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
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

<table>
<thead>
<tr>
<th>Year</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>292 kg/capita</td>
</tr>
<tr>
<td>2025</td>
<td>511 kg/capita</td>
</tr>
</tbody>
</table>

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
YOUTH CLIMATHON

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

Echo Block®
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.

**Problem**

**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*
CHO BLOCK is made from...

Oil Palm Biomass
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 needs 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?**
- 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
Echo Block is actually breathable.

Just like a human lung.

Rain Water

Nitrogen Dioxide (Pollutants)

Nitrate

Nitrates
βECHO BLOCK can even GROW PLANT
How to achieve?

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

CHO BLOCK

is natural habitat for plant growth *

Rain Water

Holdup

Air

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

Layers of Activated Carbon (<2 wt%)

Absorption

Nitrate

* Source: Rima Sabina Aouf 2019
What else can we do with ECHO BLOCK?
Echo Building® - Future Architectured Resilient Biophilic Design

- Whole building with more than 65% **Echo Block**
- With certain amounts of water sacks 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
Circular Economy for Financial Sustainability

- Purchasing Oil Palm Biomass from Farmers
- Oil Palm Farmer
- Oil Palm Biomass
- Processing Facility
- Upcycling
- Selling to Construction Company at relatively cheaper price
- Recycled materials for Green Buildings
- Revenues
- Sustaining Green Buildings
- Cultivating plant from the blocks
- Seed Propagation Technology
- Plant Monitoring & Maintenance Services
- MySDG Foundation - Seed Money of RM 20 million (USD4.3 million)
- Extra earnings for farmers - Improve quality of life
- Start-up Money
- Revenues
- Sustaining Green Buildings
- Construction Buildings
## Economic Analysis

### Product Cost

<table>
<thead>
<tr>
<th>Year</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additives + Utilities</td>
<td>$20,000</td>
<td>$30,000</td>
<td>$45,000</td>
<td>$67,500</td>
<td>$135,000</td>
</tr>
<tr>
<td>Lime Powder</td>
<td>$9,500</td>
<td>$14,250</td>
<td>$21,375</td>
<td>$32,063</td>
<td>$64,125</td>
</tr>
<tr>
<td>Water Usage</td>
<td>$5,000</td>
<td>$7,500</td>
<td>$11,250</td>
<td>$16,875</td>
<td>$33,750</td>
</tr>
<tr>
<td>Transportation Cost</td>
<td>$10,000</td>
<td>$15,000</td>
<td>$22,500</td>
<td>$33,750</td>
<td>$67,500</td>
</tr>
<tr>
<td>Oil Palm Biomass</td>
<td>$30,000</td>
<td>$45,000</td>
<td>$67,500</td>
<td>$101,250</td>
<td>$202,500</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$74,500</td>
<td>$111,750</td>
<td>$107,025</td>
<td>$125,438</td>
<td>$502,875</td>
</tr>
</tbody>
</table>

### Capital Expenditure (CapEx)

<table>
<thead>
<tr>
<th>Year</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research and Development</td>
<td>$45,000</td>
<td>$63,000</td>
<td>$94,500</td>
<td>$189,000</td>
<td>$245,700</td>
</tr>
<tr>
<td>Support and Maintenance</td>
<td>$5,000</td>
<td>$25,000</td>
<td>$37,500</td>
<td>$75,000</td>
<td>$97,500</td>
</tr>
<tr>
<td>Debt Capital and Installment</td>
<td>$49,000</td>
<td>$68,600</td>
<td>$102,900</td>
<td>$205,800</td>
<td>$267,540</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$94,000</td>
<td>$156,600</td>
<td>$234,900</td>
<td>$469,800</td>
<td>$610,740</td>
</tr>
</tbody>
</table>

### Operating Expenditure (OpEx)

<table>
<thead>
<tr>
<th>Year</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incorporation Registration</td>
<td>$200</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Salaries and Wages</td>
<td>$12,480</td>
<td>$18,720</td>
<td>$28,080</td>
<td>$42,120</td>
<td>$84,240</td>
</tr>
<tr>
<td>Marketing</td>
<td>$29,640</td>
<td>$44,460</td>
<td>$66,690</td>
<td>$100,035</td>
<td>$200,070</td>
</tr>
<tr>
<td>Logistic</td>
<td>$14,040</td>
<td>$21,060</td>
<td>$31,590</td>
<td>$47,385</td>
<td>$94,770</td>
</tr>
<tr>
<td>Utility and Miscellaneous</td>
<td>$70,824</td>
<td>$106,236</td>
<td>$159,354</td>
<td>$239,031</td>
<td>$478,062</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$127,184</td>
<td>$190,476</td>
<td>$285,714</td>
<td>$428,571</td>
<td>$857,147</td>
</tr>
</tbody>
</table>

### Revenue

<table>
<thead>
<tr>
<th>Year</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>$285,000</td>
<td>$455,000</td>
<td>$735,000</td>
<td>$1,250,000</td>
<td>$2,200,000</td>
</tr>
<tr>
<td><strong>Material Cost</strong></td>
<td>$(74,500)</td>
<td>$(111,750)</td>
<td>$(167,625)</td>
<td>$(251,438)</td>
<td>$(502,875)</td>
</tr>
<tr>
<td><strong>Gross Profit</strong></td>
<td>$210,500</td>
<td>$343,250</td>
<td>$567,375</td>
<td>$998,563</td>
<td>$1,697,125</td>
</tr>
</tbody>
</table>

### Expenses

<table>
<thead>
<tr>
<th>Year</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>CapEx</td>
<td>$(94,000)</td>
<td>$(156,600)</td>
<td>$(234,900)</td>
<td>$(469,800)</td>
<td>$(610,740)</td>
</tr>
<tr>
<td>OpEx</td>
<td>$(127,184)</td>
<td>$(190,476)</td>
<td>$(285,714)</td>
<td>$(428,571)</td>
<td>$(857,142)</td>
</tr>
<tr>
<td><strong>Total Expenses</strong></td>
<td>$(221,184)</td>
<td>$(347,076)</td>
<td>$(520,614)</td>
<td>$(888,371)</td>
<td>$(1,467,882)</td>
</tr>
</tbody>
</table>

### Profit

<table>
<thead>
<tr>
<th>Year</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profit before tax</td>
<td>$(10,684)</td>
<td>$(3,826)</td>
<td>$46,761</td>
<td>$109,192</td>
<td>$229,243</td>
</tr>
<tr>
<td>Income tax</td>
<td>$</td>
<td>$</td>
<td>$(11,723)</td>
<td>$(24,046)</td>
<td>$(55,619)</td>
</tr>
<tr>
<td>Profit / (Loss)</td>
<td>$(10,684)</td>
<td>$(3,826)</td>
<td>$35,038</td>
<td>$85,145</td>
<td>$174,624</td>
</tr>
<tr>
<td>Cumulative Profit / Loss</td>
<td>$(10,684)</td>
<td>$(14,510)</td>
<td>$(21,028)</td>
<td>$97,173</td>
<td>$271,397</td>
</tr>
<tr>
<td>ROI</td>
<td>-3.61%</td>
<td>-0.83%</td>
<td>6.79%</td>
<td>8.71%</td>
<td>11.63%</td>
</tr>
</tbody>
</table>

* $ - USD

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

Malaysian Palm Oil Board (MPOB)

Kuala Lumpur Municipal Council

Sime Darby Limited

Malaysian Construction Industry Development Board

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 CO₂.

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
Social Impacts

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
Implementation Plan

1 - 6 months
- Research and Development
- Getting the fund source
- Establish collaboration with partner in Kuala Lumpur

7 - 18 months
- Attract and retain best employee
- Product improvement
- Collaboration with local municipal councils

26 - 36 months
- Increase community outreach to whole Malaysia
- Ensure financial stabilization
- Prototyping of Echo Building®

37 - 48 months
- Purchase suitable oil palm plantation land
- Increase revenue and reduce cost
- Marketing 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®

19 - 25 months
- Officially operate in Market
- Marketing Strategy planning and executing
- Annual Review
- Testing with International Standards

26 - 36 months
- Officially operate in Market
- Marketing Strategy planning and executing
- Annual Review
- Testing with International Standards

37 - 48 months
- Officially operate in Market
- Marketing Strategy planning and executing
- Annual Review
- Testing with International Standards

49 - 60 months
- Officially operate in Market
- Marketing Strategy planning and executing
- Annual Review
- Testing with International Standards

> 60 months
- Officially operate in Market
- Marketing Strategy planning and executing
- Annual Review
- Testing with International Standards
Thank You!
References:


References:


References:


**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
Problems

Globally, we lose 137 million trees annually, accelerating climate change and biodiversity loss. Existing reforestation methods are slow and labor-intensive, limiting our ability to scale up. Our project seeks to revolutionize this process by using drones for faster, more efficient planting.

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 CO₂ eq per kg

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

Accumulation of Palm Oil Biomass in Malaysia is TROUBLING

<table>
<thead>
<tr>
<th>Biomass Type</th>
<th>Generated per ha per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palm Kernel Shell</td>
<td>2,710 tonnes</td>
</tr>
<tr>
<td>Empty Fruit Bunch</td>
<td>4,420 tonnes</td>
</tr>
<tr>
<td>Mesocarp Fibre</td>
<td>1,100 tonnes</td>
</tr>
<tr>
<td>Oil Palm Frond</td>
<td>10,880 tonnes</td>
</tr>
<tr>
<td>Oil Palm Trunk</td>
<td>2515 tonnes</td>
</tr>
</tbody>
</table>

Palm Oil 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
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
Malaysia is world’s second highest palm oil exporters, accounting for 39% world palm oil production.

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

In Palm Oil Industry, Palm Oil Biomass remained underutilised and eventually caused pollution.

Palm Oil Biomass
Generated per ha per year

- Oil Palm Frond: 10,880 tonnes
- Empty Fruit Bunch: 4,420 tonnes
- Palm Kernel Shell: 1,100 tonnes
- Mesocarp Fibre: 2,710 tonnes
- Oil Palm Trunk: 2,515 tonnes

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.

In Kuala Lumpur,

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

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 \textit{\textsuperscript{E}CHO BLOCK}

With the activated carbon finishing that provides nutrients for plants, \textit{\textsuperscript{E}CHO BLOCK} can facilitate the growth of greenery.

Without the activated carbon finishing, the \textit{\textsuperscript{E}CHO 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

<table>
<thead>
<tr>
<th>Features</th>
<th>ECHO BLOCK</th>
<th>ECOBRICKS</th>
<th>Ecobricks</th>
<th>Bio-Bricks from Bacteria Biomass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ability to facilitate plant growth</td>
<td>✔️</td>
<td>☒️</td>
<td>☒️</td>
<td>☒️</td>
</tr>
<tr>
<td>Water permeable</td>
<td>✔️</td>
<td>✔️</td>
<td>☒️</td>
<td>☒️</td>
</tr>
<tr>
<td>Durability</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>☒️</td>
</tr>
<tr>
<td>Product Sources</td>
<td>Palm Oil Biomass</td>
<td>Plastics Waste</td>
<td>Plastics Waste</td>
<td>Bacteria Biomass</td>
</tr>
<tr>
<td>Long-term carbon neutrality</td>
<td>✔️</td>
<td>☒️</td>
<td>☒️</td>
<td>✔️</td>
</tr>
</tbody>
</table>
## Potential Partnerships

|----------------------------------|--------------------------------|--------------------|---------------------------------------------------|--------------------------------|
| ● 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

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).
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

Source: Rautray et al. 2019
Appendix F
Application of Hempcrete

Figure 11. Low cost load bearing housing

Figure 12. Filler wall material for column beam structure

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

Light weight bio-brick reduces the overall weight on the beams

The bio-brick maintains humidity

The bio-brick acts as a sound insulator

Source: Rautray et al. 2019
Appendix G

Landfill Capacity in Malaysia

Landfills in Malaysia will run at overcapacity
IN ONE YEARS

- 2000: 292 kg/capita
- 2025: 511 kg/capita

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

- Establishing strong and effective administration
- Strengthening intellectual property laws
- Promoting public awareness programmes on the importance of intellectual property
- Providing advisory services on intellectual property
- Providing comprehensive and user-friendly information on intellectual property