Local initiatives towards zero waste in developing countries: Learning from Phitsanulok Municipality, Thailand

Janya Sang-Arun
Policy researcher
Sustainable Consumption and Production Group
Institute for Global Environmental Strategies (IGES)

IGES-SCP
Phitsanulok zero waste model

Geographical location
Overview of municipal solid waste management in Thailand

- Thailand has about 67 million people
- Waste generation is 16 million tonnes/year
- Waste composition is 64% organic waste, 30% recyclables, 3% hazardous waste, and 3% others
- 80% of waste is collected
- Only 35% of generated waste is properly disposed
- 26% of waste was recycled and recovery (as of 2011)

Source: PCD 2012
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 1997 with support from GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH)
- Introducing the 3Rs (reduce, reuse, recycle)
- Introducing community based waste management and public participation
- Introducing polluter pay principle
- Promoting household and community composting
- Promoting recycling business
- Applying mechanical biological treatment (MBT) prior to sanitary landfill
- Converting plastic to oil (not fully operated yet)
- Aimed for zero waste landfill since 2007
Phitsanulok Model on municipal solid waste

Household waste

- Saleable Materials
  - Sell by residents
- Organic Waste
  - Household composting
- Hazardous Waste
  - Storage
- Infected Waste
  - Incineration by hospital
- Waste to be Disposal
  - Mechanical biological treatment (MBT)

Community Base Solid Waste Management (CBM)

Disposed by Private

Screening

- Daily cover
- Refuse Derived Fuel

Source: Phitsanulok Municipality

Implementation

- Based on a voluntary basis
- Reducing use of plastic bag by using reusable containers for shopping and carrying food
- Campaign to encourage residents separate recyclables for sale
- Collaborating with waste buyers
- Promoting household organic waste composting
- Implementing a mechanical-biological treatment (MBT) and segregation of plastic from MBT for pyrolysis (liquid fuel-diesel, gasoline)
Examples of awareness raising campaign and training on community based waste management

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:**
Active recyclable waste collectors, waste buyers and waste circulators

**Motivate and encourage residents on recyclable waste separation for sale**

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

**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

**Common flows of recyclable waste under free market conditions in Phitsanulok Municipality**

- Residents
- Waste banks
- Community
- Schools
- Students
- Waste pickers in town
- Itinerant waste buyers
- Junkshops
- Waste sorting and dismantling facility (private)
- Recyclers (private)

Main flow: Waste pickers in town → Itinerant waste buyers → Junkshops → Waste sorting and dismantling facility (private) → Recyclers (private)

Other flow: Students → Waste banks → Schools → Waste pickers at dumpsite → Waste collection crews → Recyclers (private)
Benefits of sustainable recycling business

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

Benefits for all

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

Municipality

- Earn more from larger quantity and variety of sellable waste
- Expand to international market

Waste sorting facility

- Earn more from larger quantity and variety of sellable waste

Junkshops

- Work in better conditions
- Earn more from larger quantity and variety of sellable waste

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

Itinerant waste buyers

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

Benefits of sustainable recycling business

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

- Waste to be collected was decreased from 1.5 kg/person/day to 0.9 kg/person/day
- Reducing frequency of waste collection from a daily basis to every two days
- Reducing cost for waste collection and disposal (210,000 USD/year)
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%)

2.6% MBT cover ➔ 11.6% Pyrolysis ➔ 5.1% landfill

Reduction of GHG emissions (Lifecycle approach)

→ 78 t/d of waste
→ 87% emission reduction (LCA), or
→ 84% emission reduction on the waste sector (avoided landfill)

GHG emissions (tCO2eq/yr):

- Transportation
- Operation Integration
- MBT
- Pyrolysis
- Conventional sanitary landfill

Baseline ➔ Integration ➔ MBT ➔ Pyrolysis ➔ Sanitary landfill

-54% reduction
**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>
</tr>
</thead>
<tbody>
<tr>
<td>Paper</td>
<td>8.7</td>
<td>-2.08</td>
<td>-18.0</td>
</tr>
<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>
</tr>
<tr>
<td>Glass</td>
<td>15.5</td>
<td>-0.46</td>
<td>-7.1</td>
</tr>
<tr>
<td>Net</td>
<td>36</td>
<td></td>
<td>-50.5</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% aluminum 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%
- Phitsanulok Municipality may need advance technology such as incineration and ash recycling to achieve zero waste landfill, however this technology is too expensive for developing countries.