Towards Low Carbon Society in Iskandar Malaysia: Implementation and Feasibility of Community Food Waste Composting

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Content

1. Problem Statement
2. Background of Study
3. Objectives of Study
4. Methodology
5. Findings and Results
6. Conclusion
Problem Statement

Consumption Pattern

Economic Development

Industrialisation

Rapid Urbanisation

Environment

Health

Safety

Problem Statement

Background of Study

Objectives of Study

Methodology

Findings and Results

Conclusion
BACKGROUND OF STUDY

Landfill Site Fire
KEMPAS -10 FEB 2015

- Underground Fire in poorly manage landfill
- Few Weeks to suppress the burning

RM1Bil Cost for Landfills in Msia in 2014
BACKGROUND OF STUDY

WASTE COMPOSITION IN MALAYSIA

- Municipal waste: 64%
- Food waste: 49.3%
- Paper: 17.1%
- Plastic: 19.7%
- Glass: 3.7%
- Others: 18.2%
- Ferrous metal: 1.6%
- Aluminium: 0.4%

EU-SWMC (2009), MHLG (2006)

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## BACKGROUND OF STUDY

### 12 Actions Towards Low Carbon Future (Iskandar Malaysia)

1. Integrated Green Transportation
2. Green Industry
3. Low Carbon Urban Governance
4. Green Building and Construction
5. Green Energy System and Renewable Energy
6. Low Carbon Lifestyle
7. Community Engagement and Consensus Building
8. Walkable, Safe and Livable City Design
9. Smart Urban Growth
10. Green and Blue Infrastructure and Rural Resources
11. Sustainable Waste Management
12. Clean Air Environment
OBJECTIVES OF STUDY

• To implement a **community composting prototype** in a sub-urban community in Malaysia by evaluating the **socio-economic and environmental impacts**.

• to showcase effective MSW management and mitigation of GHG emission.
1. Selection of community and composting site

Felda Taib Andak

1000 ft\(^2\), located 7km away from the FTA community, was provided by the FTA LCS committee

More maps @ www.malaxi.com
1. Selection of community and composting site

Felda Taib Andak

- Special village community driven by oil palm plantation activities.
- One of the 100 Felda settlements across different states in Malaysia.
- Residential area with 600 households, palm oil plantation, and a crude palm oil processing industries.
2. Scenario Analysis

**SCENARIO 1**

- 600 households, which pays RM 4000/month for tipping fee
- Total waste produced is approximately 33.3 ton/month
METHODOLOGY

2. Scenario Analysis

SCENARIO 2
A community composting is implemented in FTA based on a collaborative model

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Findings and Results  
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3. Community engagement and workshop sessions

- Build consensus on establishing the composting site as a joint project
- Cost co-sharing
- Responsibility identification
- Drafting of memorandum of understanding
- Compost site selection
- Overall implementation from 3R practices, food waste segregation, waste collection till the completion of composting process.
- ENGAGEMENT WITH RECYCLER
- PROF FUJIWARA, OKAYAMA UNIVERSITY

VISIT TO SITE
(before construction)

25.9.2014
3R CAMPAIGN & COMPETITIONS

- 3R Campaign
- Waste Segregation Competitions among 10 blocks of residents
- Co-organise with IRDA

1.11.2014
Construction of Site (USD6000)

7 Km from the Community, in a Oil palm Plantation

25.9.2014 (BEFORE)

3.12.2014 (AFTER)
LAUNCH OF PROJECT

- By UTM Vice Chancellor, Prof Datuk Ir. Dr Wahid bin Omar
- Representatives from Felda HQ, IRDA, and University Community Transformation Centre (Ministry of Education)
- Attendees: 300 (from Community), 40 (from UTM), 20 from the Media and UCTC MOE

11.12.2014
PUBLICITY

NATIONAL NEWS:
Sinar harian, Nasional & Astro Awani
➢ TO PROMOTE Felda Taib Andak as Low Carbon Society
COOPERATION WITH CRUDE PALM OIL FACTORY

- SOURCE OF BIOMASS FOR COMPOSTING
- 2.4 ton/MONTH OF EFB (EMPTY FRUIT BUNCH, shredded form)
- USD3/TON (If need in big quantity)

21.1.2015
WORKSHOP: Food Waste Segregation

- Involved 124 houses in Seelong area
- Detailed instruction + Demo
- Attended by 30 households

9.2.2015
TRAINING ON FOOD WASTE SEGREGATION

- Attended by **30 residents** of Seelong Block
- The 1st collection for food waste: 11.2.2015
- 35 Households joined as Volunteer for food waste segregate
- 35 members joined Felda Taib Andak LCS (FTA-LCS)
BORANG PENYERTAAN SEBAGAI SUKARELANAN KERJA PENGASINGAN

SISA MAKANAN DI KAMPUNG FELDA TAIB ANDAK, KULAIJAYA

1. NAMA PENJAJAH: BTH S/J JAHANAN BT JAHANAH
2. NO. KAD PENGENALAN: 520907-01-5142
3. ALAMAT RUMAH: 30 PET 1-4 FELDA TAIB

POSEID: _______________________

4. NO. TEL.PURASAN: 07-6549780
5. NO. H/P: 07-6542341
6. PENDIRAI:

7. NO. TEL.PEJABAT:

8. NO. FAX:

9. ALAMAT E-MAIL:

Penyertaan adalah terbuka kepada semua penduduk FELDA yang menetap di Felda Taib Andak, Kulaijaya. Program ini bertujuan untuk mempromosikan dan melibatkan kepada penduduk FTA mengenai cara-cara pengasingan sisa-sisa makanan yang berasal dari rumah untuk dijualkan buah kompos.

Artara tentera pengasian program ini adalah:
1. Membantu penduduk kepada warga penduduk FTA tentang kepentingan pengasingan sisa-sisa makanan.
2. Mengasah dan memberi pengalaman kepada penduduk FTA apabila dianggap mungkin
3. Menginjakkan pengetahuan dan kemahiran
4. Menginjakkan pengetahuan sambung kompos
5. Menginjakkan pengetahuan sambung kompos
6. Bapak yang manfaatkan sambung kompos untuk dianggap buah kompos
7. Boleh memanfaatkan sambung kompos untuk dianggap buah kompos
8. Boleh memanfaatkan sambung kompos untuk dianggap buah kompos
9. Boleh memanfaatkan sambung kompos untuk dianggap buah kompos

10. SEBAWA ANU FELDA-FTA SAYA BERNYATI UNTUK MENYERTAI PROGRAM SEPERTI BERikut:

- Memanfaatkan sambung kompos
- Membantu kerja-kerja pengasingan sisi-sisi makanan untuk dianggap buah kompos
- Melakukan kerja-kerja pengasingan di kawasan Felda Taib Andak
- Menyertai program latihan pembangunan Felda Taib Andak sebagai Kampung Kendah Karbon di tempat lain
4. Data Collection

A typical routine of the composting process is followed by collecting the food waste segregated by 30 residents in Block Seelong (10/8) and shredded EFB waste (up to 2t/mth) was supplied by the CPO factory.
IN OPERATION

Food waste collection (60kg/day average) from 30 households

12.2.2015

Mixed food waste and shredded palm Empty Fruit Brunch (EFB)

Layers of compost was completed and sealed with canvas to avoid wild animals
Weighing of Food Waste

EFB collected from FGV Kulai Factory

- The prepared first piles of compost containing food waste and shredded EFB
4. Data Collection

Human capacity building

- Infrastructure (piping system, road)
  - Equipment purchase
  - Site Construction
- Fixed Cost

Carbon emission

- Fuel & Transportation
- Raw material (EFB)
- Utility cost
- Site Rental
- Manpower
- Scheduled maintenance
- Sample Analysis
- Miscellaneous cost

Variable Cost

Environment impact analysis

Financial impact analysis

- Cost of Compost (RM/kg)

30 households

Problem Statement

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## FINDINGS AND RESULTS

<table>
<thead>
<tr>
<th>Cost items</th>
<th>RM/yr</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Capital Expenses</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site Construction</td>
<td>952</td>
<td>RM 19,032 for 20 years</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>150</td>
<td>RM 3,000 for 20 years</td>
</tr>
<tr>
<td>Engagement and Workshop sessions</td>
<td>700</td>
<td>RM14,000 was spent during the 1-yr project with intensive activities</td>
</tr>
<tr>
<td><strong>Total Capital Expenses</strong></td>
<td>1,802</td>
<td>Capital cost was normalised for 20 years</td>
</tr>
<tr>
<td><strong>Operating Expenses</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maintenance</td>
<td>1,000</td>
<td>For transportation vehicles, site, miscellaneous.</td>
</tr>
<tr>
<td>Utility</td>
<td>0</td>
<td>No electricity is required. Rain water harvesting to collect the water.</td>
</tr>
<tr>
<td>Manpower</td>
<td>36,000</td>
<td>1 site manager and 2 workers</td>
</tr>
<tr>
<td>Raw material</td>
<td>240</td>
<td>RM10/t of EFB; 2t/mth</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>5,148</td>
<td>Canvas, EM, and garden tools</td>
</tr>
<tr>
<td>Compost Analysis</td>
<td>18,871</td>
<td>For compost quality testing for C/N ratio, pathogen test, proximate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>analyses and germination tests</td>
</tr>
<tr>
<td>Transportation cost &amp; fuel</td>
<td>12,000</td>
<td>Actual cost is estimated as RM2000/month, although in this study</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RM6,000 was spent as the cost was co-shared with the community</td>
</tr>
<tr>
<td><strong>Total Expenses for Scenario 2 (RM)</strong></td>
<td>75,161</td>
<td></td>
</tr>
</tbody>
</table>

**Total compost produced (t/yr)**: 18

**Production rate**: 1.5t/mth

**Cost of compost (RM/t)**: 4,175

**Cost of compost (RM/kg)**: 4.18 (about 1 euro/kg)
## Economic analysis

<table>
<thead>
<tr>
<th></th>
<th>Scenario 1</th>
<th>Scenario 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Residents</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amount of domestic waste (t/yr)</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>Organic waste (%)</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>Organic waste segregated for composting (%)</td>
<td>0</td>
<td>90</td>
</tr>
<tr>
<td>Total waste to landfill (t/yr)*</td>
<td>24</td>
<td>11</td>
</tr>
<tr>
<td>Waste tipping fees (RM/yr)</td>
<td>2,400</td>
<td>1,100</td>
</tr>
<tr>
<td><strong>Oil palm plantation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amount of purchased chemical fertiliser (t/mth)</td>
<td>3</td>
<td>1.5</td>
</tr>
<tr>
<td>Amount of purchased chemical fertiliser (t/yr)</td>
<td>36</td>
<td>18</td>
</tr>
<tr>
<td>Application of compost (t/mth)</td>
<td>0</td>
<td>1.5</td>
</tr>
<tr>
<td>Application of compost (t/yr)</td>
<td>0</td>
<td>18</td>
</tr>
<tr>
<td>Purchase of chemical fertiliser (RM/yr)</td>
<td>36,000</td>
<td>18,000</td>
</tr>
</tbody>
</table>
Expected Economic Benefits in Felda Taib Andak

Residents: Waste tipping fees
Without Composting: RM 2,400
With Composting: RM 1,100
- 54%

Plantation: Cost of Chemical Fertilizer
Without Composting: RM 36,000
With Composting: RM 18,000
- 50%
# Environmental Impact Assessment

## Scenario 1

<table>
<thead>
<tr>
<th>Items</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methane correction factor, MCF (fraction)</td>
<td>0.6</td>
</tr>
<tr>
<td>Fraction of degradable organic carbon in the waste, DOC (weight fraction)</td>
<td>0.15</td>
</tr>
<tr>
<td>Fraction of DOC that decomposes, DOC_f (weight fraction)</td>
<td>0.5</td>
</tr>
<tr>
<td>Fraction of methane in landfill gas, F</td>
<td>0.5</td>
</tr>
<tr>
<td>Stoichiometric factor, SF</td>
<td>16/12</td>
</tr>
<tr>
<td>Methane generation potential, Lo (t CH₄/t waste)</td>
<td>0.03</td>
</tr>
<tr>
<td>Methane generation potential, Lo (kg CH₄/t waste)</td>
<td>30</td>
</tr>
<tr>
<td>CO₂ generation potential from landfill site (kg CO₂e/t waste)</td>
<td>630</td>
</tr>
<tr>
<td>CO₂ generation potential from transportation (kg CO₂e/t waste)</td>
<td>844</td>
</tr>
<tr>
<td>Total GHG emissions potential (kg CO₂e/t waste)</td>
<td>1,474</td>
</tr>
</tbody>
</table>
# Environmental Impact Assessment

## Scenario 2

<table>
<thead>
<tr>
<th>Items</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diesel consumption due to transportation (l)</td>
<td>150</td>
</tr>
<tr>
<td>CO₂ emissions due to diesel consumption (kg CO₂)</td>
<td>402</td>
</tr>
<tr>
<td>Petrol consumption due to transportation (l)</td>
<td>100</td>
</tr>
<tr>
<td>CO₂ emissions due to fuel consumption (kg CO₂)</td>
<td>231</td>
</tr>
<tr>
<td>Total emission due to transportation (kg CO₂e)</td>
<td>633</td>
</tr>
<tr>
<td>CO₂ generation potential for transportation (kg CO₂e/t waste)</td>
<td>422</td>
</tr>
<tr>
<td>CO₂ generation potential for composting process (kg CO₂e/t compost)</td>
<td>88</td>
</tr>
<tr>
<td>Total GHG emissions potential (kg CO₂e/t compost)</td>
<td>510</td>
</tr>
</tbody>
</table>
Environmental Impact Assessment

Scenario 1 (landfill) = 1,474 kg CO₂e/ t waste

65%

Scenario 2 (composting) = 510 kg CO₂e/t waste

The GHG emissions from composting process is mainly based on the data obtained from the literature. Detailed environmental impact need to be further evaluated by collecting on-site emissions data over longer period of time.
• Successfully transfer the technology and knowledge to the community where the good practice of 3R (reduce, reuse and recycling) was also introduced.
• Capacity building for future waste management project
• Future direction- Secure funding to upgrade the composting project and other waste management project
• Future direction- Spin off the model to other FELDA community
THANK YOU

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