WORKSTREAM 2
WASTE FACILITIES
SNAPSHOT - SUMMARY OF WASTE FACILITIES FOR SOLID WASTE MANAGEMENT BY 2020

**VISION**
To establish targeted future operating model for waste integrated facilities

**STRATEGY**
To make Johor State as test bed in establishing comprehensive waste management model and replicate the operation model into other states in Malaysia

**SCOPING**
To cover basic infrastructure and treatment facilities for States Under Act 672

**ASPIRATION BY 2020**

<table>
<thead>
<tr>
<th>Sanitary landfills will be in operation</th>
<th>Safe Closure of landfills</th>
<th>Transfer Stations</th>
<th>Integrated Facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>23</td>
<td>44</td>
<td>17</td>
<td>13</td>
</tr>
</tbody>
</table>

**INVESTMENT**

- **RM6.7b** New Required Investment to cover States Under Act 672 (including Basic Infra)
- **RM129.6m** for land acquisition costs for 20 years (to avoid 518 hectares of land)
- **RM16m p.a.** for leachate treatment costs
- **RM5.2bn** Potential savings by government (at business as usual, government may need to fork out RM11.9bn)

**VALUE CREATION**

- **Value to the Government**
  - 220MW potential to generate 220MW renewable energy to serve 631,000 houses per month
  - 631,000 houses
  - 40% waste diversion from landfill

- **Value to the Rakyat**
  - Potential savings on leachate treatment costs,
  - GHG Reduction – potential avoidance of 5.8 million tonnes of CO2, equivalent to 1.2 million cars' emissions on the road per year
  - Creation of more than 2,500 employment

**KEY ENABLERS**
- Reliable waste data studies
- Government readiness on putting in the required RM6.7 billion investment
- The need to establish a dedicated Project Management Team within JPSPN (37 Contract staff - JPSPN; 22 Direct Hire - SWCorp)
- Siting & Zoning (close proximity to demand site)
- Stringent RFP criteria
- New set of skills (HR issues) via knowledge transfer
- Maintenance, Repair, & Overhaul (MRO), and parts companies – supply chain

**NEW REQUIRED INVESTMENT**

- 220MW potential to generate 220MW renewable energy to serve 631,000 houses per month
- 631,000 houses
- 40% waste diversion from landfill
- Potential savings on leachate treatment costs,
- GHG Reduction – potential avoidance of 5.8 million tonnes of CO2, equivalent to 1.2 million cars' emissions on the road per year
- Creation of more than 2,500 employment
Our Problem Statement
Current Solid Waste Facility Management Framework is **NOT sustainable**

Why is our current system would not sustain?....

- Current exercise - 100% direct landfilling
- No single study or policy on waste mapping nationwide
- Waste management is regarded as a ‘Low priority Items’ in government’s planning & budgeting
- Stakeholders in the whole ecosystem is working in silo

Source: Lab analysis
How Are Other Countries Been Doing?
Comparison of waste management structure with other Asia areas

In nutshell - Different jurisdictions adopted a mix of policies and measures in terms of breakdown of recycled, incinerated and landfilled waste. Malaysia is unique in that up until now we have been relying almost 90% on landfills for waste disposal.

* Note: The published Total Solid Waste Recycling rate is 59%. After excluding construction waste, sludge and used slag, the solid waste recycling rate is 48%.
Source: Hong Kong Blueprint For Sustainable Use Of Resources 2013 – 2022
Malaysia aspires to divert 40% of waste from landfill by year 2020. To achieve this, treatment facilities are needed to addressed 30% of total waste capacity.

Thus, 12,410 ton/day (or 30%) waste need to be treated in order to achieve the 40% waste diversion from landfill by year 2020.

- **BAU**
  - Total tonnage: 41,368 tonnes/day
  - 88.8%
  - *Recycling*: 4,137 tonnes/day (10.5%)
  - *Energy Recovery*: 12,410 tonnes/day (30%)
  - *Landfill*: 29,802 tonnes/day (60%)

We apprehend that we need to address this amount of waste tonnage on every single day.

*Recycling includes recyclables items direct sorting at source that are collected by concessionaires.*

Source: Lab analysis
Targeted Solid Waste Operating Business Model:
To have 40% waste diversion from landfill by 2020, the below ‘To-Be’ Model is a prerequisite…

‘Business As Usual’

Generation at source

90% disposal to dumpsite

Transfer Station

Landfill

To-Be – Integrated Waste Management System (IWMS)

Generation at source

10% - 22%

Estimated % direct from source

Recycle material

100%

+2

0% - 12%

Transfer Station

+1

40%

12%

38%

Energy, Byproducts (Recyclables material, compost, bio fertilizers)

60%

50%

36%

Point of waste diversion

** Target of 10% waste diversion from landfill by 2020

Private Informal recyclables collectors

Private Processing Factory

Industry

* Target of 30% waste diversion from landfill by 2020

Source: Lab analysis
Prioritisation is key in selecting the site for establishing an integrated waste facility for the most impact
Targeted ton per day by 2020

Key criteria – to only cover states under Act 672

<table>
<thead>
<tr>
<th>State</th>
<th>Tons per Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kuala Lumpur</td>
<td>3,191 tpd</td>
</tr>
<tr>
<td>Johor</td>
<td>4,633 tpd</td>
</tr>
<tr>
<td>Selangor</td>
<td>3,071 tpd</td>
</tr>
<tr>
<td>Pahang</td>
<td>1,666 tpd</td>
</tr>
<tr>
<td>Melaka</td>
<td>1,340 tpd</td>
</tr>
<tr>
<td>Negeri Sembilan</td>
<td>1,149 tpd</td>
</tr>
<tr>
<td>Terengganu</td>
<td>1,398 tpd</td>
</tr>
<tr>
<td>Penang</td>
<td>1,914 tpd</td>
</tr>
<tr>
<td>Perak</td>
<td>2,693 tpd</td>
</tr>
<tr>
<td>Perlis</td>
<td>191 tpd</td>
</tr>
<tr>
<td>Kelantan</td>
<td>1,295 tpd</td>
</tr>
<tr>
<td>Kedah</td>
<td>2,489 tpd</td>
</tr>
</tbody>
</table>

Site selection criteria:

1. Focus on conurbations & sites with high density population
2. Focus on sites reaching landfill design capacity
3. Focus on sites with land scarcity for new landfill
4. Focus on sites with high waste generation

Source: Lab analysis
Approach Of The Whole Programme Would Be As Follows:

There will be two EVOs...
EVO 1.0 : To have basic Facilities (Sanitary Landfills and Transfer Stations)
EVO 2.0 : To have waste treatment facilities by 2020 in order to mark 30% waste diversion from landfill

...and, the programme needs to be supported by these new additional infrastructures by 2020

Source: Lab analysis
We will begin our journey by taking Johor as our ‘test bed’…

We have also defined key parameters for the ‘To-Be’ Waste Management Operating Model as below:

**Defined key parameters on ‘To-Be’ Operating Model:**

Taking Johor state as ‘test bed’, we concluded that there is a need:

1. To establish an Integrated waste treatment for high density population
2. To establish a min capacity for Integrated waste facility Type A (for feedstock >1,000tpd)
3. To establish facility with feedstock below 1,000tpd – non thermal treatment
4. Transfer station is needed within 30km radius from collection points
5. Bank-ability – financial security is needed in determining business partnership
6. To only cover states that govern under Act 672 as it is a prere requisite implementation criteria to sync up with the IWMS
7. The future required facilities are to be determined based on waste composition pattern at that particular time and location.

**WHY Johor?**
- Data readiness – JPSPN has already engaged formal studies by professional consultant. Thus provide comfort and confidence for test bedding
- Landfills are over ageing, over capacity and critical for treatment

Source: Lab Analysis
While working on Johor Model, the lab also concluded that there is a need for **Regional Waste Centralisation Treatment Facility**, facilitated by localised smaller capacity of transfer stations.

**WHY?**

- To reduce points of **pollution**
- **Better monitoring and enforcement** from related agencies
- Able to **manage risk** at a focal point
- **Eliminate redundancies** in construction and operation of waste facilities
- **Economies of scale** for all key stakeholders in the whole ecosystem (in terms of capacity, and operation costs)
- Reduce worries in findings **land**
- Creation of **centralised market** with sufficient amount of **feedstock** and demand for byproducts (recyclables, energy and other potential related recyclables industries)

*Source: Lab analysis*
JOHOR: ‘To-Be’ Solid Waste Management Facilities Planning by 2020

JOHOR: Targeted Diversion from Landfill is 53%

Legend

<table>
<thead>
<tr>
<th>Source</th>
<th>Waste Facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sanitary Landfill</td>
<td>1</td>
</tr>
<tr>
<td>Integrated Facility A1</td>
<td>1</td>
</tr>
<tr>
<td>Stesen Pemindahan (SP)</td>
<td>8</td>
</tr>
<tr>
<td>Integrated Facility (B)</td>
<td>1</td>
</tr>
<tr>
<td>Integrated Facility (A)</td>
<td>2</td>
</tr>
<tr>
<td>Penghantaran Sisa Belum Proses</td>
<td>n/a</td>
</tr>
<tr>
<td>Penghantaran Sisa Yang Telah Proses</td>
<td>n/a</td>
</tr>
</tbody>
</table>
New Required Investment for States Under Act 672 (annual basis)
(Total required investment is RM6.7bn - including Basic Infra)

<table>
<thead>
<tr>
<th>Nos</th>
<th>2016 (RM ‘m)</th>
<th>2017 (RM ‘m)</th>
<th>2018 (RM ‘m)</th>
<th>2019 (RM ‘m)</th>
<th>2020 (RM ‘m)</th>
<th>2021 (RM ‘m)</th>
<th>2022 (RM ‘m)</th>
<th>TOTAL (RM ‘m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Required Facilities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sanitary Landfills</td>
<td>6</td>
<td>-</td>
<td>90</td>
<td>90</td>
<td>120</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Safe Closure of Landfills</td>
<td>16</td>
<td>-</td>
<td>88</td>
<td>175</td>
<td>193</td>
<td>105</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Transfer Stations</td>
<td>15</td>
<td>75</td>
<td>150</td>
<td>150</td>
<td>75</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Treatment Facilities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integrated Facility (A)</td>
<td>5</td>
<td>-</td>
<td>-</td>
<td>450</td>
<td>750</td>
<td>750</td>
<td>750</td>
<td>300</td>
</tr>
<tr>
<td>Integrated Facility (B)</td>
<td>5</td>
<td>-</td>
<td>-</td>
<td>225</td>
<td>375</td>
<td>375</td>
<td>375</td>
<td>150</td>
</tr>
<tr>
<td>Integrated Facility (A1)</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>150</td>
<td>150</td>
<td>150</td>
<td>150</td>
<td>-</td>
</tr>
<tr>
<td>Land Acquisition</td>
<td>38</td>
<td>-</td>
<td>95</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Planning</td>
<td>-</td>
<td>50</td>
<td>50</td>
<td>52</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>TOTAL (RM ‘million)</td>
<td>125</td>
<td>473</td>
<td>1,292</td>
<td>1,663</td>
<td>1,380</td>
<td>1,275</td>
<td>450</td>
<td>6,657</td>
</tr>
</tbody>
</table>

NOTE: Estimated required investment if to cover all states in West Malaysia would be amounted to RM 9.8 billion

Source: Lab analysis
Consolidated Required New Investment Costs By States and Potential Diversion (for States Under Act 672)

<table>
<thead>
<tr>
<th>NO</th>
<th>STATES</th>
<th>Required Investment</th>
<th>Estimated OPEX per annum</th>
<th>*Forecasted Incoming tonnage to landfill (MT)</th>
<th>Potential Tonnage to be diverted (MT)</th>
<th>Potential Diversion % at landfill</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Johor</td>
<td>RM2,110m</td>
<td>RM263m</td>
<td>4,352</td>
<td>2,295</td>
<td>53%</td>
</tr>
<tr>
<td>2</td>
<td>Melaka</td>
<td>RM630m</td>
<td>RM84m</td>
<td>1,532</td>
<td>1041</td>
<td>68%</td>
</tr>
<tr>
<td>3</td>
<td>Negeri Sembilan</td>
<td>RM410m</td>
<td>RM63m</td>
<td>1,149</td>
<td>595</td>
<td>52%</td>
</tr>
<tr>
<td>4</td>
<td>WP KL</td>
<td>-</td>
<td>RM142m</td>
<td>3,191</td>
<td>850</td>
<td>27%</td>
</tr>
<tr>
<td>5</td>
<td>Pahang</td>
<td>RM1,090m</td>
<td>RM93m</td>
<td>2,618</td>
<td>625</td>
<td>24%</td>
</tr>
<tr>
<td>6</td>
<td>Kedah</td>
<td>RM1,010m</td>
<td>RM153m</td>
<td>3,522</td>
<td>1,105</td>
<td>31%</td>
</tr>
<tr>
<td>7</td>
<td>Perlis</td>
<td>RM300m</td>
<td>RM18m</td>
<td>388</td>
<td>170</td>
<td>44%</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>RM5,550m</td>
<td>RM818m</td>
<td>16,853</td>
<td>6,681</td>
<td>40%</td>
</tr>
</tbody>
</table>

* Forecasted incoming tonnage received at landfill by 2020 at 5% growth per annum

6,681mt of waste representing 16.2% of the total generated waste in West Malaysia (including the states not under Act 672) vs our target of 30%

Source: Lab analysis
3 IMPLEMENTATION OPTIONS:

1ST
JOHOR AS PILOT MODEL
CAPEX: RM2.1 billion
OPEX: RM 263.3 Mil / per year
Diversion: 2,295 tpd

Targeted Diversion: 5.5%

2ND
TO COVER OTHER STATES UNDER ACT 672
CAPEX: RM6.4 billion
OPEX: RM 818.4 Mil / per year
Diversion: 6,681 tpd

Targeted Diversion: 16.2%

3RD
NATIONWIDE (WEST MALAYSIA)
CAPEX: RM9.8 billion
OPEX: RM 1.4 billion per year
Diversion: 12,410 tpd

Targeted Diversion: 30%

Source: Lab analysis
• Reliable waste data studies

• **Govt readiness on putting in the required RM6.7 billion investment**

• **The need to establish a dedicated Project Management Team within JPSPN (37 Contract staff - JPSPN); 22 Direct Hire – SWCorp**

• Siting & Zoning (close proximity to demand site)

• Stringent RFP criteria

• New set of skills (HR issues) via knowledge transfer

• Maintenance, Repair, & Overhaul (MRO), and parts companies – supply chain

Source: Lab analysis
Our True North
To have 40% waste diversion from landfill by 2020

POTENTIAL VALUE CREATION OF RM6.7bn Investment

Value to the Government

| RM79.5m | Potential savings on land acquisition costs for 20 years |
| RM16m p.a | Potential savings on leachate treatment costs |
| RM5.2bn | Potential savings by govt (coz if business as usual, govt may needs to fork out RM11.9bn) |

200MW | Potential to generate of 200MW renewable energy – to serve 400,000 houses per month |

40% | Waste diversion from landfill |

Value to the Rakyat

| 5.8m | GHG Reduction – potential avoidance of 5.8million tonnes of CO2, equivalent to 1.2million of car emission on the road per year |
| 1.2m | |

2,500 | Potential creation of more than 2,500 employment to manage new waste facilities with new skillset in Waste Treatment Technology |

Source: Lab analysis