Palm Oil Mill Emission

- **Raw Material**
  - Fresh Fruit Bunch (FFB)
  - Water

- **Product**
  - Crude Palm Oil (CPO)
  - Kernel

- **By Product**
  - Waste Water
  - Solid Waste
  - Gases waste

- **Palm Oil Mill**

- **Fresh Fruit Bunch (FFB)**

- **Water**

- **Crude Palm Oil (CPO)**

- **Kernel**

- **Waste Water**

- **Solid Waste**

- **Gases waste**
WASTE OF PALM OIL MILL

Palm oil mill process

- Empty Fruit Bunch (EFB)
- Shell
- Fiber
- Waste water
<table>
<thead>
<tr>
<th>Palm Oil Mill Waste</th>
<th>Utilization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Empty Fruit Bunch (EFB)</td>
<td>- Composting&lt;br&gt;- Mulching&lt;br&gt;- Biomass fuel for boiler</td>
</tr>
<tr>
<td>Shell</td>
<td>- Biomass Fuel for Boiler&lt;br&gt;- Briket</td>
</tr>
<tr>
<td>Fiber</td>
<td>- Biomass Fuel for boiler</td>
</tr>
<tr>
<td>Waste water</td>
<td>- Land Application&lt;br&gt;- Composting&lt;br&gt;- Methane Capture ---- for electricity</td>
</tr>
</tbody>
</table>
PRESENT STATUS OF BIOMASS UTILIZATION
Prediction of the total Energy that can be generated from Waste Biomass Palm Oil Industries in Indonesia (Year 2007)

<table>
<thead>
<tr>
<th>Type of biomass</th>
<th>Prediction of energy that can be generated</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(kJ)</td>
</tr>
<tr>
<td>FFB (78,481,000 tons)</td>
<td></td>
</tr>
<tr>
<td>EFB (15,696,200 tons)</td>
<td>$2.95 \times 10^{14}$</td>
</tr>
<tr>
<td>FIBER (10,202,530 tons)</td>
<td>$1.94 \times 10^{14}$</td>
</tr>
<tr>
<td>SHELL (3,924,050 tons)</td>
<td>$7.88 \times 10^{13}$</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$5.68 \times 10^{14}$</td>
</tr>
</tbody>
</table>

Source: Agroindustry Towards Zero Waste for waste management of Palm Oil Industry, MOE Indonesia 2010
Generated Potential Energy

Product capacity: 40 ton FFb/hr or 800 ton FFB/day

- FROM SOLID WASTE

The energy generated from biomass waste utilization equivalent to approximately 154.8 kiloliters of diesel/day

Source: Agroindustry Towards Zero Waste for waste management of Palm Oil Industry, MOE Indonesia 2010
WASTEWATER TREATMENT IN PALM OIL MILL
LIQUID BIOMASS UTILIZATION IN PALM PLANTATION

FFB

Wastewater

Lagoon system
Generated Potential Energy

The potential energy that can be generated from methane gas conversion by utilizing the waste water treatment plant palm oil is about 5.5 liters of diesel equivalent / tonne of FFB.

Product capacity: 40 ton FFb/hr or 800 ton FFB /day

The energy generated from waste water treatment utilization equivalent to approximately 4,400 liters of diesel / day

Source: Agroindustry Towards Zero Waste for waste management of Palm Oil Industry, MOE Indonesia 2010
SMALL AND MEDIUM ENTERPRISES (SMEs) WASTE UTILIZATION (small scale livestock & tofu)
Communal Bio-digester for Tofu Industry
Benefits WWTP Biogas

- 1 kg of soybeans produces 30 liters of gas, then by knowing the production capacity at each tofu industry central, it can be calculated the potential bio-gas generated (LPTP, 2008).

- If 1 family requires 0.5 m³ of biogas, converted to LPG, so that 1 M³ biogas is equivalent to 0.46 kg of LPG, then the potential economic benefits of the substitution or savings can be estimated by multiplying the price of LPG per kg with the volume of bio-gas obtained.
Bio-digester for micro-size livestock
Estimated Benefits Biodigester Cattle

- One head of cattle excreting manure an average of 12 kg per day, while 1 kg of cattle manure produces 40 liters of bio-gas (LPTP, 2008).
- When converted to LPG, 1 M3 biogas is equivalent to 0.46 kg of LPG, the potential economic benefits of the substitution or savings can be estimated by multiplying the price of LPG per kg with the volume of bio-gas obtained.
- The economic benefits have not included the utilization of pulp (sludge) waste to organic fertilizer.
# The Potential Benefit from SMEs Waste Utilization In Indonesia

<table>
<thead>
<tr>
<th>Type of SMEs</th>
<th>Biogas (m³/year)</th>
<th>Economic value (US$/year)</th>
<th>Pollution Load Reduction (ton/year)</th>
<th>Emission Reduction CO₂ (ton/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tofu</td>
<td>34.8 millions</td>
<td>8.4 millions</td>
<td>102.080</td>
<td>0.8 millions</td>
</tr>
<tr>
<td>Livestock (cattle)</td>
<td>3 billions</td>
<td>742 millions</td>
<td>548.000</td>
<td>214.6 millions</td>
</tr>
</tbody>
</table>
KEY MESSAGES

- By doing environmental management from beginning to the end and considering that waste can be utilized by implementation of waste minimization, or the principle of the 3Rs (reduce, reuse, recycle) as well as through the implementation of technology conversion within its industry or other industry, therefore palm oil industry has zero waste discharge potential.

- Potential biomass from oil palm industry in Indonesia should be managed in an integrated system using the right technology to be used as renewable and sustainable energy in order to obtain economic value as well as environmentally friendly.
The biogas captured from waste tofu industry and cattle manure will not only mitigate the local and global pollution, but could either be combusted for cooking and lighting and heating of hot water for small households which can reduce reliance to fossil fuel.
THANK YOU