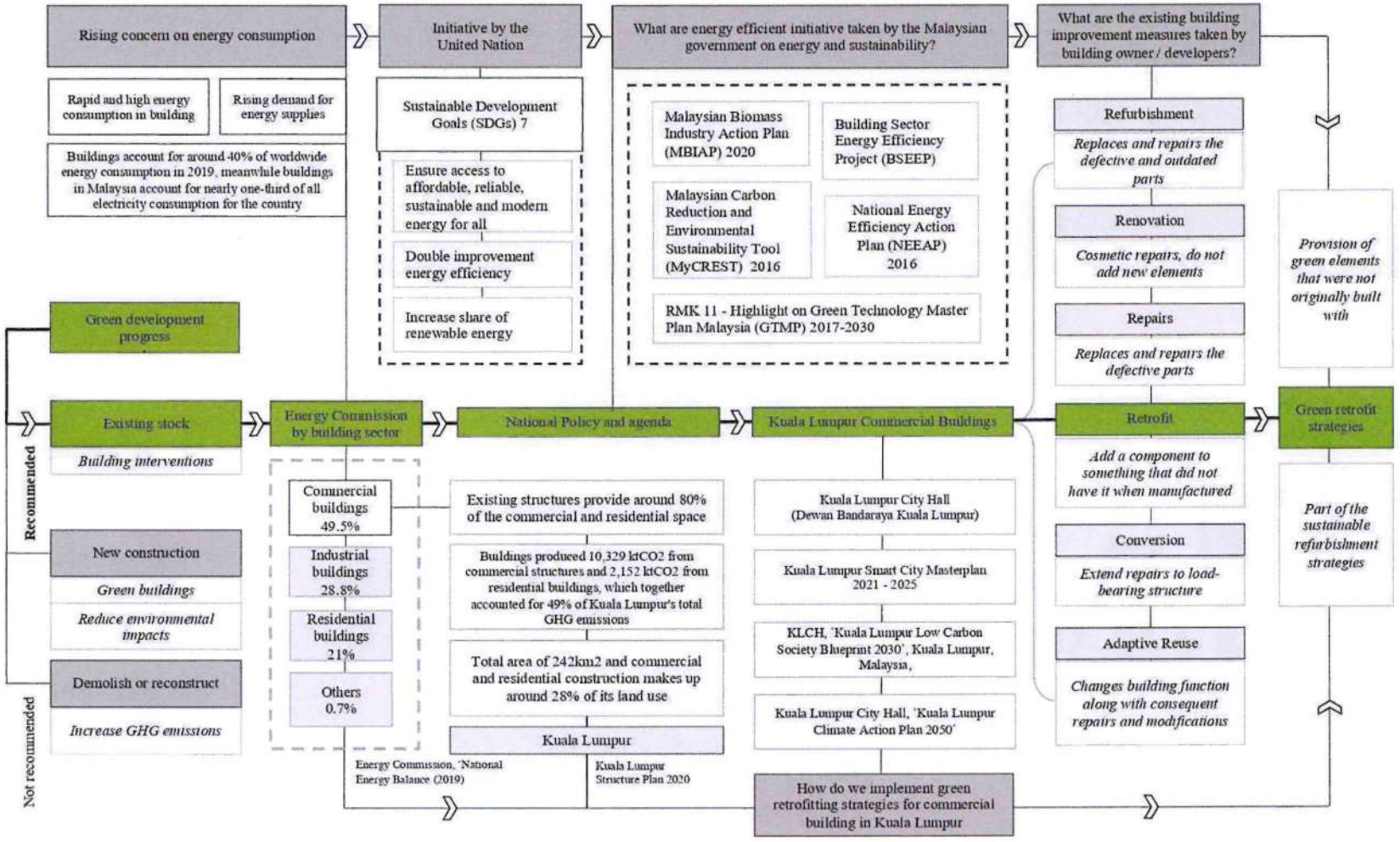
BIOS Station promotes innovative and resilient infrastructure through shaded walkway that can lower carbon emissions

SDG 11

Sustainable Cities and Communities

BIOS Station transforms urban spaces into greener options for a safe and sustainable city

The development of green retrofit strategies application in existing building stock with the highlight of Malaysian national agendas



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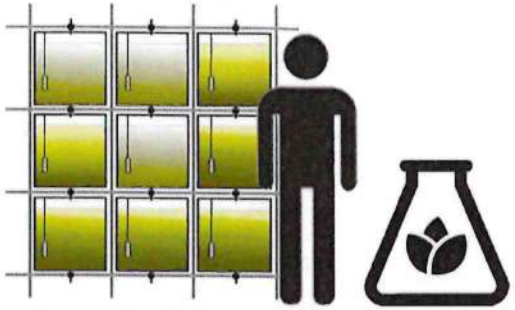
NOVELTY & COMMERCIALIZATION

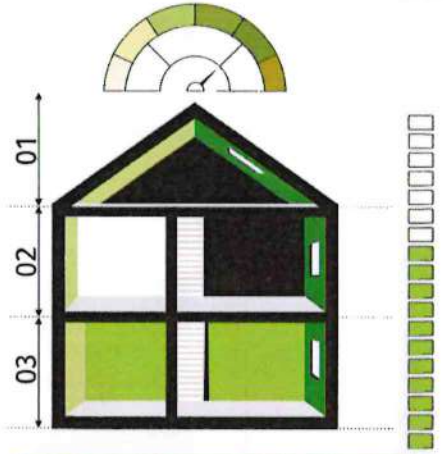


BIOMASS PRODUCTION

a single tank can produce up to 500-800mg of Biomass (Chroella / Spirulina) ready for harvest in just one week

ENVIRONMENTAL BENEFIT

Excellent Air purifier, Carbon sequestration (CO_2) and conversion into oxygen. ten-to-fifty times better than trees

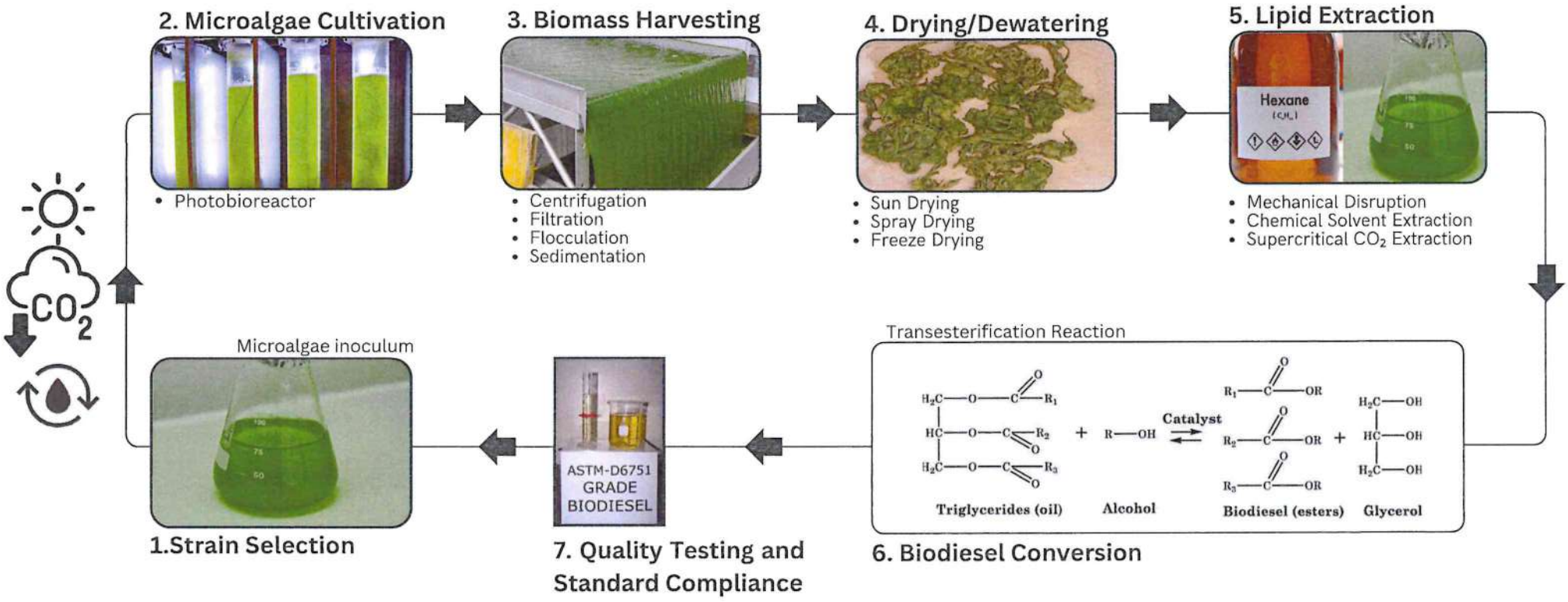


ENERGY PERFORMANCE

Reduction of heat gain (10-15 degree celcius) through External sun shading thus improved overall energy performance

Biodiesel from Microalgae PBR

- **Residual Biomass:** Used for animal feed, fertilizers, or biochar production.
- **Glycerol:** Utilized in cosmetics, pharmaceuticals, or chemical industries.
- **Proteins and Carbohydrates:** For bioethanol or food supplements.



Bio-Based Algae Products

Crude Algae Oil (CAO)

Electricity Generation: 1 ton of CAO can generate 5.4 MWh of electricity via a genset.

Biofuels: Can be converted into renewable diesel or bio-gasoline, Sustainable Aviation diesel, Fuel (SAF) and Hydrotreated Vegetable Oil

Dry Algae Cake (DAC)

Paper Pulp: After oil extraction, the remaining biomass (rich in cellulose and protein) can be converted into paper.

Electricity/Heat Generation: DAC can be used as a fuel with an energy content similar to wood chips.

Agriculture/Aquaculture Feed: DAC is a sustainable feed for both aquaculture and agriculture, thanks to algae's position at the base of the aquatic food chain.

Algal-Biochar: Carbonaceous substance that is created from algal biomass by thermal breakdown in an oxygen-absence environment. Sustainable charcoal to replace fossil charcoal

Potential Monetization of Microalgae

1. **Sale of Microalgae Products**
   Biofuels, nutritional supplements, cosmetics, and biofertilizers.

2. **Leasing or Licensing Technology**
   Collaborate with real estate and offer franchises globally.

3. **Green Building Certifications**
   Enhance property value via LEED/BREEAM and gain tax benefits.

4. **Carbon Credits**
   Earn and trade credits for CO_2 sequestration.

5. **Branding & Sponsorship**
   Showcase eco-friendly solutions and artistic installations.

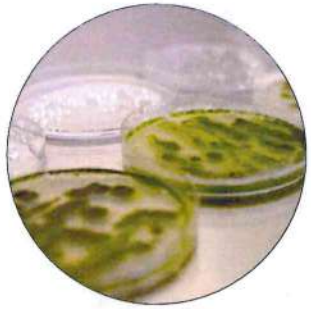
6. **R&D Collaborations**
   Partner with universities; secure grants.

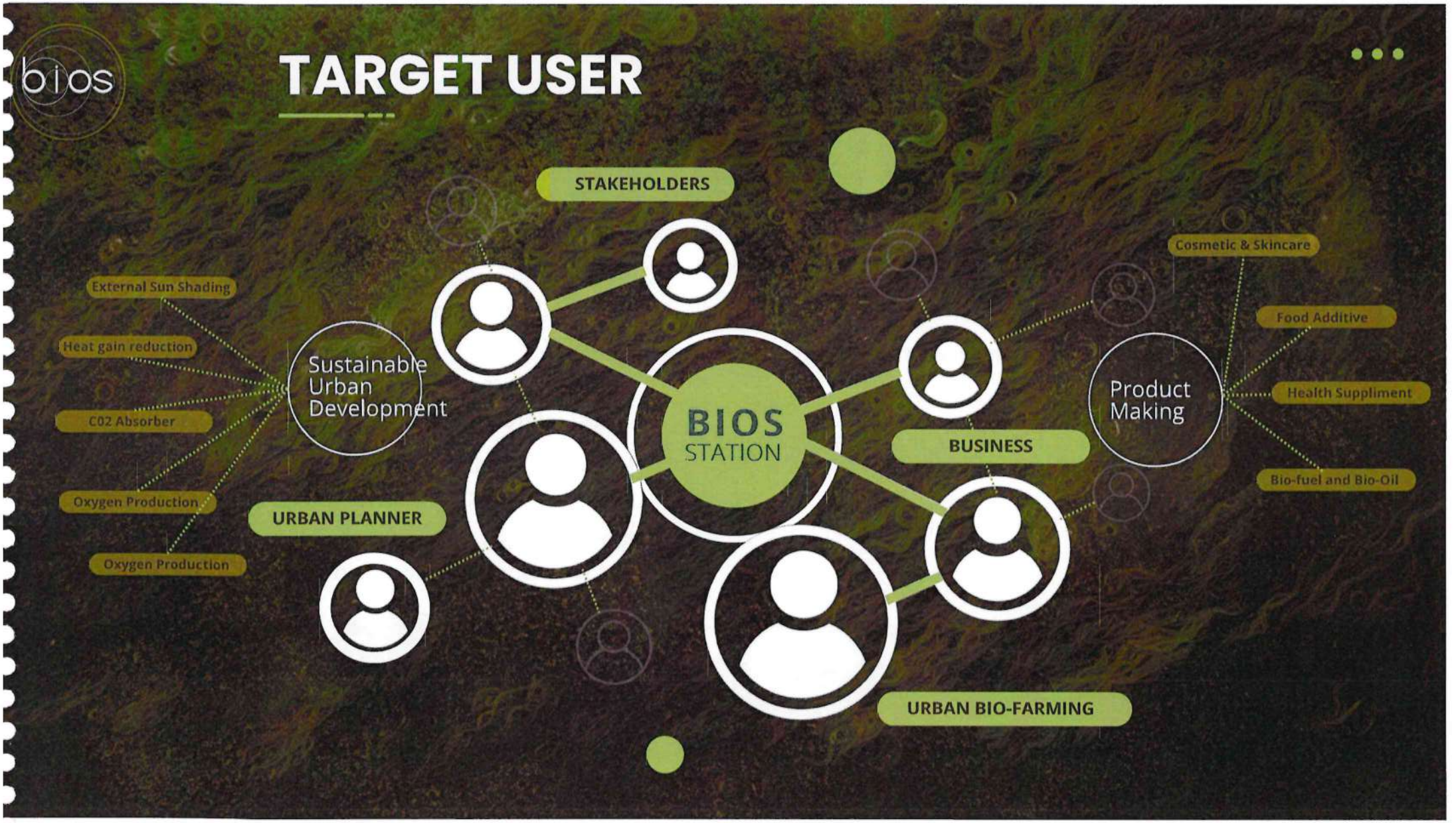
7. **Education & Tourism**
   Host interactive exhibits and eco-tourism initiatives.

8. **Urban Air Quality Solutions**
   Purify air in cities; partner with local governments.

9. **Subscription Services**
   Maintenance and algae byproduct subscriptions.



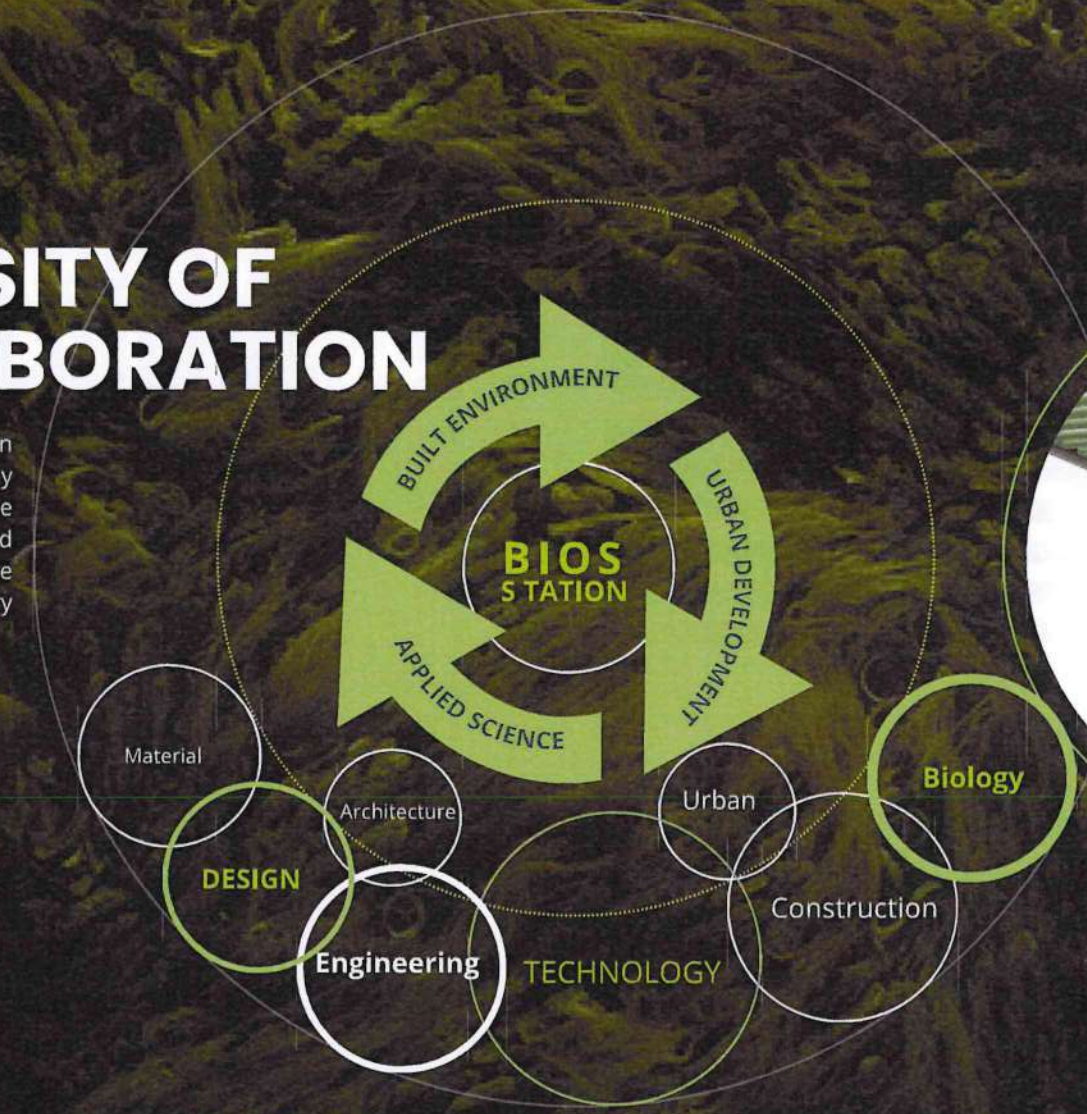


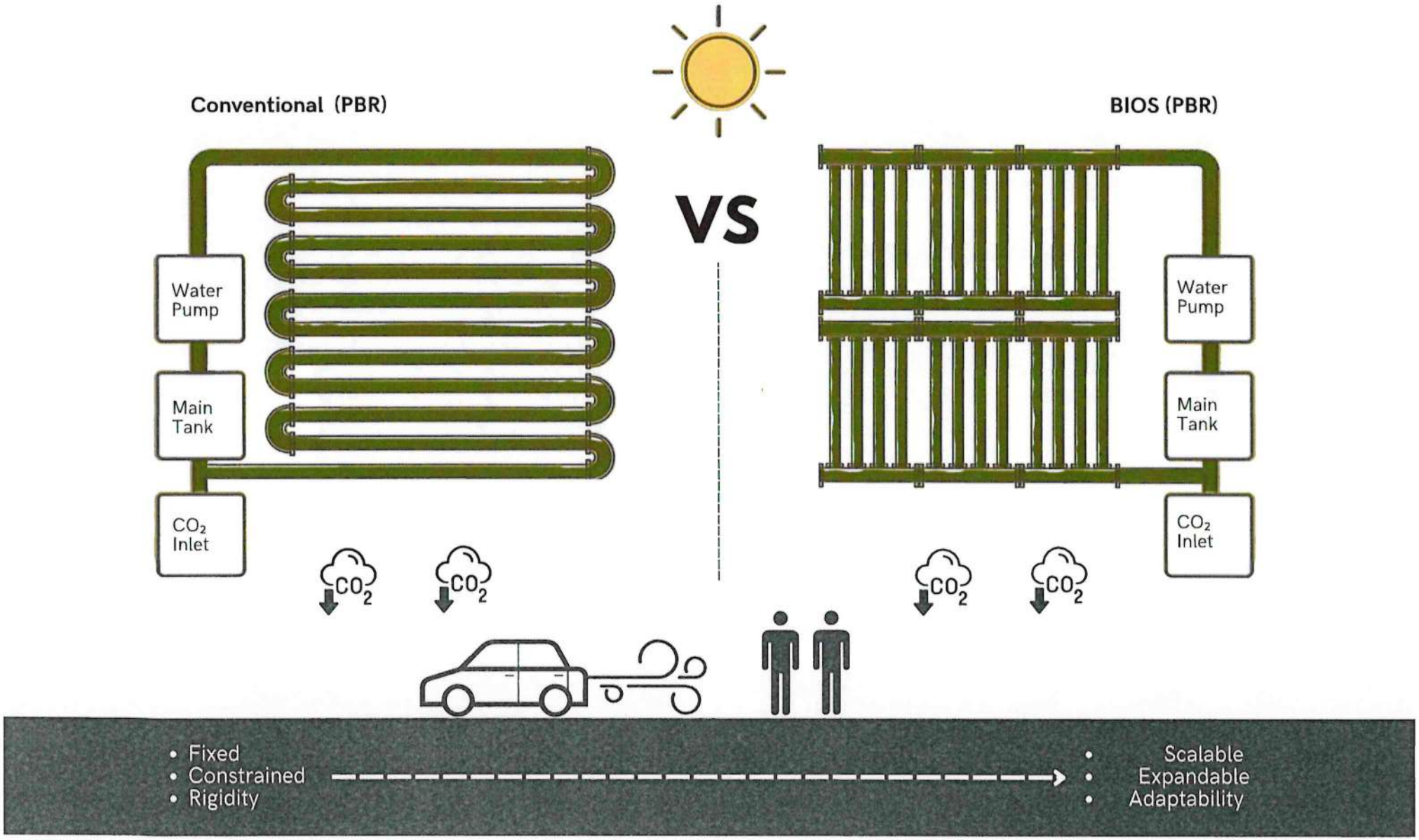


bios
TARGET USER
STAKEHOLDERS
BIOS
STATION
Sustainable
Urban
Development
External Sun Shading
Heat gain reduction
C02 Absorber
Oxygen Production
Oxygen Production
URBAN PLANNER
BUSINESS
Product
Making
Cosmetic & Skincare
Food Additive
Health Suppliment
Bio-fuel and Bio-Oil
URBAN BIO-FARMING

bios

DIVERSITY OF COLLABORATION

inspiration and integration of several diciplinary play a central role as it is the medium of a multi-layered approach in Collaborative Exploration and Discovery of **BIOS** Station




Conventional (PBR)
BIOS (PBR)
VS
Water Pump
Main Tank
CO_2 Inlet
Water Pump
Main Tank
CO_2 Inlet
CO_2
CO_2
CO_2
CO_2
• Fixed
• Constrained
• Rigidity
• Scalable
• Expandable
• Adaptability

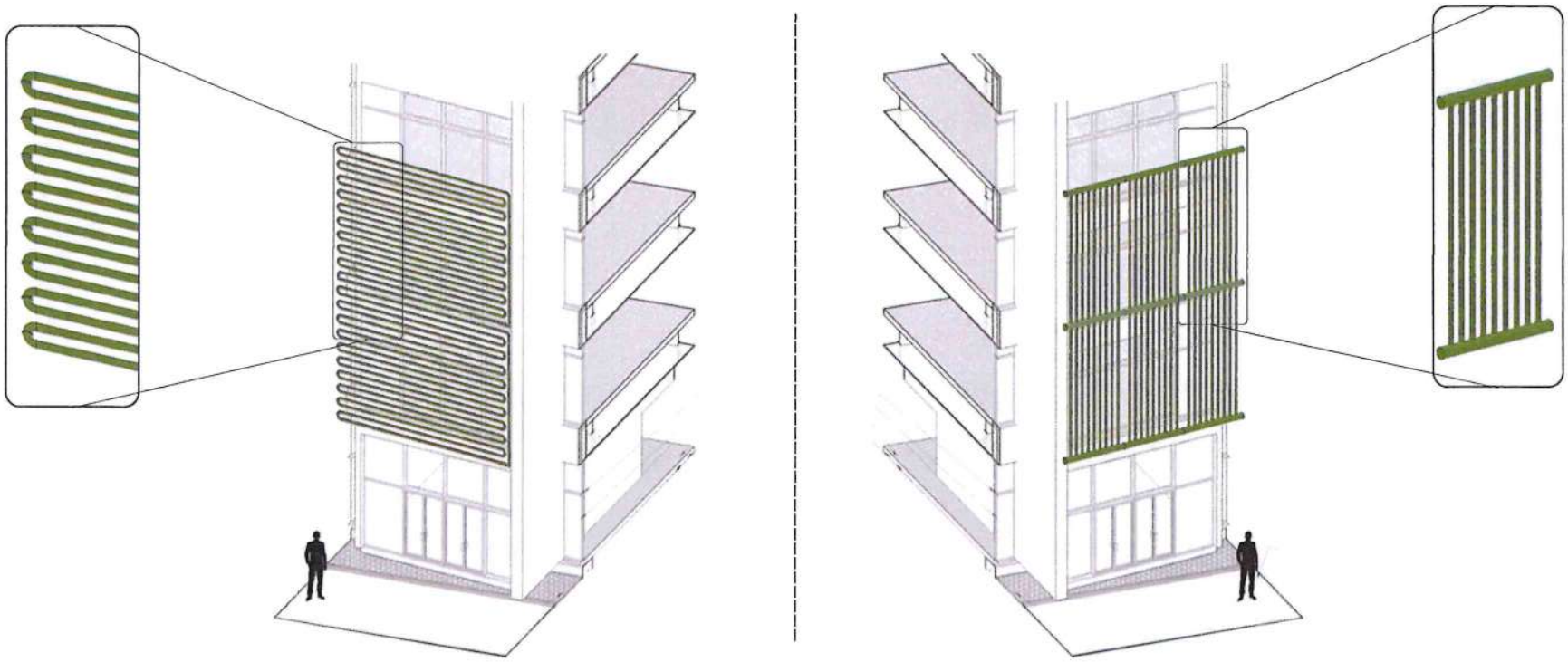
BIOS PBR

The BIOS (PBR) features a **systematic modular design** that enables scalable expansion, ensuring adaptability and efficiency for various applications.

Conventional Microalgae Photobioreactor (PBR)
with singular continuous close looped system flow

VS

BIOS Microalgae Photobioreactor (PBR)
with systematic Modular Integration

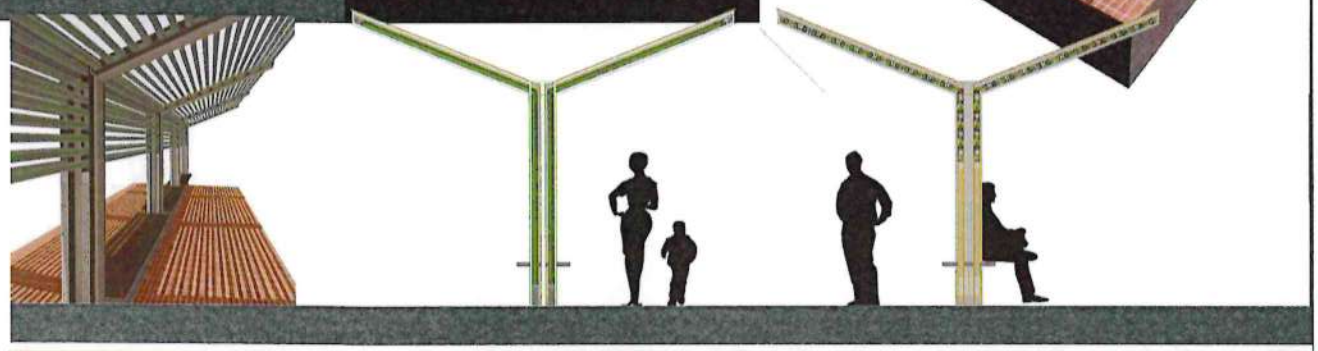


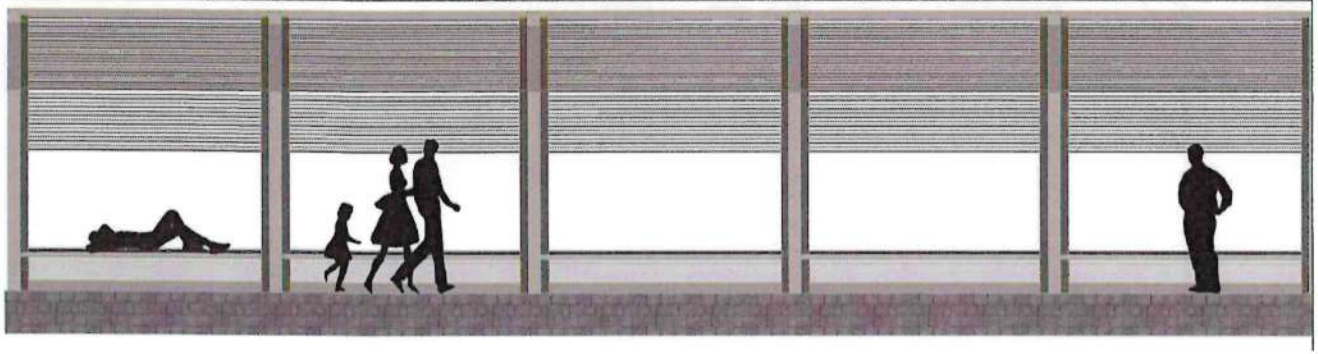
COMPONENTS

- Rainwater Gutter for Water Harvesting
- Flashing and Aluminium Steel Casing for Support and Cover
- Wood Plastic Composite Seating with Structural Steel Support
- Continuous Flow of Tubular Microalgae Photobioreactor
- Perforated Filter Panel for Bio-Filter through air exchange
- 1000L Rectangular Glass Tank for Storage and Harvesting Medium
- Vertical Upward Water Pump
- 150mm I Beam Stainless Steel Profile

MICROALGAE

- Testing and selecting the best microalgae species to grow under sunlight exposure at the Microalgae Research Laboratory
- Continuous Flow of Photobioreactor Tubular Tube (50mm radius)
- Selected Microalgae: Chroella Vulgaris (Most Robust)





1. Rainwater Gutter for Water Harvesting
2. Flashing and Aluminium Steel Casing for Support and Cover
3. Wood Plastic Composite Seating with Structural Steel Support
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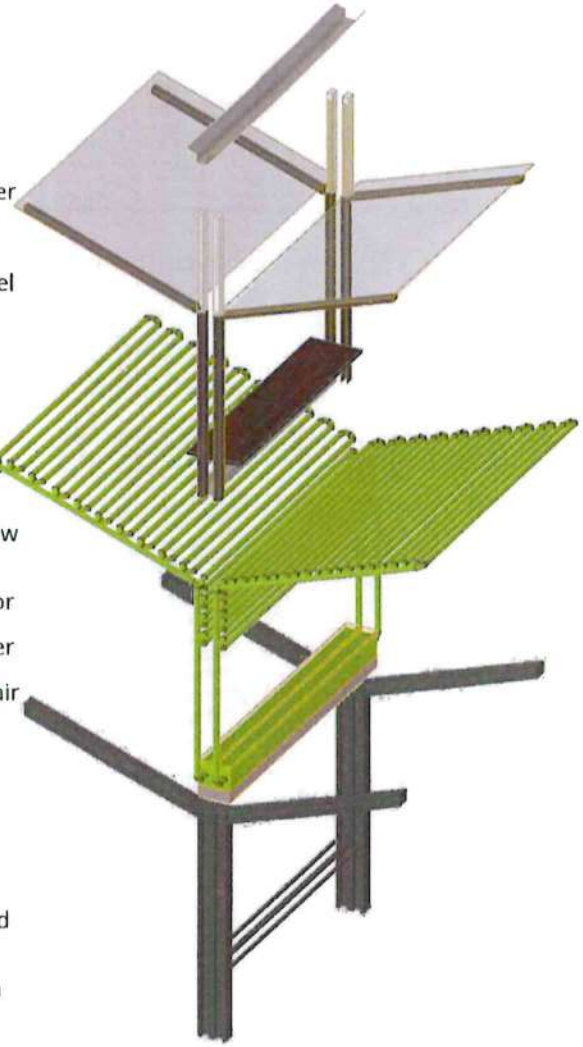
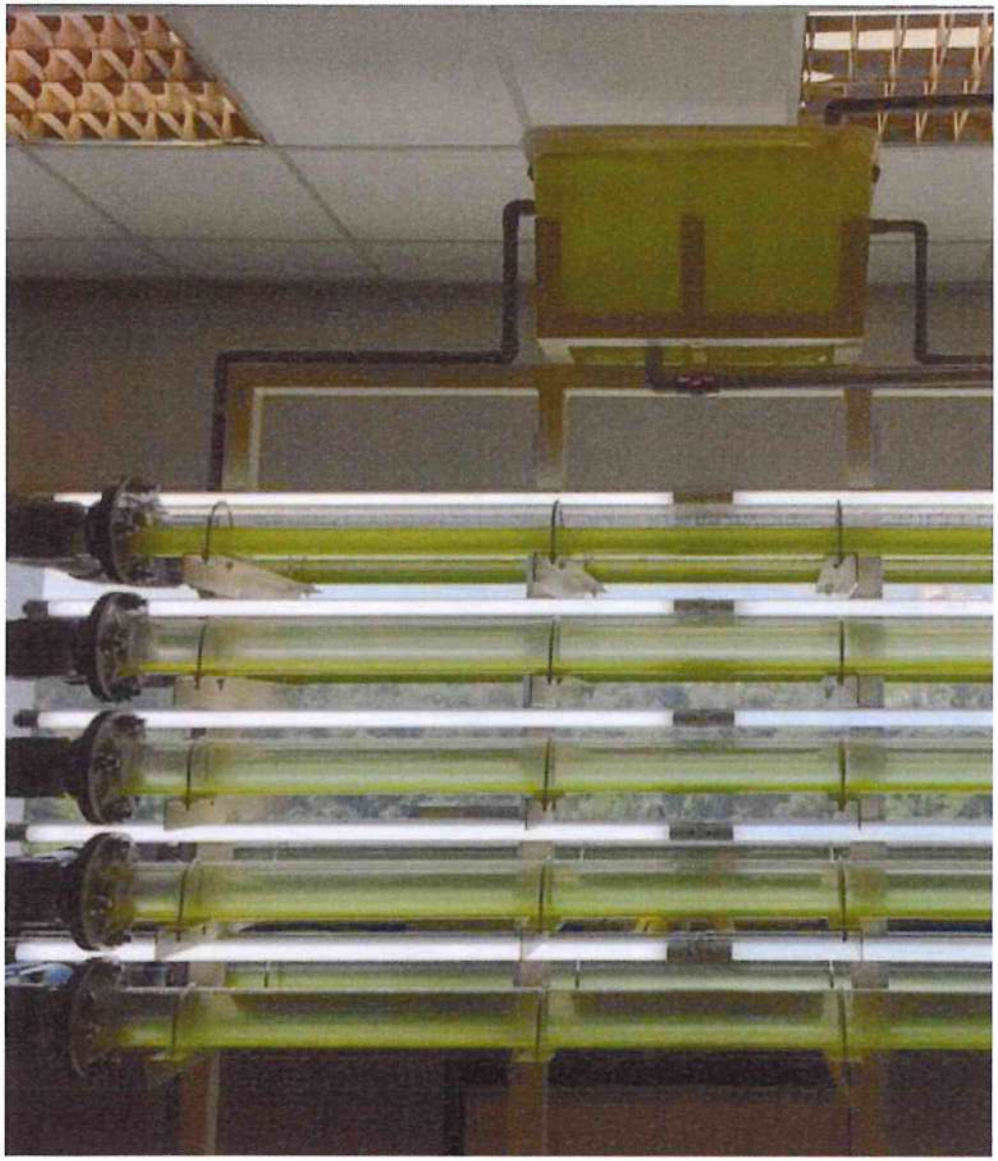




SCIENTIFIC REASONING

Photosynthesis occurs, where chlorophyll in algae absorbs sunlight and does not reflect or allow sunlight to pass through the algal cells. Some wavelengths of light are not utilized by the algae; predominantly green wavelengths are reflected. Therefore, algae appear mostly green to our eyes

Panels with higher concentrations of Chlorella vulgaris exhibit reduced light penetration, leading to lower overall surface heat gain temperature. **Panel A with 160mg showcase the best result**

I Exposed Empty Wall Surface Average Temp:	45.1°C	Thermal imaging measurements confirm that the average measurement for the exposed wall surface throughout 6 days is quite high
II **Panel A** with partial grown Microalgae inside Average Temp:	44.06°C	Thermal imaging measurements confirm that these panels also experiencing higher temperatures due to the effective photosynthesis process in the PBR
III Wall that are shaded by the PBR **Panel A** Average Temp:	34.16°C	Thermal imaging measurements confirm that these panels has signifcant reduction of temperature due to the effective shading of the PBR panel

DISCUSSION

This research highlights significant impact on the relationship between the **amount of microalgae medium** within PBR panel with **reduction of heat gain** on surface wall.

Higher Chlorella's concentration → **Reduced surface temperature**

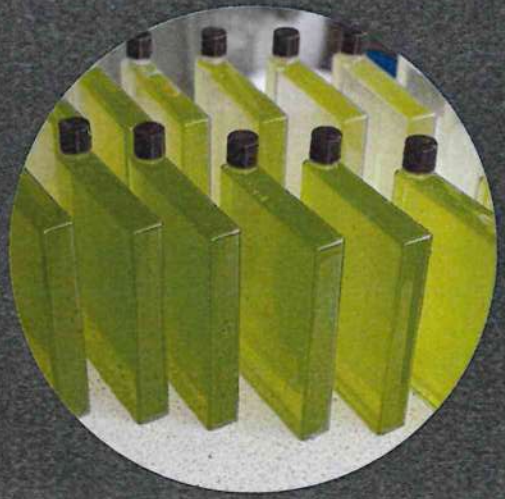
Lower Chlorella's concentration → **Higher surface heat gain**

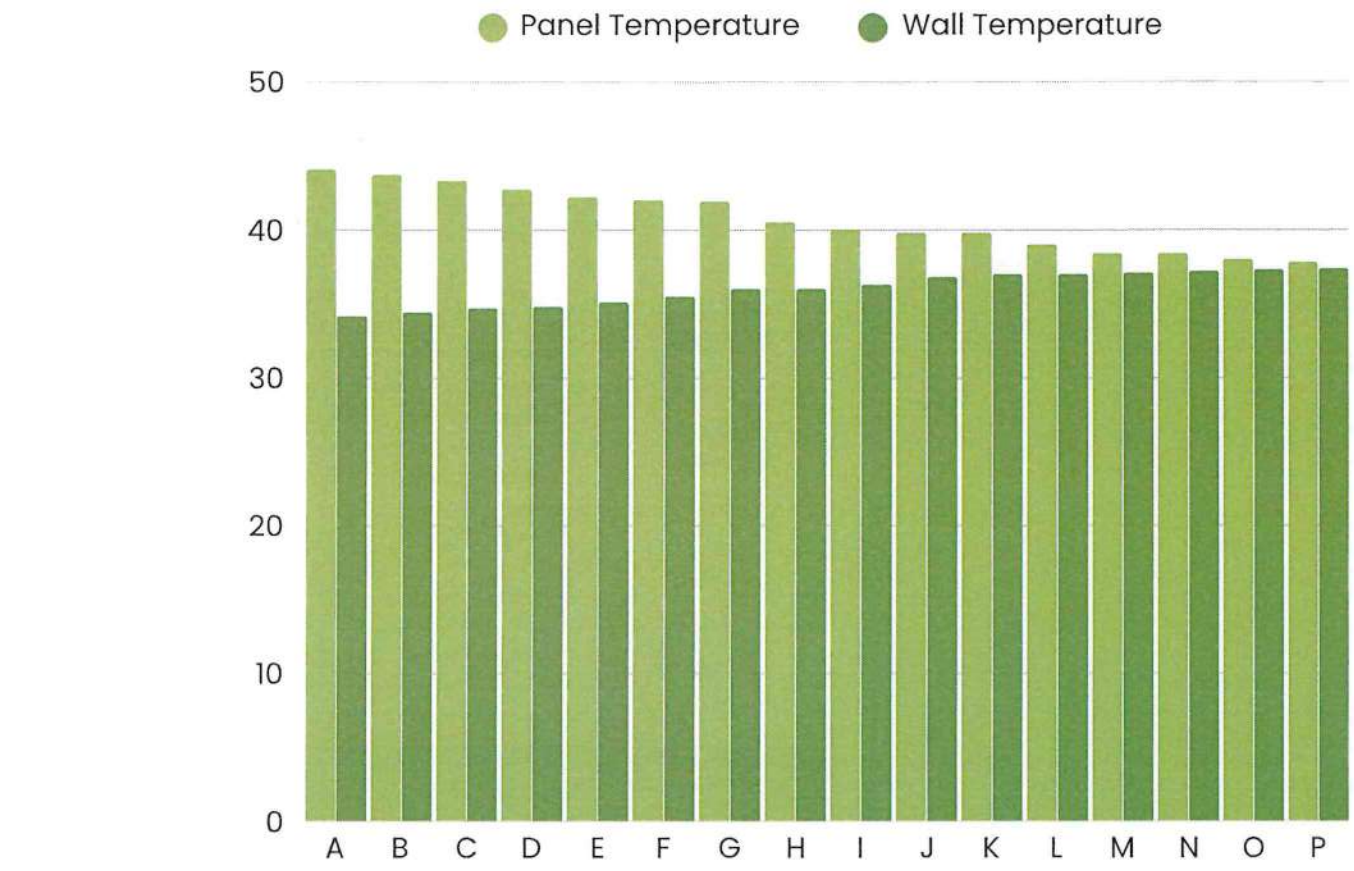
Notably, panels with higher microalgae concentrations, acting as an **effective secondary skin or double facade**

FINDINGS AND RESULT (CHART)

SUMMARY OF RESULT

Contrastly, as the Panels temperature with difeerent medium are steadily decreasing, the Wall temperature demonstrate constant rise





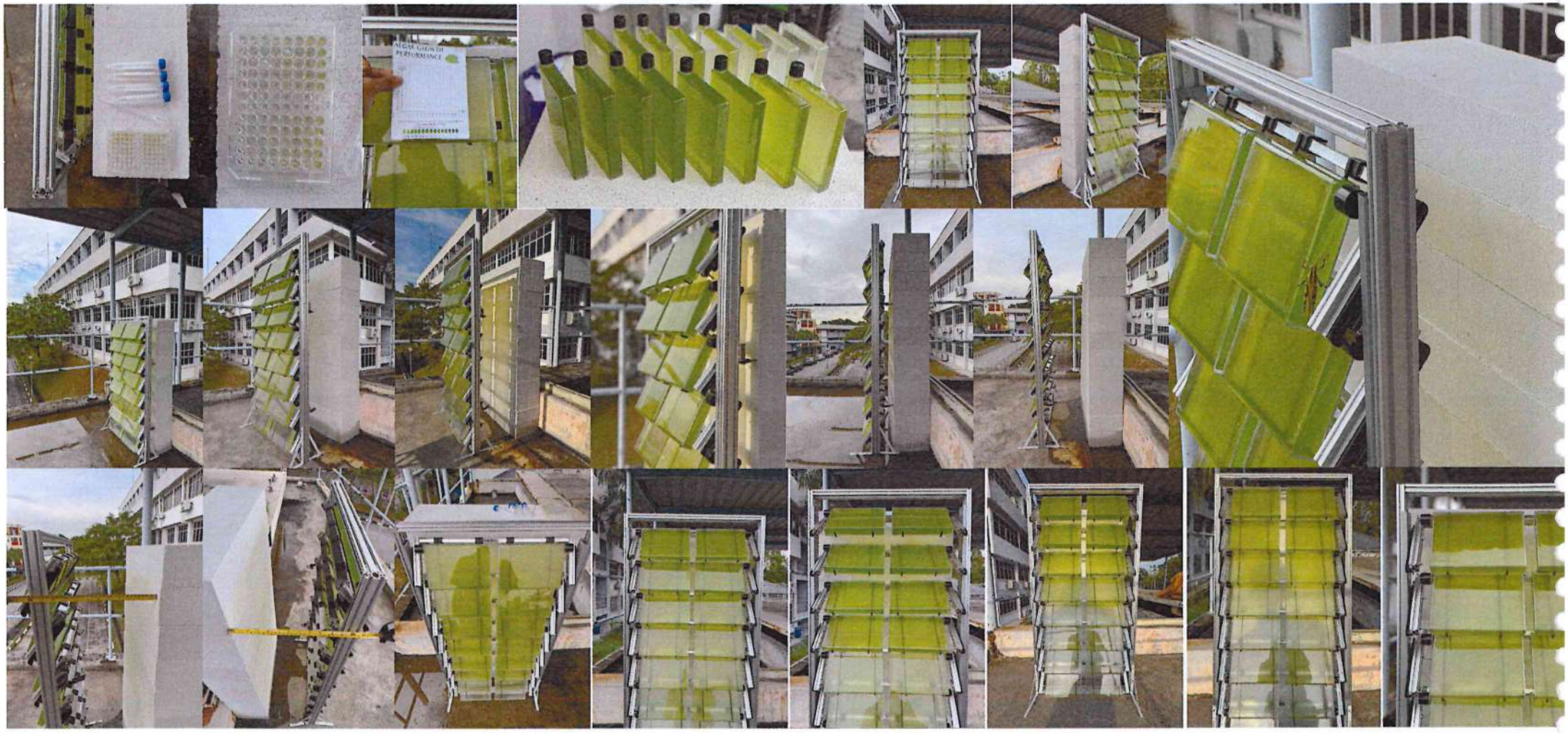
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Percentage of Reduction for panel against wall	22.5%	21.3%	19.9%	19.6%	16.9%	16%	15.3%	13.7%	10.4%	8%	7.1%	5.9%	4.9%	3.2%	1.9%	1.2%
Growth Rate Colour Intensity																

FINDINGS AND RESULT

SUMMARY OF RESULT

Using Fluke Thermal Imaging Camera, it can be concluded that the area shaded by the PBR modular (C) has a significant drop of temperature on the wall surface.

Time 21/1/24-27/1/24	-TI (Thermal Imaging Camera)	Panels															
		160 mg	150 mg	140 mg	130 mg	120 mg	110 mg	100 mg	90 mg	80 mg	70 mg	60 mg	50 mg	40 mg	30 mg	20 mg	10 mg
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Day 1 5pm-6pm	TI temp for Panel	43.9	43.6	41.3	41.2	40.3	41.0	40.4	41.0	40.0	40.5	39.4	40.2	38.8	39.8	39.3	36.8
	TI temp for wall	38.1	38.3	38.6	38.6	37.9	38.1	38.5	38.3	38.2	38.6	39.5	39.3	40.3	40.8	41.8	41.7
Day 2 5pm-6pm	TI temp for Panel	44.9	44.6	42.1	42.2	41.2	42.0	41.5	42.0	41.0	41.5	40.4	40.2	39.8	39.8	39.3	37.8
	TI temp for wall	40.1	40.8	39.7	39.3	39.1	38.1	38.9	38.3	38.4	38.9	39.4	39.2	39.5	39.1	38.8	38.4
Day 3 5pm-6pm	TI temp for Panel	45.9	45.6	44.3	44.2	43.3	42.8	43.4	42.4	41.0	41.5	40.4	39.2	39.8	39.7	38.5	38.8
	TI temp for wall	39.5	39.8	39.7	38.3	38.1	38.1	37.9	38.3	38.4	38.9	39.4	39.2	39.5	40.1	40.8	41.8
Day 4 5pm-6pm	TI temp for Panel	42.9	42.6	40.3	41.2	40.7	40.8	39.4	40.0	39.8	39.5	39.4	39.2	38.8	37.6	36.3	36.6
	TI temp for wall	37.5	37.8	38.7	38.3	38.1	38.1	37.9	38.3	38.4	38.9	39.4	39.2	39.5	40.1	40.8	42.4
Day 5 5pm-6pm	TI temp for Panel	42.9	42.6	42..3	41.2	40.5	41.5	40.4	41.0	40.0	40.5	39.4	40.2	38.8	39.8	38.3	38.8
	TI temp for wall	37.5	37.8	38.7	38.3	38.1	38.1	37.9	38.3	38.4	38.9	39.4	39.2	39.5	40.1	40.8	41.0
Day 6 5pm-6pm	TI temp for Panel	43.9	43.6	41.3	41.2	40.3	41.0	40.4	41.0	40.0	40.5	39.4	40.2	38.8	39.8	39.3	36.8
	TI temp for wall	37.5	37.8	38.7	38.3	38.1	38.1	37.9	38.3	38.4	38.9	39.4	39.2	39.5	40.1	40.8	41.4
Average Reading	TI temp for Panel	44.06	43.7	43.3	42.7	42.2	42	41.9	41.7	40.5	40	39.8	39.3	39	38.4	38	37.8
	TI temp for wall	34.16	34.4	34.7	34.8	35.1	35.3	35.5	36	36.3	36.8	37	37	37.1	37.2	37.3	37.36
Average Reduction Percentage	Percentage of Reduction for panel against wall	22.5%	21.3%	19.9%	19.6%	16.9%	16%	15.3%	13.7%	10.4%	8%	7.1%	5.9%	4.9%	3.2%	1.9%	1.2%



SURFACE HEAT GAIN EXPERIMENT

- FLUKE TIS75 THERMAL IMAGING CAMERA

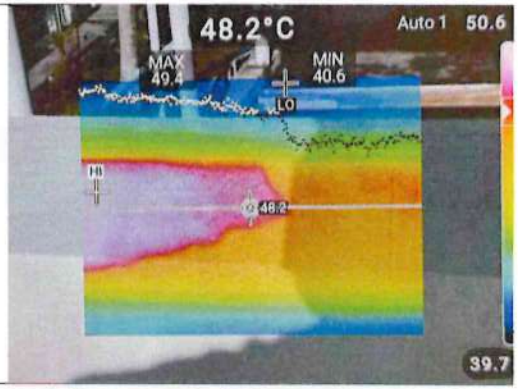
SUMMARY OF RESULT

Using Fluke Thermal Imaging Camera, it can be concluded that the area shaded by the PBR modular (C) has a significant drop of temperature on the wall surface up to 32%. There is a 16-degree Celsius temperature difference compared to the surface of the exposed wall (A)

A

Exposed Empty Wall Surface Temp:

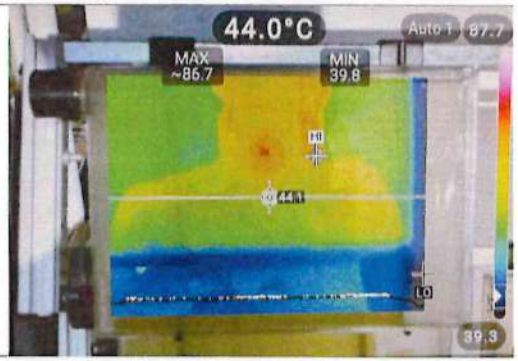
48.4°C



B

PBR with partial grown Microalgae inside, Temp:

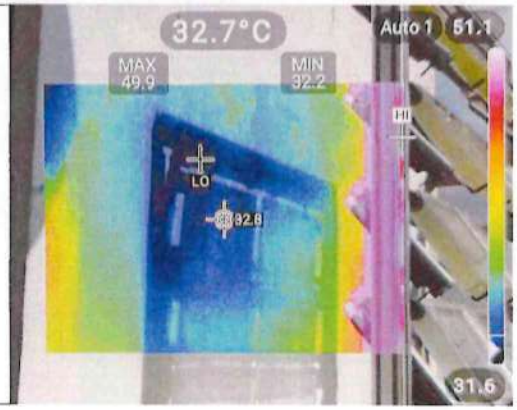
44.0°C

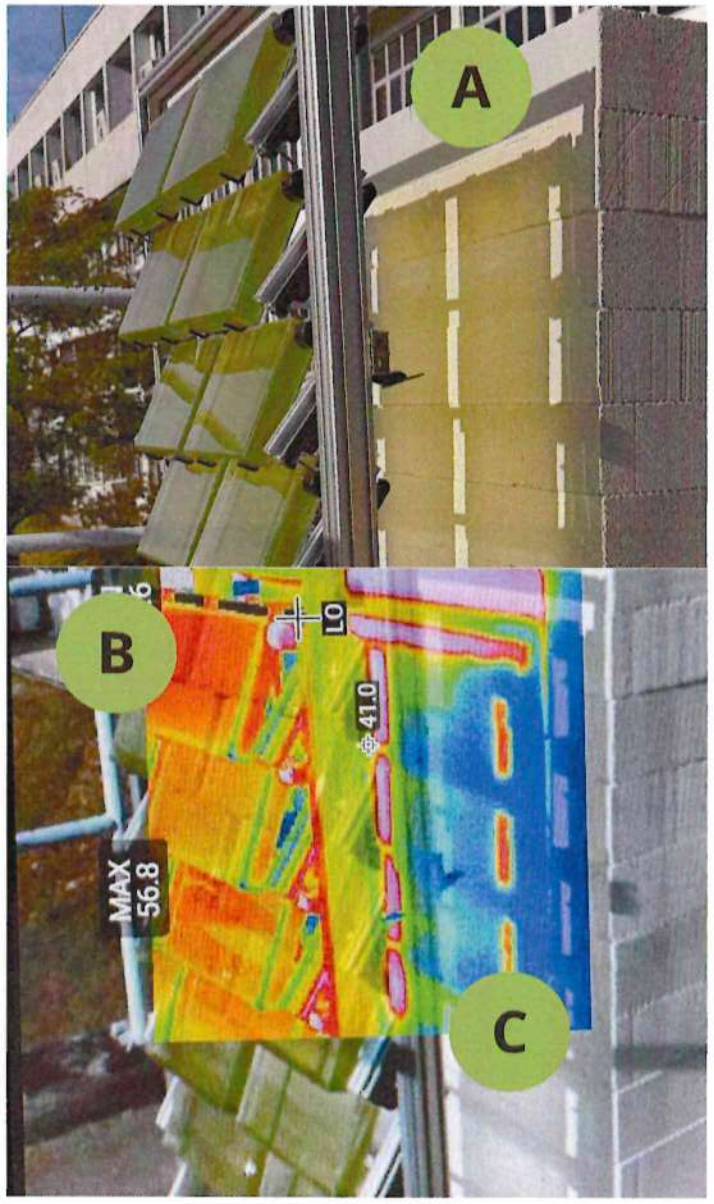


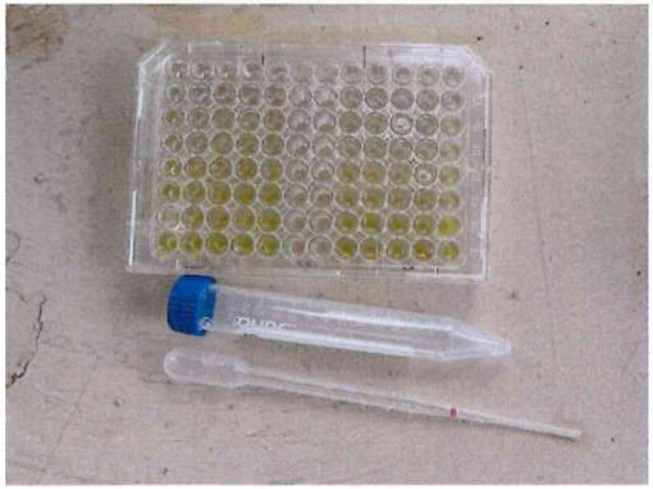
C

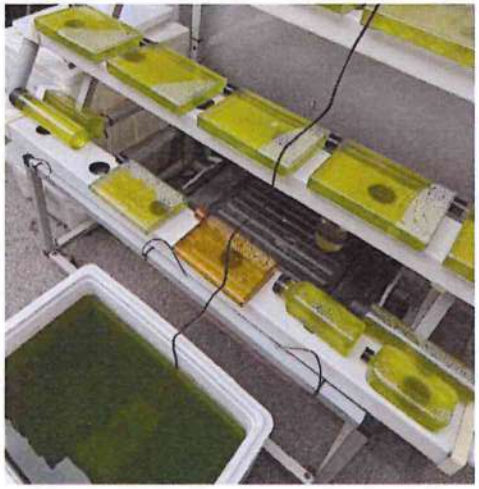
Wall that are shaded by the PBR panel Temp:

32.7°C







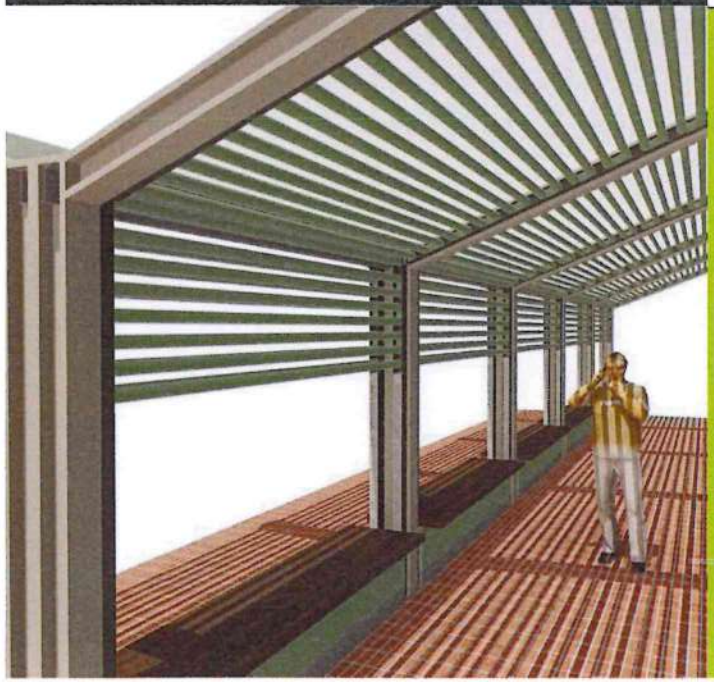


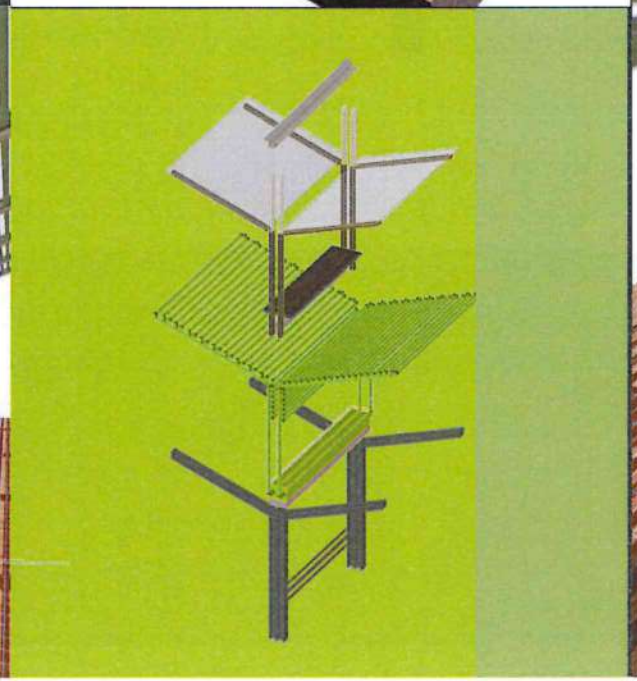
PHYSICAL MOCKUP ASSEMBLY

- Detail Measurements, Fabrication and cutting of materials
- Installation and Assembly of Modular with PBR panels

3D MODELLING & EXPLORATION

- Exploration of design parameters using 3D Modelling Software (Building Information Modelling BIM)





Experimentation and Exploration

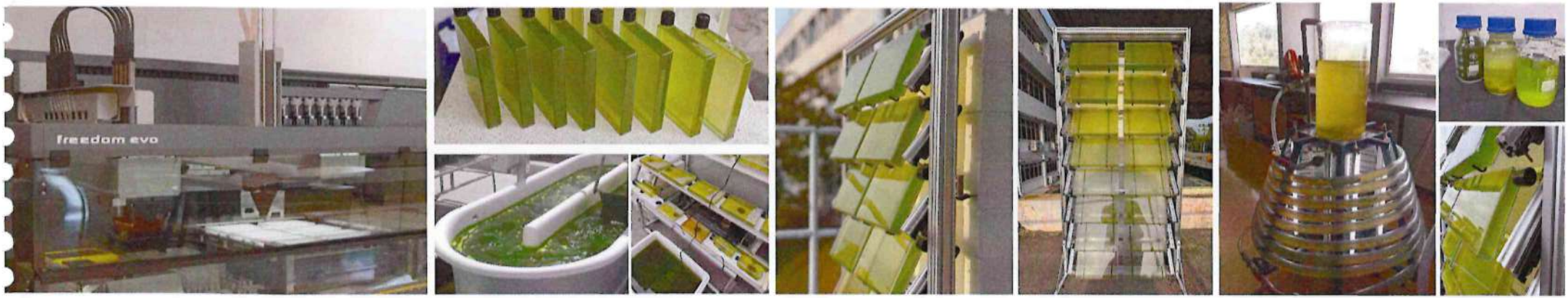
MODULAR

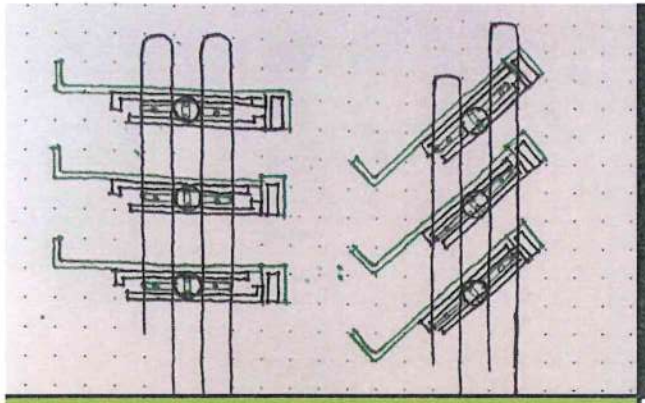
Exploration of **Microalgae Photobioreactor (PBRs)** modular designs

+

PHOTOBIOREACTOR

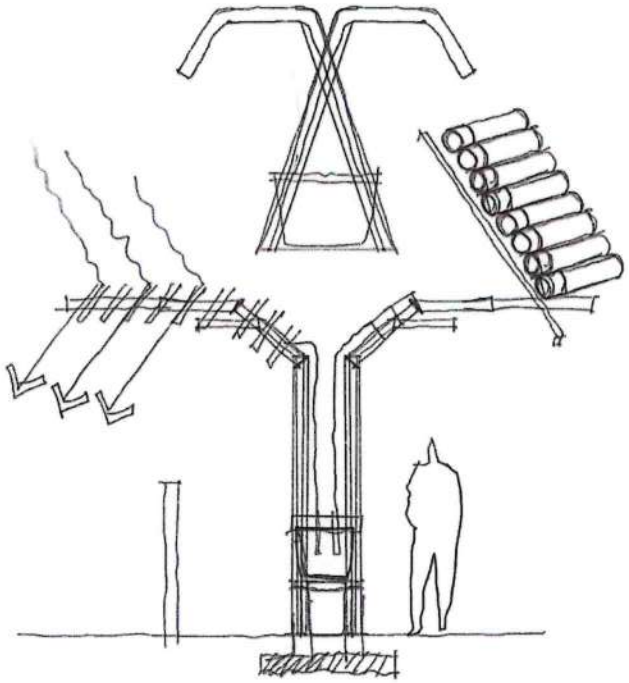
Integration of **Microalgae Photobioreactor (PBRs)** to serve as part of architectural structures and urban infrastructure

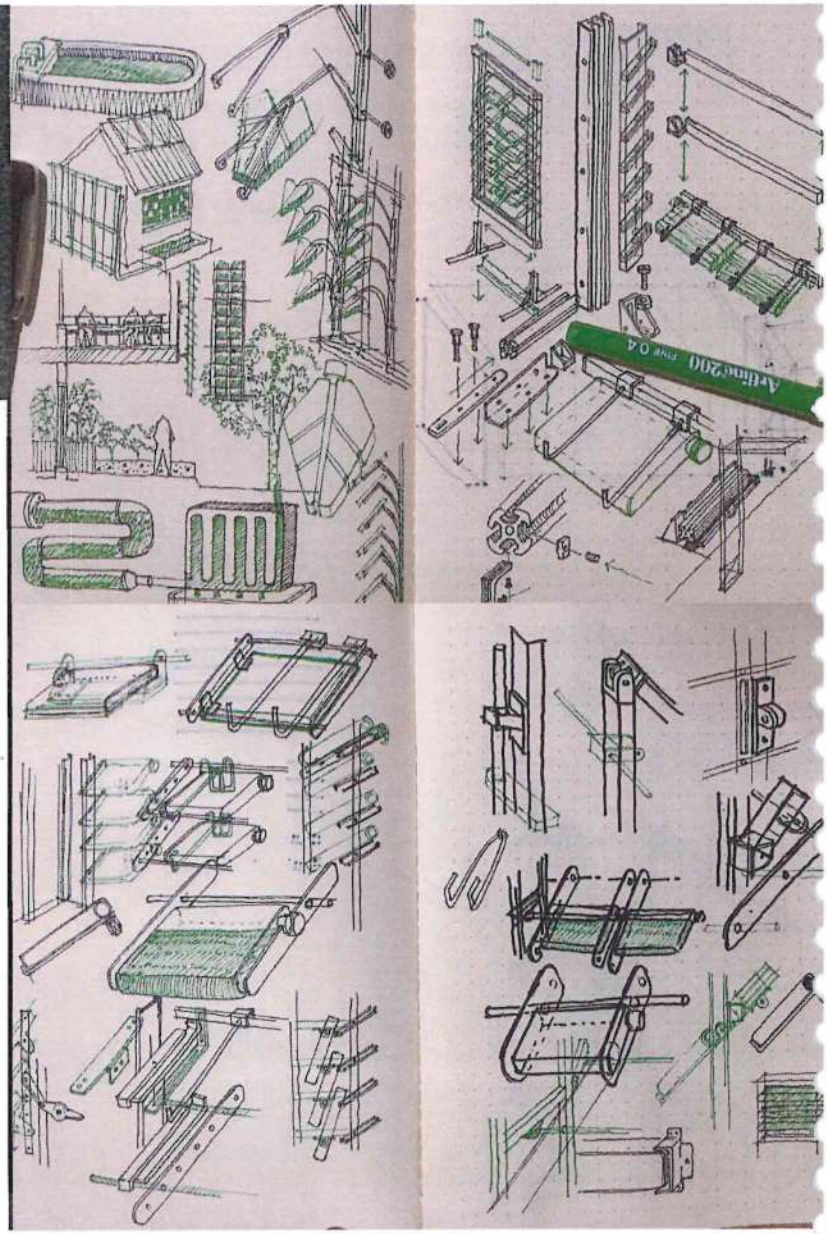




CONCEPTUAL PROCESS

- Multidiciplinary Team of Expertise
- Brainstorming for Conceptual Ideas





SUSTAINABLE DEVELOPMENT GOALS

SDG 7 Affordable and Clean Energy

BIOS Stationincreases potential investments in renewable energy through production of microalgae buofuel and biomass

SDG 9 Industry, Innovation and Infrastructure

BIOS Station promotes innovative and resilient infrastructure through bus stop station that can lower carbon emissions

SDG 11 Sustainable Cities and Communities

BIOS Station transforms urban spaces into greener options for a safe and sustainable city

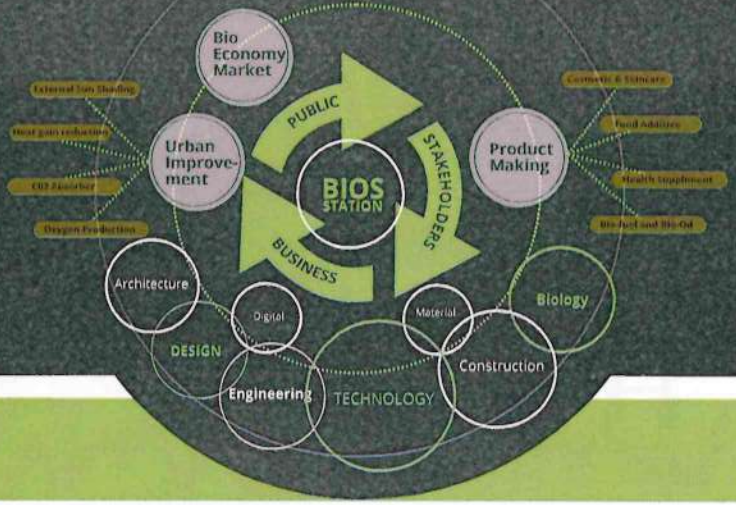
NOVELTY

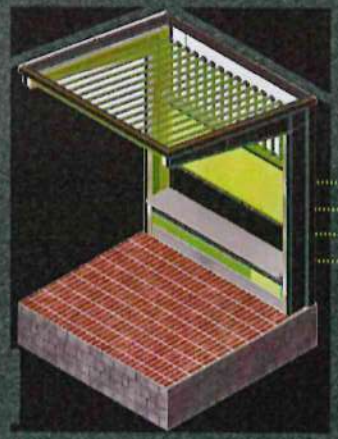
ENERGY PRODUCTION (A)
- Energy Ecosystem
- Biofuel
- Biomass

CARBON CAPTURE (B)
- Carbon Sequestration
- High Oxygen Release

REDUCTION HEAT GAIN (C)
- Shading Device
- Double Skin Protection
- Aesthetic Surfaces

COMMERCIALISATION





OUTPUT (per month)

- **1 Litre** of Algae equivalent to **15g** of biomass per month
- Max Capacity for **1 x 1** module is around **160Litre** of Algae
- **1 x 1** Module can produce up to **2400g** of dry weight of biomass
- Therefore, a single **1 x 1** Module can fix up to **4.8kg** of CO_2

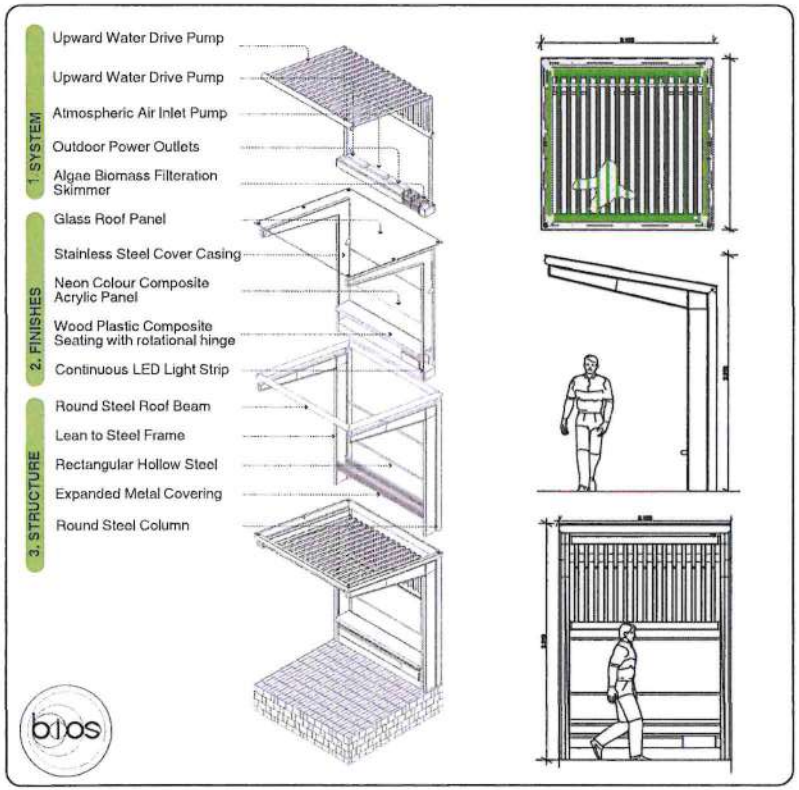
Patent Reference No (IP/PT/00264)

COMPONENTS AND SPECIFICATIONS

1 Closed Looped Algae Photobioreactor (PBR) Tubular and Tank System

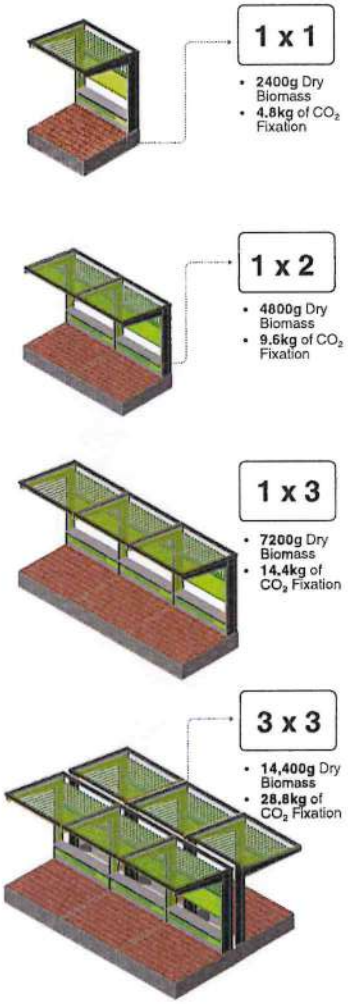
2 Accessories, Lighting and Overall Surface Finishes

3 Main Structure and Secondary Structural Steel Support

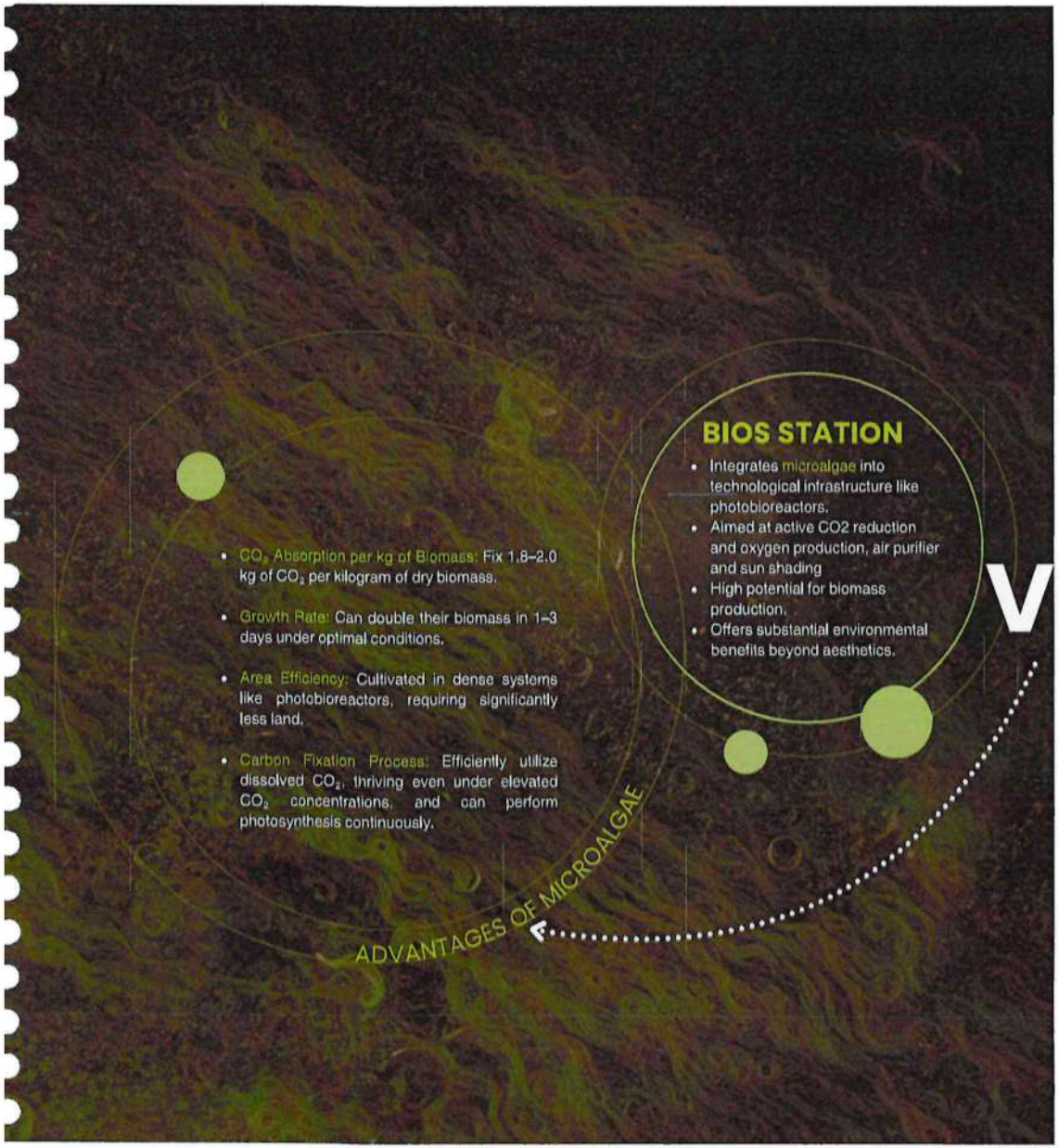


MICROALGAE
Circular Economy

- Recyclable water medium
- Continuous Exposure to Sunlight
- Availibility of Carbon Emission in Urban areas
- Efficient Growth of Microalgae Medium using Chroella Vulgaris
- Harvesting in two weeks for Logistic to Bio Economy Industry
- Production of Energy through Biomass, Biofuel Biogas and other high Value Products



FLEXIBLE BIOS MODULAR CONFIGURATION


BIOS STATION
• Integrates microalgae into technological infrastructure like photobioreactors.
• Aimed at active CO2 reduction and oxygen production, air purifier and sun shading
• High potential for biomass production.
• Offers substantial environmental benefits beyond aesthetics.
• CO_2 Absorption per kg of Biomass: Fix 1.8–2.0 kg of CO_2 per kilogram of dry biomass.
• Growth Rate: Can double their biomass in 1–3 days under optimal conditions.
• Area Efficiency: Cultivated in dense systems like photobioreactors, requiring significantly less land.
• Carbon Fixation Process: Efficiently utilize dissolved CO_2, thriving even under elevated CO_2 concentrations, and can perform photosynthesis continuously.
ADVANTAGES OF MICROALGAE
VS
CONVENTIONAL BUS STOP
• Utilizes **traditional plant** species like vines or climbers (or none)
• Primarily for natural aesthetic enhancement and sun shading
• Relies on natural growth processes.
• Provides natural aesthetics with limited environmental benefits
DISADVANTAGES OF PLANT
• **CO_2 Absorption per kg of Biomass:** Absorb approximately 1.6–1.8 kg of CO_2 per kilogram of biomass, depending on the species and environmental conditions.
• **Growth Rate:** Grow much slower, requiring months to years for significant biomass accumulation.
• **Area Efficiency:** Require large tracts of land for equivalent biomass output compared to microalgae.
• **Carbon Fixation Process:** Utilize atmospheric CO_2 through stomata, influenced by water, nutrients, and stomatal regulation. Efficiency may plateau under high CO_2 conditions.

bios

BIOS STATION

VS

CONVENTIONAL
BUS STOP

bios

PROBLEM STATEMENT

In tropical climates like Malaysia, conventional urban bus stop often struggle to provide sufficient shading or any environmental benefits due to their limited ability to act only for shading and aesthetic purposes. This limitation underscores the need for alternative solutions that can effectively harness the potential of microalgae. Therefore, understanding the reasons and advantages of using microalgae PBR over conventional bus stop becomes crucial for enhancing urban sustainability and pedestrian comfort in such environments

OBJECTIVES

OBJECTIVE 1:
Develop a scalable and efficient microalgae photobioreactor (PBR) system tailored for integration into bus stop in tropical urban context

OBJECTIVE 2:
Assess the environmental performance and demonstrate the environmental benefits of integrating microalgae PBRs into tropical bus stop

bios

INTRODUCTION

Microalgae, known for their remarkable adaptability and significant contributions to oxygen production over billions of years, are emerging as a promising **renewable energy source** with profound environmental benefits. Despite global research highlighting their potential, Malaysia has yet to fully explore microalgae as an innovative sustainable solution within technological design contexts.

This innovation seeks to **pioneer microalgae integration at the domestic scale**, envisioning their application as innovative bus stop station in tropical climates. By harnessing photosynthesis to reduce CO2 levels, increase oxygen production, and enhance biomass generation, this technology aims to elevate aesthetic of bus station while puryfying air and mitigating heat gain.

The modular nature of **microalgae cultivation systems using modular photobioreactor** promises scalability and adaptability, addressing the unique challenges posed by Malaysia's climate. By systematically using precise measuring tools for environmental performance, this study lays the groundwork for future developments in symbiotic microalgae-urban applications, positioning Malaysia at the forefront of **sustainable innovation** in urban development.

Pioneer in Modular PBR Bus Station

PENUTUP

Secara keseluruhannya, BIOS Station merupakan satu inovasi yang holistik dan berimpak tinggi dalam usaha memperkasa pembangunan bandar lestari di Malaysia. Dengan gabungan teknologi hijau, reka bentuk modular, dan pendekatan pelbagai disiplin, inovasi ini berpotensi menjadi pemangkin kepada transformasi infrastruktur awam yang lebih mesra alam dan mampan. Diharapkan projek ini dapat terus dikembangkan dan memberi sumbangan bermakna kepada agenda hijau negeri dan negara.

8) Pengiktirafan Diterima

Diamond Award – BIOS Shade, IIDEX 2024
Gold Award – BIOS Facade, IAM 2024
Silver Award – BIOS Facade, ICON 2020
Bronze Award – BIOS Facade, IAM 2023
Gold Award – BIOS Shade, IIDEX 2024
Pelbagai pembentangan jurnal dan kertas penyelidikan:

- Journal of Design and Built Environment (JDBE) Special Issue IV | October 2024. Title: Unveiling the Potential of Green Facade Retrofit for Commercial Shopping Malls in Kuala Lumpur, Malaysia
- RISE Magazine Issue 2 | October 2022. Title: Green Retrofit Framework for Sustainable Residential Refurbishment Project
- PLANNING MALAYSIA: Journal of the Malaysian Institute of Planners - Volume 21 Issue 2 | October 2023 Title: Auspicious Green Retrofit Strategies in Two-Story Terrace Houses: Case Study of Petaling Jaya Selangor Malaysia
- Malaysian Journal of Social Sciences and Humanities (MJSSH) Volume 7 Issue 12 | December 2022. Title: The Need for Sustainability Improvements in Residential Building Stock
- AIP Conference Proceedings 2881, 020002 - 3rd International Conference on Built Environment and Engineering 2022 | October 2023. Title: Observational Data on the Refurbishment Behaviour of Two-Storey Terrace Houses in PJ
- Environment-Behaviour Proceedings Journal, Volume 5 Issue 14 - AIVCE-BS-1 | July 2020. Exploration of Microalgae Photobioreactor (PBR) in Tropical Climate Building Envelope.

9) Gambar - Gambar Berkaitan:

*Seperti di dalam Lampiran di bahagian belakang

10) Implikasi Kewangan

Disokong oleh geran penyelidikan Fundamental Research Grant Scheme (FRGS) 2023. Potensi penjanaan pendapatan dari produk komersial seperti biofuel dan biomass dan pelbagai penghasilan bio product .

*Seperti di dalam Lampiran di bahagian belakang

7)Kumpulan sasar dan skop liputan:

Pengguna perhentian bas bandar, perancang dan pereka bentuk infrastruktur bandar, pihak berkuasa tempatan, dan industri bioekonomi.

7)Impak inovasi terhadap kumpulan sasar:

a. Peningkatan keselesaan pengguna melalui pengurangan suhu sekitar.
b. Menyediakan penyelesaian karbon-negatif dalam infrastruktur awam
c. Peluang komersialisasi produk sampingan seperti biofuel, makanan tambahan, dan kosmetik.

1. ELEMEN INOVATIF / KREATIF

- **Penciptaan nilai/ elemen baru:** Integrasi teknologi PBR ke dalam struktur awam sebagai komponen utama.

- **Penyelesaian masalah:** Mengatasi masalah haba bandar, kekurangan ruang hijau, dan ketidakcekapan perhentian bas konvensional.

2. ELEMEN KEBERKESANAN

- **Faedah nyata:** Penurunan suhu permukaan hingga 16°C; Penyerapan CO_2 sehingga 4.8kg setiap modul; Penghasilan oksigen dan biomass bernilai tinggi.

- **Peningkatan produktiviti /** kepuasan: Meningkatkan keselesaan pengguna; Mengurangkan kebergantungan kepada penyaman udara.

- **Penjanaan pendapatan:** Potensi penjualan biomass sebagai biofuel, bahan makanan tambahan dan produk penjagaan diri.

3. ELEMEN SIGNIFIKAN

- **Perkhidmatan mesra pelanggan:** Reka bentuk ergonomik dan menarik dengan tempat duduk, pencahayaan LED dan perlindungan matahari.

- **Penjimatan masa / kos / sumber manusia:** Penggunaan alga yang tumbuh cepat, rendah kos penyelenggaraan dan modular.

- **Pencapaian objektif inisiatif:** Menjawab keperluan perubahan iklim dan menggalakkan inovasi hijau bandar.

4. ELEMEN RELEVAN

- **Sumbangan kepada agenda organisasi / nasional:** Menyokong Matlamat Pembangunan Mampan (SDG) 7, 9 dan 11.

LAPORAN PENYERTAAN ANUGERAH INOVASI NEGERI SELANGOR 2025

TAJUK INOVASI :
B.I.O.S STATION – Bio-Initiative-Oriented Solution for Bus Stop (Perhentian Bas Bandar)

NAMA JABATAN / AGENSI / INSTITUSI :
BIOS.Built, Unit Penyelidikan dan Inovasi, Kolej Pengajian Alam Bina, Universiti Teknologi MARA(UiTM) Kampus Shah Alam

PENERANGAN HASIL INOVASI

1) Ringkasan Hasil inovasi :
BIOS Station merupakan sebuah sistem perhentian bas modular yang mengintegrasikan teknologi microalgae photobioreactor (PBR). Ia direka untuk menangkap karbon dioksida (CO_2), menghasilkan oksigen, mengurangkan suhu sekitar dan menyediakan tempat berteduh sambil meningkatkan estetika bandar.

2)Tarikh inovasi dihasilkan:
Oktober 2023

3)Tujuan Projek Inovasi
a. Membangunkan sistem PBR modular yang efisien untuk digunakan pada perhentian bas bandar di iklim tropika.
b. Menilai prestasi alam sekitar dan manfaat ekologi sistem PBR dalam konteks tropika.
c. Menyediakan penyelesaian berganda – pengurangan karbon, penghasilan tenaga bio, dan peningkatan kualiti ruang awam.

4)Proses pelaksanaan inovasi:
Projek ini dibangunkan secara in-house oleh pasukan penyelidik BIOS.Built melalui kerjasama pelbagai disiplin.

5)Proses sebelum dan selepas:
Sebelum – Perhentian bas konvensional hanya menawarkan fungsi teduhan dan estetika minimum tanpa faedah alam sekitar.
Selepas – BIOS Station memperkenalkan penyelesaian menyeluruh yang turut menyumbang kepada pengurangan karbon, penyejukan pasif, penghasilan tenaga dan penambahan nilai bioekonomi.

6)Elemen Penurunan Kuasa:
Tiada

B.I.O.S STATION

BIO - INITIATIVE - ORIENTED - SOLUTION FOR BUS STOP.
BEYOND GREEN INITIATIVE;

Urban areas in tropical climates like Malaysia face growing challenges from high carbon emissions and rising temperatures, making innovative solutions essential. Introducing **BIOS Station**—a cutting-edge integration of microalgae photobioreactor technology into public infrastructure. Harnessing microalgae's unmatched carbon capture efficiency and rapid growth, BIOS Station actively absorbs CO_2, boosts oxygen levels, and produces valuable biomass, all while offering shade for users. This revolutionary solution transforms urban walkways into sustainable, eco-friendly spaces, reducing carbon footprints and enhancing urban living, setting a new benchmark for smarter, greener cities.

Patent Reference No (IP/PT/00264)