Local initiatives towards zero waste in Phitsanulok Municipality, Thailand

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- 18.26 km$^2$ of municipal area
- 24,000 households
- 90,000 registered population
- 50,000-100,000 non-registered
- Waste generation in 2011 is about 76 tonnes/day
- Estimated waste composition is 40% organic, 40% recyclables, 20% others
IGES-SCP
Phitsanulok zero waste model

Driving force of the zero waste policy in Phitsanulok Municipality

- Rapid increase of waste generation (1.5 kg/person/day)
- The municipality changed open dumping sites very often and each time the distance from the town to dumping site is further
- Increase social resistant from local community on disposal sites
- Land price is increasing

Improvement of municipal solid waste management toward zero waste landfill

- **Started in 1996 with support from GIZ** (Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH)
- **Aimed for zero waste landfill since 2007**
- Introducing the 3Rs (reduce, reuse, recycle) based on voluntary basis
- Introducing polluter pay principle
- Introducing community based waste management and public participation
  - Avoiding use of non-biodegradable and promoting reuse
  - Household and community composing
  - Recyclable waste separation for sale
- Applying mechanical biological treatment (MBT) prior to sanitary landfill
- Converting plastic to oil (not fully operated yet)
Phitsanulok Model on municipal solid waste

**Household waste**

- Sellable Materials
  - Organic Waste
    - Sell by residents
  - Hazardous Waste
    - Storage
    - Incineration by hospital
  - Infected Waste
    - Mechanical biological treatment (MBT)

**Disposal**

- Waste to be
  - Screened
    - Daily cover
    - Refuse Derived Fuel

**Community Base Solid Waste Management (CBM)**

**Examples of awareness raising campaign and training on community based waste management**

- CBM training for communities
- Mobile awareness raising program
- Promoting reducing use of plastic shopping bag

Source: Phitsanulok Municipality

Photo: Suthi Hantrakul
Promoting recycling business

- Involvement of waste buyers since the beginning of project development process.
- Active interaction with residents (e.g. door knocking program) and other stakeholders.
- Involvement of educational institutes (schools, university).
- Continuous awareness raising and follow-up activities.
- Facilitating the mechanism of waste separation for sale and regulating the environmental and health impacts, without interfering with the business mechanism.
- Introduction of waste bank program
- Free market competition = many waste buyers.

Participatory recycling business model in Phitsanulok, Thailand

**Municipality:** Initiator, Motivator, Facilitator, Regulator and Inspector

**Waste buyers and sorting facility:** Wongpanit

- Active recyclable waste collectors, waste buyers and waste circulators

**Residents**
- Operate waste banks
- Join waste market events
- Sell household waste

**Waste pickers and buyers**
- Act as volunteers for environments
- Buy recyclables and sell sorting materials to recyclers

- Train waste pickers and itinerant waste buyers on environment, health, waste sorting techniques, etc

Motivate and encourage residents on recyclable waste separation for sale
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Common flows of recyclable waste under free market conditions in Phitsanulok Municipality

Residents
- Waste banks
  - Community
  - Schools
    - Students
  - Waste banks
    - Waste pickers at dumpsite
    - Waste collection crews
    - Itinerant waste buyers
      - Junkshops
        - Waste sorting and dismantling facility (private)
          - Recyclers (private)

Main flow ➔ Other flow

Price of recyclable materials is fluctuated but mostly increase

Note: Domestic price of recyclable materials in Thailand (Wongpanit’s price)
1 unit = 1 kg for most of materials expect for E-waste and glass
Benefits of sustainable recycling business

- **Municipality**
  - Reduce waste for disposal
  - Reduce environmental impact
  - Extend lifetime of landfill
  - Reduce budget for WM
  - Get more WM fee from residents

- ** Residents**
  - Earn from selling waste
  - Can pay waste fee to municipality

- **Waste pickers**
  - Work in better conditions (health and social status)
  - Upgrade to itinerant waste buyers

- **Junkshops**
  - Earn more from larger quantity and variety of sellable waste

- **Waste sorting facility**
  - Earn more from larger quantity and variety of sellable waste

- **Benefits for all**
  - Reduce waste for disposal
  - Reduce environmental impact
  - Extend lifetime of landfill
  - Reduce budget for WM
  - Get more WM fee from residents
  - Earn from larger quantity and variety of sellable waste
  - Expand to international market
  - Work in better conditions
  - Earn more from larger quantity and variety of sellable waste
  - Work in better conditions (health and social status)
  - Upgrade to itinerant waste buyers
  - Earn more from larger quantity and variety of sellable waste
  - Expand to international market

Sustainable organic waste management: household and community composting
Changes in MSW to landfill site after introducing the 3Rs in Phitsanulok, Thailand

The business sector
- Increase recyclable materials available for the production side
  - Quantity of recyclables increased
- Increase business opportunity
  - Numbers of junkshops increased (4 → 9 shops)
  - Numbers of tricycle waste buyers increased
  - Numbers of waste pickers decreased (240 → 70)

The residents
- Earn from selling recyclable wastes
  → (3.3-13.3 USD/month)
- Possible to pay for waste management fee
  (1 USD/month)
**IGES-SCP**  
*Phitsanulok zero waste model*

### Mechanical - Biological Waste Treatment prior to sanitary landfill

**Area:** 35.2 hectares

- Homogenizing and forming the pile
- Passive composting for 9 months
- Compost like product
- Plastic

### Conversion of plastic to oil

**Refuse Derived Fuel : RDF**

**Pyrolysis**

**Source:** Phitsanulok Municipality
Achievement of zero waste target

Before 3R implementation

142 ton/day of waste for landfill (100%)

3R implementation

- 46.5% waste reduction by reducing use of plastic bag, use reusable packaging, selling recyclable wastes, composting, etc.

76 ton/day of waste for collection by municipality (53.5%)

100%

MBT

64% reduction

27.4 ton/day of inert waste (19.3%)

5.1% landfill

2.6% MBT cover

11.6% Pyrolysis

Reduction of GHG emissions (Lifecycle approach)

→ 78 t/d of waste (2010)
→ 87% emission reduction (LCA), or
→ 84% emission reduction on the waste sector (avoided landfill)
### GHG emissions from material recycling (rough estimation)

<table>
<thead>
<tr>
<th>Recyclables</th>
<th>Weight (t/d)</th>
<th>GHG emissions per tonne (tCO₂eq)</th>
<th>Total emissions (tCO₂eq/d)</th>
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<tbody>
<tr>
<td>Paper</td>
<td>8.7</td>
<td>-2.08</td>
<td>-18.0</td>
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<tr>
<td>Plastic</td>
<td>5.4</td>
<td>0.25</td>
<td>1.4</td>
</tr>
<tr>
<td>Aluminium</td>
<td>1.4</td>
<td>-12.08</td>
<td>-17.4</td>
</tr>
<tr>
<td>Steel</td>
<td>5.0</td>
<td>-1.85</td>
<td>-9.3</td>
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<tr>
<td>Glass</td>
<td>15.5</td>
<td>-0.46</td>
<td>-7.1</td>
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<tr>
<td><strong>Net</strong></td>
<td><strong>36</strong></td>
<td></td>
<td><strong>-50.5</strong></td>
</tr>
</tbody>
</table>

Phitsanulok Municipality contributes to avoidance 50.5 tCO₂eq/day when compare with non-recycling

If this emission is included, the Municipality can achieve zero GHG emissions (LCA).

Note: Suchada et al., (2003), approximate composition of collected recyclables by various participants in the municipality is 24% paper, 15% plastic, 43% glass, 4% aluminium and 14% steel.

### Conclusion

- Phitsanulok Municipality has gradually achieved the zero waste target through the 3Rs implementation, polluter pay principle, public participation, pre-treatment prior to landfill and pyrolysis
- The remaining waste to landfill is approximately 5%
- Further action is required but cost and economic incentives is a critical issue.
Transfer of software technology to Battambang City, Cambodia

- Started in July 2012 with financial supports from the Ministry of Environment of Japan under a New Market Mechanism Program (carbon market)
- IGES and Phitsanulok Municipality provided technical supports
- Implementation in October 2012 with multi-stakeholders engagement: City Government, NGOs, Waste collection company, and Market committees.