# Institute for Global Environmental Strategies

## “Lesson Learns from Japanese Practices for Urban Waste Utilization”

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# 1. Objects and Contents of the Presentation

## Objects

- To learn the utilization of waste in urban sectors by seeing the Japanese practices
- To consider what can be to energy/materials from urban sectors in Cambodia?

## Contents

1. Objects and contents of the presentation
2. Urban Area and Biomass Utilization
3. Biomass town categorization
4. A Case of Composts from Organic Wastes
5. A Case of Biogas from Organic Wastes
6. A Case of Biodiesel from Waste Cooking Oils
7. Urban waste in Cambodia
8. A case of gasification from rice husk in Cambodia
9. Summary and Keys of success

# 2. Urban Area and Biomass Utilization

◆Urban area is the engine for the development and produces wastes from its activities.

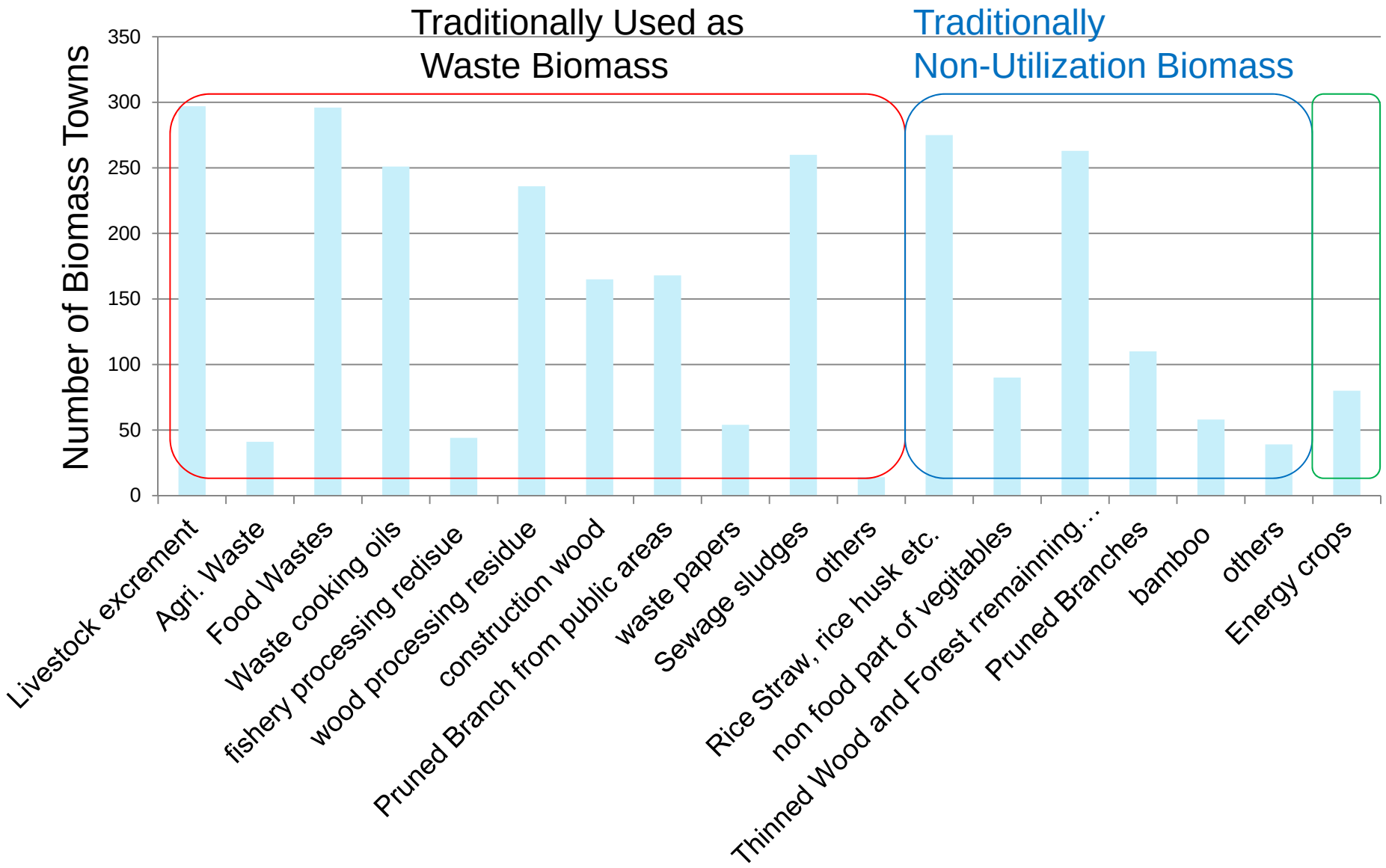
◆There are several cases the wastes from urban can be utilized for material and energy use by doing both urban waste management and GHG reduction.

◆Japanese Practice: Biomass Town
a community which utilizes biomass with strong ties among a community and local stakeholders.
318 town (2011. July)

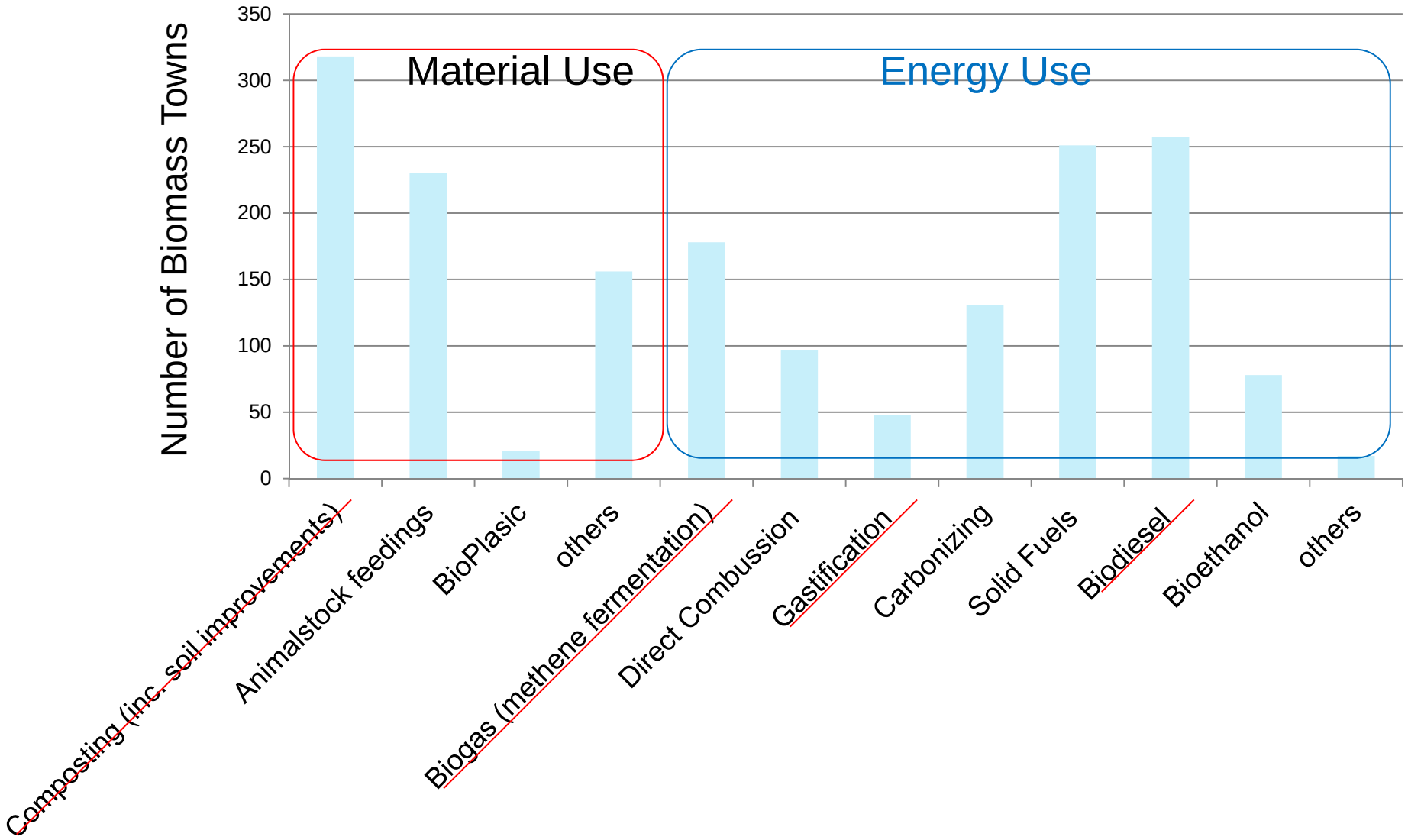
◆This biomass is included waste from urban activities.

◆This biomass can be included agro waste.

# 3. Biomass town categorization (Biomass Source)

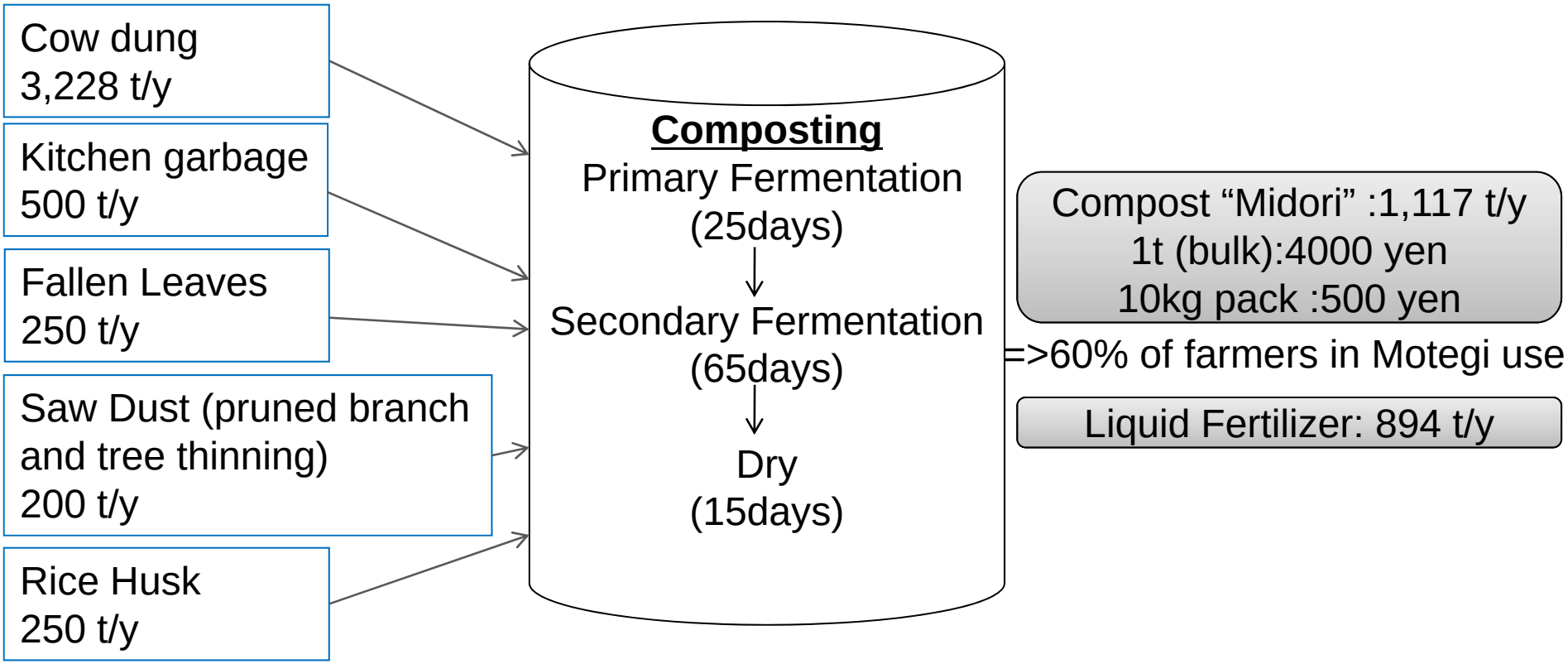


# 3. Biomass town categorization (Transforming Tech.)



# 4. A Case of Composts from Organic Wastes

Motegi Town, Tochigi Prefecture (Population：16,400,  Area: 172 km2)




Source:
Mogi Town Biomass Plan

# 4. A Case of Composts from Organic Wastes (cont.) :Simple CO2/CH4 emission reduction

Kitchen garbage
500 t/y

Fallen Leaves
250 t/y

Saw Dust
200 t/y

Rice Husk
250 t/y

Cow dung
3,228 t/y

Avoid Incineration => CO2 reduction:

=Waste Amount [t/y]* (1- water %[-])* Carbon% [t-C/t]*44/12[t-CO2/t-C]

=[Kitchen garbage]+[Fallen Leaves]+[Saw Dust]+[Rice husk]

=([500* (1-0.90)*0.442]+ [250*(1-0.80)*0.409]+[200*(1-0.57)*0.518]+[250*(1-0.30)*0.409])*44/12

= **581.8 [t-CO2/y]**

Avoid improper methane fermentation => CH4 reduction:

= [a case of compost]-[a case of pile in field]

= waste amount [t/y]*(coefficient(pile) [t-CH4/t]-coefficient(compost) [t-CH4/t])

= 3,228(0.038-0.00044)

= **121[t-CH4/y]**

In Developing Country…

Avoid methane emission from Landfill of Kitchen Garbage and Pruned Branches

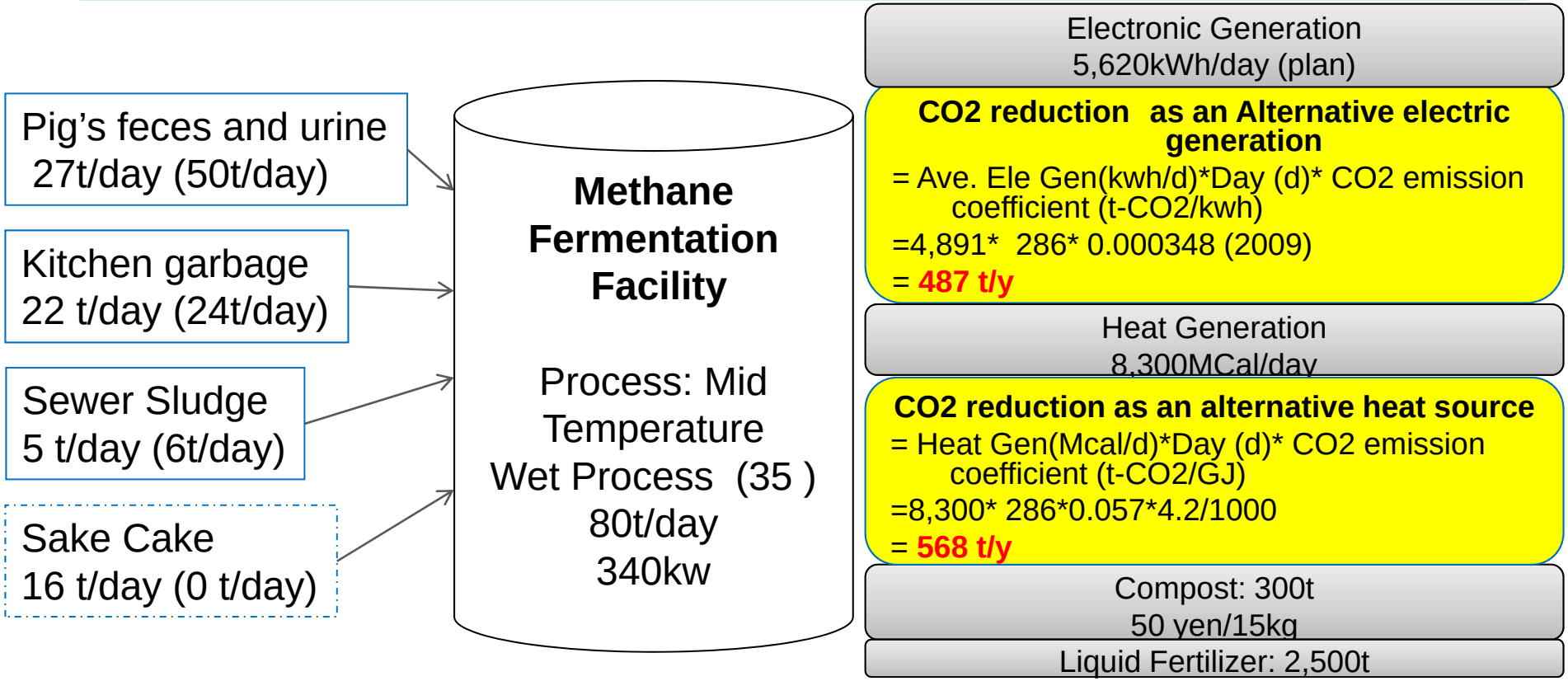
= CH4 reduction: ???

If you are interested, please see this.

**AM0025: Avoided emissions from organic waste through alternative waste treatment processes --- Version 12.0**

# 5. A Case of Biogas from Organic Wastes

Hita city, Oita Prefecture (Population： 72,000,  Area: 666 km2 (82.8 %forest  ))
1.Waste issues on incineration and landfill
2.Global Warming,
3.Environmental Issues of stockbreeding

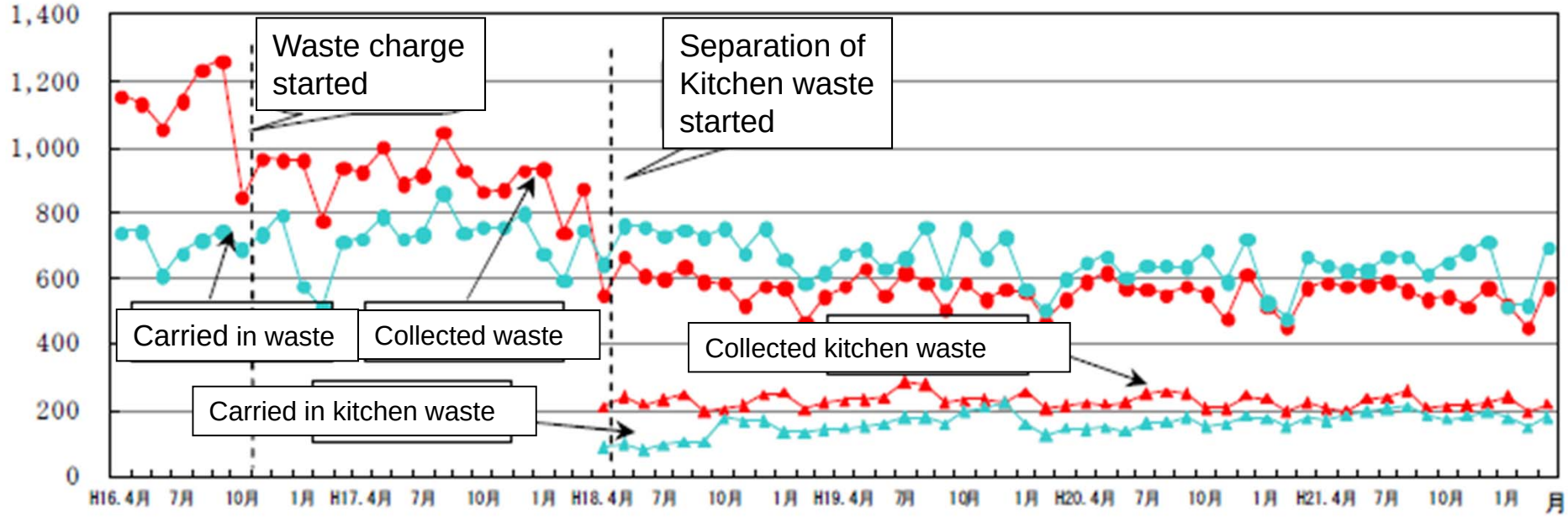



Source: Hita City

**AM0025: Avoided emissions from organic waste through alternative waste treatment processes --- Version 12.0**

# 5. A Case of Biogas from Organic Wastes (cont.)

Waste amount (t)  Monthly Waste Production (burnable waste)

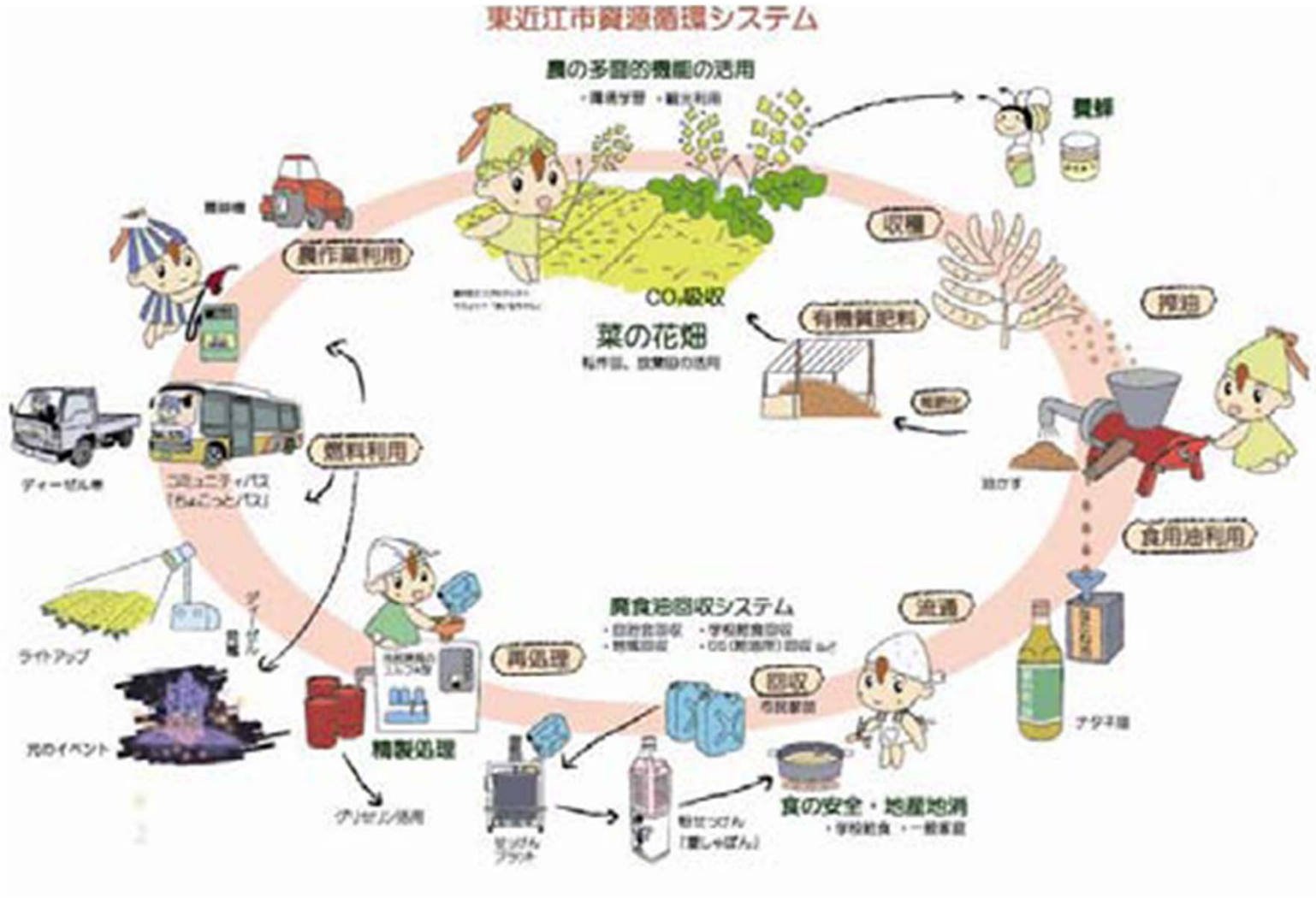



Source: Hita City

➢ succeeded waste reduction after the separation of kitchen waste
From average 900t/month to 600t/month.

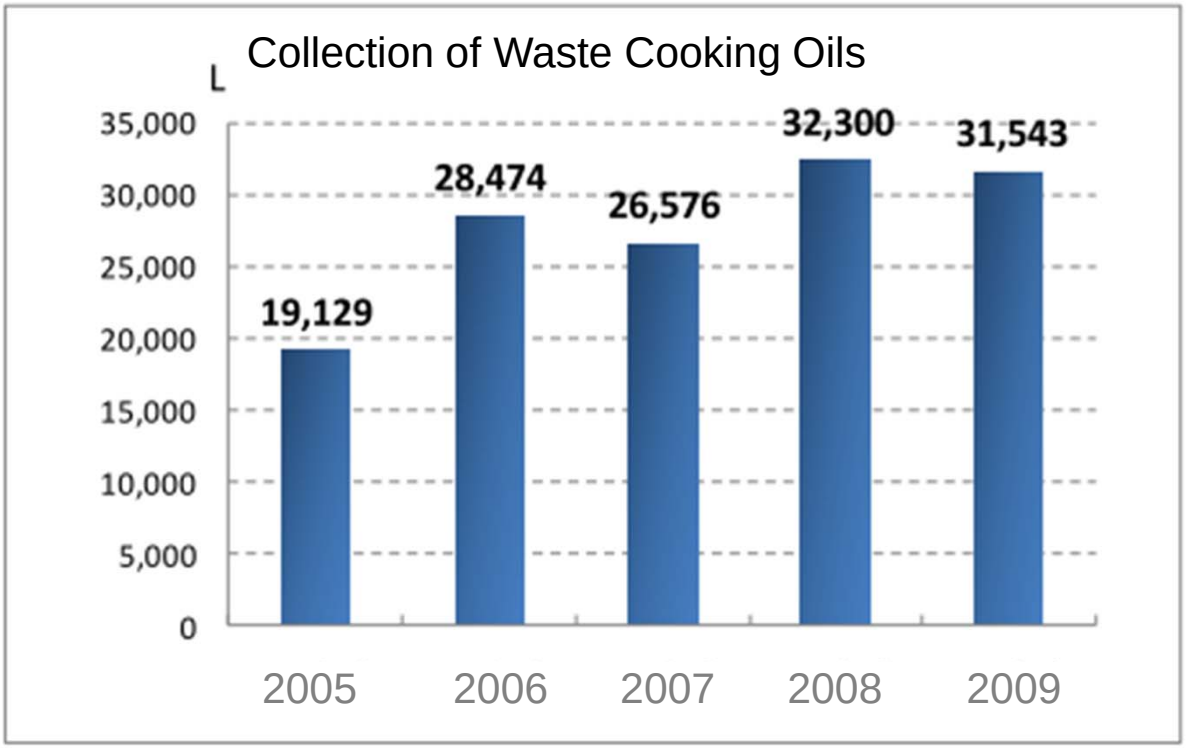
# 6. A Case of Biodiesel from Waste Cooking Oils

Higashi Omi city, Shiga Prefecture (Population： 116,797, Area: 388.58 km2)




Source: Higashi Omi City

# 6. A Case of Biodiesel from Waste Cooking Oils (cont.)




Source:
Higashi Omi City

**CO2 reduction as Diesel Alternative**,
= Biodiesel Production * coefficient of CO2 emission of diesel use
= 25,000 [L/y] * 0.000705 [t-C/L]* 44/12 (g-CO2/g-C)
= **64.6 [t-CO2/y]**

Approved Methodology: ACM0017 “production of biodiesel for use as fuel”

# 7. Urban waste in Cambodia

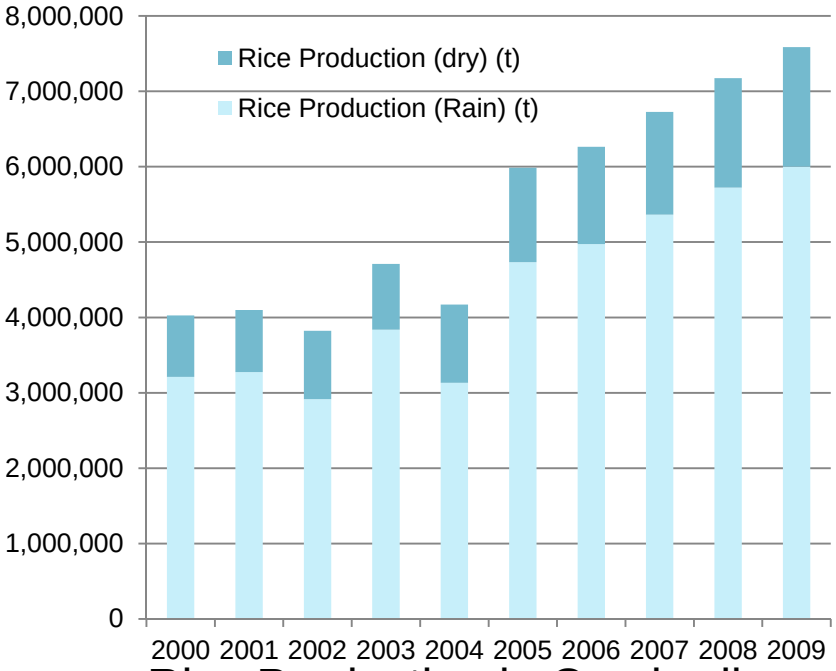
## What can be to energy from urban sectors in Cambodia?

- From Urban Sector
- Kitchen Garbage
- Waste cooking oils
- Sludge etc.
- Agricultural waste
- Animals' feces and urine
- Rice husk and Straw
- Bagasse,
- Coconuts shell
- etc.

## How can we use the biomass?

- Existing facility
- Compost plant
- Biogas refinery
- Gasification facility
- etc.

# 8. A case of gasification from rice husk in Cambodia




Rice Production in Cambodia

- Rice Production is increasing.
- large number of Rice Mill plants and processing amount.
- 22% of processing amount will be rice husk

1,502,000 t/y*0.22 =>
Rice husk production: 330,000t/y.

| City/Province | No. of Rice Mill | Annual Processing amount (t) |
|---|---|---|
| Phnom Penh | N.A. | 1,955 |
| Battambang | 344 | 422,956 |
| Banteay Meanchey | 346 | 79,400 |
| Kampong Cham | 2,134 | 21,678 |
| Kampong Chhnang | 889 | 28,452 |
| Kampong Speu | 5,339 | 114,004 |
| Kampong Thom | 5,514 | 107,376 |
| Kampot | 2,851 | 424,475 |
| Kandal | 1,358 | 32,635 |
| Koh Kong | 8 | 96,827 |
| Kratie | 520 | 49,320 |
| Mondol Kiri | 33 | N.A. |
| Pursat | 1,740 | N.A. |
| Preah Vihear | 36 | N.A. |
| Prey Veng | 2,869 | 13,607 |
| Rattanakiri | 5 | 340 |
| Siem Reap | 1,308 | 53,782 |
| Sihanouk Ville | N.A. | N.A. |
| Stung Treng | 118 | 1,092 |
| Svay Reang | 909 | 26,685 |
| Takeo | 730 | 25,549 |
| Oddormean Chey | 40 | 2,235 |
| Kep | 38 | 67 |
| Pailin | 1 | 300 |
| **Total** | **27,148** | **1,502,735** |

No. Rice Mill and processing amount (Unknown year)

Source: NEDO

# 8. A case of gasification from rice husk in Cambodia (cont.)

- In 2003, small pilot project (7kW) was initiated.
- 200kW rice husk gasification system (Ankhur technologies) with diesel engine was developed.
- 200kW gasifier with rice husks reduced 75% diesel consumption (5,500L/month)
- There are 53 biomass gasifiers in Cambodia for generating electricity for rural electrification or SMES.
- 6kg of Rice husk replaces about 1 liter of diesel.

Source: P.A. Salam et al.(2010)

**CO2 reduction from Diesel Replacement** with a 200kW gasification system
= diesel reduction* coefficient of CO2 emission of diesel use
= 5,500*12 [L/y] * 0.000705 [t-C/L]* 44/12 [g-CO2/g-C]
= **242,000 [t-CO2/y]**

**CO2 reduction potential from Diesel Replacement by rice husk.**
= rice husk production *diesel alternative [L/kg]* coefficient of CO2 emission of diesel use
= 330,000*1000[kg/y]*1/6[L/kg]*0.000705[t-C/L] *44/12 [g-CO2/g-C]
= **142,000 [t-CO2/y]**

# 9. Summary and Keys of success

Summary

- There are several waste biomass in Urban area and several technologies can be applied to the existing waste biomass. Thus, the combination of utilization of waste biomass will be varied in countries, cityies, and towns.
- Cambodia has a high potential of the waste biomass utilization for energy generation, waste management with GHG reduction.

Keys of the Success

- First priority is proper waste management
- Involvement of Stakeholders
- Utilize existing facilities, technology, human resources, and waste management systems
- Separation at source and efficient collection are keys for success


Aw khun