Conventional Bricks Industry is a

HUGE TOXIC

to Earth as it keeps

POLLUTING

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990 PJ of energy consumed in conventional bricks industry every year

Worldwide fired clay-brick production contributes emission of

0.48 kg CO_2 eq per kg

In Palm Oil Industry,

PALM OIL BIOMASS

remained

UNDERUTILISED

and eventually caused

POLLUTION.

Major application of biomass is

Soil Enrichment

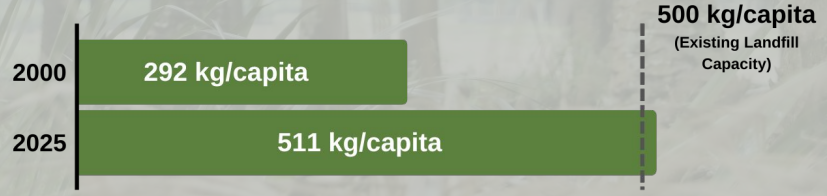
via mulching

14,500

kg/ha/year of OPF produced by replanting activity

Landfills in Malaysia will run at overcapacity

IN JUST ONE YEARS



Malaysia's landfill capacity per capita and MSW generated per capita in 2000 and 2025 (Expected)

KUALA LUMPUR
is still grappling with
URBAN HEAT ISLANDS PROBLEM.

3 - 5 °C range of UHI intensity under calm night conditions depending on land-surface cover

4 °C urban cool island intensity at daytime due to shading effect of high-rise buildings

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Participate • Accelerate • Innovate

ESCAP Economic and Social Commission for Asia and the Pacific | HACK Hackathon Thailand | UNDP | unesco | YECAP | ASIA LEDS PARTNERSHIP | Global Climate Action Partnership regional leadership, global change

Universiti Kebangsaan Malaysia The National University of Malaysia | NARATIF BAHARU UKM UNIVERSITI WATAN KITA | FKAB FAKULTI KEJURUTERAAN DAN ALAM BINA Faculty of Engineering & Built Environment

YOUTH CLIMATHON

INNOVATIVE SOLUTIONS FOR THE ACCELERATION OF CLIMATE ACTION IN ASIA & THE PACIFIC

Echo Block®

TRIPLE ECHOES

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE | 12 RESPONSIBLE CONSUMPTION AND PRODUCTION | 13 CLIMATE ACTION

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INNOVATIVE SOLUTIONS FOR THE ACCELERATION OF CLIMATE ACTION IN ASIA & THE PACIFIC

TRIPLE ECHOES

Problem

Due to rapid development of Oil Palm plantation sector, **more waste are landfilled**.

Urban Heat Island Phenomenon is persisting in Kuala Lumpur.

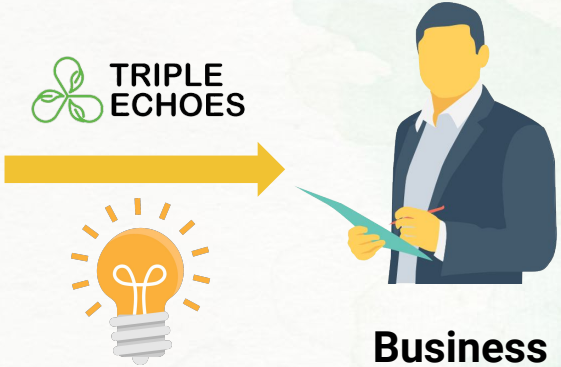
More GHG is emitted during production of bricks.

Question

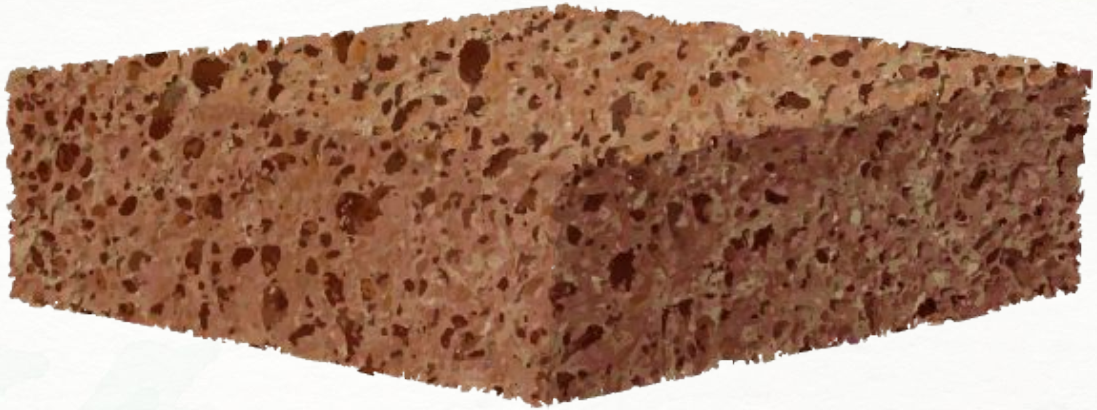
How can we:

- Make use of the **trending palm oil plantation** development
- Offer a **sustainable green construction solutions**
- **Making profits** without causing any **environmental problem**
- Solving **Urban Heat Island Phenomenon**

TRIPLE ECHOES



Business Opportunity



ECHO BLOCK

ECHO BLOCK is made from...

Oil Palm Biomass

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ECHO BLOCK - Biomass Based Sustainable Construction Materials

What

- **Oil Palm Biomass** As The Raw Material for ECHO BLOCK
- Swap Conventional Bricks for **Sustainability**

Why

- Oil Palm Biomass is an **Economic Source** that is **Under-utilized**
- Construction Sector need to be transformed by tackling **Climate Change**

How

- Forge a **Sustainable Paradigm for Oil Palm Waste:**
  Cultivate a Circular Economy with ECHO BLOCK

Process

Biomass (Oil Palm Trunk Fibre)

+

Lime Powder

+

Water

=

Why ECHO BLOCK ?

ECHO BLOCK

- ✓ **Low density**
- ✓ **Low cost**
- ✓ **Low embodied carbon**
- ✓ **Promising Mechanical Strength**

We believe that

ECHO BLOCK

is the linkage between human and nature, ensuring biodiversity in resilient city

TRIPLE ECHOES

ECHO BLOCK is actually BREATHABLE

Just like a human lung.

ECHO BLOCK can even GROW PLANT

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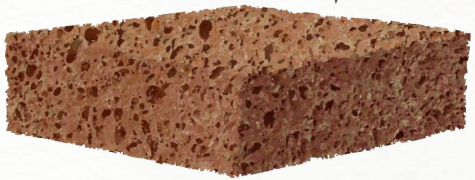
ECHO BLOCK



Biobased & Chemical Addictive

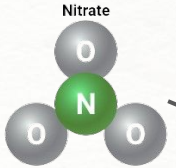
Oliver Stone Flour

Glycerol Carbonate

- An increase of porosity **7.2%**
- Contain more than **20 times** tiny porous than conventional bricks
- Holds up **air and water** - essential for plant growth

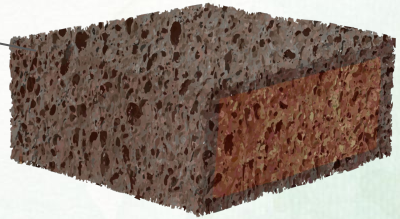
ECHO BLOCK
is natural habitat for
plant growth *

How to achieve?



Absorption

Layers of Activated Carbon (<2 wt%)



- Small amount of activated carbon purify air by absorbing nitrates, which is **super-nutrient** for plant growth
- Easier adaptation for the **plant roots extension**

Source: Rima Sabina Aouf 2019

What else can we do with

ECHO BLOCK ?

Echo Building®

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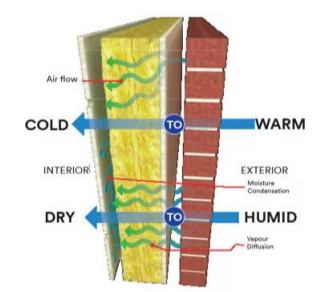
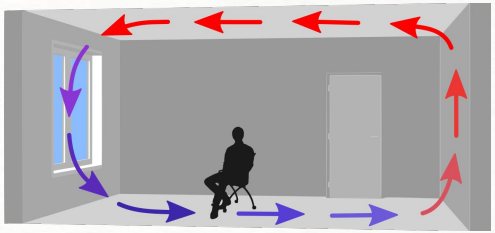
TRIPLE ECHOES

Echo Building® - Future Architectured Resilient Biophilic Design

Conceptual Design by TRIPLE ECHOES

- Whole building with more than **65%** ECHO BLOCK
- With certain amounts of **water sacs** in the block, it eventually **cool down** the interior room temperature





- With activated carbon, the building **purifies air automatically**
- Use of **natural light and ventilation**

- Biophilic design features play a **therapeutic role**
- Improve **mind restoration and productivity**

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ECHO BLOCK

TRIPLE ECHOES

Circular Economy for Financial Sustainability

Extra earnings for farmers - Improve quality of life

Oil Palm Farmer

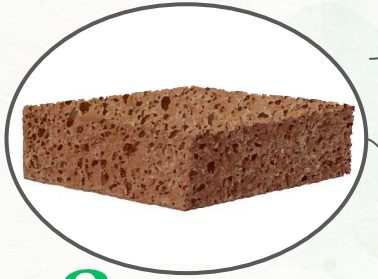
Start-up Money

Purchasing Oil Palm Biomass from Farmers

Oil Palm Biomass

Processing Facility

Upcycling



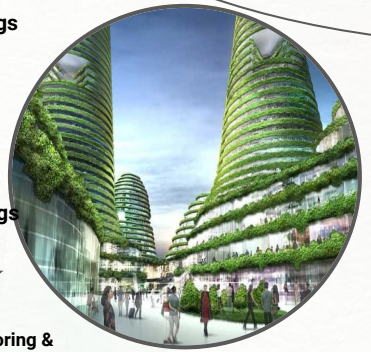
Selling to Construction Company at relatively cheaper price

Revenues

Recycling after demolishing

Construction Buildings

Cultivating plant from the blocks



Green Buildings

Sustaining Green Buildings

Sustaining Green Buildings

Seed Propagation Technology

Revenues

Revenues

Plant Monitoring & Maintenance Services

YAYASAN MySDG FOUNDATION

MySDG Foundation - Seed Money of RM 20 million (USD4.3 million)

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

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Economic Analysis

Product cost						
Year		Year 1	Year 2	Year 3	Year 4	Year 5
Additives + Utilities	$	20,000	$ 30,000	$ 45,000	$ 67,500	$ 135,000
Lime Powder	$	9,500	$ 14,250	$ 21,375	$ 32,063	$ 64,125
Water Usage	$	5,000	$ 7,500	$ 11,250	$ 16,875	$ 33,750
Transporation Cost	$	10,000	$ 15,000	$ 22,500	$ 33,750	$ 67,500
Oil Palm Biomass	$	30,000	$ 45,000	$ 67,500	$ 101,250	$ 202,500
Total	$	74,500	$ 111,750	$ 167,625	$ 251,438	$ 502,875

Capital Expenditure (CapEx)						
Year		Year 1	Year 2	Year 3	Year 4	Year 5
Research and Development	$	45,000	$ 63,000	$ 94,500	$ 189,000	$ 245,700
Support and Maintenance	$	-	$ 25,000	$ 37,500	$ 75,000	$ 97,500
Debt Capital and Installment	$	49,000	$ 68,600	$ 102,900	$ 205,800	$ 267,540
Total	$	94,000	$ 156,600	$ 234,900	$ 469,800	$ 610,740

Operating Expenditure (OpEx)						
Year		Year 1	Year 2	Year 3	Year 4	Year 5
Incorporation Registration	$	200	$ -	$ -	$ -	$ -
Salaries and Wages	$	12,480	$ 18,720	$ 28,080	$ 42,120	$ 84,240
Marketing	$	29,640	$ 44,460	$ 66,690	$ 100,035	$ 200,070
Logistic	$	14,040	$ 21,060	$ 31,590	$ 47,385	$ 94,770
Utility and Micellaneous	$	70,824	$ 106,236	$ 159,354	$ 239,031	$ 478,062
Total	$	127,184	$ 190,476	$ 285,714	$ 428,571	$ 857,142

Year		Year 1	Year 2	Year 3	Year 4	Year 5
Revenue						
Sales	$	285,000	$ 455,000	$ 735,000	$ 1,250,000	$ 2,200,000
Material cost	$	(74,500)	$ (111,750)	$ (167,625)	$ (251,438)	$ (502,875)
Gross Profit	$	210,500	$ 343,250	$ 567,375	$ 998,563	$ 1,697,125

Expenses						
CapEx	$	(94,000)	$ (156,600)	$ (234,900)	$ (469,800)	$ (610,740)
OpEx	$	(127,184)	$ (190,476)	$ (285,714)	$ (428,571)	$ (857,142)
Total Expenses	$	(221,184)	$ (347,076)	$ (520,614)	$ (898,371)	$ (1,467,882)
Profit before tax	$	(10,684)	$ (3,826)	$ 46,761	$ 100,192	$ 229,243
Income tax	$		$	$ (11,223)	$ (24,046)	$ (55,019)
Profit / (Loss)	$	(10,684)	$ (3,826)	$ 35,538	$ 76,145	$ 174,224
Cumulative Profit / Loss	$	(10,684)	$ (14,510)	$ 21,028	$ 97,173	$ 271,397
ROI		-3.61%	-0.83%	6.79%	8.71%	11.63%

Reach Break-Even Point at 3rd year with ROI 6.79%

* $ - USD

Potential Partnerships

Malaysian Palm Oil Board (MPOB)

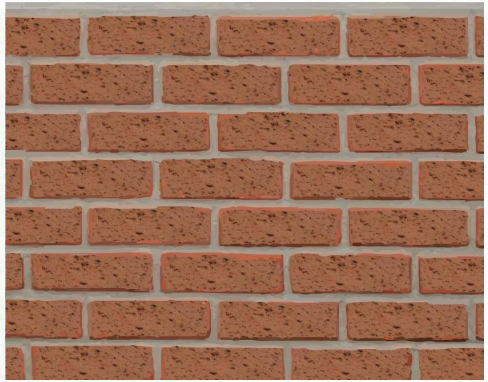
Kuala Lumpur Municipal Council

Sime Darby Limited

Malaysian Construction Industry Development Board

Sunway Construction Sdn. Bhd.

Environmental Impacts



By ECHO BLOCK , we grow plants on the wall

With existing green cover of **30%** of total land area in Kuala Lumpur city, we aim to grow more than **50%** plants in limited city space without occupying any land area, capturing more than **60,000** tons of CO_2.

Net Zero GHG Emission

during production of ECHO BLOCK

70% less Carbon produced

76% Reduction of biomass waste to be landfilled

Purify air in the city by converting pollutants into nitrates

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TRIPLE ECHOES

Social Impacts

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

Providing job opportunities

1 facility machine = 10 jobs

Seed propagation & Plant Maintenance Service for single unit **= 20 jobs**

Increasing farmers salary by **100 USD extra** per month

Reduce construction cost by **30%**

More than **20%** of low income family can afford to buy low-costing housing

Community Empowerment by providing **skills** and **Economic Opportunities**

Rapid Rural Development through **Low Costing Construction Solution**

Modernised and **Greener Urban Planning**

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Implementation Plan

1 – 6 months

- Research and Development
- Getting the fund source
- Establish collaboration with partner in Kuala Lumpur

7 – 18 months

- Officially operate in Market
- Marketing Strategy planning and executing
- Annual Review
- Testing with International Standards

19 – 25 months

- Attract and retain best employee
- Product improvement
- Collaboration with local municipal councils

26 – 36 months

- Purchasing suitable oil palm plantation land
- Increase revenue and reduce cost
- Marketing of Echo Building®

37 – 48 months

- Increase community outreach to whole Malaysia
- Ensure financial stabilization
- Prototyping of Echo Building®

49 – 60 months

- Ensure company sustainability
- Purchasing of land for constructing Echo Building®
- Annual Review

> 60 months

- Diversify the Echo Block to Asia-Pacific Countries
- Exhibition of Echo Building®
- Fulfilling legal requirements
- Increase revenue
- Securing first residents in Echo Building®

Thank You !

TRIPLE ECHOES

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Team Members

Choong Kah Fai

Role: Product Engineer & Inspector, Design Professional
Education: Civil Engineering UKM
Experiences: Active in Structural and Materials related competition since 2022, Focus on project management

Wong Yi Song

Role: Leader, Marketer, Material Inspector
Education: Chemical Engineering UKM
Experiences: Worked on more than 4 sustainability projects internationally, Biomass conversion

Dong Yanbeiyang

Role: Data Analyst, Quality Controller
Education: Civil Engineering UKM
Experiences: Specialized in material engineering with 2 years of involvement in related competitions

Supervisors

PPJ. Kehormat (Pa) Prof. Dato' Ir. Dr. Othman Bin A. Karim

Co-Supervisor

Assoc. Prof. Ir. Dr. Siti Fatin Mohd Razali

Main Supervisor

Prof. Dr. Noor Ezlin binti Ahmad Basri

Co-Supervisor

Assoc. Prof. Ir. Dr. Wan Hanna Melini Wan Mohtar

Co-Supervisor

Assoc. Prof. Ts. Dr. Rosiah Rohani

Co-Supervisor

Assoc. Prof. Ir. Dr. Hassimi Abu Hasan

Co-Supervisor

Dr. Irfana Kabir Ahmad

Co-Supervisor

Problems

Conventional Brick Industry is POLLUTING

990 PJ of energy consumed in conventional bricks industry every year

Worldwide fired clay-brick production contributes emission of

0.48 kg CO_2 eq per kg

250 acres of clay-rich land are evacuated annually for brick production

Sources: WWF 2023; Nature Journal 2023; Architect Magazine 2022

Accumulation of Palm Oil Biomass in Malaysia is TROUBLING

Palm Oil Biomass

Generated per ha per year

- Palm Kernel Shell: 2,710 tonnes
- Oil Palm Frond: 10,880 tonnes
- Empty Fruit Bunch: 4,420 tonnes
- Mesocarp Fibre: 1,100 tonnes
- Oil Palm Trunk: 2515 tonnes

Source: Wahab et al. 2021

URBAN HEAT ISLAND Phenomenon in Kuala Lumpur

6 °C UHI intensity at night time

4 °C urban cool island intensity at daytime

Source: SDI 2022

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TRIPLE ECHOES

Conventional Bricks Industry is a **HUGE TOXIC** to Earth as it keeps **POLLUTING** the environment.

990 PJ of energy consumed in conventional bricks industry every year

Worldwide fired clay-brick production contributes emission of

0.48 kg CO_2 eq per kg

250 acres of clay-rich land are evacuated annually for brick production

18 - 25 tonnes of coals are consumed just to produce **100,000** bricks

Sources: Chandan Kumar Mandal 2024; Nicolaou et. al 2023; Patangrao Kadam Mahavidyalaya 2023

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In Palm Oil Industry,

PALM OIL BIOMASS

remained

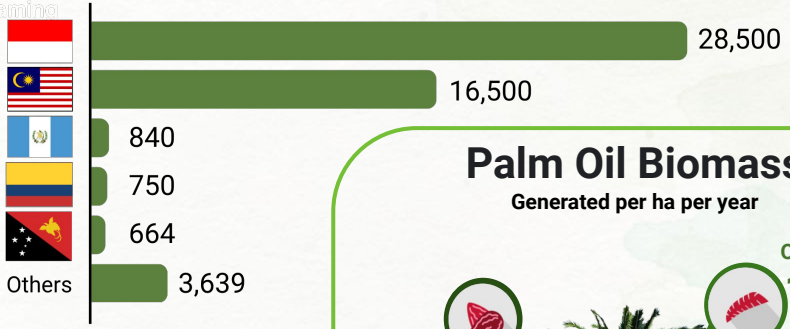
UNDERUTILISED

and eventually caused

POLLUTION.

Sources: Statista 2023; Omar et al. 2018; Oseghale Sunday Dalton et al. 2017; Wahab et al. 2021

Palm Oil Export Volume Worldwide 22/23 (metric tonnes)



2.4% of Malaysia's agriculture GDP

Palm Oil Biomass

Generated per ha per year

- Oil Palm Frond: **10,880** tonnes
- Palm Kernel Shell: **1,100** tonnes
- Empty Fruit Bunch: **4,420** tonnes
- Mesocarp Fibre: **2,710** tonnes
- Oil Palm Trunk: **2515** tonnes

Malaysia is world's **SECOND HIGHEST** palm oil exporters, accounting for **39%** world palm oil production

Major application of biomass is **Soil Enrichment** via mulching

14,500 kg/ha/year of OPF produced by replanting activity

KUALA LUMPUR

is still grappling with

URBAN HEAT ISLANDS PROBLEM.

Sources: Hellier et al. 2018; Wang et al. 2019

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3 - 5 °C range of UHI intensity under calm night conditions depending on land-surface cover

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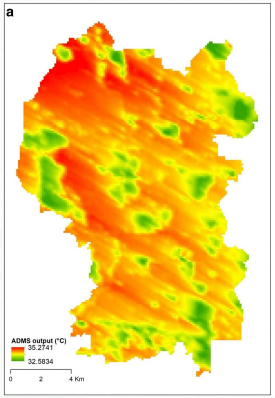
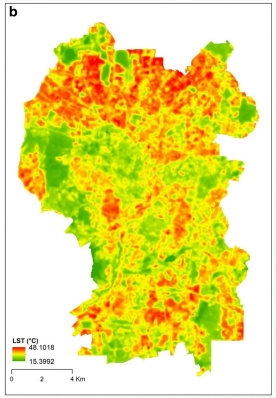


(1)



(2)

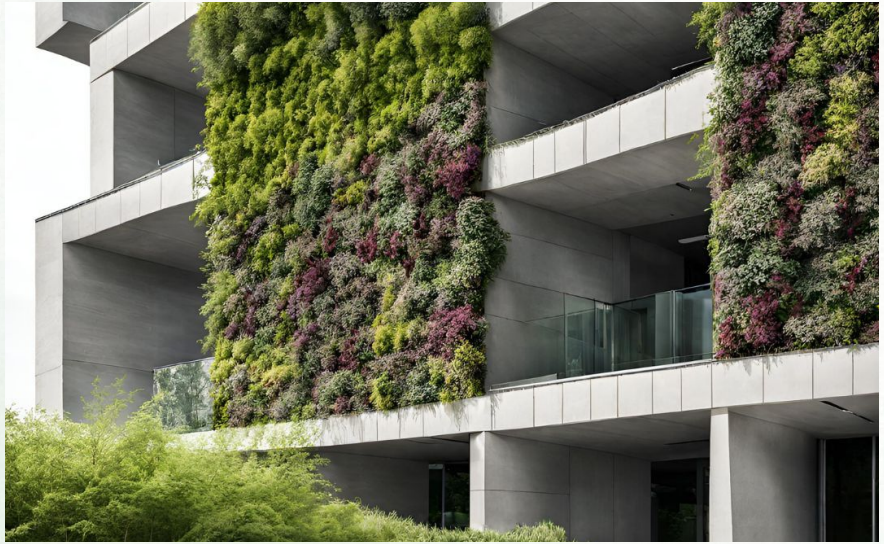
Satellite images of Kuala Lumpur at 12.00 noon (GMT+8) in 2015

(1) ADMS-Urban modelled air temperatures at 3 m above ground

(2) Derived Land Surface Temperature for Kuala Lumpur City

Versatility of ECHO BLOCK

With the activated carbon finishing that provides nutrients for plants, ECHO BLOCK can facilitate the growth of greenery.



Without the activated carbon finishing, the ECHO BLOCK supports a surface that is as smooth and durable as **conventional bricks**.

Target Group

Construction Company

- Adoption of Green Plan in Sustainable Agenda in city areas
- Aim to reduce the costing of construction
- Aim to shorten the duration of construction
- Creative and eco-friendly building design

Local Communities

- Underprivileged farmers that is underpaid by employers
- Local communities that cannot afford to buy houses

Government and Regulatory Bodies

- Better urban planning with green building
- Looking for transformation into green cities by adopting green building
- Municipal Councils that faced serious biomass accumulation issues - Trolak, Tangkak etc.

Comparative Analysis

Features	ECHO BLOCK	ECOBRICKS	ecobricks	Bio-Bricks from Bacteria Biomass
Ability to facilitate plant growth	✓	✗	✗	✗
Water permeable	✓	✓	✗	✗
Durability	✓	✓	✓	✗
Product Sources	**Palm Oil Biomass**	**Plastics Waste**	**Plastics Waste**	**Bacteria Biomass**
Long-term carbon neutrality	✓	✗	✗	✓

11th APFSD

YOUTH CLIMATHON

INNOVATIVE SOLUTIONS FOR THE ACCELERATION OF CLIMATE ACTION IN ASIA & THE PACIFIC

ESCAP · HACK Hackathon Thailand · UNDP · unesco · YECAP · ASIA LEDS PARTNERSHIP · Global Climate Action Partnership · TRIPLE ECHOES

Potential Partnerships

Malaysian Palm Oil Board (MPOB)	Kuala Lumpur Municipal Council	Sime Darby Limited	Malaysian Construction Industry Development Board	Sunway Construction Sdn. Bhd.
• Research and Development - technical aspects • Technical insights into the properties of oil palm biomass • Regulations and standards	• Sustainable construction guidelines or initiatives • Urban Development Projects • Permitting and regulatory requirements	• Stable Oil Palm Biomass suppliers • Industry certifications and standards • Market presence and distribution networks	• Regulatory landscape related to construction materials • Technical assistance and guidance from CIDB's experts • Meet industry standards and certifications	• Incorporating Echo Blocks into their construction projects • Implementation of pilot projects • Potential seed fund or grants

Appendix A

Biophilic Building Effects

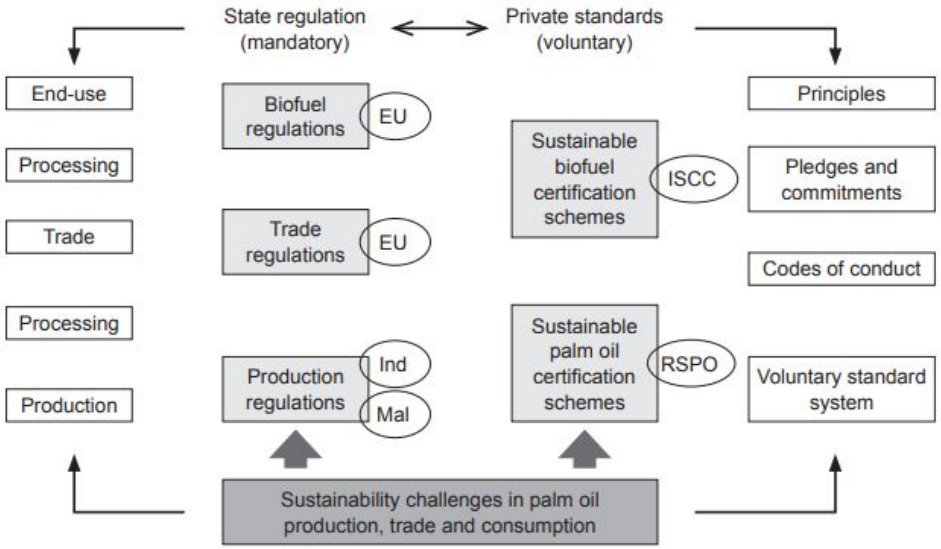
The 2015 Human Spaces report, which studied 7,600 offices workers in 16 countries, found that 58% of workers have no live plants in their workspaces. Those whose environments incorporated natural elements reported a 15% higher wellbeing score and a 6% higher productivity score than employees whose offices didn't include such elements. Other studies have shown that, in an average living space, five medium-sized plants can increase air quality by around 75% and mental health by 60%.

Source: Chipr 2021

Appendix B

Taboos on Sustainability Aspects of Oil Palm Plantation Sectors

JOURNAL OF OIL PALM RESEARCH 32 (3) (SEPTEMBER 2020)



Note: Mal - Malaysia.
Ind - Indonesia.
EU - European Union.
ISCC - Initiative for Sustainable Palm Oil.
RSPO - Roundtable on Sustainable Palm Oil.

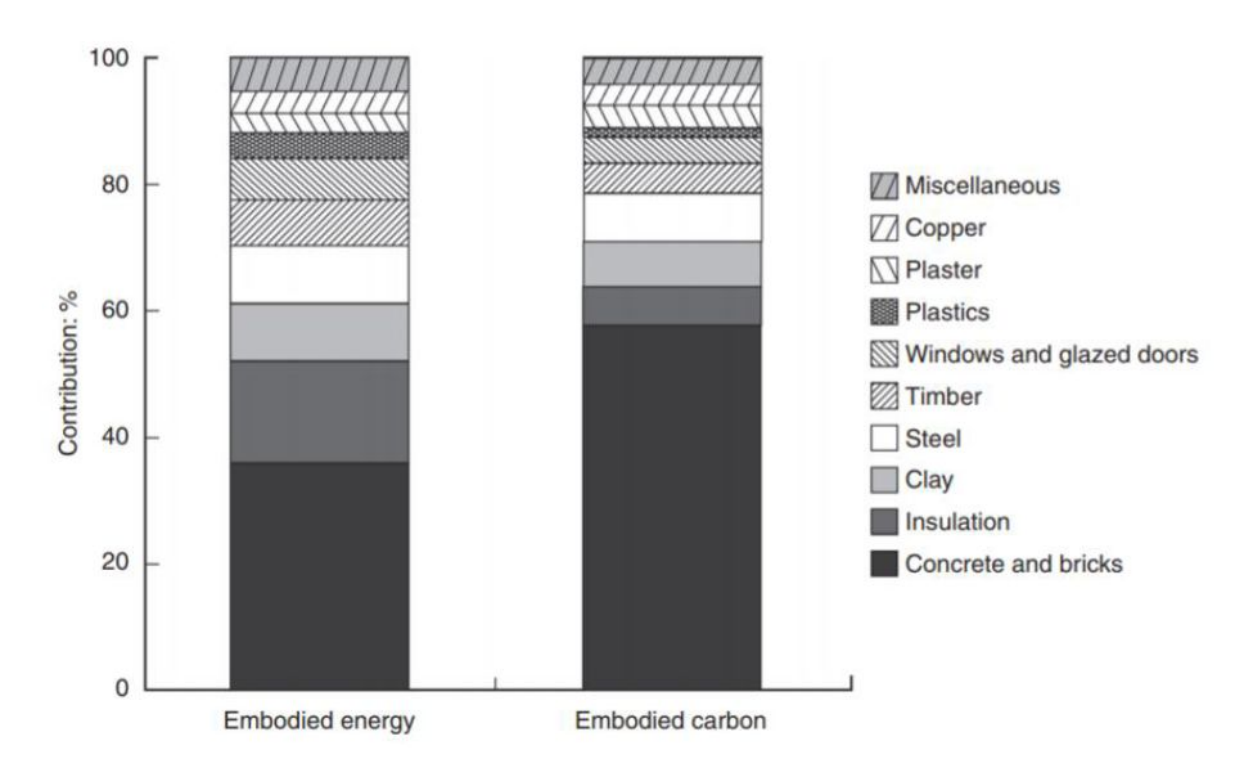
Source: Pacheco *et al.* (2018).

Figure 6. The palm oil sustainability governance landscape.

Source: Putri et al. 2022

Appendix C

Constituents Raw Materials for building that contribute to Carbon Footprint



Source: Rautray et al. 2019

Appendix D

Hempcrete Prototypes

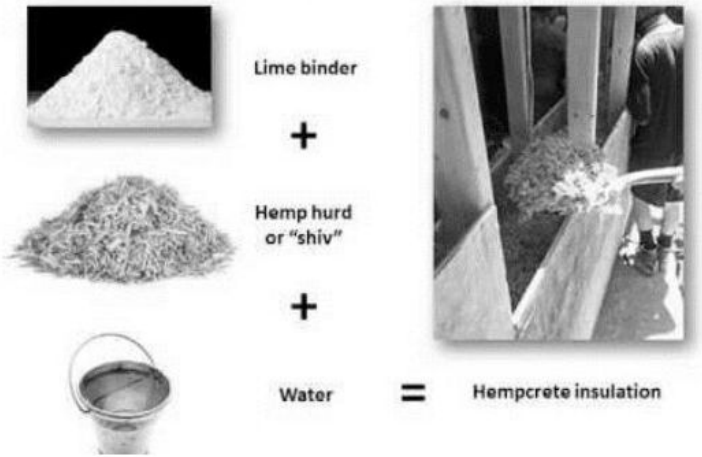


Figure 2. Constituent raw materials

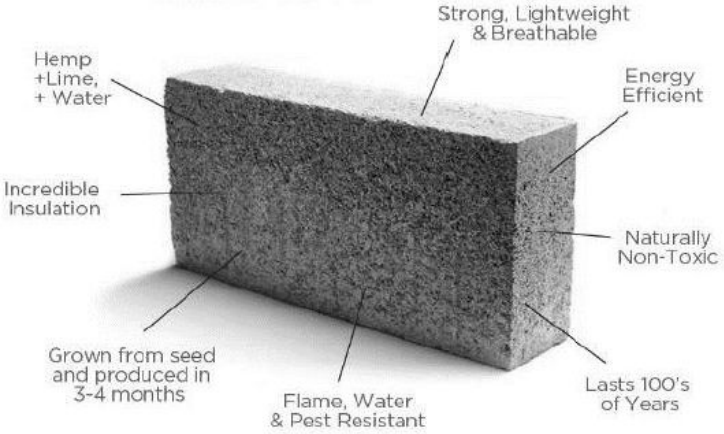


Figure 3. Benefits of hempcrete

Source: Rautray et al. 2019

Appendix E

Prototyping of Hempcrete

5.1 Prototyping – with sugar cane bagasse and wheat husk

Figure 5. Dry sugarcane bagasse was chopped into fine pieces

Figure 6. Basic tools used along with lime, stone dust and water

Figure 7. Chopped bagasse, lime, water and stone dust were mixed properly

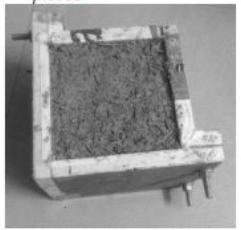


Figure 8. The mixture is properly compacted into the mould

Figure 9. The bio-brick was allowed to dry in air for a month

Figure 10. The same experiment was repeated with wheat husk

Source: Rautray et al. 2019

Appendix F

Application of Hempcrete

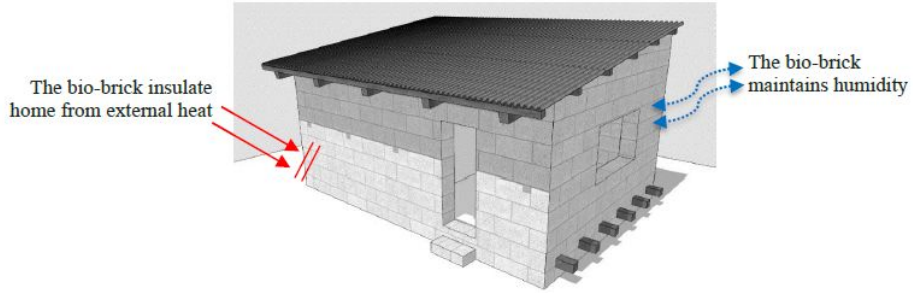


Figure 11. Low cost load bearing housing

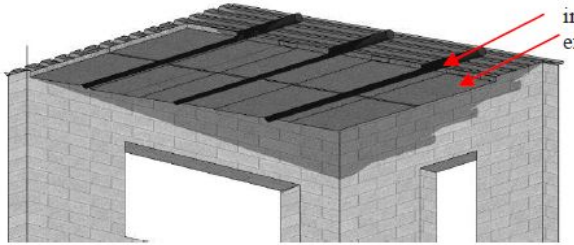


Figure 13. Used as an insulation material for corrugated sheet roofing

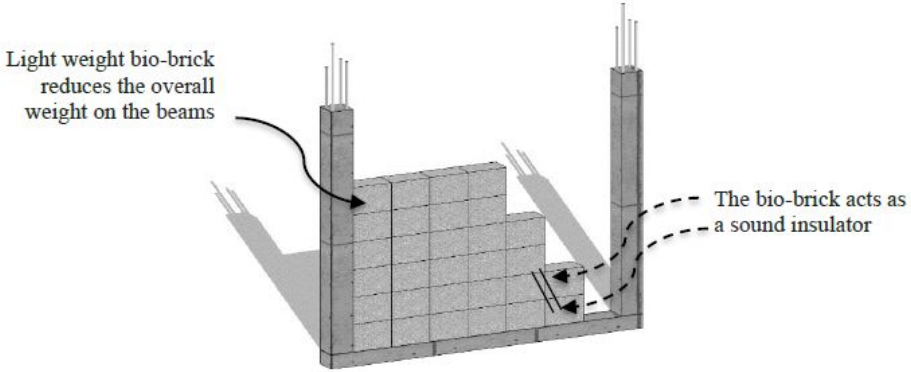


Figure 12. Filler wall material for column beam structure

Source: Rautray et al. 2019

Appendix G

Landfill Capacity in Malaysia

Landfills in Malaysia will run at overcapacity
IN ONE YEARS

Malaysia's landfill capacity per capita and MSW generated per capita in 2000 and 2025 (Expected)

With assumptions:

1. Rapid annual population growth of 1.3%
2. Waste generation rate average from 0.8 to 1.3 kg/capita/day
3. 141 solid waste landfills in Malaysia currently

Appendix H

Plan of Protection of Intellectual Property