Attachment VIII

Report on Training Workshop on

Capacity Building on Accounting and Utilizing GHG Emission Reduction Measures for Local Waste Management Actors in Developing Asian Countries

4 - 6 October 2011 at Lanxang Hotel

Vientiane Capital, Lao PDR

Reported by

Assoc. Prof. Korakanh Pasomsouk

1. Introduction

Since the green house gas emission is the hot issue not only for the Lao people but for all around the world, the three days workshop on capacity building on Accounting and Utilizing GHG Emission Reduction Measures for Local Waste Management Actors in Developing Asian Countries has been organized in Lanxang Hotel Vientiane Capital City by supporting fund from Ministry of the Environment of Japanese together with the Institute for Global Environmental Strategy (IGES) and Asia-Pacific Network for Global Change Research (APN). The workshop was organized with association of National University of Laos (NUOL), Ministry of Public Work and Transportation (MPWT), and Ministry of Natural Resource and Environment(MONRE).

Fig. 1 The opening remark by Prof. Dr. Boulinh Soysouvanh Dean of Faculty of Engineering NUOL and Mr. Khamthavy Thaiphachanh Director of Housing and Uban Planning MPWT

On the opening ceremony, Prof. Dr. Boualinh Soysouvanh, Dean of faculty of engineering at NUOL, mentioned that the climate change is serious problem which can threaten human survival. Recently Lao people from the north to the south have been faced with high dangerous of the flooding in the cause of the climate change. The climate change is caused of the human activities like cutting trees, increasing more cars on the road, and mishandling municipal solid waste. On behalf of the education sector, we are appreciated a lot, to see that this workshop is organizing with association of MPWT and belief that it will give the new experiences to the all participant especially the Urban Development Administration Authority (UDAA) of each province it will be leading to apply in the local area. He summed up that he hoped this workshop would give the methodology of the estimation of the gas emission from the waste sector. That will be useful in short and long term for the development of solid waste management project in Lao PDR.

2. Summary of the Workshop

The workshop on capacity building on Accounting and Utilizing GHG Emission Reduction Measures for Local Waste Management Actors in Developing Asian Countries was conducted in 3 days (4th- 6th October). In the first day mostly presentations of practical work both from local and abroad were made. Participants have learned from various experience especially the methodology of composting and biogas generation from the organic waste in the centralized and decentralized. The failure and success of the projects in other countries were also introduced. The second day focused the methodology of estimation of GHG emissions from the waste disposal and treatment and assigned group homework. In the last day, each municipal group made presentations its finding solution. During this workshop, all participants were satisfied the workshop content and material. Proceeding hand out which are covered all presentation were distributed. All participants have been conferred the certification of the workshop at the end and the workshop were officially closed successfully.

Fig 2. Participants of Workshop

2.1. Participants and speakers
Total participant is 55 persons

(1). Provincial Participants: 10 persons

No	Name	Province
1	Mr. Chanpheng Philachanh	Khammouan
2	Mr. Bounthong Vanhdy	Khammouan
3	Mr. Phetsamone Keophothisane	Savanaket
4	Ms. Anonglak Keomolakoth	Savanaket
5	Mr. Bounnath Soumpholphakdy	Champasack
6	Mr. vathadeth Kinpounsin	Champasack
7	Ms. Kaisone Keopasert	Luangprabang
8	Mr. Sengkeo Kanhyason	Luangprabang
9	Mr. Phongsavath Sibounmai	Sekong
10	Mr. Sounthone Koulavong	Salavanh

(2). Vientiane Municipality: 14 persons

No	Name	District
11	Mr. Vanh xaiyalat	Vientiane Capital
12	Mr. Bounkham Phakasoum	Vientiane Capital
13	Mr. Khamsouk Saphakdy	Sisattanak
14	Mr. Sone-Amphai Phethvilasone	Sisattanak
15	Mr. Phethanousone Phommavong	Sikottabong
16	Mr. Bounthy Louanglith	Sikottabong
17	Mr. Vixai Lovanhak	Chanthabouli
18	Mr. Chittavong Phanavong	Chanthabouli
19	Mr. Viengkeo Surinyaphone	Saysetha
20	Mr. Aloundeth Phonthamaly	Saysetha
21	Mr. Sengsoulith Sakounsouk	Hatxaifong
22	Mr. Keosisai Sengdala	Hatxaifong
23	Mr. Bounxom Sivongsa	Saythany
24	Mr. Kongseng Dalaseng	Saythany

(3). Ministry and University

No	Name	Organization
25	Prof. Dr. Boualinh Soysouvanh	Faculty of Eng. NUOL
26	Mr. Khamthavy Thaiphachanh	Dept. of housing and Urban planning MPWT
27	Mr. Lonechanh Yangchubulom	Dept. of housing and Urban planning MPWT
28	Mr. ViRachith Douangchanh	Dept. of housing and Urban planning MPWT
29	Ms. Manichan Vorachit	Dept. of Environment, MNRE
30	Mr. Langkone Xaignavong	Faculty of Engineering NUOL
31	Dr. Bounheng Southichak	Faculty of Engineering NUOL
32	Mr. Soukha Phokhasombath	Faculty of Environment NUOL
33	Mr. Soulixay Inthasone	Faculty of Environment NUOL
34	Ms. Vilaiwan Manuch	Supamarin Co. Ltd
35	Ms. Pimporn Manuch	Supamrin Co. Ltd

(4). Lao Speakers 5 persons

No	Name	Organisation
36	Mr. Souphavanh Keovilai	Lao BPP, MAF
37	Mr. Sengdara Douangmyxay	Dept. of housing and Urban planning MPWT
38	Assoc. Prof. Kenchanh Sinsamphan	Faculty of Environment NUOL
39	Mr. Vanxay Bouttanavong	Dept. of Environment MNRE
40	Assoc. Prof. Korakanh Pasomsouk	Faculty of Engineering NUOL

(5). International Speakers 9 persons

No	Name	Organization and Country
41	Dr. Janya Sang-Arun	IGES, Japan
42	Ms. Phiangphen Sriwiroj	Phitsanoulok Municipality Thailand
43	Dr. Murakami EMIKO	IGES, Japan
44	Dr. Yoichi Kodera	AIST, Japan
45	Mr. Yoshiaki Totoki	IGES, Japan
46	Dr. Alice Sharp	SIIT Thailand
47	Mr. Chau Kimheng	COM PED, Cambodia
48	MRs. Rungnapa Tubnonghee	Warinchamrab Municipality Thailand
49	Mr. Sutee Tubnonghee	Warinchamrab Municipality Thailand

(6). Organizing Committee staff

No	Name	Organisation
50	Mrs. Daoheuang Siboriboun	Faculty of Environment NUOL
51	Mrs. Phengsy Boudi Phong	Faculty of Environment NUOL
52	Ms. Phoutkaysone Phommavong	Faculty of Environment NUOL
53	Dr. Valy Vanaladsaysy	Faculty of Environment NUOL
54	Mr. Lemthong Chanphavong	Faculty of Environment NUOL
55	Mr. Phetsakone Bounyanithe	Faculty of Environment NUOL

2.3. Agenda

Day 1 Tuesday 4 October 20011		
8:30 – 9:00	Registration	
9:00 - 9:05	Introduction to the Workshop	- Dr. Janya Sang-Arun, IGES
9:05 - 9:15	Opening Remark	Prof. Dr. Boualinh Soysouvanh Dean of faculty of Engineering NUOL
9:15 - 920	Opening remark	Mr. Khamthavy Thaiphachanh, Director of Department of housing and Urban planning MPWT
9:20 - 9:30	Group Photo	All participants
9:30 - 9:45	Coffee Break	All participants
9:45 - 10:15	Introduction of the Lao government policy on the solid waste management	Mr. Sengdara Duanmyxay Ministry of Public work & Transport
10:15 – 10:45	Introduction of Solid waste Management and Climate change	Dr. Janya Sang-Arun, IGES
10:45 - 11:15	Climate Change and Policy	Mr. Vanxay Bouttanavong MNRE
11:15 - 11:45	Organic Waste Utilization for energy in Laos	Assoc. Prof. Korakanh Pasomsouk NUOL
11:45 - 12:15	Introduction to Lao Biogas Pilot Project (BPP)	Mr. Souphavanh Keovilay Project Director BPP
12:15 - 13:00	Lunch Break	All participants
13:00 - 13:30	Cost and benefit analysis of Biogas use	Assoc.Prof. Kenchan Sinhsumphanh NUOL
13:30 -14:00	Overview of urban organic waste management for climate change in Thailand	Dr. Alice Sharp (Sirindhorn International Institute of Technology)
14:00-14:30	Decentralized composting in municipal solid waste management: Lessons learned from Surabaya City , Indonesia	Dr. Murakami EMIKO IGES
14:30 - 15:00	Centralized Composting	Kim Heng Chau (COMPED)
15:00 - 15:15	Coffee Break	All Participant
15:15 – 15:45	Accounting GHG emission reduction from plastic waste recycling	Dr. Yoichi Kodera (AIST)
15:45 -16:15	Plastic waste conversion to liquid fuel in Thailand. Case study: Warinchamrap municipality	Ms. Rungnapa tubnonghee, Warinchamrab Municipality
16:45-17:15	Plastic recycling	Mr. Suthee Tubnonghee, Warinchamrab Municipality
Day 2 Wednesday 5 October 2011		
8:00 - 8:30	Registration	
8:30- 9:00	Lesson learns fro Japanese practices for Urban Waste tilization	Yoshiaki Totoki, IGES
9:00 -9:30	Mechanical Bio treatment in Phitsanoulok Thailand	Ms. Piangpen Sriwiroj Phitsanoulok Municipality Thailand
9:30 -9:45	Coffee Break	All participants
9:35 - 10:30	Estimation of GHG emission from the waste treatment technology	Dr. Baasansuren Jansranjav (IPCC/TSU) & Dr. Janya Sang-Arun (IGES)
10:30 - 12:00	Group Exercise on estimation of GHG emission	All participants
12:00 13:00	Lunch	All participants
13:00 17: 00	Group Exercise : GHG emission estimation	All participants

Day 3 Thursday 6 October 2011		
8:00 - 8:30	Registration	
8:30 - 11:30	Group's report	All participants
11:30-12:00	Closing Remark	All participants
12:00	Fare well lunch	All participants

3. Summary of Presentation

Topic (1) Introduction of the Lao government policy on the solid waste management
Title: Speaker: Mr. Sengdara Duangmyxay

- The presentation explained about the overview of waste management in Laos especially the waste generation rate is increasing due to population and economic of Laos is increasing. Vientiane was considered as the third biggest city of the higher waste generation in Great Mekong Sub-region (GMS) after Bangkok. But the waste collection and disposal are lacking. Only about 50 to 60% of total generated waste has been collected and transported to landfill.
- The presentation also mentioned about several projects related to waste management such as landfill development project, public campaign project, Village Cleaning day and Red Saturday.
- At the end the presentation was about the Law and regulation related to solid waste management and government policy
- The presentation concluded that the challenges ahead are changing the people's behavior in waste disposal and managing urban sprawl and uncontrolled settlement.

Discussion:

- It is unclear, in Lao PDR, which environment or urban development and planning office is in charge for municipal solid waste disposal.
- The throwing of the waste in the Lao festival is remaining unchanged behaviors of Lao people. The recommendation was that the festival area should install waste bins.
- Since the common method for waste disposal is open dumping, it is very dangerous the waste is flown out in the raining season. The design of landfill is quite good but the construction is not follow by design.

Topic (2). Introduction of Solid waste Management and Climate change
Speaker: Dr. Janya Sang Arun

Three point where introduced in this presentation,

- GHG emission from the waste sector is become important issue such as methane gas emissions from landfill of organic waste and emissions of carbon dioxide from burning of plastic or other waste. However, there is no data in the GHG emission from landfill of organic waste for Lao PDR.
- 3Rs technology can be utilized for improving the solid waste management in Lao PDR. At the same time, the GHG emission will be much reduced through the 3Rs practice. For instance, 20-98% reduction by composting and 60-100% by anaerobic digestion of food waste can be achieved on the solid waste sector. And for indirect reduction, 94%, 80%, 56-64% and 22% by recycling of plastics, recycling of steel, using recycled aluminum and by using of recycled glass can be achieved respectively .

- The Clean Development Mechanism on urban waste management is an alternative financial source, but there are many limitation.

Discussion:

- 3Rs is a basic concept for maximizing resource use before discarding them as a waste. Implementers may breakdown it into 4Rs or 5Rs when they feel more efficient for the local circumstance.

Topic(3). Climate change and policy
Speaker: Mr. Vanxay Boutanavong

- The global warming effect is increasing caused by GHG emission. The major sources of GHG emission are fossil fuel consumption for energy purpose in the industries and transportation, the land used change that includes the deforestation and agriculture and livestock development, solid waste management related emission such as methane from landfill sites and open burning/incineration of waste, etc.
- The climate change is likely to have a significant impact on global environment, economy and society through bigger tropical cyclones, frequent floods, etc.
- The climate change is a global problem. The corporation of all nations around the world is required for the solution. Laos should be the one of the active nations to tackle the climate change.

Discussion:

- There are six Green House Gases (GHG) such as CO_2, CH_4, N_2O, HFCS, PFCs, and SFs.
- In Lao there is OSOL office which is working in GMS.
- Hydro power is also the source of GHG emission when deforestation of upstream are is practiced prior to construction of the dam.

Topic (4). Organic Waste Utilization for energy in Laos
Speaker: Assoc. Prof. Korakanh Pasomsouk

- By having study data of municipal solid waste management in four major cities (e.g. Vientiane, Luangprabang, Savanaket, Champasack) in Lao. Approximately, 350 ton per day of solid wastes are transported to landfill to disposal in 2009. Since 75% of total waste to go to landfill site is organic matter, which can be utilized for energy production. The organic waste (food, vegetable, fruit, etc.) is the main source for generating energy from methane production. In Laos, the traditional methods such as burning in gardens, dumping outside on surrounding area, and throwing in nearby swam and river for the waste disposal are commonly used even in the big city.
- 3Rs techniques can be applied for mitigating GHG emission from the waste sector. The waste separation at source is recommended for all families in the major cities in order to improve the MSW management in Laos. It is possible to collect the organic waste for generating the biogas or making fuel briquette.
- At the end, the speaker showed how to make the biogas from household daily food waste using plastic and steel tanks and how to make fuel briquette from organic waste such as paper, fallen leave, vegetables, saw dust, rice husk, charcoal waste using simple wooden press.

Discussion:

- It is innovative for Laos to utilize the organic waste for energy. However, the utilization of organic matter for energy would require cooperating with households. The problem is that it is difficult for Lao people to change the ideas and the behaviors.
- How to apply this practice to all cities in Lao, if family doesn't have the animal dung, the sugar cane can be replaced it. The output gas can be use for heating or cooking purposes. Human waste from toilet is the best for biogas generation.

Topic (5). Introduction to Lao Biogas Pilot Project (LBPP)
Speaker: Mr. Souphavanh Keovilay

By this topic thee points were presented :

- ➢ Regarding the domestic biogas technology, the speaker introduced various technologies that can be used for generating biogas at households. The components of the biogas plant were also explained. He showed the design of biogas digester, which is used in LBPP.
- ➢ The benefits of domestic biogas are on energy (cooking, lighting, heating), agriculture (improving soil fertility and livestock), Health and social aspects (reducing indoor air pollution, female and child labor, creating employment), and economical aspects (saving money, generating income).
- ➢ LBPP is running the Lao Biogas Pilot Program with association of Ministry of agriculture and forestry since 2007 by supporting of the Netherlands Development Organization (SNV). The main objective of the project is to improve the livelihoods and quality of life of rural families, men and women and to reduce the impact of biomass resource depletion in Lao PDR. The project is divided into two phases. The first phase was from 2007 to 2010 with the target of 2,000 digesters and budget of 1,109,000 EURO. The second phase was from 2011 to 2012, the budget about 550,000 EURO has been allocated with the target of 1,300 digesters.

Discussion

- It is hard to implement the project in cities, because if household wants to build the digester for use, this family should have at least 10 cows. Thus, the project will be suitable only for rural area. At the same time, there are still enough and cheaper traditional energy sources like wood, and charcoal in rural area.
- To build biogas digester with size of $4m^3$, 441USD is required as the budget with around 50% subsidy from the project.

Topic (6). Cost benefits analysis in using of Biogas system in Savanaket province
Speaker: Assoc. Prof. Kanchanh Sinsamphanh

The presentation is about the research findings, conducted by a research team from national university of Laos, Faculty of Environmental science. The main objective of the research is to compare benefits and the cost in the biogas project.

Five points were presented in this topic:

- ➢ Introduction to the study which included justification, objective and outcome of the study
- ➢ Reviewing the data and related topic of other research. The speaker also mentioned about the nature of biogas generation, criteria for selection family to participate the

LBPP, introduction to CDM, and criteria of investment analysis for simple project.

- Methodology for the study included the tool of study, population of study, data formulating, and data analysis.
- The result showed that the biogas project in Suvanaket is significantly cost effective. search findings. Therefore the relevant governmental bodies should promote implementation of biogas digestion at household level in their cities.

Discussion

- The quality of the biogas digesters, built under LBPP project is low because of the goal of the project. The quantity is more important than quality in the project. The project has to reach the target by the number of digesters. It is high risk, because the price of materials (cement) is increasing every day. The cost for building digester is till high when compare to income of Lao family.
- The biogas project can also help to reduce GHG emission.

Topic (7). Overview of Urban organic waste management for climate change mitigation in Thailand
Speaker: Assoc. Prof. Dr. Alice Sharp

Four points were introduced in this presentation:

- The status of waste and waste management systems. The speaker mentioned the statistic of waste generation rate from year 2003 to 2009 in some cities of Thailand. The waste composition table showed that organic waste was the highest portion in the all region of Thailand. The flow of solid waste showed that 84% of total waste (15.16MT) were collectable, considering potentially 80% recyclable. The 40% of collectable waste is disposed by incinerator or landfill and the 60% is improper disposal such as open dump/burning. The generation rate projection by 2022 expected to reach 42,900 Ton/day in Thailand, compare to 41,410 Ton/day in 2009.
- Four Policy frameworks are waste reduction (3Rs), waste to energy, Clustering of Local government and partnerships development with some examples of practices: Phitsanulok - waste management initiative, some MSW power plant, and Rayong ISWM system.
- The speaker showed the concept of the GHG emission inventory
- The keys for the success and recommendation were mentioned like maximized recycle, good management, efficient technology, proper regulation, and private endorsement.

Discussion

- To run the sustainable waste management project will be much depended on the income. Income of the project should collect from recyclable materials.
- In Lao case, privet sectors are interested in the waste to energy projects but they should study more about the generation rate (quantity), characteristic and physical properties of the waste.
- Laos has more potential in hydro power generation.

Topic (8). Decentralized composting in municipal solid waste management: Lessons learned from Surabaya City , Indonesia

Speaker: Dr. Murakami EMIKO on behalf of Dr. D.G. J. Premakumara

In this presentation, three points has been presented:

- Introduction to decentralized composting in municipal solid waste management. Most developing cities are facing tremendous challenge to disposal solid waste in environmental friendly manner. Most common disposal method is open dumping in environmentally unsafe manner. This practice would lead to environmental and health impact, release GHG emission and discourage efficient use of resource. Decentralized approaches for composting are backyard/household composting and community composting center. The comparison between decentralized and centralized composting revealed the decentralized use low and simple technology, low capital, low transportation, and interacts with neighborhood, while the centralized need high capital, high technology and transport, less labor and low interaction.
- Case study of Surabaya City. Solid Waste Management (SWM) became serious environmental issue in Surabaya. Population is about 30 millions. The total waste generation was 1,800 ton per day, the waste collection coverage only 70% and the rest of waste left in streets, ditches and open spaces. Keputih final disposal site was closed due to public opposition and Benowa site was over capacity. Disposal site was not well developed and open dumping and burning were commonly used. Model community in Kampong Rungkut Lor developed under the technical cooperation of Kitakyushu city, Japan. The project developed SWM strategy based on the success of model community. The project provided the necessary supports for starting community composting centers. Sixteen composting centers operate to treat 110 tones of organic waste in the city. The project has achieved about 30% reduction of waste to final dumped by enhanced recycling by removing organic matters from the waste stream (78% of waste reduction from recyclable materials).
- Challenges of GHG emission reduction through decentralized composting were explained based on the social, financial and marketing, technical and institutional and policy issues.
- Based on UNFCC's calculation of emission is found that emission reduction (10 years): 2945 tCO2e. The challenges are time consuming process to get CDM approval, high transaction cost in CDM.

Discussion

It is very good project. It is very difficult to find the market for compost product in Laos.

Topic (9). Centralized Composting
Speaker: Mr. Chau Kim Heng

Four points were introduced in this topic.

- Introduction to COMPED
  COMED is a NGO established in year 2000 with the 18 staff members. The activities are for waste analysis, training and workshop, development guideline, social marketing, and composting.
- Centralized Composting
  The first composting project (2001 -2009) was in Phnom Penh on dumpsite Strung Meanchey 2000m^2. The process treated 5t/day organic waste from market and

produced compost 135t/y.
The second composting project started 2009 on the 8000m^2 next dumpsite in Battabang, able to process organic from market 10t/day.
COMPED selected centralized composting because there is no policy on decentralized, since recycling activities are not integrated in the part of solid waste management, awareness of people is limited and there is no source separation.

- Open windrow turnover composting
  Speaker explained the open windrow turned composting process. Pre-treatment is separation. Manually separation of the waste is carried out by four workers. Pilling up compost heap with the piles 3-5m wide and 1.5 -2 m high. Composting process, temperature of composting process should be 65 to 70^o C, water content is 65%, this process will take 4-6 months. Last process is screening compost and compost product.
- Difficulties and solution
  There is no source separation, no integration of composting for SWM, nobody (stakeholders) feels responsible for delivery the organic waste to the composting facilities. People don't trust the product quality because they think that the product is from the waste and it will impact to environment and health. Thus, it's difficult to find the market to sell the compost.
  COMPED must keep in touch with local government and waste collectors and also try to find the support funds in order to solve the problems.

Discussion

Due to compost product is not certified the quality by the government, people or farmers are not willing to use for agriculture.

Topic(10). GHG reduction through suitable treatment and utilization of waste plastics
Speaker: Dr. Yoichi, Kodera

In this presentation the speaker mentioned three points such as characteristic of waste plastic, lifecycle of plastic and GHG emission, and recycle method of plastic waste.

- Characteristic of the waste is related to the waste composition and the generation rate. The major components of household in Japan are kitchen waste, paper, and plastic. In Japan household responsible doing the separation waste at source into kitchen waste, wood, mixed paper, plastic waste, cans and bottle.
- Waste plastic utilization can be reduced the environmental impact through recycled materials use and the CO2 reduction.
- The life cycle of plastic is: Crude oil to naphtha, Naphtha to ethylene and other, Ethylene to polyethylene and production, plastic product use by consumer, product to waste, and recalling plastic waste for the new product. Regarding the CO_2 reduction by using recycled materials, the method was the explained together with the containers and packaging recycling law in Japan.

Topic (11). Plastic waste conversion to liquid fuel in Thailand. Case study: Warinchamrap municipality
Speaker: Mr. Rungnapa Tubnonghee.

The presentation covered current situation of transforming municipal plastic waste to liquid fuels in Thailand, characteristics and quantities of pyrolytic oil (liquid fuel), and prospect of technology and industry for reforming MPW to useful oil.

- In Warinchamrap, the waste generation rate is 24-25 ton/day. In these waste, recyclable is 20% of total MSW (12.6% of plastic waste). 90% of plastic waste is PE and PP. Most these waste is disposed in landfill.
- There are two processes 1) separation of mixed plastic from municipal solid wastes and 2) pyrolysis of the mixed plastic waste. The process of pyrolysis is de-polymerization into light crude oils, which is called pyrolytic oils.
- The pyrolytic oil from the mixed plastic waste was in a range of group of diesel, kerosene and gasoline. The quality improvement of the pyrolytic oil is carried out by using coagulation technique. Pyrolytic oil can be used with car or truck.

Discussion

- This project can be applied in Laos too but more study about data in Landfill is needed to apply in Laos.
- The by-product of the pyrolytic process can be used as wax.
- Private companies are interesting in the project

Topic (12) Plastic Recycle
Speaker Mr. Sutee Tubnonghee

Plastic waste management and recycling technology were presented in this topic:

- Plastic waste management at source was concerned by zero waste projects. The project found that the plastic bag and plastic packaging are valuable resource collected from households for recycling process. About 2-3 ton of plastic waste per day would be able to be separated from the total municipal solid waste.
- The speaker showed the low cost technology for recycling plastic such as separation and cleaning machine. The plastic waste is washed by oval water basin length of 15 m and drying by rotary dryer machine. After cleaning and drying process, the plastic is sorted out in each type of plastics.
- Making pellets is last process from plastic waste to the new product. By this process, plastic is pasted through the melting machine with the temperature control and extruded in long line form. After cooling by water, this long line plastic is cutting in to pellet and packing into the sack for sale.

Discussion

The same as previous topic, the project will be much benefit if it can apply in Lao PDR.

Topic(13) Lesson Learns from Japanese Practices for urban waste utilization
Speaker : Mr. Yoshiaki Totoki

- Urban area is the engine for the development and produces waste from its activities. Biomass town is a practice in Japan to utilize biomass with strong ties among a community and local stakeholders.
- There are several waste biomass in urban area and several technologies can be applied to the existing waste biomass. The combination of utilization of waste biomass will be varied in countries, cities, and towns.
- Keys to success; first priority on proper waste management, involvement of stakeholders, utilization of existing facilities, technologies, human resources, and waste management systems , separation at source and efficient collection.

Topic(14) Mechanical Biological Treatment – MBT in Phitsanulok, Thailand
Speaker: Ms. Piengpen Sriviroj (on behalf of Dr. Suthi Hantrakul)

- Phitsanulok has the concept of the zero waste through managing sellable materials, organic waste, hazardous waste, infectious waste, unsorted waste.
- This presentation focused on the mechanical biological treatment. MBT is the combination of the mechanical process, which is a process of sorting out recyclable materials from mixed waste stream and biological process which can be bio-drying (drying waste by air convection), anaerobic digestion, composting, or a combined method.
- The flow of MBT process in Phitsanulok was introduced with the MBT on Landfill, homogenizer, windrow, pallet built ventilation and screening. Outputs of the MBT process are compost like substances for gasification, refuse derived fuel for pyrolysis to liquid fuel.
- In conclusions, minimized leachate outflow and landfill gas emission, possible to earn carbon credit, no requirement for daily cover of the landfill, and extended lifetime of the disposal site (at least 50%)

Topic (15) Estimation of GHG emissions from waste disposal and treatment
Speaker : Dr. Janya Sang-Arun on behalf of Dr. Baasansuren Jamsranjav

- Explanation of IPCC guidelines for National GHG Inventories and how to estimate GHG emissions.
- IPCC waste model with the FOD method for methane emissions was introduced how to calculate the methane emission from the existing landfills with some parameter in city level.
- Methodologies for the GHG emissions from cases such as biological treatment (composting) and incineration and open burning of waste are explained.

4. Group exercises

At the last session of the workshop all participant has been grouped for workshop activities and exercises.

Group 1 International speakers and participants from ministry

The group is responsible for presenting about solid waste Management in Lao PDR.
In average within Lao PDR, the generation rate is 0.75kg/day/cap. At the moment within Lao PDR about 17 landfills are operating. Total waste generation is 5,000 t/day but only 2,500t/day is collected, remainder is self-disposed. The waste composition is as following: food 50%; paper 6.7%; textiles 1.2%, wood & branches 19.7%; plastic and fossil organic 10.7%.

Problem facing are lack of human resources and institutional framework, low implementation related regulations/laws and awareness & willingness to do activities.

Proposed solid waste management in Lao PDR in future:

- Applying integrated solid waste management
    - Waste separation at sources
    - Collection of different types of waste in different days

  - Community based recycling center
  - Community based composting center
  - Centralized composting center
- Selecting implementation of the composting method with the reason of:
  - Low investment
  - Environmental friendly
  - No need high technical skill
  - Support agriculture-based society (reduce cost of SWM and reduce amount of SW)

The group has also presented the current flow of solid waste with number showing, and at the end the table of calculation for GHG emission in the whole Lao PDR was presented. Total of current GHG emission is 3,982,530.50 t/year (CO2equivalent).

Discussion and comment

Q: Why the Methane gas is increased?

A: It is increased because the composting is still not applied yet in the early stages. Thus the organic waste is disposed by open dumping in other dumpsites.

Group 2. Vientiane Capital City

This group discussed more about landfill management. The existing landfill is located 32 km away from Vientiane Capital, about 200 t/day of the waste is disposed. The applied disposal method is open dumping. The proposed idea is to collected unsorted waste and to separate recyclables at the disposal site. The city does not have much budget thus this approach seems to be practical than promoting waste separation at source and scheduled the collection.

Group 3. Champasack, Sekong, Salavanh

Pakse is the capital city of Champasack province with area of 120 km^2, population is 80,000 and 11,000 households. The generation rate of the waste is 60t/day and about 30t/day is transported to landfill by the Urban Development Administration Authority (UDAA). About 50% of total generated waste is collected and transported to the landfill. The remaining was disposed in gardens or other spaces by burning or dumping. There are five trucks for waste transportation, belong to Pakse UDAA and four fifth of area are currently being used and one is used as a backup.

The landfill with area of 13.5ha is located in 17km to the north of Pakse. This landfill has been constructed under ADB loan budget and the Norwegian Agency for Development Cooperation (NORAD) project. About 5 ha bas been already used.

UDAA hires 35 workers: 5-6 for collection, 1 for driving truck and 7 persons working at landfill.

Problems facing in Pakse SWM are as following:

- No systematic waste separation at source was practiced
- Existing waste bins are not suitable for waste separation
- Irregular Time schedule for collection due to frequent troubles of trucks.
- The payment for the waste collection of household is always not in time and also some families are not willing to pay
- Waste collection is less attractive works compare to other jobs as a result workers often quit and new workers will be hired.
- The covering by clay for waste disposal in landfill does not meet the standard of landfills because of lacking equipments and fund supports.

At the end speaker showed the table for calculation of GHG emission with total GHG emission of 7.14Gt/year of CO2equivalent.

Discussion and comment

It was discussed in the short briefing for SWM in Salavanh and Sekong province. Salavanh has waste generation rate about 8t/day while Sekong is less, about 3t/day. Due to lack of funding support and the amount of the waste is less, the disposal of the waste is open dumping and burning method.

Group 4. Luangprabang

Luangprabang, a heritage city recognized by UNESCO, is located in the central of northern part of Lao with population of 82,056.

Two private stakeholders are working in the waste collection and transportation with total employers of 32 persons. The generation rate of the waste is 50t/day. The collection waste service is done twice a week. Landfill is full, UDAA of Luangprabang asks budget from the central government for new landfill construction.

Problems facing in SWM in Luangprabang are as following:

- Equipments are old and not enough
- Human resources in this field is lacking (no specialist in SWM)
- Low willingness and awareness of people
- Treatment technologies for various solid wastes are not available
- The existed landfill is full already, to construct a new landfill it needs much of budget

Recommendation

Seminars and workshops on the waste management should be organized continuously and it is encourage to have a workshop in Luangprabang.

At the end of presentation, speaker showed the result of calculation of GHG emission. About 5,978t/year of CO2 equivalent is emitted in Luangprabang.

Group 5. Savanaket , Khammouan

Savanaket Province is located in the middle of Laos, and Kaison Phamvihane is the main city of Savanaket with population of 65,724, 31 villages and household of 12,184. At the present about 4,223 households are already signed contract with UBAA for the waste collection service. Landfill is located at 18km from the city to the south with the area of 16 ha, in which 4 ha has been used. The method of disposal is open dumping. The generation rate of the solid waste is 50t/day or 18,250t/year with the composition of plastic 15%, food waste 54%, paper 9%, wood waste 16%, textile 1% and other 5% of the total waste.

Problem facing in the SWM of Savanaket are as following

- SWM has not reached to the standard yet and lack of knowledge on solid waste management
- Lack of budgets and human resources
- Lack of awareness and willingness among people
- No evaluation and monitoring of the work or project related to waste management
- Lack of technologies for the waste treatment

The result of calculation showed that GHG emission is about 270t/y of CO_2 equivalent.

5. Evaluation of Workshop.

In order to get the feedback of the workshop, all participants were asked to fulfill the evaluation form which is prepared by organizing committee at the end of seminar,.
The following is the result of analyzing from the evaluation form

(1). Total number of questionnaire form: 27

(2). Organizing committee:
- ✓ Excellence: 66%
- ✓ Good : 34%
- ✓ Fair : 0%
- ✓ Poor : 0%
- ✓ Failure: 0%

(3). Speakers and presentation
- ✓ Excellence: 40%
- ✓ Good : 60%
- ✓ Fair : 0%
- ✓ Poor : 0%
- ✓ Failure: 0%

(4). The contents and lesson
- ✓ Excellence: 88%
- ✓ Good : 2%
- ✓ Fair : 0%
- ✓ Poor : 0%
- ✓ Failure: 0%

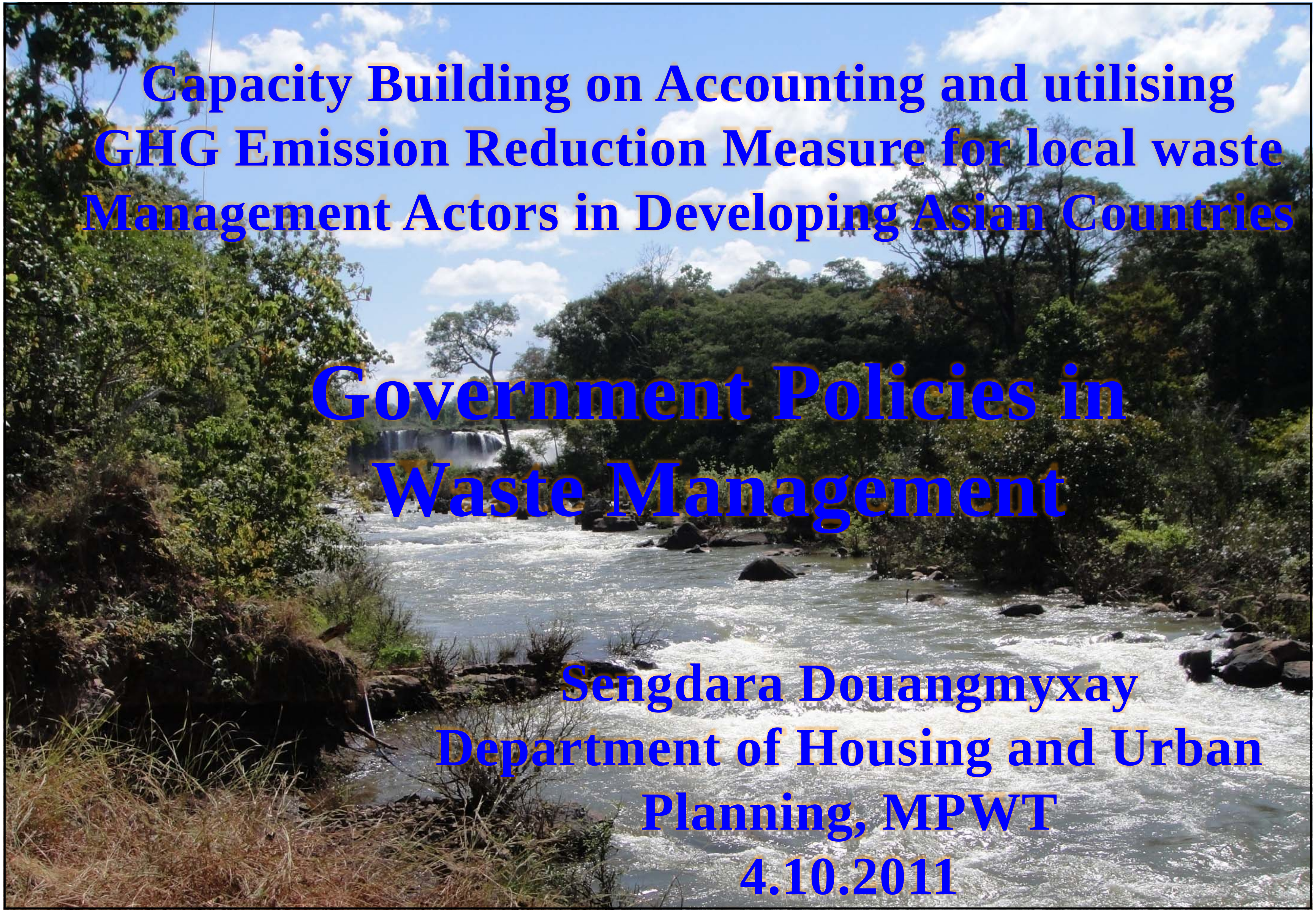
(5). Open questions and recommendation
- ✓ The content of workshop is covered all necessary topics, but it is lack of practical works which leading to implementation (8 persons)
- ✓ To control time for presentation (7 persons)
- ✓ If it is possible, this kind of seminar should be arranged every year continuously (5 persons).
- ✓ Time of workshop is too short. (5person)
- ✓ Presentations were the hot issue and easy to understand (3 person)
- ✓ To control the topic of discussion in the workshop (1 person)
- ✓ The data using in the seminar is not figured clearly about how much the GHG emission is occured (1 person)
- ✓ Microphones were not so good in service (1 person)
- ✓ LCD projector was not clear 1 (person)
- ✓ Per diem is too small not enough for living in Vientiane (1 person)
- ✓ To promote appropriate technology and machine for solid waste disposal in Laos.
- ✓ Provincial participants should have an opportunity for field visit in order to upgrade and exchange the experiences with other provinces
- ✓ Association for the solid waste management should be established in order to exchange the experiences.

6. Following Up

There are three ideas for improving municipal solid waste management in Laos in order to food security and mitigate GHG emission from the waste sectors.

1. Pilot project on reduction of waste to landfill 60% by using 3Rs practice in Vientiane
2. Pilot project on solid waste separation at source in Luangprabang or in Pakse city.
3. Pilot project on Biogas generation from the food waste (small digester system suitable for kitchen use). The project will concentrate in the communities and household where the generation of food waste is high.

Fig. 3 All participant in the Closing day


Capacity Building on Accounting and utilising
GHG Emission Reduction Measure for local waste
Management Actors in Developing Asian Countries
Government Policies in
Waste Management
Sengdara Douangmyxay
Department of Housing and Urban
Planning, MPWT
4.10.2011

1. Overview of waste management
2. Waste management projects
3. Major laws, regulations and institutions dealing with wastes
4. Future Policy Directions
5. The challenge ahead

Overview of waste management

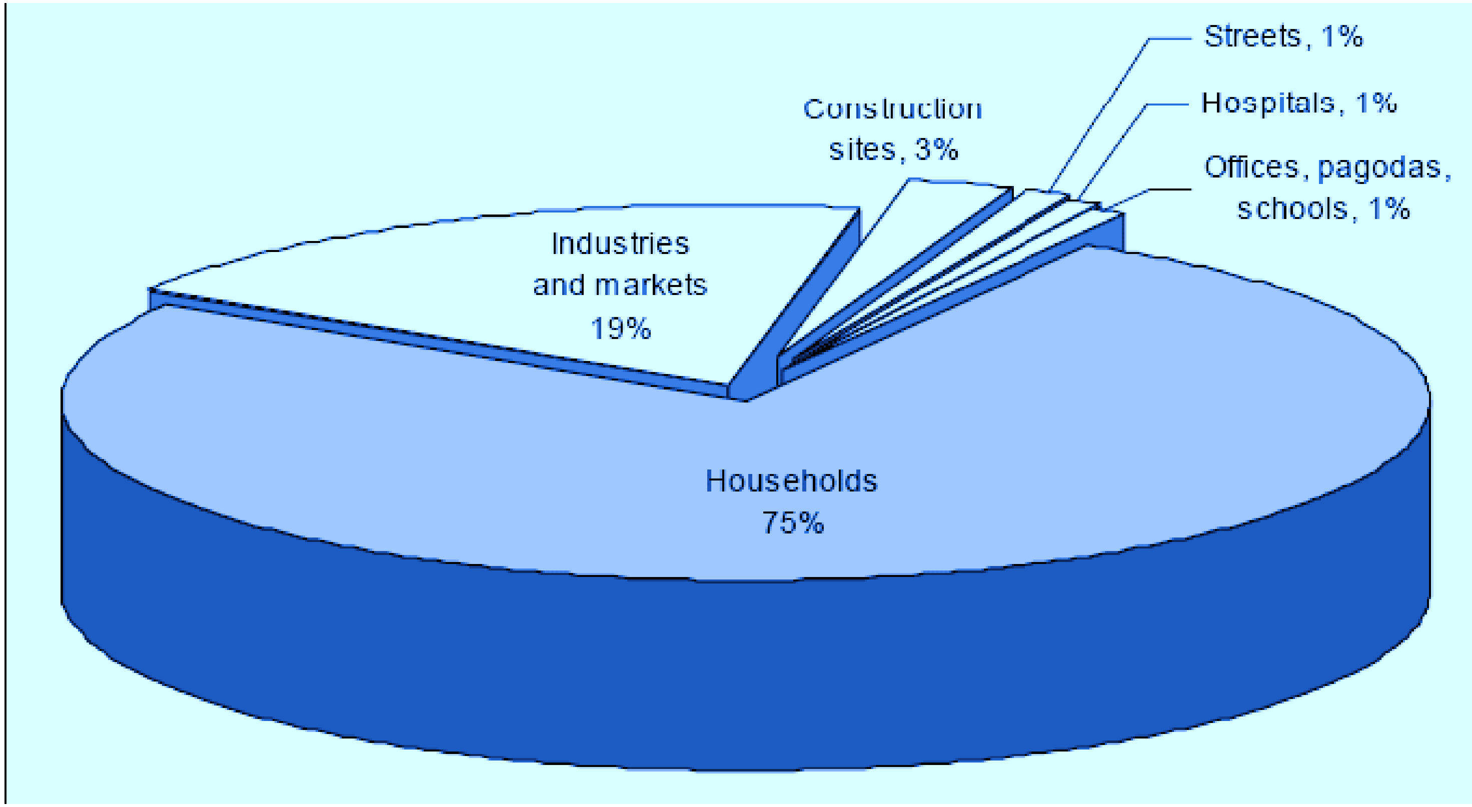
Waste generation

- Wastes are discarded materials or substances from everyday lives or industrial activities;
- On average a person in Laos produces 0.75 kg of solid waste per day;
- In a day about 5,000 tons of waste is generated;
- Vientiane is ranked the third, after Bangkok and Kunming, in the rate of waste generation in the GMS.

Waste Generation in GMS countries

Country	Capital City	Population Growth Rate, %	Urban Population	Generated Waste, Kg/day/cap
Cambodia	Phnom Penh	2.5	27.7	0.46
Lao PDR	Vientiane	2.5	15.9	0.75
Myanmar	Yangon	2.3	21.6	0.45
Thailand	Bangkok	0.8	20.0	1.60
Vietnam	Hanoi	1.6	18.3	0.45
Yunan Province	Kunming	1.2	24.0	0.79
Source: ADB-UNEP, 2004				

Wastes generation by sources



Source: Urban Cleansing Service Center

Waste collection and disposal

- Only 17 controlled landfill sites and 38 towns of 143 have the collection services;
- 50% of the total wastes are collected and disposed in landfill sites (60% in VT) ;

Waste collection and disposal

Every day about 2,500 tons of wastes are disposed of either by open burning or illegal damping into nature water ways or vacant land.

Waste recycling

- In large towns recyclable wastes are sold to middlemen;
- The plastic and cardboard are sent to Thailand, textile wastes are packed in plastic bags and sent to Vietnam for further processing;
- The CS group uses recycled plastics to produce polyethylene (PE) pipes since 1999;
- Composting of organic wastes with the use of earthworms "vermiculture", introduced by a teacher at the teacher training college.

Waste Management Projects

Landfill site construction projects

- Construction of semi-sanitary landfill in Km18 of Vientiane in 1996, ADB & JICA support;
- Environmentally sustainable solid waste in four secondary towns, 1997-2001, total budget of US$ 5,863,720, NORAD & UNDP support;
- Improvement of Km18 landfill in VT, US$ 1mill from JFPR in 1998;
- Semi-sanitary landfill in 12 towns of STDSP, 2004-2009 with US$ 1.2mill loan from ADB;
- Controlled landfill in KM 39 of VT in 2009.

Project objectives

- Formulating long-term strategies for waste management;
- Develop a viable and sustainable operational strategy for solid waste management at each project town;
- Increase the public awareness on environmentally sustainable urban planning and management through the enforcement mechanism for solid waste management;

Project objectives

- Strengthen the institutional and human resources capacity in the SWM sector;
- Operationalize the solid waste management scheme;
- Support the service capacity through the provision of vehicles, equipment and other logistics knowhow.
- Demonstrate the economic use of processing and recycling organic waste.

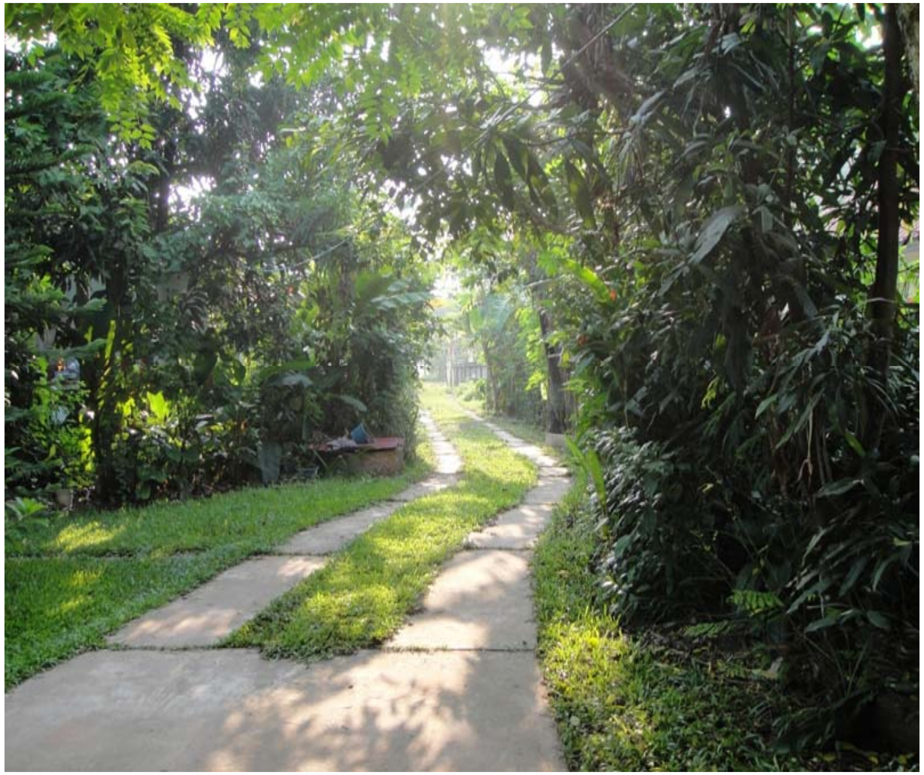
Other activities in waste management

- Public campaign project, 2008, with a budget of about US$ 120,000;
- Village Cleaning day or the red Saturday: giving instruction to villagers to clean the public spaces in their villages,

Other activities in waste management

- Local mass media and public events:
- On average once in a week through local newspapers;
- almost every day on radio,
- 15min/week on TV

Other activities in waste management



- Promotion of Environmental Sustainable Cities concept;
- Identify “Town Cleanliness” as a part of town development vision

Major laws and regulations

- Environmental Protection (1999),
- Law on Industrial Waste (1994),
- Law on Hygiene Disease Prevention and Health Promotion (2001);
- Guidelines for Hospital Waste Management (1997);
- Regulation on hygiene in public space (2004)
- Minister's Decision on the rules for landfill site management, MCTPC (2007), and
- Other bylaws and regulations

Waste management institutions

- Ministry of Water Resources and Environment,
- Ministry of Science and Technology,
- Ministry of Public Works and Transport
- Ministry of Industry and Mine,
- Ministry of Health
- Urban Development Administration Authorities

Future policy directions

- Reducing wastes and maximizing environmentally sound waste reuse and recycling as the first steps in waste management *(a signatory to UN Agenda 21);*
- Enforcing waste management guidelines in urban centers by 2015 *(MPWT SDP 2011-20);*
- Revise and fine-tune the functions and responsibilities of institutions to increase the performance efficiency;
- Striving for cost recovery in services;
- Attracting the private sector in the services combined with public campaign on 3R and environmental protection;
- Upgrading the existing and the future landfills to sanitary sites, *SDP of Urban Development Sector 2011-2020*

The challenge ahead

It is difficult to change people's behavior in waste disposal

The challenge ahead

Urban sprawl and uncontrolled settlement create a big burden to services and infrastructure improvement


Thank you for listening

Institute for Global Environmental Strategies
Sustainable Consumption and Production Group

Introduction of solid waste management and climate change

Janya SANG-ARUN, Policy Researcher

Sustainable Consumption and Production Group
Institute for Global Environmental Strategies (IGES)

About Institute for Global Environmental Strategies

- Established in 1998 as an international environmental think-tank in Japan.
- HQ in Hayama, Japan. Satellite offices in Tokyo, Kitakyushu, Kobe, Bangkok, and Beijing
- Conducts policy research in response to global environmental challenges.
- Three thematic group: Climate Change (including Market Mechanism), Natural Resource Management, and Sustainable Consumption and Production.
- Four cross-cutting issue group: Environment and Economics, Governance and Capacity Development, Business and Environment, Local Governmental Initiative
- Inter-governmental programme (IPCC/TSU, APN.)

Presentation outline

- GHG Emissions from waste management
- Climate benefits from 3R approach
- CDM
- Conclusion

Solid waste management in Laos

- Open dumping and burning are common practices in Laos.
- Most of the disposal sites are not well developed.
- These practices can lead to environmental and health impacts on local residents, release GHGs to atmosphere and discourage efficient use of resources

Source of GHG emissions from solid waste management

1) Methane gas emissions from landfills of organic waste
2) Emissions of carbon dioxide from burning of plastic waste and other wastes (If incineration is used for energy purpose then the emissions of CO_2 of fossil origin are included in Energy sector. However, CO_2 emissions (fossil origin) from incineration of waste without energy recovery are included in Waste sector.)
3) Energy used for collection, recycling and others are also source of GHG. And agricultural waste is categorized in emissions from agricultural, forestry and other land use

Waste composition in GMS countries

Country	Food	Paper	Plastic	Metals	Glass	Others
Cambodia	66	3	14	1	1	15
China	50	15	10	3	3	19
Lao PDR	60		15		15	10
Thailand	64	8	17	2	3	6
Viet Nam	49	2	16	6	7	20

GHG emissions from landfills of organic waste in GMS countries

Country	GHG emissions in Million ton CO2 equivalent/year		
	1994	2000	Present*
China	42.6		45.4 – 113.4
Viet Nam	1.39	5.60	3.0 - 7.4
Thailand	0.41	4.89	5.3 - 13.5
Lao PDR	0.24**		No data
Cambodia	0.124		0.12 – 0.34
Myanmar	No data		No data

Note: * Present estimation is based on waste generation and composition that we could obtained through secondary source of data. Lower value represents potential emissions from landfills of food and paper in shallow-unmanaged landfill and the higher value represents its emissions from deep-well managed landfills.

** 1990

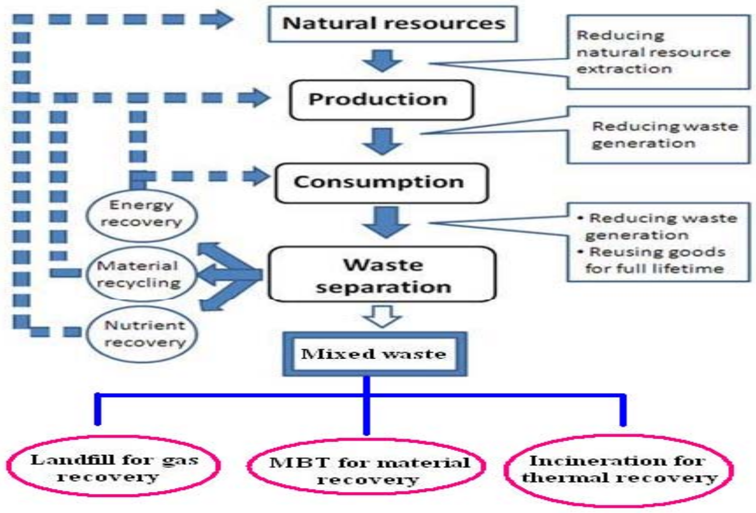
How to improve solid waste management in Laos with co-benefits on climate change and resource efficiency?

- Reducing waste generation by promoting waste minimization, reuse and recycle
- Enhancing organic waste separation for utilization (e.g. animal feed, composting, anaerobic digestion)
- Avoiding burning of plastic waste by establishing waste recycling business

Reduce waste flow to disposal site

Reduce cost for waste collection and disposal, reduce environmental impact, avoid GHG emissions, etc

How can the 3Rs reduce GHG emissions and enhance resource efficiency?



Climate benefits of 3Rs in various sectors

Sectors	Climate co-benefits
Waste	- Reduced methane emissions from landfill - Reduced carbon dioxide emissions from burning of plastics
Energy and transport	- Reduced emissions from energy use in the process of resource extraction, agriculture, good production and distribution, and waste transportation and treatment - Reduced emissions from fossil fuels by using energy recovered from waste
Industry	- Reduced emissions from industrial processes by reducing product demand - Reduced emissions from chemical fertilizer production
Agriculture	- Avoided nitrous oxide emissions from farmland by reducing use of chemical fertilizer - Increased soil carbon sequestration
Land use change and forestry	- Reduced emissions from mining and deforestation

How much can 3Rs reduce GHG emissions?

- **Direct emissions from SWM**
  - 20-98% reduction by composting and 60-100% by anaerobic digestion of food waste (compared to landfill).
- **Indirect GHG reductions**
  - 94% by recycling of plastic.
  - 80% by recycling of steel.
  - 56-64% by using 50% recycled aluminum.
  - 22% by increasing use of recycled glass from 25% to 59%.

National climate change action plan and 3Rs

Country	Mention of the waste sector	Mention of 3Rs	Source
China	Yes	Yes	NCCCC, 2007
Thailand	Yes	Yes	ONEP, 2008
Cambodia	No	No	MOE, 2002
Lao PDR	No	No	STEA, 2000
Viet Nam	No	No	MNRE, 1999

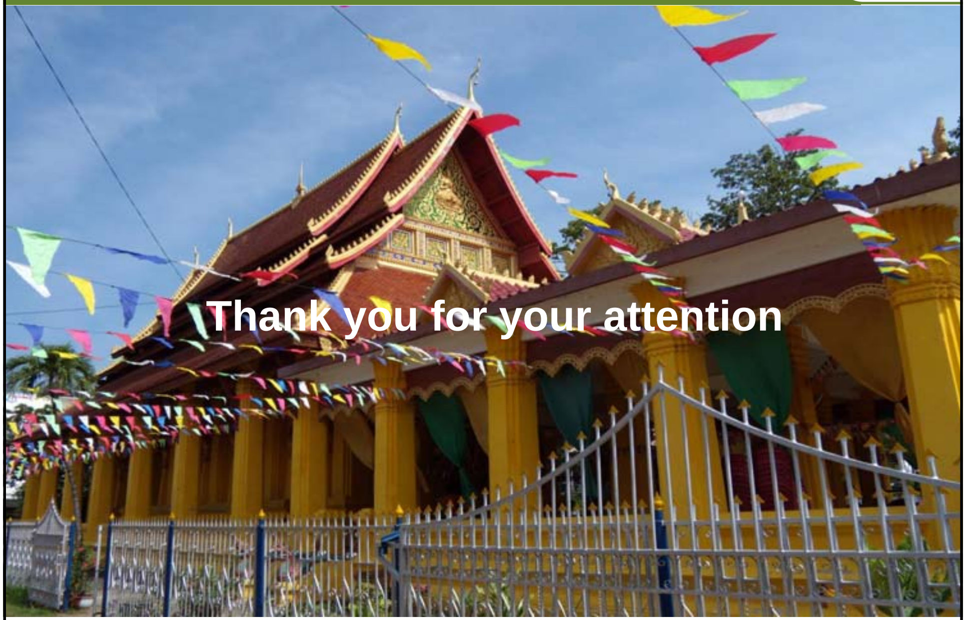
Clean Development Mechanism and urban waste management

- CDM is an alternative financial source, but its procedure is time consuming and requires many specific data input. Also, it is one-time/project-specific.
- Projects that have been registered to CDM
  - Composting
  - Anaerobic digestion
  - Landfill gas recovery
  - Landfill gas flaring
  - Controlled combustion
  - Refuse derived fuel (RDF)
- Market mechanism for Post 2012 is not fixed yet.

Conclusions

- GHG emissions from the waste sector in Laos is increasing.
- 3Rs is an approach to achieve sustainable solid waste management because it could enhance resource efficiency and also avoid greenhouse gas emissions.
- National government should emphasize the 3Rs as a climate change mitigation measure, as it could contribute to GHG emission reduction from various sectors.
- There is possibility that waste utilization projects can receive additional financial revenue through carbon markets (e.g., the CDM, NAMA). However, the priority for solid waste management should be given to proper waste management and utilization of resources.

IGES SCP Group
Waste and climate change



Sang-Arun, J. | IGES | http://www.iges.or.jp | Accounting and utilising GHG emissions reduction measure.., 4-6 October 2011, Vientiane Capital | 15

Organic Waste Utilization for Energy in Lao PDR

Assoc. Prof. Korakanh Pasomsouk
Head of Department of Mechanical Engineering
Faculty of Engineering NUOL

IGES Institute for Global Environmental Strategies

Outline

1. Introduction
2. Current Situation of MSW in Laos
3. Waste To Energy
4. Conclusion

Assoc. Prof. Korakanh Pasomsouk, National University of Laos 2

Introduction

- Climate Change is recognized as serious problem
- It significant impacts on the global environment, economy and society
- It can ultimately threaten human survival
- Human activities are generating greenhouse gases (GHG) into the atmosphere
- Rising levels of greenhouse gases are already changing the climate.
- Climate change is a global issue:
  1 tCO_2 emitted in Laos = 1 tCO_2 emitted in Japan

Introduction

Impact of Climate Change on society

Climate change will cause **heavier tropical cyclones**.


13:59
7. 8.2006

Introduction

- In order to prevent climate change, there is now needed radical reductions in green house gas emissions.
- GHG emissions from the waste are small compared to those from energy and agricultural sectors.
- However, the GHG emissions from the waste sectors are increasing rapidly due to escalating waste generation in most country.

Introduction

- Most developing countries are facing the problem of MSW disposal because of lacking of budget and human resources.
- In parallel with the population and economic growth, each year the quantity of solid waste increases gradually.

- It is found that open dumping and burning are commonly used as the method of disposal MSW.

Introduction

- In these wastes, the organic waste is higher portion
- In the landfill where open dumping disposal is used, the organic waste (food, vegetable, fruit etc.) mainly contaminates other wastes
- The organic waste is the main source of Methane gas generation (GHG emission)

MSW Management in Laos

- In Laos Industrial pollution issues are at the early stage.
- Urbanization policy makes urban population rapid increasing.
- Currently many people in rural areas are moving to the city for finding new job.
- Students are interested to study in University rather than working at the field.
- The tourist activities are also increasing

MSW Management in Laos

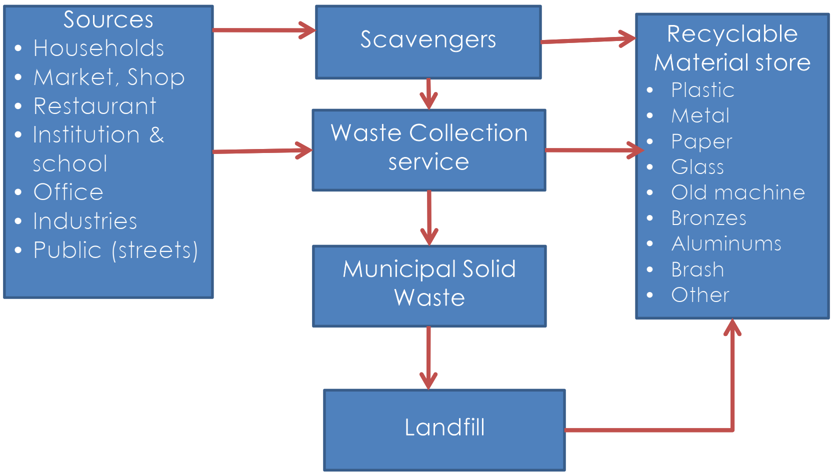
- The problem following of those is the increasing amount of solid waste and human waste
- In 2009 within Lao PDR about 350 tons per day of solid waste are disposed in landfill
- To transport waste to disposal in landfill will cost USD4.5/ton
- The organic waste (75%) is the main portion which makes others in landfill contaminate
- Three traditional methods for disposing MSW are commonly used in Laos: Burning, Dumping and Throwing

MSW Management in Laos

- So far no waste separation mechanism are applied in Laos.
- Organic waste over 220 tons per day are transported together with other waste to landfill for disposal
  - Food waste
  - Vegetable & fruit waste
  - Grass and leaves
  - Paper
  - Wood and trees residue
- In fact, these organic wastes can be used as the valuable sources for production

MSW Management in Laos

The Flow of MSW



MSW Management in Laos

Four studied cities :

1. Vientiane,
2. Luangprabang,
3. Savanaket,
4. Champasack.

The sources of Solid Waste Vientiane

Place	Quantity (ton/day)	Percentage (%)
Household	178	75
Street	2	1
Shop	36	16
Market	9	4
Hospital	2	1
School and office	2	1
Construction place	6	2

MSW Management in Laos

Generation Rate

Provinces	Population person	Prod./capita/ day kg	Amount ton/day
Vientiane CC	330,798	0.64	211.7
Luangprabang	70,481	0.60	42.3
Savanaket	65,724	0.64	42
Champasack	72,955	0.7	51

MSW Management in Laos

MSW Composition Analyzing

MSW Management in Laos

IGES Institute for Global Environmental Strategies

Composition of MSW in the main cities

Waste fraction	Vientiane (%)	Luangprabang (%)	Savanaket (%)	Champasack (%)
Plastic	13	9	15	6
Glass	6	6	2	2
Paper	6	8	9	4
Metal	3	1	1	1
Food Vegetable	30	51	54	62
Textile	2	1	1	1
Wood/Grass/Leaf	19	23	16	21
Other	21	1	2	3

Assoc. Prof. Korakanh Pasomsouk, National University of Laos 17

MSW Management in Laos

IGES Institute for Global Environmental Strategies

Food Waste

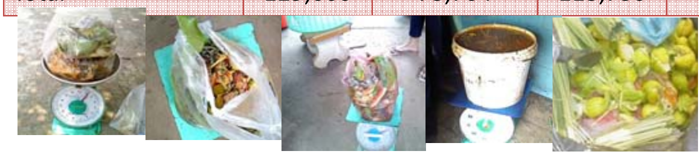
Assoc. Prof. Korakanh Pasomsouk, National University of Laos 18

MSW Management in Laos

IGES Institute for Global Environmental Strategies

Generation rate of Food waste

Source	Vientiane (Kg/day)	Luangprabang (Kg/day)	Savanaket (kg/day)	Champasack (kg/day)
Hotel& Restaurant	3,555	1,008	520	714
Restaurant	7,605	4,992	2,720	4,100
Small restaurant	37,180	13,104	12,240	13,800
Household (3-5ps)	81,320	54,000	98,250	60,000
Total	129,660	73,704	113,730	78,614



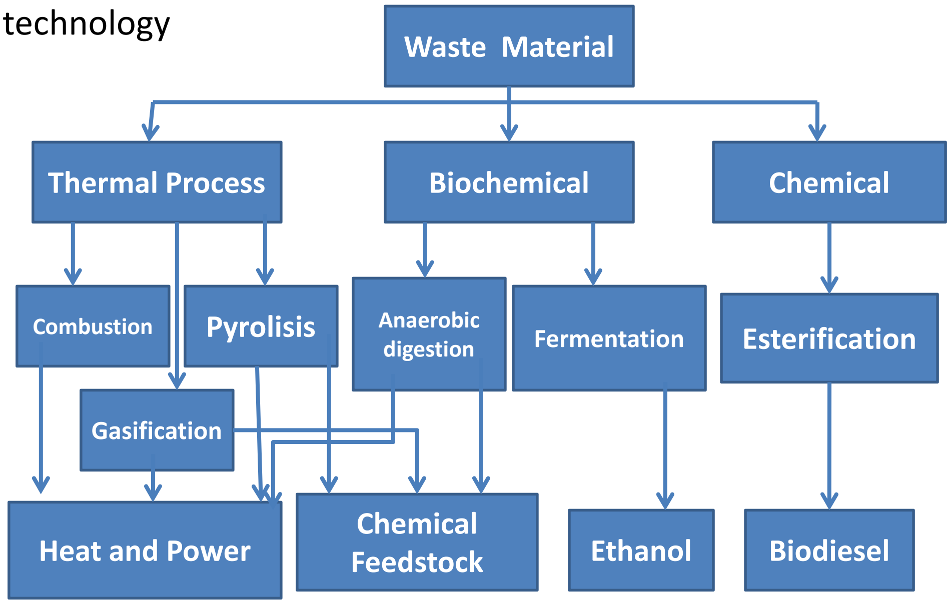
Assoc. Prof. Korakanh Pasomsouk, National University of Laos 19

What is The Waste ?

IGES Institute for Global Environmental Strategies

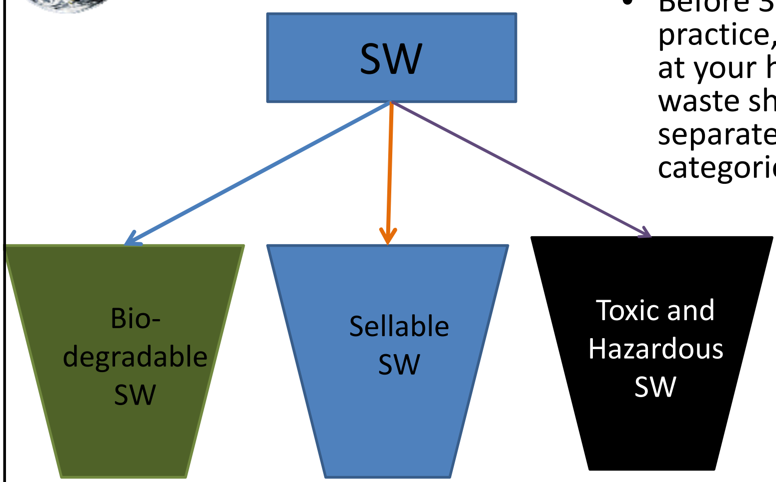
Assoc. Prof. Korakanh Pasomsouk, National University of Laos 20

Waste to Energy technology



21

Solid waste Separation at source



- Before 3Rs practice, first of all at your house, the waste should be separated into 3 categories

Assoc. Prof. Korakanh Pasomsouk, National University of Laos

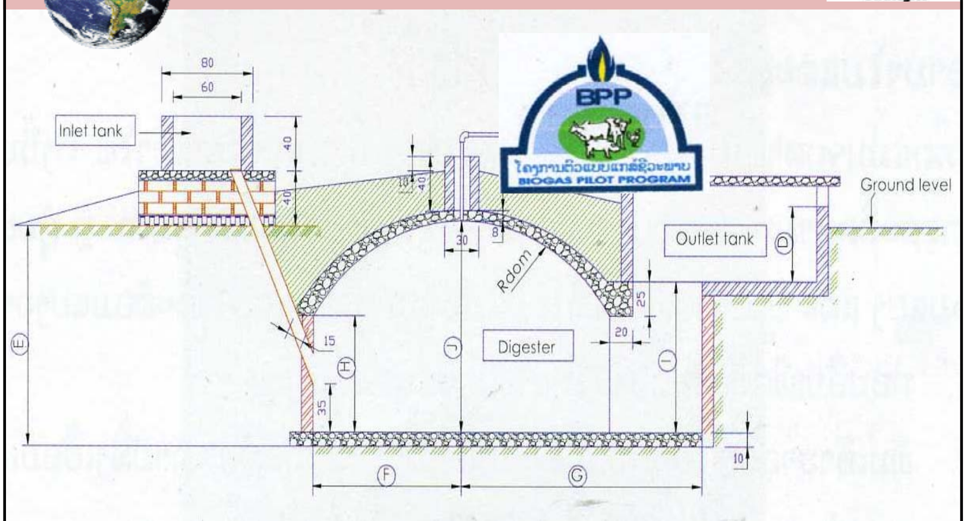
22

Bio-Chemical Process: Biogas

- Within Lao PDR, SNV supports the Department of livestock and Fisheries(DLF) Ministry of Agriculture and forestry to implement the Biogas Pilot Program
- The target of this project is 6,600 digesters over 4 years
- The budget for this program is provided by Dutch Government.

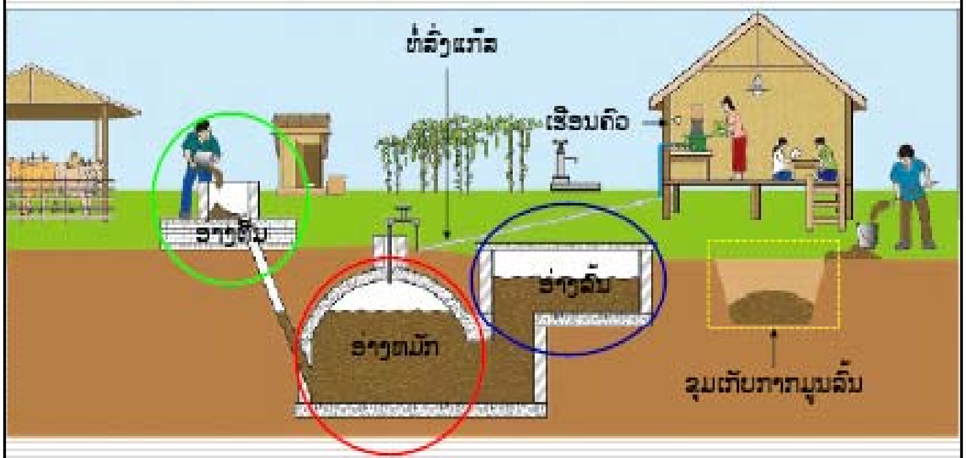
Assoc. Prof. Korakanh Pasomsouk, National University of Laos 23

Biogas Pilot Program



Assoc. Prof. Korakanh Pasomsouk, National University of Laos 24

Biogas Pilot Program



Assoc. Prof. Korakanh Pasomsouk, National University of Laos 25

Biogas Pilot Program

Assoc. Prof. Korakanh Pasomsouk, National University of Laos 26

Biogas Pilot Program

Detail subsidy component for each size of digester

Digester size	$4m^3$	$6m^3$	$8m^3$	$10m^3$
Total cost (LK)	3,651,000	4,232,000	4,894,000	5,584,000
Customer component (LK)	1,791,000	2,372,000	3,034,000	3,724,000
BPP component (LK)	1,860,000	1,860,000	1,860,000	1,860,000

Biogas Pilot Program

Comparison 1m3 of Biogas with other types of energy

Type of Energy	Unit	Quantity
Wood chip	kg	5
Charcoal	Kg	1.6
Fuel oil	L	0.75
LPG Gas	Kg	0.45
Electricity	W	1.7

Application

1. Cooking 2 Lighting

3. Engine consumption

Biogas Generation from Kitchen waste

- High quality left over food can be stored for the next meal
- Low and middle quality food can be fed to domestic animals
- Food waste , pour quality food, vegetable, fruit can be the good material for generating biogas
- One Lao family (3-5 person) generates food waste 2– 3 kg/day in average

Biogas Generation from Kitchen waste

Biogas Tank is Made of plastic water container 168L

Biogas Generation from Kitchen waste

Biogas Tank is Made of plastic water container 168L

Assoc. Prof. Korakanh Pasomsouk, National University of Laos

31

Biogas Generation from Kitchen waste

Biogas Tank is made of used steel tank 260L

Assoc. Prof. Korakanh Pasomsouk, National University of Laos

32

Biogas Generation from Kitchen waste

The animal waste 30 kg mixing with 20L of water should be filled into biogas tank at the starting day

1. Separate food waste
2. Collect vegetable and fruit waste
3. If vegetable and fruit waste are the big size, chop it into small size
4. Mix these wastes together with water
5. Fill these waste to biogas tank
6. Do it for every day

Assoc. Prof. Korakanh Pasomsouk, National University of Laos 33

Biogas Generation from Kitchen waste

Digester size m3	Animal Waste input at starting day kg	Food waste input per day kg	Water input per day Littre	Gas generation m3 /day
o.168	30	8 – 10	0.4 –0.48	0.15
0.260	50	10 – 20	1 – 1.5	0.20

Assoc. Prof. Korakanh Pasomsouk, National University of Laos 34

Thermal Process
Small scale

Small-scale such as domestic cooking can be very inefficient, with heat transfer losses of 30 - 90% of the original energy contained in the waste.
This problem can be used of more efficient stove technology and the use of dry, compact biomass fuels, such as wood.



Thermal Process:
Fuel Briquettes

Material for making fuel briquettes at house

- Paper waste 40% with saw dust 60%
- Grass
- Paper
- Charcoal waste
- Rice husk 60% with paper 40% and cassava powder
- Tree Leave and vegetable
- Mixed waste

Cassava or corn starch maybe needed for binding

Fuel Briquette press

Assoc. Prof. Korakanh Pasomsouk, National University of Laos 39

How to make Fuel Briquette

Step1. Sorting out material to put into the briquette (paper, agriculture waste, grass..)
Step2. Drying material under sun
Step3. Chopping or crashing material up into small piece
Step4. Mixing the material with cassava starch in water
Step5. Squeezing mixed material and loading Cylinder
Step6. Using briquette press
Step7. Realizing briquette and drying for few day before use

Assoc. Prof. Korakanh Pasomsouk, National University of Laos 40

How to make Fuel Briquette



How to make Fuel Briquette




Briquetting press

A simple Extrusion machine is built up in mechanical workshop for making briquettes from charcoal waste

Conclusion

- So far in Laos, there is not suitable for the high investment of the waste to energy (Power plant or Biogas factory)
- The Community or Family scale is more efficiency and profitable
- Less rubbish in the streets and in dumping surrounding area
- Less solid waste to transport to landfill
- Benefits to climate change (avoid emission gases to GHG)
- The Solid waste management is not very difficult but the human attitude changing is too difficult.


Thank you
and Please save our earth
45

Lao Biogas Pilot Program

Souphavanh Keovilay
Program Manager
Biogas Pilot Program,
Department of Livestock and Fisheries,
Ministry of Agriculture and Forestry

Content

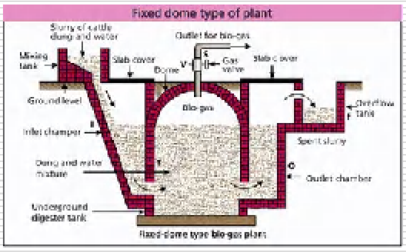
1. Domestic Biogas technology
2. Benefits of Domestic Biogas
3. Lao Biogas Pilot Program

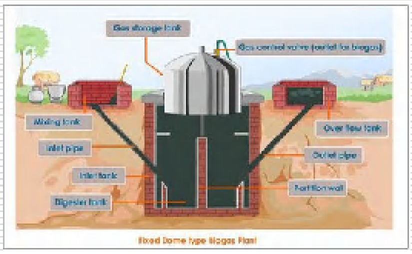
1. Domestic Biogas Technology

- What is Biogas?
  - The term 'biogas' is commonly used to refer to a gas which has been produced by the biological breakdown of organic matter in the absence of oxygen.
  - Biogas burns very clean with a flame comparable to that of liquefied petroleum gas (LPG) and can be used directly in a simple low-pressure gas burner.

1. Domestic Biogas Technology

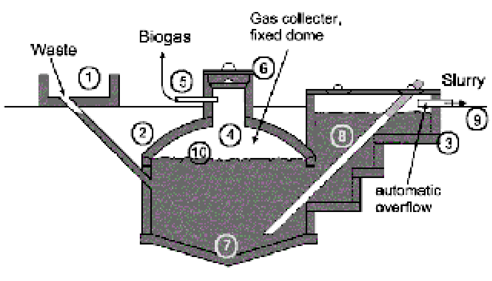
Biogas Plant models

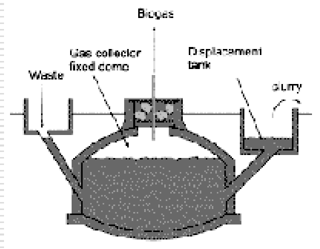


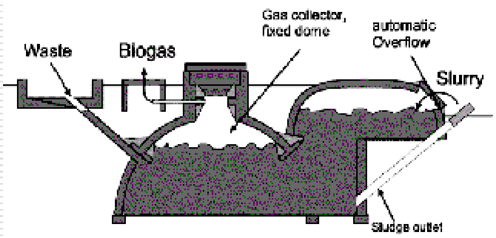


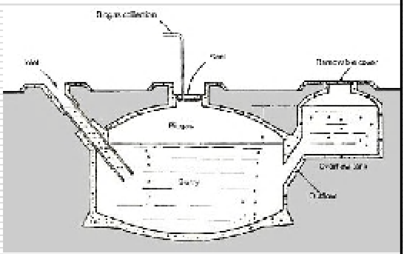
1. Domestic Biogas Technology

Biogas Plant models



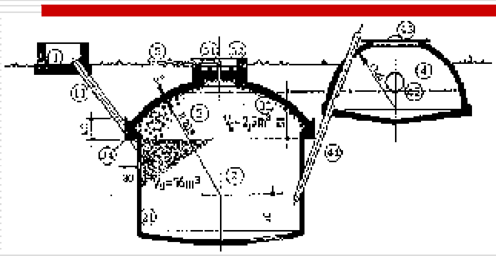


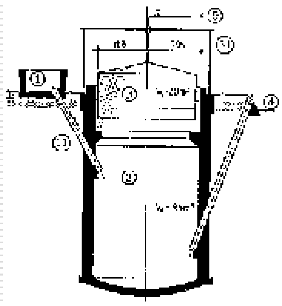


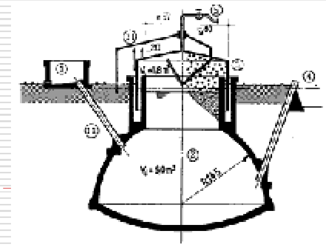


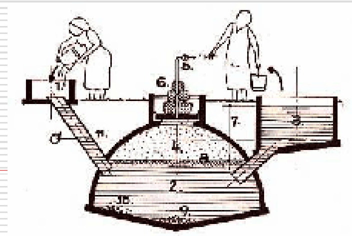
1. Domestic Biogas Technology

Biogas Plant models



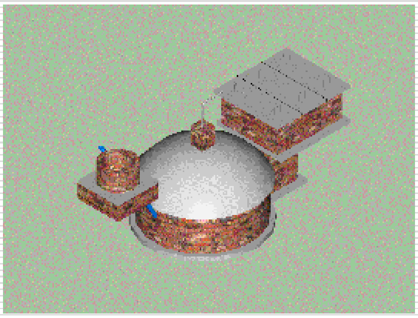




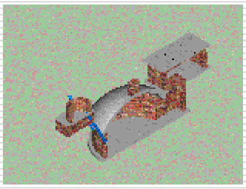


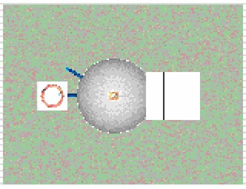
1. Domestic Biogas Technology

Lao Biogas Plant model



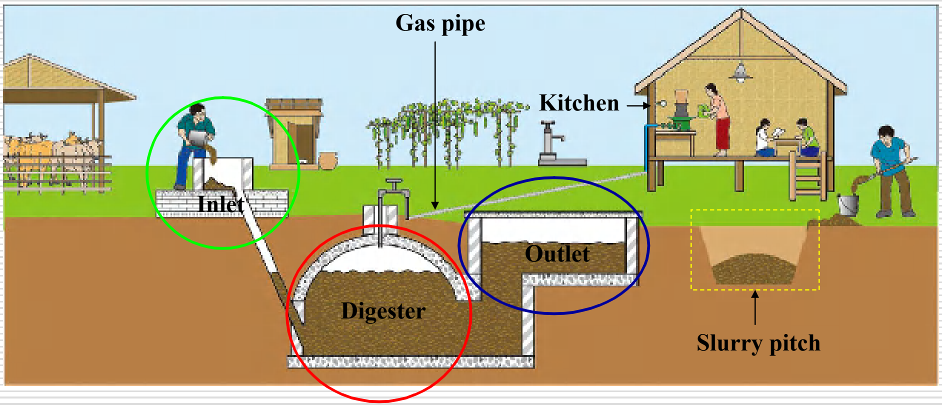
- Nepal model customised for Laos
- Fixed dome, masonry + concrete
- No moving parts
- Sizes: $4m^3$, $6m^3$, $8m^3$, $10m^3$





1. Domestic Biogas Technology

Biogas Plant Component

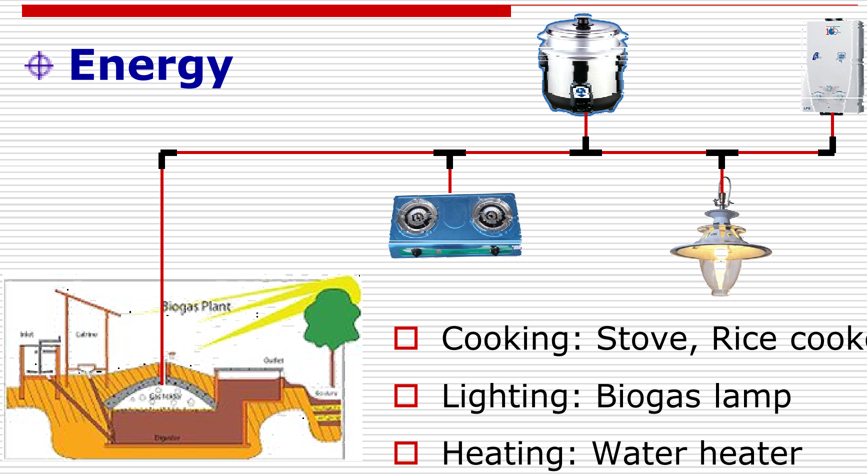


1. Domestic Biogas Technology

Biogas plant operation

2. Benefits of Domestic Biogas

- **Energy**



- Cooking: Stove, Rice cooker
- Lighting: Biogas lamp
- Heating: Water heater

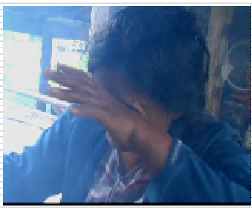
2. Benefits of Domestic Biogas

⌖ Agriculture

- Slurry is effective organic fertilizer
  - Improve soil fertility
  - Safer than raw manure (no weeds and pathogents)
- Improve livestock
  - Slurry can be used for feeding animal and fish
  - Encourages stabling of animals

2. Benefits of Domestic Biogas

⌖ Health



- Reduce eye irritation and respiratory diseases caused by indoor smoke
- Reduce transmission of zoonosis.

2. Benefits of Domestic Biogas

Social

- Reduce drudgery
- Reduce female and child labour
- Save time from cooking and collecting firewood
- Create employment

2. Benefits of Domestic Biogas

Economic

- Save money
  - Reduce expenses on electricity, firewood, charcoal and chemical fertilizer
- Generate income for local masons

2. Benefits of Domestic Biogas

Environment

- Cleaner village (reduce smell and insects)
- Better water quality (reduce Nitrogen contamination)
- Reduce deforestation
- Reduce emission of greenhouse gases

3. Lao Biogas Pilot Program

♦ Introduction

- In 2006, MoU on the implementation of Biogas Pilot Program (BPP) was signed between Netherlands Development Organization (SNV) and Ministry of Agriculture and Forestry (MAF).
- Since 2007, BPP has been implemented under the Department of Livestock and Fisheries, MAF

3. Lao Biogas Pilot Program

♦ Introduction

Name of the project	Biogas Pilot Program (BPP)	
Location	5 provinces (Vientiane Capital, Savannakhet, Xiengkhouang, Vientiane province, Khammouan)	
Period	2007 - 2010	2011 - 2012
Target	2,000 digesters	1300 digesters
Budget	1,109,000 €	550,000 €
Supporter	DGIS, Government of the Netherlands	
Implementing organization	Department of Livestock and Fisheries, Ministry of Agriculture and Forestry	

3. Lao Biogas Pilot Program

♦ Goal and purpose of BPP

- Goal:
  - To improve the livelihoods and quality of life of rural families, men and women, and reduce the impact of biomass resource depletion in Lao PDR, exploiting the market and non-market benefits of domestic biogas digesters.
- Purpose:
  - To establish a series of biogas pilot activities to form the basis of a future larger scale biogas program that will establish a commercially viable domestic biogas sector

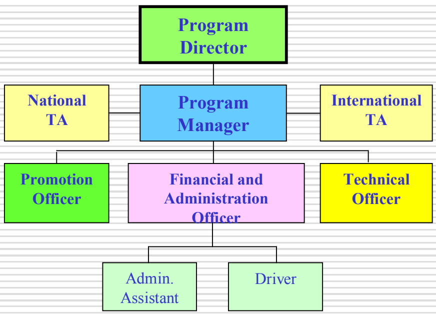
3. Lao Biogas Pilot Program

♦ Project Components

1. Program Management
2. Promotion and Marketing
3. Construction and after sell services
4. Investment and Subsidy
5. Quality Control
6. Research and Development
7. Training
8. Extension
9. Monitoring and Evaluation
10. Institutional Support

3. Lao Biogas Pilot Program

♦ Program Management

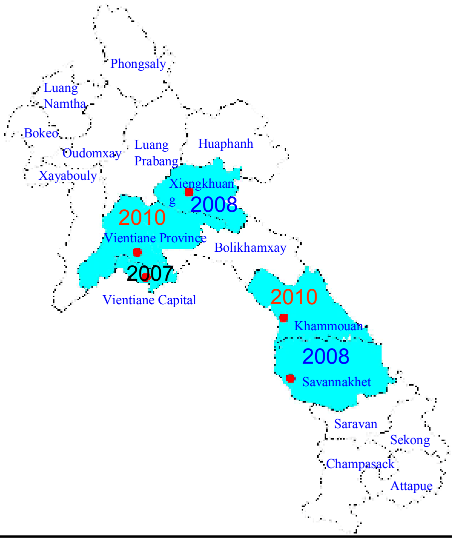


- 7 permanent staff and 2 TA from SNV based in BPP office
- 4 FAPO staff working in each PBPPO
- Each target district has district coordinator
- Project Steering committee at provincial level
- Biogas Advisory Board (BAB) at national level

3. Lao Biogas Pilot Program

♦ Program Management

- 2007: Started in Vientiane Capital
- 2008: Expanded to Savannakhet and Xiengkhouang
- 2009: Implement in the same 3 provinces.
- 2010: Expanded to Vientiane province and Khammouan
- 2011: Implement in 5 provinces



3. Lao Biogas Pilot Program

♦ Promotion and Marketing

- Promotion materials (brochure, poster…)
- Mass media (TV, radio, newspaper)
- Exhibition
- Village meeting
- Direct sell

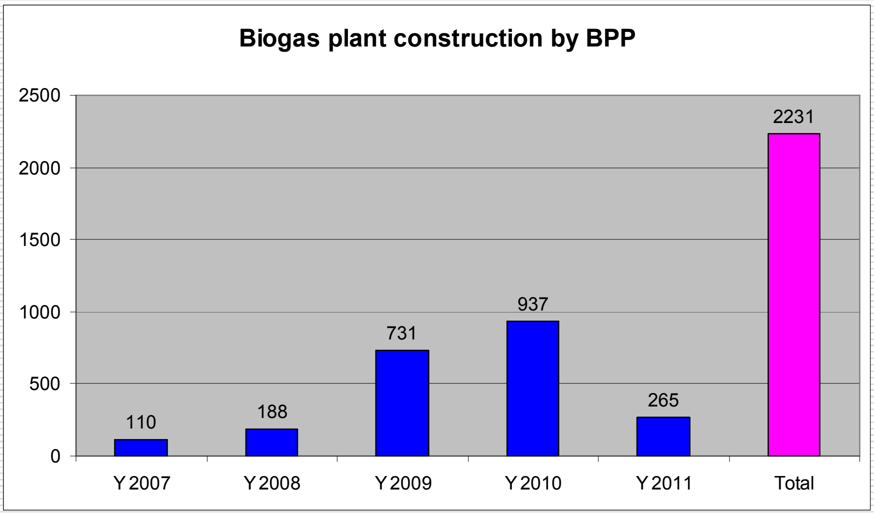
3. Lao Biogas Pilot Program

♦ Construction and after sell services

- Up to now, 2,200 biogas digesters have been installed in 720 villages, 40 districts, 5 provinces.
- Masons provide regular services for 2 year after construction with close monitoring of DAFO officers.
- PAFO conduction warranty inspection after 2 years and warranty fee paid for the mason.

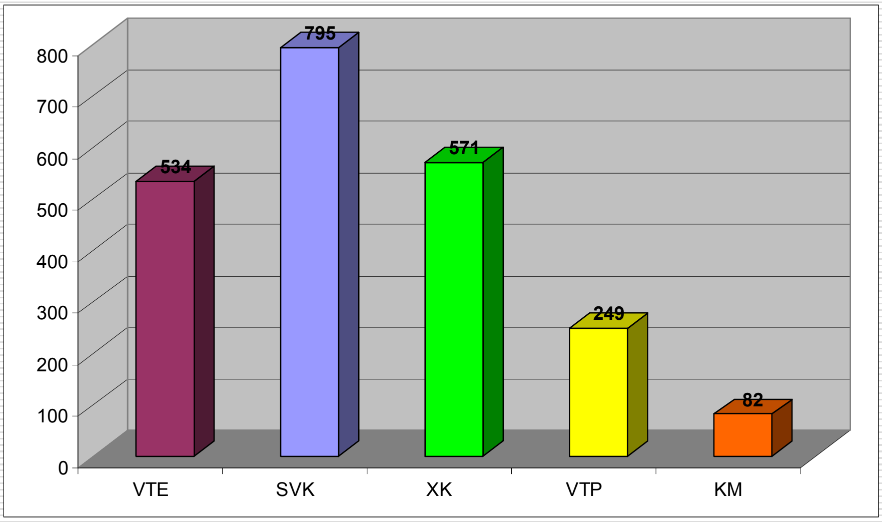
3. Lao Biogas Pilot Program

♦ Construction and after sell services



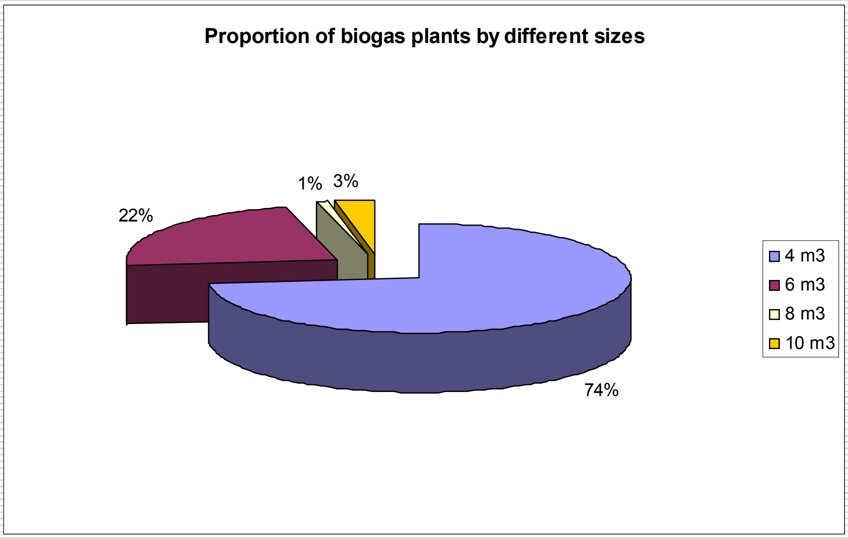
3. Lao Biogas Pilot Program

♦ Construction and after sell services



3. Lao Biogas Pilot Program

♦ Construction and after sell services



3. Lao Biogas Pilot Program

♦ Investment and Subsidy

- Provide subsidy to households
- Incentive for PAFO and DAFO officers to implement activities
- Facilitate farmers to access to loan

3. Lao Biogas Pilot Program

♦ Investment and Subsidy

Size:	$4m^3$	$6m^3$	$8m^3$	$10m^3$
Total Biodigester Cost (USD)	**441**	**514**	**615**	**706**
Household Costs	222	295	396	487
BPP Subsidy (in kind + cash)	219	219	219	219
Subsidy Proportion	*50%*	*43%*	*36%*	*31%*

Skilled Labor (trained mason)	*4%*
Unskilled Labor (can be household)	*17%*
Construction materials	*79%*

Accessories	*22%*
Skilled + Unskilled Labor	*54%*
After sale service fund	*3%*
Advanced cash subsidy	*21%*

3. Lao Biogas Pilot Program

♦ Quality Control (QC)

- DAFO officers implement quality checking on every biogas plant constructed by the mason (3 steps: before, during and after construction)
- PAFO officers conduct the quality of quality checking of DAFO officers (20%)
- BPP technician carry out quality of quality checking of DAFO and PAFO officers (10%)
- SNV perform quality checking by the program officers (2%)

3. Lao Biogas Pilot Program

♦ Research and Development

- Mini survey on the price of construction materials
- Study on biogas appliances (quality and price and new devices)
- Study on other biogas digester models

3. Lao Biogas Pilot Program
♦ Training

- Staff training (QC, Promotion, Extension)
- Mason training (including mason refresh training)
- User training

3. Lao Biogas Pilot Program
♦ Extension

- Bioslurry extension:
  - Direct use
  - Produce compost

3. Lao Biogas Pilot Program

♦ Monitoring and Evaluation

- Routine follow up (Attend monthly meeting of PBPPO)
- Organize project steering committee meeting every quarter
- Conduct annual biogas user survey

3. Lao Biogas Pilot Program

♦ Institutional support

- Capacity building for partner organizations (skills improvement)
- Organize Biogas Advisory Board meeting every six months
- Organize annual meeting

3. Lao Biogas Pilot Program

♦ Impacts of BPP

- About 12.940 people benefit from biogas
- Electricity saving: $198.559/year
- Fertilizer savings: $182.942/year
- Wood and charcoal saving: $230.818/year
- Reduce CO_2 emission: 2231 Ton/year

3. Lao Biogas Pilot Program

♦ Impacts of BPP

Indicators	units	Qty	Source
Average Household Size	People per household	5.8	*BUS, 2007
Electricity Savings	USD per year	89	*BUS, 2007
Fertilizer Savings	USD per year	82	*BUS, 2007
Average HH wood and charcoal expenditure	Kip per month per household	98.533	*BUS, 2007
Proportion of wood and charcoal replaced by biogas	Per cent (%)	70	*BUS, 2007
Biogas Carbon emission savings	Ton of CO_2 per HH	1	Low Estimate

*BUS= Biogas User Survey


Thank you for your attention

Overview of urban organic waste management for climate change mitigation in Thailand

Assoc. Prof. Dr. Alice Sharp
Sirindhorn International Institute of Technology

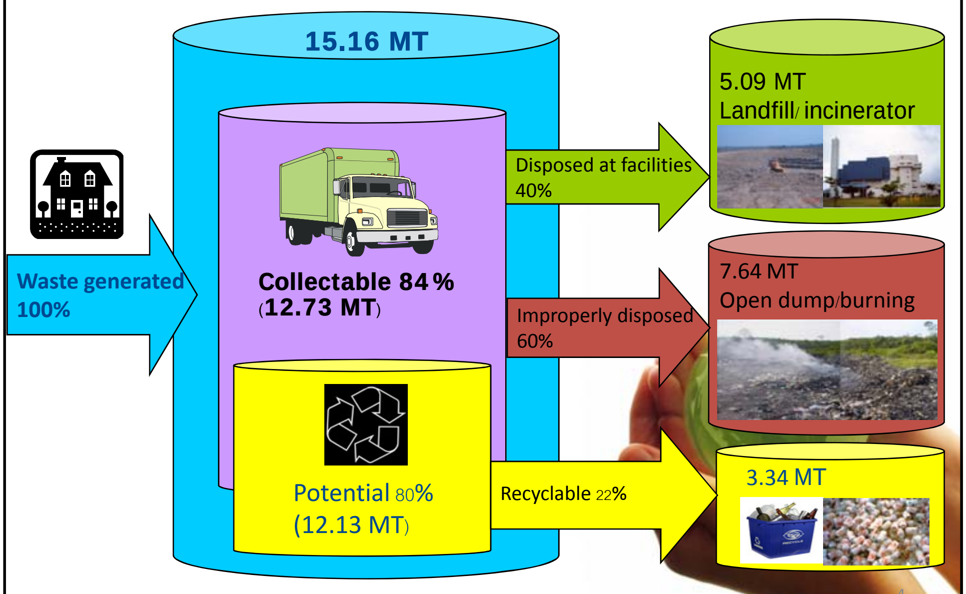
Content

- Status of Waste and Waste Management Systems
- National Policy & Targets on Waste Management
- Example of practices
- GHG emission reduction

Status of waste generation

Area	Amount of Solid Waste (ton/day)				
	2003	2005	2006	2008 (PCD)	2009 (PCD)
Bangkok	9,356	8,291	8379	8,780	8,834 (+0.6%)
Municipalities and City of Pattaya (2007 offices)	12,500	12,635	12,912	14,915	16,368 (+9.7%)
Others sub district administration offices (5,770 offices)	18,100	18,295	18,697	17,369	16,208 (-6.68%)
Total	39,956	39,221	39,988	41,064	41,410

Situation in waste management

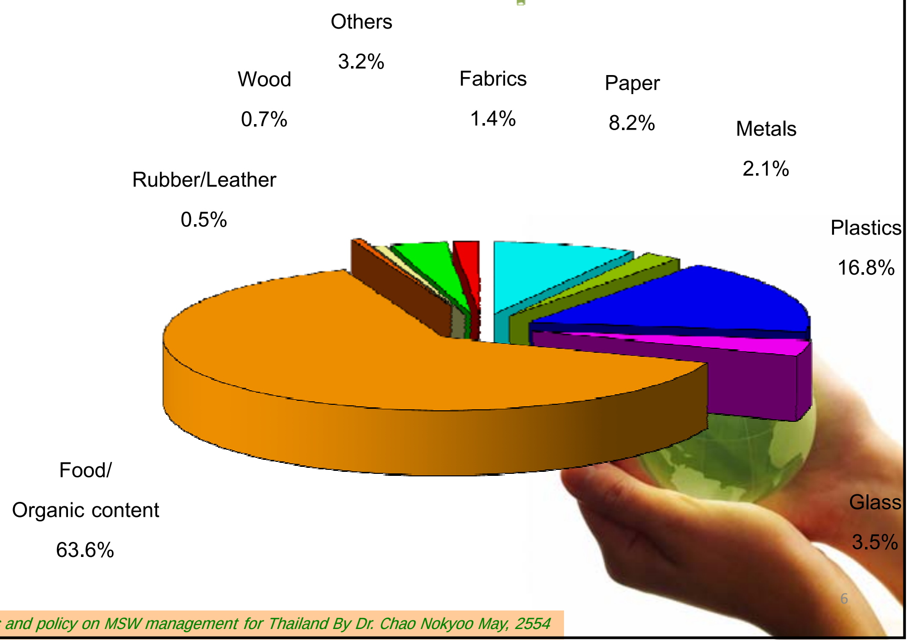


Status and policy on MSW management for Thailand By Dr. Chao Nokyoo May, 2554

Waste composition in different regions

Waste Components (% of wet weight)	Regions of Thailand					
	North	Central	North-East	East	South	Average
Organics	59.71	62.56	67.53	67.53	57.65	61.43
Garden waste	0.96	0.60	0.51	0.77	0.25	0.62
Recyclable	24.06	20.43	20.21	21.61	26.73	22.61
Hazardous waste	0.05	0.34	0.14	0.37	0.19	0.22
Other waste	15.23	16.34	11.61	17.57	15.18	15.19
Total	100	100	100	100	100	100
Waste Density (kg/m^3)	179.47	185.28	176.82	167.28	209.40	183.65

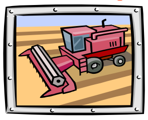
MSW Waste composition



Status and policy on MSW management for Thailand By Dr. Chao Nokyoo May, 2554

Current waste management technology

Sanitary landfill



- In operation 94 sites
- Terminated 10 sites
- Cannot operate 6 sites
- Under planning or construction 11 sites

Incinerator

Phuket city muni.	(250 T/d)
Kao Samui muni*	(140 T/d)
LamPhun**	(10 T/d)
Kao Tao	(5T/d)

* **shutdown for maintenance**
** **Shutdown**

Integrated system

Vieng Fang	150 T/d
Rayong	80 T/d
Chonburi**	400 T/d
Mae Sai	60 T/d

**Shutdown

ข้อมูล ณ เดือนพฤษภาคม 2554

Status and policy on MSW management for Thailand By Dr. Chao Nokyoo May, 2554

Forecast quantity of waste

Year	Waste generation (Ton/day)	Year	Waste generation (Ton/day)
2008	40,662.42	2016	42,105.87
2009	40,878.24	2017	42,251.20
2010	41,081.72	2018	42,390.82
2011	41,274.20	2019	42,525.18
2012	41,456.81	2020	42,654.65
2013	41,630.50	2021	42,779.57
2014	41,796.11	2022	42,900.26
2015	41,954.36		

Status and policy on MSW management for Thailand By Dr. Chao Nokyoo May, 2554

Policy Framework

- Applying 3Rs for achieving waste reduction & utilization;
- Promoting the integrated waste management system to reduce the landfill areas and generate the renewable energy;
- Encouraging the cooperation of adjacent Local Governments for establishment of waste management facility;
- Endorsing public and private sectors to participate in waste management project.

Policy 1- Waste Reduction (3Rs)

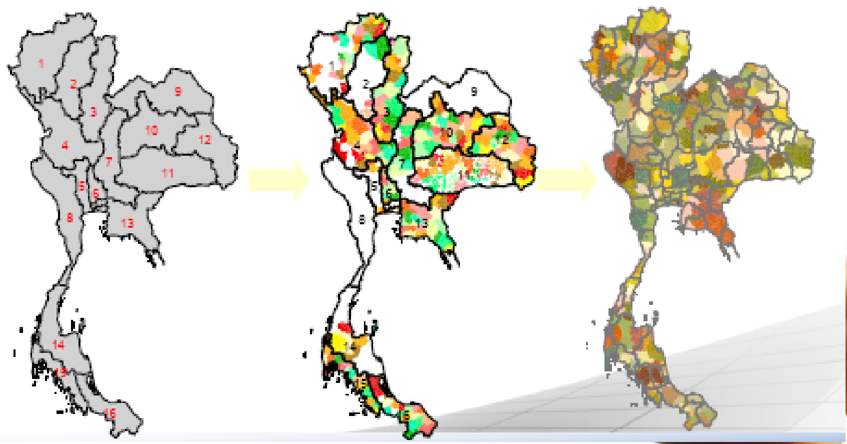
- National Waste Target
- Waste reduction **not less than 30 %**
  - Applying 3Rs
  - Green Procurement
- Integrated Waste Management System
  - **Waste disposal in engineered practice not less than 40%**
- Household Hazardous Waste (HHW) Management System
  - **HHW properly managed at least 30%**

Policy 2 – Waste to Energy

Reference on Policy Issues

Policy 3- Clustering of Local Government

Supporting Local Government Clusters to obtain long-term effectiveness of waste management



Reference on Policy Issues

Criteria to Develop Cluster

Cluster Size	Waste Loading to System (T/d)
Large Cluster	> 500
Medium Cluster	
M1	250 - 500
M2	100 - 250
M3	50 - 100
Small Cluster	< 50

Reference on Policy Issues

Appropriate Technology

L	Sorting + Bio-conversion Process + Incineration + Landfill
M1	Sorting + Anaerobic Digestion + Gasification/Pyrolysis/ Stoker Incineration + Landfill
M2	Sorting + Bio-conversion Process + Pyrolysis/ Gasification + Landfill
M3	Sorting + Bio-conversion Process + Pyrolysis/ Gasification + Landfill
S	Sorting + Bio-conversion Process + Landfill

Reference on Policy Issues

Policy 4 – Partnerships development

- Several waste management projects in Thailand has been implemented as a result of partnerships between local government and private sector

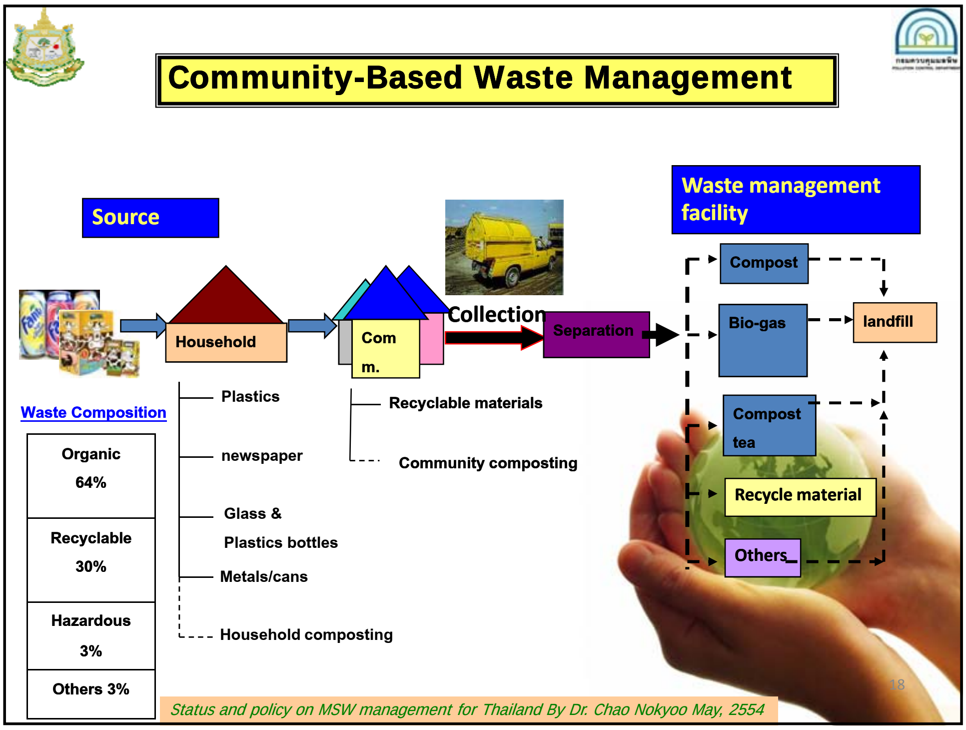
Conventional municipal solid waste

Municipal solid waste

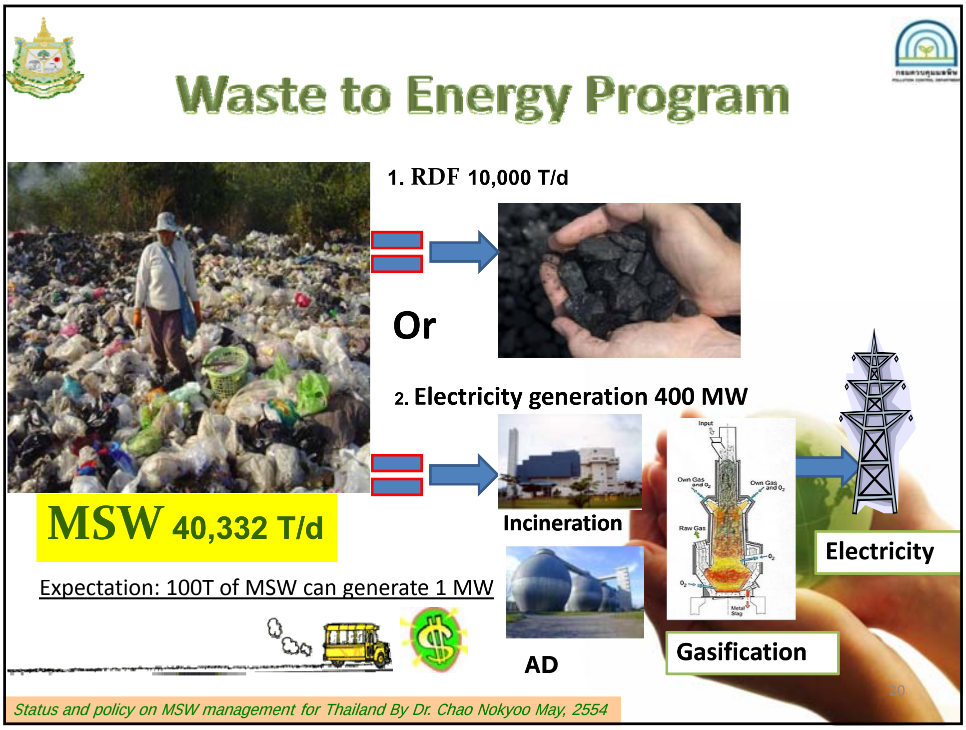
- Open dumping
- Open burning
- Incinerators
- Landfill

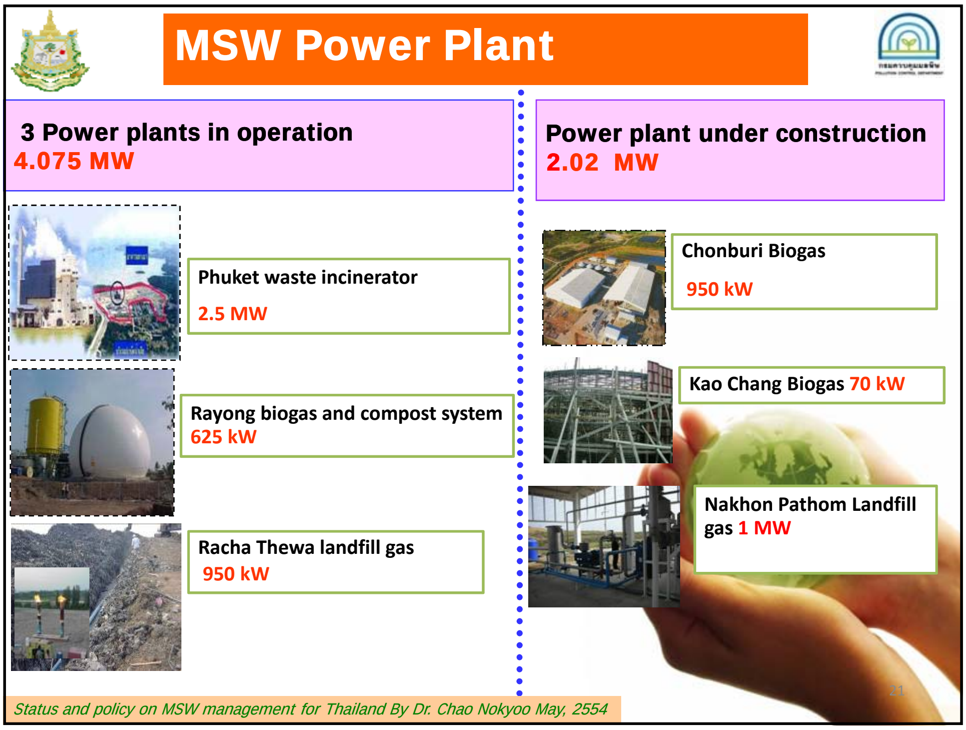
Status and policy on MSW management for Thailand By Dr. Chao Nokyoo May, 2554

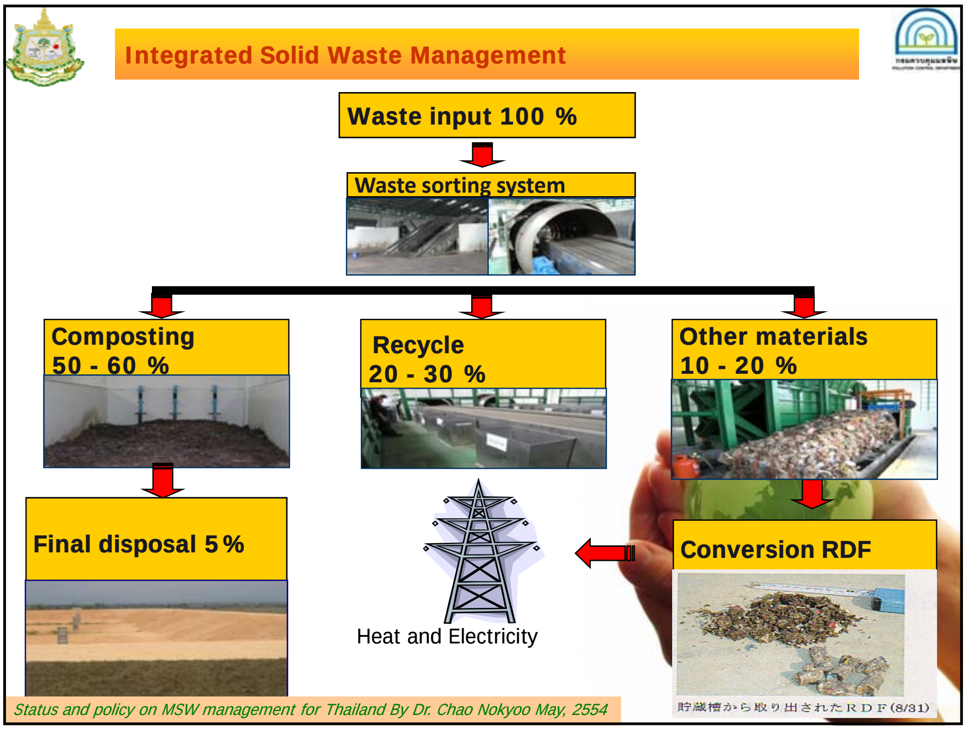

Integrated Waste Management: Opportunity
Waste reduction/ separation at sources
Waste Utilization
· Compost
· Waste to energy
· Waste separation
Final Disposal
(Sanitary Landfill)
Current approaches
➢ Community-based waste management
➢ Waste to energy
➢ Integrated Waste Management
17
Status and policy on MSW management for Thailand By Dr. Chao Nokyoo May, 2554

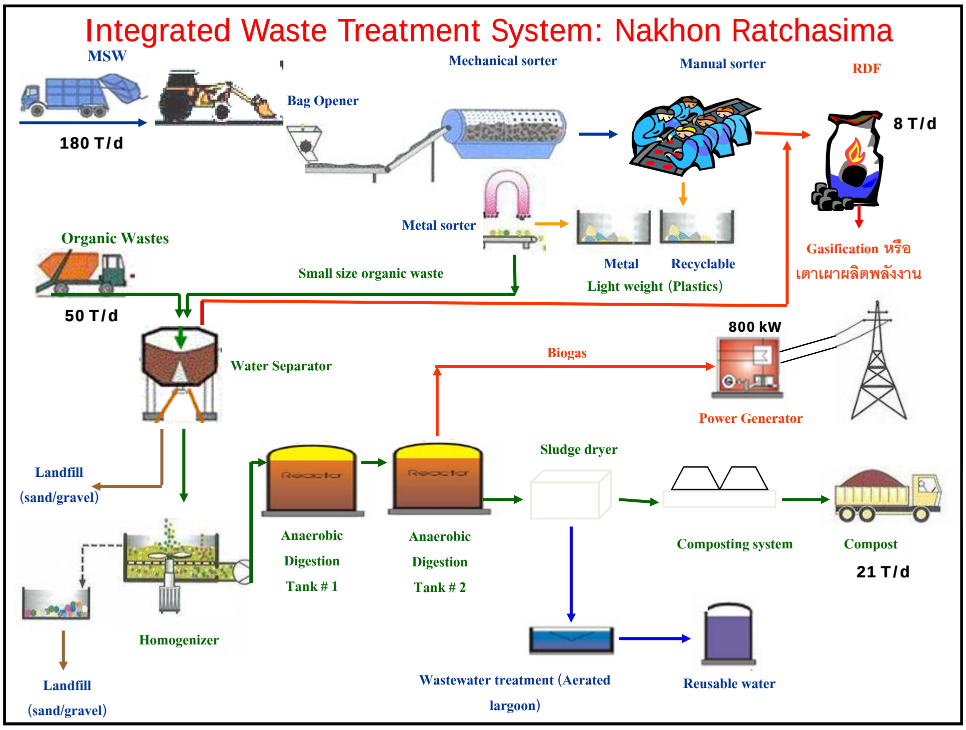

Community-Based Waste Management
Source
Household
Com m.
Collection
Separation
Waste management facility
Compost
Bio-gas
landfill
Compost tea
Recycle material
Others
Waste Composition
Organic 64%
Recyclable 30%
Hazardous 3%
Others 3%
Plastics
newspaper
Glass & Plastics bottles
Metals/cans
Household composting
Recyclable materials
Community composting
18
Status and policy on MSW management for Thailand By Dr. Chao Nokyoo May, 2554

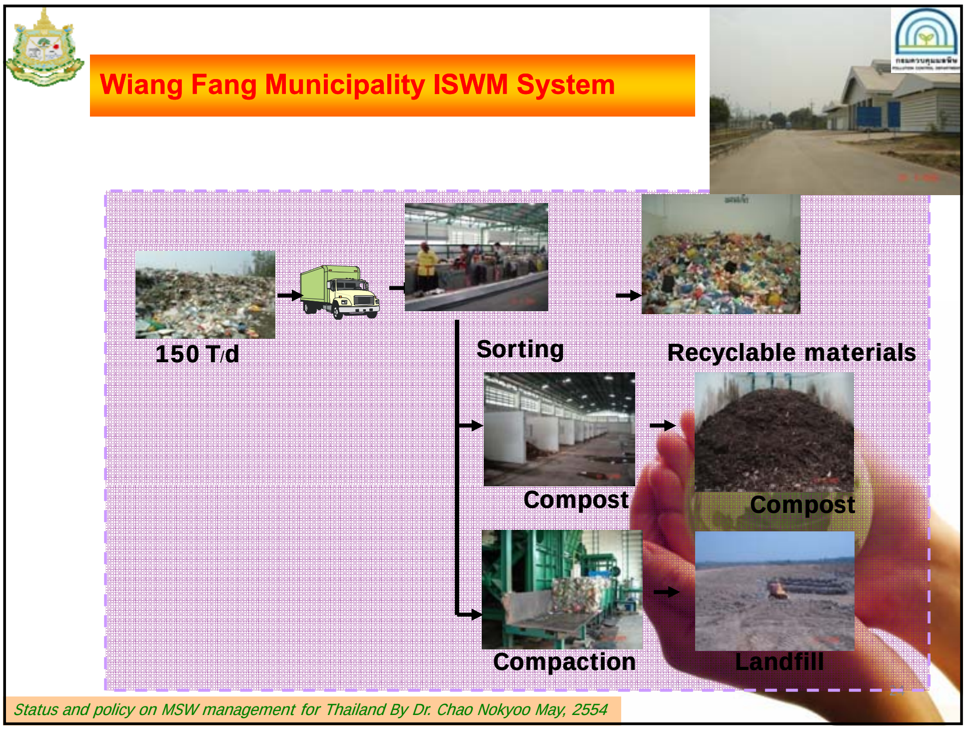

Phitsanulok – Waste Management Initiatives
ศูนย์ปุ๋ยชีวภาพประจำชุมชน
Community Compost Fertilizer Center

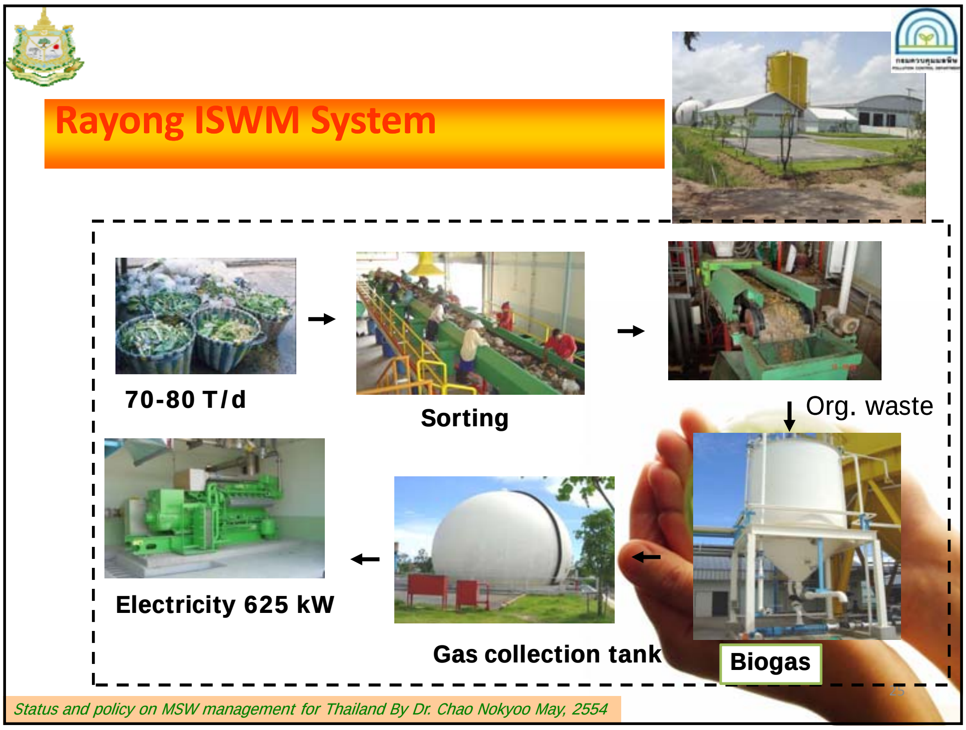

Waste to Energy Program
1. RDF 10,000 T/d
Or
2. Electricity generation 400 MW
Incineration
AD
Gasification
Electricity
MSW 40,332 T/d
Expectation: 100T of MSW can generate 1 MW
Status and policy on MSW management for Thailand By Dr. Chao Nokyoo May, 2554


MSW Power Plant
3 Power plants in operation
4.075 MW
Power plant under construction
2.02 MW
Phuket waste incinerator
2.5 MW
Rayong biogas and compost system
625 kW
Racha Thewa landfill gas
950 kW
Chonburi Biogas
950 kW
Kao Chang Biogas 70 kW
Nakhon Pathom Landfill gas 1 MW
Status and policy on MSW management for Thailand By Dr. Chao Nokyoo May, 2554


Integrated Solid Waste Management
Waste input 100 %
Waste sorting system
Composting
50 - 60 %
Recycle
20 - 30 %
Other materials
10 - 20 %
Final disposal 5 %
Heat and Electricity
Conversion RDF
貯蔵槽から取り出されたＲＤＦ(8/31)
Status and policy on MSW management for Thailand By Dr. Chao Nokyoo May, 2554


Integrated Waste Treatment System: Nakhon Ratchasima
MSW
180 T/d
Bag Opener
Mechanical sorter
Manual sorter
RDF
8 T/d
Metal sorter
Metal
Recyclable
Light weight (Plastics)
Gasification หรือ
เตาเผาผลิตพลังงาน
Organic Wastes
50 T/d
Small size organic waste
Water Separator
Biogas
800 kW
Power Generator
Landfill
(sand/gravel)
Anaerobic
Digestion
Tank # 1
Anaerobic
Digestion
Tank # 2
Sludge dryer
Composting system
Compost
21 T/d
Homogenizer
Landfill
(sand/gravel)
Wastewater treatment (Aerated
largoon)
Reusable water


Wiang Fang Municipality ISWM System
150 T/d
Sorting
Recyclable materials
Compost
Compost
Compaction
Landfill
Status and policy on MSW management for Thailand By Dr. Chao Nokyoo May, 2554



GHG Emission Inventory

Activity	Direct Emissions		Indirect Emissions	Avoided Emissions	Emission reducing Actions
	Gross emissions	Net emissions			
Collection & Transport	CO_2 from fuels consumption	CO_2 from fuels consumption	CO_2 from electric vehicles CO_2 from outsourced transport		-Use of electric vehicles -Use of alternative fuels -Change mean of transportation
Transfer	CO_2 from on-site fuels consumption	CO_2 from on-site fuels consumption	CO_2 from electricity consumption		-Actions to improve energy efficiency of equipments and facilities
Mechanical pre-treatment	CO_2 from on-site fuels consumption	CO_2 from on-site fuels consumption	CO_2 from electricity consumption		-Actions to improve energy efficiency of equipments and facilities
Sorting, recycling and recovering	CO_2 from on-site fuels consumption	CO_2 from on-site fuels consumption	CO_2 from purchased electricity consumption	-Avoided GHG in corresponding to the emission resulting from the production of an equivalent quantity of materials -CO_2 avoided through potential production of solid recovered fuels.	-Actions to improve sorting rate -Recovery of sorting rejects
Physico-chemical waste treatment	CO_2 from on-site fuels consumption	CO_2 from on-site fuels consumption	CO_2 from purchased electricity consumption	-CO_2 avoided through potential production of alternative fuels	-Actions to optimize alternative fuel production

Activity	Direct Emissions		Indirect Emissions	Avoided Emissions	Emission reducing Actions
	Gross emissions	Net emissions			
Biological treatment (Compost & AD)	-CO_2 form biomass -CO_2 from fuels consumption -CH_4 & N_2O	-CO_2 from on-site fuels consumption -CH_4 & N_2O	CO_2 from purchased electricity consumption	-CO_2 avoided through energy production -CO_2 avoided through compost use -CO_2 avoided through recovery of the heat produced	-Optimization of aerobic conditions for composting processes -Optimization of energy and/or material recovery
Landfill	-CH_4 from landfill gas -CO_2 from landfill gas -CO_2 from on-site fuels consumption	-CH_4 from landfill gas -CO_2 from on-site fuels consumption	CO_2 from purchased electricity consumption	-CO_2 avoided through energy production	-Optimization of CH_4 oxidation, capture and combustion -Optimization of energy recovery
Incineration	-CO_2 from waste -CO_2 from additional fossil fuels -N_2O	-CO_2 from waste -CO_2 from additional fossil fuels -N_2O	CO_2 from purchased electricity consumption	-CO_2 avoided through energy production -CO_2 avoided through slag and ash recycling	-Optimization of energy recovery
Mechanical Biological Treatment (MBT)	-CO_2 form biomass -CO_2 from fuels consumption -CH_4 & N_2O	-CO_2 from on-site fuels consumption -CH_4 & N_2O	CO_2 from purchased electricity consumption	-CO_2 avoided through energy production -CO_2 avoided through compost reuse -CO_2 avoided through material recovery -CO_2 avoided through potential production of alternative fuels	-Actions to improve sorting and compost quality -Optimization of energy and material recovery

Keys to success

- Maximized Recycle
- Good Management
- Efficient Technology
- Proper Regulation
- Private Endorsement

Recommendations

- Sorting plants.
- Upgrading recyclable material plant.
- Electronic waste recycling plant.
- Hazardous waste recycle plant.
- Waste exchange program.
- Waste to energy – Highly interested by researchers and investors (both local and foreigner) in producing electricity and fuel oil.

29

Institute for Global Environmental Strategies (IGES)

Kitakyushu Urban Centre

DECENTRALISED COMPOSTING IN MUNICIPAL SOLID WASTE MANAGEMENT: Lessons Learned from Surabaya City, Indonesia

D.G.J.PREMAKUMARA
Policy Researcher, IGES

A Workshop on Capacity Building on Accounting and Utilising GHG Emission Reduction Measures for Local Waste Management Actors in Developing Asian Countries, 29-31 August 2011, Battambang, Cambodia

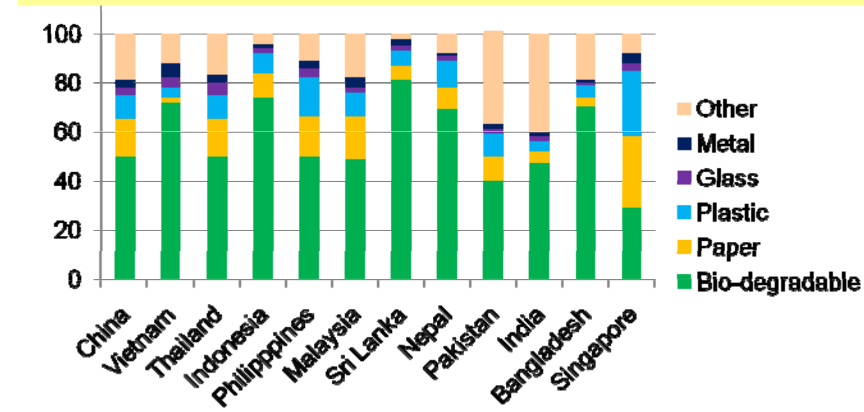
Presentation outline

- Introduction to Decentralised Composting in Municipal Solid Waste Management (MSWM)
- Discussion on Surabaya's Case Study
- Identify Potential and Challenges of GHG Emissions Reduction through Decentralised Composting
- Conclusion and Recommendation

Developing cities in Asia are facing tremendous challenge to dispose the solid waste in environmental friendly manner

The un-taped potential of organic waste in MSWM

Estimates show that over half of the waste generated in developing nations in Asia is organic and easily can be composted, but not effectively utilised



Source: Visvanathan (2006), APO (2007), Sang-Arun et al. (2011), Premakumara (2010)

Decentralised approach for composting

In decentralised composting, waste is composted near its source using appropriate technology such as small-scale, labour intensive, locally acceptable, and economically affordable.

Backyard Composting or Household Composting (this approach is feasible for households with a high level of composting awareness and a garden for placing the drum and/or for using the product compost).

Community Composting Centers (these schemes are usually small scale and are integrated with the residential waste collection system. The waste is either sorted at source or it is sorted after collection, depending on the degree of initiative taken by the residents)

DECENTRALISED COMPOSTING IN MUNICIPAL SOLID WASTE MANAGEMENT: Lessons Learned from Surabaya City, Indonesia

Decentralised Vs Centralised Composting

	Decentralised	Centralised
	Low and simple technology Labour intensive	Highly technical Less labour
	Low capital Low O & M Low transportation	High capital High O & M High transportation
	Interacts with neighborhood Provides no. of jobs Awareness generation Organic neighborhood farming	Low interaction Highly mechanised Individual awareness Mostly sale purpose

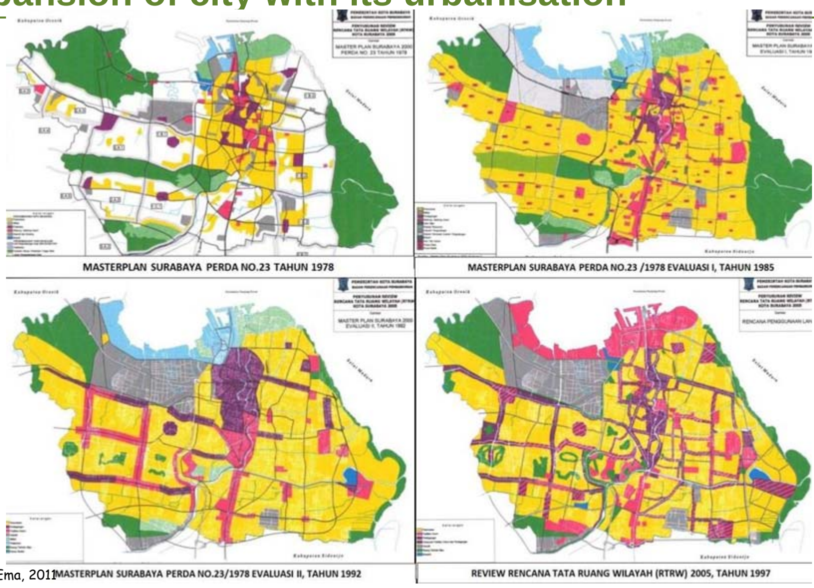
| IGES -KUC| http://www.iges.or.jp D.G.J.PREMAKUMARA, 29 August 2011

Case study of Surabaya City

The city of 3 million people (2010) is the second largest city in Indonesia and serves as an important commercial and industrial capital of East Java

Source: Ema, 2011

Expansion of city with its urbanisation



Source: Ema, 2011

Two-tiered System of MSWM in Surabaya (under the Community Primary Collection (Copricol) Law in 1980)

Responsibility of Community (Kampong). Waste collection is organised by Community-based Organisation (Rukun Warga). Residents pay for waste collection

H/H storage

Collection by RW

Transfer station

Responsibility of the Cleansing and Landscaping Department of the city. Residents pay for collection

Commercial/industrial

Collection by the city

SWM became a serious environmental issue in Surabaya

- The total waste generation was 1,800 tons per day in 2004 (residential 68%, markets 16%. Commercial/industrial 11%, streets and open spaces 5%)
- The city's waste collection coverage only 70% rest left in the streets, ditches and open spaces
- Keputih final disposal site was closed in 2001 due to public opposition and only final site at Benowa is over capacity and finding a new site is difficult due to a scarcity of public lands
- Disposal site was not well developed and open dumping and burning were common practices

Model Community in Kampong Rungkut Lor developed under the technical cooperation of Kitakyushu City, Japan

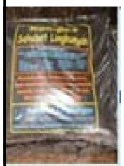
Educated women to start H/H business from recycling materials

Educated residents to separate waste at source and use of compost bin

Educated residents to start organic farming at H/H and community

Model community for community based SWM (200 H/H)

Collected H/H waste separately

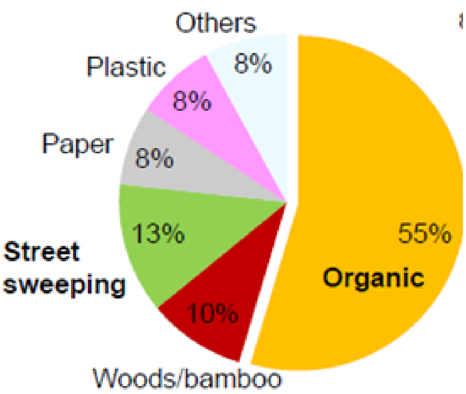


Rest sell in Market

Organic waste treated at composting center

DECENTRALISED COMPOSTING IN MUNICIPAL SOLID WASTE MANAGEMENT:
Lessons Learned from Surabaya City, Indonesia

Development of SWM Strategy based on the success of model community under the strong political support of the Mayor



Source: KITA, 2002.

Organic waste shares more than half of total amount of waste generation

Prioratise reduction of organic waste

Promote Decentralised Composting

- Waste sorting at source
- Composting at H/H
- Composting centers
- Promote recycled products integrating informal sector

IGES -KUC| http://www.iges.or.jp D.G.J.PREMAKUMARA, 29 August 2011

Public awareness campaign

Counseling activities


counseling To student


Counseling to Businessman


Counseling to community


Counseling to officer

Environmental campaign

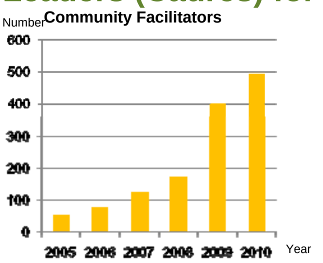


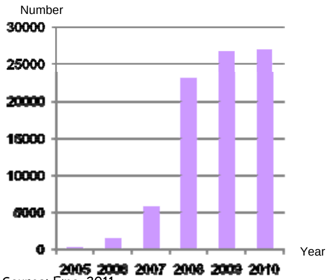

Socialization in school




Source: Ema, 2011

Recruitment of Facilitators and training of Environmental Leaders (Cadres) for community mobilisation





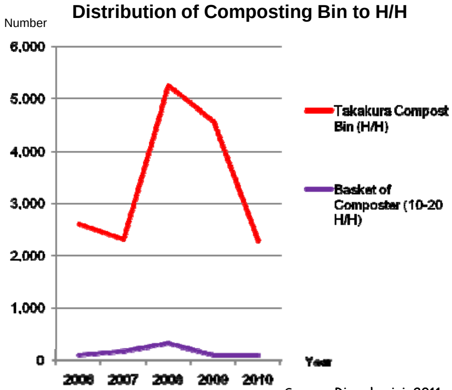
Source: Ema, 2011

Developed training materials for awareness raising

Source: Rismaharini, 2011

Support for starting composting programmes

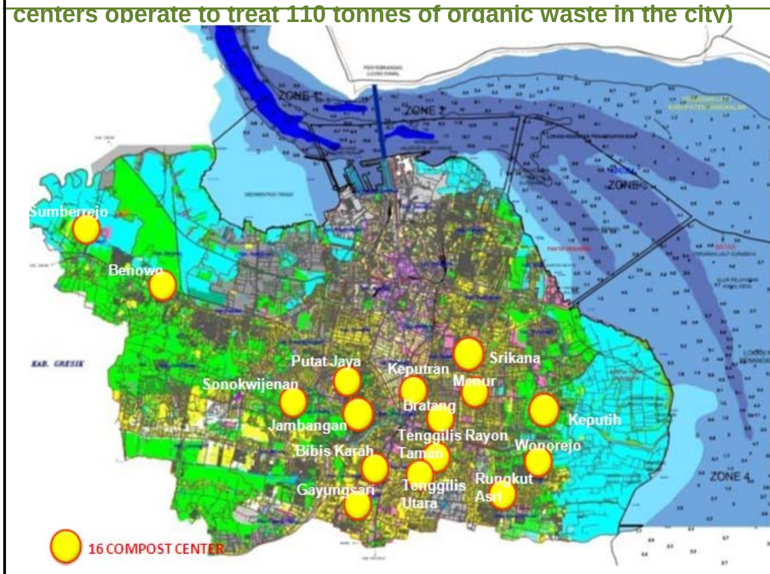
Distribution of compost bins to attended to training and willing to do residents (Over 20,000 H/H)



Source: Rismaharini, 2011

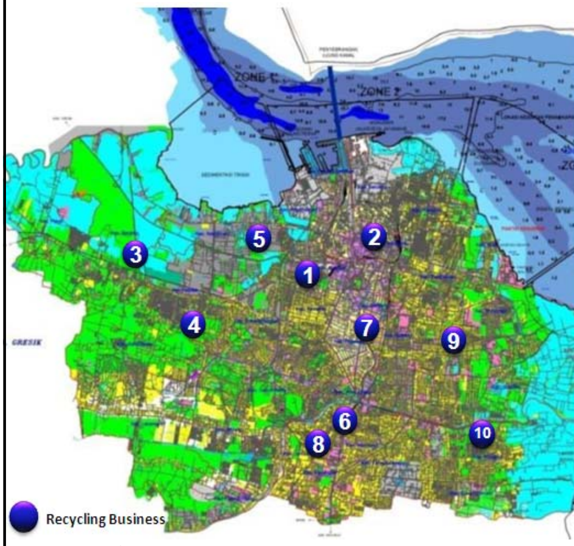
Provide necessary support for starting community composting centres: cleansing tools, composting tools, lands and capital cost for building, and buying composting products for city greening

Distribution of Composting Centres in the City (16 composting centers operate to treat 110 tonnes of organic waste in the city)



Source: Ema, 2011

Promotion of Recycled Product Village integrating informal businesses with private sector

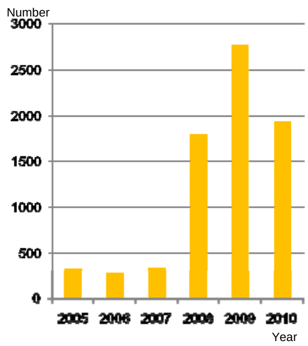


Source: Rismaharini, 2011

Establish both rewarding and law enforcements for motivating community to participate

- Rewards are given to the communities willing to participate through Surabaya Green and Clean Programme
- Reward s are given to Outstanding Environmental Leaders at the National Day Awarding Ceremony

Number of communities wiling to contest to Surabaya Green and Clean Award has been increased



Source: Ema, 2011

Strict in law enforcement to the communities not properly handle the SWM

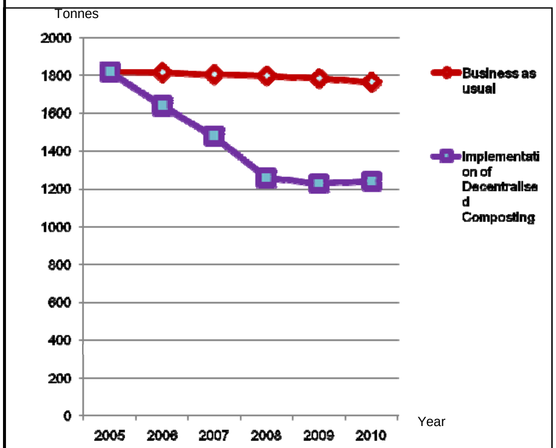
Motivation of Staff and Local Politicians

Capacity building (locally and internationally) for staff and local politicians

Recognition of its efforts at national and international level

Source: ema, 2011

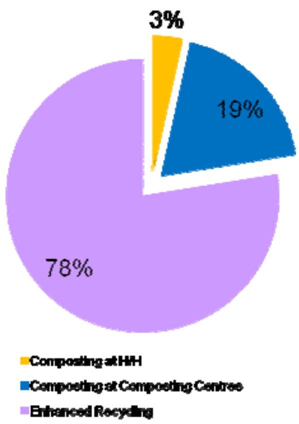
Achievement: Reduction of waste to be final dumped



Source: Ema, 2011

30% waste reduction to be land filled by 5 years

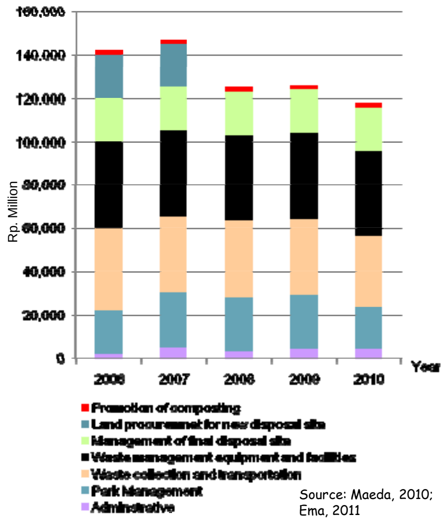
Enhanced recycling by removing organic matters from the waste stream (78% of waste reduction from recycling materials)



30% waste reduction using limited municipal budget

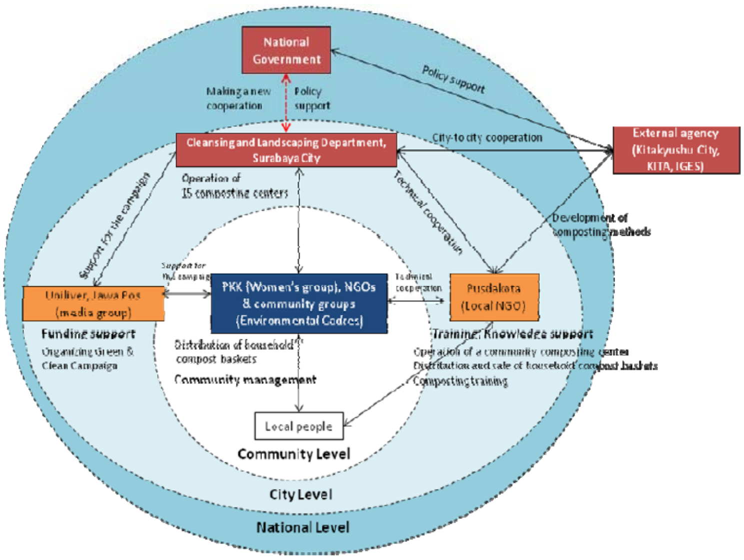
NO	BUDGET	BUDGET 2009	%	BUDGET 2010	%	NOTES
1.	Total budget	4.364.366.780.398	100 %	4.383.712.427.048	100 %	
2.	Environmental budget		4.7 %		4.6 %	
	Sea, Fishery and Farming Development Program	35.334.139.497	0,8%	23.405.280.994	0,5 %	Farming Dept.
	Environment Control and Conservation Program	11.430.786.532	0,3%	13.918.825.429	0,3 %	Bappeko, Farming, Transportation, Environment
	Green Open Space and City Park Program	40.652.921.024	0,9%	58.200.507.958	1,3 %	Farming, Spatial and Cleaning Dept.
	City Cleanliness Management Program	118.486.923.877	2,7%	105.705.809.320	2,4 %	31 district, Cleaning Dept

Only 1-2% of Cleaning and Landscape Department Budget is used for composting



Source: Maeda, 2010; Ema, 2011

Established public, private and community partnership



Lessons Learned: Achieving Sustainable Development

- Decentralised composting often goes along with primary waste collection services, which improve the overall performance of the municipal waste collection services, as well as hygienic conditions within the service areas.
- Decentralised composting diverts the organic, a larger fraction from the municipal waste stream close to the source of generation, reducing transportation costs and prolonging the life span of landfills. It further enhances recycling activities.
- Decentralised composting schemes can easily be initiated without large investments. Instead of setting up one capital intensive centralised plant, decentralised plants can gradually set up over several years thus distributing capital requirements over time.
- Given their smaller size and location, Decentralised composting are more flexible in management and operation and can better adapt to changes in the local needs and requirements.

DECENTRALISED COMPOSTING IN MUNICIPAL SOLID WASTE MANAGEMENT:
Lessons Learned from Surabaya City, Indonesia

Achieving Sustainable Development (continue…)

➢Decentralised composting provide employment opportunities in the neighbourhoods, as labour intensive technology adopted to the local socio-economic situation. It offers new and safer income opportunities particularly for urban poor working in the informal sector.

➢Decentralised composting activities and the interaction between residents in issues of waste handling, hygiene, cleanliness and environment can significantly enhance environmental awareness in a community and strengthened the social capital.

Issues and Challenges in implementing Decentralised Composting

Social Issues

- Segregation of waste at source
- Support from community leaders, civil society groups and households
- Keeping communities motivated
- Motivating the farmers use compost instead of fertliser

Financial and Marketing issues

- Lack of seed money
- Labour costs maintenance through only sale of composting
- Lack of user pay system and options
- Adjustment of working capitol for O & M
- Insufficient market demand for composting
- Poor quality and competition from chemical fertilisers

Technical issues

- Lack of sound resource persons/institutions that can provide know-how for composting
- Inadequate attention and knowledge on the biological process
- Lack of quality assurance and standards

Institutional and Policy issues

- Lack of policies, legal guidelines and regulations for composting
- Lack of integrated approach for SWM
- No proper institutional and implementation arrangements
- Frequent changes in policies/ no consistent long term policies
- Lack of support from the city leaders and relevant staff and departments

Pre-requisites for Decentralised Composting

- Pre-requisite for the promotion of Decentralised composting is not merely funds for implementation but rather necessary changes in the solid waste management policy and strategy of the responsible authorities and changes of mind-sets of politicians, officials and citizens.
- Decentralised composting should be considered as part of an integrated solid waste management strategy rather than isolated project.
- Participation and cooperation of many stakeholders is required, including national governments, municipalities, local communities, waste generators, and the private sector.
- Community participation and cooperation can be achieved through establishing community awareness programme, establishing rewarding system and enforcing existing by-laws.
- Municipality needs to provide support for community initiatives by allocating lands, providing technical assistance, cost sharing for capital investments,
- Improving market compatibility through establishing quality standards, regulating and monitoring the performance, issuing certificates, initiating buy-back programmes, linking with agricultural and horticultural activities.

Potential of GHG emission reduction through Decentralised Composting

Bratang Composting Centre, Surabaya

Scenario, Base condition

- Waste Quantity: 1.4 tons per day
- Organic fraction: 65%
- Degradable Organic Carbon, Fraction: 0.50
- Methane Correction Factor: 1.0
- Compost Efficiency: 95%
- Crediting Period: 10 Years

Source: Komalirani, 2011

Calculation of Emission Reduction based on UNFCCC's AMS-111F for small-scale projects

- Emission Reduction (ERs) (10 years): 2945 tCO_2e
- Certified Emission Reduction Pricing: 29,450 Euro (based on 10 Euro/1tCO_2e in CER market)

Challenges: Time consuming process for getting CDM approval

e.g. Development of CDM Project for the Decentralised Composting in Bangladesh (Waste Concern) are taken over 4 years

7 January 2004	DCC gives NOC for preparation and implementation of the projects under CDM
29 February 2004	WC submits two CDM Projects to National CDM Committee for LFG Recovery (LFG & Composting) along with commitment letter of Dutch investor.
18 April 2004	National CDM Committee approved the projects
8 August 2004	National CDM Board headed by the PM office gives final approval of the project.
17 Sep 2005	First CDM Project of WC (Landfill Gas Extraction and Utilization) Registered with UNFCCC.
24 Jan 2006	DCC's Signs 15 years Concession Agreement for the 700 tons/day capacity compost plant
18 May 2006	Second CDM Project of WC (700 ton capacity compost plant) Registered with UNFCCC (after development of a new methodology AM 0025)
16 May 2007	Compost Project Registered from Board of Investment (BoI)
August 2007	Environmental Clearance (IEE) from DoE for Construction (Site Clearance)
Nov 2007	Construction Process of Compost Plant Started November 2007
March 2008	Trail Production and Monitoring started and full production by June 2008

Source: Waste Concern, 2008

Challenges: High transaction cost in CDM

Transaction costs per ton of CO2 equivalent reduced are highly dependent on the size of the total emission reductions achieved by the project (Krey,2004).

Project size (tCO2e/a)				Transaction costs (Euro/tCO2e)			
Baseline (Krey,2004)	**Senario 1**	**Senario 2**	**Senario 3**	**Baseline (Krey, 2004)**	**Scenario 1**	**Scenario 2**	**Scenario 3**
1000000				0.1			
100000				0.25			
10000				1.8			
			5250				6
		2805				12	
1000				18			
	294				150		
100				176			

Note:
1. Scenario 1: Case study of Bratang composting centre
2. Scenario 2: Bundling the existing 16 composting centres in the city
3. Scenario 3: Assumption that city operate 31 composting centers including one for each of its waste management districts

Possibility in bundling small-scale decentralised composting schemes in the city

NO.	Compost plant name	total	inorganic	organic	ERs (10 years)
		m³	m³	m³	tCO2e/a
1	Menur	169	51	118.0	2832
2	Keputran	53	0	53.0	1272
3	Bratang	191	68.5	122.5	2945
4	Rungkut	101	24.5	76.5	1824
5	Wonorejo	139	38.5	100.5	2400
6	Liponsos	70	10	60.0	1440
7	Srikana	69.5	22.5	47.0	1200
8	Tenggilis utara	112	28.5	83.5	1990
9	Tenggilis rayon taman	113	39	74.0	1776
10	Gayungsari	66	17.5	48.5	1152
11	Bibis karah	52	9	43.0	1032
12	Jambangan	80	23	57.0	1368
13	Sonokwijenan	151	48.5	102.5	2448
14	Putat jaya	102	18	84.0	2020
15	Benowo	94	36.5	57.5	1400
16	Sumber rejo	51	10.5	40.5	960
Total		**1614**	**446**	**1,168**	28059

Source: Komalirani, 2011

Cost/benefits calculation under the 3 scenarios

Scenario	**Certified Emission Reduction Pricing (CER)/Euro (10 Euro/tCO2e)**	**Transaction cost/Euro**
Scenario1	29450	441750 ☻
Scenario2	280590	336708☻
Secenario 3	525000	315000☺

Risks need to be considered in decentralised composting

- Bundling individual composting plants together is effective, but management of a complex bundled structure with number of decentralised composting plants makes the operation and monitoring of the project activity difficult. There is a risk that the emission reductions are either not achieved as expected or that the emission reductions achieved by the project are not properly monitored.
- The engineering risks rather small in decentralised composting projects, because they are based on simple, labour intensive, low-tech approach.
- However, long term sustainability and operational risks are high. The compost might not find buyers resulting financial risk because the project might become unviable. Sustaining community support for waste segregation at source and pay for monthly waste collection services are highly challengeable and risky.
- Keeping continuous support from political leaders, officials and other stakeholders is also risks with sudden political changes in the city.
- The institutional set-up need to be considered. The complexity of institutional set-up grows with the level of decentralised approach. Ownership of the emission reduction achieved by the composting projects came not clear in some situations where owners are not clear.

DECENTRALISED COMPOSTING IN MUNICIPAL SOLID WASTE MANAGEMENT: Lessons Learned from Surabaya City, Indonesia

Policy Recommendations

- The contribution that decentralised composting project makes to sustainable development and the conservativeness of the methodologies (e.g.. Gold Standards) used for monitoring are need to consider. Rather than trying to fulfill the perfect requirements of the Gold Standards, simple values need to be considered and such figures should be calculated per unit in order to insure the comparability among different project types and sizes.
- In order to reduce the high cost burden, simplified monitoring methodologies, lowered registration fee for small and decentralised projects, removed or even turned into a registration grant while the registration fee for large centralised projects could be increased.
- Outside the CDM, the voluntary market need to be strengthened to provide opportunities for selling emission reductions. The problem is however little information in the developing countries about voluntary market and lack of awareness and capacity. This can be overcome through strengthening city-to-city networks for information sharing and capacity building

CAMBODIAN EDUCATION WASTE MANAGEMENT ORGANIZATION

CENTRALIZED COMPOSTING

Chau Kim Heng, COMPED
Organization

Workshop on Capacity Building on Accounting and Utilizing GHG Emission Reduction Measures for Local Waste Management Actors in Developing Asian Countries, Vientiane, Laos, 04 - 06 October 2011.

Contents

Organization COMPED

- NGO, established in 2000
- 18 staff members (2011)
- Activities and experiences: waste analysis, trainings and workshops, development guidelines, social marketing, social engagement, composting

CENTRALIZED COMPOSTING

Centralized Composting

- First composting project (2001 – 2009) in Phnom Penh on Dump site Stung Meanchey, 2000 m^2. Processes 5 t/day (1152 t/y) organic market waste. Compost product 135 t/y.
- Second composting project started 2009 on 8000 m^2 next to dumpsite Battambang. Able to process organic market waste 10 t/day.

Why Centralized Composting

- No decentralized composting policy,
- Recycling activities are not integrated in **(part of)** solid waste management, composting is a project,
- Awareness of the people (stakeholders) is limited,
- Land issues,
- No source separation etc.

Open Windrow turned Composting

Pre-treatment (waste separation)

- 4 waste pickers working hard at the waste separation every day (manually).

Pre-treatment (pilling up compost heap)

- with the piles 3-5 m wide and 1.5 -2 m high,

- waste separation continues.

Composting Process

- Best condition during composting process
  - temperature of the composting pile is between 65 °C - 70 °C
  - water content is 65%

- Compost process will take 4 – 6 months.

Screening compost

Minimum requirements for composting the product

- The moisture of the compost has to be less than 45% .
- Compost has to contain organic matter and other nutrients.
- Compost should be free of unwanted materials like plastic, rubber, metal, glass and stones.

Compost Production

COMPED Compost

N nitrogen > 1.32%

P phosphorus > 1.72%

K potassium > 2.24%

pH value of 7.0-7.5.

DIFFICULTIES AND SOLUTIONS

Difficulties and Obstacles

- No source separation: sorting out the non-compostable waste (from the beginning till end composting procedure) takes a lot of time.
- Composting is not integrated into SWM: Nobody (stakeholders) feels responsible for the delivery of organic waste to the compost facility.
- Compost quality: people are not very much aware about the environmental impact of the waste, often the waste is mixed with hazardous waste.
- No incentives from the local government: the waste delivery to the composting site is for free but should be either subsidized or chargeable.
- No regulations and guidelines on composting and compost products by the government: difficult to develop market strategies.

Possible Solutions

- Keep in touch with the local government by constantly sending reports and asking for support (if necessary).
- Keep in touch with to the waste collectors, keep on asking for waste.
- Try to find (financial) support to cover the costs.
- Work hard on compost marketing by demonstrating the use and benefits of composting.

Prospects

- The Compost Project is a branch of the COMPED organization. With our ongoing project we introduce the topic of composting to local and international organizations, trying to find project-partners and funding for additional projects.

THANK YOU FOR YOUR KIND ATTENTION

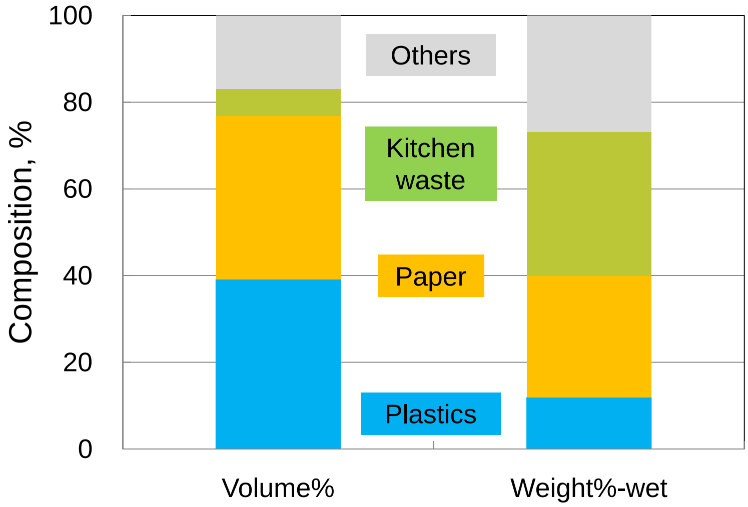
GHG Reduction through Suitable Treatment and Utilization of Waste Plastics

Yoichi KODERA, PhD, Senior Research Scientist
National Inst. of Advanced Industrial Science & Technology (AIST) at Tsukuba

Aug., 2011 Cambodia

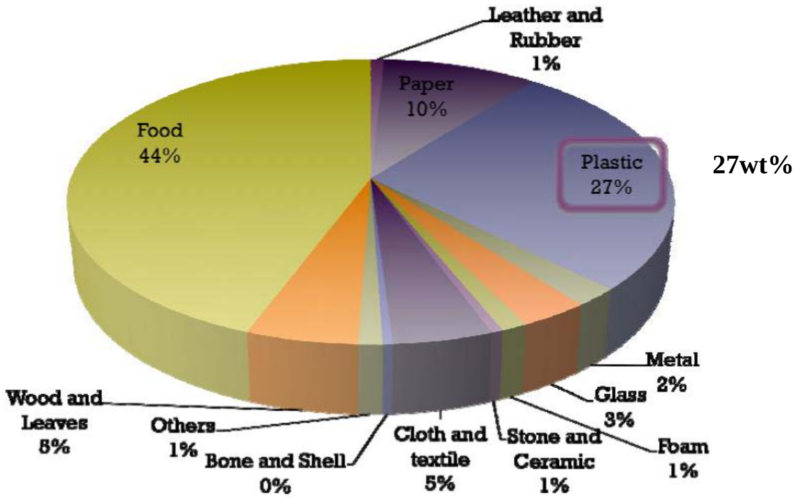
Contents

Major components of household wastes



Source: White paper, Ministry of Environment, Japan

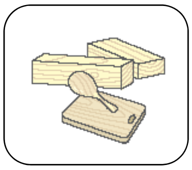
Municipal wastes in Bangkok, Thailand



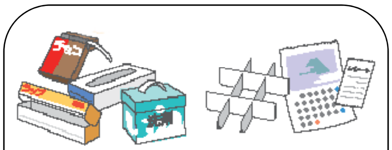
http://gec.jp/gec/en/Activities/EST/2009/wasteplatics/D2_AliceSharp.pdf

Typical separate collection of household wastes in Japan

Combustibles | Non-combustibles | Resources | Hazardous



Kitchen waste **Wood**



Mixed paper: Some cities collect it separately for recycling.

Waste plastics: plastic resources
- Containers & packaging :
- PET bottles

Cans
ferrous/aluminum

Glass bottles
clear, brown, others

Challenges from incineration and landfill recycling for some purposes

Food waste → Compositing

Mixed paper → Recycled paper

Increase recycling amount of waste plastics

Plastics → Recycled resin and fuel

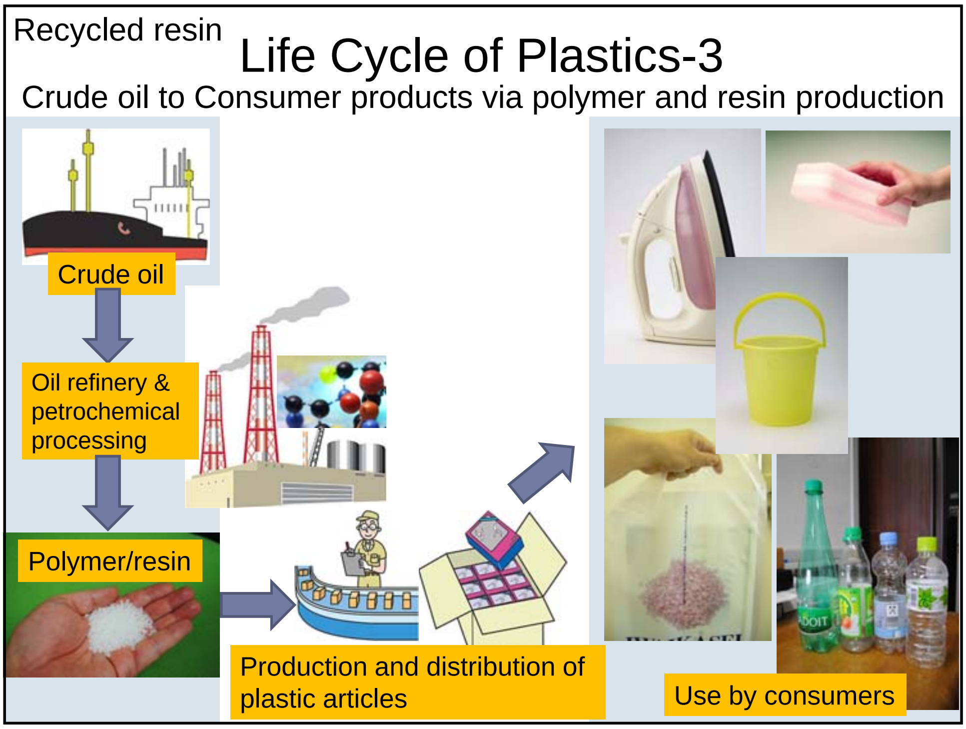
Environmental impact such as CO_2 emission?

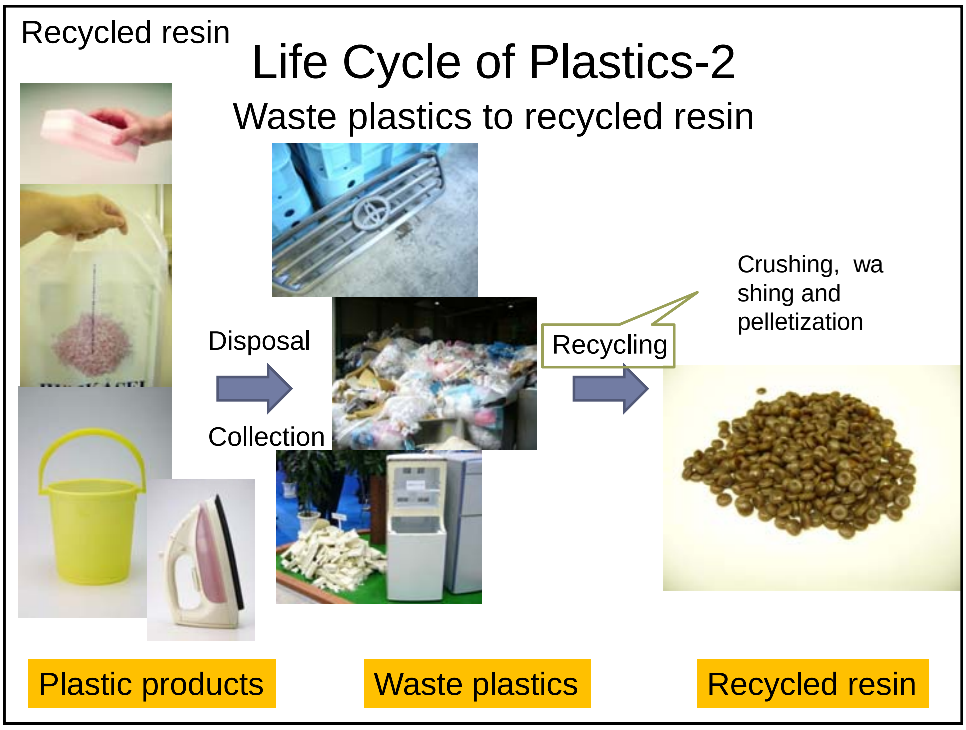
Why do we recycle wastes?

1. Local government & waste management company:
   Sell valuable materials to obtain benefits.
2. Reduce material or energy consumption by using waste resources.
3. Reduce environmental impact by the conversion of wastes to energy or materials.

Reduction of environmental impact through waste plastics utilization

- 1. As a recycled resin
  - Waste plastics that are separately collected can be processed to produce recycled resin. Termoplastics such as PE, PP and PS are the typical feedstock.
  - This is one of Clean Development Mechanism approved by the UN.
    - http://cdm.unfccc.int/UserManagement/FileStorage/T1INGS9C34QMRP2YXJ78UHAZVD5FL6
- 2. As a cleaner fuel than coal or heavy oil
  - Some plastics can be processed to produce solid, liquid and gaseous fuel. These fuels gives the cleaner flue gas than coal and heavy oil like less CO_2 per weight and less NO_x.


Recycled resin
Life Cycle of Plastics-3
Crude oil to Consumer products via polymer and resin production
Crude oil
Oil refinery & petrochemical processing
Polymer/resin
Production and distribution of plastic articles
Use by consumers


Recycled resin
Life Cycle of Plastics-2
Waste plastics to recycled resin
Disposal
Collection
Recycling
Crushing, wa shing and pelletization
Plastic products
Waste plastics
Recycled resin

Recycled resin

Life Cycle of Plastics-3

Production of recycled plastic articles

Injection molding

Construction material

Recycled resin

CO_2 Reduction by Using Recycled PS (1)

Clean white PS tray

Clean but colored tray

CO_2 Reduction by Using Recycled PS (3)

Consumers
Crude oil ⇒ New PS ⇒ PS tray ⇒ ⇒ Waste (Clean white tray)
separate collection
followed by pelletization
Consumers
Recycled PS ＋ New PS ⇒ Recycled PS tray ⇒⇒ Waste
60% 40%

Environmental Impact	Recycled PS Tray-60%	New PS Tray
Energy as Feedstock / GJ	11	32
Energy of Transportation and Processing / GJ	25	33
CO_2 / ton	2.4	4.5
SO_x / kg	1.6	2.7
NO_x / kg	2.4	3.2
Solid waste / kg	8.7	22

CO_2 Reduction by Using Recycled PS (4)

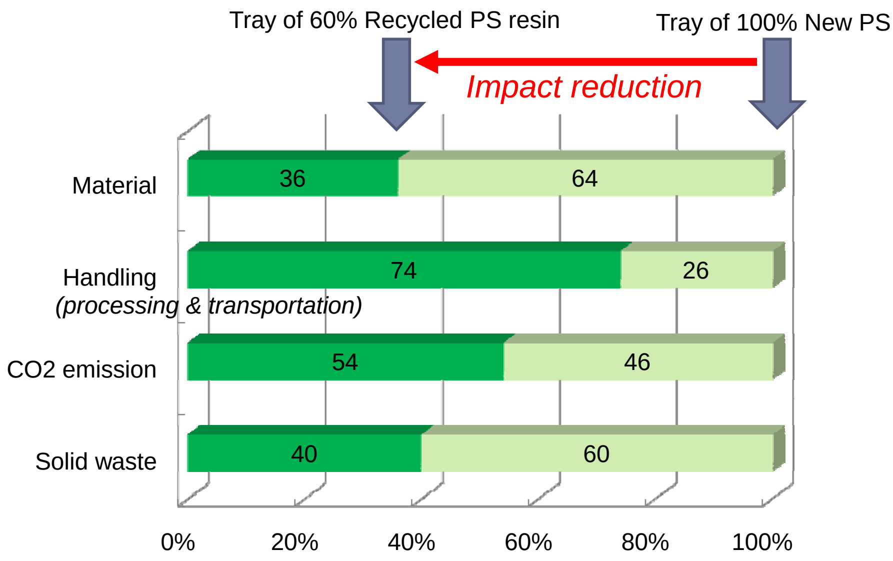


Table: Environmental impact reduction by using 60% recycled resin

Typical end-user application of waste plastics

Solid fuel

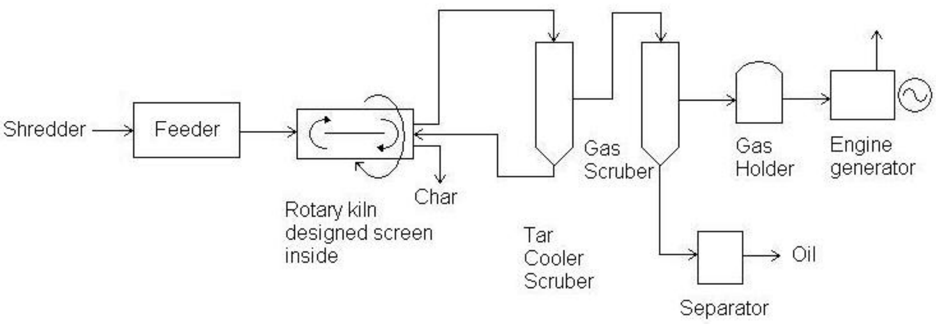
- Production: Crushing and pelletization. Drying process is required for wet wastes. Pelletization is carried out at ca.200 ˚C.

Liquid fuel

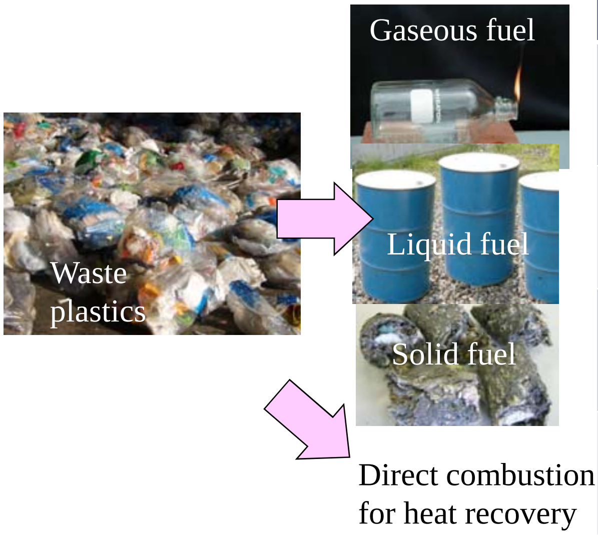
- Production: Pyrolysis followed by distillation. Crushing and separation required for some wastes.

Gaseous fuel

- Production: crushing and pyrolysis.
- Steam gen. – power gen., or gas turbine combustion– power gen.
- Major trouble: pluging of tar-ash mixture at a tubing between a kiln and gas-tar separator.

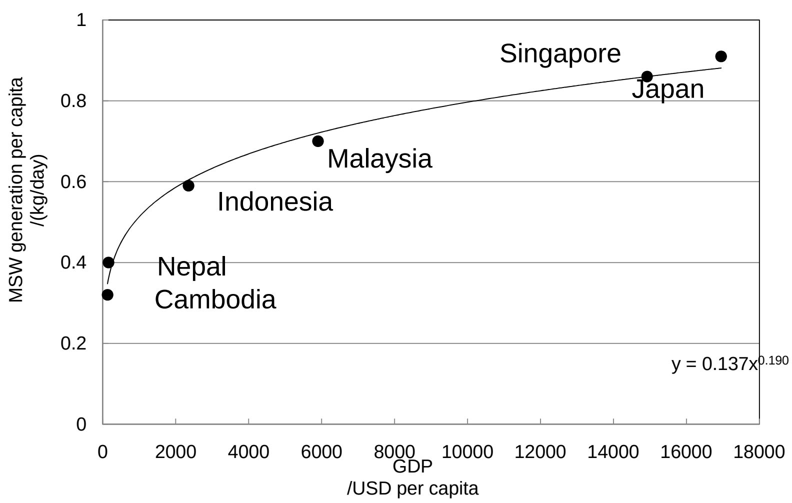


Reduction of environmental impact by using cleaner fuel derived from waste plastics



Heat	Ash	Flue gas	Similar fuel
◎	◎	◎	LNG/LPG
◎	◎	○	Diesel oil
○	△	△ or ×	Coal
△	×	×	none

Waste generation with GDP



Increasing trend in three categories of high, middle and low generation

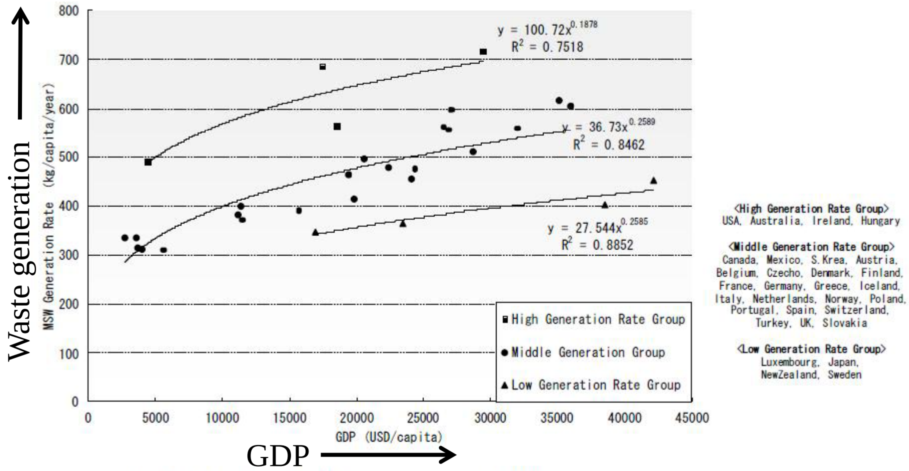


Fig. 4 Relationship of GDP per capita and MSW generation rate

M.Tanaka、http://www5.cao.go.jp/keizai-shimon/special/pdf/1004item7.pdf

Urban Solid Waste Generation (1995)

"*What a waste: Solid waste management in Asia*," The International Bank for Reconstruction, and Development/THE WORLD BANK

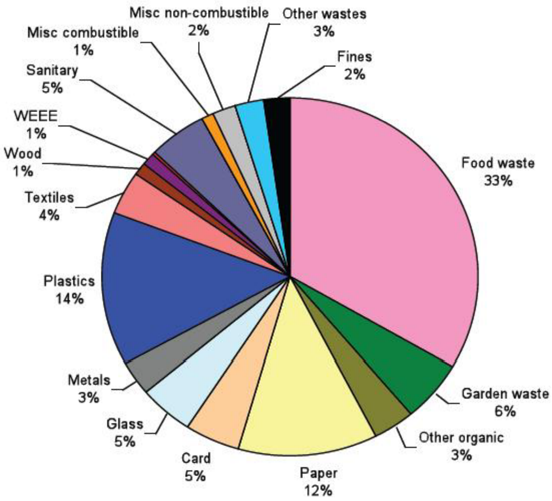
*http://web.mit.edu/urbanupgrading/urban environment/resources /references/pdfs/WhatAWasteAsia.pdf

Country	GNP Per Capita [1] (1995 US $)	Current Urban Population (% of Total)[2]	Current Urban MSW Generation (kg/capita/day)
Nepal	200	13.7	0.50
Bangladesh	240	18.3	0.49
Myanmar	240*	26.2	0.45
Vietnam	240	20.8	0.55
Mongolia	310	60.9	0.60
India	340	26.8	0.46
Lao PDR	350	21.7	0.69
China	620	30.3	0.79
Sri Lanka	700	22.4	0.89
Indonesia	980	35.4	0.76
Philippines	1,050	54.2	0.52
Thailand	2,740	20.0	1.10
Malaysia	3,890	53.7	0.81
Korea, Republic of	9,700	81.3	1.59
Hong Kong	22,990	95.0	5.07
Singapore	26,730	100	1.10
Japan	39,640	77.6	1.47

[1]World Bank, 1997b
[2]United Nations, 1995
*estimated GNP

See Figure 7 for comparison to 2025.

Household wastes (UK) 2006-7



http://www.resourcesnotwaste.org/upload/documents/webpage/RRF%20Advisory%20Committee/JulianParfitt(2010)presentation.pdf

Properties of waste fractions

Type	LHV	Total solid	C fossil	CO_2 from Fossil C	C bio.	CH_4 potential
	MJ/kg-Wet	% Wet base	% Total solid	kg/100kg-Total solid	% Total solid	L/kg-Dry solid
Plastics	34.1	89.1	79.3	290.8	0.4	0
Paper	12.9	90.5	0.2	0.7	32.7	158.1
Kitchen waste	5.8	29.6	0.5	1.8	49	435.7
Garden waste	7.5	52.2	0.8	2.9	43.1	114.6
Cardboard	13.6	80.6	2.1	7.7	42.4	154.8

E. Gentil, J. Clavreul, T. H. Christensen, *Waste Management & Res.*, 27, 850 (2009).

Recycled resin

Life Cycle of Plastics-1

Raw Material
- Crude oil to naphtha
- Naphtha to ethylene and others

Polymers
- Ethylene to polyethylene
- Production of other chemicals

Plastic articles
- Molding
- Film production

Recycled resin

Life Cycle of Plastics-2

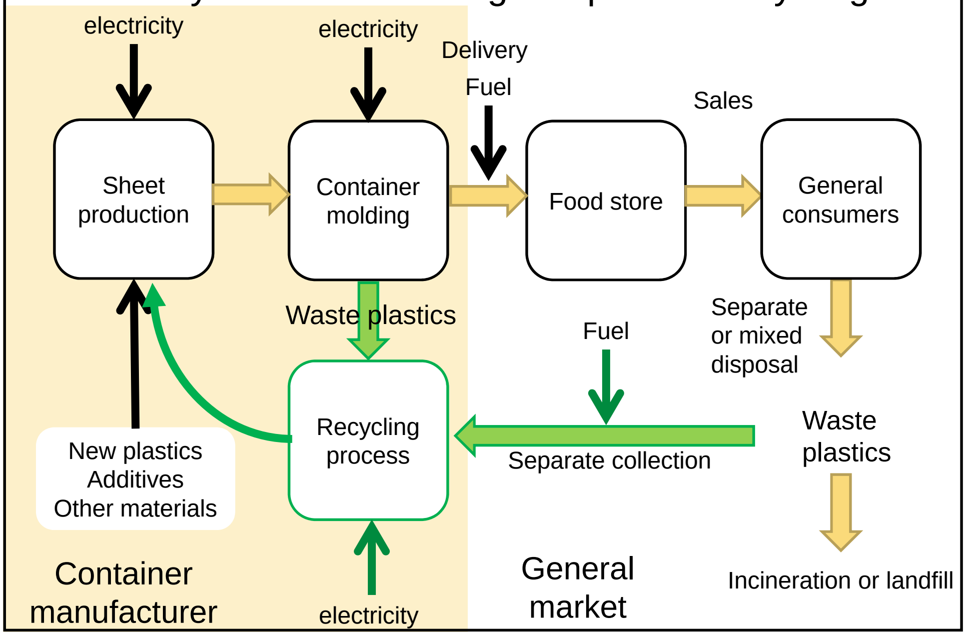
Used by Consumers
- Sole, mixed or composite
- Soft and hard plastics

Collection
- Whole components of wastes
- Separate component of wastes

Treatment
- Disposal/incineration or landfill
- Recycling/recycled resin or fuel

CO_2 Reduction by Using Recycled PS (2)

Life cycle of once-through disposal & recycling



Typical Recycling Laws relating to Waste Plastics in Japan

Name of law	Example of plastic recycling	Problems
Containers & packaging recycling law	Resin production is preferential to the use as coal substitute in cokes oven and syngas production	Higher cost, 80 yen/kg, in resin production than cokes oven treatment, 40 yen/kg.
Home appliance recycling law	Clean plastic parts are recycled in cascade way. Vertical recycling by precise separation has been commercialized.	Mixed plastics and non-recyclable plastics such as polyurethane.
End of Life Vehicle recycling law	ASR containing plastics and dirt is allowed to incinerate for heat recovery.	Precise recovery of metals and plastics draw attention.

Other target plastics in future: E-wastes for metal recovery, plastic products of non-packaging, marine debris, textile, and agriculture film like in a greenhouse

Status of Recycling

- Waste is separated into industrial waste produced by business activities and all other municipal waste (mainly produced by households).
- Waste recycling volumes and recycling ratios tend to consistently rise after establishment of recycling laws.

Waste

Municipal waste

Produced by households

Volume produced **48.11 million tons (100%)**

Obligation for collection, transport and disposal is shouldered by local authorities.

- Volume recycled 9.78 million t (20%)
- Volume reduced 32.75 million t (73%)
- Final disposal volume 5.53 million t (12%)

Industrial Waste

Produced by business activities

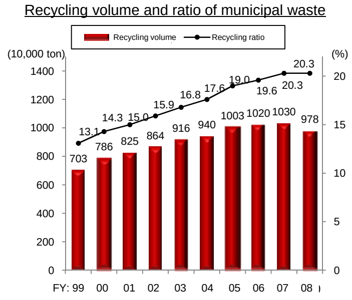
Volume produced 419 million tons (100%)

Companies producing waste are responsible for treatment.

- Volume recycled 219million t (52%)
- Volume reduced 180million t (43%)
- Final disposal volume 20.million t (5%)

Regulated by relevant laws

Recycling volume and ratio of municipal waste



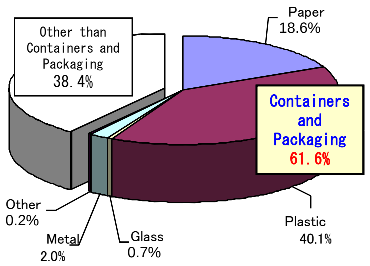
Municipal waste: Data collected in FY08.
Industrial waste: Data collected in FY07

Background of Containers and Packaging Recycling Law

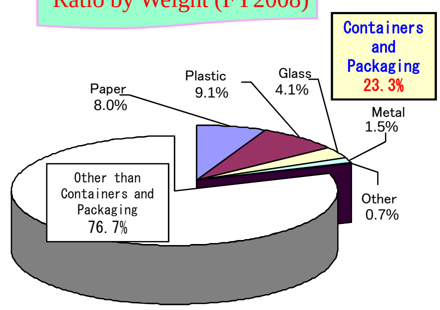
It is necessary to solve problems of tight final disposal site and establish recycling-oriented society aiming for zero refuse with the increase of disposal volume for Municipal waste.

Containers and packaging waste counts up about 60% of household waste (volume ratio)

Ratio by Volume (FY2008)



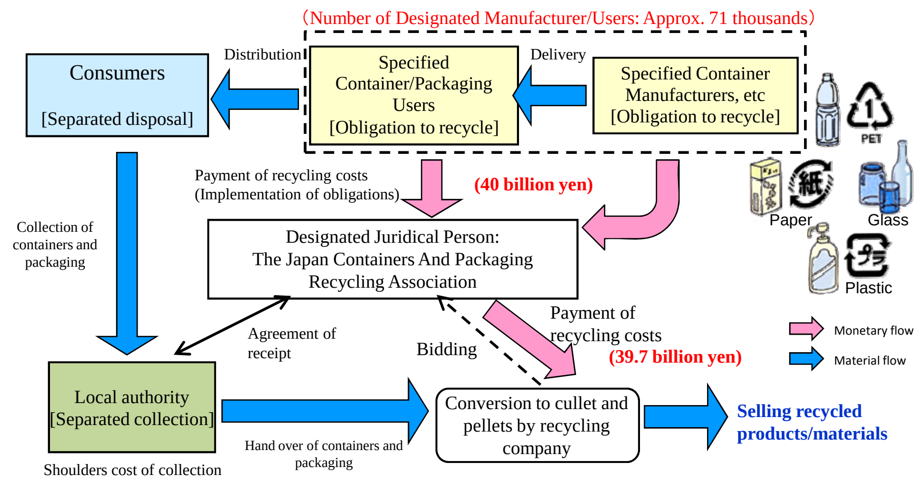
Ratio by Weight (FY2008)



※ Ratio by volume and by weight was calculated based on the sample survey targeting for 6 cities and 3 areas across the nation.

Overview of Containers and Packaging Recycling Law

The basic principle of this law is that every player has a role to play in recycling. Consumers should separate their waste according to category, municipalities should collect the separated waste, and businesses should recycle what has been collected into new products.



Issues and concerns about the Law

Currently, we identify some issues and concerns about Japan's Containers and Packaging Law such as
1) efficiency of recycling system (e.g. cost reduction, cost efficiency and creation of high value-added recycled products),
2) improvement of fairness, transparency and stability,
3) promotion of prevention and re-use.

1. efficiency of recycling system
   - ✓ Cost reduction / cost efficiency
     - including social costs of the whole processes: from separate collection to recycling
   - ✓ Creation/promotion of high value-added recycled products

2. improvement of fairness, transparency and stability
   - ✓ Reconsideration of roles and responsibilities of relevant players (i.e. consumers, local governments and Designated Manufacturer/Users) and their cooperation
     - based on the idea of EPR
   - ✓ Prevention of free-riders

3. promotion of prevention and re-use
   - ✓ Methods for setting quantitative prevention targets and units

Seeking the possibility and suitable technologies of waste plastics recycling for developing countries

UNEP
United Nations
Environment Programme

National Institute of
Advanced Industrial Science
and Technology
AIST

**UNEP-AIST Workshop
on
Waste Plastics-to-Resources**

AIST Tsukuba Center
March 1 – 4, 2011

City officials, researchers and technology providers from Thailand, Philippines, and Japan gathered at AIST under the framework of UNEP.

Plastic waste conversion to liquid fuel in Thailand. Case Study : Warinchamrap Municipality

Budget Supporting By
Energy Policy and Planning Office,
Ministry of Energy,
Royal Thai Government

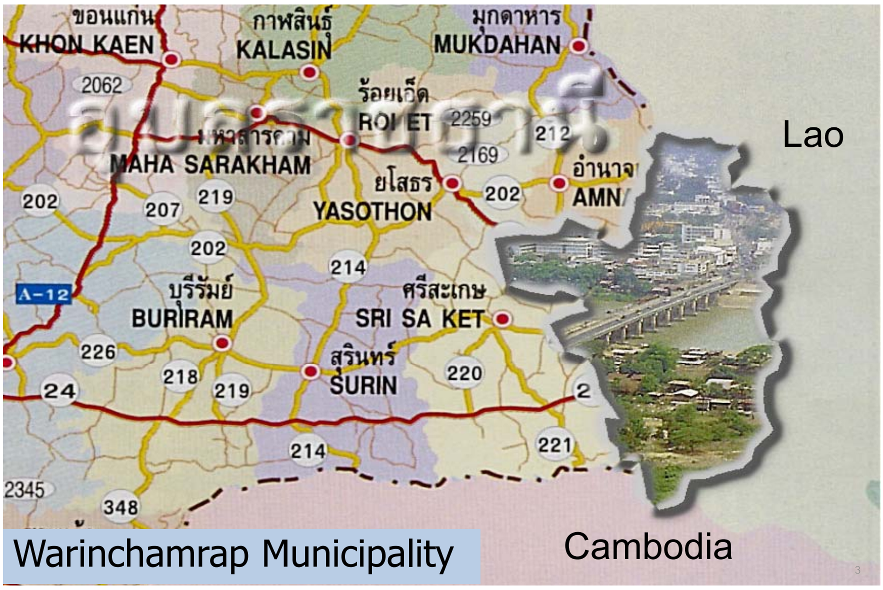
Rungnapa Tubnonghee
Warinchamrap Municipality
& Muang Sa-ad Co.Ltd

Outline of Presentations

1. Introduction
2. Current status of reforming MPW to useful oil in Thailand
3. Characteristics and qualities of the pyrolytic oil (Liquid Fuel)
4. Prospect of technology and industry for reforming MPW to useful oil
5. Ackhowledgement

2

1.Introduction



1.Introduction

- The generation amount of MSW in Warinchamrap Municipality is ~ 24-25 tons per day.
- The recyclable waste is about 20% of total MSW (12.6% of plastic waste (PW)).



90% of municipal plastic waste is PE and PP. Most of these waste is disposed in landfill.

5

- Thai government Policy of Renewable energy promoted local organization to converse MSW to energy.
- The Energy Policy and Planning Office (EPPO), Ministry of Energy, Royal Thai Government provided budgets for 3 pilot projects in 2009-2010: Warinchamrap , Khonkhan, and Pitsanulok Municipality.

6

2.Current status of reforming MPW to useful oil in Thailand

(Muang Sa-ad Co., plant of Warinchamrap site)

7

Disposed waste at the landfill cell (G mine) is 125,000 tons (7years)

The process consists of 2 parts:

1.Separation of MSW



2.Pyrolysis of MPW



9

1. Separation of MSW at the front end system





10

The mixed plastic waste

11

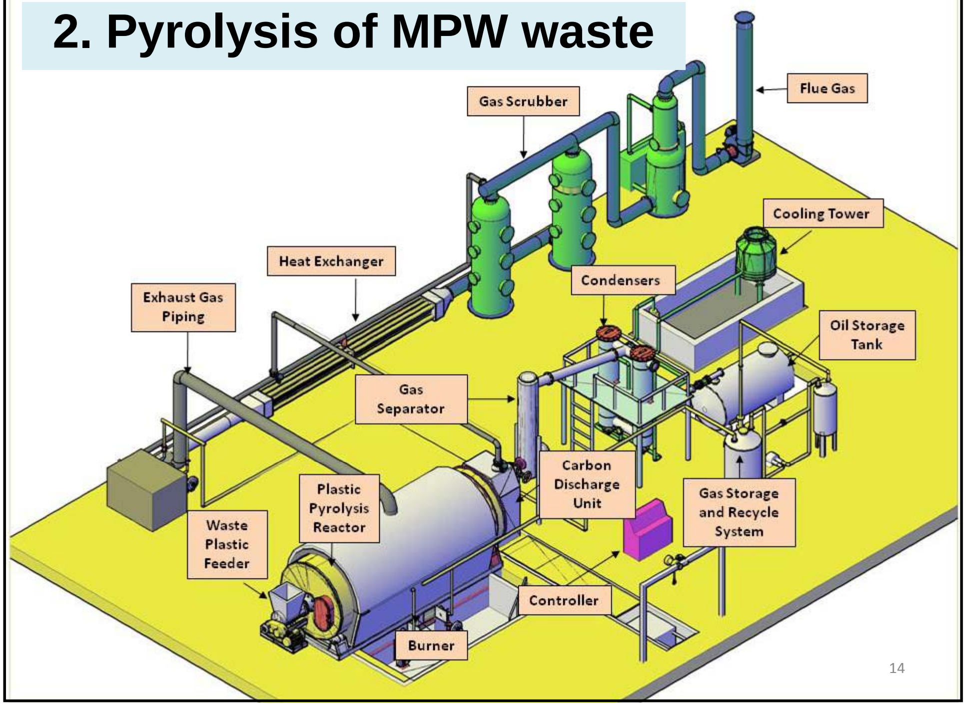
Cleaning and drying

MPW Raw Material for Pyrolysis

90% of mixed plastic waste are PE and PP

13

2. Pyrolysis of MPW waste

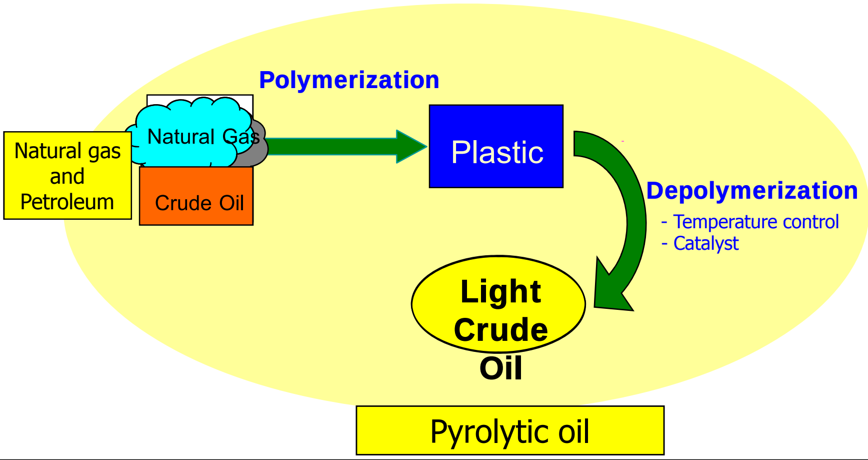


14

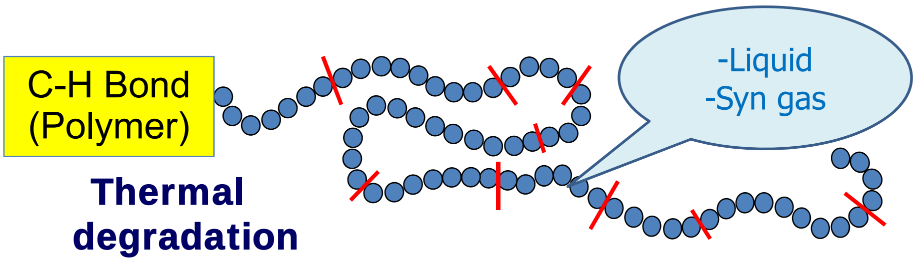
Concept of Pyrolysis

Process of Plastic Production is Polymerization

Decomposition of plastic is De-Polymerization



Pyrolysis Process



Thermal degradation

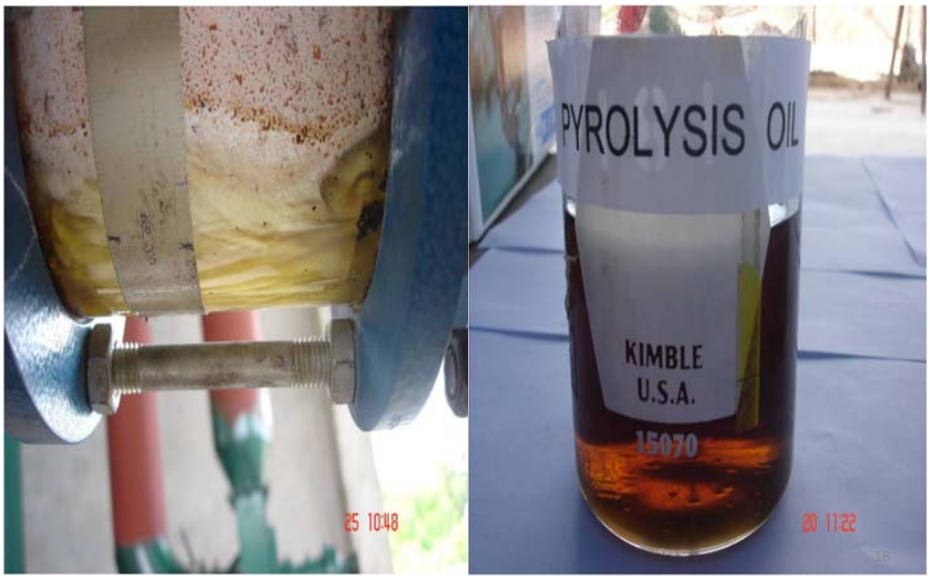
Catalytic degradation

Operate with high temperature ($< 500^{o}$ C) in absent oxygen or without oxygen and then produce liquid hydrocarbon and syn-gas

Pyrolysis Process

17

Pyrolytic oil



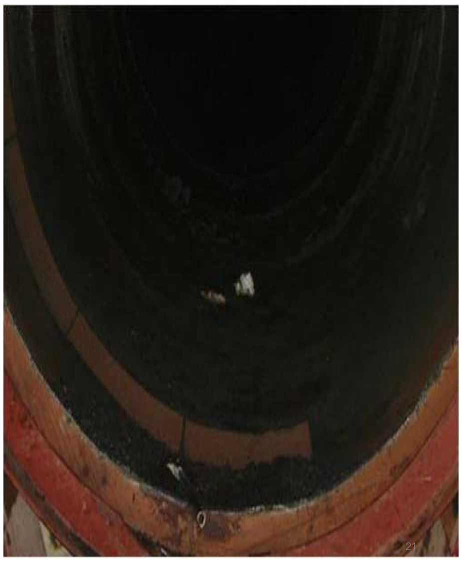
18

Pyrolytic oil in oil tank

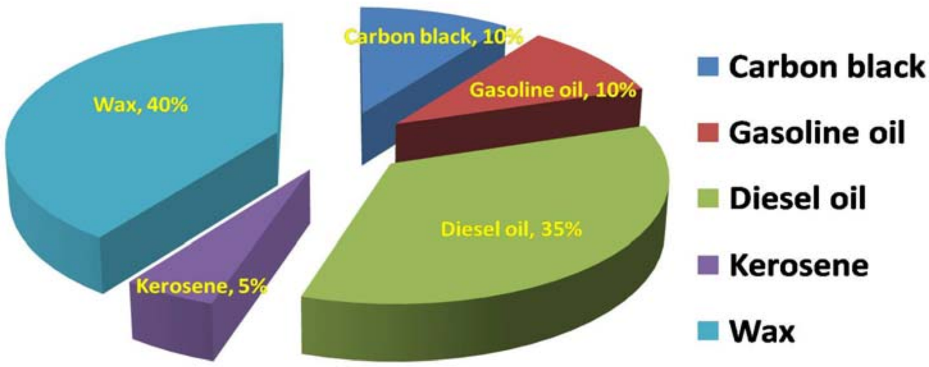
Exhaust gas scrubbing and Syn-gas System

Non-condesable gas is Syn Gas return to reactor for fuel gas. Eahaust gas was treated by Wet scrubber before release to atmosphese.

By Product; Wax and Carbon Black



Ratio and capacity of production



Mixed plastic waste (tons)		Yield of production 60%	Crude oil (Liter)	Crude oil (Barrel)
Day	10	→	6,600	40.3
MO	300		198,000	1,209.8
Year	3,000		1,980,000	12,098.3

3.Characteristics of Pyrolytic oil

The major products in the pyrolytic oil for MPW were having a group of diesel range, as well as that of kerosene and gasoline range.

23

3.Characteristics of pyrolytic oil

- Quality Improvement of the pyrolytic oil is carried out by using coagulation technique.

24

4. Prospect of technology and industry for reforming MPW to useful oil

As the economic support from Ministry of Energy in Thailand is guarantee of price on 18 bahts per liter for a distillation industry.

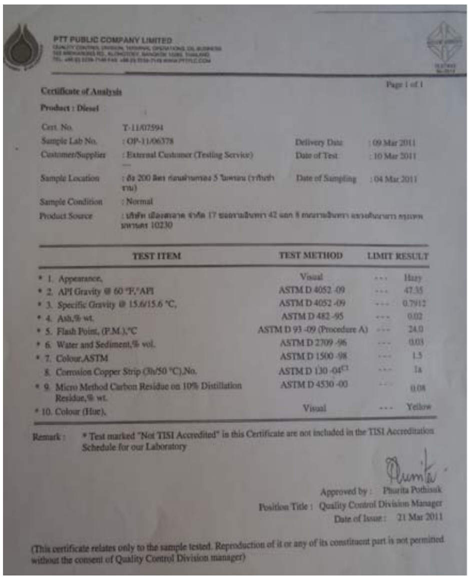
25

Utilization of Distilled pyrolytic oil with diesel engine

26

Utilization of pyrolytic oil with gasoline engine

Quality Test of Diesel and Gasoline oil(PTT)



PTT PUBLIC COMPANY LIMITED

Certificate of Analysis

Page 1 of 1

Product : Diesel

Cert. No.	T-11/07594		
Sample Lab No.	: OP-11/06378	Delivery Date	: 09 Mar 2011
Customer/Supplier	: External Customer (Testing Service)	Date of Test	: 10 Mar 2011
Sample Location	: [illegible]	Date of Sampling	: 04 Mar 2011
Sample Condition	: Normal		
Product Source	: [illegible] 10230		

TEST ITEM	TEST METHOD	LIMIT	RESULT
* 1. Appearance,	Visual	---	Hazy
* 2. API Gravity @ 60 °F,°API	ASTM D 4052 -09	---	47.35
* 3. Specific Gravity @ 15.6/15.6 °C,	ASTM D 4052 -09	---	0.7912
* 4. Ash,% wt.	ASTM D 482 -95	---	0.02
* 5. Flash Point, (P.M.),°C	ASTM D 93 -09 (Procedure A)	---	24.0
* 6. Water and Sediment,% vol.	ASTM D 2709 -96	---	0.03
* 7. Colour,ASTM	ASTM D 1500 -98	---	1.5
8. Corrosion Copper Strip (3h/50 °C),No.	ASTM D 130 -04[E1]	---	1a
* 9. Micro Method Carbon Residue on 10% Distillation Residue,% wt.	ASTM D 4530 -00	---	0.08
* 10. Colour (Hue),	Visual	---	Yellow

Remark : * Test marked "Not TISI Accredited" in this Certificate are not included in the TISI Accreditation Schedule for our Laboratory

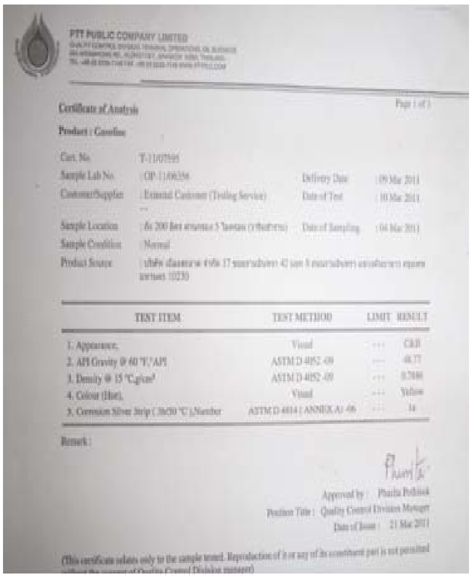
Approved by : Phurita Pothisak

Position Title : Quality Control Division Manager

Date of Issue : 21 Mar 2011

(This certificate relates only to the sample tested. Reproduction of it or any of its constituent part is not permitted without the consent of Quality Control Division manager)

Sample of Infiltrated diesel oil 5µ



PTT PUBLIC COMPANY LIMITED

Certificate of Analysis

Page 1 of 1

Product : Gasoline

Cert. No.	T-11/07595		
Sample Lab No.	: OP-11/06356	Delivery Date	: 09 Mar 2011
Customer/Supplier	: External Customer (Testing Service)	Date of Test	: 10 Mar 2011
Sample Location	: [illegible]	Date of Sampling	: 04 Mar 2011
Sample Condition	: Normal		
Product Source	: [illegible] 10230		

TEST ITEM	TEST METHOD	LIMIT	RESULT
1. Appearance,	Visual	---	C&B
2. API Gravity @ 60 °F,°API	ASTM D 4052 -09	---	48.77
3. Density @ 15 °C,g/cm³	ASTM D 4052 -09	---	0.7846
4. Colour (Hue),	Visual	---	Yellow
5. Corrosion Silver Strip (3h/50 °C),Number	ASTM D 4814 (ANNEX A) -06	---	1a

Remark :

Approved by : Phurita Pothisak

Position Title : Quality Control Division Manager

Date of Issue : 21 Mar 2011

(This certificate relates only to the sample tested. Reproduction of it or any of its constituent part is not permitted without the consent of Quality Control Division manager)

Sample of Infiltrated gasoline oil 5µ

Quality Test of Diesel and Gasoline oil(PTT)

Test Item (March 2011)	Test Method	Result (Diesel)	Result (Gasoline)
1.Appearance	Visual	Hazy	C&B
2.API Gravity@60°F	ASTM D 4052-09	47.35	48.77
3.Specific Gravity @15.6/15.6°C (Density@15°C,g/cm^3)	ASTM D 4052-09	0.7912	0.7846
4.Ash,%wt (ไม่สูงกว่า 0.05)	ASTM D 482-95	0.02	-
5.Flash Point,(P.M),°C	ASTM 93-09	24.0	-

Sample of Infiltrated diesel oil 5μ **Sample of Infiltrated gasoline oil 5μ**

Test Item (March 2011)	Test Method	Result (Diesel)	Result (Gasoline)
6. Water and sediment,%vol (ไม่สูงกว่า0.05)	ASTM D 2709-96	0.03	-
7.Colour,ASTM /Colour(Hue)	ASTM D 1500-98	1.5 /Yellow	Yellow
8.Corrosion Copper strip(3h/50°C),No. (ไม่สูงกว่าหมายเลข1)	ASTM D 130-04$^{\varepsilon 1}$	1a	1a ASTM D 4814
9.Micro Method Carbon Residue,%wt (ไม่สูงกว่า 0.05)	ASTM D 4530-00	0.08	-

CONCLUSION

- The technology for reforming MPW to oil is applicable for plastic waste recycling in Thailand.
- This technology can save the space for landfill and thus extend lifetime of landfill and also avoid CO2 emission from burning of plastic waste.

31

CONCLUSION

- The characteristic of PO is similar to crude oil. It will be improved to useful fuel oil by distillation.
- Moreover, the distillation of crude oil for valuable diesel-range and gasoline-range hydrocarbons similar commercial oil quality is still required and developed for a standard and safety engine concern.

32

ACKNOWLEDGMENT

- Muang Sa-ad Company and National Center of Excellence for Environmental and Hazardous Waste Management, Ubon Ratchathani University, Thailand.

- We are also very grateful to Associate Prof Tharapong Vitidsant, Faculty of Science, Chulalongkorn University, Thailand for his dedication and suggestion.

33

Thank you for attention

Chum bai dee & Sawadee

Polymer Energy Technology
Green Business : Win- Win Solution

34


การพัฒนาเมืองอย่างยั่งยืน สู่ความเป็นเมืองวารินน่าอยู่

Plastic Recycle

"Workshop on Capacity Building on Accounting and Utilising GHG Emission Reduction Measures for Local Waste Management Actors in Developing Asian Countries, 4-6 September 2011, Vientiane, Lao."

MR.SUTEE TUBNONGHEE
WARINCHAMRAP MUNICIPALITY
UBON RATCHATHANI PROVINCE,THAILAND

Plastic waste management

- **Part 1: Plastic waste management at source**

  -Plastic waste separation in community by the Zero waste project .

- **Part 2: Plastic waste management at disposal site.**

  -Plastic waste separation in demonstration area by the Zero waste of pilot project .

  -Plastic waste separation in landfill by the scavengers.

  -Value add of plastic reforming to pellet and oil.

  -Sanitary Landfill.

Plastic waste management at source

- Plastic waste separation in community by the Zero waste project

Solid waste separation at household in community

Plastic waste from household
- Plastic bag
- Package bag

Landfill Site : Sanitary Landfill

Plastic waste management at disposal site.

Plastic waste separation in demonstration area by the Zero waste of pilot project .

Plastic waste separation in demonstration area by the Zero waste of pilot project.

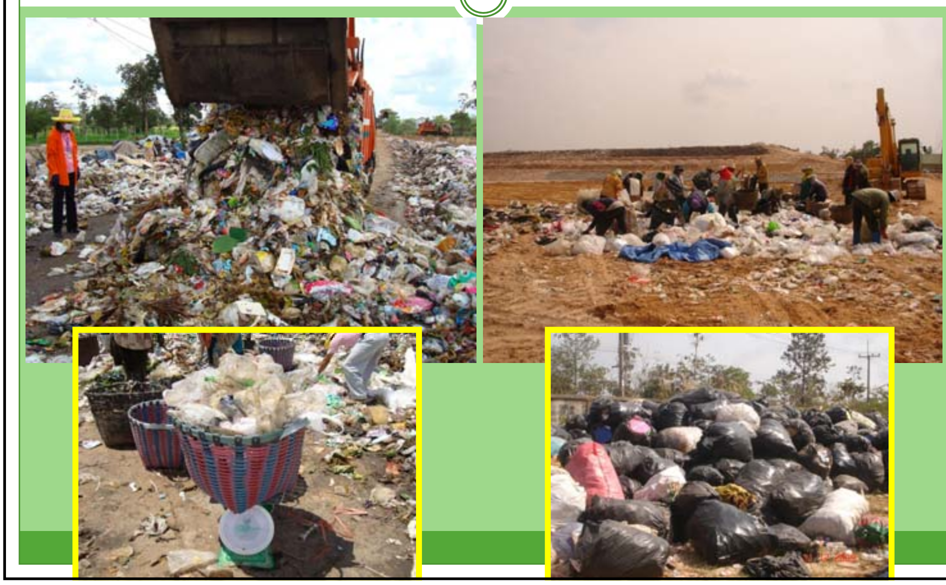
Plastic waste was separated out of the total municipal solid waste about 2-3 tons per day of the pilot project.

The rest of solid waste?

- Food waste was taken to mix for composting. The other wastes were buried in sanitary landfill. So the solid waste can be reduced and decrease expenditure of collection and disposal cost.

Sanitary Landfill

Plastic waste separation in landfill by the scavengers



Plastic waste was prepared for cleaning

Value add of plastic reforming to pellet

Plastic waste separation and cleaning (Original)

Plastic waste from landfill

Water basin

Plastic bag washing

Drum dryer machine

Plastic waste separation and cleaning (Original)

Sorting out kind of the plastic

Rotary dryer machine

Pile of plastic

Plastic compactor

Plastic waste separation and cleaning (Modification)

Oval water basin has length 15 meters

Plastic waste separation and cleaning (Modification)

Two oval water basins was constructed

Plastic waste separation and cleaning (Modification)

Plastic bag was washed and after that was taken to drum dryer

Plastic waste separation and cleaning (Modification)

Drum dryer machine

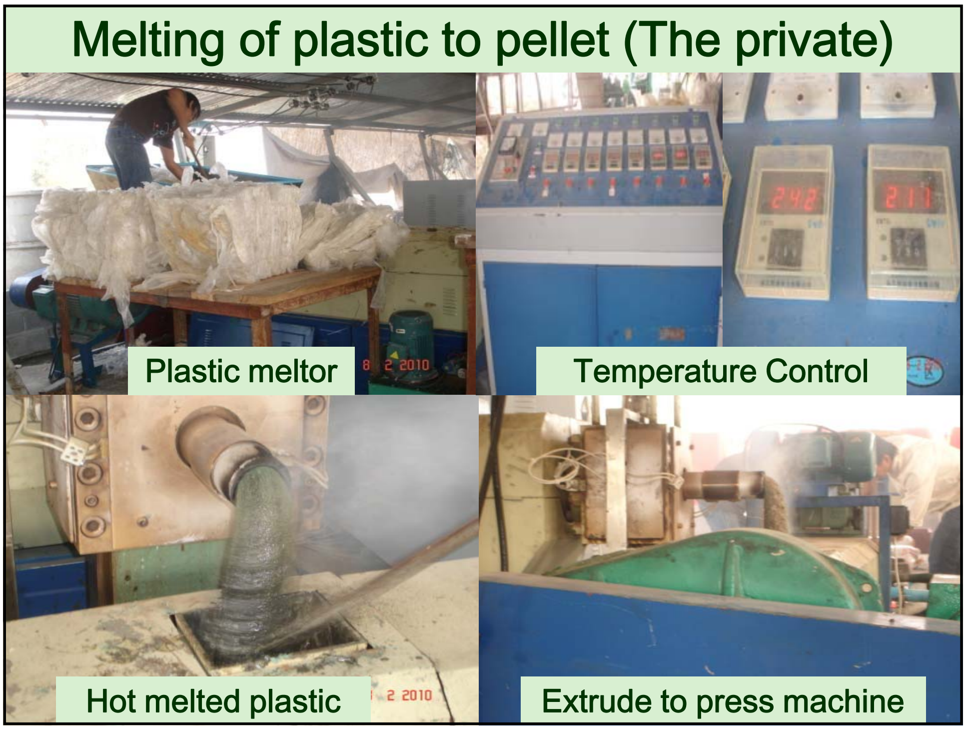
Plastic waste separation and cleaning (Modification)

Plastics were selected and sorted out in each types

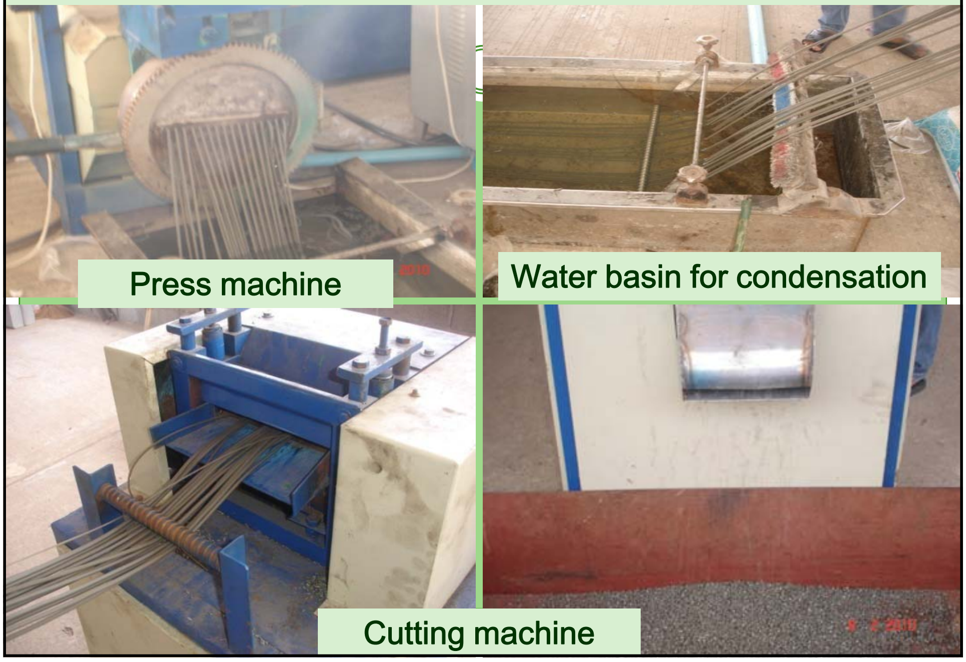
Plastic waste separation and cleaning (Modification)

Rotary dryer


Plastics were prepared for melting to pellet.
The fractions of plastic were taken to reform to oil.


Melting of plastic to pellet (The private)
Plastic meltor
Temperature Control
Hot melted plastic
Extrude to press machine

Melting of plastic to pellet (The private)



Melting of plastic to pellet (The private)

Melting of plastic to pellet (The private)

PP plastic shredding and cleaning (The private)

PP plastic shredding and cleaning (The private)

Water basin for washing

Belt conveyer and hook

Shredded plastic of PP

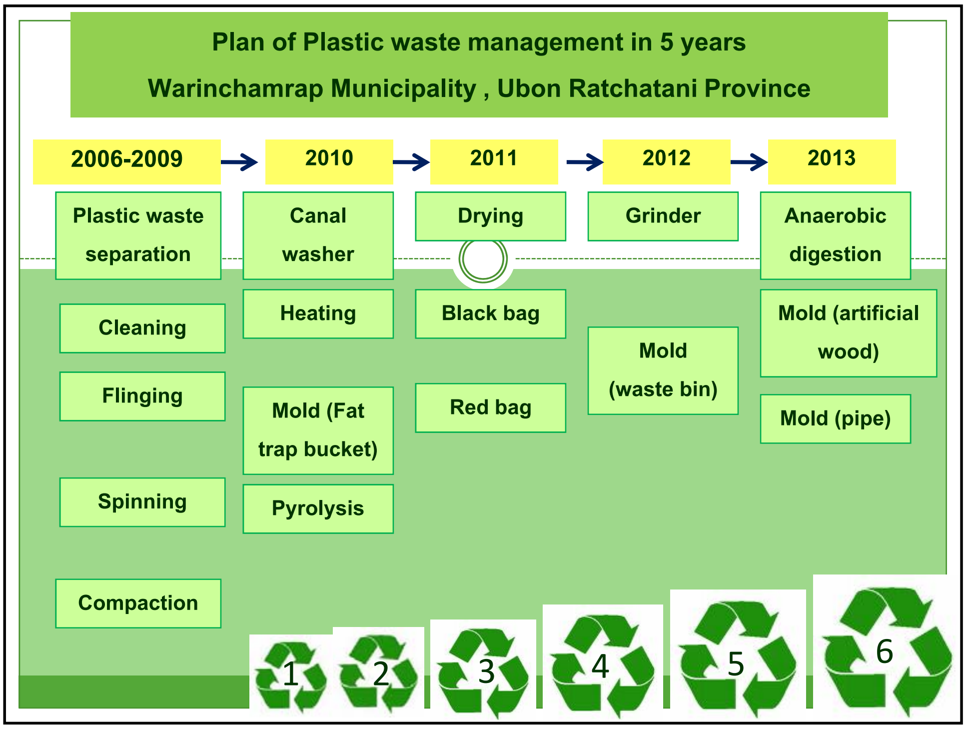
Plastic meltor

PP plastic shredding and cleaning (The private)

Step and procedure of PP were operated like plastic bag.

Production of fat trap bucket from recycle plastic powder.

Production of fat trap bucket from recycle plastic powder.


Plan of Plastic waste management in 5 years
Warinchamrap Municipality , Ubon Ratchatani Province
2006-2009
2010
2011
2012
2013
Plastic waste separation
Canal washer
Drying
Grinder
Anaerobic digestion
Cleaning
Heating
Black bag
Mold (waste bin)
Mold (artificial wood)
Flinging
Mold (Fat trap bucket)
Red bag
Mold (pipe)
Spinning
Pyrolysis
Compaction
1
2
3
4
5
6

Institute for Global Environmental Strategies

"Lesson Learns from Japanese Practices for Urban Waste Utilization"

Yoshiaki Totoki
Sustainable Consumption and Production
Institute for Global Environmental Strategies
Contact: totoki@iges.or.jp

Workshop on Capacity Building on Accounting and Utilizing GHG Emission Reduction Measures for Local Waste Management Actors in Developing Asian Countries, Vientiane, Laos, 4-6 October 2011.

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 Laos?

Contents

2. Urban Area and Biomass Utilization

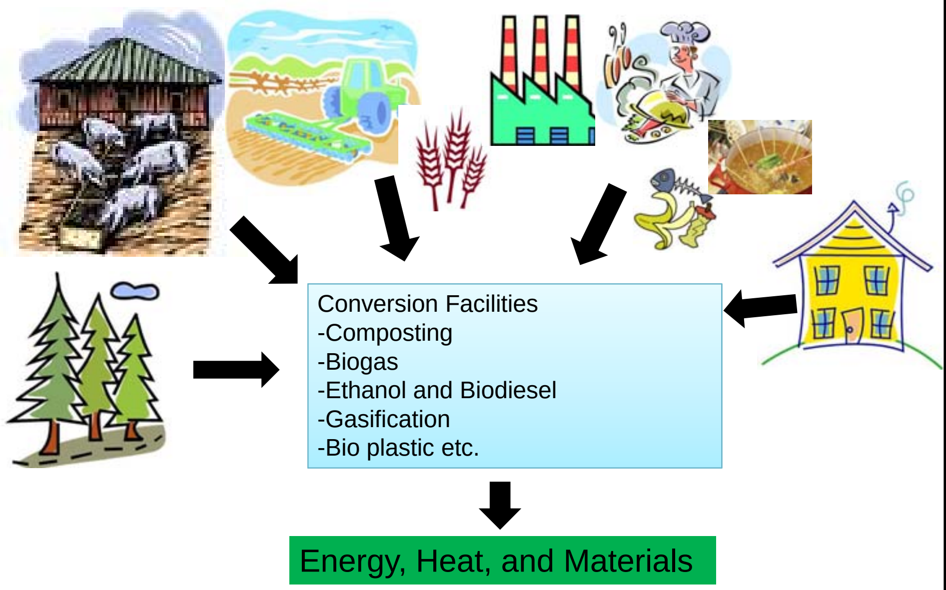
◆Urban area is the engine for the development and produces wastes from its activities.

◆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.

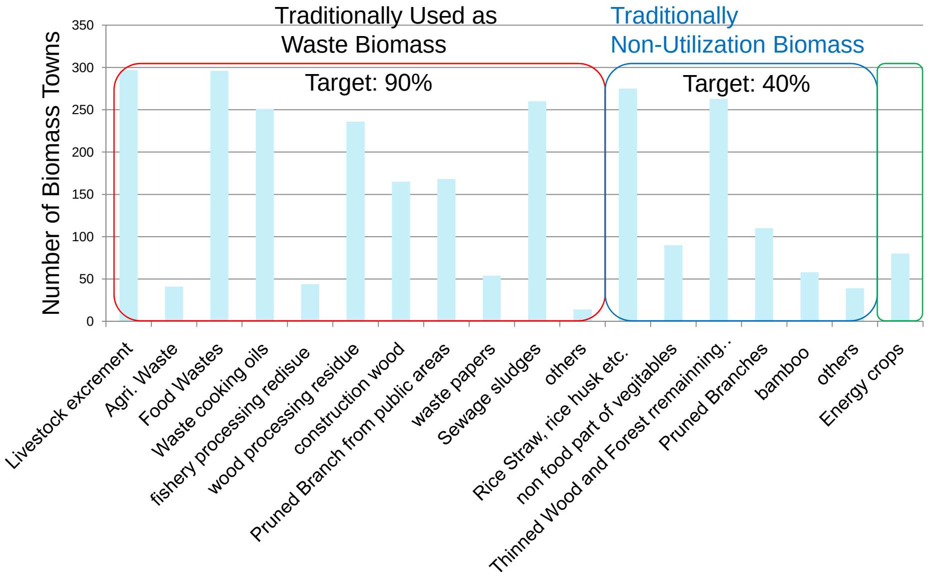
◆Japanese Practice: Biomass Town
a community which utilizes biomass with strong ties among a community and local stakeholders.
318 town (2011. July)

◆Biomass, as renewable energy source, is biological materials from living, or recently living organisms. This biomass is included waste from urban activities and can be included agro waste.

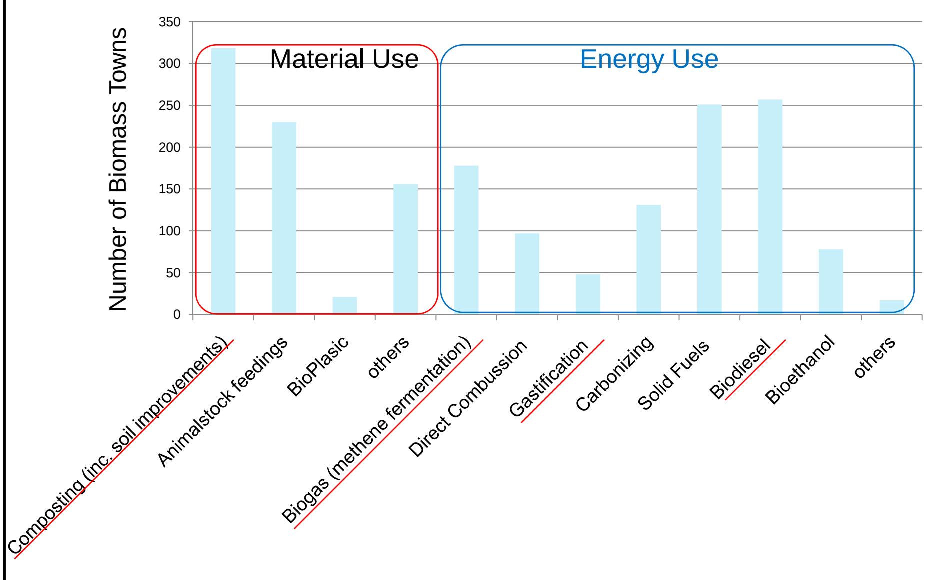
3. Biomass town



3. Biomass town (Biomass Source)



3. Biomass town (Transforming Tech.)



4. A Case of Composts from Organic Wastes

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

- Cow dung 3,228 t/y
- Kitchen garbage 500 t/y
- Fallen Leaves 250 t/y
- Saw Dust (pruned branch and tree thinning) 200 t/y
- Rice Husk 250 t/y

→

Composting
Primary Fermentation
(25days)
↓
Secondary Fermentation
(65days)
↓
Dry
(15days)

→

Compost "Midori" :1,117 t/y
1t (bulk):4000 yen
10kg pack :500 yen
=>60% of farmers in Motegi use

Liquid Fertilizer: 894 t/y

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

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]**

- Cow dung 3,228 t/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]**

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

Pig's feces and urine 27t/day (50t/day)

Kitchen garbage 22 t/day (24t/day)

Sewer Sludge 5 t/day (6t/day)

Sake Cake 16 t/day (0 t/day)

Methane Fermentation Facility

Process: Mid Temperature Wet Process (35)
80t/day
340kw

Electronic Generation
5,620kWh/day (plan)

CO2 reduction as an Alternative electric generation
= Ave. Ele Gen(kwh/d)*Day (d)* CO2 emission coefficient (t-CO2/kwh)
=4,891* 286* 0.000348 (2009)
= **487 t/y**

Heat Generation
8,300MCal/day

CO2 reduction as an alternative heat source
= Heat Gen(Mcal/d)*Day (d)* CO2 emission coefficient (t-CO2/GJ)
=8,300* 286*0.057*4.2/1000
= **568 t/y**

Compost: 300t
50 yen/15kg

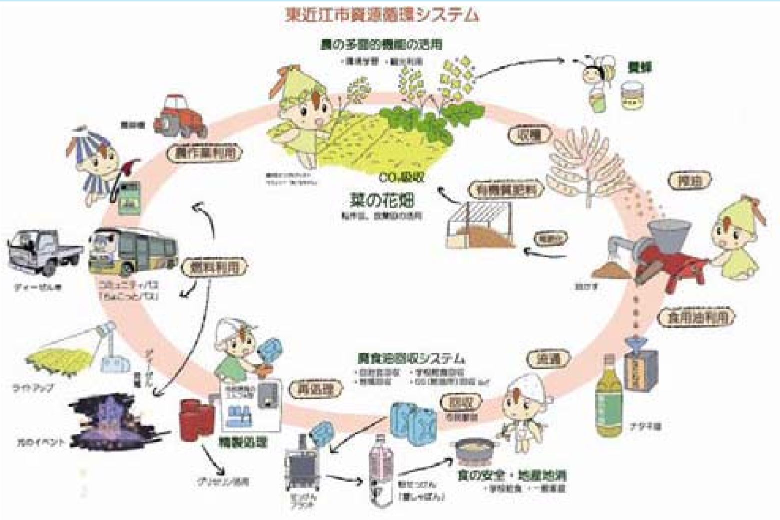
Liquid Fertilizer: 2,500t

Source: Hita City

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

6. A Case of Biodiesel from Waste Cooking Oils

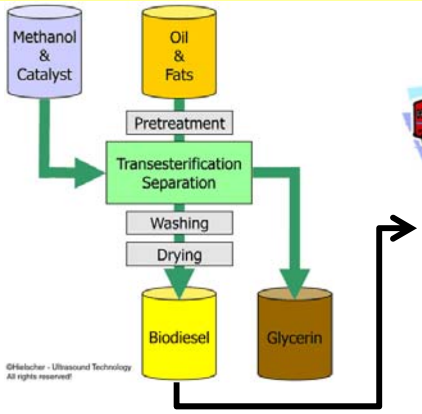
Higashi Omi city, Shiga Prefecture (Population : 116,797, Area: 388.58 km2)



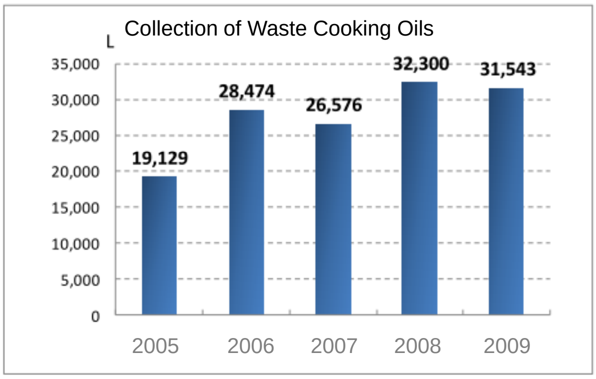
Source: Higashi Omi City

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

$$
\begin{array}{l} CH_2OCOR_1 \\ | \\ CHOCOR_2 + 3CH_3OH \\ | \\ CH_2OCOR_3 \end{array}
\underset{}{\overset{KOH}{\rightleftharpoons}}
\begin{array}{l} R_1COOCH_3 \\ R_2COOCH_3 \\ R_3COOCH_3 \end{array}
+
\begin{array}{l} CH_2OH \\ | \\ CHOH \\ | \\ CH_2OH \end{array}
$$



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. waste in Laos

What can be to energy from urban sectors in Laos?

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

How can we use the biomass?

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

8. A potential of gasification from rice husk in Laos

Year (1000ton)	1996	1997	1998	1999	2000
Rice	1,413	1,660	1,675	2,103	2,155
Corn	77	78	110	96	77
Sweet Potato	92	94	108	81	52
Vegetables	117	132	150	269	288
Sugar Cane	87	95	170	174	174
Coffee	10	12	17	18	23

Source: FAO

- Percentage of Rice production in Laos is high.
- Rice Production is increasing.
- 22% of processing amount will be rice husk

2,000,000 t/y*0.22 => Rice husk production: 440,000t/y.

8. A potential of gasification from rice husk in Laos

Heat(500- 600 ° C)

(C6H12O6)m → (H2+ CO+CH4+.....+C5H12) :Gas
:Biomass + (H2O+...+ CH3OH+CH3COOH+...) :Liquid
+ C : Char

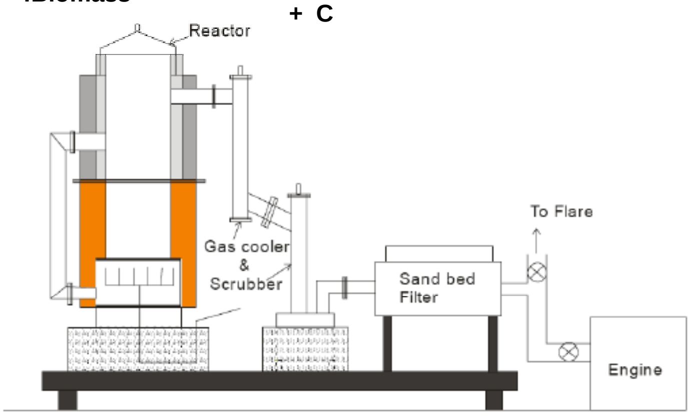


Figure 3 - Schematic representation biomass gasification

Source: www.bioenergy3.org

8. A potential of gasification from rice husk in Laos

Gasifier with rice husk to generate electricity

First Demonstration Biomass with rice husk

Supported by NEDO

Capacity : 200 kW

Implemented by TRI

(Technology Research Institute)

- 200kW gasifier with rice husks reduced 75% diesel consumption (5,500L/month)
- 6kg of Rice husk replaces about 1 liter of diesel. (based on the Calorie)

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]
= **170 [t-CO2/y]**

8. A potential of gasification from rice husk in Laos

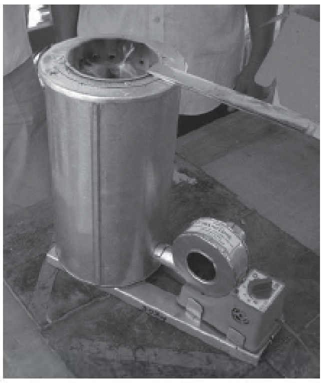


Figure 2 Reed's Woodgas Campstove (left) for sale on the Internet (US$55) and Anderson's Juntos B+ TLUD gasifier (with removable fuel canister) hand-made in Cambodia with GERES (estimated cost under US$20). For cooking, the pot can be placed on top of the unit or (better) be positioned on a simple pot support structure of any size so that the gasifier can be moved for refilling without disturbing the pot. (*photos: Tom Reed, left, Paul Anderson, right*)

Source: http://www.hedon.info

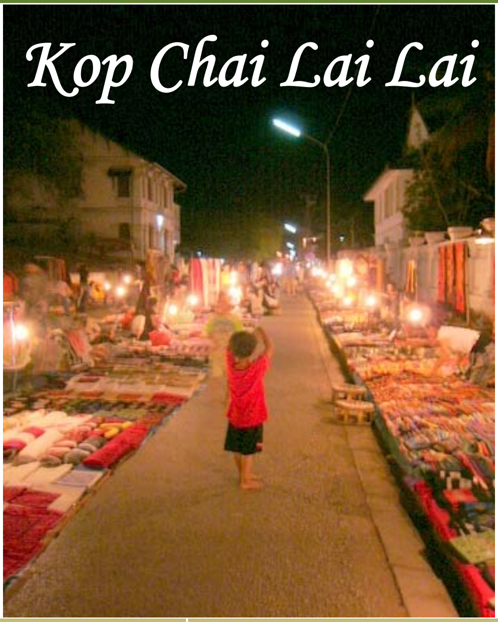
9. Summary and Keys of success

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, cities, and towns.
- Laos has a high potential of the waste biomass utilization for energy generation and material uses.

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


Kop Chai Lai Lai

Phitsanulok
Mechanical Biological Treatment – MBT

Suthi Hantrakul Deputy Mayor, Phitsanulok City Municipality

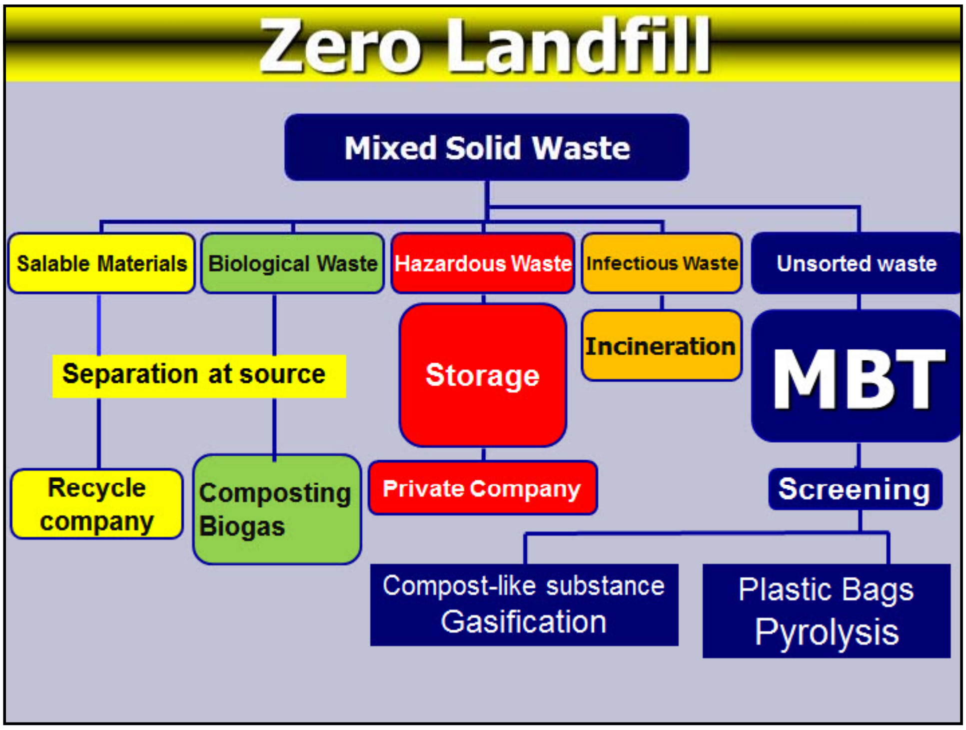
Area 18.26 km²

32,000 Households

78,000 registered inhabitants

50,000-100,000 non-registered inhabitants

Annual Budget 16.6 million USD


Zero Landfill
Mixed Solid Waste
Salable Materials
Biological Waste
Hazardous Waste
Infectious Waste
Unsorted waste
Separation at source
Storage
Incineration
MBT
Recycle company
Composting Biogas
Private Company
Screening
Compost-like substance Gasification
Plastic Bags Pyrolysis


ชุมชน
บรมไตรโลกนารถ ๒๑

Hazardous Waste

Drop off

Collection

Storage

Transport

Disposed by Private Company

Infectious Waste : Incinerate


Mechanical Biological Treatment -MBT

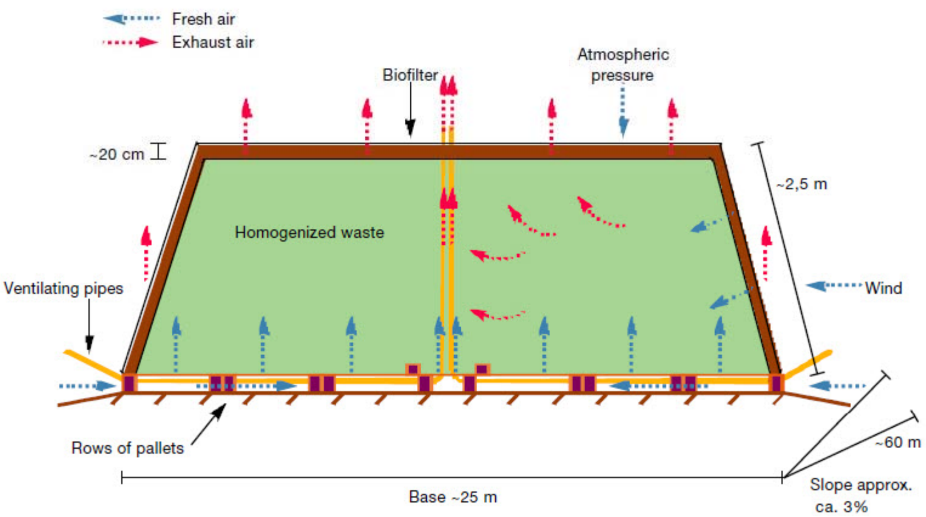
- Mechanical is a process of sorting out recyclable materials from mixed waste stream (e.g., metals, glass, paper, furniture, etc.).
- This can be done manually or by automated machine.
- Separation at Source

Mechanical Biological Treatment -MBT

The Biological process can be

- Biodrying (waste is dried by air convection)
- Anaerobic Digestion
- Composting
- or a combined method.

Scheme of the current windrow and ventilation system

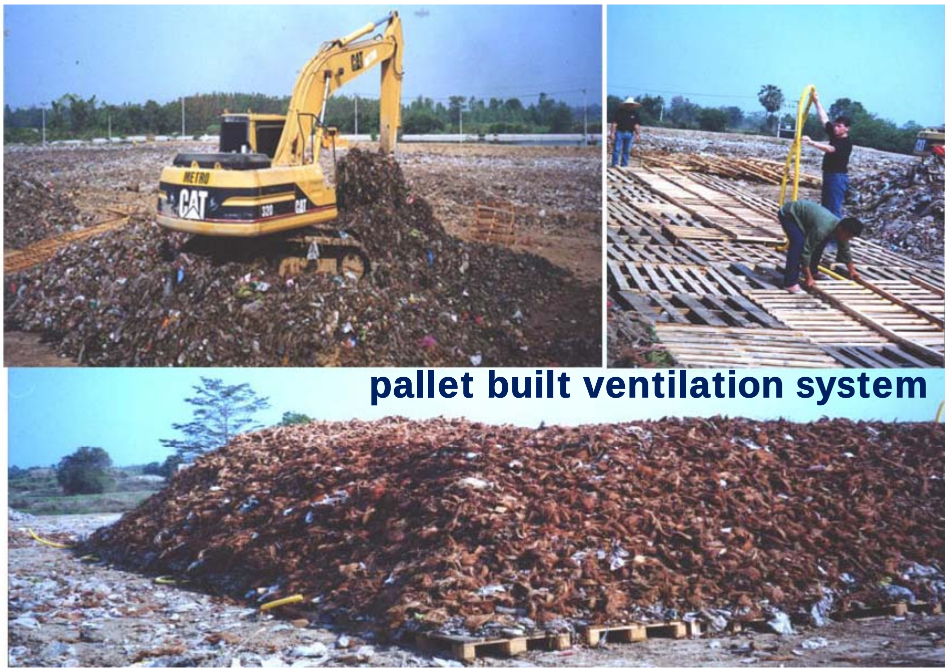


Dipl.-Bioi. Gabriele Janikowski, IKW GmbH


MBT on Landfill


FABER-AMBRA
'00 8 18
Homoginizer

Exacavator building the windrow



pallet built ventilation system

Screening

Compost-Like Substance

Biomass : For Gasification

Refuse Derived Fuel :RDF

Pyrolysis to liquid fuel

Conclusion

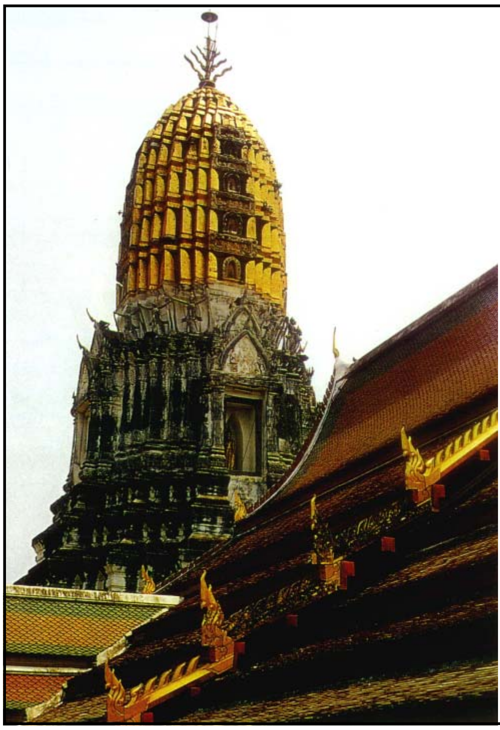
- Small fraction of inert residue for final treatment
- Minimized leachate outflow by using it as an activator for the biological process
- Minimized landfill gas emission as only stabilized organic waste is disposed in the landfill
- Possible to earn carbon credits – additional revenues
- No requirement for daily cover of the landfill
- Extended lifetime of disposal site by at least twice (reduce waste volume by at least 50% : density > 1.3 t/m³)

- Pyrolysis, Gasification, RDF

100 tons of unsorted waste

- 30 tons High Caloric Fraction (RDF)
- 30 tons Compost-like Subatance

*Per ton *Thai Baht	Landfill	MBT+Landfill	MBT+Pyrolysis	MBT+Pyrolysis+ Gasification
Investment Cost	100	100	100	100
Operating Cost	200	30	30	30
After Care	50	-	-	-
MBT		350	350	350
Pyrolysis			150	150
Gasification				100
Total	350	480	330	230



Thank you

For

Your Attention

Estimation of GHG emissions from waste disposal and treatment

Baasansuren Jamsranjav, IPCC TFI TSU

Workshop on Capacity Building on Accounting and Utilising GHG Emission Reduction Measures for Local Waste Management Actors in Developing Asian Countries
4-6 October 2011, Lao People's Democratic Republic

WMO UNEP

ipcc INTERGOVERNMENTAL PANEL ON climate change

Contents

- Background
- IPCC Guidelines for National Greenhouse Gas Inventories
- How to estimate greenhouse gas (GHG) emissions from
  - Solid waste disposal on land
  - Biological treatment of solid waste
  - Incineration and open burning of waste
- Tools and other materials to support estimation of GHG emissions
- Summary

WMO UNEP

ipcc INTERGOVERNMENTAL PANEL ON climate change

Background

- Disposal and treatment of waste produce GHGs
  - Typically, solid waste disposal sites (SWDS) are the largest source in the Waste sector
- Emissions of GHGs from waste disposal and treatment are expected to increase in developing countries
- Estimating of GHG emissions is an important element of climate actions
- Emission inventory is estimates of all emissions/removals of particular gases from given sources from a defined region in a specific period of time
  - provides information on emission trends
  - enables different policy options to reduce emissions to be compared
  - allows to monitor the implementation of the policies
  - is a key input to scientific studies on climate change

WMO UNEP

ipcc INTERGOVERNMENTAL PANEL ON climate change

IPCC Guidelines for National GHG Inventories

- IPCC National Greenhouse Gas Inventories Programme (NGGIP) provides internationally accepted methodologies for national GHG inventories for estimation of national GHG emissions and removals. Available at (http://www.ipcc-nggip.iges.or.jp/)
  - "1995" and "Revised 1996" IPCC Guidelines for National GHG Inventories
  - IPPC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (GPG 2000)
  - IPCC Good Practice Guidance for Land use, Land-Use Change and Forestry (GPG-LULUCF)
  - 2006 IPCC Guidelines for National GHG Inventories
    - ❑ Evolutionary development from previous guidelines through GPG 2000 and GPG-LULUCF
    - ❑ Updated/improved methods and default data

WMO UNEP

ipcc INTERGOVERNMENTAL PANEL ON climate change

How to estimate GHG emissions

- Common methodological approach

$$Emissions = AD * EF$$

AD (Activity data): Data on the magnitude of a human activity resulting in emissions or removals taking place during a given period of time (e.g. amount of solid waste open-burned, Gg/yr)

EF (Emission factor): A coefficient that quantifies the emissions or removals of a gas per unit activity (e.g. kg CH_4/Gg of waste open-burned)

- Collection of AD and EF/parameters are an integral part of emission estimation
- The availability of solid waste data (data on solid waste generation, composition and management etc.)
- The IPCC Guidelines provide default data and detailed guidance on data collection

WMO UNEP INTERGOVERNMENTAL PANEL ON climate change

Solid Waste Disposal on Land: CH_4 Emissions

- Revised 1996 IPCC Guidelines provide two methods: mass balance and first order decay (FOD)
- Mass balance approach
  - assumes that all potential CH_4 is released in the year of waste disposal
  - estimates **potential emission** rather than the actual annual emission

$$CH_4 Emissions(Gg/yr) = (MSW_T \bullet MSW_F \bullet MCF \bullet DOC \bullet DOC_F \bullet F \bullet 16/12 - R) \bullet (1 - OX)$$

MSW_T: total MSW generated, Gg/yr

MSW_F: fraction of MSW disposed to SWDSs

MCF: methane correction factor, fraction

DOC: degradable organic carbon, fraction

DOC_F: fraction of DOC dissimilated

F : fraction of CH_4 in landfill gas (default is 0.5)

R_T: recovered CH_4, Gg/yr

OX: oxidation factor, fraction (default is 0)

WMO UNEP INTERGOVERNMENTAL PANEL ON climate change

Solid Waste Disposal on Land: CH_4 Emissions

- First order decay (FOD) method produces more accurate estimates of annual emissions
  - accounts for the fact that emissions will occur over many years
  - estimates **actual** annual emissions of CH_4
- Updated and improved FOD method is provided in Volume 5 of the 2006 IPCC Guidelines
  - FOD Spreadsheet model (IPCC Waste Model) with step-by-step guidance (http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol5.html)
- FOD method requires data for historical disposals of waste
  - 2006 Guidelines provide guidance on how to estimate historical waste disposal data

INTERGOVERNMENTAL PANEL ON climate change

FOD Spreadsheet Model (IPCC Waste Model)

- CH_4 emissions in year *T* from SWDS (Gg)

$$CH_4 Emissions = \left[\sum_x CH_4 generated_{x,T} - R_T\right] * (1 - OX_T)$$

T : inventory year
X : waste category or type/material
R_T : recovered CH_4 in year *T*, Gg
OX_T : oxidation factor in year *T*, fraction

- Estimation of amount of CH_4 generated in SWDS is based on FOD
- The basis for calculation is the amount of decomposable DOC in waste - part of the organic carbon that will degrade under the anaerobic conditions in SWDS
- Keeps a running total of the amount of decomposable DOC taking account of the amount deposited each year and the amount remaining from previous years

INTERGOVERNMENTAL PANEL ON climate change

FOD Spreadsheet Model (*cont.*)

- All input parameters are entered into cells colored yellow in the worksheets with yellow colored tabs. Other sheets are calculated automatically
- Default regional AD and parameters are incorporated in the spreadsheet and selection of appropriate region in the *"Parameters"* sheet will adjust the IPCC defaults in other sheets
- Two options for estimation of emissions from municipal solid waste (MSW) depending on data availability
  - Waste composition
  - Bulk waste
- Allows selection of DOC and methane generation rate constant (*k*) for modeling by waste composition or bulk waste options
- Allows selection of appropriate default *k* value for the selected climate zone
- Allows to define a delay time
  - Period between deposition of the waste and the start of CH_4 generation

WMO UNEP

ipcc INTERGOVERNMENTAL PANEL ON climate change

	A	B	C	D	E	F
1						
2		**Parameters**	**Country**			
3			**Region**	Asia- Southeast		
4		Please enter parameters in the yellow cells. If no national data are available, copy the IPCC default value.				
5		Help on parameter selection can be found in the 2006 IPCC guidelines				
6						
7			**IPCC default value**		**Country-specific parameters**	
8					**Value**	**Reference and remarks**
9		**Starting year**		1950	1950	
10						
11		**DOC (Degradable organic carbon)**	Waste by composition			
12		**(weight fraction, wet basis)**	**Range**	**Default**		
13		Food waste	0.08-0.20	0.15	0.15	
14		Garden	0.18-0.22	0.2	0.2	
15		Paper	0.36-0.45	0.4	0.4	
16		Wood and straw	0.39-0.46	0.43	0.43	
17		Textiles	0.20-0.40	0.24	0.24	
18		Disposable nappies	0.18-0.32	0.24	0.24	
19		Sewage sludge	0.04-0.05	0.05	0.05	
20						
21		Industrial waste	0-0.54	0.15	0.15	
22						
23		**DOCf (fraction of DOC dissimilated)**		0.5	0.5	
24						
25		**Methane generation rate constant** (k)	Wet temperate			
26		**(years^{-1})**	**Range**	**Default**		
27		Food waste	0.1–0.2	0.185	0.185	
28		Garden	0.06–0.1	0.1	0.1	
29		Paper	0.05–0.07	0.06	0.06	
30		Wood and straw	0.02–0.04	0.03	0.03	
31		Textiles	0.05–0.07	0.06	0.06	
32		Disposable nappies	0.06–0.1	0.1	0.1	
33		Sewage sludge	0.1–0.2	0.185	0.185	
34						
35		Industrial waste	0.08–0.1	0.09	0.09	
36						
37		**Delay time (months)**		6	6	

Parameters / MCF / Activity / Amnt_Deposited / Recovery_OX / Results / HWP / Stored_C / Theory / Defaults / Food

Methane calculation from: Food waste

		National values
DOC	DOC	0.15
DOCf	DOCf	0.500
Methane generation rate constant	k	0.185
Half-life time ($t_{1/2}$, years):	h = ln(2)/k	3.7
exp1	exp(-k)	0.83
Process start in deposition year. Month M	M	13.00
exp2	exp(-k*((13-M)/12))	1.00
Fraction to CH4	F	0.500

Year	Amount deposited	MCF	Decomposable DOC (DDOCm) deposited	DDOCm not reacted. Deposition year	DDOCm decomposed. Deposition year	DDOCm accumulated in SWDS end of year	DDOCm decomposed	CH_4 generated
	W	MCF	D = W * DOC * DOCf * MCF	B = D * exp2	C = D * (1-exp2)	H = B + ($H_{last\ year}$ * exp1)	E = C + $H_{last\ year}$ * (1 - exp1)	Q = E * 16/12 * F
	Gg	fraction	Gg	Gg	Gg	Gg	Gg	Gg
1950	693	0.71	37	37	0	37	0	0
1951	693	0.71	37	37	0	67	6	4
1952	693	0.71	37	37	0	92	11	8
1953	693	0.71	37	37	0	113	16	10
1954	693	0.71	37	37	0	131	19	13
1955	693	0.71	37	37	0	145	22	15
1956	693	0.71	37	37	0	158	25	16
1957	693	0.71	37	37	0	168	27	18
1958	693	0.71	37	37	0	176	28	19
1959	693	0.71	37	37	0	183	30	20
1960	693	0.71	37	37	0	189	31	21
1961	693	0.71	37	37	0	193	32	21
1962	693	0.71	37	37	0	197	33	22
1963	693	0.71	37	37	0	201	33	22
1964	693	0.71	37	37	0	203	34	23
1965	693	0.71	37	37	0	206	34	23
1966	693	0.71	37	37	0	208	35	23
1967	693	0.71	37	37	0	209	35	23
1968	693	0.71	37	37	0	210	35	24
1969	693	0.71	37	37	0	212	36	24
1970	693	0.71	37	37	0	212	36	24
1971	693	0.71	37	37	0	213	36	24

Parameters / MCF / Activity / Amnt Deposited / Recovery_OX / Results / HWP / Stored_C / Theory / Defaults / Food / Garden

Biological Treatment of Solid Waste: Composting

- An aerobic process and a large fraction of DOC in the waste material is converted into CO_2
  - Reduced volume and stabilization of waste
  - Some carbon storage also occurs in the residual compost
  - Depending on its quality, the compost can be recycled as a fertilizer or soil amendment (increased organic matter, higher water-holding capacity etc.)
- CH_4 and N_2O can both be formed during composting
  - CH_4 can be formed in anaerobic sections of the compost
  - Poorly working composts are likely to produce more both of CH_4 and N_2O

WMO UNEP

INTERGOVERNMENTAL PANEL ON climate change

Biological Treatment of Solid Waste: Anaerobic digestion

- Natural decomposition of organic material without oxygen
- Produces biogas (CH_4+CO_2) and biosolid
  - Generated CH_4 can be used to produce heat and/or electricity
  - Biosolid (digestate) can be used as fertilizer or soil amendment
- N_2O emissions from the process are assumed to be negligible

INTERGOVERNMENTAL PANEL ON climate change

Biological Treatment of Solid Waste: CH_4 Emissions

- Estimation of CH_4 emissions:

$$CH_4 Emissions = \sum_i (M_i \bullet EF_i) \bullet 10^{-3} - R$$

CH_4 Emissions: total CH_4 emissions in inventory year, Gg CH_4
M_i : mass of organic waste treated by biological treatment type *i*, Gg
EF_i : emission factor for treatment *i*, g CH_4/kg waste treated
i : composting or anaerobic digestion
R : total amount of CH_4 recovered in inventory year, Gg CH_4

INTERGOVERNMENTAL PANEL ON climate change

Biological Treatment of Solid Waste: N_2O Emissions

- Estimation of N_2O emissions:

$$N_2OEmissions = \sum_i (M_i \bullet EF_i) \bullet 10^{-3}$$

N_2O Emissions: total N_2O emissions in inventory year, Gg N_2O
M_i : mass of organic waste treated by biological treatment type *i*, Gg
EF_i : emission factor for treatment *i*, g N_2O/kg waste treated
i : composting or anaerobic digestion

WMO UNEP

INTERGOVERNMENTAL PANEL ON climate change

Incineration and Open Burning of Waste: CO_2 Emissions

- Based on the total amount of waste combusted:

$$CO_2Emissions = \sum_i (SW_i \bullet dm_i \bullet CF_i \bullet FCF_i \bullet OF_i) \bullet 44/12$$

CO_2 Emissions: CO_2 emissions in inventory year, Gg/yr
SW_i : total amount of solid waste of type *i (wet weight) incinerated or open-burned, Gg/yr*
dm_i : dry matter content in the waste (wet weight) incinerated or open-burned, (fraction)
CF_i : fraction of carbon in the dry matter (total carbon content), (fraction)
FCF_i : fraction of fossil carbon in the total carbon, (fraction)
OF_i : oxidation factor, (fraction)
44/12 : conversion factor from C to CO_2
i : type of waste incinerated/open-burned such as MSW, industrial solid waste (ISW), sewage sludge, hazardous waste, clinical waste, etc.

- Estimation of the amount of fossil carbon is the most important factor determining the CO_2 emissions as only CO_2 emissions of fossil origin (e.g., plastics, certain textiles, rubber, liquid solvents, and waste oil) should be included

WMO UNEP

INTERGOVERNMENTAL PANEL ON climate change

Incineration and Open Burning of Waste: CO_2 Emissions

- For municipal solid waste:

$$CO_2Emissions = MSW \bullet \sum_j (WF_j \bullet dm_j \bullet CF_j \bullet FCF_j \bullet OF_j) \bullet 44/12$$

CO_2 Emissions: CO_2 emissions in inventory year, Gg/yr

MSW : total amount of municipal solid waste as wet weight incinerated or open-burned, Gg/yr

WF_j : fraction of waste type/material of component *j* in the MSW (as wet weight incinerated or open-burned)

dm_j : dry matter content in the component j of the MSW incinerated or open-burned, (fraction)

CF_j : fraction of carbon in the dry matter (i.e., carbon content) of component *j*

FCF_j : fraction of fossil carbon in the total carbon of component *j*

OF_j : oxidation factor, (fraction)

44/12 : conversion factor from C to CO_2

j : component of the MSW incinerated/open-burned (e.g., plastics, certain textiles, rubber)

Incineration and Open Burning of Waste: CH_4 Emissions

- CH_4 emissions result from incomplete combustion of waste and can be affected by temperature, residence time, and air to waste ratio

$$CH_4Emissions = \sum_i (IW_i \bullet EF_i) \bullet 10^{-6}$$

CH_4 Emissions: CH_4 emissions in inventory year, Gg/yr

IW_i : amount of solid waste of type *i incinerated or open-burned, Gg/yr*

EF_i : aggregate CH_4 emission factor, kg CH_4/Gg of waste

10^{-6} : conversion factor from kilogram to gigagram

i : category or type of waste incinerated/open-burned (MSW, ISW, hazardous waste, clinical waste, sewage sludge, etc.)

- The amount and composition of waste should be consistent with the activity data used for estimating CO_2 and N_2O emissions from incineration/open burning

WMO UNEP ipcc INTERGOVERNMENTAL PANEL ON climate change

Incineration and Open Burning of Waste: N_2O Emissions

- The N_2O emissions are mainly determined by technology, combustion temperature (emitted at relatively low combustion temperatures 500-950°C) and waste composition

$$N_2OEmissions = \sum_i (IW_i \bullet EF_i) \bullet 10^{-6}$$

N_2O Emissions: N_2O emissions in inventory year, Gg/yr
IW_i : amount of incinerated/open-burned waste of type *i* , *Gg/yr*
EF_i : N_2O emission factor (kg N_2O/Gg of waste) for waste of type *i*
10^{-6} : conversion from kilogram to gigagram
i : category or type of waste incinerated/open-burned (MSW, ISW, hazardous waste, clinical waste, sewage sludge, etc.)

WMO UNEP

ipcc INTERGOVERNMENTAL PANEL ON climate change

Tools and other materials to support emission estimation

- IPCC EFDB
  - Provides a wide variety of EFs and other parameters with background documentation or technical references so that users can select and use appropriate data on their own responsibility
  - Accessible at http://www.ipcc-nggip.iges.or.jp/EFDB/ and also available in CD ROM
- 2006 IPCC Guidelines Software
  - Complete version available by end of 2011 or early 2012
- Information on TFI website
  - FAQ
  - Presentations
  - Documents (meeting reports, brochures etc.)

WMO UNEP

ipcc INTERGOVERNMENTAL PANEL ON climate change

Summary

- Emission estimates or emission inventories provide information on the level and trend of emissions and enable to monitor the implementation of policies /measures to reduce emissions
- IPCC Guidelines for National Greenhouse Gas Inventories provide globally applicable methods to estimate national emissions and removals
- Updated and improved methods for estimation of GHG emissions from treatment and disposal of solid waste and wastewater are given in Volume 5 of the 2006 IPCC Guidelines
- IPCC TFI provides additional supporting tools and materials for estimation of GHG emissions/removals (EFDB, software and other materials on TFI website)

WMO UNEP

INTERGOVERNMENTAL PANEL ON climate change

Thank you

WMO UNEP

INTERGOVERNMENTAL PANEL ON climate change

ນະໂຍບາຍຂອງລັດຖະບານ ກ່ຽວກັບ ການຈັດການຂີ້ເຫຍື່ອ

ແສງດາລາ ດວງມີໄຊ
ພະແນກເຄຫາແລະຜັງເມືອງ

1. ສເຫນີຍໍ້ກ່ຽວກັບການຈັດການຂີ້ເຫຍື່ອ
2. ໂຄງການການຈັດການຂີ້ເຫຍື່ອ
3. ກົດຫມາຍ, ລະບຽບການຫລັກໆ ແລະ ສະຖາບັນທີ່ກ່ຽວຂອງກັບ ຂີ້ເຫຍື່ອ
4. ທິດທານະໂຍບາຍ ໃນຕໍ່ຫນ້າ
5. ສິ່ງທ້າທາຍໃນຕໍ່ຫນ້າ

ສເໜີນິຍໍກ່ຽວກັບການຈັດການຂີ້ເຫຍື່ອ

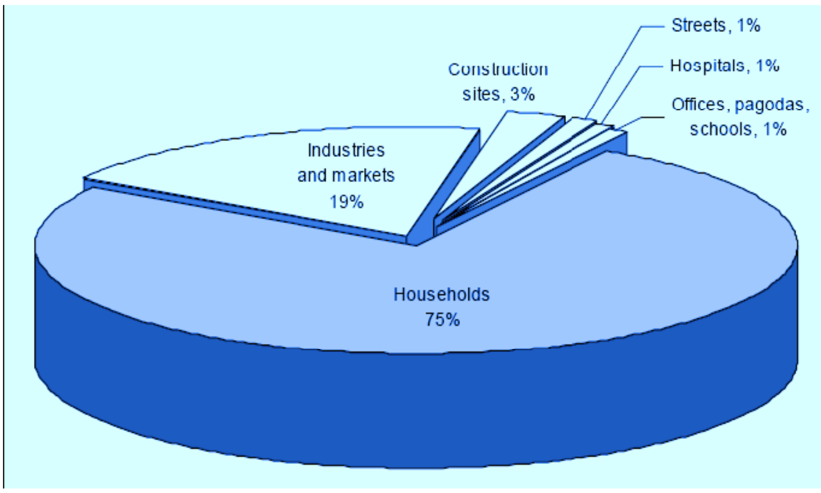
ການຜະລິດຂີ້ເຫຍື່ອ

- ຂີ້ເຫຍື່ອແມ່ນວັດຖຸ ຫລື ສິ່ງເສດຈາກ ການດຳລົງຊີວິດປະຈຳວັນ ແລະກິດຈະກຳຕ່າງໆ ທາງອຸດສະຫະກຳ
- ໂດຍສະເລ່ຍ ແລ້ວ ຢູ່ປະເທດລາວ ຄົນຜູ່ໜຶ່ງຜະລິດຂີ້ເຫຍື່ອ 0.75kg ຕໍ່ວັນ
- ໃນວັນໜຶ່ງ ມີການຜະລິດຂີ້ເຫຍື່ອປະມານ 500 ໂຕນ
- ໃນບັນດາ ປະເທດ GMS, ວຽງຈັນ ໃນການຜະລິດຂີ້ເຫຍື່ອ ຖືກຈັດໃຫ້ເປັນທີ 3 ຫລັງຈາກ ບາງກອກ,

ການຜະລິດຂີ້ເຫຍື່ອ ໃນປະເທດ GMS

ປະເທດ	ເມືອງຫລວງ	ເຫຍື່ອອັດຕາເພີ່ມ ຂື້ນຂອງ ປະຊາກອນ, %	ຈຳນວນ ປະຊາກອນ	ອັດຕາຜະລິດ ຂີ້ເຫຍື່ອ Kg/day/cap
ກຳປູເຈຍ	ພະນົມເປັນ	2.5	27.7	0.46
ສ.ປ.ປລາວ	ວຽງຈັນ	2.5	15.9	0.75
ພະມ້າ	ຢ່າງກູ້ງ	2.3	21.6	0.45
ໄທ	ບາງກອກ	0.8	20.0	1.60
ວຽດນາມ	ຮ່າໂນຍ	1.6	18.3	0.45
ແຂວງຢູນ່ານ	ຄຸນມີງ	1.2	24.0	0.79
Source: ADBUNEP, 2004				

ການຜະລິດຂີ້ເຫຍື່ອ ອີງໃສ່ແຫລ່ງ



Source: Urban Cleansing Service Center

ການເກັບ ແລະການກຳຈັດ

- ມີພຽງແຕ່ 17 ສະໜາມຂີ້ເຫຍື່ອທີ່ຄວບຄຸມ ແລະ 38 ເມືອງ ຈາກ 143 ໄດ້ມີການບໍລິການເກັບຂີ້ເຫຍື່ອ
- 50% ຂອງຂີ້ເຫຍື່ອທັງໝົດ ຖືກເກັບ ແລະທຳການບຳບັດ ຢູ່ສະໜາມຂີ້ເຫຍື່ອ (60% ຢູ່ວຽງຈັນ)

ການເກັບ ແລະການກຳຈັດ

- ແຕ່ລະວັນ ຂີ້ເຫຍື່ອປະມານ 2,500 ໂຕນ ຖືກກຳຈັດ ໂດຍການກອງເປີດ ຫລື ຖິ້ມຊະຊາຍບໍ່ເປັນລະບຽບ ສູ່ແຫລ່ງນ້ຳທຳມະຊາດ ຫລືບ່ອນຫວ່າງ

ການຜະລິດຄືນ

- ໃນຕົວເມືອງໃຫຍ່ ຂີ້ເຫຍື່ອຜະລິດຄືນໄດ້ ໄດ້ສົ່ງຂາຍໃຫ້ພໍ່ຄ້າ
- ປະລາສຕິກ ແລະເຈັ້ຍແຂງ ຖືກສົ່ງຂາຍໄປປະເທດໄທ, ແຜ່ນແພຖືກບັ້ນຈຸໃສ່ຖົງຢາງ ແລະສົ່ງໄປຫວຽດນາມ ເພື່ອດຳເນີນຂັ້ນຕອນຕໍ່ໄປ
- ກຸ່ມບໍລິສັດ CS ນຳໃຊ້ປະລາສຕິກຜະລິດຄືນໃໝ່ ຜະລິດທໍ່ PE ຕັ້ງແຕ່ປີ1999
- ການບົ່ມຂີ້ເຫຍື່ອອິນຊີເຮັດຝຸ່ນ ໂດຍການໃຊ້ຂີ້ກະເດືອນ ໄດ້ມີການນຳສະເໜີໂດຍຄູສອນ ວິທະຍາໄລຄູ

ໂຄງການການຈັດການຂີ້ເຫຍື່ອ

ໂຄງການການກໍ່ສ້າງສະໜາມຂີ້ເຫຍື່ອ

- ການກໍ່ສ້າງ ສະໜາມຂີ້ເຫຍື່ອ ເຄິ່ງອະນາໄມ ຢູ່ ຫລັກ18 ຂອງວຽງຈັນ ປີ 1996 , ສະໜັບສະໜູນທຶນ ADB & JICA
- ໂຄງການຂີ້ເຫຍື່ອ ສະພາບແວດລ້ອມຍືນຍົງ ຢູ່ ສີ່ຕົວເມືອງຂັ້ນສອງ 199-2001 , ງົບປະມານ ທັງໝົດ 5,863,720ໂດນລາ ໂດຍແມ່ນ NORAD& UNDP ສະໜັບສະໜູນທຶນ
- ການປັບປຸງສະໜາມຂີ້ເຫຍື່ອ ຫລັກ18 ວຽງຈັນ 1ລ້ານໂດນລາ ຈາກ JFPR 1998
- ສະໜາມຂີ້ເຫຍື່ອເຄິ່ງອະນາໄມ ຢູ່ 12 ຕົວເມືອງ ຂອງSDTSP.2004 - 2009 ໂດຍ ທຶນກູ້ຢືມ ທະນາຄານADB 1.2 ລ້ານໂດນລາ
- ສະໜາມຂີ້ເຫຍື່ອຄວບຄຸມ ຢູ່ຫລັກ 32 ຂອງວຽງຈັນ ໃນປີ 2009

ຈຸດປະສົງຂອງ ໂຄງການ

- ວາງທິດທາງຍຸດທະສາດ ໄລຍະຍາວ ໃນການຈັດການຂີ້ເຫຍື່ອ
- ພັດທະນາຍຸທະສາດປະຕິບັດການ ແບບຍືນຍົງ ຖາວອນ ສຳລັບການຈັດການ ຂີ້ເຫຍື່ອ ຢູ່ແຕ່ລະໂຄງການເມືອງ
- ເພີ່ມຄວາມຕື່ນຕົວຂອງສາທາລະນະ ໃນການວາງຜັງເມືອງ ແລະ ການຈັດການ ແບບຍືນຍົງ ແລະ ແວດລ້ອມທີ່ດີ ໂດຍຜ່ານກົນໄກຊຸກຍູ້ ການຈັດການຂີ້ເຫຍື່ອ.

ຈຸດປະສົງຂອງ ໂຄງການ

- ສ້າງຄວາມເຂັ້ມແຂງໃຫ້ ສະຖາບັນ, ສັບພະຍາກອນມະນຸດ ໃນ ຂະແຫນງ ຂີ້ເຫຍື່ອ
- ການປະຕິບັດການ ໂຄງການ ການຈັດການຂີ້ເຫຍື່ອ
- ສະຫນັບສະຫນູນ ການບໍລິການປະລິມານ ໂດຍການສະໜອງ ລົດ, ອຸປກອນ, ແລະ ເຄື່ອງມືການຂົນສົ່ງປະເພດຕ່າງໆ
- ຊີ້ແຈງດ້ານເສດຖະກິດ ຂອງຂະບວນການການຜະລິດຄືນ ຂອງຂີ້ເຫຍື່ອອິນຊີ

ກິດຈະກໍາອື່ນໆ ໃນການຈັດການຂີ້ເຫຍື່ອ

- ໂຄງການສາທາລະນະຊົນ 2008 ໂດຍທຶນ 120,000ໂດນລາ
- ວັນອະນາໄມປະຈໍາບ້ານ ຫລື ວັນເສົາແດງ : ໃຫ້ ປະຊາຊົນ ທໍາຄວາມສະອາດ ສະຖານທີ່ ສາທາລະນະ ທີ່ຕັ້ງຢູ່ພາຍໃນບ້ານເຂົາເຈົ້າ

ກິດຈະກໍາອື່ນໆ ໃນການຈັດການຂີ້ເຫຍື່ອ

- ສ້າງສື່ສານມວນຊົນ ແລະສາທາລະນະ:
  - ລົງໜັງສືພິມ ໜຶ່ງຄັ້ງຕໍ່ອາທິດ
  - ອອກຂ່າວທາງວິດທະຍຸ ທຸກໆວັນ
  - ລາຍການ TV 15min/ວັນ

ກິດຈະກໍາອື່ນໆ ໃນການຈັດການຂີ້ເຫຍື່ອ

- ສົ່ງເສີມການສ້າງຕົວເມືອງແບບຍືນຍົງ ແລະແວດລ້ອມທີ່ດີ
- ກໍານົດ ຕົວເມືອງສະອາດ ແມ່ນສ່ວນໜຶ່ງຂອງວິໄສທັດການພັດທະນາຕົວເມືອງ

ກົດໝາຍ ແລະກົດລະບຽບ

- ການປ້ອງກັນສະພາບແວດລ້ອມ (1999)
- ກົດໝາຍ ກ່ຽວກັບຂີ້ເຫຍື່ອ ໂຮງງານ
- ກົດໝາຍ ສຂະພິບານ ປ້ອງກັນພະຍາດລະເບີດ ແລະ ການສົ່ງເສີມດ້ານສຸຂະພາບ (2001)
- ປື້ມຄູ່ມື ການຈັດການຂີ້ເຫຍື່ອໂຮງໝໍ 1997)
- ກົດລະບຽບ ສຸຂະພິບານ ຢູ່ ສາທາລະນະ (2004)
- ຂໍ້ກຳນົດຂອງລັດຖະມົນຕີ ຕໍ່ກົດໝາຍ ການຈັດການສະໜາມຂີ້ເຍື່ອ MCTPC(2007) ແລະ
- ອື່ນ ໆອີງຕາມລະບຽບກົດໝາຍ

ສະຖາບັນ ການຈັດການຂີ້ເຫຍື່ອ

- ກະຊວງຊັບພະຍາກອນທຳຊາດ ແລະແວດລ້ອມ
- ກະຊວງວິທະຍາສາດ ແລະເຕັກໂນໂລຢີ,
- ກະຊວງ ໂຍທາທິການແລະຂົນສົ່ງ
- ກະຊວງອຸດສະຫະກຳ ແລະ ການຄ້າ
- ກະຊວງ ສາທາລະນະສຸກ
- ອົງການພັດທະນາ ແລະບໍລິຫານຕົວເມືອງ

ທິດທາງນະໂຍບາຍຕໍ່ໜ້າ

- ການຫລຸດຜ່ອນຂີ້ເຫຍື່ອ ແລະ ເຮັດໃຫ້ແວດລ້ອມດີທີ່ສຸດ ໂດຍການ ຖືເອົາ ການໃຊ້ຄືນ , ການຜະລິດຄືນ ເປັນ ບາດກ້າວທໍາອິດ ຂອງການຈັດການຂີ້ເຫຍື່ອ (ສັນຍາກັບ UN agenda 21)
- ສົ່ງສົມຄູ່ມືປະຕິບັດ ການຈັດການຂີ້ເຫຍື່ອຢູ່ສຸນກາງຕົວເມືອງໃຫຍ່ 2015 (MPWT 2011 - 2020)
- ທົບທວນ ໜ້າທີ່ ແລະຄວາມຮັບຜິດຊອບ ຂອງສະຖາບັນຕ່າງໆເພື່ອ ເປັນການເພີ່ມປະສິດທິພາບໃຫ້ສູງຂື້ນ
- ພະຍາຍາມ ຜ່ານຜ່າ ຕົ້ນທຶນການບໍລິການເອົາຄືນມາໃຊ້
- ດຶງດູດ ພາກເອກຊົນ ໃນການບໍລິການລວມກັນລະຫ່ວ່າງ ສາທາລະນະ ໂດຍ 3Rs ແລະ ປ້ອງກັນສະພາບແວດລ້ອມ

ສິ່ງທ້າທາຍໃນຕໍ່ໜ້າ

- ມັນມີຄວາມຍຸ້ງຍາກຫລາຍ ທີ່ຈະປ່ຽນ ບຸກຄະລິກ ຂອງປະຊາຊົນ ໃນການບໍາບັດຂີ້ເຫຍື່ອ

ສິ່ງທ້າທາຍໃນຕໍ່ໜ້າ

- ຜັງເມືອງ ບໍ່ໄດ້ຄວບຄຸມ ສ້າງໃຫ້ ມີການກໍ່ສ້າງ ສິ່ອຳນບ

Institute for Global Environmental Strategies
Sustainable Consumption and Production Group

ສະເໜີ ການຈັດການຂີ້ເຫຍື່ອ ແລະ ການປ່ຽນແປງພູມອກາດ

- ຈັນຍາແສງອາລຸນ ນັກຄົ້ນຄວ້າດ້ານນະໂຍບາຍ ໜ່ວຍງານ ການບໍລິໂພແລະການຜະລິດທີ່ຍືນຍົງ ສະຖາບັນຍຸດທະສາດສະພາບແວດລ້ອມໂລກ

iGES Institute for Global Environmental Strategies

ກ່ຽວກັບສະຖາບັນຍຸດທະສາດ ສະພາບແວດລ້ອມໂລກ

- ສ້າງຕັ້ງຂຶ້ນໃນປີ 1998 ເປັນ ຄັງຄວາມຄິດ ສະພາບແວດລ້ອມສາກົນ ທີ່ປະເທດຍີ່ປຸ່ນ
- ສໍານັກງານໃຫຍ່ ຢູ່ ຮາຍຍາມາ ຍີ່ປຸ່ນ ຫ້ອງການດາວທຽມທີ່ໂຕກຽວ ກິຕາກິຍູຊຸ, ໂກເບ, ບາງກອກ ແລະ ປັກກິງ
- ດໍາເນີນການວິໃຈ ກ່ຽວກັບນະໂຍບາຍ ເພື່ອຮັບມືກັບ ສິ່ງທ້າທາຍ ສະພາບແວດລ້ອມໂລກ
- ມີສາມຫນ່ວຍງານສຶກສາຫົວຂໍ້ ຄື : ການປ່ຽນແປງພູມອາກາດ (ລວມເອົາກົນໄກຕະລາດ) ການຈັດການຊັບພະຍາກອນທໍາມະຊາດ, ແລະ ການບໍລິໂພກແລະການຜະລິດແບບຍືນຍົງ
- ມີສີ່ຫນ່ວຍງານຕະລຸມບອນເຫດການຄື: ສະພາບແວດລອ້ມແລະເສດຖະສາດ, ກາພັດທະນາບຸກຄະລາກອນແລະ ການປົກຄອງ, ທຸລະກິດແລະ ສະພາບແວດລ້ອມ, ການລິເລີ້ມພາກລັດທ້ອງຖິ່ນ
- ໂຄງການລັດຖະບານຮ່ວມ (IPCC/TSU, APN)

ສາລະບານ

- ການປ່ອຍແກສສູ່ເຮືອນແກ້ວ ຈາກການຈັດການຂີ້ເຫຍື່ອ
- ຜົນທີ່ໄດຮັບຈາກການປະຕິບັດ 3R
- CDM
- ສະຫລຸບ

ການຈັດການຂີ້ເຫຍື່ອຢູ່ປະເທດລາວ

- ການກອງ ແລະການເຜົາຂີ້ເຫຍື່ອແບບເປີດ ເປັນວິທີການ ບຳບັດທີ່ໃຊ້ກັນຫລາຍໃນ ປະເທດລາວ
- ສະຫນາມຂີ້ເຫຍື່ອເກືອບທຸກໆແຫ່ງ ແມ່ນບໍ່ມີ ການ ພັດທະນາທີ່ດີ
- ການກະທຳດັ່ງກາວນີ້ ແມ່ນສິ່ງຜົນໃຫ້ ແວດລ້ອມ ແລະ ສຸຂະພາບຂອງ ຜູ່ອາໃສຢູ່ ທ້ອງຖິ່ນ, ເກີດແກ໋ສເຮືອນແກ້ວຕໍ່ ບັນ ຍາກາດ, ເປັນການໃຊ້ສັບພະຍາກອນ ທີ່ບໍ່ມີປະສິດທິພາບ

ແຫລ່ງຂອງການປ່ອຍແກສສູ່ເຮືອນແກ້ວ ຈາກການຈັດການຂີ້ເຫຍື່ອ

1) ແກສມີເທນປ່ອຍອອກມາຈາກ ສະໜາມຂີ້ເຫຍື່ອ ຂອງ ຂີ້ເຫຍື່ອອິນຊີ

2) ການປ່ອຍແກສຄາບອນໄດອອກໄຊ ຈາກການຈູດ ຂີ້ເຫຍື່ອປະລາສຕິກ ແລະ ຂີ້ເຫຍື່ອປະເພດອື່ນ (ຖ້າເຕົາເຜົາຫາກຖືກນຳມາໃຊ້ ສຳລັບຜະລິດພະລັງງານ ນັ້ນ ການປ່ອຍ CO2 ຂອງເຊື້ອເພີງທີ່ແຮ່ ແມ່ນລວມໃສ່ພາກສວ່ນ ພະລັງງານ, ຢ່າງໃດກໍຕາມ ການປ່ອຍ CO2 ໃນເຕົາເຜົາ ທີ່ບໍ່ນຳເອພະລັງງານກັບມາໃຊ້ຄືນໄດ້ ກໍຖືວ່າ ເປັນພາກສ່ວນຂີ້ເຫຍື່ອ)

3) ພະລັງງານທີ່ໃຊ້ໃນການເກັບ, ການຜະລິດຄືນ, ແລະອື່ນໆ ນັ້ນ ກໍແມ່ນແຫລ່ງ ການປ່ອຍແກສເຮືອນແກ້ວ. ແລະ ຂີ້ເຫຍື່ອຈາກກະສິກຳ ຖືກຈັດໃຫ້ເປັນການປ່ອຍແກສ ຈາກພາກສ່ວນ ກະສິກຳ, ປ່າໄມ້ ແລະ ການໃຊ້ທີ່ດິນ

ອົງປະກອບຂີ້ເຫຍື່ອ ໃນບັນດາປະເທດ ລຸ່ມແມ່ນ້ຳຂອງ

ປະເທດ	ອາຫານ	ເຈັ້ຽ	ປະລາສຕິກ	ໂລຫະ	ແກ້ວ	ອື່ນໆ
ກຳປູເຈຍ	66	3	14	1	1	15
ຈີນ	50	15	10	3	3	19
ລາວ	60		15		15	10
ໄທ	64	8	17	2	3	6
ຫວຽດນາມ	49	2	16	6	7	20

6

ການປ່ອຍແກສສູ່ເຮືອນແກ້ວ ຈາກ ສະໜາມຂີ້ເຫຍື່ອ ຂອງ ຂີ້ເຫຍື່ອທີ່ເປັນອິນຊີ ໃນປະເທດລຸ່ມແມ່ນ້ຳຂອງ

ປະເທດ	ການປ່ອຽ ແກສເຮອນແກ້ວ ເປັນ ພັນ ton CO2 ທຽບເທົ່າ/ປີ		
	1994	2000	ປະຈຸບັນ*
ຈີນ	42.6		45.4 – 113.4
ຫວຽດນາມ	1.39	5.60	3.0 7.4
ໄທ	0.41	4.89	5.3 13.5
ສປປລາວ	0.24**		No data
ກຳປູເຈຽ	0.124		0.12 – 0.34
ພະມ້າ	ບໍ່ມີຂໍ້ມູນ		ບໍ່ມີຂໍ້ມູນ

Note: * Present estimation is based on waste generation and composition that we could obtained through secondary source of data. Lower value represents potential emissions from landfills of food and paper in shallow-unmanaged landfill and the higher value represents its emissions from deep-well managed landfills.

** 1990

7

ຈະປັບປຸງການຈັດການຂີ້ເຫຍື່ອ ຢູ່ລາວໄດ້ຢ່າງໃດ ເພື່ອໃຫ້ມີ ຜົນປະໂຍດຮ່ວມກັນ ລະຫວ່າງ ການປ່ຽນແປງພູມອາກາດ ແລະ ປະສິດທິພາບຂອງ ຊັບພະຍາກອນ?

- ລຸດຜ່ອນການຜະລິດຂີ້ເຫຍື່ອ ໂດຍການ ສົ່ງເສີມ ການໃຫ້ເສດຂີ້ເຫຍື່ອນ້ອຍທີ່ສຸດ , ການນຳໃຊ້ຄືນ, ແລະການຜະລິດຄືນ
- ວ້ ເຫຍື່ອຊຸກຍູ້ການແຍກຂີ້ເຫຍື່ອອິນຊີ ເພື່ອນຳໄປໃຊ້ (ເປັນອາຫານສັດ, ປຸ໋ຍ, ການເຮັດແກສຊີວະພາບ)
- ຫລີກລຽງການຈູດຂີ້ເຫຍື່ອປະລາສຕິກ ໂດຍການ ດຳເນີນທຸລະກິດ ການຜະລິດຄືນໃໝ່

↓

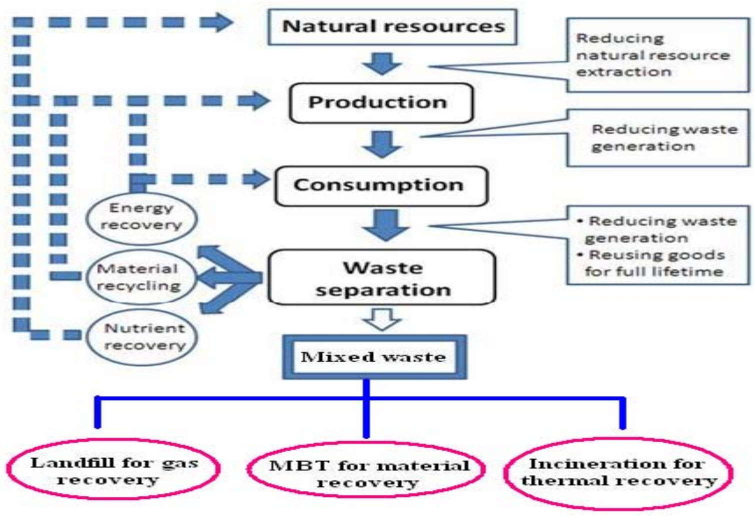
ຫລຸດຜ່ອນຂີ້ເຫຍື່ອ ທີ່ສົ່ງໄປສະໜາມບຳບັດລົງ

↓

ຣ້ ລຸດຜ່ອນ ຕົ້ນທຶນການເກັບຂົນສົ່ງ ການກຳຈັດ, ຫລຸດຜ່ອນ ຜົນກະທົບຕໍ່ແວດລອ້ມ ຫລີກລຽງການປ່ອຍແກສສູ່ເຮືອນແກ້ວ, etc

8

3Rs ຈະສາມາດຫລຸດຜ່ອນການປ່ອຍແກສ ສູ່ເຮືອນແກ້ ແລະ ເຮັດໃຫ້ ຊັບພະຍາກອນມີປະສິດທິພາບໄດ້ຢ່າງໃດ?



9

ຜົນດີຕໍ່ພູມອາກາດ ຂອງ3Rs ໃນພາກສ່ວນຕ່າງໆ

Š ພາກສ່ວນ	ຜົນດີຮ່ວມ ຕໍ່ພູມອາກາດ
ēເຫຍື່ອ	- ຫລຸດຜ່ອນ ການປ່ອຍ ມີເທນ ຈາກ ສະໜາມຂີ້ເຫຍື່ອ - ຫລຸດຜ່ອນການປ່ອຍ ຄາບອນໄດອອກໄຊຈາກການຈູດປະລາສຕິກ
ພະລັງງານ ແລະ ການຂົນສົ່ງ	- ຫລຸດຜ່ອນການປ່ອຍແກສ ຈາກການໃຊ້ ພະລັງງານ ໃນຂະບວນການ ຂອງການຂຸດຄົ້ນຊັບພະຍາກອນ ການກະເສດ, ການຜະລິດ ແລະ ຈຳໜ່າຍ ສິນຄ້າ ແລະ ການຂົນສົ່ງ ແລະບຳບັດ ຂີ້ເຫຍື່ອ - ຫລຸດຜ່ອນການປ່ອຍແກສຈາກການເຊື້ອໄຟທີ່ເປັນແຮ່ ໂດຍການນຳເອົາພະລັງງານຈາກຂີ້ເຫຍື່ອກັບມາໃຊ້
ອຸດສະຫະກຳ	- ຫລຸດຜ່ອນ ການປ່ອຍແກສ ຈາກ ຂະບວນການຜະລິດ ຂອງອຸດສະຫະກຳ ໂດຍການ ຫລຸດຜ່ອນ ຄວາມຕ້ອງການຜະລິດຕະພັນລົງ -ຫລຸດຜ່ອນ ການປ່ອຍແກສ ຈາກ ການຜະລິດປຸຍເຄມີ
ກະສິກຳ	- ລົບລ້າງການປ່ອຍ ແກສ ນີເຕີຣາອອກໄຊ ຈາກເໜື້ອທີ່ປູກຝັງ ໂດບການ ຫລຸດຜ່ອນການໃຊ້ປຸ້ຍເຄມີ - ເພີ່ມຄາກບອນໃຫ້ດິນ Increased soil carbon sequestration
ປ່ຽນແປງການໃຊ້ເນື້ອທີ່ດິນ ແລະປ່າໄມ້	-ີ້ເຫຍື່ອຫລຸດຜ່ອນ ການປ່ອຍແກສ ຈາກ ບໍ່ແຮ່ ແລະ ການຖາງປ່າ

10

ດວ້ຍ R3Rs ສາມາດລຸດຜ່ອນ ການປ່ອຍແກສສູ່ເຮືອນແກ້ວ ຫລາຍປານໃດ?

- ການປ່ອຍໂດຍກົງ ຈາກ ຂີ້ເຫຍື່ອ
  - **20-98%** ຫລຸດຜ່ອນລົງໂດຍການບົ່ມຝຸ່ນ ແລະ **60-100%** ໂດຍການຜະລິດແກດສຊີວະພາບ ຂອງເສດອາຫານ (ທຽບໃສ່ກັບ ສະໜາມຂີ້ເຫຍື່ອ).
- ການຫລຸດຜ່ອນການປ່ອຍແກສ ໂດຍທາງອອ້ມ
  - **94%** ໂດຍການຜະລິດປລາສຕິກຄືນໃມ່.
  - **80%** ໂດຍການ ຜະລິດເຫລັກຄືນຫໃມ່.
  - **56-64%** ເຫຍື່ອໂດຍການນໍາໃຊ້50% ຂອງ ອາລູມີນຽມ ທີ່ຜະລິດຄືນໃຫມ່.
  - **22%** ເຫຍື່ອໂດຍການ ເພີ່ມການຜະລິດແກ້ວຄືນໃຫມ່ ຈາກ **25% to 59%.**

11

ແຜນປະຕິບັດງານການປ່ຽນແປງພູມອາກາດແຫ່ງຊາດ ແລະ 3Rs

Country	Mention of the waste sector	Mention of 3Rs	Source
China	Yes	Yes	NCCCC, 2007
Thailand	Yes	Yes	ONEP, 2008
Cambodia	No	No	MOE, 2002
Lao PDR	No	No	STEA, 2000
Viet Nam	No	No	MNRE, 1999

12

ຂີ້ເຫຍື່ອ ກົນໄກພັດທະນາຄວາມສະອາດ ແລະ ການຈັດການຂີ້ເຫຍື່ອຕົວເມືອງ

- CDM ແມ່ນ ແຫລ່ງທຶນທາງເລືອກໜຶ່ງອີກ, ແຕ່ມີຂັ້ນຕອນຍາວໃຊ້ເວລາຫລາຍ ແລະ ຕ້ອງການ ຂໍ້ມູນສະເພາະຫລາຍໆຢ່າງ. ແລະອີກຢ່າງໜຶ່ງ ແມ່ ໂຄງການ ຄັ້ງດຽວ / ໂຄງການສະເພາະ
- ຂີ້ເຫຍື່ອ ໂຄງການທີ່ໄດ້ລົງທະບຽນ ກັບ **CDM**
  - ການບົ່ມຝຸ່ນ
  - ການຍ່ອຍສະລາຍແບບປິດ (ແກສຊີວະພາບ)
  - ການນຳເອົາແກສ ຈາກ ສະໜາມຂີ້ເຫຍື່ອມາໃຊ້
  - ການຈູດແກສ ສະໜາມຂີ້ເຫຍື່ອ
  - ຄວບຄຸມການ ເຜົາໄໝ້
  - ປັບປຽນເສດໃຫ້ເປັນເຊື້ອເພີງ **(RDF)**
- ກົນໄກການຕະຫລາ ສຳລັບ ປີ 2012 ຍັງບໍ່ທັນໄດ້ ກຳໜົດໄວ້

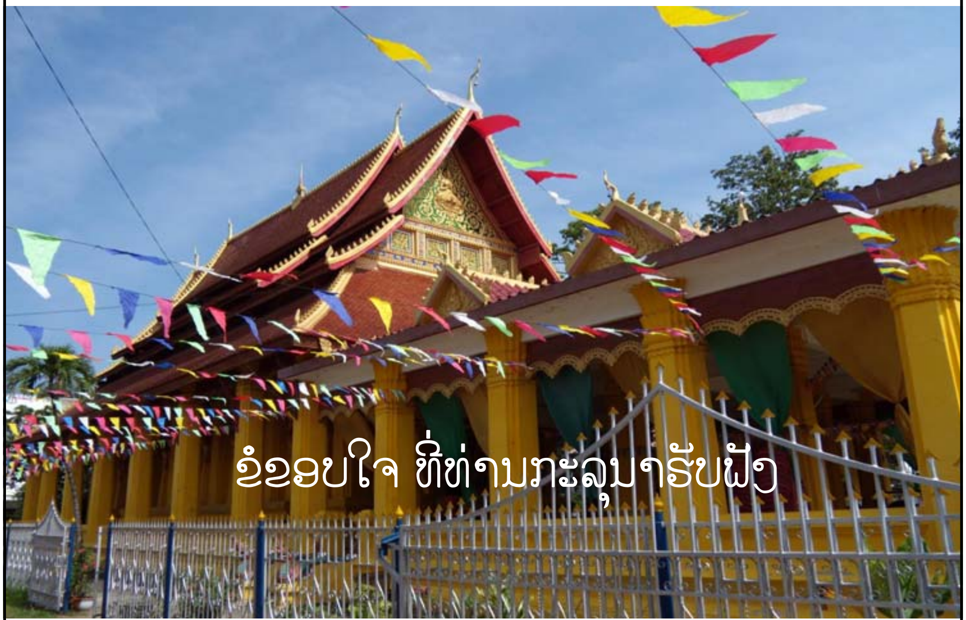
13

ສະຫລຸບ

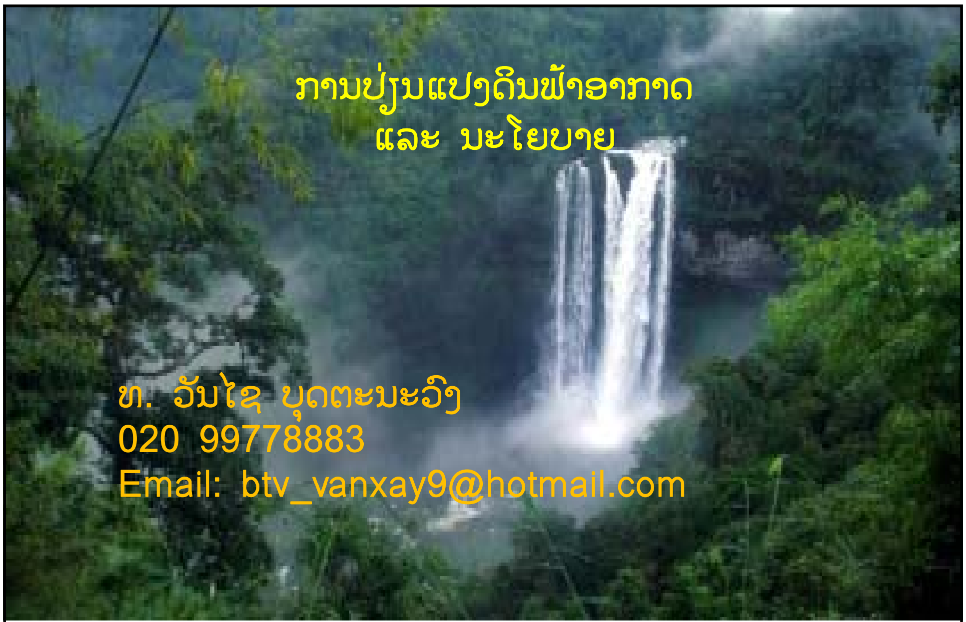
ການປ່ອຍແກສສູ່ ເຮືອນແກ້ວ ຈາກພາກສ່ວນຂີ້ເຫຍື່ອ ຢູ່ປະເທດລາວ ມີການເພີ່ມຂື້ນ

- **3Rs** ເປັນວິທີທາງທີ່ ເຮັດໃຫ້ ປະສິດຜົນ ຂອງການຈັດການຂີ້ເຫຍື່ອ ແບບຍືນຍົງ ເນື່ອງຈາກວ່າ ມັນຊວ່ຍໃຫ້ປະສິທິພາບຂອງຊັບພະກອນສູງຂື້ນ ແລະ ລົບລ້າງ ການປ່ອຍແກສສູ່ເຮືອນແກ້ວ.
- ລັດຖະບານ ຈະຕ້ອງເນັ້ນໜັກ ໃຫ້ຄວາມສຳຄັນ 3Rs ໃຫ້ກາຍເປັນ ມາດຕາການ ການບັນເທົາ ການປ່ຽນແປງພູມອາກາດ
- ມີຄວາມເປັນໄປໄດ້ ທີ່ຈະເຮັດໃຫ້ໂຄງການ ສາມາດມີລາຍຮັບງົບປະມານ ເພີ່ມເຕີມ ໂດຍຜ່ານ ຕະລາດຄາບອນ (ເຊັ່ນ : CDM, NAMA). ຢ່າງໃດກໍຕາມ, ສິ່ງສຳຄັນກອ່ນເພີ່ນ ສຳລັບ ການຈັດການຂີ້ເຫຍື່ອ ຈະຕ້ອງ ໃຫ້ມີການຈັດການ ແລະນຳໃຊ້ ຊັບພະຍາກອນ ຢ່າງຖືກວິທີ

14



15



ກະຊວງຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ

ສາລະບານສະເໜີ

1. ສາຍເຫດ ແລະ ຜົນກະທົບ
2. ການແກ້ໄຂ ໃນລະດັບໂລກ
3. ການແກ້ໄຂ ຢູ່ ສປປ ລາວ

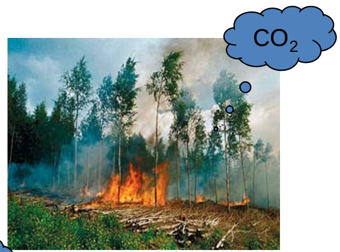
2

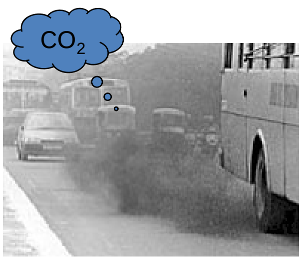
I. ສາຍເຫດ ແລະ ແຫຼ່ງກຳເນີດຂອງການປ່ຽນແປງດິນຟ້າອາກາດ

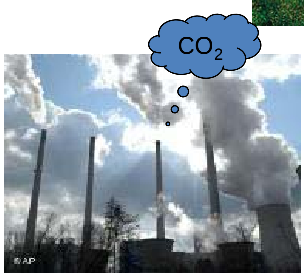
- ແຫຼ່ງກຳເນີດ ຂອງ GHG ມາຈາກ:
  1. ການເຜົາໄໝ້ນ້ຳມັນເຊື້ອໄຟ ຢູ່ຂະແໜງຕ່າງໆ:
     - ອຸດສາຫະກຳ ປຸງແຕ່ງ
     - ອຸດສາຫະກຳດ້ານພະລັງງານ
     - ການຂົນສົ່ງ
  2. ການປ່ຽນແປງຈາກການນຳໃຊ້ດິນ:
     - ການຕັດໄມ້ທຳລາຍປ່າ
     - ການປູກຝັງ ແລະ ລ້ຽງສັດ
     - ສິ່ງເສດເຫຼືອ
     - ອື່ນໆ...

ແຫຼ່ງກຳເນີດ ຂອງ ທາດອາຍພິດເຮືອນແກ້ວ:

1.	ຄາບອນໄດອອກໄຊ	CO_2 = GWP: 1
2.	ມີເທນ	CH_4 = GWP: 21
3.	ໄນຕຣັດອອກໄຊ	N_2O = GWP: 310
4.	ໄຮໂດຣຟຣູອໍໂຣຄາບອນ	HFCs = GWP: 140 – 11,700
5.	ເປີໂດຣຟຣູອໍໂຣຄາບອນ	PFCs = GWP: 6,500– 9,200
6.	ຊັນເຟີເອກຊາຟຣູໂອໄຣ	SF_6 = GWP: 23,900







ແຫຼ່ງກຳເນີດຂອງທາດອາຍພິດເຮືອນແກ້ວ

ແຫຼ່ງກຳເນີດຂອງທາດອາຍພິດເຮືອນແກ້ວ

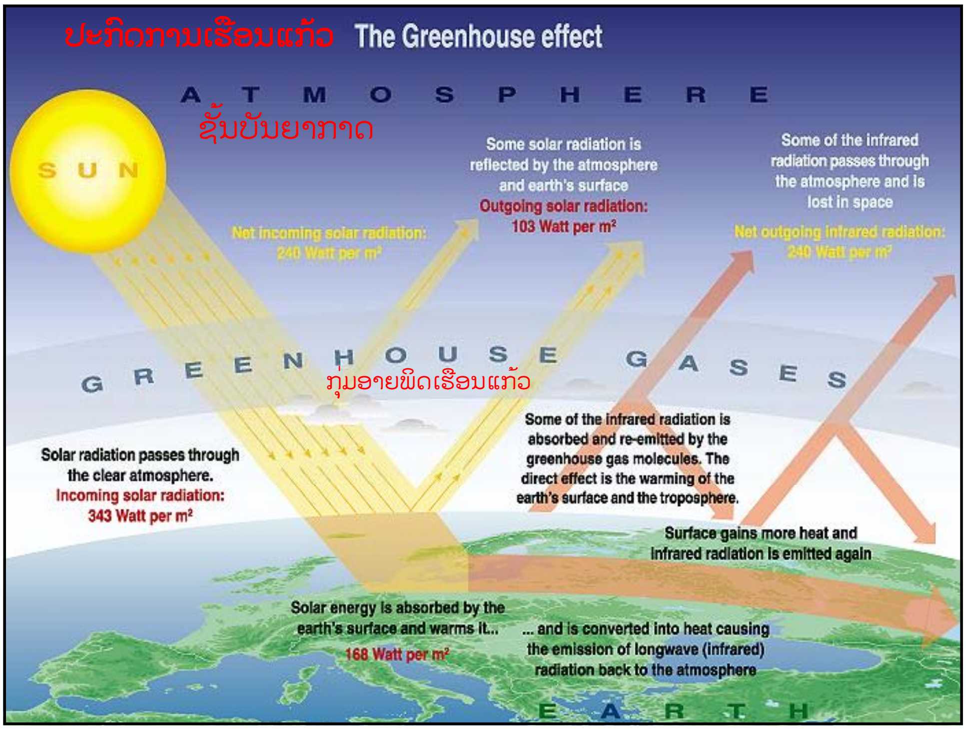
ຂີ້ເຫຍື້ອ ປ່ອຍ → $CH_4 + N_2O$

ມູນສັດ ປ່ອຍ → CH_4

ສິ່ງເສດເຫຼືອ, ນ້ຳເປື້ອນປ່ອຍ → CH_4

ແຫຼ່ງກຳເນີດຂອງທາດອາຍພິດເຮືອນແກ້ວ

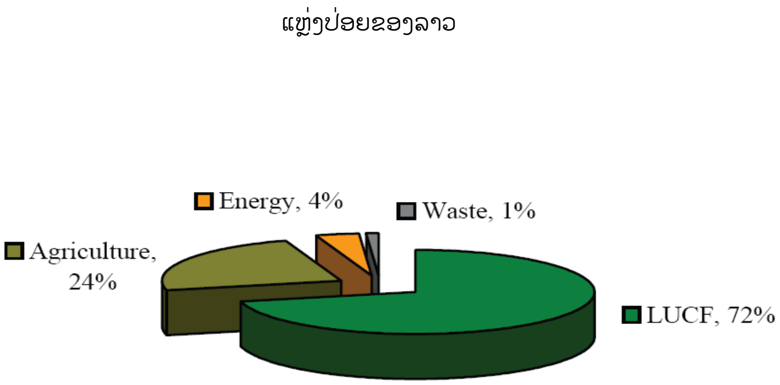
ບັນດາກິດຈະກຳທີ່ນຳໃຊ້ພະລັງງານເຊື້ອໄຟ, ຖ່ານຫີນ ປ່ອຍ → CO2



ການປ່ອຍ GHG

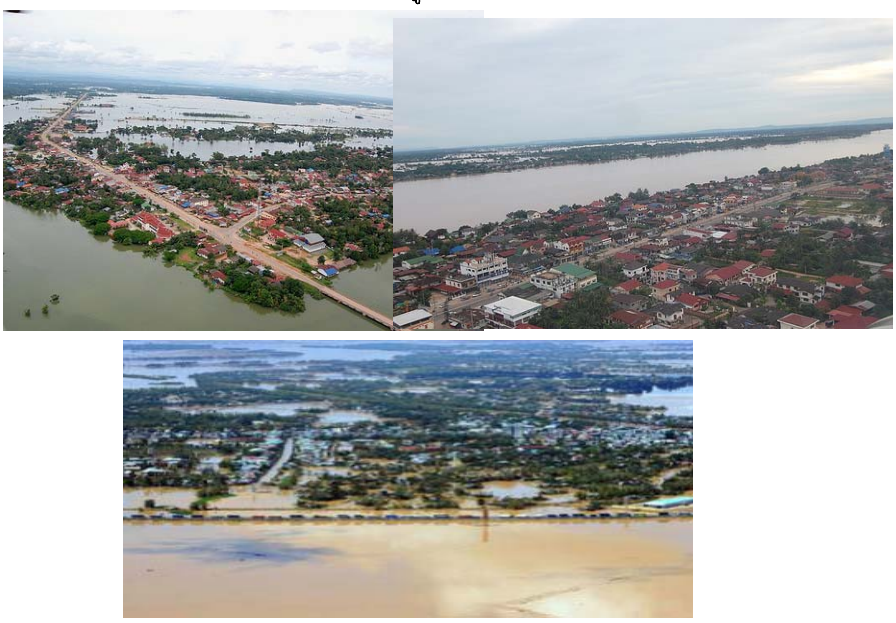
World Rank	Countries	% of World Emission*
1	China	7,010,170
2	USA	6049,435.88
3	Russia	1,524,993
4	India	1,342,962
5	Japan	1,257,963
6	Germany	860,522
7	Canada	639,403

Countries	% of World Emission*
8. United Kingdom	587,261
9. South Korea	465,643
10.Italy	449,948
14. Indonesia	378,250
22. Thailand	268,082
26. Malaysia	177,584
38 Vietnam	98,663
151. Lao PDR	1,280
172. Cambodia	5353



II. ຜົນກະທົບຈາກການປ່ຽນແປງດິນຟ້າອາກາດ

ໄພນ້ຳຖ້ວມ ຢູ່ ສປປ ລາວ 2008



ຜົນກະທົບຈາກນ້ຳຖ້ວມ

ວຽງຈັນ, ເດືອນສິງຫາ ປີ 2008

ພະຍຸເກດສະນາ ພາກໃຕ້ຂອງລາວ ປີ 2009

It was the worst flood in living memory.

ຝົນກະທົບ ຢູ່ສປປລາວ

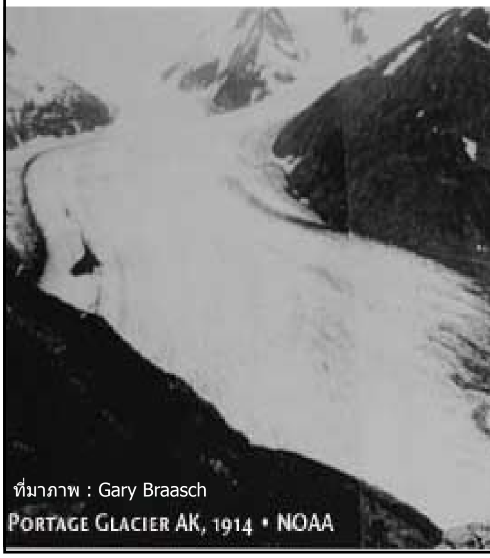
ຝົນກະທົບ ຢູ່ ສປປລາວ

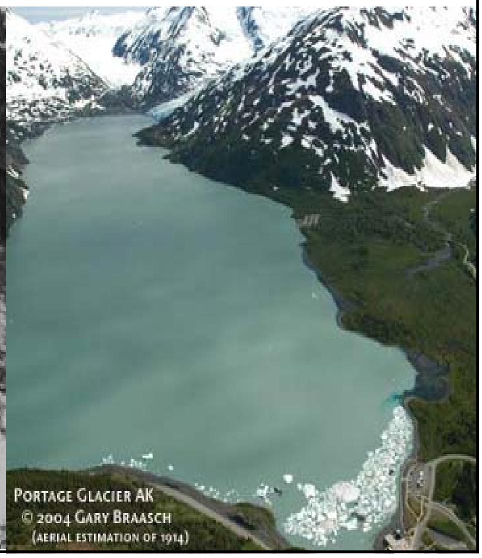
ຝົນກະທົບ

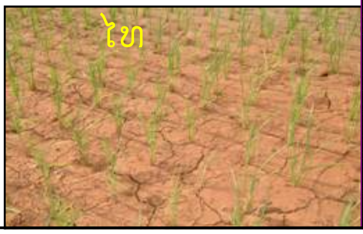
1. ດ້ານສຸຂະພາບ
2. ດ້ານກະສິກຳ
3. ຊັບພະຍາກອນນ້ຳ
4. ຊັບພະຍາກອນປ່າໄມ້
5. ດ້ານຊີວະນາໆພັນ
6. ດ້ານເສດຖະກິດ
7. ການທ່ອງທ່ຽວ

ຖານນ້ຳກ້ອນຖາວອນ ທີ່ອາລາສະກ້າ ບໍລິເວນຂົ້ວໂລກເໜືອ

ປີ 1994 ປີ 2004







ການເພີ່ມຂຶ້ນ ຂອງໄພແຫ້ງແລ້ງ

Drought in Gujarat, India, 1 June 2003

Dry bed of the Usmansagar Lake, in Hyderabad, 6 June 2003.

ອິນເດັຍ

Drought in India, May 2003

Drought in Central Java, August 2002

Wivenhoe Dam, Australia

ໄພແຫ້ງແລ້ງ ຍັງຈະສືບຕໍ່ຄຸກຄາມມະນຸດ ແລະສິ່ງທີ່ ມີຊີວິດອື່ນໃນໂລກ

ປາກກິດສະຖານ

ບັງກຣາແດສ

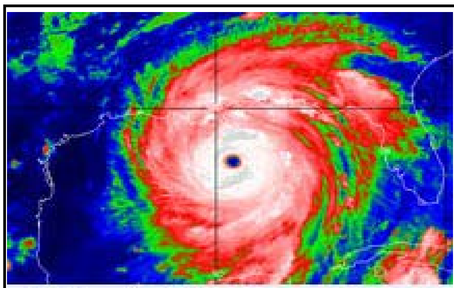
ອິນເດັຍ

ຫວຽດນາມ

ຟິລິປິນ

ຝົນກະທົບ ຢູ່ສປປລາວ

ຝົນຕົກໜັກນ້ຳຖ້ວມຖະຫົນ
ຫາງ ແລະ ເຮືອນຊານ ຂອງພວກ
ເຮົາ



ພາຍຸ





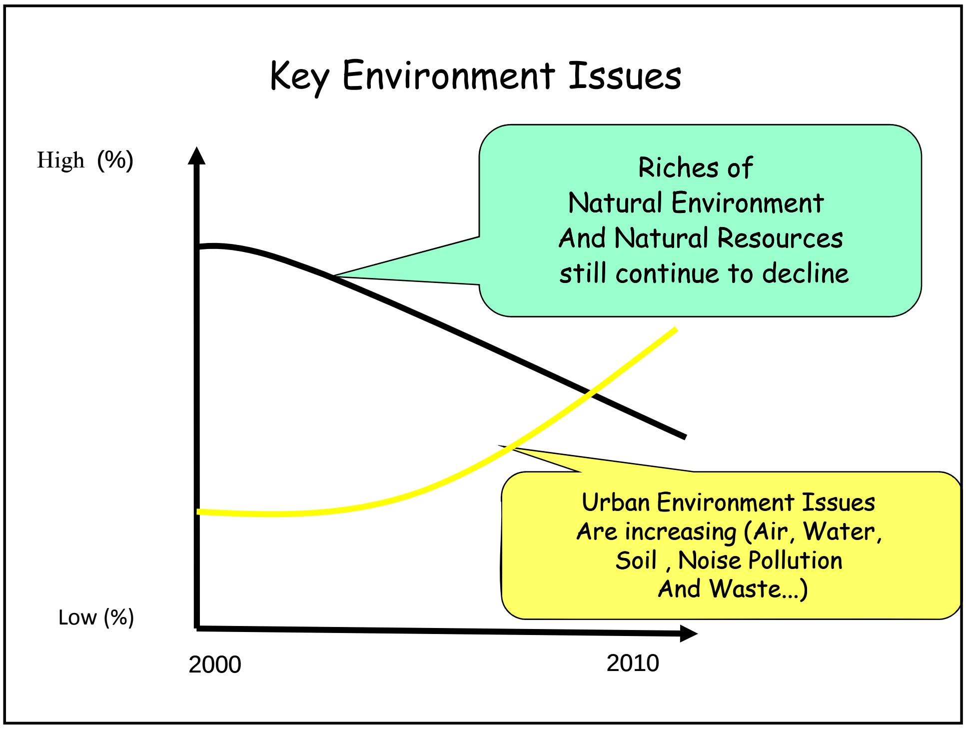

ພະຍາດລະບາດ ໃນທົ່ວທິດ ຂອງໂລກ

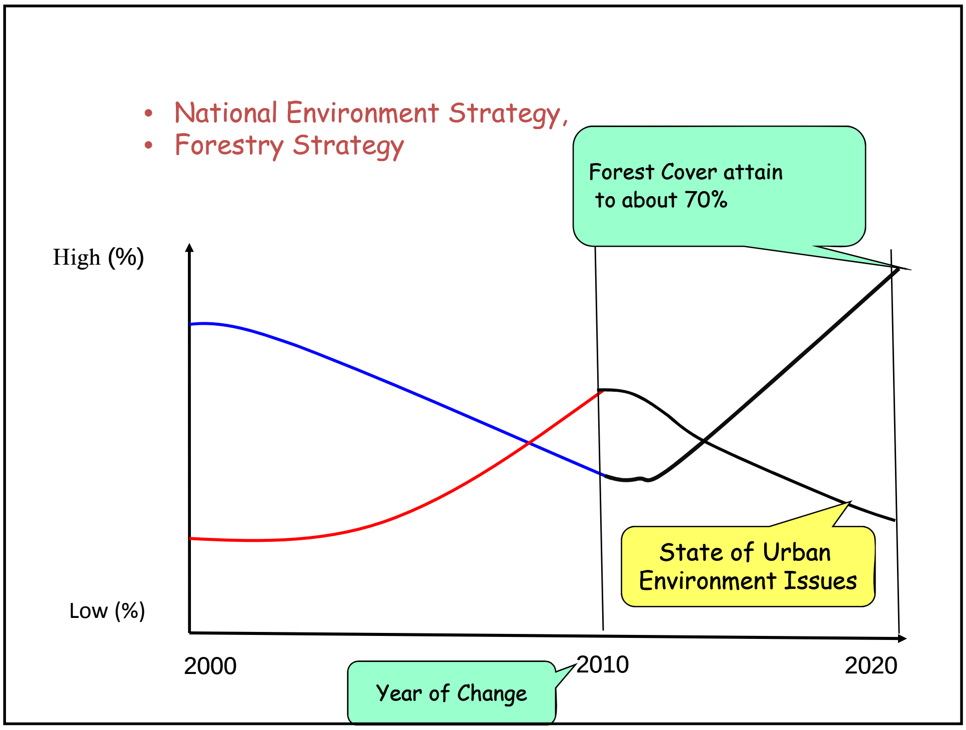
- ຕົວນຳເຊື້ອລະບາດ
- ໂລກຊາຣ
- ໄຂ້ຫວັດສັດປີກ
- ໂລກລະບົບທາງເດີນຫາຍໃຈ

ພະຍຸໄຕຟຸ່ນ ທີສສ ຫວຽດນາມ

Hurricane Katrina (29 August 2005) killed at least 1,500 people and displaced thousands, and caused nearly $100 billion worth of damage.Water level reached as high as 4 m.

III. ການແກ້ໄຂ


Key Environment Issues
High (%)
Riches of
Natural Environment
And Natural Resources
still continue to decline
Urban Environment Issues
Are increasing (Air, Water,
Soil , Noise Pollution
And Waste...)
Low (%)
2000
2010


National Environment Strategy,
Forestry Strategy
Forest Cover attain
to about 70%
High (%)
State of Urban
Environment Issues
Low (%)
2000
2010
2020
Year of Change

ການແກ້ໄຂຂອງລາວ

- ລັດຖະບານລາວໄດ້ລົງນາມ ຕໍ່ UNFCCC ໃນ 1995.
  Annex 1: ປະເທດ LDC ບໍ່ຮັບຜິດຊອບຕໍ່ການປ່ອຍ GHGs.
  Non annex 1: ປະເທດພັດທະນາຮັບຜິດຊອບຕໍ່ການປ່ອຍ GHGs.

- ລັດຖະບານລາວໄດ້ລົງນາມ ຕໍ່ Kyoto Protocol ໃນ 2003.
  CDM, Clean development mechanism.
  REDD+

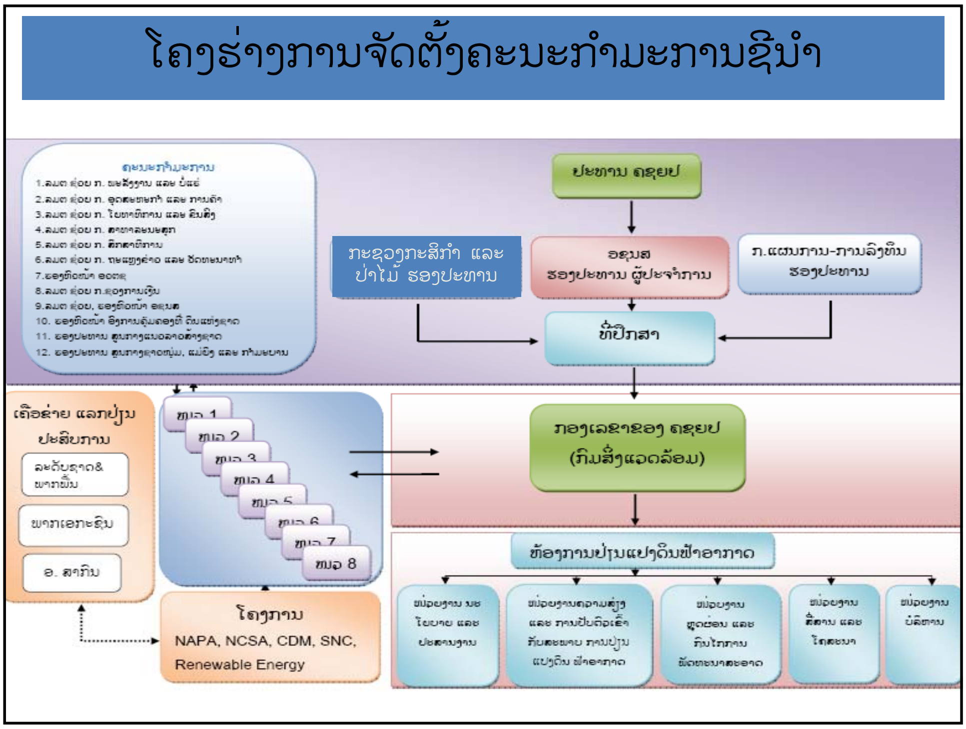
- ລັດຖະບານໄດ້ສຳເລັດ ບົດສືສານແຫ່ງຊາດກ່ຽວກັບການປ່ຽນແປງດິນຟ້າອາກາດ.
  ສະບັບທຳອິດໃນປີ2000.
  ສະບັບທີ 2 ຈະສຳເລັດທ້າຍປີ2011.

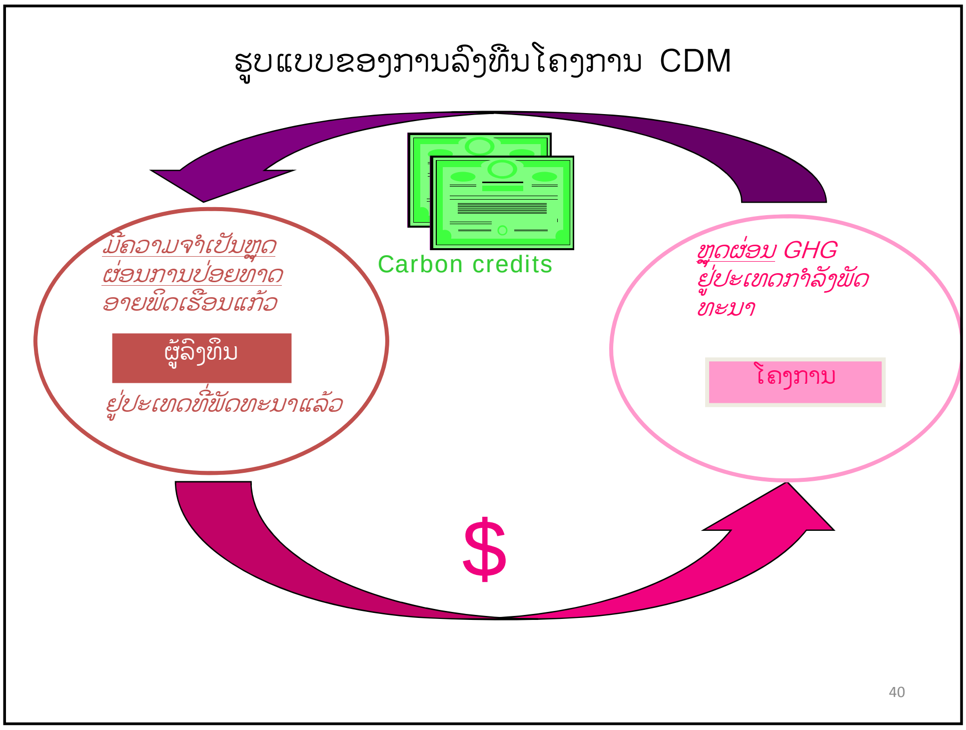
ສຳເລັດ (NAPA) ໃນປີ2009,
ມີ 45 ໂຄງການ
ມີງົບປະມານ US$ 85 ລ້ານ, ກວມເອົາ4ຂົງເຂດງານຄື:

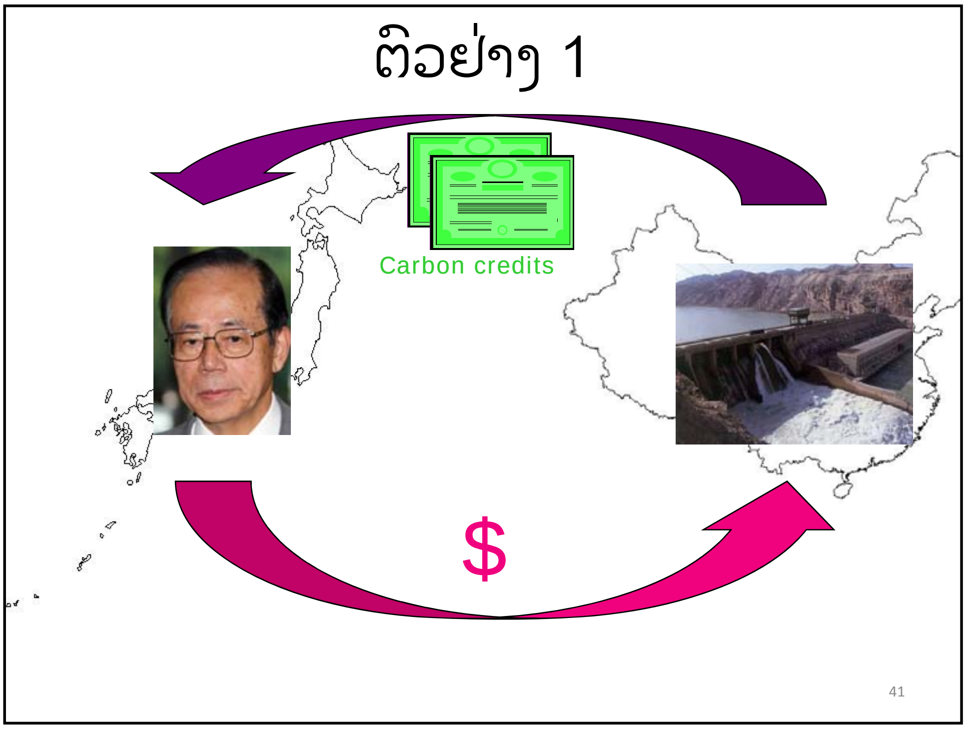
- ກະສິກຳ.
- ປ່າໄມ້.
- ຊັບພະຍາກອນນໍ້າ.
- ສາທາ

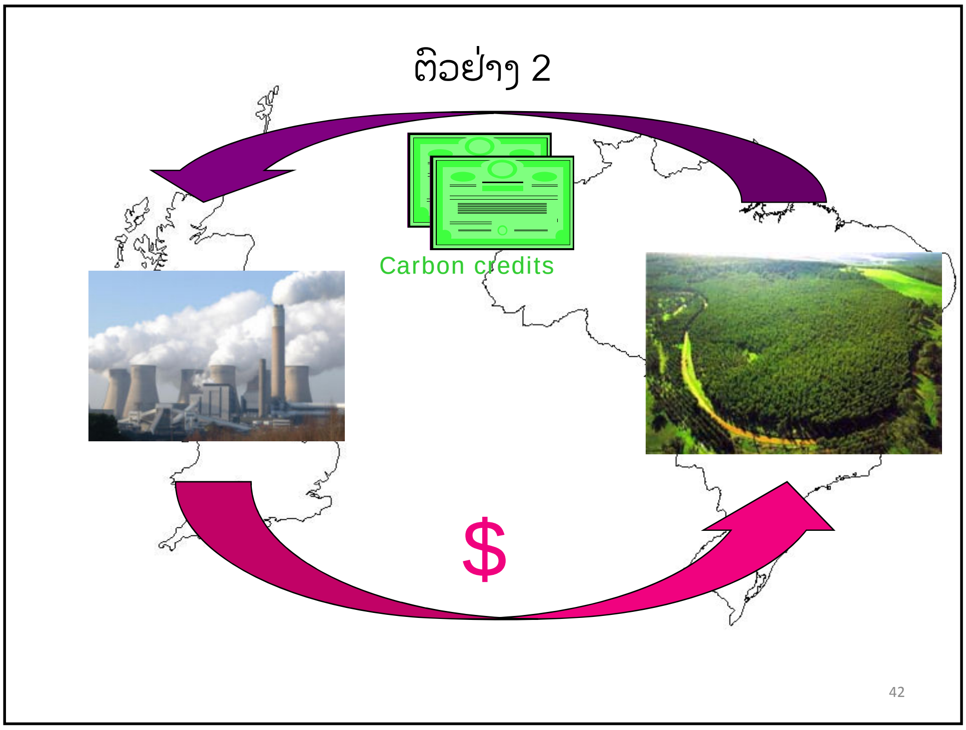
ສຳເລັດ ຍຸດທະສາດວ່າດ້ວຍການປ່ຽນແປງດິນຟ້າອາກາດປີ 2010.
ມີ 8 ຂົງເຂດວຽກງານທີ່ຕິດພັນ ຄື:

- ກະສິກຳ ແລະ ການຄ້ຳປະກັນສະບຽງອາຫານ.
- ປ່າໄມ້ ແລະ ການປ່ຽນແປງການນຳໃຊ້ທີ່ດິນ.
- ຊັບພະຍາກອນນໍ້າ.
- ສາທາ.
- ພະລັງງານ ແລະ ຂົນສົ່ງ.
- ອຸດສາຫະກຳ.
- ການພັດທະນາຕົວເມືອງ.
- ກະຊວງການເງິນ.


ໂຄງຮ່າງການຈັດຕັ້ງຄະນະກຳມະການຊີ້ນຳ
ປະທານ ຄຊຍປ
ກະຊວງກະສິກຳ ແລະ ປ່າໄມ້ ຮອງປະທານ
ອຊນສ ຮອງປະທານ ຜູ້ປະຈຳການ
ກ.ແຜນການ-ການລົງທຶນ ຮອງປະທານ
ທີ່ປຶກສາ
ກອງເລຂາຂອງ ຄຊຍປ (ກົມສິ່ງແວດລ້ອມ)
ຫ້ອງການປ່ຽນແປງດິນຟ້າອາກາດ
ຫມວ 8
ໂຄງການ
NAPA, NCSA, CDM, SNC, Renewable Energy

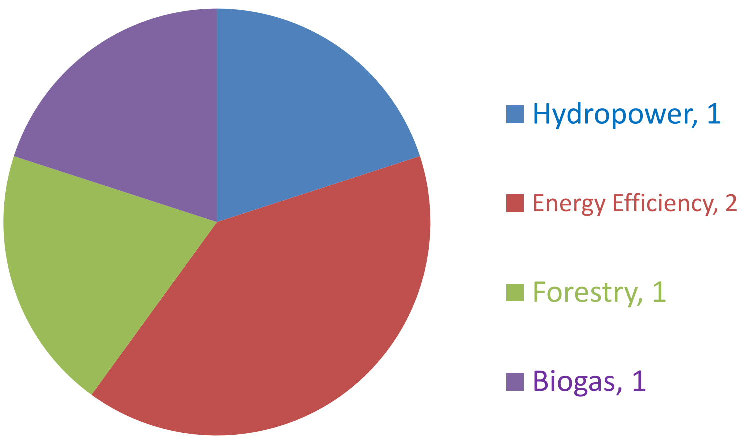

ຮູບແບບຂອງການລົງທືນໂຄງການ CDM
Carbon credits
ມີຄວາມຈຳເປັນຫຼຸດຜ່ອນການປ່ອຍທາດອາຍພິດເຮືອນແກ້ວ
ຜູ້ລົງທືນ
ຢູ່ປະເທດທີ່ພັດທະນາແລ້ວ
ຫຼຸດຜ່ອນ GHG ຢູ່ປະເທດກຳລັງພັດທະນາ
ໂຄງການ
$
40


ຕົວຢ່າງ 1
Carbon credits
$
41


ຕົວຢ່າງ 2
Carbon credits
$
42

ປະສິດທິພາບ ຂອງພະລັງງານ ຢູ່ຂົງເຂດອຸດສາຫະກຳ.

Approval CDM projects



UNFCCC

ການແກ້ໄຂຢູ່ໃນລະດັບໂລກ (UNFCCC)

UN Climate Change Conference 2007 Bali - Indonesia

UNITED NATIONS CLIMATE CHANGE CONFERENCE POZNAŃ 2008 POLAND

COP15 COPENHAGEN

UNITED NATIONS CLIMATE CHANGE CONFERENCE DEC 7-DEC 18 2009

- ເປົ້າໝາຍຫລັກ: *"ເພື່ອຄວບຄຸມລະດັບຄວາມເຂັ້ມຂຸ້ນ ຂອງທາດອາຍພິດເຮືອນແກ້ວ ໃນບັນຍາກາດໃຫ້ຄົງທີ່ຢູ່ໃນລະດັບທີ່ປອດໄພ.*
- ປະຈຸບັນມີທັງໝົດ 193 ປະເທດທີ່ໄດ້ລົງນາມສົນທິສັນຍາ

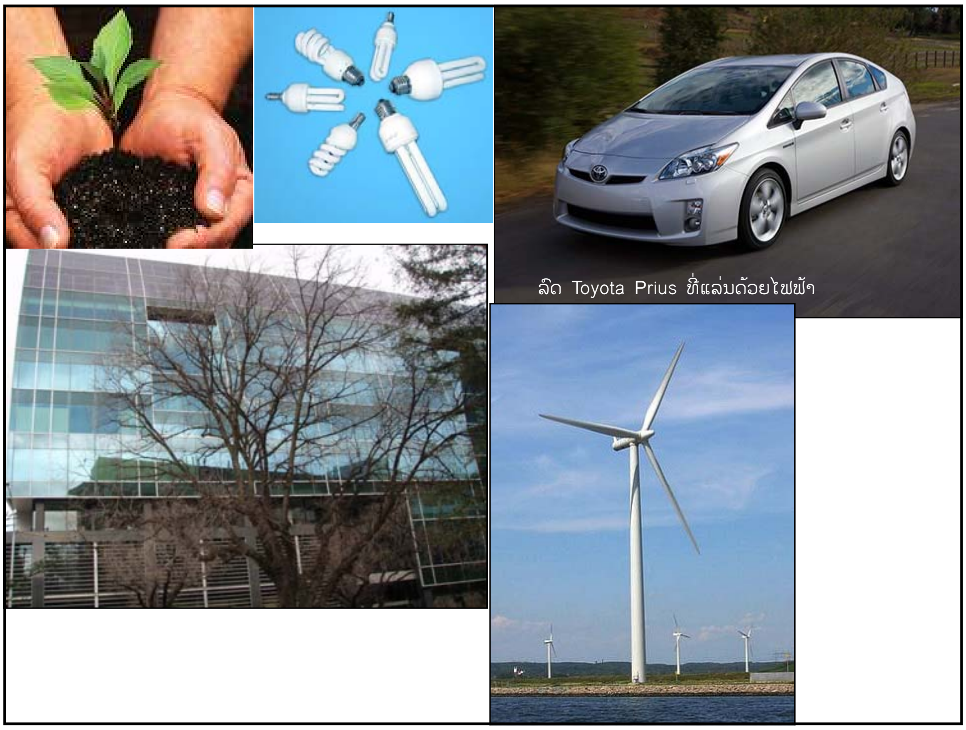
45

Moving towards low carbon society

One innovative approach – fossil-fuel free school bus

(Source: Chow Kok Kee)

Another innovative approach – More efficient public transport system



ຂອບໃຈຫຼາຍໆ

ການນຳໃຊ້ ຂີ້ເຫຍື່ອອິນຊີ ເປັນພະລັງງານ ຢູ່ ສປປ ລາວ

Assoc. Prof. Korakanh Pasomsouk
Head of Department of
Mechanical Engineering
Faculty of Engineering NUOL

ສາລະບານ

1. ສະເໜີ
2. ສະພາບປະຈຸບັນຂອງການຈັດການ ຂີ້ເຫຍື່ອໃນ ລາວ
3. ຂີ້ເຫຍື່ອ ເປັນພະລັງງານ
4. ສະຫລຸບ

ສະເໜີ

- ການປ່ຽນແປງ ພູມອາກາດ ຖືວ່າ ເປັນບັນຫາສຳຄັນຍິ່ງ
- ມັນໄດ້ສົ່ງຜົນກະທົບໃຫ້ແກ່ ສະພາບແວດລ້ອມ, ເສດຖະກິດ ແລະສັງຄົມ ຂອງໂລກ
- ມັນຍັງໄດ້ນາບຄູ່ການດຳລົງຊີວິດຂອງມວນມະນຸດໃນໂລກ
- ກິດຈະກຳຕ່າງໆຂອງມະນຸດ ໄດ້ສ້າງໃຫ້ມີ ແກສເຮືອນແກ້ວ ສູ່ບັນຍາກາດ
- ການເພີ່ມຂຶ້ນຂອງ ແກສເຮືອນແກ້ວ ນີ້ເອງ ສົ່ງຜົນໃຫ້ ມີການປ່ຽນແປງພູມອາກາດ
- ການປ່ຽນແປງພູມອາກາດຈຶ່ງເປັນເຫດການຂອງທົ່ວທຸກແຫ່ງ ໃນໂລກ

1 tCO_2 emitted in Laos = 1 tCO_2 emitted in Japan

ສະເໜີ

ຜົນກະທົບຂອງ ການປ່ຽນແປງພູມອາກາດ ຕໍ່ສັງຄົມ

Climate change will cause **heavier tropical cyclones**.


13:59
7. 8.2006

ສະເໜີ

- ເພື່ອປ້ອງກັນ ການປ່ຽນແປງ ພູມອາກາດ ພວກເຮົາຕ້ອງລຸດຜ່ອນການປ່ອຍແກສ ເຮືອນແກ້ວລົງ
- ຖ້າທຽບໃສ່ ພາກສ່ວນອື່ນໆແລ້ວ ການປ່ອຍແກສເຮືອແກ້ວ ຂອງ ພາກສ່ວນຂີ້ເຫຍື່ອ ແມ່ນມີນ້ອຍກວ່າ
- ຢ່າງໃດກໍຕາມ, ຍ້ອນມີການຜະລິດຂີ້ເຫຍື່ອເພີ່ມຂື້ນເລື້ອຍໆ ໃນທຸກໆປະເທດ ນັ້ນ ຈຶ່ງ ເຮັດໃຫ້ ການປ່ອຍແກສ ເຮືອນແກ້ວ ເພີ່ມຂື້ນ ຢ່າງໄວວາ

Assoc. Prof. Korakanh Pasomsouk, National University of Laos 7

ສະເໜີ

- ຫລາຍປະເທດ ກຳລັງພັດທະນາ ກຳລັງ ປະເສີນກັບບັນຫາ ການຈັດການ ຂີ້ເຫຍື່ອ ເພາະວ່າ ປະເທດເຫລົ່ານີ້ ຂາດແຄນດ້ານ ງົບປະມານ ແລະບຸກຄະລສກອນ
- ໂດຍຂະໜານກັນກັບການຂະຫຍາຍຕົວ ດ້ານ ເສຖະກິດ ແລະປະກອນ ຂອງປະເທດ, ໃນແຕ່ລະປີ ປະລິມານຂີ້ເຫຍື່ອກໍ່ເພີ່ມຂື້ນ ເຊັ່ນດຽວກັນ
- ເຫັນໄດ້ວ່າ ການບຳບັດ ຂີ້ເຫຍື່ອໂດຍ ກອງໄວ້ແບບເປີດ ຈຶ່ງເປັນ ວິທີການ ທີ່ນຳມາໃຊ້ກັນທົ່ວໆໄປ

Assoc. Prof. Korakanh Pasomsouk, National University of Laos 8

ສະເໜີ

- ໃນບັນດາຂີ້ເຫຍື້ອເຫລົ່ານີ້ ມັນປະກອບມີ ຂີ້ເຫຍື່ອອິນຊີ ເປັນສ່ວນໃຫຍ່
- ຢູ່ສະໜາມກຳຈັດຂີ້ເຫຍື່ອ ທີ່ນຳໃຊ້ ວິທີການກອງເປີດໄວ້, ເພື່ອບຳບັດຂີ້ເຫຍື່ອ ນັ້ນ, ເຫັນວ່າ ຂີ້ເຫຍື່ອອິນຊີ (ເສດອາຫານ, ຜັກ, ໝາກໄມ້, ແລະອື່ນໆ) ເປັນຕົວທີ່ ພາໃຫ້ ສ່ວນອື່ນໆ ເໝົ່າເໝັນ.
- ຂີ້ເຫຍື່ອອິນຊີ ເປັນ ແຫລ່ງເກີດ ແກສ ມີເທນ (ການປ່ອຍແກສເຮືອນແກ້)

ການຈັດການຂີ້ເຫຍື່ອໃນ ປະເທດລາວ

- ປະເທດລາວ, ມີມລະພິດທາງອຸດສະຫະກຳ ຍັງບໍ່ທັນຫລາຍເທື່ອ
- ນະໂຍບາຍການຂະຫຍາຍຕົວເມືອງ ເຮັດໃຫ້ ປະຊາກອນອາໃສຢູ່ຕົວເມືອງເພີ່ມຂຶ້ນຢ່າງໄວ ວາ
- ປະຊາຊົນຢູ່ຊົນນະບົດ ມັກຈະລັ່ງໄຫລ ເຂົ້າ ສູ່ຕົວເມືອງ ເພື່ອຊອກວຽກເຮັດງານທຳ
- ນັກຮຽນມັກຈະສືບຕໍ່ການຮຽນຢູ່ມະຫາວິທະ ຍາໄລ ຫລາຍກວ່າ ເຮັດວຽກ ຢູ່ຕາມໄຮ່ນາ
- ຈຳນວນນັກທ່ອງທ່ຽວກໍເພີ່ມຂື້ນ

ານຈັດການຂີ້ເຫຍື່ອໃນ ປະເທດລາວ

- ບັນຫາທີ່ຕາມມາ ກໍຄື ການເພີ່ມຂື້ນຂອງຂີ້ເຫຍື່ອນັ້ນເອງ
- ໃນປີ 2009 ທົ່ວປະເທດ ລາວ ຂີ້ເຫຍື່ອ ປະມານ 350 ໂຕນ ຕໍ່ວັນ ຖືກສົ່ງໄປກໍາຈັດທີ່ສະໜາມຂີ້ເຫຍື່ອ
- ການຂົນສົ່ງ ຂີ້ເຫຍື່ອໄປກໍາຈັດ ທີ່ສໍາໜາມຂີ້ເຫຍື່ອ ຕອ້ງມີຄ່າໃຊ້ຈ່າຍ 4.5 USD ຕໍ່ໂຕນ.
- ຂີ້ເຫຍື່ອອິນຊີ (75%) ເປັນຕົ້ນເຫດໃຫ້ສະໜາມຂີ້ເຫຍື່ອ ເປີະເປື້ອນ
- ສາມວິທີການກໍາຈັດຂີ້ເຫຍື່ອ ແບບດັ້ງເດີມ ໄດ້ ຍັງຖືກນໍາໃຊ້ໃນ ປະເທດລາວ: ການູດ, ການກອງປະໄວ້ ແລະ ການຖົມຊະຊາຍ

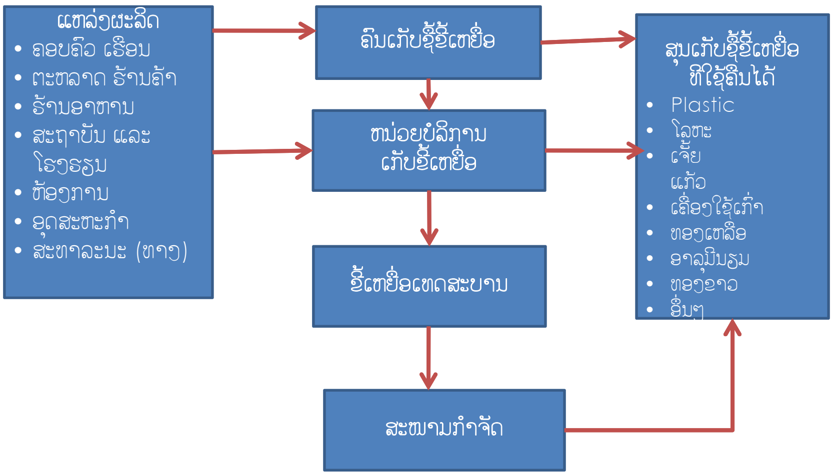
Assoc. Prof. Korakanh Pasomsouk, National University of Laos 11

ການຈັດການຂີ້ເຫຍື່ອໃນ ປະເທດລາວ

- ປະຈບັນ ຢູ່ປະເທດລາວ ຍັງບໍ່ທັນມີ ການນໍາໃຊ້ກົນໄກ ການແຍກຂີ້ເຫຍື່ອ
- ແຕລະວັນ ມີຂີ້ເຫຍື່ອອິນຊີ ປະມານ 220 ໂຕນ ຖືກນໍາໄປກໍາຈັດຖົມ ຮ່ວມກັບສ່ວນອື່ນໆ ທີ່ສະໜາມຂີ້ເຫຍື່ອ:
  - ເສດອາຫານ
  - ເສດຜັກ ແລະໝາກໄມ້
  - ຫຍ້າ ແລະ ໃບໄມ້
  - ເຈັ້ຍ
  - ໄມ້ ແລະກິ່ງຫງ່າໄມ້
- ໃນຕົວຈິງແລ້ວ ຂີ້ເຫຍື່ອອິນຊີ ສາມາດນໍາມາໃຊ້ ເປັນຊັບພະຍາກອນ ໃຫ້ການຜະລິດ ໄດ້

Assoc. Prof. Korakanh Pasomsouk, National University of Laos 12

ການຈັດການຂີ້ເຫຍື້ອໃນ ປະເທດລາວ



Assoc. Prof. Korakanh Pasomsouk, National University of Laos 13

ການຈັດການຂີ້ເຫຍື້ອໃນ ປະເທດລາວ

ຕົວຢ່າງແຫລ່ງ ການເກີດຂອງຂີ້ເຫຍື່ອ ທີ່ວຽງຈັນ

Place	Quantity (ton/day)	Percentage (%)
Household	178	75
Street	2	1
Shop	36	16
Market	9	4
Hospital	2	1
School and office	2	1
Construction place	6	2

Assoc. Prof. Korakanh Pasomsouk, National University of Laos 14

ການຈັດການຂີ້ເຫຍື່ອໃນ ປະເທດລາວ

ອັດຕາການເກີດຂື້ນຂອງຂີ້ເຫຍື່ອ

ແຂວງ	Population person	Prod./capita /day kg	Amount ton/day
ນະຄອນຫລວງວຽງຈັນ	330,798	0.64	211.7
ຫລວງພະບາງ	70,481	0.60	42.3
ສະຫວັນນະເຂດ	65,724	0.64	42
ຈຳປາສັກ	72,955	0.7	51

Assoc. Prof. Korakanh Pasomsouk, National University of Laos 15

ການຈັດການຂີ້ເຫຍື່ອໃນ ປະເທດລາວ

ການວິເຄາະ ສ່ວນປະກອບຂອງຂີ້ເຫຍື່ອ

Assoc. Prof. Korakanh Pasomsouk, National University of Laos 16

ການຈັດການຂີ້ເຫຍື້ອໃນ ປະເທດລາວ

ສ່ວນປະກອບຂອງຂີ້ເຫຍື້ອ ຂອງສີ່ຕົວເມືອງ ທີ່ທຳການສຶກສາ

ອົງປະກອບ	ວຽງຈັນ (%)	ຫລວງພະບາງ (%)	ສະຫວັນນະເຂດ (%)	ຈຳປາສັກ (%)
Plastic	13	9	15	6
ແກ້ວ	6	6	2	2
ເຈ້ຍ	6	8	9	4
ໂລຫະ	3	1	1	1
ເສດອາຫານ, ຜັກ	30	51	54	62
ແຜ່ນແພ	2	1	1	1
ໄມ້/ຫຍ້າ/ໃບໄມ້	19	23	16	21
ອື່ນໆ	21	1	2	3

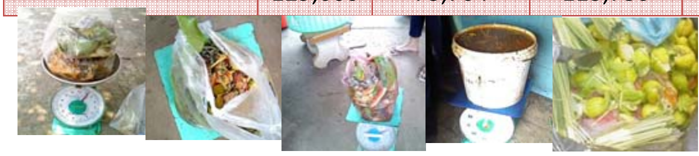
ການຈັດການຂີ້ເຫຍື້ອໃນ ປະເທດລາວ

ເສດອາຫານ

ການຈັດການຂີ້ເຫຍື່ອໃນ ປະເທດລາວ

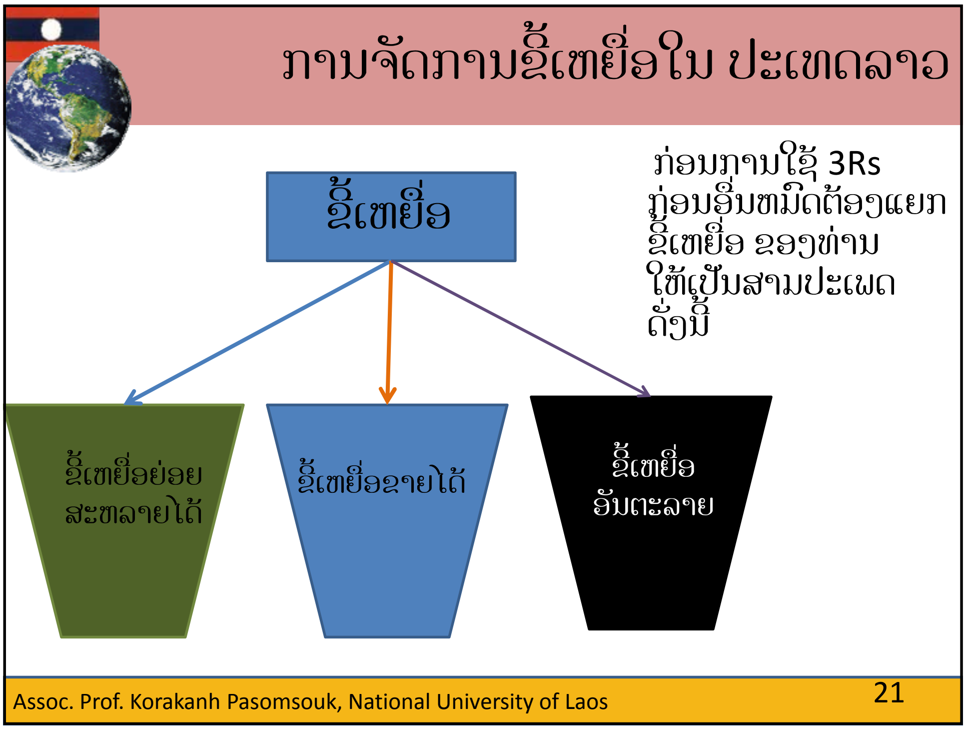
ອັດຕາການເກີດຂອງເສດອາຫານ

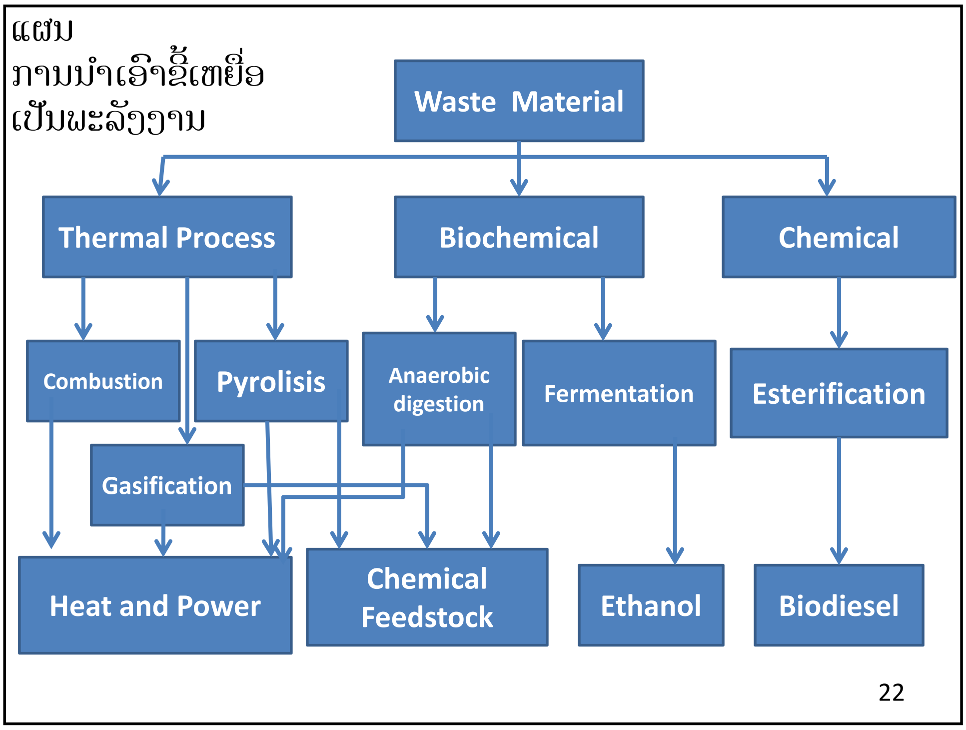
Source	ວຽງຈັນ (Kg/day)	ຫລວງພະບາງ (Kg/day)	ສະຫວັນນະເຂດ (kg/day)	ຈຳປາສັກ (kg/day)
ໂຮງແຮມ , ຮ້ານອາຫານ	3,555	1,008	520	714
ຮ້ານອາຫານ	7,605	4,992	2,720	4,100
ຮ້ານອາຫານນ້ອຍ (ເຝີ)	37,180	13,104	12,240	13,800
ຄອບຄົວ (3 - 5 ຄົນ)	81,320	54,000	98,250	60,000
ລວມ	129,660	73,704	113,730	78,614



ຂີ້ເຫຍື່ອແມ່ນຫຍັງ

Institute for Global Environmental Strategies

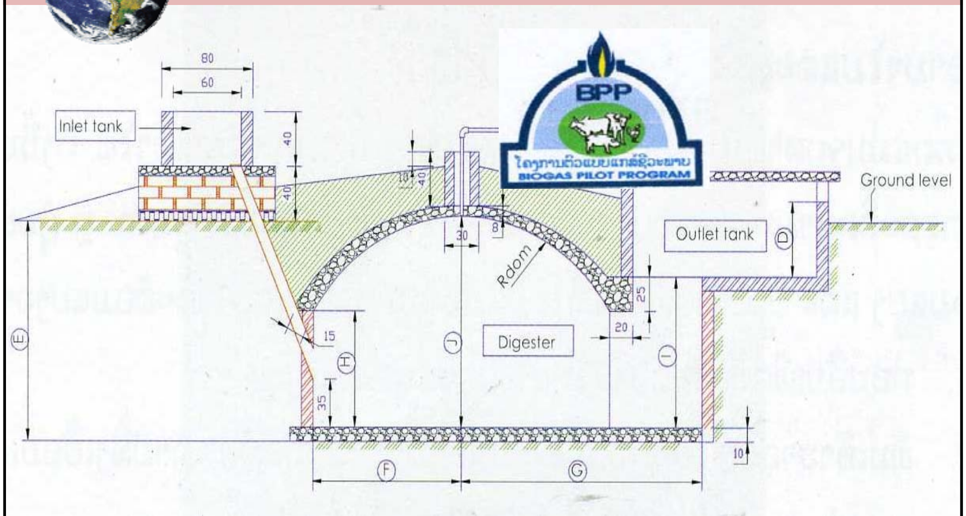

ການຈັດການຂີ້ເຫຍື່ອໃນ ປະເທດລາວ
ຂີ້ເຫຍື່ອ
ກ່ອນການໃຊ້ 3Rs
ກ່ອນອື່ນຫມົດຕ້ອງແຍກ
ຂີ້ເຫຍື່ອ ຂອງທ່ານ
ໃຫ້ເປັນສາມປະເພດ
ດັ່ງນີ້
ຂີ້ເຫຍື່ອຍ່ອຍ
ສະຫລາຍໄດ້
ຂີ້ເຫຍື່ອຂາຍໄດ້
ຂີ້ເຫຍື່ອ
ອັນຕະລາຍ
Assoc. Prof. Korakanh Pasomsouk, National University of Laos
21


ແຜນ
ການນຳເອົາຂີ້ເຫຍື່ອ
ເປັນພະລັງງານ
Waste Material
Thermal Process
Biochemical
Chemical
Combustion
Pyrolisis
Anaerobic digestion
Fermentation
Esterification
Gasification
Heat and Power
Chemical Feedstock
Ethanol
Biodiesel
22

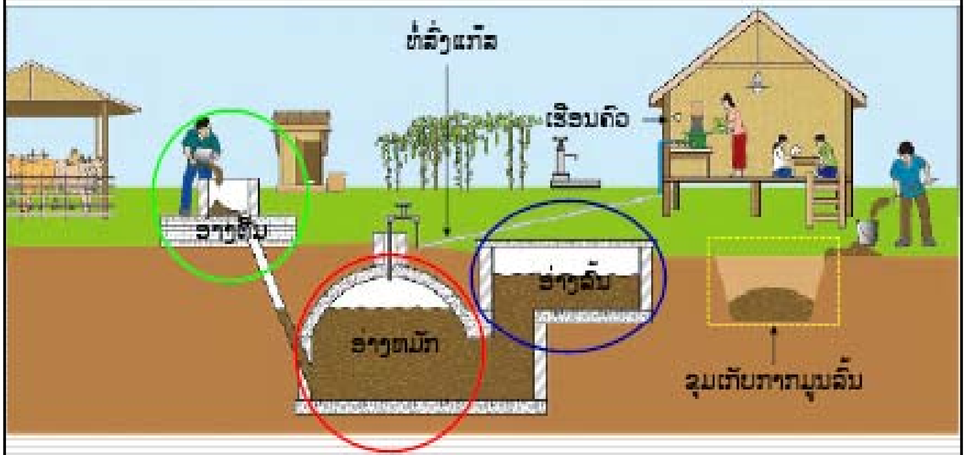
ຂະບວນການເຄມີ - ຊີວະ : ແກສຊີວະພາບ

- ທົ່ວປະເທດ, ອົງການ SNV, ໄດ້ສະໜັບສະໜູນ ກົມປະມົງ ແລະລ້ຽງສັດ ກະຊວງກະສິກຳ ແລະປ່າໄມ້ ໃນການ ດຳເນີນ ໂຄງການ ຕົວແບບແກສຊີວະພາບ
- ເປົ້າໝາຍຂອງໂຄງການ ຄື ສ້າງບໍ່ແກສໃຫ້ໄດ້ 6,600 ບໍ່ ພາຍໃນເວລາ 4ປີ
- ສະນັບສະໜຸນທຶນຈາກລັດຖະບານ ຮອນແລນ

ໂຄງການຕົວແບບແກສຊີວະພາບ



ໂຄງການຕົວແບບແກັສຊີວະພາບ



Assoc. Prof. Korakanh Pasomsouk, National University of Laos 25

ໂຄງການຕົວແບບແກັສຊີວະພາບ

IGES Institute for Global Environmental Strategies

Assoc. Prof. Korakanh Pasomsouk, National University of Laos 26

Biogas Pilot Program

Detail subsidy component for each size of digester

Digester size	$4m^3$	$6m^3$	$8m^3$	$10m^3$
Total cost (LK)	3,651,000	4,232,000	4,894,000	5,584,000
Customer component (LK)	1,791,000	2,372,000	3,034,000	3,724,000
BPP component (LK)	1,860,000	1,860,000	1,860,000	1,860,000

Assoc. Prof. Korakanh Pasomsouk, National University of Laos 27

ໂຄງການຕົວແບບແກສຊີວະພາບ

ການປຽບທຽບ 1m3 ແກສຊີວະພາບ ກັບ ພະລັງງານ ຊະນິດອື່ນໆ

ຊະນິດພະລັງງານ	ຫົວໜ່ວຍ	ຈຳນວນ
ໄມ້ຟືນ	kg	5
ຖ່ານ	Kg	1.6
ນ້ຳມັນເຊື້ອໄຟ	L	0.75
ແກສ LPG	Kg	0.45
ໄຟຟ້າ	W	1.7

ການນຳໃຊ້

1. ແຕ່ງກິນ 2 ແສງສະຫວ່າງ

3. ເດີນເຄື່ອງຈັກ

Assoc. Prof. Korakanh Pasomsouk, National University of Laos 28

ການຜະລິດ ແກສຊີວະພາບ ຈາກ ເສດອາຫານ

- ອາຫານເຫລືອ ທີ່ມີຄຸນະພາບດີ ຄວນເກັບໄວ້ ຮັບປະທານຄາບຕໍ່ໄປ
- ອາຫານເຫລືອຄຸນນະພາບປານກາງ ແລະຕໍ່າ ຄວນນໍາໄປເກືອສັດ
- ສ່ວນເສດອາຫານທີ່ ຄູນນະພາບບໍ່ດີ, ຜັກ, ຫມາກໄມ້, ສາມາດເປັນ ວັດຖຸດິບທີ່ດີ ສໍາລັບຜະລິດແກສຊີວະພາບ
- ຄອບຄົວໜຶ່ງ (3-5ຄົນ) ໂດຍສະເລ່ຍ ແລ້ວ ຜະລິດ ເສດອາຫານ 2-3 *kg/day*

ການຜະລິດ ແກສຊີວະພາບ ຈາກ ເສດອາຫານ

ການຜະລິດ ແກສຊີວະພາບ ຈາກ ເສດອາຫານ

ຖັງແກສຊີວະພາບ ຜະລິດຈາກ ຖັງນ້ຳປະລາສຕິກ 168L

Assoc. Prof. Korakanh Pasomsouk, National University of Laos 31

Biogas Generation from Kitchen waste

ຖັງແກສຊີວະພາບ ຜະລິດຈາກ ຖັງໂລຫະ 260L

Assoc. Prof. Korakanh Pasomsouk, National University of Laos 32

ການຜະລິດ ແກສຊີວະພາບ ຈາກ ເສດອາຫານ

The animal waste 30 kg mixing with 20L of water should be filled into biogas tank at the starting day

1. Separate food waste
2. Collect vegetable and fruit waste
3. If vegetable and fruit waste are the big size, chop it into small size
4. Mix these wastes together with water
5. Fill these waste to biogas tank
6. Do it for every day

ການຜະລິດ ແກສຊີວະພາບ ຈາກ ເສດອາຫານ

Digester size m3	Animal Waste input at starting day kg	Food waste input per day kg	Water input per day Littre	Gas generation m3 /day
o.168	30	8 – 10	0.4 –0.48	0.15
0.260	50	10 – 20	1 – 1.5	0.20

ຂະບວນການ ຄວາມຮ້ອນ

ວິເຄາະຄ່າຄວາຮ້ອນ ຂອງ ຂີ້ເຫຍື່ອ

Component	Heat Value	Vientiane		LuangPrabang		Savanaket		Champasack	
		%	Heat value of component (kj/kg)	%	Heat value of component (kj/kg)	%	Heat value of component (kj/kg)	%	Heat value of component (kj/kg)
Plastic	32,565	13	4,233.3	9	2,930	15	4,884.6	6	1,953.8
Glass	140	6	8.4	6	8.4	2	2.4	2	2.8
Paper	16,747	6	1,004.8	8	1,339.7	9	1,507	4	669.88
Metal	697.8	3	21	1	6.97	1	6.97	1	6.97
Food	4,472	30	1,341.6	51	2,280	54	2,415	62	277.64
Textile	17,445	2	349	1	174	1	174.4	1	174.4
Wood	18,608	19	3.535.5	23	4,280	16	2,977	21	3,907.68
Dirt , Ash	6,978	21	1,465	1	690.78	2	139.56	3	21
Total			11,958.6		10,288.8		12,107.3		7,014.17

Assoc. Prof. Korakanh Pasomsouk, National University of Laos 35

ຂະບວນການທາງຄວາມຮ້ອນ ໃຊ້ໃນຂອບເຂດນ້ອຍໆ

ໃຊ້ໃນຂົງເຂດ ແຄບໆ ເຊັ່ນວ່າ ການແຕ່ງກິນ ປະຈຳຄອບຄົວ
ມັນຈະມີປະສິດທະພາບຕ່ຳ ເພາະມີການສູນເສຍຫລາຍ ປະມານ
30 - 90% ຂອງພະລັງງານທັງຫມົດ
ບັນຫາດັ່ງກ່າວຕອ້ງແກ້ດ ດວ້ຍ ໃຊ້ເຕົາປະຢັດ ແລະ ການ ອັດ
ຂີ້ເຫຍື່ອ ໃຫ້ເປັນແທ່ງ ແຂງແກ່ນ ເຫມືອນໄມ້



Assoc. Prof. Korakanh Pasomsouk, National University of Laos 36

ຂະບວນການຜ່ານຄວາມຮ້ອນ: ກ້ອນເຊື້ອເພີງ

ວັດສະດຸທີ່ນຳມາຜະລິດ ກ້ອນເຊື້ອເພີງໃນຄອບຄົວ

- ເຈ້ຍເສດ 40% ແລະ ຂີ້ເລື່ອຍ 60%
- ຫຍ້າ
- ເຈັ້ຍ
- ເສດຖ່ານ
- ຂີ້ແກບ60% ປະສົມກັບເຈັ້ຍ 40% ແລະ ແປ້ງມັນຕົ້ນ
- ໃບໄມ້ ແລະຜັກຫຍ້າ
- ຂີ້ເຫຍື່ອປະສົມ

ແປ້ງມັນຕົ້ນ ອາໃຊ້ເພື່ອເປັນກາວ

Assoc. Prof. Korakanh Pasomsouk, National University of Laos 37

ເຄື່ອງໜີບ ເຮັດກ້ອນເຊື້ອເພີງ

ເປັນເຄື່ອງອັດໜີບ ລາຄາຖືກ ເຊິ່ງ ເຮັດດ້ວຍໄມ້ ແຕ່ ມີກຳລັງສູງ ທຸກໆຄົນສາມາດເຮັດເອງໄດ້ ໃນຄອບຄົວ

Assoc. Prof. Korakanh Pasomsouk, National University of Laos 38

ວິທີຜະລິດກ້ອນເຊື້ອເພີງ

1. ຄັດເລືອກວັດສະດຸ ທີ່ຕ້ອງການຜະລິດ ເປັນກ້ອນເຊື້ອເພີງ
2. ນຳໄປຕາກໃຫ້ແຫ້ງ ດ້ວຍ ແດດ
3. ຊ້ອມ ຫລື ບົດໃຫ້ມຸ່ນ
4. ປະສົມວັດສະດຸດັ່ງກ່າວ ກັບນ້ຳ ແລະແປ້ງມັນຕົ້ນ
5. ປັ້ນເປັນກ້ອນ ແລະ ຮ່າຍລົງໃສ່ ກະບອກສູບ
6. ໃຊ້ເຄື່ອງຫນີບ ຫນີບ ໃຫ້ເປັນກ້ອນເຊືອເພີ້ງ
7. ເອົາກ້ອນເຊື້ອເພີງອອກຈາກກະບອກສູບ ແລະນ້ຳໄປຕາກ ແດດ ສາມສີ່ວັນ ກ່ອນຈະນຳໃຊ້

ວິທີຜະລິດກ້ອນເຊື້ອເພີງ

ວິທີຜະລິດກ້ອນເຊື້ອເພີງ

ວິທີຜະລິດກ້ອນເຊື້ອເພີງ

ເຄື່ອງອັດ ຖ່ານມຸ່ນ
ແບບງ່າຍດາຍ ອອກແບບ
ແລະຜະລິດ ທີ່ໂຮງຊ່າງກົນຈັກ

Conclusion

- ປະຈຸບັນ ປະເທດລາວຍັງບໍ່ເໝາະສົມກັບ ການລົງທຶນສູງ ເພື່ອເອົາຂີ້ເຫຍື່ອເປັນພະລັງງານ (ໂຮງງານໄຟຟ້າຄວາມຮ້ອນ ໂຮງງານຜະລິດ ແກສຊີວະພາບ)
- ໃນຜະລິດ ໃນລະດັບຄອບຄົວ ຫລືຊຸມຊົນ ຈະເໝາະກວ່າ
- ເມື່ອມີການຈັດຕັ້ງປະຕິບັດ ຈະເຮັດໃຫ້ມີປະລິມານຂີ້ເຫຍື່ອ ທີ່ຈະໄປກຳຈັດນ້ອຍລົງ
- ມີຜົນດີ ຕໍ່ການປ່ຽນແປງພູມອາກາດ(ຫລີກລຽງ ການປ່ອຍແກສ ເຮືອນແກ້ວ)
- ການຈັດການຂີ້ເຫຍື່ອ ເປັນເລື່ອງບໍ່ຍາກ ແຕ່ວ່າ ການປ່ຽນນິໃສຄົນ ເປັນການຍາກທີ່ສຸດ

Assoc. Prof. Korakanh Pasomsouk, National University of Laos 43

ໂຄງການ ຕົວແບບແກ໊ສຊີວະພາບ

ສຸພາວັນ ແກ້ວວິໄລ
ຜູ້ບໍລິຫານໂຄງການ
ໂຄງການຕົວແບບແກ໊ສຊີວະພາບ,
ກົມລ້ຽງສັດ ແລະ ການປະມົງ,
ກະຊວງ ກະສິກຳ ແລະ ປ່າໄມ້

ຫົວຂໍ້ນຳສະເໜີ

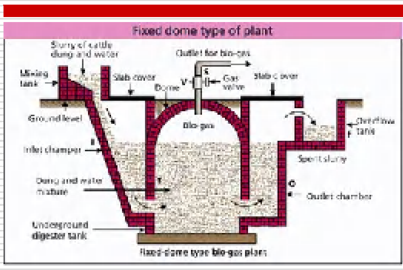
1. ເຕັກໂນໂລຊີແກ໊ສຊີວະພາບ ສຳລັບຄົວເຮືອນ
2. ຄຸນປະໂຫຍດ ຂອງແກ໊ສຊີວະພາບ ສຳລັບຄົວເຮືອນ
3. ໂຄງການ ຕົວແບບແກ໊ສຊີວະພາບ ຢູ່ ສ.ປ.ປ.ລາວ

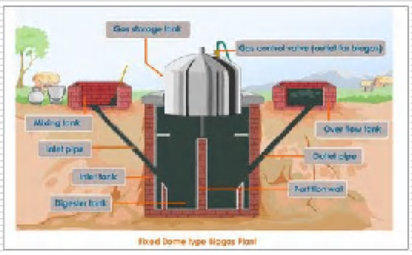
1. ເຕັກໂນໂລຊີແກ๊ສຊີວະພາບ ສຳລັບຄົວເຮືອນ

- ແກ๊ສຊີວະພາບແມ່ນຫຍັງ?
  - ແກ๊ສຊີວະພາບ ແມ່ນອາຍແກ๊ສປະສົມ ທີ່ເກີດຈາກການຍ່ອຍສະຫລາຍ ຂອງວັດຖຸດິບອິງຄະທາດ ເຊັ່ນຂີ້ສັດ, ພືດຜັກ, ໃບໄມ້ ແລະ ອື່ນໆ ໂດຍຜ່ານການໝັກ ໃນສະພາບບໍ່ມີອາກາດ.
  - ແກ๊ສຊີວະພາບ ສາມາດໃຊ້ເປັນພະລັງງານຫຸງຕົ້ມ ແລະ ໃຊ້ເພື່ອຈຸດປະສົງອື່ນໆ ຄືກັບກັບແກ๊ສ LPG ທີ່ມີຂາຍທົ່ວໄປ

1. ເຕັກໂນໂລຊີແກ๊ສຊີວະພາບ ສຳລັບຄົວເຮືອນ

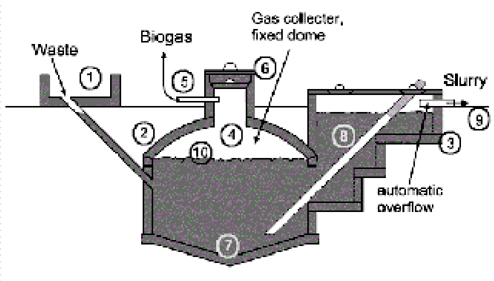
♦ ແບບຂອງບໍ່ແກ๊ສ

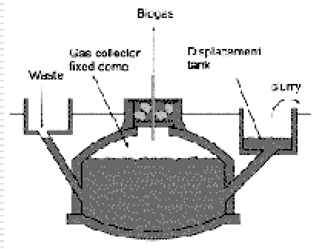


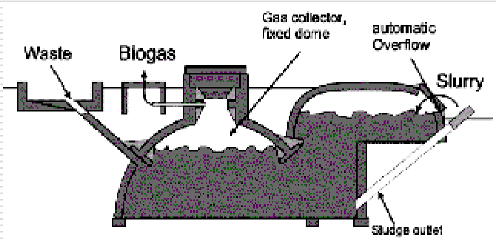


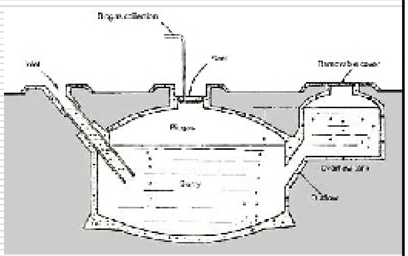
1. ເຕັກໂນໂລຊີແກ໊ສຊີວະພາບ ສຳລັບຄົວເຮືອນ

♦ ແບບຂອງບໍ່ແກ໊ສ



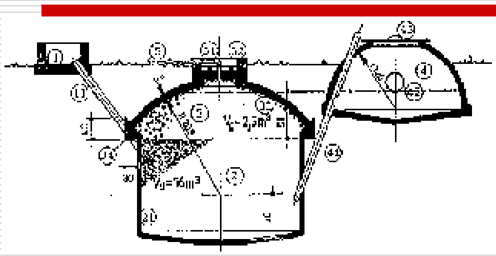


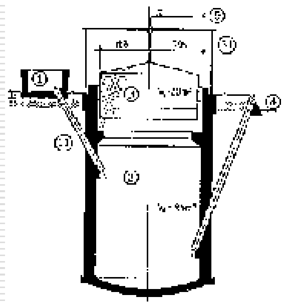


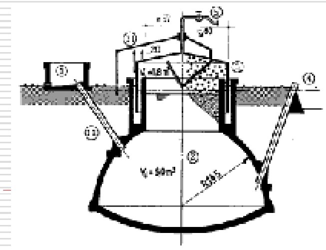


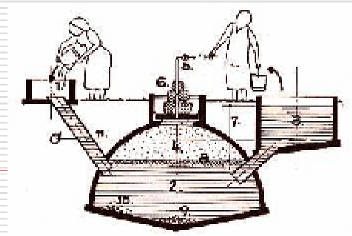
1. ເຕັກໂນໂລຊີແກ໊ສຊີວະພາບ ສຳລັບຄົວເຮືອນ

♦ ແບບຂອງບໍ່ແກ໊ສ



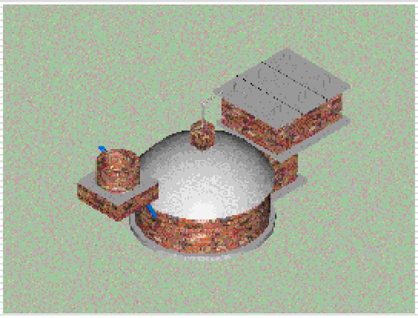




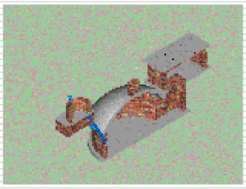


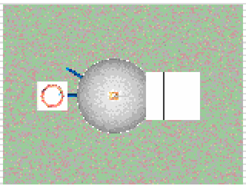
1. ເຕັກໂນໂລຊີແກ໊ສຊີວະພາບ ສໍາລັບຄົວເຮືອນ

♦ ແບບບໍ່ແກ໊ສຂອງລາວ



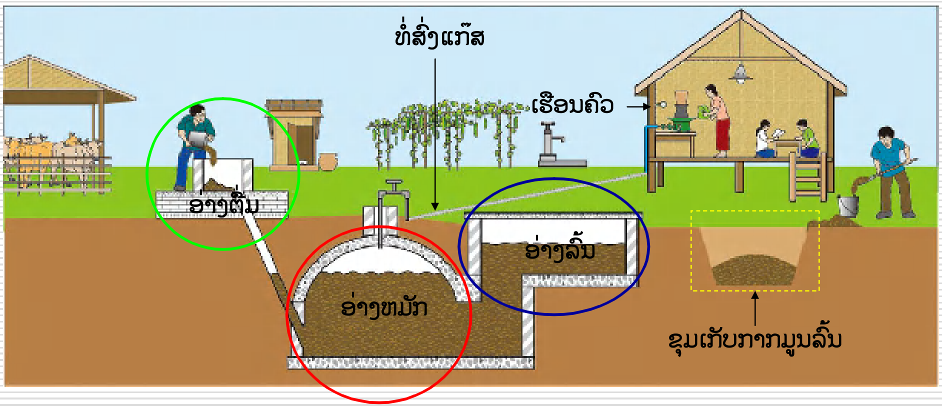
- ດັດແປງມາຈາກແບບ ທີ່ນໍາໃຊ້ຢູ່ປະເທດເນປານ
- ກໍ່ສ້າງດ້ວຍດິນຈີ່, ສ່ວນໂຄ້ງເບື້ອງເທິງ (dome) ເທດ້ວຍເບຕົງ
- ບໍ່ສາມາດເຄື່ອນຍ້າຍໄດ້
- ຂະໜາດຂອງບໍ່: $4m^3$, $6m^3$, $8m^3$, $10m^3$





1. ເຕັກໂນໂລຊີແກ໊ສຊີວະພາບ ສໍາລັບຄົວເຮືອນ

♦ ໂຄງສ້າງຂອງບໍ່ແກ໊ສ

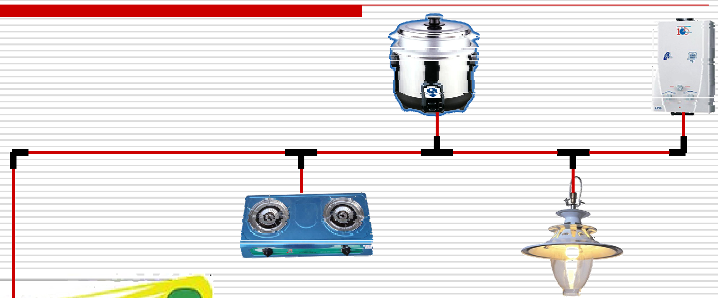


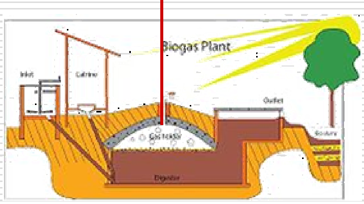
1. ເຕັກໂນໂລຊີແກ໊ສຊີວະພາບ ສຳລັບຄົວເຮືອນ

♦ ການທຳງານຂອງບໍ່ແກ໊ສ

2. ຄຸນປະໂຫຍດ ຂອງແກ໊ສຊີວະພາບສຳລັບຄົວເຮືອນ

♦ ດ້ານພະລັງງານ





- ແຕ່ງກິນ: ເຕົາແກ໊ສ, ໝໍ້ຫຸງເຂົ້າ
- ແສງສະຫວ່າງ: ດອກໄຟແກ໊ສ
- ຜະລິດຄວາມຮ້ອນ: ໝໍ້ນ້ຳອຸ່ນ

2. ຄຸນປະໂຫຍດ ຂອງແກ໊ສຊີວະພາບສໍາລັບຄົວເຮືອນ

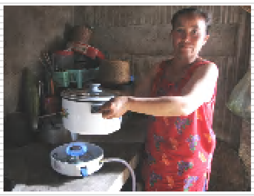
♦ ດ້ານກະສິກໍາ

- ກາກມູນລົ້ນເປັນຝຸ່ນຊີວະພາບທີ່ມີປະສິດທິຜົນສູງ
  - ປັບປຸງຄຸນນະພາບຂອງດິນ
  - ປອດໄພກວ່າຝຸ່ນຄອກທົ່ວໄປ (ບໍ່ມີແກ່ນຫຍ້າ ແລະ ເຊື້ອພະຍາດ)
- ປັບປຸງການລ້ຽງສັດ
  - ກາກມູນລົ້ນສາມາດໃຊ້ເປັນອາຫານສັດ ແລະ ປາໄດ້
  - ຊຸກຍູ້ຊາວກະສິກອນລ້ຽງສັດໄວ້ໃນຄອກ

2. ຄຸນປະໂຫຍດ ຂອງແກ໊ສຊີວະພາບສໍາລັບຄົວເຮືອນ

♦ ດ້ານສຸຂະພາບ

- ຫລຸດຜ່ອນພະຍາດຕາ ແລະ ພະຍາດທາງລະບົບຫາຍໃຈທີ່ເກີດຈາກຄວນໄຟ
- ຫລຸດຜ່ອນການແຜ່ເຊື້ອພະຍາດຕິດຕໍ່ ຈາກສັດສູ່ຄົນ.



2. ຄຸນປະໂຫຍດ ຂອງແກ໊ສຊີວະພາບສຳລັບຄົວເຮືອນ

♦ ດ້ານສັງຄົມ

- ຫລຸດຜ່ອນວຽກໃນການຊອກຫາຟືນ
- ຫລຸດຜ່ອນແຮງງານ ຜູ້ຍິງ ແລະ ເດັກນ້ອຍ
- ປະຫຍັດເວລາ ໃນການແຕ່ງຢູ່ຄົວກິນ
- ສ້າງວຽກເຮັດງານທຳ

2. ຄຸນປະໂຫຍດ ຂອງແກ໊ສຊີວະພາບສຳລັບຄົວເຮືອນ

♦ ດ້ານເສດຖະກິດ

- ປະຫຍັດເງິນ
  - ຫລຸດຜ່ອນຄ່າໄຟຟ້າ.
  - ຫລຸດຜ່ອນຄ່າໃຊ້ຈ່າຍ ສຳລັບຊື້ຟືນ, ຖ່ານ ແລະ ປຸຍເຄມີ
- ສ້າງລາຍຮັບ ໃຫ້ແກ່ນາຍຊ່າງ ກໍ່ສ້າງ.

2. ຄຸນປະໂຫຍດ ຂອງແກ໊ສຊີວະພາບສຳລັບຄົວເຮືອນ

♦ ດ້ານສະພາບແວດລ້ອມ

- ບ້ານສະອາດຈົບງາມ (ຫລຸດຜ່ອນກິ່ນເໝັນ, ແມງວັນ ແລະ ເຊື້ອໂລກ)
- ປັບປຸງຄຸນນະພາບນ້ຳ (ຫລຸດຜ່ອນການປົນເປື້ອນ ຂອງໄນໂຕຣເຈນ)
- ຫລຸດຜ່ອນການຕັດໄມ້ທຳລາຍປ່າ
- ຫລຸດຜ່ອນການປ່ອຍອາຍພິດເຮືອນແກ້ວສູ່ອາກາດ

3. ໂຄງການຕົວແບບແກ໊ສຊີວະພາບ ຢູ່ ສ.ປ.ປ.ລາວ

♦ ພາກສະເໜີ

- ໂຄງການ ຕົວແບບແກ໊ສຊີວະພາບ ເປັນສ່ວນນຶ່ງຂອງແຜນງານແກ໊ສຊີວະພາບອາຊີ (7 ປະເທດ) ຊຶ່ງແມ່ນລັດຖະບານຂອງປະເທດເນເທີແລນໃຫ້ການສະໜັບສະໜູນ ໂດຍຜ່ານອົງການພັດທະນາ ຂອງປະເທດເນເທີແລນ (SNV).
- ໃນປີ 2006, ໄດ້ມີການເຊັນບົດບັນທຶກຄວາມເຂົ້າໃຈ ກ່ຽວກັບການຈັດຕັ້ງປະຕິບັດ ໂຄງການ ລະຫວ່າງ ອົງການ SNV ແລະ ກະຊວງກະສິກຳ ແລະ ປ່າໄມ້.
- ເລີ່ມຈັດຕັ້ງປະຕິບັດ ແຕ່ປີ 2007 ເປັນຕົ້ນມາ ໂດຍກົມລ້ຽງສັດ ແລະ ການປະມົງ.

3. ໂຄງການຕົວແບບແກັສຊີວະພາບ ຢູ່ ສ.ປ.ປ.ລາວ

♦ ພາກສະເໜີ

ຊື່ໂຄງການ	ໂຄງການ ຕົວແບບແກັສຊີວະພາບ (BPP)	
ທີ່ຕັ້ງໂຄງການ	5 ແຂວງ (ນະຄອນຫລວງ, ສະຫວັນນະເຂດ, ຊຽງຂວາງ, ວຽງຈັນ, ຄໍາມ່ວນ)	
ໄລຍະຈັດຕັ້ງປະຕິບັດ	2007 - 2010	2011 - 2012
ຄາດໝາຍ	2,000 ບໍ່	1,300 ບໍ່
ງົບປະມານ	1,109,000 ຢູໂຣ	550,000 ຢູໂຣ
ຜູ້ໃຫ້ທຶນ	ລັດຖະບານຂອງປະເທດ ເນເທີແລນ	
ອົງການຈັດຕັ້ງປະຕິບັດ	ກົມລ້ຽງສັດ ແລະ ການປະມົງ, ກະຊວງ ກະສິກໍາ ແລະ ປ່າໄມ້	

3. ໂຄງການຕົວແບບແກັສຊີວະພາບ ຢູ່ ສ.ປ.ປ.ລາວ

♦ ເປົ້າໝາຍ ແລະ ຈຸດປະສົງຂອງໂຄງການ

ເປົ້າໝາຍ:

- ເພື່ອຍົກລະດັບຊີວິດການເປັນຢູ່ ແລະ ຄຸນນະພາບຊີວິດ ຂອງປະຊາຊົນຢູ່ຊົນນະບົດໃຫ້ດີຂື້ນ, ຍົກລະດັບບົດບາດຍິງຊາຍ ແລະ ຫລຸດຜ່ອນການທໍາລາຍຊັບພະຍາກອນປ່າໄມ້ ໂດຍການສົ່ງເສີມການນໍາໃຊ້ແກັສຊີວະພາບ ທີ່ມີຜົນປະໂຫຍດ ດ້ານພະລັງງານ, ກະສິກໍາ, ເສດຖະກິດ, ສຸຂະພາບ ແລະ ສະພາບແວດລ້ອມ.

ຈຸດປະສົງ:

- ເພື່ອດໍາເນີນກິດຈະກໍາຕ່າງໆຢ່າງຕໍ່ເນື່ອງ ແລະ ສ້າງເປັນພື້ນຖານໃຫ້ແກ່ການຂະຫຍາຍເປັນໂຄງການຂະໜາດໃຫຍ່ ແລະ ໃຫ້ກາຍເປັນການບໍລິການດ້ານແກັສຊີວະພາບ ໃນຮູບແບບການຄ້າ.

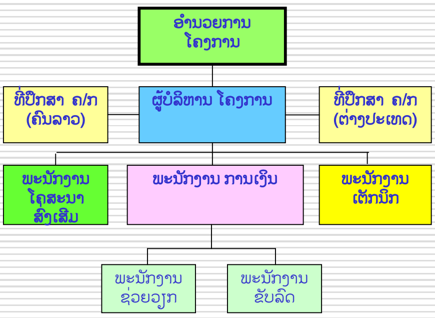
3. ໂຄງການຕົວແບບແກ໊ສຊີວະພາບ ຢູ່ ສ.ປ.ປ.ລາວ

♦ ກິດຈະກຳຂອງໂຄງການ

1. ວຽກງານ ບໍລິຫານໂຄງການ
2. ວຽກງານ ໂຄສະນາເຜີແຜ່
3. ວຽກງານ ກໍ່ສ້າງ ແລະ ບໍລິການຫລັງການກໍ່ສ້າງ
4. ວຽກງານ ລົງທຶນ ແລະ ສະໜອງເງິນອຸດໜູນ
5. ວຽກງານ ຄວບຄຸມຄຸນນະພາບ
6. ວຽກງານ ຄົ້ນຄ້ວາ ແລະ ພັດທະນາ
7. ວຽກງານ ຝຶກອົບຮົມ
8. ວຽກງານ ສົ່ງເສີມການນຳໃຊ້ກາກມູນລົ້ນ
9. ວຽກງານ ຕິດຕາມ ແລະ ປະເມີນຜົນ
10. ວຽກງານ ຊຸກຍູ້ສະຖາບັນ

3. ໂຄງການຕົວແບບແກ໊ສຊີວະພາບ ຢູ່ ສ.ປ.ປ.ລາວ

♦ ວຽກງານ ບໍລິຫານໂຄງການ

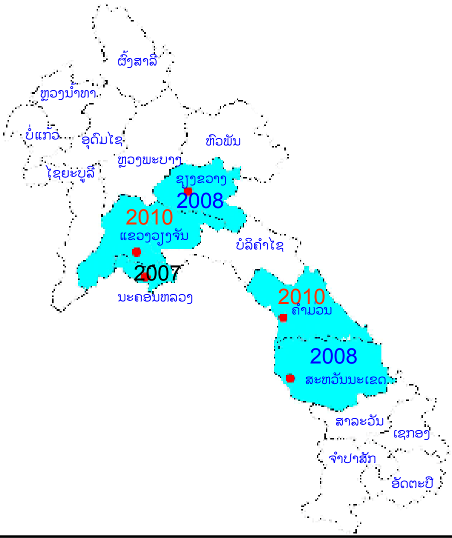


- ຫ້ອງການໂຄງການຂັ້ນສູນກາງ: ມີພະນັກງານ ປະຈຳ 7 ຄົນ ແລະ ທີ່ປຶກສາ ຂອງ SNV 2 ຄົນ.
- ຫ້ອງການໂຄງການຂັ້ນແຂວງ: ມີພະນັກງານຂອງພະແນກ ກະສິກຳ ແລະ ປ່າໄມ້ ປະຈຳຢູ່ 4 ຄົນ.
- ຂັ້ນເມືອງ: ແຕ່ລະເມືອງເປົ້າໝາຍ ມີຜູ້ປະສານງານໂຄງການຂັ້ນເມືອງ
- ຄະນະຊີ້ນຳໂຄງການ ຂັ້ນແຂວງ
- ຄະນະທີ່ປຶກສາໂຄງການ (BAB)

3. ໂຄງການຕົວແບບແກັສຊີວະພາບ ຢູ່ ສ.ປ.ປ.ລາວ

♦ ວຽກງານ ບໍລິຫານໂຄງການ

- 2007: ເລີ່ມຈັດຕັ້ງປະຕິບັດຢູ່ນະຄອນຫລວງວຽງຈັນ
- 2008: ຂະຫຍາຍອອກໄປແຂວງສະຫວັນນະເຂດ ແລະ ຊຽງຂວາງ
- 2009: ຈັດຕັ້ງປະຕິບັດຢູ່ 3 ແຂວງດັ່ງກ່າວ.
- 2010: ຂະຫຍາຍອອກໄປແຂວງວຽງຈັນ ແລະ ຄໍາມ່ວນ
- 2011: ຈັດຕັ້ງປະຕິບັດ ຢູ່ 5 ແຂວງດັ່ງກ່າວ



3. ໂຄງການຕົວແບບແກັສຊີວະພາບ ຢູ່ ສ.ປ.ປ.ລາວ

♦ ວຽກງານ ໂຄສະນາເຜີຍແຜ່

- ຜະລິດອຸປະກອນໂຄສະນາ (ແຜນພັບ, ໃບປີວ, ໂພສເຕີ...)
- ໂຄສະນາຜ່ານສື່ມວນຊົນ (ໂທລະທັດ, ວິທະຍຸ, ໜັງສືພິມ)
- ຈັດກອງປະຊຸມຢູ່ຂັ້ນບ້ານ
- ເຂົ້າຫາຄອບຄົວເປົ້າໝາຍໂດຍກົງ

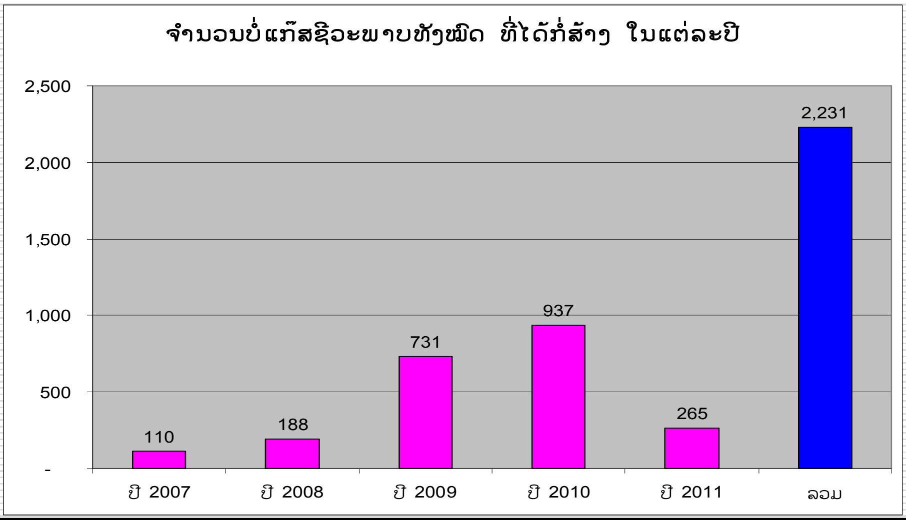
3. ໂຄງການຕົວແບບແກ๊ສຊີວະພາບ ຢູ່ ສ.ປ.ປ.ລາວ

♦ ວຽກງານ ກໍ່ສ້າງ ແລະ ບໍລິການຫລັງການກໍ່ສ້າງ

- ມາຮອດປະຈຸບັນ ໄດ້ຕິດຕັ້ງບໍ່ແກ๊ສຊີວະພາບ ສໍາເລັດແລ້ວ 2,231 ບໍ່ ຢູ່ໃນ 727 ບ້ານ, 40 ເມືອງ ຂອງ 5 ແຂວງເປົ້າໝາຍ.
- ນາຍຊ່າງກໍ່ສ້າງ ສະໜອງການບໍລິການ ເປັນ ເວລາ 2 ປີ ຫລັງຈາກກໍ່ສ້າງ ພາຍໃຕ້ການ ຕິດຕາມຢ່າງໃກ້ສິດ ຂອງພະນັກງານເມືອງ.
- ພະນັກງານແຂວງ ລົງກວດກາບໍ່ແກ๊ສ ເມື່ອນໍາໃຊ້ຄົບ 2 ປີ ເພື່ອຢັ້ງຢືນຄຸນນະພາບ ຂອງການບໍລິການ.

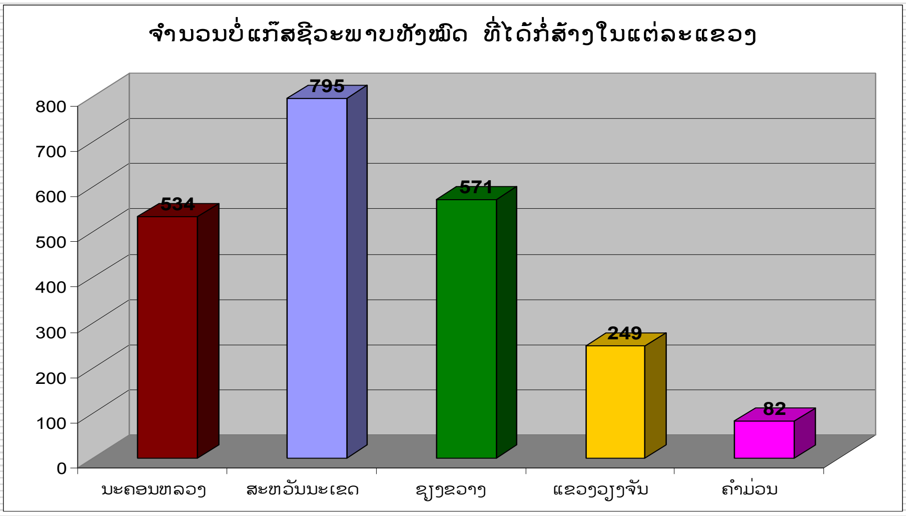
3. ໂຄງການຕົວແບບແກ๊ສຊີວະພາບ ຢູ່ ສ.ປ.ປ.ລາວ

♦ ວຽກງານ ກໍ່ສ້າງ ແລະ ບໍລິການຫລັງການກໍ່ສ້າງ



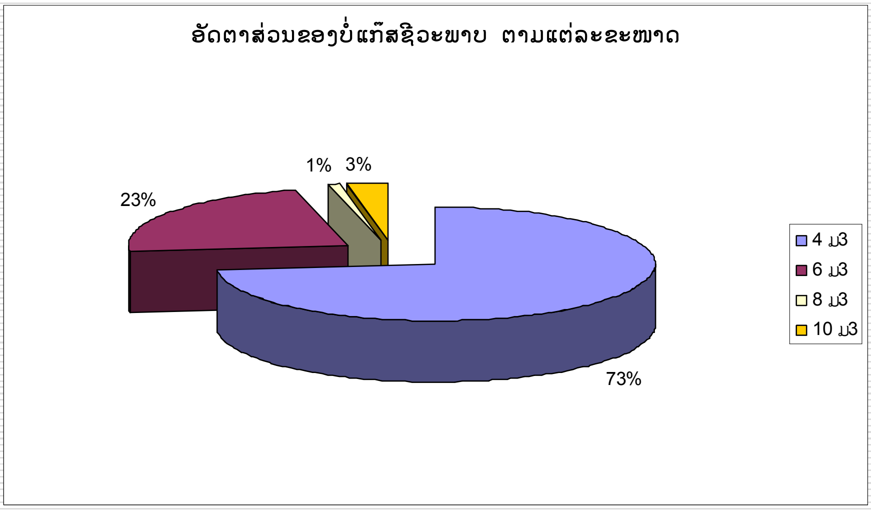
3. ໂຄງການຕົວແບບແກັສຊີວະພາບ ຢູ່ ສ.ປ.ປ.ລາວ

♦ ວຽກງານ ກໍ່ສ້າງ ແລະ ບໍລິການຫລັງການກໍ່ສ້າງ



3. ໂຄງການຕົວແບບແກັສຊີວະພາບ ຢູ່ ສ.ປ.ປ.ລາວ

♦ ວຽກງານ ກໍ່ສ້າງ ແລະ ບໍລິການຫລັງການກໍ່ສ້າງ



3. ໂຄງການຕົວແບບແກ๊ສຊີວະພາບ ຢູ່ ສ.ປ.ປ.ລາວ

♦ ວຽກງານ ລົງທຶນ ແລະ ສະໜອງເງິນອຸດໜູນ

- ຄອບຄົວທີ່ຈະສ້າງບໍ່ແກ໊ສ ອອກທຶນສົມທົບ
- ໂຄງການ ສະໜອງເງິນອຸດໜູນ ໃຫ້ແກ່ຄອບຄົວ
- ສະໜອງເງິນອຸດໜູນ ໃຫ້ແກ່ພະນັກງານແຂວງ ແລະ ເມືອງ ເພື່ອຕອບແທນການເຄື່ອນໄຫວວຽກງານ
- ອຳນວຍຄວາມສະດວກ ໃຫ້ແກ່ຄອບຄົວ ທີ່ມີຈຸດປະສົງ ຢາກກູ້ຢືມເງິນ ມາສ້າງບໍ່ແກ໊ສຊີວະພາບ

3. ໂຄງການຕົວແບບແກ໊ສຊີວະພາບ ຢູ່ ສ.ປ.ປ.ລາວ

♦ ວຽກງານ ລົງທຶນ ແລະ ສະໜອງເງິນອຸດໜູນ

ລາຍການ	$4m^3$	$6m^3$	$8m^3$	$10m^3$
ມູນຄ່າລວມ (ໂດລາ)	441	514	615	706
ມູນຄ່າທີ່ຄອບຄົວປະກອບສ່ວນ	222	295	396	487
ມູນຄ່າທີ່ໂຄງການອຸດໜູນ (ວັດຖຸ + ເງິນສົດ)	219	219	219	219
ທຶນຂອງໂຄງການ ຄິດເປັນ%	*50%*	*43%*	*36%*	*31%*

ຄ່າແຮງງານນາຍຊ່າງ	*4%*
ຄ່າແຮງງານຜູ້ຊ່ວຍຊ່າງ (ອາດຈະເປັນສະມາຊິກຄ/ຄ)	*17%*
ວັດຖຸກໍ່ສ້າງ	*79%*

ອຸປະກອນຕິດຕັ້ງ	*22%*
ຄ່າແຮງງານນາຍຊ່າງ	*54%*
ກອງທຶນບໍລິການຫລັງການກໍ່ສ້າງ	*3%*
ເງິນສົດ	*21%*

3. ໂຄງການຕົວແບບແກ๊ສຊີວະພາບ ຢູ່ ສ.ປ.ປ.ລາວ

♦ ວຽກງານ ຄຸ້ມຄອງຄຸນນະພາບ

- ພະນັກງານເມືອງ ເປັນເຈົ້າການໃນການລົງຕິດຕາມການກໍ່ສ້າງ ຂອງນາຍຊ່າງ ແລະ ກວດກາເຕັກນິກ ຂອງບໍ່ແກ๊ສຊີວະພາບ (ມີ 3 ໄລຍະ: ກ່ອນການກໍ່ສ້າງ, ຊ່ວງກຳລັງກໍ່ສ້າງ ແລະ ຫລັງຈາກກໍ່ສ້າງສຳເລັດ).
- ພະນັກງານແຂວງ ລົງກວດກາຄຸນນະພາບ ຂອງການກວດກາ ເຕັກນິກ ຂອງພະນັກງານເມືອງ ໂດຍສຸ່ມກວດ 20% ຂອງຈຳນວນບໍ່ແກ๊ສ ທີ່ສ້າງສຳເລັດ ໃນແຕ່ລະເດືອນ
- ວິຊາການໂຄງການ ລົງກວດກາຄຸນນະພາບ ຂອງການກວດກາເຕັກນິກ ຂອງພະນັກງານແຂວງ ແລະ ເມືອງ ໂດຍສຸ່ມກວດ 10% ຂອງຈຳນວນບໍ່ແກ๊ສ ທີ່ສ້າງສຳເລັດ ໃນແຕ່ລະໄຕມາດ

3. ໂຄງການຕົວແບບແກ๊ສຊີວະພາບ ຢູ່ ສ.ປ.ປ.ລາວ

♦ ວຽກງານ ຄົ້ນຄວ້າ ແລະ ພັດທະນາ

- ທຳການສຳຫລວດ ລາຄາວັດຖຸກໍ່ສ້າງ ໃນແຕ່ລະທ້ອງຖິ່ນ
- ສຶກສາອຸປະກອນແກ๊ສຊີວະພາບ ທີ່ນຳເຂົ້າມາຈາກຕ່າງປະເທດ (ຄຸນນະພາບ, ລາຄາ, ອຸປະກອນ ຊະນິດໃໝ່ ແລະ ຄວາມເປັນໄປໄດ້ ໃນການຜະລິດຢູ່ພາຍໃນ)
- ສຶກສາບໍ່ແກ๊ສຊີວະພາບ ປະເພດອື່ນໆ

3. ໂຄງການຕົວແບບແກ໊ສຊີວະພາບ ຢູ່ ສ.ປ.ປ.ລາວ

♦ ວຽກງານ ຝຶກອົບຮົມ

- ຈັດຝຶກອົບຮົມໃຫ້ແກ່ພະນັກງານ ຂັ້ນເມືອງ ແລະ ແຂວງ ທີ່ເຮັດວຽກຮ່ວມກັບໂຄງການ (ການກວດກາຄຸນນະພາບ, ການໂຄສະນາເຜີຍແຜ່, ການສົ່ງເສີມກາກມູນລົ້ນ)
- ຈັດຝຶກອົບຮົມນາຍຊ່າງກໍ່ສ້າງ (ຝຶກນາຍຊ່າງໃໝ່ ແລະ ຝຶກລື້ມຄືນໃຫ້ແກ່ນາຍຊ່າງເກົ່າ)
- ຈັດຝຶກອົບຮົມ ວິທີການນຳໃຊ້ ແລະ ບຳລຸງຮັກສາບໍ່ແກ໊ສ ໃຫ້ແກ່ຄອບຄົວ

3. ໂຄງການຕົວແບບແກ໊ສຊີວະພາບ ຢູ່ ສ.ປ.ປ.ລາວ

♦ ວຽກງານ ສົ່ງເສີມການນຳໃຊ້ກາກມູນລົ້ນ

- ຝຶກອົບຮົມການນຳໃຊ້ກາກມູນລົ້ນ.
  - ນຳໃຊ້ໂດຍກົງ
  - ຜະລິດຝຸ່ນບົ່ມ
- ທຳການທົດລອງປະສິດທິພາບຂອງກາກມູນລົ້ນ

3. ໂຄງການຕົວແບບແກ๊ສຊີວະພາບ ຢູ່ ສ.ປ.ປ.ລາວ

♦ ວຽກງານ ຕິດຕາມ ແລະ ປະເມີນຜົນ

- ຕິດຕາມການເຄື່ອນໄຫວວຽກງານ ຢູ່ພາກສະໜາມ ຢ່າງເປັນປົກກະຕິ (ເຂົ້າຮ່ວມກອງປະຊຸມປະຈຳເດືອນ ຂອງຫ້ອງການໂຄງການຂັ້ນແຂວງ)
- ຈັດກອງປະຊຸມ ຄະນະຊີ້ນຳໂຄງການ ໃນທຸກໆໄຕມາດ
- ດຳເນີນການສຳຫລວດຂໍ້ມູນຜູ້ຊົມໃຊ້ ແກ๊ສຊີວະພາບປະຈຳປີ.

3. ໂຄງການຕົວແບບແກ๊ສຊີວະພາບ ຢູ່ ສ.ປ.ປ.ລາວ

♦ ວຽກງານ ຊຸກຍູ້ສະຖາບັນ

- ສ້າງຄວາມເຂັ້ມແຂງ ໃຫ້ແກ່ອົງການຈັດຕັ້ງທີ່ເຮັດວຽກຮ່ວມກັບ ໂຄງການ (ຍົກລະດັບຄວາມຮູ້ຄວາມສາມາດຂອງພະນັກງານ)
- ຈັດກອງປະຊຸມຄະນະທີ່ປຶກສາໂຄງການ ໃນທຸກໆ 6 ເດືອນ
- ຈັດກອງປະຊຸມສະຫລຸບວຽກງານປະຈຳປີ

3. ໂຄງການຕົວແບບແກັສຊີວະພາບ ຢູ່ ສ.ປ.ປ.ລາວ

♦ ຜົນກະທົບຂອງໂຄງການ

- ຫລາຍກ່ວາ 12.940 ຄົນ ໄດ້ນຳໃຊ້ຜົນປະໂຫຍດ ຈາກບໍ່ແກັສຊີວະພາບ
- ປະຫຍັດຄ່າໄຟຟ້າ ຫລາຍກວ່າ $198.559/ປີ
- ປະຫຍັດຄ່າໃຊ້ຈ່າຍ ໃນການຊື້ປຸຍເຄມີ ຫລາຍກວ່າ $182.942/ປີ
- ປະຫຍັດຄ່າໃຊ້ຈ່າຍ ໃນການຊື້ຟືນ ແລະ ຖ່ານ ຫລາຍກວ່າ $230.818/ປີ
- ຫລຸດຜ່ອນການປ່ອຍອາຍກາກໂບນິກ ສູ່ອາກາດ ໄດ້ຫລາຍກວ່າ 2,231 ໂຕນ/ປີ

3. ໂຄງການຕົວແບບແກັສຊີວະພາບ ຢູ່ ສ.ປ.ປ.ລາວ

♦ ຜົນກະທົບຂອງໂຄງການ

ຕົວຊີ້ວັດ	ຫົວໜ່ວຍ	ຈຳນວນ	ແຫລ່ງຂໍ້ມູນ
ຈຳນວນຄົນໃນຄອບຄົວ	ຄົນ/ຄອບຄົວ	5.8	*BUS, 2007
ປະຫຍັດຄ່າໄຟຟ້າ	ໂດລາ/ຄອບຄົວ/ປີ	89	*BUS, 2007
ປະຫຍັດຄ່າປຸຍ	ໂດລາ/ຄອບຄົວ/ປີ	82	*BUS, 2007
ຄ່າໃຊ້ຈ່າຍໃນການຊື້ຟືນ ແລະ ຖ່ານ	ກີບ/ຄອບຄົວ/ປີ	1,182,396	*BUS, 2007
ການຫລຸດຜ່ອນການໃຊ້ຟືນ ແລະ ຖ່ານ ຫລັງຈາກໃຊ້ແກັສ	%	70	*BUS, 2007
ການຫລຸດຜ່ອນ ອາຍກາກໂບນິກ	ໂຕນ/ບໍ່ແກັສ/ປີ	1	ສະເລ່ຍຕ່ຳສຸດ

*BUS= ບົດລາຍງານ ການສຳຫລວດຂໍ້ມູນ ຜູ້ຊົມໃຊ້ແກັສຊີວະພາບ


ຂໍຂອບໃຈ

"ການວິເຄາະຕົ້ນທຶນ - ຜົນປະໂຫຍດທີ່ໄດ້ຮັບຈາກການນຳໃຊ້ ລະບົບແກັສຊີວະພາບ ຂອງປະຊາຊົນແຂວງສະຫວັນນະເຂດ"

ສະເໜີໂດຍ:

ຮສ. ແກ່ນຈັນ ສິນສຳພັນ

ຄະນະວິທະຍາສາດ ສິ່ງແວດລ້ອມ
ມະຫາວິທະຍາໄລແຫ່ງຊາດລາວ

ພາກທີ 1: ພາກສະເໜີ

1.1 ພາບຄວາມເປັນມາຂອງບັນຫາ:

- ພັກ - ລັດຖະບານ ມີແຜນບູລິມະສິດກ່ຽວກັບການປົກປັກຮັກສາ ຟື້ນຟູບູລະນະປ່າໄມ້ ແລະ ຂະຫຍາຍເນື້ອທີ່ປົກຫຸ້ມຂອງປ່າໄມ້ໃຫ້ໄດ້ 70% ໃນປີ 2020, ເພື່ອປະຕິບັດໂຄງການເປັນຄູ່ຮ່ວມມື ໃນຂະແໜງການປ່າໄມ້; ເພື່ອຄຸ້ມຄອງປ່າໄມ້ໃຫ້ເປັນແຫຼ່ງຊຶມຊັບດູດເອົາ CO_2.
- ການນຳໃຊ້ພະລັງງານຈາກ Biogas ແມ່ນສ່ວນໜຶ່ງ ຂອງກິດຈະກຳປະຈຳວັນຂອງປະຊາຊົນ ຫຼືຊາວກະສິກຳທີ່ຊ່ວຍລຸດຜ່ອນການຕັດໄມ້ຂອງປະຊາຊົນ ທີ່ມາເຮັດເຊື້ອເພີງໄດ້ ເຊັ່ນ: ຟືນ, ຖ່ານ.

ພາກທີ 1: ພາກສະເໜີ

1.2 ຈຸດປະສົງຂອງການສຶກສາ:

- ປຽບທຽບອັດຕາສ່ວນ ລະຫວ່າງຜົນປະໂຫຍດ ກັບຕົ້ນທຶນຂອງ ການນຳໃຊ້ແກ໊ສຊີວະພາບ ຂອງປະຊາຊົນ

ພາກທີ 1: ພາກສະເໜີ:

1.3 ຂອບເຂດຂອງການສຶກສາ:

- ພື້ນທີ່ການສຶກສາແມ່ນເມືອງຈຳພອນ ແຂວງສະຫວັນນະເຂດ.
- ສຳລັບໄລຍະເວລາຂອງການວິເຄາະຕົ້ນທຶນ - ຜົນປະໂຫຍດຂອງການນຳໃຊ້ແກ໊ສຊີວະພາບແມ່ນນັບແຕ່ປີ 2009 - 2023 ເປັນເວລາ 15 ປີ (ນັບທັງປີຖານ) ເຊິ່ງເທົ່າກັບອາຍຸການໃຊ້ງານຂອງບໍ່ແກ໊ສຊີວະພາບ, ໂດຍຖືວ່າຖານຂໍ້ມູນດ້ານຕ່າງໆ ແມ່ນຄິດທີ່ນັບແຕ່ປີ 2009 ເປັນຕົ້ນມາ.
- ການວິເຄາະຄວາມຄຸ້ມຄ່າຂອງໂຄງການຕົວແບບແກ໊ສຊີວະພາບຄັ້ງນີ້ ແມ່ນນຳໃຊ້ມູນຄ່າຕົ້ນທຶນ ແລະ ຜົນປະໂຫຍດທີ່ໄດ້ຮັບຈາກການນຳໃຊ້ແກ໊ສຊີວະພາບສະເລ່ຍຕໍ່ຕົວຢ່າງ ຫຼື ຕໍ່ໜຶ່ງບໍ່ແກ໊ສເທົ່ານັ້ນ.

ພາກທີ 1: ພາກສະເໜີ:

1.4 ປະໂຫຍດທີ່ຈະຮັບຈາກການສຶກສາ:

- ຮັບຮູ້ຜົນປະໂຫຍດທີ່ໄດ້ຮັບຈາກການນຳໃຊ້ແກ๊ສຊີວະພາບ ທີ່ເປັນຮູບປະທຳຫຼາຍຂຶ້ນ. ໝາຍວ່າ ຜົນປະໂຫຍດທີ່ໄດ້ຮັບ ຈາກການນຳໃຊ້ແກັສຊີວະພາບທາງດ້ານເສດຖະກິດ - ສັງຄົມ ແລະ ສິ່ງແວດລ້ອມນັ້ນ ແມ່ນຈະໄດ້ຖືກວິເຄາະໃຫ້ເປັນມູນຄ່າທາງເສດຖະສາດ ທີ່ວັດເປັນຕົວເງິນໄດ້.
- ເປັນບົດຕົວແບບຂອງການປະເມີນມູນຄ່າທາງເສດຖະສາດດ້ານສິ່ງແວດລ້ອມ ໃຫ້ແກ່ນັກສຶກສາພາຍໃນຄະນະວິທະຍາສາດສິ່ງແວດລ້ອມ, ເຊິ່ງນຳໃຊ້ເຄື່ອງທາງເສດຖະສາດ ເຂົ້າໃນການວິເຄາະຄວາມຄຸ້ມຄ່າຂອງໂຄງການພັດທະນາ ທີ່ຕິດພັນກັບການນຳໃຊ້ຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ.

ພາກທີ 2: ທົບທວນເອກະສານ ແລະ ບົດວິໄຈກ່ຽວຂ້ອງ

2.1 ສະພາບທົ່ວໄປ ກ່ຽວກັບແກ๊ສຊີວະພາບ:

2.1.1 ຄວາມເປັນມາຂອງແກ๊ສຊີວະພາບ:

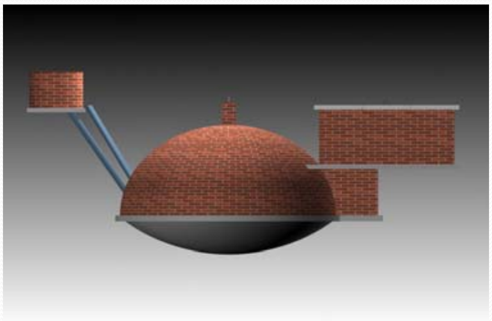
- Robert Boyle ແລະ Stephen Hale ໄດ້ຄົ້ນພົບແກ๊ສໃນສັດຕະວັດທີ 17 ຈາກການກວນຕະກອນໃນລຳທານ ແລະ ທະເລສາບ ເຊິ່ງເຮັດໃຫ້ມີແກ๊ສທີ່ສາມາດຕິດໄຟໄດ້ລອຍຂຶ້ນມາ.
- 1859 ທ່ານ Sir Humphrey Davy ໄດ້ຄົ້ນພົບວ່າ: ໃນແກ๊ສທີ່ເກີດຂຶ້ນຈາກຂີ້ງົວ ນັ້ນມີແກ๊ສມີເທນປະສົມຢູ່ນຳ.
- ໃນອິນເດຍ 1859 ໄດ້ສ້າງຖັງໝັກແກ๊ສໃນສະພາວະໄຮ້ອາກາດ ຂຶ້ນເປັນຄັ້ງທຳອິດ.
- ຕໍ່ມາ 1985 ໃນອັງກິດໄດ້ມີການຄິດຄົ້ນນະວັດຕະກຳໃໝ່ຂຶ້ນມາ ໂດຍໃຊ້ຖັງສິ່ງປະຕິກູນຜະລິດແກ๊ສ ແລ້ວນຳແກ๊ສໄປໄຕ້ໄຟໃຫ້ແສງສະຫວ່າງຕາມຖະໜົນ.
- ມາເຖິງ 1970 ກໍ່ໄດ້ມີການອອກສິດທິບັດສຳລັບຖັງໝັກແກ๊ສຊີວະພາບໃນເຢຍລະມັນ.

ພາກທີ 2: ທົບທວນເອກະສານ ແລະ ບົດວິໄຈກ່ຽວຂ້ອງ

2.1 ສະພາບທົ່ວໄປ ກ່ຽວກັບແກັສຊີວະພາບ:

2.1.2 ບໍ່ແກັສຊີວະພາບແມ່ນຫຍັງ?

Lao-Neth Model



ບໍ່ແກັສຊີວະພາບ ເປັນເຕັກໂນໂລຊີແບບງ່າຍດາຍ ແຕ່ທົນທານ. ເຊິ່ງມັນຝັງຢູ່ໃນພື້ນດິນ ບໍ່ມີພາກສ່ວນໃດເຄື່ອນທີ່ ແລະ ບໍ່ໃຊ້ສານເຄມີ. ມັນຖືກອອກແບບມາໃຫ້ມີອາຍຸໃຊ້ງານຢ່າງຕ່ຳສຸດ 15 ປີ.

ພາກທີ 2: ທົບທວນເອກະສານ ແລະ ບົດວິໄຈກ່ຽວຂ້ອງ

2.1 ສະພາບທົ່ວໄປ ກ່ຽວກັບແກັສຊີວະພາບ:

2.1.3 ເງື່ອນໄຂຂອງຄອບຄົວ ທີ່ຈະກໍ່ສ້າງບໍ່ແກັສຊີວະພາບ:

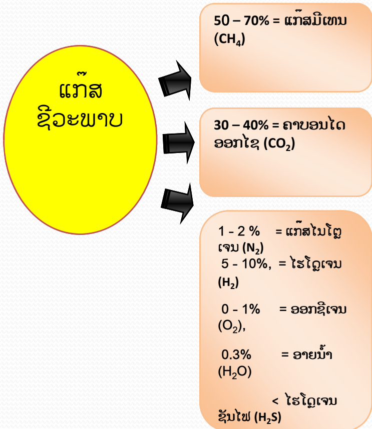
- ມີຄວາມຕ້ອງການຢາກນຳໃຊ້ແກັສຊີວະພາບຢ່າງແທ້ຈິງ ແລະ ມີຄວາມຮັບຜິດຊອບໃນການ ນຳໃຊ້ ແລະ ການບົວລະບັດຮັກສາບໍ່ແກັສຊີວະພາບຂອງຕົນ.
- ມີຈຳນວນສັດລ້ຽງພຽງພໍ ຕາມຂະໜາດຂອງບໍ່ແກັສຊີວະພາບ:
- ມີຄອກສັດຖາວອນ ແລະ ຕ້ອງໃຫ້ມີສັດຢູ່ຄອກ ຢ່າງໜ້ອຍ 12 ຊົ່ວໂມງຕໍ່ມື້
- ມີເນື້ອທີ່ດິນສຳລັບກໍ່ສ້າງບໍ່ແກັສຊີວະພາບ ຕ້ອງມີຂະໜາດຢ່າງຕ່ຳ 3 m X 7 m.
- ມີແຫຼ່ງນ້ຳໃຊ້ຢ່າງພຽງພໍ ເພື່ອໃຊ້ໃນການປະສົມມູນສັດ ໃສ່ບໍ່ແກັສຊີວະພາບ.

ຂະໜາດບໍ່ແກັສ	4 m^3	6 m^3	8 m^3	10 m^3
ຈຳນວນງົວ	5 - 8 ໂຕ	9 - 13 ໂຕ	14 - 18 ໂຕ	19 ໂຕຂຶ້ນໄປ
ຈຳນວນໝູ	6 - 10 ໂຕ	11 - 15 ໂຕ	16 - 25 ໂຕ	26.ໂຕຂຶ້ນໄປ

ພາກທີ 2: ທົບທວນເອກະສານ ແລະ ບົດວິໄຈກ່ຽວຂ້ອງ

2.1 ສະພາບທົ່ວໄປ ກ່ຽວກັບແກັສຊີວະພາບ:

2.1.4 ແກັສຊີວະພາບແມ່ນຫຍັງ?



ແກັສຊີວະພາບ ແມ່ນໄດ້ມາຈາກການໝັກມູນ ຕ່າງໆ ເຊັ່ນ: ມູນງົວ 1 ກິໂລ ຜະລິດແກັສຊີວະ ພາບໄດ້ 40 ລິດ, ມູນຄວາຍ 1 ກິໂລ ຜະລິດແກັສຊີວະພາບໄດ້ 35 ລິດ, ມູນໝູ 1 ກິໂລ ຜະລິດ ແກັສຊີວະພາບໄດ້ 50 ລິດ, ມູນໄກ່ 1 ກິໂລ ຜະລິດແກັສຊີວະພາບໄດ້ 60 ລິດ, ມູນຄົນ 1 ກິໂລ ຜະລິດແກັສຊີວະພາບໄດ້ 50 ລິດ.

ພາກທີ 2: ທົບທວນເອກະສານ ແລະ ບົດວິໄຈກ່ຽວຂ້ອງ

2.2 ສະພາບທົ່ວໄປ ກ່ຽວກັບແກັສຊີວະພາບ:

- ກາກມູນລົ້ນ ແມ່ນຂີ້ສັດ (ຂີ້ໝູ, ງົວ, ຄວາຍ, ໄກ່ ຢ່າງໃດຢ່າງໜຶ່ງ ຫຼື ປະສົມກັນ) ທີ່ລົ້ນແລ້ວໄຫຼອອກມາຈາກບໍ່ແກັສຊີວະພາບ, ເຊິ່ງໄດ້ຜ່ານການບົ່ມ ເພື່ອຜະລິດແກັສຊີວະພາບ ແລະ ໄດ້ຖືກຍ່ອຍສະລາຍຢ່າງລະອຽດ ແລ້ວ.
- ຖ້າມີການນຳໃຊ້ກາກມູນລົ້ນ ມີປະສິດທິພາບຈະເຮັດໃຫ້ຄອບຄົວຂອງຊາວກະສິກອນ ສາມາດເພີ່ມຜົນຜະລິດຂອງເຄື່ອງປູກຂອງຝັງ, ໝູ, ປາ ແລະ ຊ່ວຍເພີ່ມລາຍຮັບໄດ້ ເພາະຕົ້ນທຶນໃນການຜະລິດຫຼຸດລົງ.

ພາກທີ 2: ທົບທວນເອກະສານ ແລະ ບົດວິໄຈກ່ຽວຂ້ອງ

2.3 ສະພາບການນຳໃຊ້ໄມ້ຟືນ - ຖ່ານ ຢູ່ ສປປ ລາວ:

- ສປປ ລາວ: ການນຳໃຊ້ໄມ້ຟືນເປັນພະລັງງານສະເລ່ຍ 1 m^3/ຄົນ/ປີ.
- 2007 ແລະ 2010: ມີປະລິມານການນຳໃຊ້ໄມ້ຟືນຄື: 4,684,515 m^3/ຄົນ/ປີ ແລະ 5,040,563 m^3/ຄົນ/ປີ ຕາມລຳດັບ.
- ການຊົມໃຊ້ຖ່ານຂອງປະຊາຊົນທີ່ອາໃສໃນເຂດຕົວເມືອງແມ່ນ 31.9 ກິໂລ /ຄົນ/ປີ ແລະ ເຂດຊົນນະບົດແມ່ນ 1.1 ກິໂລ/ຄົນ/ປີ. ປີ 2007 ໄດ້ມີການນຳໃຊ້ຖ່ານເປັນພະລັງງານ 17,949 ໂຕນ/ປີ ແລະ 19,254 ໂຕນ/ປີ

ພາກທີ 2: ທົບທວນເອກະສານ ແລະ ບົດວິໄຈກ່ຽວຂ້ອງ

2.4 ສະພາບການທົ່ວໄປກ່ຽວກັບ carbon credit:

2.4.1 ຄວາມເປັນມາກ່ຽວກັບ CARBON CREDIT:

- ທົ່ວໂລກກຳລັງປະສົບບັນຫາ Climate Change ນຳໄປສູ່ປະກົດການທີ່ເອີ້ນວ່າ: Greenhouse Effect ຫຼື Global Warming.
- Inter governmental Panel on Climate Change ຄາດວ່າ: ໃນສັດຕະວັດທີ 21 ນີ້ ໂລກຈະມີອຸນນະພູມສະເລ່ຍເພີ່ມຂຶ້ນ 1.4 - 5.8 ອົງສາ C, ລະດັບນ້ຳທະເລຈະເພີ່ມຂຶ້ນ 0.09 - 0.88 ແມັດ.
- ເພື່ອແກ້ໄຂບັນຫາດັ່ງກ່າວ, ໃນປີ 1992 ປະເທດຕ່າງໆ ໄດ້ເຮັດຂໍ້ຕົກລົງທີ່ເອີ້ນວ່າ: United Nations Framework Convention on Climate Change (UNFCCC) ໂດຍມີວັດຖຸປະສົງເພື່ອຫຼຸດ ແລະ ຮັກສາລະດັບ Greenhouse Gas ໃຫ້ຢູ່ໃນລະດັບທີ່ເປັນອັນຕະລາຍຕໍ່ສະພາວະອາກາດຂອງໂລກໜ້ອຍທີ່ສຸດ.

ພາກທີ 2: ທົບທວນເອກະສານ ແລະ ບົດວິໄຈກ່ຽວຂ້ອງ

2.4 ສະພາບການທົ່ວໄປກ່ຽວກັບ carbon credit:

2.4.2 ກົນໄກການຫຼຸດແກ๊ສເຮືອນແກ້ວພາຍໃຕ້ອະນຸສັນຍາກຽວໂຕ:

- ກົນໄກຊື້ - ຂາຍສິດການປ່ອຍແກ๊ສເຮືອນແກ້ວ **(Emission Trading: ET)** ກົນ ໄກນີ້ ໃຊ້ສະເພາະປະເທດໃນກຸ່ມ Annex 1.
- ກົນໄກການດຳເນີນງານຮ່ວມກັນ **(Joint Implementation: JI)** ກົນໄກນີ້ ກຳນົດໃຫ້ປະເທດໃນກຸ່ມ Annex 1 ສາມາດຮ່ວມກັນດຳເນີນໂຄງການ ເພື່ອ ຫຼຸດປະລິມານ ແກ๊ສເຮືອນແກ້ວສ່ວນໃຫຍ່.
- ກົນໄກການພັດທະນາທີ່ສະອາດ **(Clean Development Mechanism: CDM)** ກົນໄກນີ້ ກຳນົດໃຫ້ປະເທດໃນກຸ່ມ Annex 1 ສາມາດດຳເນີນໂຄງ ການຫຼຸດປະລິມານແກ๊ສເຮືອນແກ້ວຮ່ວມກັບປະເທດໃນກຸ່ມ Non Annex 1 ໄດ້.

ພາກທີ 2: ທົບທວນເອກະສານ ແລະ ບົດວິໄຈກ່ຽວຂ້ອງ

2.4 ສະພາບການທົ່ວໄປກ່ຽວກັບ carbon credit:

2.4.3 ສະຖານະການ ການປ່ອຍແກ๊ສເຮືອນແກ້ວທົ່ວໂລກ:

ຈາກການຄາດການຂອງ Netherlands Environmental Assessment Agency (PBL) ໃນປີ 2007 ທົ່ວໂລກມີການປ່ອຍ CO_2 ເພີ່ມຂຶ້ນ 3% ຕາມ ການເພີ່ມຂຶ້ນຂອງປະຊາກອນໂລກ ແລະ ການຂະຫຍາຍຕົວທາງດ້ານເສດ ຖະກິດ ໂດຍທີ່ສາທາລະນະລັດ ປະຊາຊົນຈີນ ມີການປ່ອຍ CO_2 ຫຼາຍທີ່ສຸດ ຄິດເປັນ 24% ຂອງປະລິມານການປ່ອຍ CO_2 ທົ່ວໂລກ, ຮອງລົງມາແມ່ນ ອາເມຣິກາ 21%, ກຸ່ມປະຊາຄົມຢູໂຣບ 15 ປະເທດ ແມ່ນ 12%, ອິນເດຍ 8% ແລະ ລັດເຊຍ 6% ເປັນຕົ້ນ.

ພາກທີ 2: ທົບທວນເອກະສານ ແລະ ບົດວິໄຈກ່ຽວຂ້ອງ

2.4 ສະພາບການທົ່ວໄປກ່ຽວກັບ carbon credit:

2.4.4 Carbon Credit ແມ່ນຫຍັງ?

Carbon Credit ແມ່ນກຳມະສິດໃນປະລິມານແກ๊ສເຮືອນແກ້ວທີ່ຫຼຸດໄດ້ພາຍໃຕ້ພິທີສານກຽວໂຕ ທັງທີ່ເກີດຈາກໄກຊື້ຂາຍສິດໃນການປ່ອຍແກ๊ສເຮືອນແກ້ວ **(Emission Trading: ET)**, ກົນໄກດຳເນີນຮ່ວມກັນ **(Joint Implementation: JI)** ແລະ ກົນໄກພັດທະນາທີ່ສະອາດ **(Clean Development Mechanism: CDM)**. ການຊື້ - ຂາຍຈະເຮັດໃຫ້ມີລັກສະນະທີ່ເອີ້ນວ່າ: Cap and Trade ນັ້ນໝາຍວ່າ: ປະເທດ ຫຼື ຜູ້ຜະລິດລາຍໃດມີການປ່ອຍແກ๊ສເຮືອນແກ້ວຫຼາຍ ຫຼື ໜ້ອຍກວ່າໂຄຕ້າການປ່ອຍແກ๊ສເຮືອນແກ້ວສຸດທິທີ່ໄດ້ຮັບ, ປະເທດ ຫຼື ຜູ້ຜະລິດ ດັ່ງກ່າວ ຈະສາມາດທຳການຊື້ ຫຼື ຂາຍ Carbon Credit ກັບປະເທດ ຫຼື ຜູ້ຜະລິດອື່ນໄດ້.

ພາກທີ 2: ທົບທວນເອກະສານ ແລະ ບົດວິໄຈກ່ຽວຂ້ອງ

2.4 ສະພາບການທົ່ວໄປກ່ຽວກັບ carbon credit:

2.4.5 ຄວາມຮູ້ກ່ຽວກັບຕະຫຼາດ Carbon Credit:

ຕະຫຼາດ Carbon Credit ຈະປະກອບມີຜູ້ຊື້ຫຼັກ 3 ປະເພດ ໄດ້ແກ່:

- ລັດຖະບານໃນກຸ່ມປະເທດ Annex 1
- ກອງທຶນຄາບອນ (Carbon Fund) ເປັນກອງທຶນທີ່ເກີດຂຶ້ນຈາກການລວມຕົວກັນຂອງລັດຖະບານ ຫຼື ກຸ່ມບໍລິສັດເອກະຊົນ ເພື່ອຮັບຊື້ການປະລິມານການຫຼຸດຜ່ອນແກ๊ສເຮືອນແກ້.
- Carbon Broker ເປັນນາຍໜ້າຮັບຊື້ຄາບອນ ເພື່ອນຳເອົາໄປຂາຍໃຫ້ບໍລິສັດເອກະຊົນ ຫຼື ລັດຖະບານຂອງປະເທດໃນກຸ່ມ Annex 1.

ພາກທີ 2: ທົບທວນເອກະສານ ແລະ ບົດວິໄຈກ່ຽວຂ້ອງ

2.4 ສະພາບການທົ່ວໄປກ່ຽວກັບ carbon credit:

2.4.6 ຄວາມຕ້ອງການ - ການສະໜອງ ແລະ ລາຄາໃນຕະຫຼາດ Carbon Credit:

ປະລິມານຄວາມຕ້ອງການ Carbon Credit ໃນປີ 2008 - 2012

ກຸ່ມ (ປະເທດ)	ປະລິມານ (ລ້ານໂຕນ CO_2e)
ກຸ່ມປະຊາຄົມຢູໂຣບ	1,940
ຍີ່ປຸ່ນ	450
ອື່ນໆ	45
ລວມ	**2,435**

ພາກທີ 2: ທົບທວນເອກະສານ ແລະ ບົດວິໄຈກ່ຽວຂ້ອງ

2.4 ສະພາບການທົ່ວໄປກ່ຽວກັບ carbon credit:

2.4.6 ຄວາມຕ້ອງການ - ການສະໜອງ ແລະ ລາຄາໃນຕະຫຼາດ Carbon Credit:

ປະລິມານການສະໜອງຂອງ Carbon Credit ປະເພດໂຄງການ 2008 - 2012

ໂຄງການ	ປະລິມານ (ລ້ານໂຕນ CO_2e)
CDM	1,600
JI	230
ລວມ	**1,830**

ພາກທີ 2: ທົບທວນເອກະສານ ແລະ ບົດວິໄຈກ່ຽວຂ້ອງ

2.5 ການດູດຊັບ CO_2 ຂອງປ່າໄມ້ໃນ ສປປ ລາວ:

ປະເພດປ່າ	ເນື້ອທີ່ (ເຮັກຕາ)	ການດູດຊັບ CO_2 ໂຕນ/ປີ
ປ່າດົງດິບ/ປ່າດົງປະສົມ	1,589,873	150
ປ່າດົງດິບ/ປ່າທີ່ຖືກລົບກວນ	4,033,725	75
ປ່າດົງດິບ/ປ່າເຊື່ອມໂຊມ	2,113,086	50
ປ່າປະສົມ	733,141	125
ປ່າປະສົມເຊື່ອມໂຊມ	600,141	50
ປ່າຟື້ນຕົວໃໝ່	317,999	75

ພາກທີ 2: ທົບທວນເອກະສານ ແລະ ບົດວິໄຈກ່ຽວຂ້ອງ

2.6 ແນວຄວາມຄິດທາງທິດສະດີ:

2.6.1 ການພິຈາລະນາ ແລະ ຈຳແນກຜົນປະໂຫຍດ - ຕົ້ນທຶນ:

ກ. ຜົນປະໂຫຍດ:

- ຜົນປະໂຫຍດຈາກການນຳໃຊ້ຊັບພະຍາກອນຂອງໂຄງການໃດໜຶ່ງ ແມ່ນເກີດມີຜົນປະໂຫຍດ ທາງກົງ ແລະ ທາງອ້ອມ.
- ຜົນປະໂຫຍດທາງກົງ ແລະ ທາງອ້ອມ ແມ່ນຈະຢູ່ໃນຮູບຂອງຜົນປະໂຫຍດທາງການເງິນ (Financial Benefit) ແລະ ຜົນປະໂຫຍດທາງເສດຖະສາດ (Economic Benefit)

ພາກທີ 2: ທຶບທວນເອກະສານ ແລະ ບົດວິໄຈກ່ຽວຂ້ອງ

2.6 ແນວຄວາມຄິດທາງທິດສະດີ:

2.6.1 ການພິຈາລະນາ ແລະ ຈໍາແນກຜົນປະໂຫຍດ - ຕົ້ນທຶນ:

ຂ. ຕົ້ນທຶນຂອງການດໍາເນີນໂຄງການ:

- ຕົ້ນທຶນຈາກການນໍາໃຊ້ຊັບພະຍາກອນຂອງໂຄງການໃດໜຶ່ງ ແມ່ນເກີດມີຕົ້ນທຶນທາງກົງ ແລະ ທາງອ້ອມ.
- ຕົ້ນທຶນທາງກົງ ແລະ ທາງອ້ອມ ແມ່ນຈະຢູ່ໃນຮູບຂອງຕົ້ນທຶນທາງການເງິນ (Financial Cost) ແລະ ຕົ້ນທຶນທາງເສດຖະສາດ (Economic Cost)

22 February 2012 21

ພາກທີ 2: ທຶບທວນເອກະສານ ແລະ ບົດວິໄຈກ່ຽວຂ້ອງ

2.6 ແນວຄວາມຄິດທາງທິດສະດີ:

2.6.2 ການປະເມີນມູນຄ່າຂອງປະໂຫຍດ - ຕົ້ນທຶນເປັນຕົວເງິນ:

- ການຄິດລາຄາສິນຄ້າທີ່ມີຕະຫຼາດ ແລະ ລາຄາຕະຫຼາດບໍ່ຖືກບິດເບືອນ:
- ການຄິດລາຄາສິນຄ້າທີ່ມີຕະຫຼາດ ແລະ ລາຄາຕະຫຼາດຖືກບິດເບືອນ:
- ການຄິດລາຄາສິນຄ້າທີ່ບໍ່ຢູ່ໃນລະບົບຕະຫຼາດ:

22 February 2012 22

ພາກທີ 2: ທົບທວນເອກະສານ ແລະ ບົດວິໄຈກ່ຽວຂ້ອງ

2.6 ແນວຄວາມຄິດທາງທິດສະດີ:

2.6.3 ມູນຄ່າທາງດ້ານເສດຖະສາດ ຂອງສິ່ງແວດລ້ອມ:

(1). ມູນຄ່າຈາກການໃຊ້ປະໂຫຍດ (use value) ເຊິ່ງປະກອບດ້ວຍ:

- ມູນຄ່າການໃຊ້ປະໂຫຍດທາງກົງ (direct use value):
- ມູນຄ່າການໃຊ້ປະໂຫຍດທາງອ້ອມ (indirect use value):
- ມູນຄ່າເພື່ອໃຊ້ໃນອະນາຄົດ (option value):

(2). ມູນຄ່າທີ່ບໍ່ໄດ້ໃຊ້ປະໂຫຍດ (Non use value) ເຊິ່ງປະກອບດ້ວຍ:

- ມູນຄ່າທີ່ເປັນມໍລະດົກຕົກທອດ (bequest value):
- ມູນຄ່າຂອງການຄົງຢູ່ (existence value):

ພາກທີ 2: ທົບທວນເອກະສານ ແລະ ບົດວິໄຈກ່ຽວຂ້ອງ

2.6 ແນວຄວາມຄິດທາງທິດສະດີ:

2.6.5 ຫຼັກເກນທີ່ໃຊ້ໃນການພິຈາລະນາວິເຄາະການດຳເນີນໂຄງການໃດໜຶ່ງ:

ການປຽບທຽບຕົ້ນທຶນ ແລະ ຜົນປະໂຫຍດຕອບແທນຂອງການດຳເນີນໂຄງການໃດໜຶ່ງ. ຫຼັກເກນທີ່ນິຍົມໃຊ້ກັນທົ່ວໄປໄດ້ແກ່:

- ຫຼັກເກນມູນຄ່າປະຈຸບັນຂອງຜົນຕອບແທນ ຫຼື ຜົນປະໂຫຍດສຸດທິ (Net Present Value: NPV):

$$NPV = \sum_{t=0}^{n} \frac{B_t - C_t}{(1+r)^t}$$

- ອັດຕາຜົນ ຕອບແທນພາຍໃນ (Internal Rate of Return: IRR)

$$IRR = r_1 + (r_2 - r_1)\frac{NPV_1}{NPV_1 - NPV_2}$$

- ອັດຕາສ່ວນຂອງຜົນປະໂຫຍດຕໍ່ຕົ້ນທຶນ (Benefit – Cost Ratio: B/C ratio).

$$\frac{B}{C} = \frac{PVB}{PVC} = \frac{\sum_{t=0}^{n}\frac{B_t}{(1+r)^t}}{\sum_{t=0}^{n}\frac{C_t}{(1+r)^t}} > 1$$

ພາກທີ 2: ທົບທວນເອກະສານ ແລະ ບົດວິໄຈກ່ຽວຂ້ອງ

2.7 ບົດວິໄຈກ່ຽວຂ້ອງ:

- ພຸດສະຫວ່າງ ໄພມວົງ, ສູນທອນ ຖາວິວອນ (2006) "ການນຳ ໃຊ້ແກ໊ສຊີວະພາບແທນໄມ້ຟືນ ແລະ ຖ່ານ ຂອງປະຊາຊົນບ້ານໜອງພູວຽງ ເມືອງປາກງື່ມ ແຂວງນະຄອນຫຼວງວຽງຈັນ".
- ແສງພອນ ວົງພູທອນ (2009) "ປະເມີນການນຳໃຊ້ໄມ້ຟືນເຜົາຖ່ານ ຢູ່ບ້ານສີມສະຫວາດ ເມືອງປາກງື່ມ ນະຄອນຫຼວງວຽງຈັນ" .
- ໂມນີວັນ ຄູນບູລົມ, ພອນສະຫວັດ ປາດາວົງ, ສຸພາພອນ ຄູນບູລົມ (2010) "ຄຸນປະໂຫຍດທາງດ້ານສິ່ງແວດລ້ອມ , ຈາກການນຳໃຊ້ແກ໊ດຊີວະພາບ ຂອງປະຊາຊົນບ້ານໜອງພູວຽງ ເມືອງປາກງື່ມ ແຂວງ ນະຄອນຫຼວງວຽງຈັນ".
- ວິທະໄຊ ເພັດລຽບ, "ການປະເມີນຄວາມຜິດປົກະຕິຂອງລະບົບທາງເດີນຫາຍໃຈ ແລະ ສານເຄມີອັນຕະລາຍ ຕໍ່ພະນັກງານລົມຄວັນແຜ່ນຢາງ ໃນສະຫະກອນກອງທຶນສວນຢາງພາລາ ແຂວງສົງຂາ ປະເທດໄທ".

ພາກທີ 3: ວິທີການສຶກສາ

3.1 ວິທີການສຶກສາ:

3.1.1 ເຄື່ອງມືການສຶກສາ:

- ສ້າງແບບຟອມສອບຖາມ 1 ກຸ່ມຕົວຢ່າງຄື: ກຸ່ມສຶກສາ ແມ່ນກຸ່ມຕົວຢ່າງປະຊາຊົນທີ່ນຳໃຊ້ແກ໊ສຊີວະພາບ.
- ປ້ອນຂໍ້ມູນລົງໃນ Ms. Excel ເພື່ອຊອກຫາຈຳນວນເປີເຊັນ (percentage), ຄ່າສະເລ່ຍ (Mean), ຄ່າຜັນປ່ຽນມາດຖານ (SD: Standard Divisions) ຂອງຂໍ້ມູນໃນກຸ່ມຕົວຢ່າງ.

ພາກທີ 3: ວິທີການສຶກສາ

3.1 ເຄື່ອງມືໃນການສຶກສາ:

3.1.2 ແບບຈຳລອງ

ແບບຈຳລອງການປຽບທຽບຕົ້ນທຶນ ແລະ ຜົນປະໂຫຍດຕອບແທນຂອງການດຳເນີນໂຄງການ:

$$NPV = \sum_{t=0}^{n} \frac{B_t - C_t}{(1+r)^t} \qquad IRR = r_1 + (r_2 - r_1)\frac{NPV_1}{NPV_1 - NPV_2} \qquad \frac{B}{C} = \frac{PVB}{PVC} = \frac{\sum_{t=0}^{n} \frac{B_t}{(1+r)^t}}{\sum_{t=0}^{n} \frac{C_t}{(1+r)^t}} > 1$$

ແບບຈຳລອງທີ່ໃຊ້ໃນການທົດສົມມຸດຖານທາງສະຖິຕິ:

$$Z = \frac{\bar{X}_{BG} - \bar{X}_{CG}}{\sqrt{\frac{S_{CG}^2}{n_{CG}} + \frac{S_{BG}^2}{n_{BG}}}}$$

ພາກທີ 3: ວິທີການສຶກສາ

3.1 ເຄື່ອງມືໃນການສຶກສາ:

3.1.3 ສົມມຸດຖານຂອງການສຶກສາ:

- ຕົ້ນທຶນຂອງການນຳໃຊ້ແກ໊ສຊີວະພາບ ແມ່ນໜ້ອຍກວ່າຜົນປະໂຫຍດທີ່ໄດ້ຮັບຈາກການນຳໃຊ້ແກ໊ສຊີວະພາບຂອງປະຊາຊົນ ໃນໂຄງການຕົວແບບແກ໊ສຊີວະພາບ ແຂວງສະຫວັນນະເຂດ.

ພາກທີ 3: ວິທີການສຶກສາ

3.2 ການເກັບກຳລວບລວມຂໍ້ມູນ:

3.2.1 ແຫຼ່ງຂໍ້ມູນ:

- ຂໍ້ມູນພາກຫ້ອງການເຊັ່ນ: ພະແນກກະສິກຳ - ປ່າໄມ້ແຂວງສະຫວັນນະເຂດ, ໂຄງການຕົວ ແບບແກັສຊີວະພາບສູນກາງ ແລະ ແຂວງສະຫວັນນະເຂດ, ບັນດາກະຊວງທີ່ກ່ຽວ ຂ້ອງ, Internet ເຊັ່ນ: www.google.com/biogas, www.biogaslao.org ແລະ ອື່ນໆ.
- ຂໍ້ມູນ ພາກສະໜາມແມ່ນໄດ້ຈາກການສຳຫຼວດພື້ນທີ່ຕົວຈິງ, ການສຳພາດ ພາກສ່ວນກ່ຽວຂ້ອງ, ການສ້າງແບບຟອມສອບຖາມກຸ່ມສຶກສາ.

22 February 2012 29

ພາກທີ 3: ວິທີການສຶກສາ

3.2 ການເກັບກຳລວບລວມຂໍ້ມູນ:

3.2.2 ປະຊາກອນ ແລະ ກຸ່ມຕົວຢ່າງ:

ປະເພດບໍ່ແກັສ	ຈຳນວນປະຊາກອນ	ຂະໜາດຂອງຕົວຢ່າງ
4 m^3	95	39
6 m^3	10	09
8 m^3	00	00
10 m^3	02	02
Total	107	50

22 February 2012 30

ພາກທີ 3: ວິທີການສຶກສາ

3.3 ການວິເຄາະຂໍ້ມູນ:

3.3.1 ການວິເຄາະຕົ້ນທຶນຂອງການນຳໃຊ້ແກ໊ສຊີວະພາບ:

(1). ຕົ້ນທຶນຂອງກຸ່ມຕົວຢ່າງ ໃນການນຳໃຊ້ແກ໊ສຊີວະພາບ:

- ແຮງງານຂຸດບໍ່ແກ໊ສ
- ໄລຍະເວລາທີ່ໃຊ້ໃນການຂຸດບໍ່ແກ໊ສ
- ຄ່າອຸປະກອນກໍ່ສ້າງບໍ່ແກ໊ສ
- ແຮງງານກຳມະກອນຊ່ວຍວຽກກໍ່ສ້າງບໍ່ແກ໊ສ
- ໄລຍະເວລາທີ່ໃຊ້ໃນການກໍ່ສ້າງບໍ່ແກ໊ສ
- ເນື້ອທີ່ດິນທີ່ໃຊ້ໃນການກໍ່ສ້າງບໍ່ແກ໊ສ
- ໄລຍະເວລາໃນທີ່ໃຊ້ໃນການເຕີມມູນສັດໃສ່ບໍ່ແກ໊ສ
- ແຮງງານທີ່ໃຊ້ໃນການເຕີມມູນສັດໃສ່ບໍ່ແກ໊ສ
- ນ້ຳມັນລົດ

22 February 2012 31

ພາກທີ 3: ວິທີການສຶກສາ

3.3 ການວິເຄາະຂໍ້ມູນ:

3.3.1 ການວິເຄາະຕົ້ນທຶນຂອງການນຳໃຊ້ແກ໊ສຊີວະພາບ:

(2). ຕົ້ນທຶນຂອງໂຄງການທີ່ປະກອບໃນການສ້າງບໍ່ແກ໊ສ:

- ອຸປະກອນທີ່ປະກອບໃນການນຳໃຊ້ແກ໊ສຊີວະພາບ
- ສິນທຶບທຶນກໍ່ສ້າງບໍ່ແກ໊ສໃຫ້ປະຊາຊົນ
- ຄ່າຄ້ຳປະກັນໃນການສ້າງບໍ່ແກ໊ສປີທີ 2

22 February 2012 32

ພາກທີ 3: ວິທີການສຶກສາ

3.3 ການວິເຄາະຂໍ້ມູນ:

3.3.2 ການວິເຄາະຜົນປະໂຫຍດຂອງການນຳໃຊ້ແກັສຊີວະພາບ:

(1). ຜົນປະໂຫຍດທີ່ກຸ່ມຕົວຢ່າງໄດ້ຮັບຈາກການນຳໃຊ້ແກັສຊີວະພາບ:

- ຫຼຸດຜ່ອນດ້ານເວລາໃນການໄປເອົາຟືນ
- ຫຼຸດຜ່ອນຄ່າໃຊ້ຈ່າຍດ້ານນ້ຳມັນໃນການໄປເອົາຟືນ
- ຫຼຸດຜ່ອນແຮງງານໃນການໄປເອົາຟືນ
- ຫຼຸດຜ່ອນຄ່າໃຊ້ຈ່າຍໃນການຊື້ຟືນ
- ຫຼຸດຜ່ອນຄ່າໄຟຟ້າ
- ຫຼຸດຜ່ອນການຊື້ປຸ໋ຍເຄມີ
- ມີລາຍຮັບຈາກການຂາຍກາກມູນລົ້ນ
- ຫຼຸດຜ່ອນຄ່າໃຊ້ຈ່າຍໃນການເດີນທາງໄປປິ່ນປົວພະຍາດທາງລະບົບຫາຍໃຈ

ພາກທີ 3: ວິທີການສຶກສາ

3.3 ການວິເຄາະຂໍ້ມູນ:

3.3.2 ການວິເຄາະຜົນປະໂຫຍດຂອງການນຳໃຊ້ແກັສຊີວະພາບ:

(2). ຜົນປະໂຫຍດທີ່ສັງຄົມໄດ້ຮັບ:

ແມ່ນມູນຄ່າການໃຊ້ປະໂຫຍດທາງອ້ອມ (indirect use value) ຫຼື ແມ່ນມູນຄ່າທີ່ສະທ້ອນເຖິງຄວາມເພິ່ງພໍໃຈຂອງສັງຄົມໄດ້ຮັບຈາກສິ່ງແວດລ້ອມ ທີ່ເກີດຂຶ້ນຈາກການຫຼຸດຜ່ອນການຕັດ ຕົ້ນໄມ້ມາເປັນຟືນ ແລະ ເຜົາຖ່ານ.

ພາກທີ 3: ວິທີການສຶກສາ

3.4 ການຕີຄວາມໝາຍຂໍ້ມູນ:

3.4.1 ການວັດຕົ້ນທຶນຂອງການນຳໃຊ້ແກ໊ສຊີວະພາບເປັນຕົວເງິນ:

- ແຮງງານຂຸດບໍ່ແກ໊ສ,
- ໄລຍະເວລາທີ່ໃຊ້ໃນການຂຸດບໍ່ແກ໊ສ,
- ແຮງງານກຳມະກອນຊ່ວຍວຽກກໍ່ສ້າງ ບໍ່ແກ໊ສ,
- ໄລຍະເວລາທີ່ໃຊ້ໃນການກໍ່ສ້າງບໍ່ແກ໊ສ,
- ເນື້ອທີ່ດິນທີ່ໃຊ້ໃນການກໍ່ ສ້າງບໍ່ແກ໊ສ,
- ແຮງງານທີ່ໃຊ້ໃນການເຕີມມູນສັດໃສ່ບໍ່ແກ໊ສ
- ໄລຍະເວລາ ທີ່ໃຊ້ໃນການ ເຕີມມູນສັດໃສ່ບໍ່ແກ໊ສ.

ພາກທີ 3: ວິທີການສຶກສາ

3.4 ການຕີຄວາມໝາຍຂໍ້ມູນ:

3.4.2 ການວັດຜົນປະໂຫຍດຂອງການນຳໃຊ້ແກ໊ສຊີວະພາບເປັນຕົວເງິນ:

ຜົນປະໂຫຍດທີ່ບໍ່ເປັນຕົວເງິນຈາກການນຳໃຊ້ແກ໊ສຊີວະພາຍ:

- ການຫຼຸດຜ່ອນ ແຮງງານໃນການໄປເອົາຟືນ,
- ການຫຼຸດຜ່ອນດ້ານເວລາໃນການໄປເອົາຟືນ,
- ການຫຼຸດຜ່ອນການຕັດຕົ້ນໄມ້ມາເປັນຟືນ ແລະ ເຜົາຖ່ານ.

ພາກທີ 3:   ວິທີການສຶກສາ

3.4 ການຕີຄວາມໝາຍຂໍ້ມູນ:

3.4.3 ການຕີຄວາມໝາຍຄວາມຄຸ້ມຄ່າຂອງໂຄງການຕົວແບບແກ๊ສຊີວະພາບ:

- ການວັດຄວາມຄຸ້ມຄ່າ ຂອງໂຄງການຕົວແບບແກ໊ສຊີວະພາບແຂວງສະຫວັນນະເຂດ ໂດຍການສຶກສາຂໍ້ມູນຈາກກຸ່ມຕົວຢ່າງນັ້ນ ແມ່ນປະຕິບັດໄດ້ດ້ວຍການປຽບທຽບຕົ້ນທຶນ ແລະ ຜົນປະໂຫຍດຂອງໂຄງການ ໂດຍນໍາໃຊ້ຫຼັກເກນມູນຄ່າປະຈຸບັນຂອງຜົນຕອບແທນ ຫຼື ຜົນປະໂຫຍດສຸດທິ (Net Present Value: NPV), ອັດຕາຜົນຕອບແທນພາຍໃນ (Internal Rate of Return: IRR) ແລະ ອັດຕາສ່ວນຂອງຜົນປະໂຫຍດຕໍ່ຕົ້ນທຶນ (Benefit – Cost Ratio: B/C ratio).
- ອັດຕາສ່ວນຫຼຸດ ທີ່ໃຊ້ໃນການຄໍານວນຄັ້ງນີ້ແມ່ນ 12%

ພາກທີ 3:   ວິທີການສຶກສາ

3.4 ການຕີຄວາມໝາຍຂໍ້ມູນ:

3.4.4 ການທົດສອບສົມມຸດຖານ:

$$Z = \frac{\bar{X}_{BG} - \bar{X}_{CG}}{\sqrt{\frac{S_{CG}^2}{n_{CG}} + \frac{S_{BG}^2}{n_{BG}}}}$$

- ຖ້າຄ່າຂອງ Z ນ້ອຍກ່ວາຄ່າວິກິດ, ສະແດງວ່າປະຕິເສດ H_0 ໝາຍຄວາມວ່າ: ດ້ວຍລະດັບຄວາມເຊື້ອໝັ້ນ 95%, ການນໍາໃຊ້ແກ๊ສຊີວະພາບຂອງປະຊາຊົນພາຍໃນໂຄງການຕົວແບບແກ๊ສຊີວະພາບແຂວງສະຫວັນນະເຂດ ແມ່ນເກີດມີຜົນປະໂຫຍດຈາກການການນໍາໃຊ້ແກ๊ສຊີວະພາບ ສູງກ່ວາຕົ້ນທຶນຂອງການນໍາໃຊ້ແກ๊ສຊີວະພາບຢ່າງແທ້ຈິງ.
- ຖ້າຄ່າຂອງ Z ໃຫຍ່ກ່ວາຄ່າວິກິດ , ສະແດງວ່າຍອມຮັບ H_0 ໝາຍຄວາມວ່າ: ດ້ວຍລະດັບຄວາມເຊື້ອໝັ້ນ 95%, ການນໍາໃຊ້ແກ๊ສຊີວະພາບຂອງປະຊາຊົນພາຍໃນໂຄງການຕົວແບບແກ๊ສຊີວະພາບແຂວງສະຫວັນນະເຂດ ແມ່ນເກີດມີຜົນປະໂຫຍດຈາກການການນໍາໃຊ້ແກ๊ສຊີວະພາບ ສູງກ່ວາຕົ້ນທຶນຂອງການນໍາໃຊ້ແກ๊ສຊີວະພາບບໍ່ມີຄວາມເປັນຈິງ.

ພາກທີ 4: ຜົນໄດ້ຮັບຂອງການສຶກສາ

4.1 ສະພາບທົ່ວໄປ ກ່ຽວກັບພື້ນທີ່ການສຶກສາ:

- ແຂວງສະຫວັນນະເຂດ ມີ GDP ສົກປີ 2009 - 2010 ແມ່ນ 6,918.55 ຕື້ກີບ ເຊິ່ງສະເລ່ຍຕໍ່ຫົວຄົນໄດ້ 897 ໂດລາສະຫະລັດ.
- ໂຄງປະກອບທາງດ້ານເສດຖະກິດຂອງແຂວງ: ດ້ານກະສິກຳ - ປ່າໄມ້ 49.04% ເພີ່ມຂຶ້ນ 7.29%, ອຸດສາຫະກຳ 24.54% ເພີ່ມຂຶ້ນ 16.28% ແລະ ການບໍລິການ 26.42% ເພີ່ມຂຶ້ນ 16.50%.
- ເມືອງຈຳພອນຕັ້ງຫ່າງຈາກທີ່ຕັ້ງຂອງແຂວງສະຫວັນນະເຂດ ໄປທາງທິດຕາເວັນອອກ 54 ກິໂລແມັດ. GDP ສົກປີ 2009 - 2010 ສະເລ່ຍຕໍ່ຫົວຄົນໄດ້ 9,699,074 ກີບ
- ໂຄງປະກອບທາງດ້ານເສດຖະກິດເມືອງຈຳພອນ: ກະສິກຳ - ປ່າໄມ້ ກວມ 80.32% , ອຸດສະຫະກຳ - ຫັດຖະກຳກວມ 14.49% ແລະ ດ້ານບໍລິການ ກວມ 5.19%

ພາກທີ 4: ຜົນໄດ້ຮັບຂອງການສຶກສາ

4.1 ສະພາບທົ່ວໄປ ກ່ຽວກັບພື້ນທີ່ການສຶກສາ (ຕໍ່):

- BPP/SVK ແມ່ນຖືກຈັດ ຕັ້ງຂຶ້ນໃນວັນທີ 10 ມິຖຸນາ 2008
- ໂດຍແມ່ນແຜນງານການປະມົງ ແລະ ລ້ຽງສັດ ພະແນກກະສິກຳ - ປ່າໄມ້ແຂວງສະຫວັນນະເຂດ ເປັນຜູ້ຈັດຕັ້ງປະຕິບັດໂຄງການ.
- ໜ້າວຽກຂອງໂຄງການມີດັ່ງນີ້:

(1). ວຽກງານການຝຶກອົບຮົມພະນັກງານວິຊາການ:
- ຝຶກອົບຮົມພະນັກງານວິຊາການຂັ້ນແຂວງໄດ້ 4 ທ່ານ
- ພະນັກງານວິຊາການ ຂັ້ນເມືອງ 13 ທ່ານ
- ນາຍຊ່າງສຳລັບສ້າງບໍ່ແກັສ 60 ທ່ານ.

ພາກທີ 4: ຜົນໄດ້ຮັບຂອງການສຶກສາ

4.1 ສະພາບທົ່ວໄປ ກ່ຽວກັບພື້ນທີ່ການສຶກສາ (ຕໍ່):

(2). ວຽກງານໂຄສະນາ ແລະ ສົ່ງເສີມການນຳໃຊ້ແກ໊ສຊີວະພາບ:

ປີ	ຈຳນວນບ້ານ	ຜູ້ເຂົ້າຮ່ວມທັງໝົດ	ຍິງ
2008	78	4,100	1,621
2009	67	3,536	1,289
2010	47	2,303	690
ລວມ	192	9,939	3,600

ພາກທີ 4: ຜົນໄດ້ຮັບຂອງການສຶກສາ

4.1 ສະພາບທົ່ວໄປ ກ່ຽວກັບພື້ນທີ່ການສຶກສາ (ຕໍ່):

(3). ວຽກງານກໍ່ສ້າງບໍ່ແກ໊ສຊີວະພາບ:

ເມືອງ	2008	2009	2010	ລວມ
ໄກສອນພົມວິຫານ	12	61	12	52
ອຸທຸມພອນ	9	28	6	43
ໄຊພູທອງ	9	26	5	40
ສອງຄອນ	6	52	15	73
ອາດສະພັງທອງ	15	82	28	125
ຈຳພອນ	*4*	*66*	*20*	*90*
ໄຊບູລີ	1	19	2	22
ອາດສະພອນ	0	23	8	31
ຊົນນະບູລີ	Na	3	5	8
ພະລານໄຊ	Na	Na	0	0
ພີນ	Na	Na	1	1
ລວມ	56	360	102	518

ພາກທີ 4: ຜົນໄດ້ຮັບຂອງການສຶກສາ

4.2 ສະພາບທົ່ວໄປຂອງກຸ່ມຕົວຢ່າງ:

ເພດ	ຈຳນວນ (ຄົນ)	ເປີເຊັນ (%)
ຍິງ	12	24
ຊາຍ	38	76
ລວມ	50	100

22 February 2012 43

ພາກທີ 4: ຜົນໄດ້ຮັບຂອງການສຶກສາ

4.2 ສະພາບທົ່ວໄປຂອງກຸ່ມຕົວຢ່າງ (ຕໍ່):

ອາຊີບ	ຈຳນວນ (ຄົນ)	ເປີເຊັນ (%)
ພະນັກງານລັດ	7	14
ທະຫານ	2	4
ຕຳຫຼວດ	1	2
ປູກຝັງ - ລ້ຽງສັດ	36	72
ຄ້າຂາຍທົ່ວໄປ	4	8
ລວມ	50	100

22 February 2012 44

ພາກທີ 4: ຜົນໄດ້ຮັບຂອງການສຶກສາ

4.2 ສະພາບທົ່ວໄປຂອງກຸ່ມຕົວຢ່າງ (ຕໍ່):

ເກນອາຍຸສະມາຊິກ ໃນຄອບຄົວ	ຈຳນວນຄົນ		ເປີເຊັນ (%)	
	ລວມ	ຍິງ	ລວມ	ຍິງ
ຕ່ຳກ່ວາ 15 ປີ	2	1	28.57	25
15 - 60 ປີ	4	2	57.14	50
60 ປີຂຶ້ນໄປ	1	1	14.29	25
ລວມ	7	4	100	100

ພາກທີ 4: ຜົນໄດ້ຮັບຂອງການສຶກສາ

4.2 ສະພາບທົ່ວໄປຂອງກຸ່ມຕົວຢ່າງ (ຕໍ່):

ປີທີ່ໃຊ້ແກ๊สຊີວະພາບ	ຈຳນວນ ຄອບຄົວ	ເປີເຊັນ (%)
2008 (1)	9	18
2009 (2)	22	44
2010 (3)	13	26
2011 (4)	6	12
ລວມ	50	100
ຄ່າສະເລ່ຍ	2.32	

ພາກທີ 4: ຜົນໄດ້ຮັບຂອງການສຶກສາ

4.3 ຕົ້ນທຶນຂອງການນຳໃຊ້ແກ໊ສຊີວະພາບຂອງກຸ່ມຕົວຢ່າງ:

ຕົ້ນທຶນຂອງກຸ່ມຕົວຢ່າງຕໍ່ 1 ບໍ່ແກ໊ສ		ຕົ້ນທຶນໂຄງການຕໍ່ 1 ບໍ່ແກ໊ສ	
ຄ່າແຮງງານຄຸມຂຸມບໍ່ແກ໊ສ	252,000	ມູນຄ່າອຸປະກອນການໃຊ້ແກ໊ສ	302,000
ຄ່າອຸປະກອນກໍ່ສ້າງບໍ່ແກ໊ສ	784,000	ເງິນສົມທົບການກໍ່ສ້າງບໍ່ແກ໊ສ	820,000
ຄ່າແຮງງານກຳມະກອນ	189,000	ຮັບປະກັນຄຸນະພາບບໍ່ແກ໊ສ	200,000
ມູນຄ່າເນື້ອທີ່ດິນກໍ່ສ້າງບໍ່ແກ໊ສ	1,575,000		
ມູນຄ່າແຮງານເຕີມມູນສັດ	25,440		
ນ້ຳມັນລົດ	15,400		
ລວມ	2,840,40		1,322,000
ຕົ້ນທຶນໃນປີຖານ (0: 2009):		3,922,000	
ຕົ້ນທຶນປີທີ 1 (2010)		240,840	
ຕົ້ນທຶນປີທີ 2 (2011) ເປັນຕົ້ນມາ		40,840	

ພາກທີ 4: ຜົນໄດ້ຮັບຂອງການສຶກສາ

4.4 ຜົນປະໂຫຍດຂອງການນຳໃຊ້ແກ໊ສຊີວະພາບຂອງກຸ່ມຕົວຢ່າງ:

ຜົນປະໂຫຍດຂອງກຸ່ມຕົວຢ່າງຕໍ່ 1 ບໍ່ແກ໊ສ		ຜົນປະໂຫຍດຂອງສັງຄົມຕໍ່ 1 ບໍ່ແກ໊ສ	
ມູນຄ່າການໃຊ້ນ້ຳມັນ	18,800	ມູນຄ່າງການດູດຊັບ CO_2 ຂອງ ຕົ້ນໄມ້ທີ່ຄົງຢູ່	1,280,000
ມູນຄ່າແຮງງານທີ່ບໍ່ໄດ້ໄປເອົາຟືນ	82,080		
ມູນຄ່າການຊື້ຟືນທີ່ລຸດລົງ	84,000		
ມູນຄ່າລຸດຜ່ອນຄ່າໄຟຟ້າ	107,560		
ມູນຄ່າການລຸດຄ່າຊື້ປຸ໋ຍເຄມີ	2,100,000		
ມູນຄ່າການຂາຍກາກມູນລົ້ນ	14,000		
ມູນຄ່າລຸດຄ່າໃຊ້ຈ່າຍການໄປປິ່ນປົວ ພະຍາດລະບົບທາງເດີນຫາຍໃຈ	15,000		
ຜົນປະໂຫຍດຂອງການນຳໃຊ້ແກ໊ສຊີວະພາບນັບແຕ່ປີທີ 1 ເປັນຕົ້ນມາ			3,701,440

ພາກທີ 4: ຜົນໄດ້ຮັບຂອງການສຶກສາ

4.5 ປຽບທຽບອັດຕາສ່ວນລະຫວ່າງຜົນປະໂຫຍດ ກັບຕົ້ນທຶນຂອງການນໍາໃຊ້ແກ໊ສຊີວະພາບຂອງຕົວຢ່າງ:

ການວິເຄາະຄວາມຄຸ້ມຄ່າຂອງໂຄງການຕົວແບບແກ໊ສຊີວະພາບ ຈາກກຸ່ມຕົວຢ່າງດັ່ງກ່າວ ໃນໄລຍະເວລາ 15 ປີ (ນັບທັງປີຖານ), ຄືນັບແຕ່ປີ 2009 - 2023. ໂດຍຖືວ່າຖານຂໍ້ມູນດ້ານຕ່າງໆ ແມ່ນຄືງທີ່ນັບແຕ່ປີ 2009 ເປັນຕົ້ນມາ. ແຕ່ການວິເຄາະຄວາມຄຸ້ມຄ່າຂອງໂຄງການຕົວແບບແກ໊ສຊີວະພາບຄັ້ງນີ້ແມ່ນນໍາໃຊ້ມູນຄ່າຕົ້ນທຶນ ແລະ ຜົນປະໂຫຍດທີ່ໄດ້ຮັບຈາກການນໍາໃຊ້ແກ໊ສຊີວະພາບສະເລ່ຍຕໍ່ຕົວຢ່າງ ຫຼື ຕໍ່ໜຶ່ງບໍ່ແກ໊ສເທົ່ານັ້ນ. ລາຍລະອຽດເບິ່ງຕາຕະລາງຕໍ່ໄປນີ້

22 February 2012 49

ປີທີ (t)	C_G	$PVC_G = C_G/(1+0.12)^t$	B_G	$PVB_G = B_G/(1+0.12)^t$	NPV
2009 (0)	3,922,000	3,922,000.00	-	-	(3,922,000.00)
2010 (1)	240,840	215,035.71	3,701,440	3,304,857.14	3,009,217.39
2011 (2)	40,840	32,557.40	3,701,440	2,950,765.31	2,767,939.51
2012 (3)	40,840	29,069.11	3,701,440	2,634,611.88	2,406,903.92
2013 (4)	40,840	25,954.56	3,701,440	2,352,332.04	2,092,959.93
2014 (5)	40,840	23,173.71	3,701,440	2,100,296.46	1,819,965.16
2015 (6)	40,840	20,690.81	3,701,440	1,875,264.70	1,582,578.40
2016 (7)	40,840	18,473.94	3,701,440	1,674,343.48	1,376,155.13
2017 (8)	40,840	16,494.59	3,701,440	1,494,949.54	1,196,656.63
2018 (9)	40,840	14,727.31	3,701,440	1,334,776.37	1,040,570.99
2019 (10)	40,840	13,149.39	3,701,440	1,191,764.62	904,844.34
2020 (11)	40,840	11,740.52	3,701,440	1,064,075.55	786,821.16
2021 (12)	40,840	10,482.61	3,701,440	950,067.46	684,192.31
2022 (13)	40,840	9,359.47	3,701,440	848,274.51	594,949.84
2023 (14)	40,840	8,356.67	3,701,440	757,387.96	517,347.69
Total	4,693,760	4,371,265.82	51,820,160	24,533,767.01	16,859,102.39

ພາກທີ 4: ຜົນໄດ້ຮັບຂອງການສຶກສາ

4.5 ປຽບທຽບອັດຕາສ່ວນລະຫວ່າງຜົນປະໂຫຍດ ກັບຕົ້ນທຶນຂອງການນໍາໃຊ້ແກັສຊີວະພາບຂອງຕົວຢ່າງ (ຕໍ່):

ຈາກຕາຕະລາງຂ້າງເທິງນັ້ນ ເຫັນວ່າ:

- NPV = 16,859,102.39 ກີບ.
- B/C = PVB/PVC = 5.61
- IRR = 90.90%

ໄດ້ຈາກ: $r_1 = 0.90$ $NPV_1 = 39{,}561.13$

$r_2 = 0.91$ $NPV_2 = -4{,}542.46$

$$IRR = r_1 + (r_2 - r_1)\frac{NPV_1}{NPV_1 - NPV_2} = 0.9090$$

ພາກທີ 4: ຜົນໄດ້ຮັບຂອງການສຶກສາ

4.6 ການທົດສອບສົມມຸດຖານຂອງການສຶກສາ:

ຈາກການທົດສອບສົມມຸດຖານ ເພື່ອວັດຜົນຂອງການສຶກສາຂໍ້ມູນຕົ້ນທຶນ ແລະ ຜົນປະໂຫຍດສະເລ່ຍຈາກການນໍາໃຊ້ແກັສຊີວະພາບ ຂອງກຸ່ມຕົວຢ່າງແມ່ນເຫັນວ່າ: Z = - 9.84 ເຊິ່ງນ້ອຍກ່ວາຄ່າວິກິດ, ສະແດງວ່າ: ປະຕິເສດ H_0 ໝາຍຄວາມວ່າ: ດ້ວຍລະດັບຄວາມເຊື່ອໝັ້ນ 95%, ການນໍາໃຊ້ແກັສຊີວະພາບຂອງປະຊາຊົນ ພາຍໃນໂຄງການຕົວແບບແກັສຊີວະພາບ ແຂວງສະຫວັນນະເຂດ ແມ່ນເກີດມີຜົນປະໂຫຍດທີ່ໄດ້ຮັບຈາກການການນໍາໃຊ້ແກັສຊີວະພາບສູງກ່ວາຕົ້ນທຶນຂອງການນໍາໃຊ້ແກັສຊີວະພາບຢ່າງແທ້ຈິງ.

ພາກທີ 5: ສະຫຼຸບ ແລະ ການສະເໜີແນະ

5.1 ສະຫຼຸບຜົນຂອງການສຶກສາ:

- ຕົ້ນທຶນໃນການນຳໃຊ້ແກ๊ສຊີວະພາບ ສະເລ່ຍຕໍ່ຕົວຢ່າງແມ່ນ: 4,162,840 ກີບ. ຜົນປະໂຫຍດສ່ວນເພີ່ມທີ່ໄດ້ຮັບຈາກການນຳໃຊ້ແກ໊ສຊີວະພາບສະເລ່ຍຕໍ່ຕົວຢ່າງແມ່ນ 3,701,440 ກີບ.
- ອັດຕາສ່ວນລະຫວ່າງຜົນປະໂຫຍດ ກັບຕົ້ນທຶນຂອງການນຳໃຊ້ແກ໊ສຕໍ່ຕົວຢ່າງເທົ່າກັບ 5.61, ມູນຄ່າປະຈຸບັນສຸດທິຂອງການນຳໃຊ ແກ໊ສຊີວະພາບຕໍ່ຕົວຢ່າງເທົ່າກັບ 16,859,102.39 ກີບ ແລະ ອັດຕາຜົນຕອບແທນພາຍໃນຕໍ່ຕົວຢ່າງເທົ່າກັບ 90.90%. ໝາຍຄວາມວ່າ: ໃນຕົວຢ່າງທີ່ເຮົາສຶກສານັ້ນ ໂຄງການຕົວແບບແກ໊ສຊີວະພາບແຂວງສະຫວັນນະເຂດ ແມ່ນມີຄວາມຄຸ້ມຄ່າໃນການລົງທຶນ.
- ດ້ວຍລະດັບຄວາມເຊື້ອໝັ້ນ 95%, ການນຳໃຊ້ແກ໊ສຊີວະພາບ ຂອງປະຊາຊົນພາຍໃນແຂວງສະຫວັນນະເຂດ ແມ່ນເກີດມີຜົນປະໂຫຍດທີ່ໄດ້ຮັບຈາກການນຳໃຊ້ແກ໊ສຊີວະພາບ ສູງກ່ວາຕົ້ນທຶນຂອງການນຳໃຊ້ແກ໊ສຊີວະພາບຢ່າງແທ້ຈິງ.

22 February 2012 53

ພາກທີ 5: ສະຫຼຸບ ແລະ ການສະເໜີແນະ

5.2 ການສະເໜີແນະ:

1. ໂຄງການຕົວແບບແກ໊ສຊີວະພາບສູນກາງ - ແຂວງ - ເມືອງ ຮ່ວມມືກັບ ຂະແໜງການສົ່ງເສີມການປູກຝັງ - ລ້ຽງສັດຢ່າງຈິງຈັງ ໃນການນຳໃຊ້ກາກມູນລົ້ນຈາກບໍ່ແກ໊ສ ໃຫ້ເກີດຜົນປະໂຫຍດສູງສຸດ
2. ໂຄງການຕົວແບບແກ໊ສຊີວະພາບຂັ້ນໃດກໍ່ຕາມ, ຕ້ອງສົ່ງເສີມໃຫ້ປະຊາຊົນໄດ້ນຳໃຊ້ແກ໊ສຊີວະພາບໃຫ້ຖືກກຸ່ມເປົ້າໝາຍຢ່າງແທ້ຈິງ.
3. ຖ້ານັກສຶກສາທ່ານໃດ ທີ່ສົນໃຈກ່ຽວກັບຫົວຂໍ້ຂອງການສຶກສາດັ່ງກ່າວນີ້, ແມ່ນສະເໜີໃຫ້ມີການສຶກສາປຽບທຽບຕົ້ນທຶນ - ຜົນປະໂຫຍດທີ່ໄດ້ຮັບ ດ້ວຍການສຶກສາຈາກກຸ່ມສຶກສາ ກັບ ກຸ່ມປຽບທຽບຢ່າງຊັດເຈນ.

22 February 2012 54

Thanks for your Attention

22 February 2012

55

ສະເໜີຍໍ້ ການຈັດການຂີ້ເຫຍື່ອອີນຊີ ເພື່ອການບັນເທົາການປຽນແປງ ພູມອາກາດ ຢູປະເທດໄທ

ຣ.ສ. ອາລິສ ຊາບປ
ສະຖາບັນ ເຕັກໂນໂລຢີ ນາໆຊາດ ສິຣິນທອນ

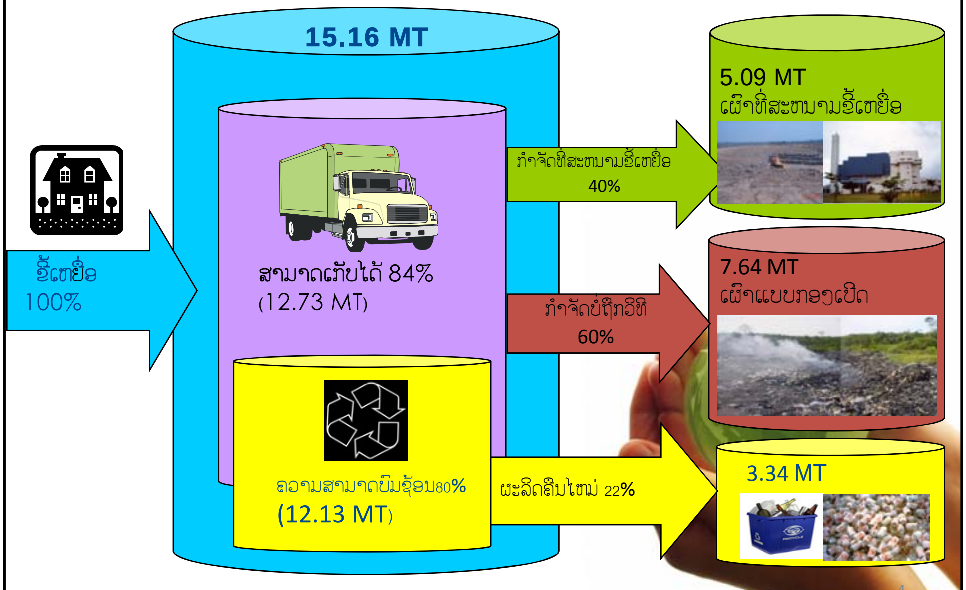
ສາລະບານ

- ສະຖານະພາບ ຂອງຂີ້ເຫຍື່ອ ແລະ ລະບົບການຈັດການຂີ້ເຫຍື່ອ
- ນະໂຍບາຍແຫ່ງຊາດ ແລະເປົ້າໝາຍຂອງການຈັດການຂີ້ເຫຍື່ອ
- ພາກປະຕິບັດຕົວຢ່າງ
- ການຫລຸດຜ່ອນການປ່ອຍແກສສູ່ເຮືອນແກ້ວ

ສະພາບການຜະລິດຂີ້ເຫຍື່ອ

ເນື້ອທີ່	ປະລິມານ ຂີ້ເຫຍື່ອ (ໂຕນ/ວັນ)				
	2003	2005	2006	2008 (PCD)	2009 (PCD)
ບາງກອກ	9,356	8,291	8379	8,780	8,834 (+0.6%)
ເທດສະບານ ແລະຕົວເມືອງພັດທະຍາ (2007 ຫ້ອງການ)	12,500	12,635	12,912	14,915	16,368 (+9.7%)
ເມືອງນ້ອຍອື່ນໆແລະ ຫ້ອງການບໍລິຫານເມືອງອື່ນໆ (5,770 ຫ້ອງການ)	18,100	18,295	18,697	17,369	16,208 (-6.68%)
ລວມ	39,956	39,221	39,988	41,064	41,410

ສະພາບການ ໃນການຈັດການຂີ້ເຫຍື່ອ

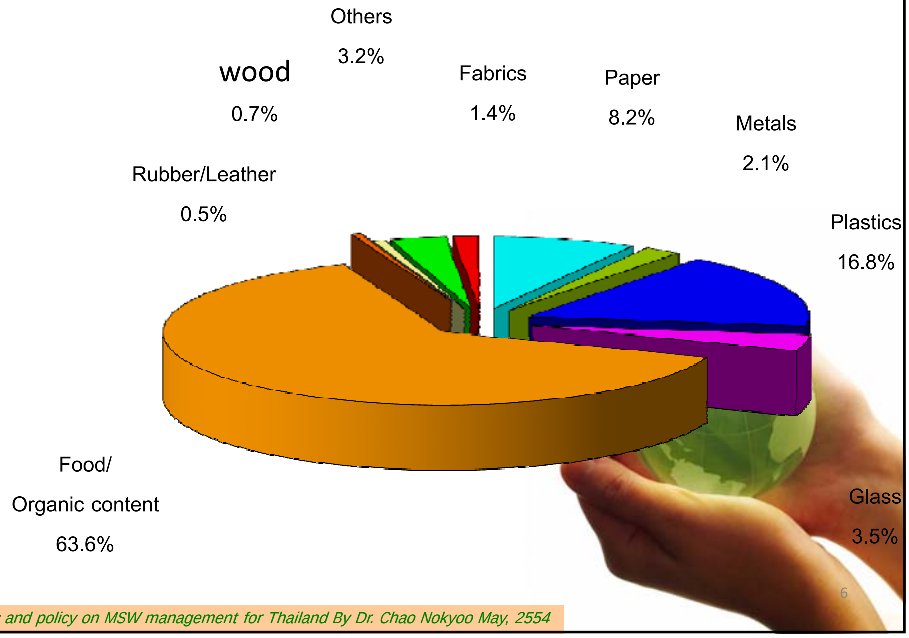


Status and policy on MSW management for Thailand By Dr. Chao Nokyoo May, 2554

ອົງປະກອບຂີ້ເຫຍື້ອ ຢູ່ພາກແຕກຕ່າງກັນ

ອົງປະກອບຂີ້ເຫຍື້ອ (% ຂອງນ້ຳໜັກປຽກ)	ພາກຕ່າງໆຂອງປະເທດໄທ					
	ເໜືອ	ກາງ	ຕາເວັນອອກສ່ຽງເໜືອ	ຕາເວັນອອກ	ໃຕ້	ສະເຫລ່ຍ
ອິນຊີ	59.71	62.56	67.53	67.53	57.65	61.43
ຂີ້ເຫຍື່ອຈາກສວນ	0.96	0.60	0.51	0.77	0.25	0.62
ຜະລິດໄຫມ່ໄດ້	24.06	20.43	20.21	21.61	26.73	22.61
ຂີ້ເຫຍື່ອອັນຕະລາຍ	0.05	0.34	0.14	0.37	0.19	0.22
ຂີ້ເຫຍື່ອອື່ນໆ	15.23	16.34	11.61	17.57	15.18	15.19
ລວມທັງຫມົດ	100	100	100	100	100	100
Waste Density (kg/m^3)	179.47	185.28	176.82	167.28	209.40	183.65

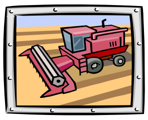
ອົງປະກອບຂອງຂີ້ເຫຍື້ອ



Status and policy on MSW management for Thailand By Dr. Chao Nokyoo May, 2554

ເຕັກໂນໂລຍີ ການຈັດການຂີ້ເຫຍື່ອປະຈຸບັນ

ສະໜາມຂີ້ເຫຍື່ອ



- ດຳເນີນການໄດ້ 94 ແຫ່ງ
- *ເຕັມແລ້ວ* 10 ແຫ່ງ
- *ບໍ່ສາມາດດຳເນີນການໄດ້ 6 ແຫ່ງ*
- Uກກຳລັງວາງແຜນຫລືກໍ່ສ້າງ**11** ແຫ່ງ

ເຕົາເຜົາ

ເທສະບານເມືອງພູເກດ	(250 T/ວັນ)
ເທສະບານເມືອງ ສະມຸຍ*	(140 T/ວັນ)
ລຳພູນ **	(10 T/ວັນ)
Kao Tao	(5T/ວັນ)

* ປິດເພື່ອຊ້ອມບຳລຸງຮັກສາ
** ປິດ

ລະບົບປະສົມະສານກັນ

ວຽງຟັງ	150 T/ວັນ
ຣະຍອງ	80 T/ວັນ
ຈັນທະບູລີ**	400 T/ວັນ
ເມໃສ	60 T/ວັນ

**ປິດ

ข้อมูล ณ เดือนพฤษภาคม 2554

7

Status and policy on MSW management for Thailand By Dr. Chao Nokyoo May, 2554

ການພະຍາກອນ ປະລິມານຂີ້ເຫຍື່ອ

ປີ	ອັດຕາພະລິດຂີ້ເຫຍື່ອ (ໂຕນ/ວັນ)	ປີ	ອັດຕາພະລິດຂີ້ເຫຍື່ອ (ໂຕນ/ວັນ)
2008	40,662.42	2016	42,105.87
2009	40,878.24	2017	42,251.20
2010	41,081.72	2018	42,390.82
2011	41,274.20	2019	42,525.18
2012	41,456.81	2020	42,654.65
2013	41,630.50	2021	42,779.57
2014	41,796.11	2022	42,900.26
2015	41,954.36		

Status and policy on MSW management for Thailand By Dr. Chao Nokyoo May, 2554

ແຜນງານນະໂຍບາຍ

- ນຳໃຊ້ 3Rs ເພື່ອບັນລຸ ການລຸດຜ່ອນຂີ້ເຫຍື່ອ & ການນຳໃຊ້;
- ສົ່ງເສີມລະບົບການຈັດການຂີ້ເຫຍື່ອແບບປະສົມປະສານ ເພື່ອລຸດຜ່ອນ ເນື້ອທີ່ຂອງສະໜາມຂີ້ເຫຍື່ອລົງ ແລະຜະລິດພະລັງງານທົດແທນ
- ເພີ່ມທະວີການຮ່ວມມືກັນ ກັບພາກລັດ ຢ່າງໃກ້ສິດ ເພື່ອສ້າງສິ່ງອຳນວຍໃຫ້ການຈັດຂີ້ເຫຍື່ອ
- ອະນຸມັດ ໃຫ້ສາທາລະນະຊົນ ແລະເອກຊົນ ເຂົ້າຮ່ວມໂຄງການການຈັດການຂີ້ເຫຍື່ອ

ນະໂຍບາຍ 1 ການຫລຸດຜ່ອນຂີ້ເຫຍື່ອລົງ (3Rs)

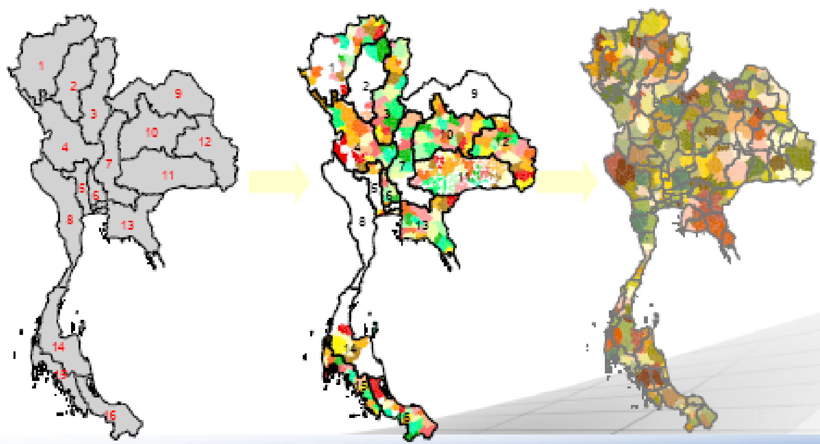
- ເປົ້າໝາຍຂີ້ເຫຍື່ອແຫ່ງຊາດ
- ການຫລຸດຜ່ອນຂີ້ເຫຍື່ອລົງ ບໍ່ໃຫ້ຕ່ຳກວ່າ 30%
  - ນຳໃຊ້ 3Rs
  - ສັນຫາສີຂຽວ
- ລະບົບການຈັດການຂີ້ເຫຍື່ອແບບປະສົມປະສານ
  - ການກຳຈັດຂີ້ເຫຍື່ອ ໃນທາງປະຕິບັດ ແບບວິສະວະກຳບໍ່ໃຫ້ຫລຸດ 40%
- ລະບົບການຈັດການຂີ້ເຫຍື່ອອັນຕະລາຍ
  - ຕ້ອງຈັດການຂີ້ເຫຍື່ອອັນຕະລາຍໃຫ້ຖືກວິທີ ຢ່າງໜ້ອຍບໍ່ໃຫ້ຫລຸດ 30%

ນະໂຍບາຍ 2 – ເຮັດໃຫ້ຂີ້ເຫຍື້ອ ກາຍເປັນພະລັງງານ

Reference on Policy Issues

ນະໂຍບາຍ 3 ການຈັດເຂດ ຂອງພາກລັດທ້ອງຖິ່ນ

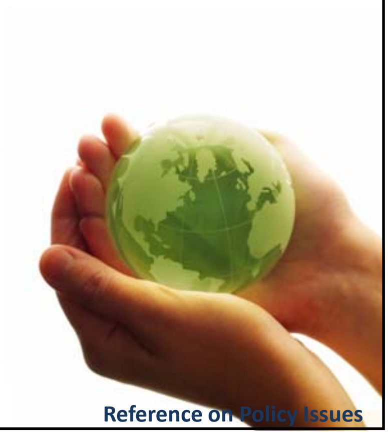
Supporting Local Government Clusters to obtain long-term effectiveness of waste management



Reference on Policy Issues

ເກນ ເພື່ອການຈັດແບ່ງເຂດ

ຂະໜາດຂອງເຂດ	ການຮັບພາລະຂີ້ເຫຍື່ອສູ່ລະບົບ ໂຕນ/ວັນ
ເຂດຂະໜາດໃຫຍ່	>500
ເຂດຂະໜາດກາງ	
M1	250 - 500
M2	100 - 250
M3	50 - 100
ເຂດຂະໜາດໜ້ອຍ	< 50



Reference on Policy Issues

ເຕັກໂນໂລຍີທີ່ເໝາະສົມ

L	Sorting + Bio-conversion Process + Incineration + Landfill
M1	Sorting + Anaerobic Digestion + Gasification/Pyrolysis/ Stoker Incineration + Landfill
M2	Sorting + Bio-conversion Process + Pyrolysis/ Gasification + Landfill
M3	Sorting + Bio-conversion Process + Pyrolysis/ Gasification + Landfill
S	Sorting + Bio-conversion Process + Landfill

Reference on Policy Issues

ນະໂຍບາຍ 4 – ພັດທະນາ ຫຸ້ນສ່ວນ

- ມີຫລາຍ ໂຄງການ ການຈັດການ ຂີ້ເຫຍື່ອ ຢູ່ປະເທດໄທ ໄດ້ຖືກນຳ ໄປປະຕິບັດໃຫ້ເກີດຜົນ ເນື່ອງ ມາຈາກ ການເປັນຫຸ້ນສ່ວນກັນລະຫວ່າງພາກ ລັດ ແລະພາກເອກຊົນ

ຂີ້ເຫຍື່ອຕົວເມືອງຕາມແບບທຳມະດາ

ຂີ້ເຫຍື່ອຕົວເມືອ

- ກອງໄວ້ແບບເປີດ
- ເຜົາແບບເປີດ
- ໃຊ້ເຕົາເຜົາ
- ສະໜາມຂີ້ເຫຍື່ອ

Status and policy on MSW management for Thailand By Dr. Chao Nokyoo May, 2554

ການຈັດການຂີ້ເຫຍື່ອແບບຮ່ວມກັນ: ການະໂອກາດ

ການຫລຸດຂີ້ເຫຍື່ອລົງ /ການແຍກ ຢູ່ບ່ອນຜະລິດ

ການນຳໃຊ້ ຂີ້ເຫຍື່ອ
- ການບົ່ມຝຸ່ນ
- ຂີ້ເຫຍື່ອເປັນພະລັງງານ
- ການແຍກຂີ້ເຫຍື່ອ

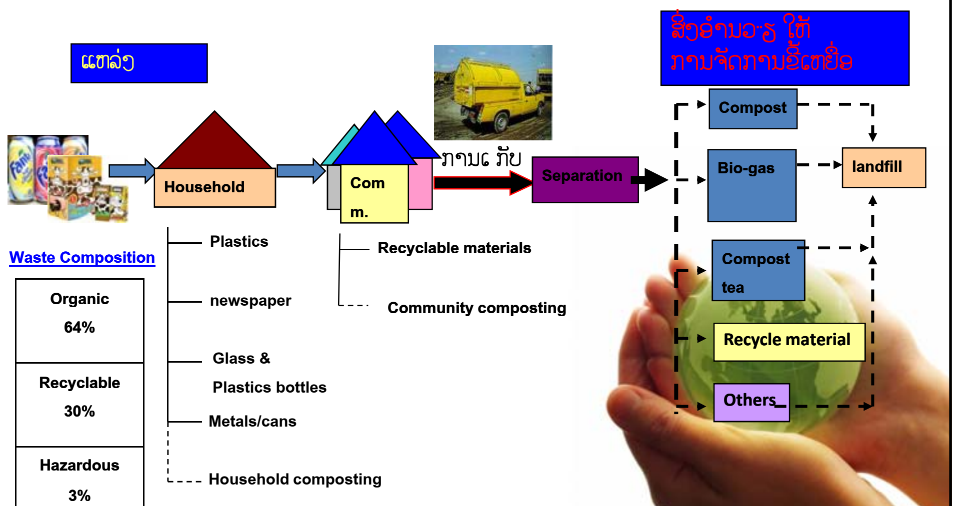
ກຳຈັດຂັ້ນສຸດທ້າຍ (ສະໜາມຂີ້ເຫຍື່ອ)

ວິທີດຳເນີນການປະຈຸບັນ
- ການຈັດການ ຂີ້ເຫຍື່ອ ແບບຂຸມຊົນເປັນຫລັກ
- ຂີ້ເຫຍື່ອ ເປັນພະລັງງານ
- ການຈັດການ ຂີ້ເຫຍື່ອ ແບບຮ່ວມກັນ

Status and policy on MSW management for Thailand By Dr. Chao Nokyoo May, 2554

17

ການຈັດການຂີ້ເຫຍື່ອ ແບບຂຸມຊົນ ເປັນຫລັກ



Waste Composition

Organic 64%
Recyclable 30%
Hazardous 3%
Others 3%

Status and policy on MSW management for Thailand By Dr. Chao Nokyoo May, 2554

18

ພິດສະນຸໂລກ - ການລິເລີ່ມ ການຈັດການຂີ້ເຫຍື່ອ

ຂີ້ເຫຍື່ອ -ເປັນພະລັງງານ

MSW 40,332 T/d

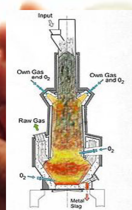
1. RDF 10,000 T/d

Or

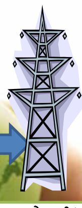
2. ການຜະລິດກະແສໄຟຟ້າ 400 MW

ເຕົາເຜົາ

AD



Gasification

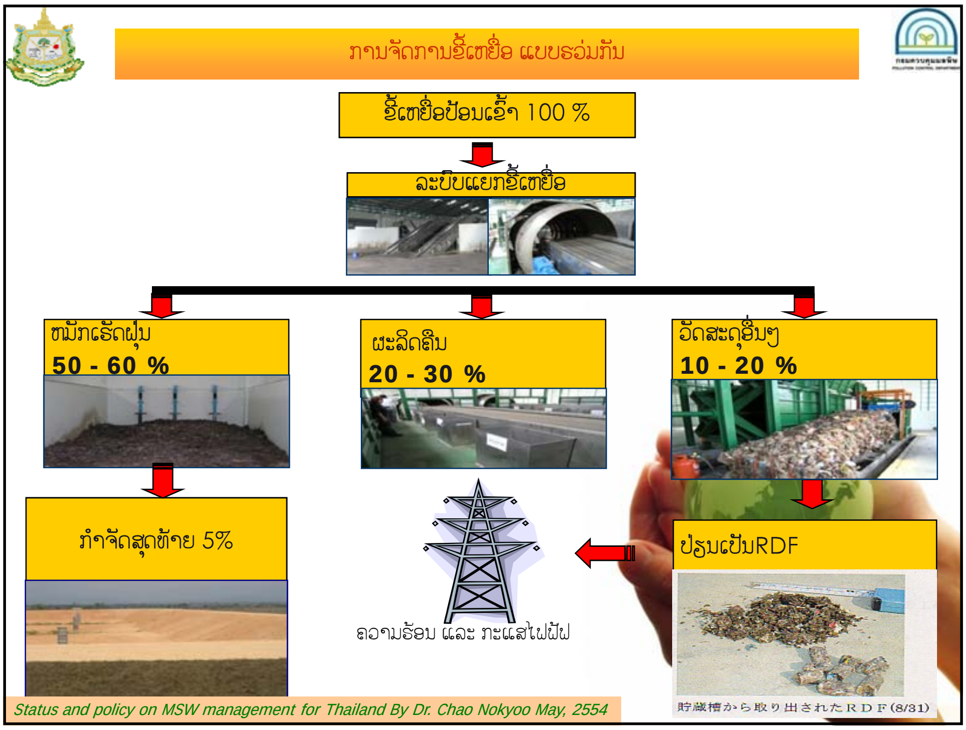


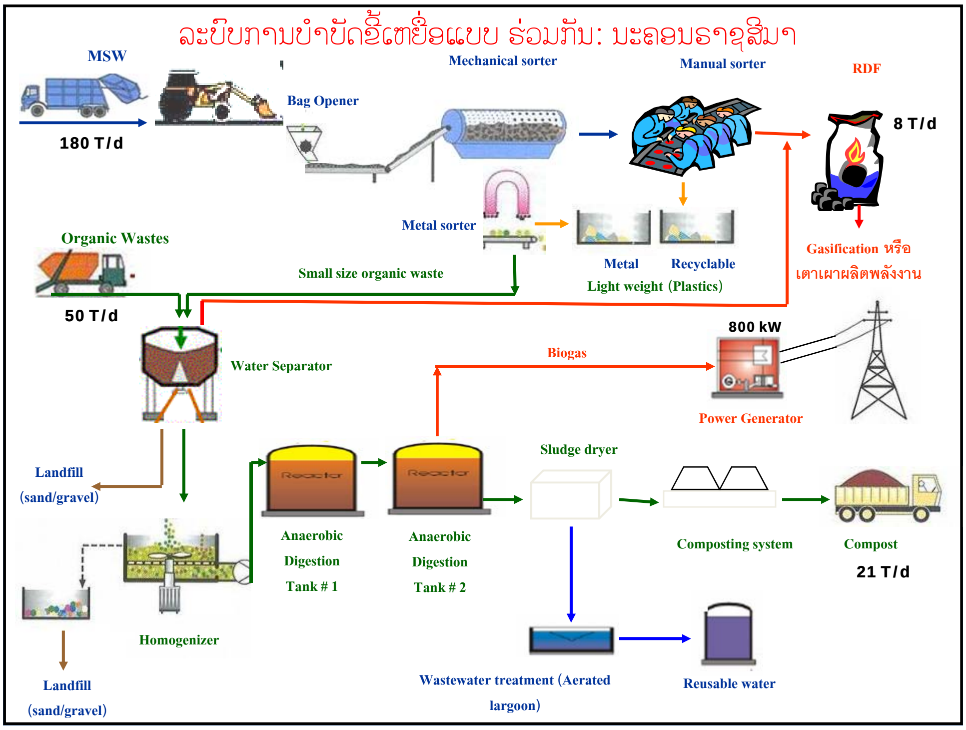
ກະແສໄຟຟ້າ

Expectation: 100T of MSW can generate 1 MW

Status and policy on MSW management for Thailand By Dr. Chao Nokyoo May, 2554


ໂຮງງານໄຟຟ້າຄວາມຮ້ອນ ຈາກຂີ້ເຫຍື້ອຕົວເມືອງ
3 ໂຮງງານ ໄຟຟ້າ ດໍາເນີນການຢູ່
4.075 MW
ໂຮງງານ ໄຟຟ້າ ກໍາລັງກໍ່ສ້າງ
2.02 MW
ເຕົາເຜົາ ຂີ້ເຍື້ອພູເກດ
2.5 MW
ແກສຊີວະພາບ ແລະ ຝຸ່ນໝັກທີ່ ຣະຍອງ
system 625 kW
ແກສຈາກ ສະໜາມຂີ້ເຫຍື້ອ ທີ່ ຣາຈາທີວາດ
950 kW
ແກສຊີວະພາບ ຈົນບູລີ
950 kW
ແກສຊີວະພາບ ເຂົາຊ້າງ
70 kW
ແກສຈາກ ສະໜາມຂີ້ເຫຍື້ອ ນະຄອນປະຖົມ 1 MW
Status and policy on MSW management for Thailand By Dr. Chao Nokyoo May, 2554

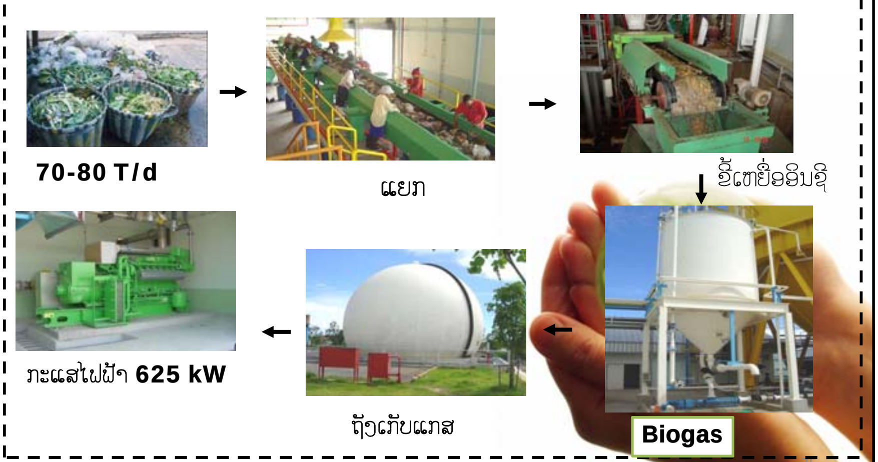

ການຈັດການຂີ້ເຫຍື້ອ ແບບຮ່ວມກັນ
ຂີ້ເຫຍື້ອປ້ອນເຂົ້າ 100 %
ລະບົບແຍກຂີ້ເຫຍື້ອ
ໝັກເຮັດຝຸ່ນ
50 - 60 %
ຜະລິດຄືນ
20 - 30 %
ວັດສະດຸອື່ນໆ
10 - 20 %
ກໍາຈັດສຸດທ້າຍ 5%
ຄວາມຮ້ອນ ແລະ ກະແສໄຟຟ້າ
ປ່ຽນເປັນRDF
貯蔵槽から取り出されたＲＤＦ(8/31)
Status and policy on MSW management for Thailand By Dr. Chao Nokyoo May, 2554



ລະບົບການບໍາບັດຂີ້ເຫຍື່ອແບບ ຮ່ວມກັນ: ນະຄອນຣາຊສີມາ
MSW
180 T/d
Bag Opener
Mechanical sorter
Manual sorter
RDF
8 T/d
Metal sorter
Metal
Recyclable
Light weight (Plastics)
Gasification หรือ
เตาเผาผลิตพลังงาน
Organic Wastes
50 T/d
Small size organic waste
Water Separator
800 kW
Biogas
Power Generator
Landfill
(sand/gravel)
Homogenizer
Anaerobic
Digestion
Tank # 1
Anaerobic
Digestion
Tank # 2
Sludge dryer
Composting system
Compost
21 T/d
Landfill
(sand/gravel)
Wastewater treatment (Aerated
largoon)
Reusable water

ລະບົບການຈັດການຂີ້ເຫຍື່ອ ຮ່ວມ ທີ່
ເທດສະບານວຽງຟັງ
150 T/d
ແຍກ
ວັດຖຸທີ່ຜະລິດໃໝ່ໄດ້
ບົ່ມຝຸ່ນ
Compost
ອັດເປັນກ້ອນ
Landfill
Status and policy on MSW management for Thailand By Dr. Chao Nokyoo May, 2554

ລະບົບການຈັດການຂີ້ເຫຍື້ອ ຮ່ວມ ທີ່ ເທດຣະຍອງ



Status and policy on MSW management for Thailand By Dr. Chao Nokyoo May, 2554

GHG Emission Inventory

Activity	Direct Emissions		Indirect Emissions	Avoided Emissions	Emission reducing Actions
	Gross emissions	Net emissions			
Collection & Transport	CO_2 from fuels consumption	CO_2 from fuels consumption	CO_2 from electric vehicles CO_2 from outsourced transport		-Use of electric vehicles -Use of alternative fuels -Change mean of transportation
Transfer	CO_2 from on-site fuels consumption	CO_2 from on-site fuels consumption	CO_2 from electricity consumption		-Actions to improve energy efficiency of equipments and facilities
Mechanical pre-treatment	CO_2 from on-site fuels consumption	CO_2 from on-site fuels consumption	CO_2 from electricity consumption		-Actions to improve energy efficiency of equipments and facilities
Sorting, recycling and recovering	CO_2 from on-site fuels consumption	CO_2 from on-site fuels consumption	CO_2 from purchased electricity consumption	-Avoided GHG in corresponding to the emission resulting from the production of an equivalent quantity of materials -CO_2 avoided through potential production of solid recovered fuels.	-Actions to improve sorting rate -Recovery of sorting rejects
Physico-chemical waste treatment	CO_2 from on-site fuels consumption	CO_2 from on-site fuels consumption	CO_2 from purchased electricity consumption	-CO_2 avoided through potential production of alternative fuels	-Actions to optimize alternative fuel production

Activity	Direct Emissions		Indirect Emissions	Avoided Emissions	Emission reducing Actions
	Gross emissions	Net emissions			
Biological treatment (Compost & AD)	-CO_2 form biomass -CO_2 from fuels consumption -CH_4 & N_2O	-CO_2 from on-site fuels consumption -CH_4 & N_2O	CO_2 from purchased electricity consumption	-CO_2 avoided through energy production -CO_2 avoided through compost use -CO_2 avoided through recovery of the heat produced	-Optimization of aerobic conditions for composting processes -Optimization of energy and/or material recovery
Landfill	-CH_4 from landfill gas -CO_2 from landfill gas -CO_2 from on-site fuels consumption	-CH_4 from landfill gas -CO_2 from on-site fuels consumption	CO_2 from purchased electricity consumption	-CO_2 avoided through energy production	-Optimization of CH_4 oxidation, capture and combustion -Optimization of energy recovery
Incineration	-CO_2 from waste -CO_2 from additional fossil fuels -N_2O	-CO_2 from waste -CO_2 from additional fossil fuels -N_2O	CO_2 from purchased electricity consumption	-CO_2 avoided through energy production -CO_2 avoided through slag and ash recycling	-Optimization of energy recovery
Mechanical Biological Treatment (MBT)	-CO_2 form biomass -CO_2 from fuels consumption -CH_4 & N_2O	-CO_2 from on-site fuels consumption -CH_4 & N_2O	CO_2 from purchased electricity consumption	-CO_2 avoided through energy production -CO_2 avoided through compost reuse -CO_2 avoided through material recovery -CO_2 avoided through potential production of alternative fuels	-Actions to improve sorting and compost quality -Optimization of energy and material recovery

ສາຍເຫດທີ່ພາໃຫ້ມີຜົນສຳເລັດ

- ການຜະລິດໃໝ່ສູງສຸດ
- ການຈັດການທີ່ດີ
- ເຕັກໂນໂລຍີ ມີປະສິດທິພາບ
- ລະບຽບຫລັກການຖືກຕ້ອງຊັດເຈນ
- ອະນຸມັດໃຫ້ພາກເອກກະຊົນສ່ວນ

ຂໍ້ສະເໜີແນະນຳ

- **ໂຮງງານ ແ** ຍກຂີ້ເຫຍື່ອ
- ຍົກລະດັບໂຮງງານຜະລິດຄືນໃໝ່
- ຂີ້ເຫຍື່ອໂຮງງານ ຜະລິດຄືນໃໝ່ ສຳລັບຂີ້ເຫຍື່ອເອເລັກໂຕຣນິກ
- ຂີ້ເຫຍື່ອໂຮງງານ ຜະລິດຄືນໃໝ່ ສຳລັບຂີ້ເຫຍື່ອປະເພດອັນຕະລາຍ
- **ໂຄງການແລກປ່ຽນ**ຂີ້ເຫຍື່ອ
- ຂີ້ເຫຍື່ອ ເປັນພະລັງງານ – ມີຄວາມສົນໃຈຫລາຍສຳລັບນັກວິໃຈ ແລະນັກລົງທຶນ (ພາຍໃນ ແລະ ຕ່າງປະເທດ) ໃນການຜະລິດພະລັງງານໄຟຟ້າ ແລະ ນ້ຳມັນ

29

ການບິ່ມຝ່ນແບບແຍກອອກເປັນພາກສວ່ນ ໃນການຈັດການຂີ້ເຫຍື່ອ

ບົດຮຽນ ຈາກ ເມືອງສຸລະບາຍປາ ອິນໂດເນເຊັຍ

D.G.J PREMAKUMARA

Policy Researcher, IGES

ຫົວນໍາສະເໜີ

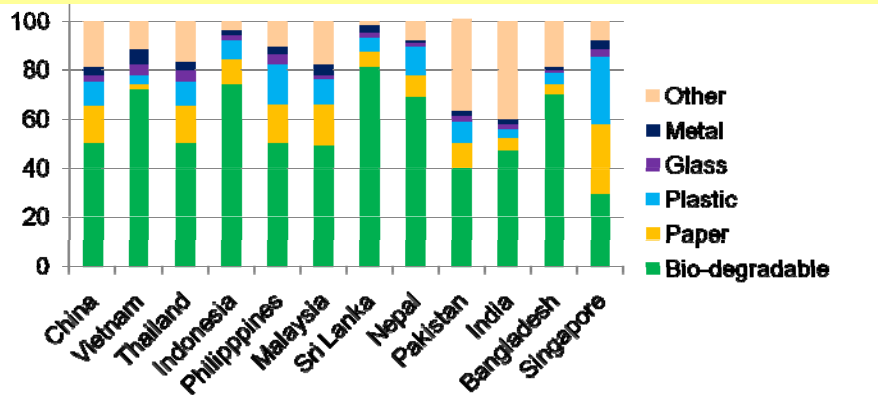
- ສະເໜີກ່ຽວກັບ ການບົ່ມຝົ່ນແບບແຍກເປັນພາກສ່ວນ ໃນການຈັດການຂີ້ເຫຍື່ອຕົວເມືອງ
- ສົນທະນາ ກໍລະນີສຶກສາ ສຸຣາບາຍປາ
- ກໍານົດຄວາສາມາດບົ່ມຊ້ອນແລະ ສິ່ງທ້າທາຍ ຕໍ່ການຫລຸດຜ່ອນ ການປ່ອຍແກສສູ່ເຮືອນແກ້ວໂດຍ ການບົ່ມຝຸ່ນແບບແຍກເປັນພາກສ່ວນ
- ສະຫຼຸບແລະສະເໜີ

ເມືອງທີ່ພວມພັດທະນາ ຢູ່ ອາຊີກຳລັງປະເຊີນຫນ້າກັບບັນຫາ ການກຳຈັດຂີ້ເຫຍື່ອ ເພື່ອໃຫ້ມັນເປັນມິດກັບສິ່ງແວດລ້ອມ

Most common disposal method is open dumping in environmentally unsafe manner. These practices can lead to environmental and health impacts on local residents, release GHG to atmosphere and discourage efficient use of resources.

ຄວາມບົ່ມຊ້ອນ ຂອງຂີ້ເຍື່ອຕົວເມືອງ ທີ່ບໍ່ສາມມາດຢຸດຍັ້ງໄດ້

ສະແດງໃຫ້ເຫັນໂດຍປະມານວ່າ ຫລາຍກວ່າເຄິ່ງຫນຶ່ງ ຂອງປະລິມານຂີ້ເຫຍື່ອ ທີ່ຜະລິດຂື້ນ ໃນປະເທດ ກຳລັງພັດທະນາ ອາຊີ ເປັນຂີ້ເຫຍື່ອອິນຊີ ຊຶ່ງມັນສາມາດ ບົ່ມເຮັດຝຸ່ນໄດ້ງາຍໆ ແຕ່ບໍ່ມີປະສິດທິພາບ



Source: Visvanathan (2006), APO (2007), Sang-Arun et al. (2011), Premakumara (2010)

ໂດຍວິທີ ການບົ່ມຝຸ່ນແບບພາກສ່ວນ

ໂດຍວິທີ ການບົ່ມແບບແຍກເປັນພາກສ່ວນນີ້ ຂີ້ເຫຍື່ອໄດ້ມາບົ່ມ ຢູ່ໃກ້ກັບ ແຫລ່ງຜະລິດ , ນໍາໃຊ້ເຕັກໂນໂລຢີ ທີ່ເຫມາະສົມກວ່າ, ຂະໜາດນ້ອຍ, ແຮງງານບໍ່ຫລາຍ, ມີການຍອມຮັບ, ດ້ານເສດຖະກິດ ແລ້ວສາມາດຈັບຈ່າຍໄດ້.

ການບົ່ມຝຸ່ນຈາກຂີ້ເຫຍື່ອຈາກະໜາມຫຍ້າ ຫລື ການບົ່ມຝຸ່ນ ແບບຄົວເຮືອນ (ເຫມາະສົມກັບຄອບຄົວທີ່ມີລະດັບຄວາມສໍານຶກສູງ ສໍາລັບການບົ່ມ ແລະມີສວນຄົວສໍາລັບວາງຖັງບົ່ມ ແລະນໍາໃຊ້ຜະລິດຕະພັນ

ການບົ່ມແບບລວມສູນຂອງຊຸມຊົນ (ປົກະຕິເປັນລະບົບນ້ອຍ ແລະ ຮວ່ມກັນ ກັບ ລະບົບເກັບຂີ້ເຍື່ອຂອງທີ່ພັກອາໃສ. ຂີ້ເຫຍື່ອແມ່ນຖືກແຍກໃນບ່ອນຜະລິດ ຫລື ພາຍຫລັງການເກັບ ໂດຍຂຶ້ນກັບ ລະດັບການລິເລີ່ມຂອງຊຸມຊົນນັ້ນ

ສົມທຽບກັນລະຫວ່າງ ກາບົ່ມແບບລວມສຸນ ແລະແບບແຍກເປັນພາກສ່ວນ

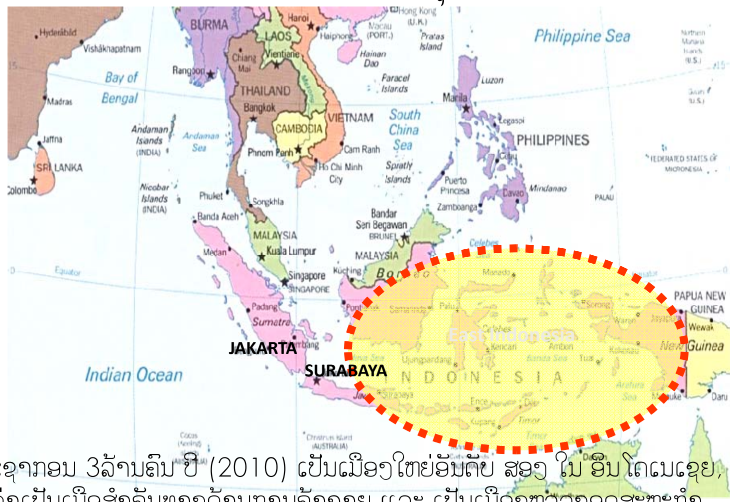
ແຍກເປັນພາກສ່ວນ

- ເຕັກໂລຢີຕ່ຳ ແລະງ່າຍດາຍ
- ແຮງງານປະຈຳ
- ລົງທຶນນ້ອຍ
- O&M ນ້ອຍ
- ການຂົນສົ່ງນ້ອຍ
- ປະສານກັບເພື່ອນບ້ານ
- ສນອງງານທໍາຈໍານວນໜຶ່ງ
- ປູກຝັງຈິດສໍານຶກ
- ອິນຊີຈາກ ຟາມໃກ້ຄຽງ

ລວມສຸນ

- ເຕັກນິກສູງ
- ແຮງງານນອ້ຍ
- ລົງທຶນສູງ
- O&M ສູງ
- ການຂົນສົ່ງສູງ
- ມີການປະສານ້ອຍ
- ກົນໄກໃຫຍ່
- ຈິດສໍານຶກສວ່ນບຸກຄົນ
- ທັງໝົດ ແມ່ນເພື່ອຂາຍ

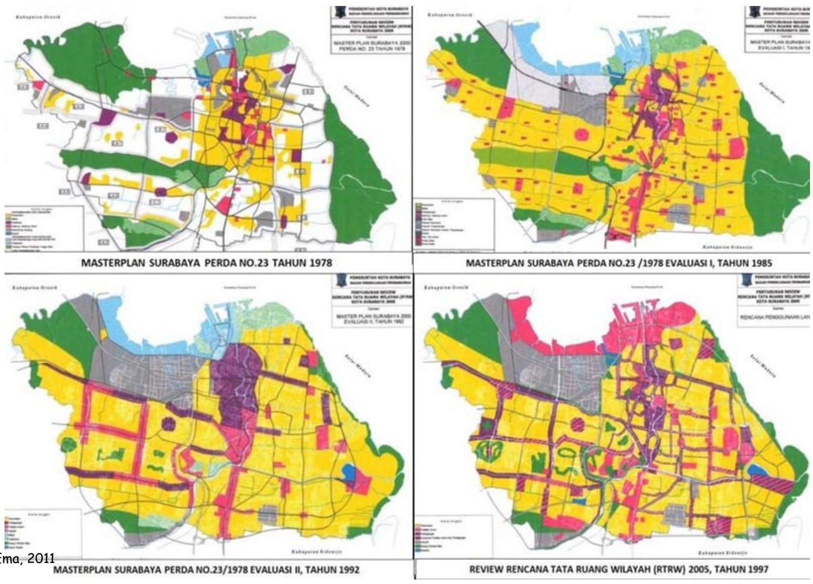
ກໍລະນີສຶກສາ ເມືອງສຸຣະບາຍປາ



ປະຊາກອນ 3ລ້ານຄົນ ປີ (2010) ເປັນເມືອງໃຫຍ່ອັນດັບ ສອງ ໃນ ອິນໂດເນເຊຍ, ຖືວ່າເປັນເມືອສຳຄັນທາງດ້ານການຄ້າຂາຍ ແລະ ເປັນເມືອງຫລວງອຸດສະຫະກຳ ໃນພາກຕາເວັນອອກ

Source: Ema, 2011

ການຂະຫຍາຍຕົວເມືອງອອກໄປ ໂດຍການພັດທະນາຕົວມືອງ



Source: Ema, 2011

ສອງລະບົບປົນກັນ ໃນການຈັດການຂີ້ເຫຍື່ອ ຕົວເມອງ ສຸຣາໄບຍາ(ຮັບຜິດຊອບການເກັບ ໂດຍຊຸມຊົນ ກົດໝາຍ ປີ 1980

ຄວາມຮັບຜິດຊອບຂອງຊຸມຊົນ (ກຳປົງ)ໃ ການເກັບຂີ້ເຫຍື່ອ ແມ່ ຈັດຕັ້ງ ໂດຍອົງກອນຂອງຊຸມຊົນ. ຜູ່ຢູ່ອາໃສຕ້ອງຈ່າຍຄ່າເກັບຂີ້ເຫຍື່ອ

ຮັບຜິດຊອບຂອງພະແນກການອະນາໄມ ແລະ ການຮັກສາພື້ນທີ່ດິນໃ ຜູ່ຢູ່ອາໃສຈ່າຍເງິນຄ່າ ເກັບຂີ້ເຫຍື່ອ

ຂີ້ເຫຍື່ອຕົວເມືອງການເປັນບັນຫາທີ່ສຳຄັນຍິງ ຂອງເມືອງ ສຸລາບາຍປາ

- ການຜະລິດຂີ້ເຫຍື່ອທັງໝົດ ແມ່ນ 1,800 ໂຕນຕໍ່ວັນ ປີ2004 (ທີ່ພັກອາໃສ 68%, ຕະລາດ 16%, ສຸການຄ້າ/ອຸດສະຫະກຳ 11%, ຖະນົນ ແລະບ່ອນຫວ່າງ 5%)
- ການເກັບຂີ້ເຫຍື່ອຂອງເມືອງ ໄດ້ແຕ່ 70% ເຫລືອນັ້ນ ຖີ້ມໄວ້ຕາມ ຖະນົນ,ຄອງນ້ຳ, ແລະບອ່ນຫວ່າງ.
- ສະໜາມບຳບັດແຫ່ງສຸດທ້າຍ ເກພຸດຕີ ແມ່ນໄດ້ປິດໃຊ້ ແຕ່ປີ 2001 ສາຍເຫດຍ້ອນ ການຕ້ານຂອງສັງຄົມ ແລະ ມີແຕ່ ສະໜາມສຸດທ້າຍ ຢູ້ ເບນ ໂນວາ ກໍລົ້ນຂີດຄວາມສາມາດແລ້ວ, ຜລະຈະຊອກແຫ່ງໃໝ່ ກໍຍາກຫລາຍເພາະວ່າ ດິນສາທາລະທາຍາກ
- ສະໜາມກຳຈັດ ບໍ່ໄດພັດທະນາດີ, ຜລະ ການຈູດ ການກອງ ຂີ້ເຫຍື່ອ ເປັນການນຳມາປະຕິບັດກັນທົ່ວໆໄປ

ຊຸມຊົນຕົວແບບ ຢູ່ ກໍາໂປງຣັງກຸດລໍ ໄດ້ພັດທະນາພາຍໃຕ້ ການຮ່ວມມືທາງເຕັກນິກ ຂອງ ເມືອງກິຕາກິອູຊຸ ຍີ່ປຸ່ນ

ສຶກສາໃຫ້ແມ່ຍິງ ຮູ້ເຮັດຫລະກິດຂີ້ເຫ ຍື້ອຜະລິດຄືນໃຫມ່

ສຶກສາໃຫ້ປະຊາຊົນຮູ້ແຍກຂີ້ເຫຍື້ອກອ່ຖີ້ມ ແລະການບົ່ມຝຸ່ນ

ສຶກສາໃຫ້ປະຊາຊົນເລີ່ມເຮັດຟາມອິນຊີ ຢູ່ເຮືອນຫລືຊຸມຊົນ

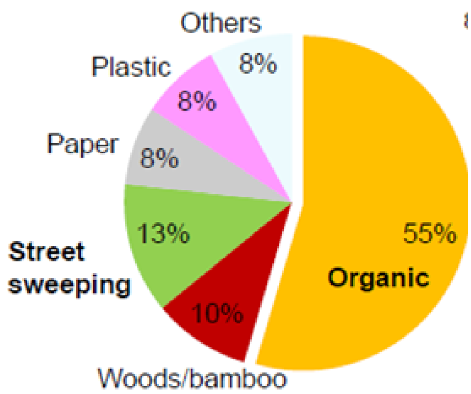
Model community for community based SWM (200 H/H)

ເກັບຂີ້ເຫຍື້ອຈາກຄົວເຮືອ ນ ແຍກຕ່າງຫາກ

ສ່ວນເຫລືອ ຂາຍຢູ່ຕະລາດ

ຂີ້ເຫຍື່ອຖືກບໍາບັດຢູ່ ສູນບົ່ມຝຸ່ນ

ພັດທະນາຍຸດທະສາດ SWM ອີງໃສ່ ຜົນສໍາເລັດ ຂອງຊຸມຊົນຕົວແບບ ພາຍໃຕ້ ການສະໜັບສະໜູນຂອງນາຍຍົກເທສະມົນຕີ



Source: KITA, 2002.

ຂີ້ເຫຍື່ອອິນຊີມີປະລິມານກວມເອົາ ເຄິ່ງໜຶ່ງ ຂອງ ຂເຫຍື້ອທັງໝົດ

ໃຫ້ບຸລິມະສິດ ການລຸດຜ່ອນຂອງຂີ້ເຫຍື່ອອິນຊີລົງ

ສົ່ງເສີມການບົ່ມຝຸ່ນແບບແຍກເປັນພາກສ ວ່ນ.

- ການແຍກຂີ້ເຫຍື່ອຢູ່ແຫລ່ງຜະລິດ
- ການບົ່ມຝຸ່ນຢູ່ເຮືອນ
- ສູນບົ່ມຝຸ່ນ
- ສົ່ງເສີມ ຜະລິດຕະພັນທີ່ ຜະລິດຄືນໃຫມ່ ປະສົມປະສານ ກັບພາກສ່ວນອື່ນໆ

ການປູກຝັງຈິດສຳນຶກຂອງສັງຄົມ

Counseling activities

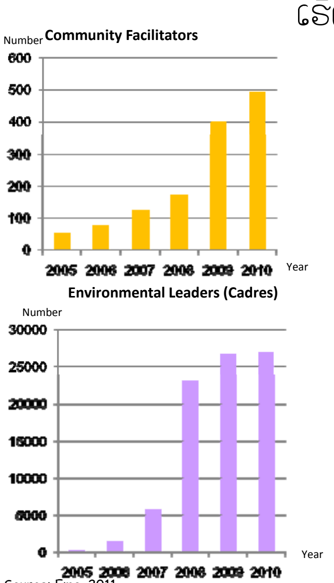
ອົບຮົມນັກຮຽນ | ອົບຮົມໃຫ້ ພາກທຸລະກິດ | ອົບຮົມໃຫ້ຊຸມຊົນ | ອົບຮົມໃຫ້ພະນັກ ງານຫ້ອງການ

Environmental campaign

Socialization in school

Source: Ema, 2011

ຮັບສະໝັກເອົາພະນັກງານອຳນວຍຄວາມສະດວກດ້ານຕ່າງໆ ແລະຫົວໜ້າການຈັດຝຶກອົບຮົມ ສະພາບແວດລ້ອມ ເພື່ອເຄື່ອນໄຫວ ເຮັດວຽກ ຕາມຊຸມຊົນຕ່າງໆ



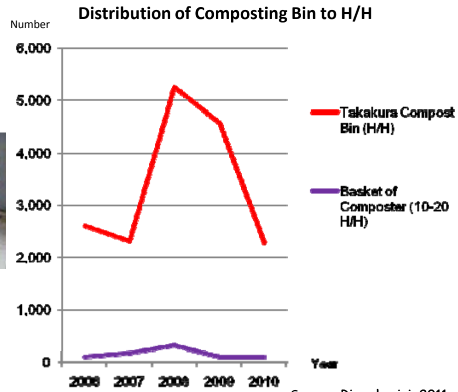
Source: Ema, 2011

Developed training materials for awareness raising

Source: Rismaharini, 2011

ສະໜັບສະໜຸນ ການເລີ້ມຕົ້ນໂຄງການການບົ່ມຝຸ່ນ

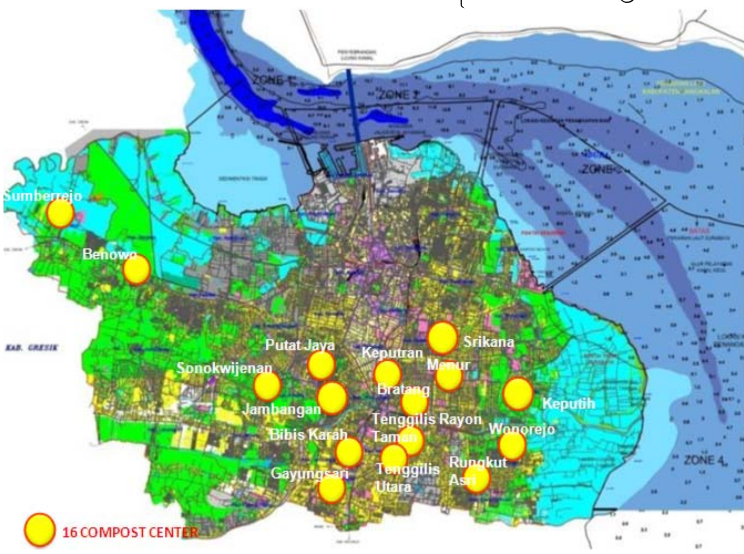
ແຈກຢາຍຖັງບົ່ມຝຸ່ນ ເຮັດໃຫ້ເຂົ້າຮ່ວມ
ການຝຶກ ປະຊາຊົນ ສມັກໃຈ 20,000 ຄຄ



Source: Rismaharini, 2011

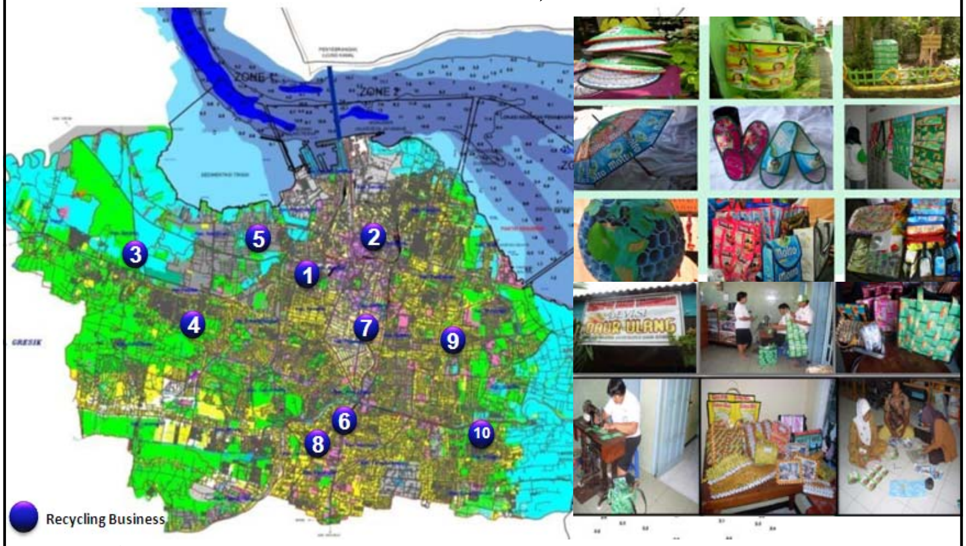
ສະໜອງສິ່ງທີ່ຈຳເປັນ ເພື່ອເຮັດໃຫ້ ສາມາດເລີ້ມ
ເປັນສູນບົ່ມຝຸນຂອງຊຸມຊົນ: ເຄື່ອງທຳຄວາມສະອາດ,
ເຄື່ອງມືບົ່ມຝຸ່ນ,, ທີ່ດິນແລະຕົ້ນທຶນ ເພື່ອກໍ່ສ້າງ ແລະ
ຊື້ ຜະລິດຕະພັນ ຝຸ່ນໝັກ ເພື່ອຕົວເມືອງສີຂຽວ

ຂະຫຍາຍ ສູນບົ່ມຝຸ່ນອອໄປໃຫ້ທົ່ວເມືອງ (16 ສູນ
ສາມາດບຳບັດຂີ້ເຫຍື່ອອິນຊີໃນຕົວເມືອງ ໄດ້110ໂຕນ



Source: Ema, 2011

ສົ່ງເສີມຜະລິດຕະພັນຈາກການຜະລິດຄືນໃຫມ່ຂອງບ້ານ ໂດຍສົມທົບແບບພິເສດກັບທຸລະກິດພາກເອກຊົນ

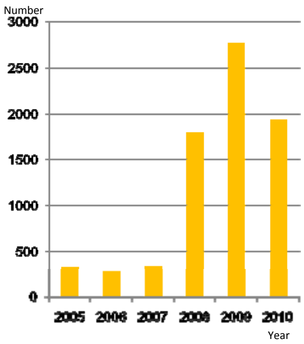


Source: Rismaharini, 2011

ສ້າງໃຫ້ມີລາງວັນ ແລະການປະຕິບັດລະບຽບ ເພື່ອຊຸກຍູ້ໃຫ້ມີການເຂົ້າຮ່ວມຫລາຍຂຶ້ນ

- ມອບລາງວັນໃຫ້ແກ່ ຊຸມຊົນໃດທີ່ສມັກໃຈເຂົ້າຮ່ວມ ໂຄງການ ເມືອງສຸຣາບາຍາ ສີຂຽວ ແລະ ສະອາດ
- ມອບລາງວັນໃຫ້ແກ່ ຜູ່ນໍາພາສະພາບແວດລ້ອມ ທີ່ເອົາໃຈໃສ່ ໃນວັນມອລາງວັນແຫ່ງຊາດ

, ຈໍານວນຜູ່ເຂົ້າຮ່ວມ ໂຄງການເພີ່ມຂຶ້ນ



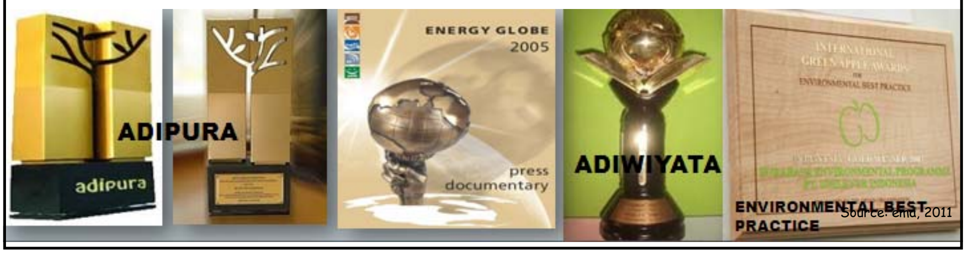
Source: Ema, 2011

ປະຕິບັດລະບຽບກົດໝາຍຢ່າງເຄັ່ງຄັດ ຕໍ່ ຜູ່ ບໍ່ປະຕິບັດການເກັບມ້ຽນຂີ້ເຫຍື້ອ

ການຈູງໃຈພະນັກງານ ແລະ ນັກການເມືອງທ້ອງຖິ່ນ

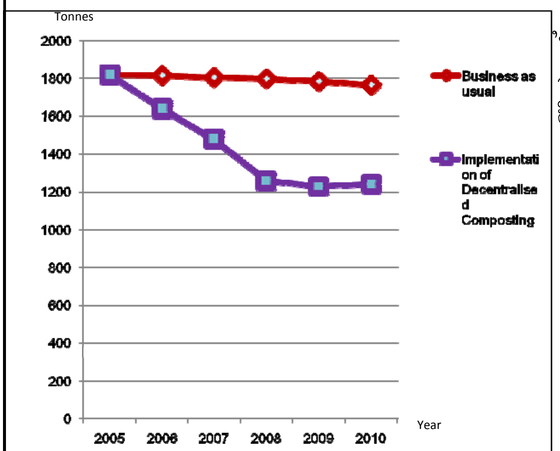
- ການກໍ່ສ້າງບຸກຄະລາກອນ (ພາຍໃນ ແລະ ຕ່າງປະເທດ) ສໍາລັບ ພະນັກງານ ແລະນັກການເມືອງທ້ອງຖິ່ນ

ຮັບຮອງ ຄວາມພະຍາຍາມ ຄວາມສາມາດ ທາງພາຍໃນແລະຕ່າງປະເທດ



Source: Ema, 2011

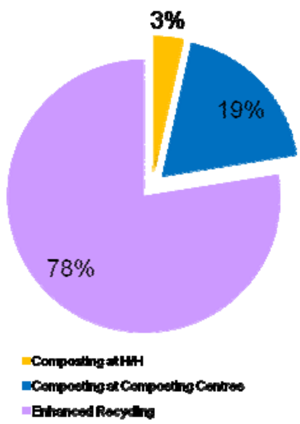
ປະສົບຜົນສໍາເລັດ: ລຸດຜ່ອນຂີ້ເຫຍື່ອທີ່ຈະນໍາໄປບໍາບັດຂັ້ນສຸດທ້າຍໄດ້



Source: Ema, 2011

- 30% ຂີ້ເຫຍື່ອໄດ້ລຸດລົງ ທີ່ຈະບໍາບັດ ຢູ່ສະໜາມຂີ້ເຫຍື່ອ

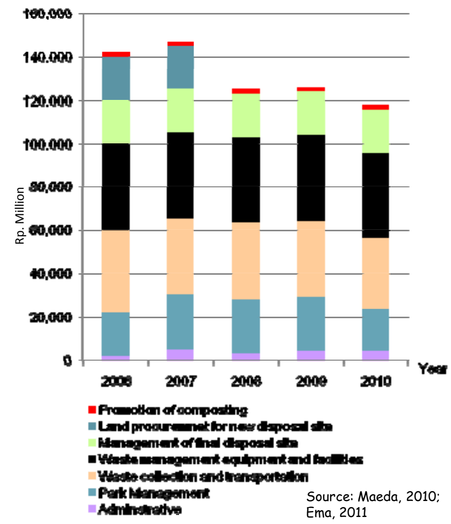
- ສົ່ງເສີມການຜະລິດຄືນໃຫມ່ ໃຫ້ຫລາຍຂື້ນ ໂດຍການແຍກເອົາສິ່ງທີ່ເປັນອິນຊີອອກ ຈາກຂີ້ເຫຍື່ອລວມ (78% ຂອງຂີ້ເຫຍື່ອທີ່ລຸດລົງຈາກຂີ້ເຫຍື່ອຜະລິດຄືນໃໝ່)



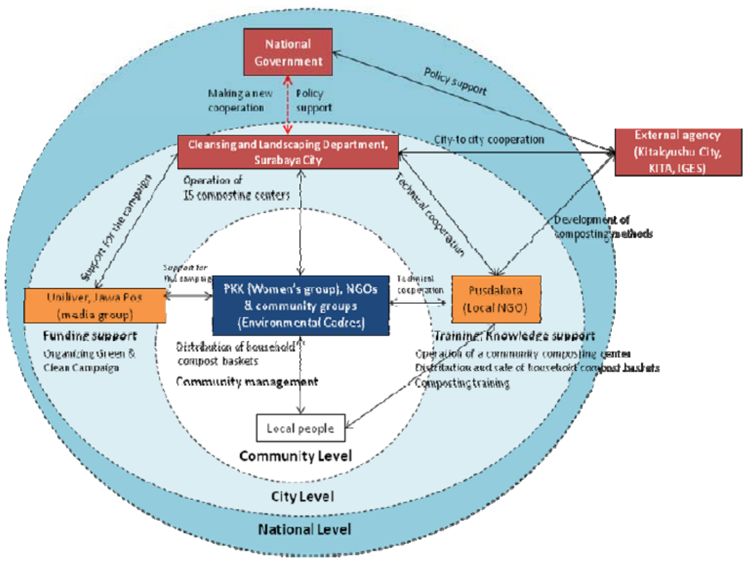
ການຫລຸດຜ່ອນຂີ້ເຫຍື້ອລົງ 30% ໂດຍການກຳຈັດການນຳໃຊ້ງົບປະມານເທສະບານ

NO	BUDGET	BUDGET 2009	%	2010	%	NOTES
1.	Total budget	4.364.366.780.398	100 %	4.383.712.427.048	100 %	
2.	Environmental budget		4.7 %		4.6 %	
	Sea, Fishery and Farming Development Program	35.334.139.497	0,8%	23.405.280.994	0,5 %	Farming Dept.
	Environment Control and Conservation Program	11.430.786.532	0,3%	13.918.825.429	0,3 %	Bappeko, Farming, Transportation, Environment
	Green Open Space and City Park Program	40.652.921.024	0,9%	58.200.507.958	1,3 %	Farming, Spatial and Cleaning Dept.
	City Cleanliness Management Program	118.486.923.877	2,7%	105.705.809.320	2,4 %	31 district, Cleaning Dept

Only 1-2% of Cleaning and Landscape Department Budget is used for composting



ສ້າງຜູ້ມີສ່ວນຮ່ວມ ທັງພາກສະທາລະນະ, ເອກຊົນ ແລະ ຊຸມຊົນ



ຖອດຖອນບົດຮຽນ: ຜົນສຳເລັດ ການພັດທະນາແບບຍືນຍົງ

- ການບົ່ມຝຸ່ນແບບແຍກເປັນພາກສ່ວນ ທຸກເທື່ອ ຈະຕ້ອງໄປຄຽງຄູ່ກັບ ການບໍລິການກຸ້ມເກັບຂີ້ເຫຍື້ອ, ຊຶ່ງເປັນການປັບປຸງການປະຕິບັດ ຂອງ ການ ບໍລິການ ການເກັບຂີ້ເຫຍື້ອ ເທສບານ ລວມທັງການສະພາບສຸຂະອນາໄມ ໃນເຂດ ການບໍລິການນັ້ນອີກດ້ວຍ
- ການບົ່ໃ"ມຝຸ່ນແບບແຍກເປັນພາກສ່ວນ ສະກັດກັ້ນ ພາກສ່ວນ ອິນຊີ ທີ່ເປັນສ່ວນ ທີ່ໃຫຍ່ ໃນປະລິມານຂີ້ເຫຍື້ອຕົວເມືອງ, ໃກ້ກັບແຫລ່ງຜະລິດ, ລຸດຜ່ອນຕົ້ນທຶນ ການຂົນສົ່ງ, ຍືດອາຍຸການຂອງສະໜາມຂີ້ເຫຍື້ອ, ສົ່ງເສີມໃຫ້ ການຜະລິດຄືນໃໝ່
- ແບບແຜນຂອງການບົ່ມຝຸ່ນແບບແຍກເປັນພາກສ່ວນ ງ່າຍໃນການຈະລິເລີ້ມ ບໍ່ຕ້ອງການການລົງທຶນສູງ. ແທນທີ່ຈະຕັ້ງເປັນໂຮງງານແບບລວມສູນໃຫຍ່ໆ ແບບແຍກເປັນພາກສ່ວນ ສາມາດກໍ່ຕັ້ງເປັນສ່ວນນ້ອຍຫລາຍ ແຫ່ງໃຊ້ເວລາຫລາຍໆປີ ແລະໃຊ້ທຶນແຈກຢາຍໄປແຕ່ລະປ
- ມີຂະໜາດພ້ອຍຕ້ອງການບ່ອນຕັ້ງນ້ອຍ, ການບົ່ມຝຸ່ນແບບແຍກເປັນພາກສ່ວນ ມີຄວາມຍືດຢຸ່ນ ໃນການຈັດການແລະການດຳເນີນການ ແລະ ສາມາດຮອງຮັບກັບ ການປ່ຽນແປງ ຄວາມຕ້ອງການຂອງທ້ອງຖິ່ນໄດ້ດີ

ຖອດຖອນບົດຮຽນ: ຜົນສຳເລັດ ການພັດທະນາແບບຍືນຍົງ (ຕໍ່)

- ການບົ່ມຝຸ່ນແບບແຍກເປັນພາກສ່ວນ ສະໜອງໃຫ້ມີການຈ້າງງານ ແກ່ ເພື່ອນບ້ານ ທີ່ເປັນຄົນງານ ທີ່ເຂົ້າໃຈເຕັກໂນໂລຢີໄດ້ງ່າຍ ທີແທດເຫາະກັບ ສະພາບເສດຖະກິດ-ສັງຄົມ ຂອງທ້ອງຖິ່ນນັ້ນ. ມັນເປັນການ ສະໜອງໂອກາດ ໃຫ້ມີລາຍຮັບທີ່ໃໝ່ ແລະຮັບປະກັນ ໂດຍສະພາະແລ້ວໃນເຂດ ທີ່ທຸກຍາກ ທຳງານກັບບ່ອນທີ່ບໍ່ໝັ້ນຄົງ
- ກິດຈະກຳ ແລະ ການພົວພັນ ກັບ ຊຸມຊົນ ໃນການຖືຂີ້ເຫຍື່ອ, ສຸຂາອະນາໄມ, ການທຳຄວາສະອາດ, ແລະ ສະພາບແວດລ້ອມ ຂອງ ການບົ່ມຝຸ່ນແບບແຍກອອກເປັນພາກສ່ວນ ສາມາດສົ່ງເສີມໃຫ້ ມີຄວາມສະມັກໃຈໃນຊຸມຊົນ ແລະ ຕົ້ນທຶນຂອງສັງຄົມມີຄວາມເຂັ້ມແຂງ

ບັນຫາ ແລະ ສິ່ງທ້າທາຍໃຫ້ການບົ່ມຝຸ່ນແບບ ແຍກເປັນພາກສ່ວນ

ບັນຫາທາງສັງຄົມ

- ແຍກຂີ້ເຫຍື່ອ ຢູ່ແຫລ່ງຜະລິດ
- ສະໜັບສະໜູນຈາກ ຜູ່ນໍາຊຸມຊົນ, ກຸ່ມສະມາຄົມ ໂຍທາ ແລະ ຄອບຄົວ
- ເຮັດການຈູງໃຈໃຫ້ແກ່ຊຸມຊົນ
- ຈູງໃຈໃຫ້ ຟາມຫັນມາໃຊ້ຝຸ່ນໝັກແທນປຸ໋ຍເຄມີ

ບັນຫາທາງການເງິນແລະ ການຕະລາດ

- ຂາດເງິນບໍາລຸງ
- ຄ່າແຮງງານ ການສ້ອມບໍາລຸງ ພຽງແຕ່ໄດ້ຈາກການຂາຍ ຝຸ່ນ
- ຂາຍລະບົບການຈ່າຍຂອງຜູ່ຊົມໃຊ້
- ການປັບການທໍາງານ ຂອງ O&M
- ຄວາມຕ້ອງການຂອງຕະລາດນ້ອຍ ບໍ່ພຽງພໍ
- ຄຸນະພາບຕໍ່າແລະ ແຂ່ງຂັນກັບປຸຍເຄມີ

ບັນຫາທາງເຕັກນິກ

- ຂາດບຸກຄະລາກອນ /ສະຖາບັນ ທີ່ສາມາດໃຫ້ຄວາມຮູ້ ວິທີ ການບົ່ມຝຸ່ນ
- ຂາດແຄນຄວາມເອົາໃຈໃສ່ ແລະຄວາຫຮູ້ ກ່ຽວກັບຂະບວນການທາງອິນຊີ
- ຂາດການປະກັນຄຸນນະພາບ ແລະ ມາດຕາຖານຮອງບົ່ມຝຸ່ນ

ບັນຫາ ສະຖາບັນ ແລະ ນະໂຍບາຍ

- ຂາດນະໂຍບາຍ,ຄູ່ມືແນະນໍາຫລັກການ,ແລະ ກົດລະບຽບໃນການບົ່ມຝຸ່ນ
- ຂາດການຮວກັນລະຫວາງ ການຈັດການຂີ້ເຫຍື່ອຕົວເມືອງ
- ບໍ່ມີການຈັດແຈງສະຖາບັນ ແລະການປະຕິບັດທີ່ແນ່ນອນ
- ນະໂຍບາຍປ່ຽນແປງເລື້ອຍໆ ເປັນນະໂຍບາຍບໍ່ຄົງ
- ຂາດການສະໜັບສະໜຸນ ຈາກຜູ່ນໍາຕົວເມືອງແລະພະນັກງານຂອງພະແນກກ່ຽວຂ້ອງ

ຄວາມຕ້ອງການເບື້ອງຕົ້ນ ຂອງການບົມຝຸ່ນແບບແຍກເປັນສ່ວນ

- ຄວາມຕ້ອງການເບື້ອງຕົ້ນ ຂອງການບົມຝຸ່ນແບບແຍກເປັນສ່ວນ ບໍ່ແມ່ນງົບປະມານຢ່າງດຽວ ແຕ່ມັນຕ້ອງການ ການປ່ຽນແປງນະໂຍບາຍແລະຍຸດທະສາດ ໃນການຈັດການຂີ້ເຫຍື່ອ ຂອງອໍານາດທ້ອງຖິ່ນ ແລະການປ່ຽນແປງ ຊຸດແນວຄິດຂອງ ນັກການເມືອງ ພະນັກງານ ຫົວໜ້າຫ້ອງການ
- ການບົມຝຸ່ນແບບແຍກເປັນສ່ວນ ຄວນເປັນສວ່ນຮວ່ມກັບ ຍຸດທະສາດ ການຈັດການຂີ້ເຫຍື່ອ ດີກວ່າ ຈະເປັນໂຄງການໂດດດ່ຽວ
- ມັນຕ້ອງການ ໃຫ້ມີ ການເຂົ້າຮ່ວມ ແລະ ການຮວ່ມມື ຂອງຜູ່ມີສວ່ນຮ່ວມທັງຫລາຍ ລວມທັງ ອົງການຂອງລັດແຫ່ງຊາດ, ເທສະບານ, ຊຸມຊົນທ້ອງຖິ່ນ, ຜູ່ຜະລິດຂີ້ເຫຍື່ອ, ແລະ ພາກ ເອກຊົນ
- ການເຂົ້າຮ່ວມຂອງຊຸມຊົນ ສາມາດປະຕິບັດໄດ້ໂດຍວິທີ ສ້າງໂຄງການສະໝັກໃຈເຂົ້າຮວ່ມ, ກ້າງລະບົບການໃຫ້ລາງວັນ ແລະການປະຕິບັດກົດໝາຍໃໝ່
- ເທດສະບານເມືອງຕ້ອງການ ສະໜັບສະໜູນການລິເລີ່ມຂອງຊູມຊົນ ໂດຍການຈັດເນື້ອທີ່ດິນ ໃຫ້ການປຶກສາທາງເຕັກນິກ ຕົ້ນທຶນ ແລະການລົງທຶນ.
- ປັບປຸງການຕະລາດ ການດໍາເນີນການໃຫ້ແທດເໝາະກັບ ຄຸນນະພາບມາດຕາຖານ, ກົດລະບຽບແລະຕິດຕາມ, ມອບໃບຍັງ, ລີເລີ່ມການຊີວັດຖຸເກົ່າມ ສ້າງສາຍພົວພັນກັບ ກິດຈະກໍາພາກສ່ວນກະສິກໍາ

ຄວາມສາມາດປົ່ມຂຸອັນ ການລຸດຜ່ອນກາປ່ອຍແກສສູ່ເຮືອນແກ້ວ

ສຸນກາງການປົ່ມຝຸ່ນທີ່ເມືອງ ບຣາຕ້ອງ,ສູຣາບາຍປາ

ແນວທາງ, ອີງໃສ່ ສະພາບ

- ປະລິມານຂີ້ເຫຍື່ອ% 1.4 ໂນ ຕໍ່ວັນ
- ພາກສວ່ນທີ່ເປັນອີນຊາ : 65%
- ການຍ່ອຍສະຫລາຍ ຂອງອີນຊີ ຄາບອນ:0.50
- ສວ່ນ ຂອງ ມີເທນ 1.0
- ປະສິດທິພາບການປົ່ມ 95%
- ໄລຍະເກຣດິດ : 10 ປີ

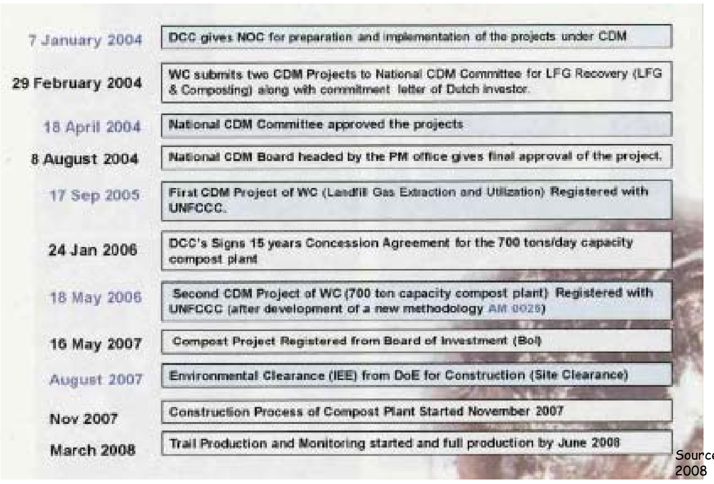
ການຄິດໄລ່ ການລຸດຜ່ອນການປ່ອຍແກສ ອີງໃສ່ UNFCCC's AMS 111F ສໍາລັບ ໂຄງການຂະໜາດນ້ອຍ

- ການຫລຸດຜ່ອນການປ່ອຍແກສ ERs (10ປີ) , 2945 tCO2
- ຢັ້ງຢືນການປ່ອຍແກສ
  ມູນຄ່າ ຫລຸດຜ່ອນ 29,450 Euro
  (ອີງໃສ່ 10Euro/1tCo2 ຢູຕະລາດ CER

Source: Komalirani, 2011

ສິ່ງທ້າທາຍ: ໃຊ້ເວລາ ດົນເພື່ອຂະບວນການ ຮອງຮັບ CDM

ຊື່ວ່າ, ການພັດທະນາ ໂຄງການ CDM ສໍາລັບການປົ່ມແບບແຍກສວ່ນ ຢູ່ ບັງຄະລາເທສ ໃຊ້ເວລາ ກວ່າ 4ປີ



7 January 2004	DCC gives NOC for preparation and implementation of the projects under CDM
29 February 2004	WC submits two CDM Projects to National CDM Committee for LFG Recovery (LFG & Composting) along with commitment letter of Dutch investor.
18 April 2004	National CDM Committee approved the projects
8 August 2004	National CDM Board headed by the PM office gives final approval of the project.
17 Sep 2005	First CDM Project of WC (Landfill Gas Extraction and Utilization) Registered with UNFCCC.
24 Jan 2006	DCC's Signs 15 years Concession Agreement for the 700 tons/day capacity compost plant
18 May 2006	Second CDM Project of WC (700 ton capacity compost plant) Registered with UNFCCC (after development of a new methodology AM 0025)
16 May 2007	Compost Project Registered from Board of Investment (BoI)
August 2007	Environmental Clearance (IEE) from DoE for Construction (Site Clearance)
Nov 2007	Construction Process of Compost Plant Started November 2007
March 2008	Trail Production and Monitoring started and full production by June 2008

Source: Waste Concern, 2008

ສິ່ງທ້າທາຍ : ມູນຄ່າການຊື້ຂາຍ CDM ສູງ

Transaction costs per ton of CO2 equivalent reduced are highly dependent on the size of the total emission reductions achieved by the project (Krey,2004).

Project size (tCO2e/a)				Transaction costs (Euro/tCO2e)			
Baseline (Krey,2004)	**Senario 1**	**Senario 2**	**Senario 3**	**Baseline (Krey, 2004)**	**Scenario 1**	**Scenario 2**	**Scenario 3**
1000000				0.1			
100000				0.25			
10000				1.8			
			5250				6
		2805				12	
1000				18			
	294				150		
100				176			

Note:
1. Scenario 1: Case study of Bratang composting centre
2. Scenario 2: Bundling the existing 16 composting centres in the city
3. Scenario 3: Assumption that city operate 31 composting centers including one for each of its waste management districts

ຄວາມສາມາດເປັນໄປໄດ້ ທີ່ຈະລວມເອົາບັນດາການບົ່ມຂະນ້ອຍໆ ພາຍໃນເມືອງລວມກັນເຂົ້າ

NO.	Compost plant name	total	inorganic	organic	ERs (10 years)
		m³	m³	m³	tCO2e/a
1	Menur	169	51	118.0	2832
2	Keputran	53	0	53.0	1272
3	Bratang	191	68.5	122.5	2945
4	Rungkut	101	24.5	76.5	1824
5	Wonorejo	139	38.5	100.5	2400
6	Liponsos	70	10	60.0	1440
7	Srikana	69.5	22.5	47.0	1200
8	Tenggilis utara	112	28.5	83.5	1990
9	Tenggilis rayon taman	113	39	74.0	1776
10	Gayungsari	66	17.5	48.5	1152
11	Bibis karah	52	9	43.0	1032
12	Jambangan	80	23	57.0	1368
13	Sonokwijenan	151	48.5	102.5	2448
14	Putat jaya	102	18	84.0	2020
15	Benowo	94	36.5	57.5	1400
16	Sumber rejo	51	10.5	40.5	960
Total		**1614**	**446**	**1,168**	28059

Cost/benefits calculation under the 3 scenarios

Scenario	Certified Emission Reduction Pricing (CER)/Euro (10 Euro/tCO2e)	Transaction cost/Euro
Scenario1	29450	441750 ☻
Scenario2	280590	336708☻
Secenario 3	525000	315000☺

30

Source: Komalirani, 2011

ຈຳເປັນຕ້ອງພິຈາລະນາຄວາມສ່ຽງ ໃນການບົ່ມຝຸ່ນແບບແຍກອອກເປັນພາກສ່ວນ

- ການລວມຕົວກັນເຂົ້າຂອງໂຮງງານນ້ອຍໆ ແມ່ນມີຜົນດີ, ແຕ່ການຈັດການ ໂຄງສ້າງ ການລວມຕົວທີ່ມີໂຮງງານຍ່ອຍຫລາຍໂຮງງານນັ້ນ ເຮັດໃຫ້ ການຕິດຕາມແລະການ ດຳເນີນການຍຸ້ງຍາກຫລາຍ. ມັນຈະມີຄວາມສ່ຽງທີ່ວ່າ ການລຸດຜ່ອນການປ່ອຍແກສອາດຈະ ບໍ່ໄດ້ຮັບຜົນດັ່ງທີ່ຄາດໄວ້ຫລືວ່າ ການຫລຸດຜ່ອນການປ່ອຍແກສ ໄດ້ຮັບຜົນ ແຕ່ໂຄງການ ອາດຕິດຕາມບໍ່ໄດ້
- ຄວາມສ່ຽງທາງວິສະວະ ແມ່ນມີນ້ອຍ ສຳລັບໂຄງການການບົ່ມຝຸ່ນ ແບບແຍກເປັນສ່ວນນີ້ ຍ້ອນວ່າອີງໃສ່ ງ່າຍດາຍ, ແຮງງານເລັງລັດ, ເຕັກໂລໂລຢີຕ່ຳ,
- ເຖິງຢ່າງໃດກໍຕາມ, ຄວາມສະເຖຍລະພາບ ໃນໄລຍະຍາວ ແລະ ການດຳເນີນການມີຄວາມສ່ຽງສູງ. ຝຸ່ນບົ່ມ ອາດບໍ່ມີຜູ່ຊື້ ສົ່ງຜົນໃຫ້ ມີຄວາມສ່ຽງທາງການເງິນ ເພາະວ່າໂຄງການອາດ ຢູ່ບໍ່ຫລອດ. ການສະໜັບສະໜູນຂອງ, ຊຸມຊົນໃນການສະໜອງ ຂີ້ເຫຍື່ອທີ່ມີການແຍກ ແລ້ວຈ່າຍເປັນລາຍເດືອນສຳລັບການບໍລິການເກັບຂີ້ເຍື່ອ ແມ່ນ ມີຄວາມທ້າທາຍ ແລະ ຄວາມສ່ຽງສູງ
- ການສະໜັບສະໜູນຂອງ ຜູ່ນຳການເມືອງ, ຫົວໜ້າຫ້ອງການ ແລະ ຜູ່ມີສ່ວນຮ່ວມອື່ນໆແມ່ນມີຄວາມສ່ຽງ, ການປ່ຽນການເມືອງຂອງເມືອງຢ່າງກະທັນຫັນ
- ການກໍ່ຕັ້ງສະຖາບັນ ກໍຄວນພິຈາລະນາ. ການກໍ່ຕັ້ງສະຖາບັນຂະຍາຍຕົວຂື້ນໂດຍ ລະດັບຂອງການແຍກອອກເປັນພາກສ່ວນ. ເຈົ້າຂອງກິດຈະການຂອງການລຸດຜ່ອນການປ່ອຍແກສ ມີຜົນເນື່ອງຈາກ ໂຄງການການບົ່ມຝຸ່ນ ທີ່ບໍ່ແຈ້ມແຈ້ງ ໃນບາງສະຖານະການ ຊຶ່ງເຈົ້າຂອງບໍ່ເຂົ້າໃຈແຈ້ງເຊັ່ນດຽວກັນ

ແນະນຳນະໂຍບາຍ

- ການປະກອບສ່ວນ ຊຶ່ງໂຄງການການບົ່ມຝຸ່ນແບບແຍກ ເຮັດໃຫ້ເປັນການ ພັດທະນາແບບຍືນຍົງ ແລະ ວິທີການແບບເກົ່າ (Gold standards) ໃຊ້ສຳລັບຕິດຕາມນັ້ນຄວນມີການພິຈາລະນາຕື່ມ. ຍາກ ທີ່ຈະປະສົບຜົນສຳເລັດ ຕາມມາດຕາການຂອງ Gold standards. ໂດຍສັງເກດຕົວເລກງ່າຍໆ ເຊັ່ນ ຈະຕ້ອງສະແດງ ໃຫ້ເຫັນການຄິດໄລ່ ຕໍ່ຫົວໜ່ວຍ ເພື່ອຄວາມໝັ້ນໃຈ ໃນການສົມທຽບກັນລະຫວ່າງ ໂຄງການທີ່ມີຂະໜາດ ແລະຊະນິດດຽວກັນ
- ເພື່ອເປັນການຫລຸດຜ່ອນຕົ້ນທຶນລົງ, ຕ້ອງ ຫຍໍ້ວິທີການກວດກາຕິດຕາມ ໃຫ້ນ້ອຍລົງ, ລົງທະບຽນລາຄາຕໍ່າ ສຳລັບໂຄງການນອ້ຍ, ຫລືອາດຈະລົບອອກ ຫລື ເອົາໄປເປັນງົບການລົງທະບຽນ ໃນຂະນະດຽວກັນ ການລົງທະບຽນ ຂອງໂຄງການໃຫຍ່ ຈະຕ້ອງເພີ່ມຂື້ນ
- ຢູ່ພາຍນອກ ຂອງCDM, ຕະລາດແບບສະໝັກໃຈ ຕ້ອງການໃຫ້ ມີຄວາມ ເຂັ້ມແຂງທີ່ຈະເປີດໂອກາດ ເພື່ອ ການຂາຍການລຸດຜ່ອນການປ່ອຍແກສ. ຢ່າງໃດກໍຕາມບັນຫາຂອງມັນ ກໍມີຢູ່ວ່າ ມີຂ່າວສານ ຂໍ້ມູນນ້ອຍຫລາຍ ໃນປະເທດ ທີ່ກຳລັງພັດທະນາກ່ຽວກັບຕະລາດສະໝັກໃຈ ແລະຂາດ ຄວາມສະມັກໃຈ ແລະ ບຸກຄະລາກອນ. ໃນກໍລະນີນີ້ ສາມາດ ແກ້ໄຂໄດ້ ໂດຍການສ້າງເຄືອຂາຍ ເມືອງຕໍ່ເມືອງ ໃຫ້ເຂັ້ມແຂງເພື່ອຈະໄດ້ ແລກປ່ຽນຂໍ້ມູນກັນ ແລະ ກໍສ້າງບຸກຄະລາກອນ.

ອົງການການສຶກສາ ການຈັດການຂີ້ເຫຍື່ອ ແຫ່ງປະເທດ ກຳປູເຈຍ

ການບົ່ມຝຸນແບບລວມສຸມ

Chau Kim Heng, COMPED
Organization

Workshop on Capacity Building on Accounting and Utilizing GHG Emission Reduction Measures for Local Waste Management Actors in Developing Asian Countries, Vientiane, Laos, 04 - 06 October 2011.

ສາລະບານ

1. ສະເຫນີ ກ່ຽວກັບ COMPED
2. ການບົ່ມຝຸນແບບລວມສຸມ
3. ການບົ່ມແບບກອງເປີດ
4. ບັນຫາຂໍ້ຫຍຸ້ງຍາກ ແລະວິທີແກ້

ອົງການ COMPED

- NGO, ສ້າງເມື່ອ 2000
- ພະນັກງານທັງໝົດ 18 ຄົນ (2011)
- ກິດຈະກຳ ແລະ ປະສົບການ: ການວິເຄາະ ອີ້ເຫຍື່ອ, ຈັດຝຶກອົບຮົມ, ພັດທະນາປື້ມຄູ່ມື, ການຕະລາດໃຫ້ສັງຄົມ,ຜູກພັນກັບສັງຄົມ, ການບົ່ມຝຸ່ນ

ການບົ່ມຝຸ່ນແບບລວມສຸມ

ການບົ່ມຝຸ່ນແບບລວມສູນ

- ໂຄງການບົ່ມຝຸ່ນຄັ້ງທຳອິດ ປີ (2001 – 2009) ຢູ່ທີ່ພະນົມເປັນ ທີ່ສະໜາມຂີ້ເຫຍື່ອ Stung Meanchey, 2000 m^2. ຂະບວນການຍົ່ມ 5 t/ວັນ (1152 t/ປີ) ຂີ້ເຫຍື່ອອິນຊີຈາກຕະລາດ. ຜະລິຕະພັນ ຝຸ່ນຫມັກ 135 t/ປີ.
- ໂຄງການບົ່ມຝຸ່ນຄັ້ງ ທີ ສອງ ເລີ້ມ ປີ 2009 ເນື້ອທີ່ 8000 m^2 ໃກ້ກັບສະໜາມຂີ້ເຫຍື່ອ ບັດຕະບອງ. ສາມາດບົ່ມຝຸ່ນຈາກ ຂີ້ເຫຍື່ອອິນຊີຈາກຕະລາດ 10 t/ວັນ.

ເປັນຫຍັງ ຈຶ່ງບົ່ມຝຸ່ນແບບລວມສູນ

- ບໍ່ມີນະໂຍບາຍການບົ່ມຝຸ່ນແບບແຍກ
- ການຜະລິດຄືນໃໝ່ ບໍ່ໄດ້ນຳມາໃຊ້ ຮ່ວມກັນກັບການຈັດການຂີ້ເຫຍື່ອ, ການບົ່ມຝຸ່ນຈຶ່ງເປັນໂຄງການໜຶ່ງ
- ຄວາມຕື່ນຕົວ ຂອງປະຊາຊົນ (ຜູ່ທີ່ມີສ່ວນຮ່ວມ) ມີຈຳກັດ
- ບັນຫາເນື້ອທີ່ດິນ
- ບໍ່ມີການແຍກຂີ້ເຫຍື່ອຢູ່ແຫລ່ງຜະລິດ ແລະ ອື່ນໆ.

ການບົ່ມຝຸ່ນແບບກອງເປີດ ແລະປີ້ນ

ການບຳບັດເບື້ອງຕົ້ນ (ການແຍກຂີ້ເຫຍື່ອ)

- ຜູ້ເກັບຂີ້ເຫຍື່ອ 4ຄົນ ທຳງານຫນັກ ທຸກວັນ ຢູ່ບ່ອນແຍກຂີ້ເຫຍື່ອ (ແຍກດ້ວຍມື).

ການບຳບັດເບື້ອງຕົ້ນ (ເຮັດຂີ້ເຫຍື່ອເປັນກອງຍາວ)

- ກອງຂີ້ເຫຍື່ອ ກວ້າງ 3-5 m ແລະ ສູງ 1.5 2 m

- waste separation continues.

ຂັ້ນຕອນການບົ່ມຝຸ່ນ

- ສະພາວະຂະບວນການບົ່ມຝຸ່ນທີ່ດີທີ່ສຸດ
  - ອຸນຫະພູມການບົ່ມ ໃນລະຫວ່າງ 65 - 70˚C
  - ຄວາມຊື້ນ 65%

- Compost process will take 4 – 6 months.

ການກວດສອບ ຝຸ່ນໝັກ

ຄວາມຕ້ອງການຂັ້ນຕົ້ນ ສໍາລັບ ຜະລິດຕະພັນຝຸ່ນບົ່ມ

- ຄວາມຊື້ນຂອງຝຸ່ນບົ່ມ ຈະຕ້ອງໃຫ້ຕໍ່າກວ່າ 45%
- ຝຸ່ນບົ່ມຈະຕ້ອງປະກອບດ້ວຍ ສານອິຊີ ແລະ ສານອາຫານອື່ນໆ
- ຝຸ່ນບົ່ມ ຈະຕ້ອງປາສະຈາກ ວັດສະດຸທີ່ບໍ່ຕ້ອງການເຊັ່ນ ປລາສຕິກ, ຢາງຍືດ, ໂລຫະ, ແກ້ວ, ແລະກ້ອນຫີນ.


ຜະລິດຕະພັນ ຝຸ່ນບົ່ມ

COMPED Compost

ໄນໂຕຣເຈນ	N	> 1.32%
ຟົສຟໍຣັສ	P	> 1.72%
ໂປຕາຊອມ	K	> 2.24%
ຄ່າຂອງ	pH	7.07.5.

ຂໍ້ຫຍຸ້ງຍາກ ແລະ ວິທີການແກ້ໄຂ

ຂໍ້ຫຍຸ້ງຍາກ ແລະ ອຸປສັກ

- ບໍ່ມີການແຍກຂີ້ເຍື່ອຢູ່ແຫລ່ງຜະລິດ: ແຍກເອົາສິ່ງທີ່ບໍ່ສາມາດຍິ່ມໄດ້ອອກ (ຈາກຕົ້ນຈົນຂັ້ນສຸດທ້າຍ ຂອງຂະບວນການການບົ່ມ ໃຊ້ເວລາຫລາຍ)
- ການບົ່ມຝຸ່ນບໍ່ປະຕິບັດຮ່ວມກັບ ການຈັດການຂີ້ເຫຍື່ອຕົວເມືອງ: ບໍ່ມີໃຜ (ຜູ່ມີສ່ວນຮ່ວມ) ຮັບຜິດຊອບ ນຳເອົາ ຂີ້ເຫຍື່ອປະເພດອິນຊີ ສົ່ງໃຫ້ ສູນບົ່ມຝຸ່ນ
- ຄຸນນະພາບຂອງຝຸ່ນບົ່ມ: ປະຊາຊົນ ຂາດຈິດສຳນຶກ ຕໍ່ຜົນກະທົບຕໍ່ສິ່ງແວດລ້ອມ, ຈະພົບເຫັນຢູ່ເລື້ອຍໆ ຂີ້ເຫຍື່ອອັນຕະລາຍ ໄດ້ປົນມາກັບຂີ້ເຫຍື່ອຕົວເມືອງ.
- ບໍ່ມີການກະຕຸກຊຸກຍູ້ ຫລືຈູງໃຈ ຈາກ ພາກລັດ: ການຂົນສົ່ງຂີ້ເຫຍື່ອສູ່ສູນບົ່ມ ແມ່ນບໍ່ມີຄ່າໃຊ້ຈ່າຍ ແຕ່ມັນຄວນ ໃຫ້ມີການຊົດເຊີຍ ຫລື ເກັບເງິນໄດ້
- ບໍ່ມີກົດລະບຽບ ແລະຄູ່ມືແນະນຳ ໃນການບົ່ມຝຸ່ນ ແລະ ຜະລິດຕະພັນຝຸ່ນບົ່ມ ໂດຍພາກລັດ: ການຂະຫຍາຍຕະລາດມີຄວາມຫຍຸ້ງຍາກຫລາຍ

ວິທີທາງ ແກ້ໄຂບັນຫາ

- ຕິດຕໍ່ພົວພັນກັບ ພາກລັດທ້ອງຖິ່ນ ໂດຍການສົ່ງບົດລາຍງານ ຢ່າງເປັນປະຈໍາ ແລະຮ້ອງຂໍ ການສະໜັບສະໜູນ (ຖ້າຈໍາເປັນ)
- ຕິດຕໍ່ພົວພັນກັບຜູ່ເກັບຂີ້ເຫຍື່ອ ແລະ ຖາມເອົາຂີ້ເຫຍື່ອ
- ພະຍາຍາມຂົນຂວາຍຫາແຫລ່ງທຶນສະໜັບສະໜູນ ເພື່ອຖົມຂຸມຕົ້ນທຶນ
- ອອກແຮງຢ່າງໜັກໜ່ວງດ້ານການຕະລາດ ໂດຍການ ຊີ້ແຈງ ການນໍາໃຊ້ ແລະຜົນທີ່ໄດ້ຮັບ ຈາກ ການບົ່ມຝຸ່ນ

ຄວາມຄາດຫວັງ

- ໂຄງການການບົ່ມຝຸ່ນແມ່ນ ຂະແໜງໜຶ່ງຂອງ ອົງການ COMPED. ໂດຍການດໍາເນີນໂຄງການ ນີ້ ພວກເຮົາໄດ້ ສະເໜີ ຫົວຂໍ້ ການບົ່ມຝຸ່ນ ສູ່ ອົງການພາຍໃນແລະຕ່າງປະເທດ ພະຍາຍາມ ຄູ່ຮ່ວມໂຄງການ ແລະທຶນ ເພື່ອໂຄງການໃໝ່ອີກ.

ຂໍຂອບໃຈ

ທີ່ທ່ານກະລຸນາຕັ້ງໃຈຟັງ

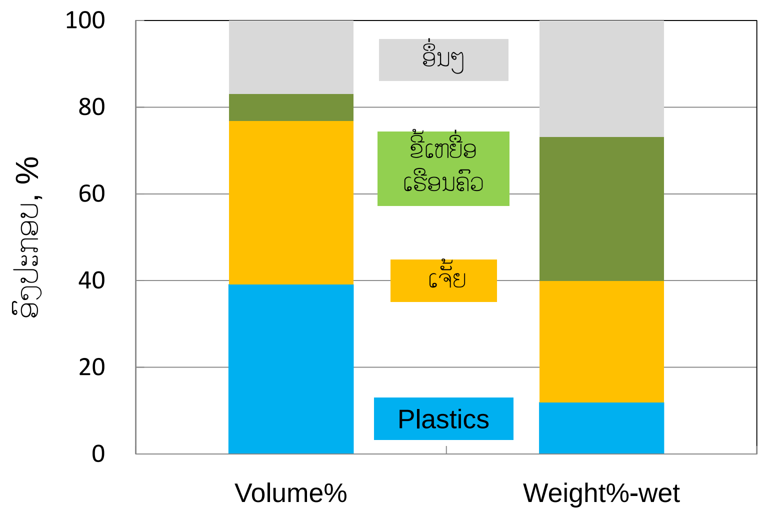
ການລຸດຜ່ອນແກສເຮືອນແກ້ວ ໂດຍ ການບຳບັດ ແລະການນຳໃຊ້ຂີ້ເຫຍື່ອປະລາສຕິກ ຢ່າງເຫມາະສົມ

Yoichi KODERA

ສາລະບານ

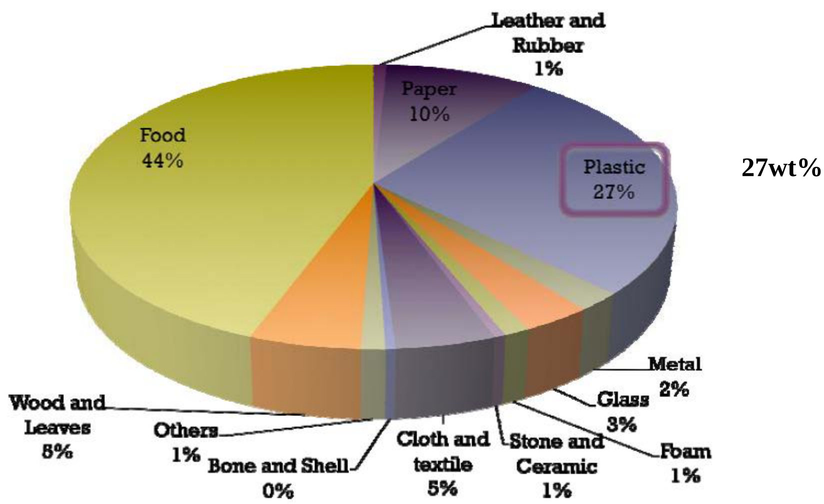
1. ຄຸນລັກສະນະຂອງຂີ້ເຫຍື່ອປະລາສຕິກ
2. ຮອບວຽນຊີວິດຂອງປະລາສຕິກ ແລະການປ່ອຍແກສGHG
3. ວິທີຜະລິດປະລາສຕິກໄຫມ່ຄືນ

ອົງປະກອບຫລັກຂອງ ຂີ້ເຫຍື່ອ ຄົວເຮືອນ

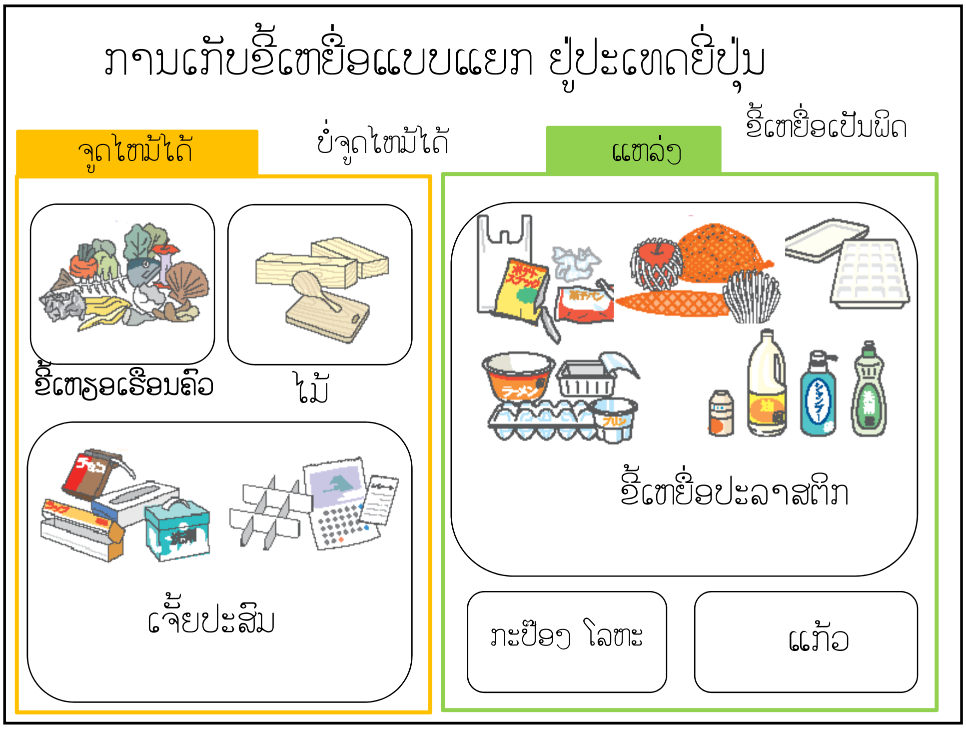


Source: White paper, Ministry of Environment, Japan

ຂີ້ເຫຍື່ອຈາກເທດສະບານ ເມືອງບາງກອກ ປະເທດໄທ



http://gec.jp/gec/en/Activities/EST/2009/wasteplatics/D2_AliceSharp.pdf



ສິ່ງທ້າທາຍຕໍ່ການຈູດເຜົາແລະການຜະລິດຄືນ
ຂອງສະໜາມຂີ້ເຫຍື່ອ ເພື່ອຈຸດປະສົງໃດໜຶ່ງ

ເສດອາຫານ → ການບົ່ມຝຸ່ນ

ເຈ້ັຍປະສົມ → ການຜະລິດເຈ້ັຍຄືນໄຫມ່

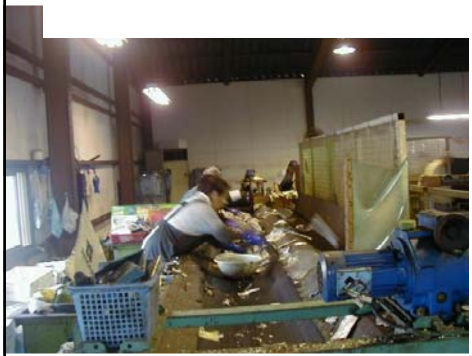
Increase recycling amount of waste plastics

ປະລາສຕິກ → ຢາງ ແລະນ້ຳມັນຜະລິດຄືນໄຫມ່

Environmental impact such as CO_2 emission?

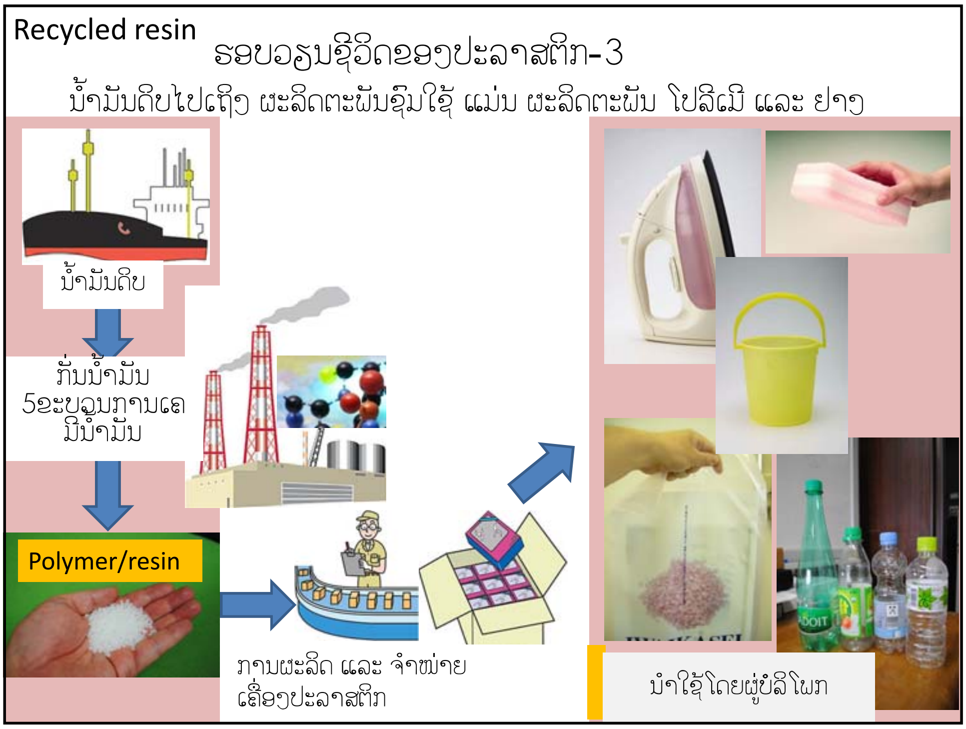
ເປັນຫຍັງ ພວກເຮົາຈຶ່ງຜະລິດຄືນໃໝ່?

1. ລັດ ແລະບໍລິສັດຈັດການຂີ້ເຫຍື່ອ ຂາຍສິ່ງທີ່ມີຄ່າ ເພື່ອມີຜົນຕອບແທນ
2. ຫລຸດຜ່ອນການໃຊ້ວັດສະດຸ ໂດຍການໃຊ້ຂີ້ເຫຍື່ອແທນ
3. ຫລຸດຜ່ອນຜົນກະທົບຕໍ່ແວດລ້ອມ ໂດຍການປ່ຽນຂີ້ເຫຍື່ອໃຫ້ເປັນພະລັງງານ

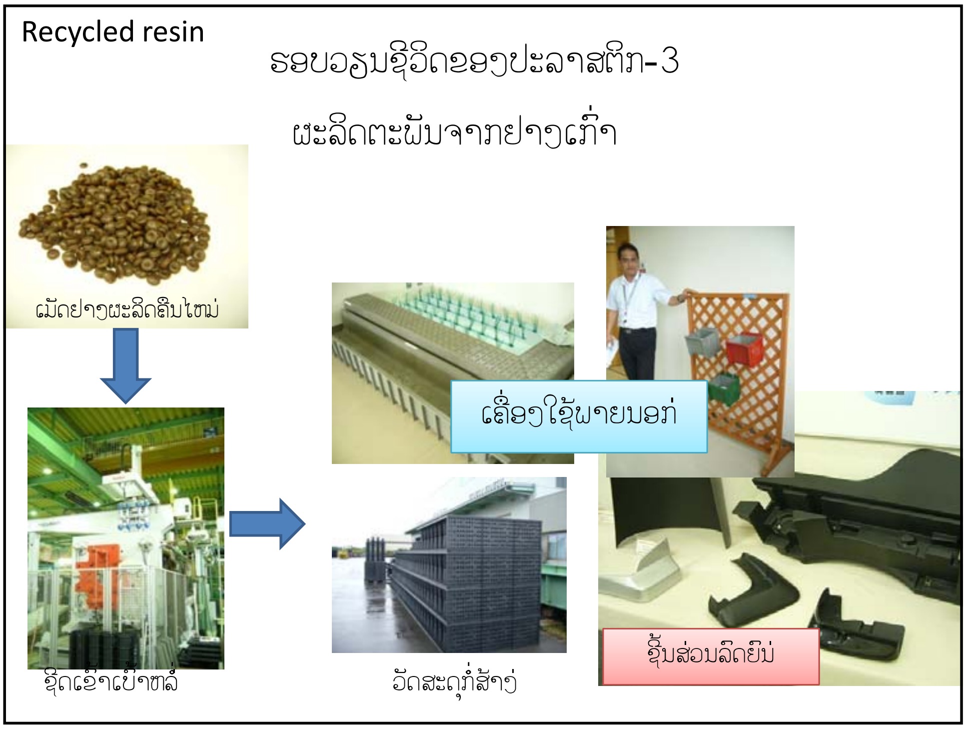


ຫລຸດຜ່ອນຜົນກະທົບຕໍ່ແວດລ້ອມ ໂດຍການໃຊ້ປະລາສຕິກເກົ່າ

1. ການຜະລິດຢາງຄືນ
   - ຂີ້ເຫຍື່ອປະລາສຕິກ ສາມານຳເຂົ້າຂະບວນການຜະລິດເປັນຢາງໄດ້. ຈຳພວກເທີໂມປະລາສຕິກ ເຊັ່ນ PE, PP ແລະ PS ເປັນແຫລ່ງວັດຖຸ
   - ນີ້ແມ່ນCDM ອີກຢ່າງໜຶ່ງ ທີ່ຮອງຮັບຈາກ UN
2. ເປັນເຊື້ອເພີງທີ່ສະອາດ ກວ່າ ຖ່ານຫີນ, ແລະນ້ຳມັນດິບ
   - ປະລາສຕິກບາງປະເພດ ສາມາດນຳມາຜະລິດໃຫ້ເປັນເຊື້ອເພີງແຂງ, ແຫລວ ແລະ ອາຍ ໄດ້. ເຊື້ອເພີງດັ່ງກ່າວໃຫ້ອາຍຄວັນສະອາດກວ່າຖ່ານຫີນ ແລະ ນ້ຳມັນ ຊຶ່ງວ່າ ມີ CO_2 ນ້ອຍຕໍ່ມວນສານ ແລະ CO_x ນ້ອຍ


Recycled resin
ຮອບວຽນຊີວິດຂອງປະລາສຕິກ-3
ນ້ຳມັນດິບໄປເຖິງ ຜະລິດຕະພັນຊົມໃຊ້ ແມ່ນ ຜະລິດຕະພັນ ໂປລີເມີ ແລະ ຢາງ
ນ້ຳມັນດິບ
ກັ່ນນ້ຳມັນ
5ຂະບວນການເຄມີນ້ຳມັນ
Polymer/resin
ການຜະລິດ ແລະ ຈຳໜ່າຍ
ເຄື່ອງປະລາສຕິກ
ນຳໃຊ້ໂດຍຜູ່ບໍລິໂພກ


ຮອບວຽນຊີວິດຂອງປະລາສຕິກ-2
ຜະລິດຕະພັນປະລາສຕິກສູ່ ຜະລິດຢ່າງຄືນໃຫມ່
Disposal
Collection
Recycling
Crushing, wash
ing and
pelletization
ຜະລິດຕະພັນປະລາສຕິກ
ຂີ້ເຫຍື່ອປະລາສຕິກ
ຢາງທີ່ຜະລິດຄືນໃຫມ່


Recycled resin
ຮອບວຽນຊີວິດຂອງປະລາສຕິກ-3
ຜະລິດຕະພັນຈາກຢາງເກົ່າ
ເມັດຢາງຜະລິດຄືນໃໝ່
ເຄື່ອງໃຊ້ພາຍນອກ
ຊີດເຂົ້າເບົ້າຫລໍ່
ວັດສະດຸກໍ່ສ້າງ
ຊີ້ນສ່ວນລົດຍົນ


Recycled resin
ການຫລຸດຜ່ອນCO2 ໂດຍການໃຊ້ຜະລິດຕະພັນ ຢາງເກົ່າ (1)
ພາຊະນະຂາວສະອາດ
ພາຊະນະສະອາດ ແຕ່ ໃຊ້ສີ

ການຫລຸດຜ່ອນCO2 ໂດຍການໃຊ້ຜະລິດຕະພັນ ຢາງເກົ່າ (3)

Consumers

ນ້ຳ ັ້ນດິບ ⇒ PSໃໝ່ ⇒ ພາ § ະນະ PS ⇒ ⇒ ຂີ້ເຫ ື້ອ (ພະ § ະນະສະອາດຂາວ)

ການເກັບ ແລະແ ̈ກ

followed by pelletization

ບໍລິໂພກ

° ະລິດຄືນ PS + PS ໃໝ່ ⇒ ພາ § ະນະ° ະລິດໃໝ່PS † ⇒⇒ ຂີ້ເຫ ື້ອ

60% 40%

Environmental Impact	Recycled PS Tray-60%	New PS Tray
Energy as Feedstock / GJ	11	32
Energy of Transportation and Processing / GJ	25	33
CO_2 / ton	2.4	4.5
SO_x / kg	1.6	2.7
NO_x / kg	2.4	3.2
Solid waste / kg	8.7	22

ການຫລຸດຜ່ອນCO2 ໂດຍການໃຊ້ຜະລິດຕະພັນ ຢາງເກົ່າ (4)

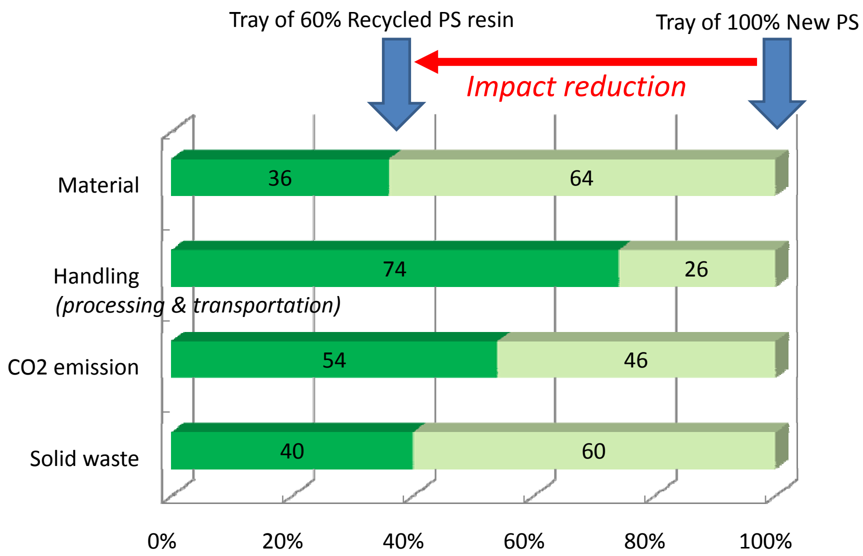


Table: Environmental impact reduction by using 60% recycled resin

ການນຳໃຊ້ ຂັ້ນສຸດທ້າຍ ຂອງຢາງເກົ່າ

ຢາງເກົ່າ

ເຊື້ອໄຟ

ເຜົາເຮັດຄວາມຮ້ອນ

ເຊື້ອເພີງແຂງ

ການຜະລິດ: ບົດໃຫ້ມຸ່ນ ແລະຜະລິດເມັດ, ອົບແຫ້ງ ຖ້າຂີ້ເຫຍື່ອປຽກ. ຜະລິດເມັດ ໃນອຸນຫະພູມ 200 ອົງສາ

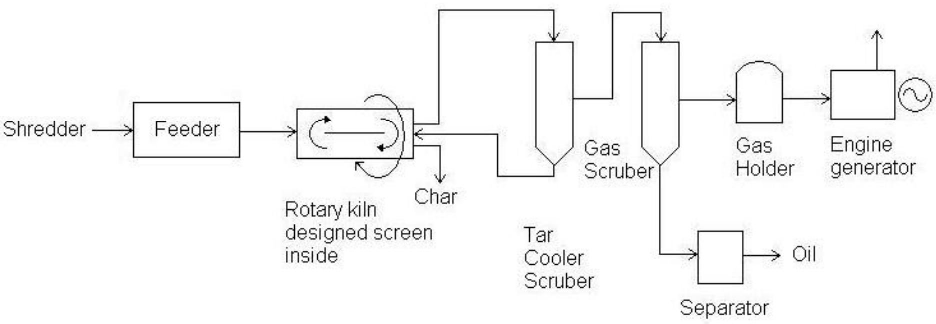
ເຊື້ອເພີງແຫລວ

ການຜະລິດ: ໄພໂຣໄລສີສ ຕາມດ້ວຍ ການກັ່ນ.

ການບົດ ແລະການແຍກ ອາດມີຄວາມຕ້ອງການສໍາລັບ ຂີ້ເຫຍື່ອບາງຊະນິດ

ເຊື້ອເພີງແກສ

- ການຜະລິດ: ບົດໃຫ້ມຸ່ນ ຂະບວນການ ໄພໂຣໄລຊສີສ
- ຜະລິດອານນ້ຳ-ກໍາລັງງານ ຫລື ແກສເຫີບາຍ
- ບັນຫາຫລັກ: ມີ tar ຫລາຍ ຕ້ອງມີວິທີແຍກອອກຈາກ ແກສ



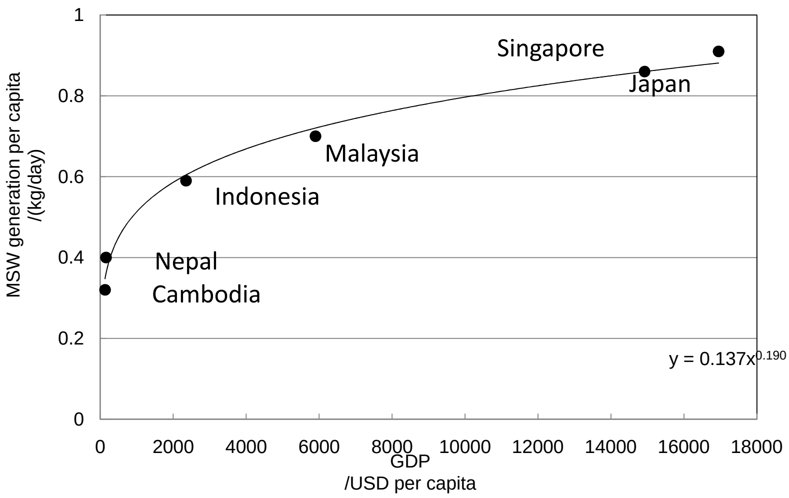
ການຫລຸດຜ່ອນຜົນກະທົບຕໍ່ແວດລ້ອມ ໂດຍການນຳໃຊ້ ເຊື້ອເພີງສະອາດ ຈາກ ຂີ້ເຫຍື່ອປະລາສຕິກ

ຂີ້ເຫຍື່ອປະລາສຕິກ

ຈູດເຜົາໂດຍກົງ
ເພື່ອໄດ້ຄວາມຮ້ອນ

Heat	Ash	Flue gas	Similar fuel
◎	◎	◎	LNG/LPG
◎	◎	○	Diesel oil
○	△	△ or ×	Coal
△	×	×	none

ການຜະລິດ ຂີ້ເຫຍື່ອ ສົມທຽບ GDP



ແນວໂນ້ມເພີ່ມຂຶ້ນ ໃນລັກສະນະ ການຜະລິດ ສູງ,ກາງ, ຕໍ່າ

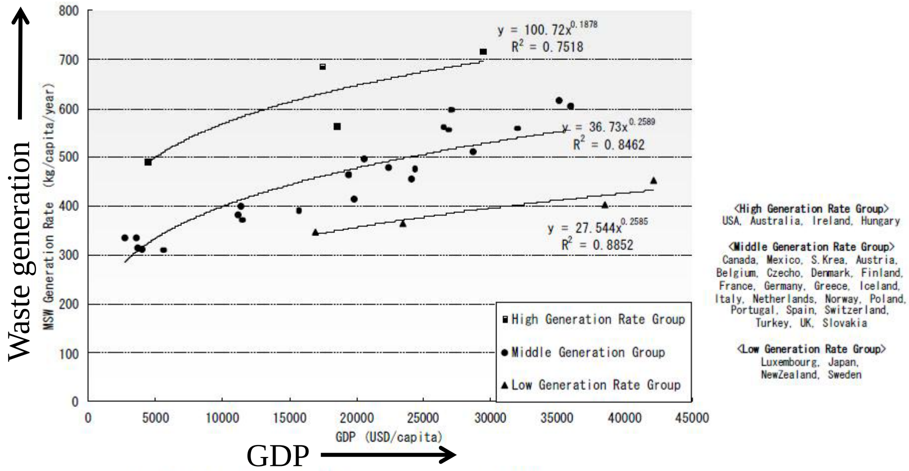


Fig. 4 Relationship of GDP per capita and MSW generation rate

M.Tanaka、http://www5.cao.go.jp/keizai-shimon/special/pdf/1004item7.pdf

ການຜະລິດຂີ້ເຫຍື້ອຕົວເມືອງ 1995

"*What a waste: Solid waste management in Asia*," The International Bank for Reconstruction, and Development/THE WORLD BANK

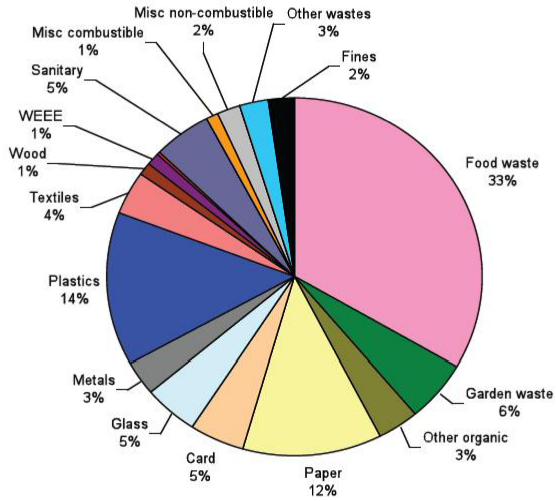
*http://web.mit.edu/urbanupgrading/urbanenvironment/resources/references/pdfs/WhatAWasteAsia.pdf

Country	GNP Per Capita [1] (1995 US $)	Current Urban Population (% of Total)[2]	Current Urban MSW Generation (kg/capita/day)
Nepal	200	13.7	0.50
Bangladesh	240	18.3	0.49
Myanmar	240*	26.2	0.45
Vietnam	240	20.8	0.55
Mongolia	310	60.9	0.60
India	340	26.8	0.46
Lao PDR	350	21.7	0.69
China	620	30.3	0.79
Sri Lanka	700	22.4	0.89
Indonesia	980	35.4	0.76
Philippines	1,050	54.2	0.52
Thailand	2,740	20.0	1.10
Malaysia	3,890	53.7	0.81
Korea, Republic of	9,700	81.3	1.59
Hong Kong	22,990	95.0	5.07
Singapore	26,730	100	1.10
Japan	39,640	77.6	1.47

[1]World Bank, 1997b
[2]United Nations, 1995
*estimated GNP

See Figure 7 for comparison to 2025.

ຂີ້ເຫຍື່ອຈາກຄົວເຮືອນ ປະເທດ ອັງກິດ 2006 - 7



http://www.resourcesnotwaste.org/upload/documents/webpage/RRF%20Advisory%20Committee/JulianParfitt(2010)presentation.pdf

ຄຸນສົມບັດ ຂອງອົງປະກອບຕາງໆຂອງຂີ້ເຫຍື່ອ

Type	LHV	Total solid	C fossil	CO_2 from Fossil C	C bio.	CH_4 potential
	MJ/kg-Wet	% Wet base	% Total solid	kg/100kg-Total solid	% Total solid	L/kg-Dry solid
Plastics	34.1	89.1	79.3	290.8	0.4	0
Paper	12.9	90.5	0.2	0.7	32.7	158.1
Kitchen waste	5.8	29.6	0.5	1.8	49	435.7
Garden waste	7.5	52.2	0.8	2.9	43.1	114.6
Cardboard	13.6	80.6	2.1	7.7	42.4	154.8

E. Gentil, J. Clavreul, T. H. Christensen, *Waste Management & Res.*, 27, 850 (2009).

Recycled resin

ຮອບວຽນຊີວິດຂອງ ປະລາສຕິກ 1

Raw Material
- ນ້ຳມັນດິບ ສູ່ ນາບຕາ
- ນາບຕາສູ່ ເອຕີແລນ ແລະອື່ນໆ

Polymers
- ເອຕີແລນສູ່ ໂປລີເອຕີແລນ
- ການຜະລິດ ແລະ ຂະບວນການເຄມີ

Plastic articles
- ເບົ້າຫລໍ່
- ຜະລິຕະພັນຟິມ

Recycled resin

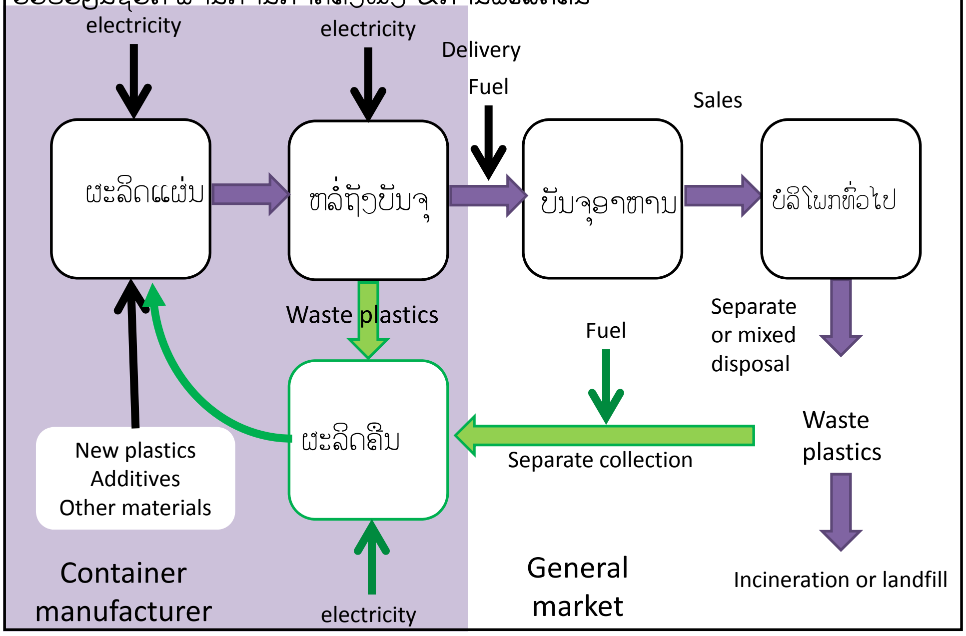
ຮອບວຽນຊີວິດຂອງ ປະລາສຕິກ 2

Used by Consumers
- ດ່ຽວ, ປົນ, ຫລື ປະສົມ
- ປະລາສຕິກ ນຸ້ມ ແລະ ແຂງ

Collection
- ທັງຫມົດສວ່ນປະກອບຂອງ ຂີ້ເຫຍື່ອ
- ການແຍກອົງປະກອບຕ່າງຂອງຂີ້ເຫຍື່ອ

Treatment
- ກຳຈັດ/ເຜົາ ຫລື ສະຫນາມຂີ້ເຫຍື່ອ
- ການຜະລິດຄືນ, ຢາງ ຫລື ເຊື້ອເພີງ

ການຫລຸດຜ່ອນ CO2 ໂດຍການນຳໃຊ້ PS ຜະລິດຄືນ (2
ຮອບວຽນຊີວິດ ຜ່ານການກຈັດຄັ້ງໜຶ່ງ &ການຜະລິດຄືນ



ກົດໝາຍການຜະລິດຄືນໃໝ່ ທີ່ພົວພັນ ໃຫ້ ຍີ່ເຫຍື່ອປະລາສຕິກຂອງປະເທດຍີ່ປຸ່ນ

ຊື່ກົດໝາຍ	ຕົວຢ່າງປະລາສຕິກ ຜະລິດຄືນໃໝ່	ບັນຫາ
ການຜະລິດຄືນໃໝ່ ພາຊະນະບັນຈຸ ແລະຫຸ້ມຫໍ່	ຜະລິດຕະພັນຢາງ ໄດ້ຮັບສິດທິນຳໃຊ້ ຖ່ານຫີນ ເປັນສານສ່ວນປະສົມຜະລິດຕະພັນ	ຜະລິດຕະພັນ ຢາງ ລາຄາສູງ 80 ເຢນ/kg ກວ່າເຕົາຖານຫີນ 40ເຢນ/kg
ກົດໝາຍເຄື່ອງໃຊ້ຄົວເຮືອນຈາກປະລາສຕິກຜະລິດຄືນ	ຊີ້ນສ່ວນປະລາສຕິກສະອາດ ທຳການຜະລິດຄືນໃໝ ໃນຮູບແບບວັດຖຸທຽມ. ການຜະລິຄືນທາງຕັ້ງ ໂດຍການແຍກທີ່ຊັດເຈນ ໄດ້ດຳເນີນທາງພານິດ	ປະລາສຕິກປະສົມ ແລະປະລາສຕິກທີ່ຍໍ່ໄດ້ ຜະລິດຄືນເຊັ່ນ ໂປລີຣີເທນ
ກົດໝາຍ ການຜະລິດຄືນ ລົດຍົນ ໄລຍະສຸດທ້າຍ	ASR ປະກອບມີ ປະລາສຕິກ ແລະ ຝຸ່ນເປື້ອນ ອະນຸຍາ ໃຫ້ເຜົາ ເພື່ອໄດ້ຄວາມຮອ້ນ	ເອົາໃຈໃສ່ການນຳເອົາ ໂລຫະ ແລະ ປະລາສຕິກ ມາໃຊ້ຄືນ ຢ່າງຊັດເຈນ

ສະຖານະພາບການ˚ ະລິດຄືນ

- Waste is separated into industrial waste produced by business activities and all other municipal waste (mainly produced by households).
- Waste recycling volumes and recycling ratios tend to consistently rise after establishment of recycling laws.

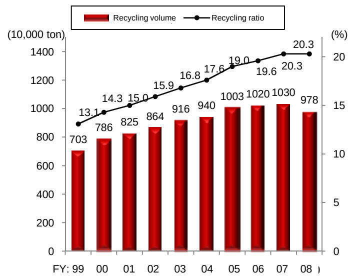
Waste

Municipal waste
Produced by households
Volume produced **48.11 million tons (100%)**
Obligation for collection, transport and disposal is shouldered by local authorities.
- Volume recycled 9.78 million t (20%)
- Volume reduced 32.75 million t (73%)
- Final disposal volume 5.53 million t (12%)

Industrial Waste
Produced by business activities
Volume produced 419 million tons (100%)
Companies producing waste are responsible for treatment.
- Volume recycled 219million t (52%)
- Volume reduced 180million t (43%)
- Final disposal volume 20.million t (5%)

Municipal waste: Data collected in FY08.
Industrial waste: Data collected in FY07

Recycling volume and ratio of municipal waste



Regulated by relevant laws

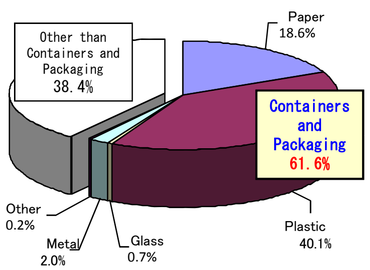
Copyright METI

Background of Containers and Packaging Recycling Law

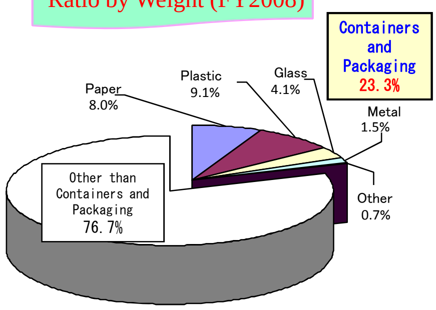
It is necessary to solve problems of tight final disposal site and establish recycling-oriented society aiming for zero refuse with the increase of disposal volume for Municipal waste.

Containers and packaging waste counts up about 60% of household waste (volume ratio)

Ratio by Volume (FY2008)



Ratio by Weight (FY2008)

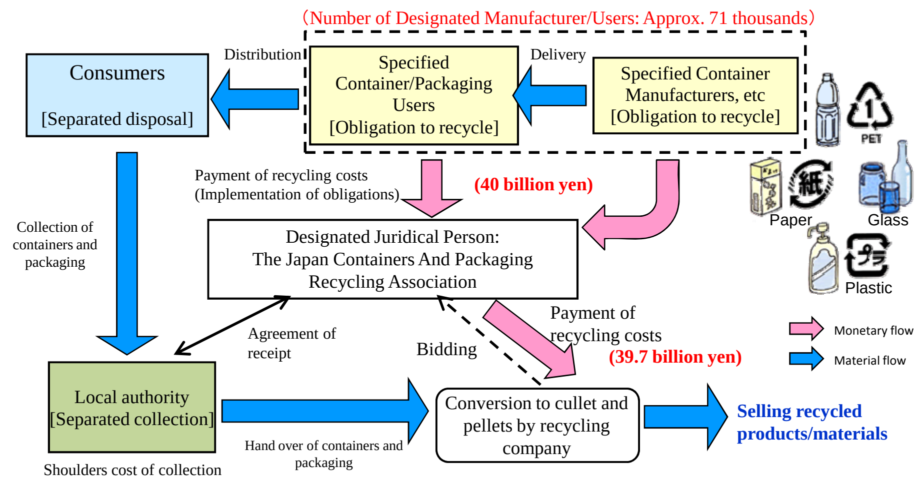


※ Ratio by volume and by weight was calculated based on the sample survey targeting for 6 cities and 3 areas across the nation.

Copyright METI

Overview of Containers and Packaging Recycling Law

The basic principle of this law is that every player has a role to play in recycling. Consumers should separate their waste according to category, municipalities should collect the separated waste, and businesses should recycle what has been collected into new products.



Issues and concerns about the Law

Copyright METI

Currently, we identify some issues and concerns about Japan's Containers and Packaging Law such as
1) efficiency of recycling system (e.g. cost reduction, cost efficiency and creation of high value-added recycled products),
2) improvement of fairness, transparency and stability,
3) promotion of prevention and re-use.

1. efficiency of recycling system
- ✓ Cost reduction / cost efficiency
  - including social costs of the whole processes: from separate collection to recycling
- ✓ Creation/promotion of high value-added recycled products

2. improvement of fairness, transparency and stability
- ✓ Reconsideration of roles and responsibilities of relevant players (i.e. consumers, local governments and Designated Manufacturer/Users) and their cooperation
  - based on the idea of EPR
- ✓ Prevention of free-riders

3. promotion of prevention and re-use
- ✓ Methods for setting quantitative prevention targets and units

Seeking the possibility and suitable technologies of waste plastics recycling for developing countries

UNEP
United Nations Environment Programme

National Institute of Advanced Industrial Science and Technology
AIST

UNEP-AIST Workshop on Waste Plastics-to-Resources

AIST Tsukuba Center
March 1 – 4, 2011

City officials, researchers and technology providers from Thailand, Philippines, and Japan gathered at AIST under the framework of UNEP.

การดำเนินงาน
โครงการส่งเสริมการแปรรูป
ขยะเป็นน้ำมัน

ได้รับการสนับสนุนงบประมาณจาก
กองทุนเพื่อส่งเสริมการอนุรักษ์พลังงาน
ส่วนอนุรักษ์พลังงานและพลังงานหมุนเวียน
สำนักงานนโยบายและแผนพลังงาน
กระทรวงพลังงาน

รุ่งนภา ทับหนองฮี
(rungnapa2511@gmail.com)
สุธีร์ ทับหนองฮี (hs3isp@gmail.com)
บริษัทเมืองสะอาดจำกัด

หัวข้อในการนำเสนอ

1. บทนำและที่มาของโครงการ
2. สถานการณ์ปัจจุบันของการแปรรูปขยะพลาสติกเป็นน้ำมันในประเทศไทย
3. คุณสมบัติและคุณภาพของน้ำมันดิบจากขยะพลาสติก
4. โอกาสการพัฒนาเทคโนโลยีและอุตสาหกรรมการแปรรูปขยะพลาสติกเป็นน้ำมันในประเทศไทย
5. กิตติกรรมประกาศ

2

1.บทนำและที่มาของโครงการ

1.บทนำและที่มาของโครงการ

- ปริมาณการเกิดขยะมูลฝอยในเทศบาลเมืองวารินชำราบ ประมาณวันละ 24-25 ตัน จากจำนวนประชากร 30,000 คน ในพื้นที่รับผิดชอบ 12.9 ตารางกิโลเมตร
- ปริมาณขยะรีไซเคิลมีประมาณร้อยละ 20 ของปริมาณขยะมูลฝอยทั้งหมดที่เกิดขึ้น
- วิเคราะห์องค์ประกอบขยะมูลฝอย พบว่ามีขยะพลาสติกคิดเป็นร้อยละ 12.6 ของปริมาณขยะมูลฝอยทั้งหมด



ปริมาณขยะพลาสติก90% จะเป็นขยะพลาสติกชนิด PE :Polyethylene และPP : Polypropylene ซึ่งส่วนใหญ่จะอยู่ในหลุมฝังกลบขยะมูลฝอย

5

- รัฐบาลไทยมีนโยบายที่จะส่งเสริมการใช้พลังงานทดแทน โดยให้องค์กรปกครองส่วนท้องถิ่นทำการคัดแยกและแปรรูปขยะมูลฝอยให้เป็นพลังงานทดแทน
- สำนักงานนโยบายและแผนพลังงาน กระทรวงพลังงาน ของรัฐบาลไทย จึงได้สนับสนุนงบประมาณให้แก่องค์กรปกครองส่วนท้องถิ่น จำนวน 3 แห่ง ได้แก่ เทศบาลเมืองวารินชำราบ เทศบาลนครพิษณุโลก และเทศบาลนครขอนแก่นในการก่อสร้างระบบคัดแยกและระบบแปรรูปขยะพลาสติกเป็นน้ำมัน ในปี 2009-2010

6

2. สถานการณ์ปัจจุบันของการแปรรูปขยะพลาสติกเป็นน้ำมันในประเทศไทย

(บริษัทเมืองสะอาด จำกัด ผู้ลงทุนโรงงานในพื้นที่เทศบาลเมืองวารินชำราบ)

7

ปริมาณขยะมูลฝอย
ที่ฝังกลบในบ่อฝังกลบ
บ่อG จำนวน 125,000 ตัน
ระยะเวลา 7 ปี (ปี 2000-2007)

กระบวนการแปรรูปขยะพลาสติกเป็นน้ำมัน แบ่งออกเป็น 2 ส่วน

ส่วนที่ 1 ระบบการคัดแยกขยะ



ส่วนที่ 2 ระบบการแปรรูป(ไพโรไลซิส)



9

1.ระบบการคัดแยกขยะมูลฝอยด้วยเครื่องจักรกล(the front end system)





10

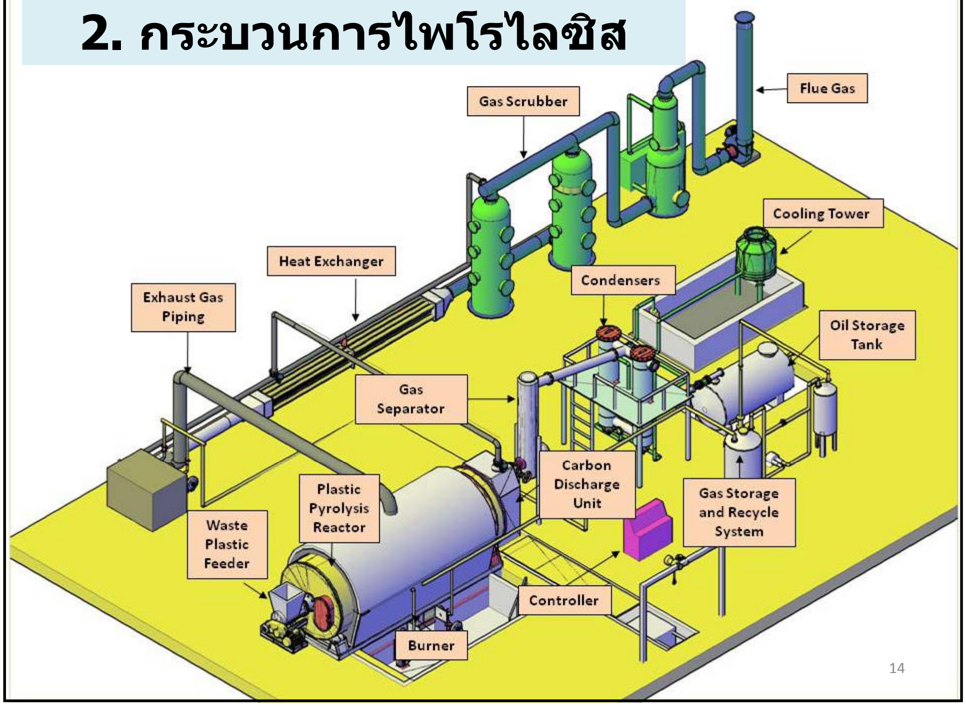
ขยะพลาสติกที่ทำการคัดแยกได้จากบ่อฝังกลบ

การทำความสะอาดและการทำให้ขยะพลาสติกแห้ง

วัตถุดิบขยะพลาสติกเตรียมพร้อม กระบวนการไพโรไลซิส

ส่วนใหญ่จะเป็นขยะพลาสติกประเภท LDPE, HDPE และ PP

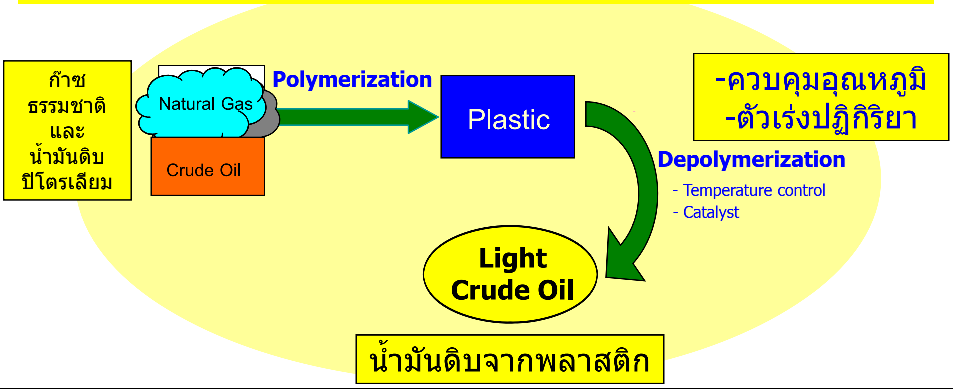
2. กระบวนการไพโรไลซิส



แนวคิดของกระบวนการแปรรูปพลาสติกเป็นน้ำมัน

การผลิตพลาสติก คือ โพลิเมอร์ไรเซชั่น [Polymerization]

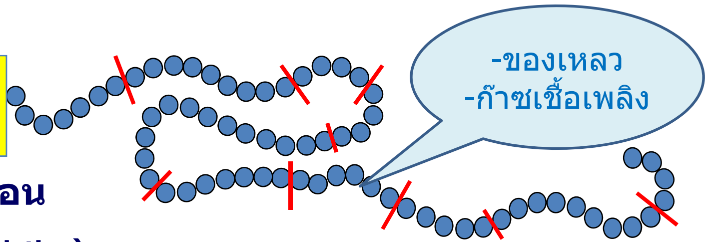
การทำลายโครงสร้างพลาสติก คือ ดี-โพลิเมอร์ไรเซชั่น [De-Polymerization]



กระบวนการไพโรไลซิส

คือ การเผาด้วยความร้อนสูงเพื่อทำลายโครงสร้างทางเคมีของพลาสติก

C-H Bond (Polymer)



- **ด้วยความร้อน**

  (thermal degradation)

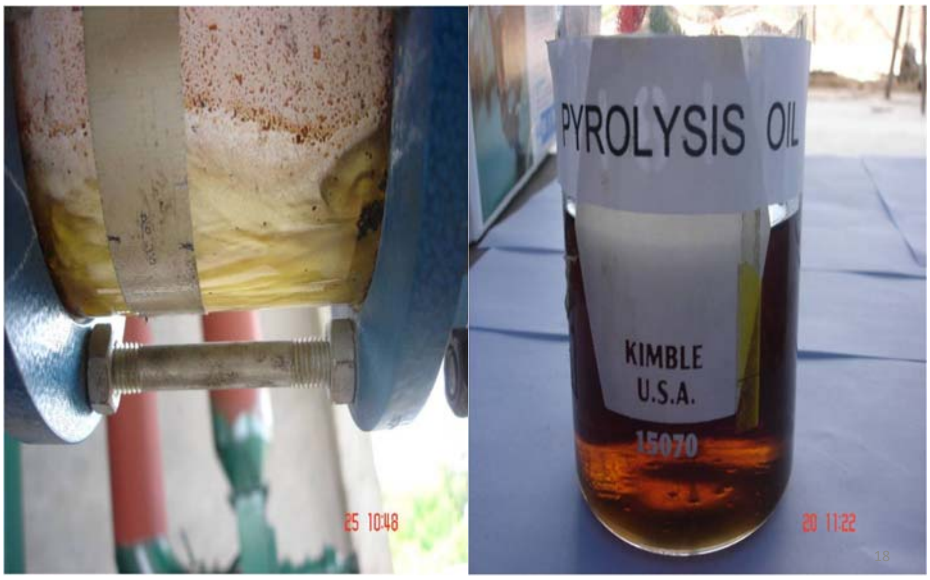
- **ด้วยตัวเร่งปฏิกิริยา**

  (catalytic degradation)

เดินเครื่องได้ที่อุณหภูมิสูงประมาณ (< 500°C)เกิดผลิตภัณฑ์ส่วนใหญ่เป็นเชื้อเพลิงเหลว และส่วนน้อยเป็นก๊าซเชื้อเพลิงไฮโดรคาร์บอน

กระบวนการแปรรูปขยะพลาสติกเป็นน้ำมันด้วยกระบวนการไพโรไลซิส

ผลิตภัณฑ์ที่ได้จากกระบวนการไพโรไลซิส คือ น้ำมันไพโรไลติก (Pyrolytic oil)

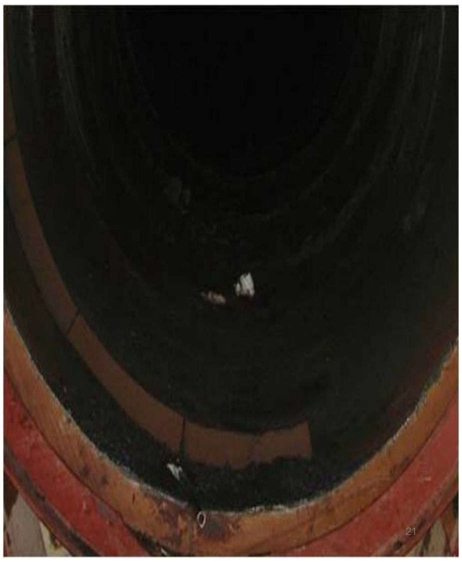


ผลิตภัณฑ์ที่ได้จากกระบวนการไพโรไลซิส คือ น้ำมันไพโรไลติก (Pyrolytic oil)

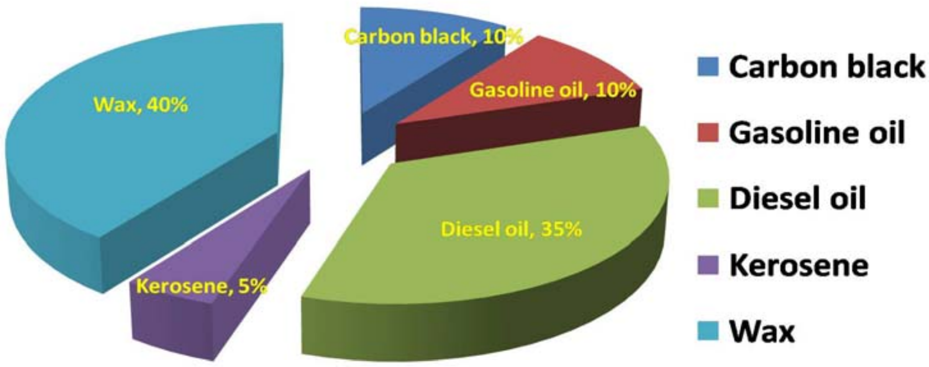
ระบบการบำบัดก๊าซด้วยเครื่องบำบัดอากาศพ่นละอองฝอยน้ำ (Exhaust gas scrubbing)และการนำก๊าซเชื้อเพลิงไปใช้ใหม่ (Syn-gas)

ก๊าซที่ไม่ควบแน่นจะถูกนำกลับเข้าไปเป็นพลังงานความร้อนใหม่ภายหลังการทำให้สะอาดขึ้นแล้ว (Syn Gas) ส่วนก๊าซที่ถูกปลดปล่อยออกภายนอกบรรยากาศจะถูกนำเข้าสู่เครื่องบำบัดอากาศพ่นละอองฝอยน้ำ(Wet crubber)

ผลพลอยได้จากการผลิต:แว๊กซ์(Wax)และผงคาร์บอน(Carbon Black) ที่เป็นของเสียที่เหลือจากการเผาไหม้ในถังปฏิกิริยาไพโรไลซิส



สัดส่วนและอัตรากำลังการผลิต



ขยะพลาสติกรวม(ตัน)		ผลลัพธ์ของการผลิต	น้ำมันดิบ(ไพโรไลติก) (ลิตร)	น้ำมันดิบ(ไพโรไลติก) (บาเรล)
วัน	10	60% →	6,600	40.3
เดือน	300		198,000	1,209.8
ปี	3,000		1,980,000	12,098.3

3.คุณสมบัติและคุณภาพของน้ำมันดิบ

คุณสมบัติส่วนใหญ่ของน้ำมันคล้ายน้ำมันดิบและบางส่วนคล้ายน้ำมันดีเซล คีโซลิน และเบนซีน

23

3.คุณสมบัติและคุณภาพของน้ำมันดิบ

- การทดลองปรับปรุงคุณภาพเพื่อให้สามารถใช้ประโยชน์ได้ในรูปน้ำมันเชื้อเพลิงด้วยกระบวนการตกตะกอนและกระบวนการกลั่นตามจุดเดือดทั้งในประเภทน้ำมันดีเซลและน้ำมันเบนซิน

24

4. โอกาสการพัฒนาเทคโนโลยีและอุตสาหกรรมการแปรรูปขยะพลาสติกเป็นน้ำมันในประเทศไทย

กระทรวงพลังงานได้ประกันราคาขายหน้าโรงกลั่นจำนวน 18 บาทต่อลิตร ซึ่งจะต้องทำการขนส่งไปที่จังหวัดระยอง ทำให้เพิ่มต้นทุนมากขึ้น และยังไม่มีแนวทางการจำหน่ายที่ถูกต้องตามกฎหมาย

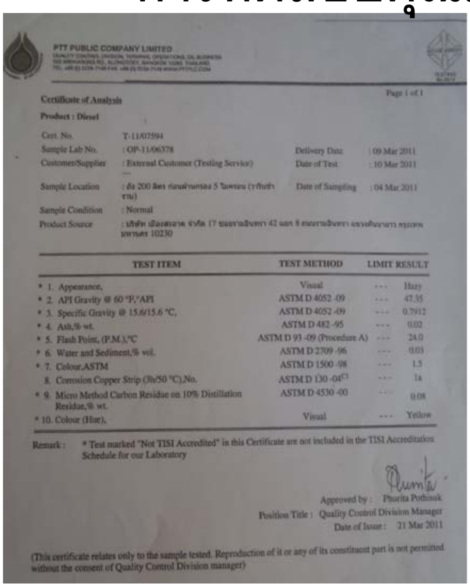
การใช้ประโยชน์ของน้ำมันดีเซลที่ได้จากการกลั่นน้ำมันดิบจากขยะพลาสติก

26

การใช้ประโยชน์ของน้ำมันเบนซินที่ได้จากการกลั่นน้ำมันดิบจากขยะพลาสติก

27

การทดสอบคุณภาพน้ำมัน(ปตท)



PTT PUBLIC COMPANY LIMITED

Certificate of Analysis

Page 1 of 1

Product : Diesel

Cert. No. T-11/07594
Sample Lab No. : OP-11/06378 — Delivery Date : 09 Mar 2011
Customer/Supplier : External Customer (Testing Service) — Date of Test : 10 Mar 2011
Sample Location : ถัง 200 ลิตร [illegible] 5 ไมครอน [illegible] — Date of Sampling : 04 Mar 2011
Sample Condition : Normal
Product Source : [illegible] 10230

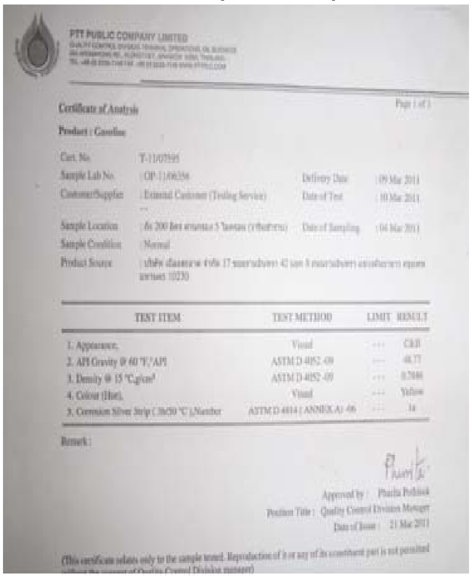
TEST ITEM	TEST METHOD	LIMIT	RESULT
* 1. Appearance,	Visual	---	Hazy
* 2. API Gravity @ 60 °F,°API	ASTM D 4052 -09	---	47.35
* 3. Specific Gravity @ 15.6/15.6 °C,	ASTM D 4052 -09	---	0.7912
* 4. Ash,% wt.	ASTM D 482 -95	---	0.02
* 5. Flash Point, (P.M.),°C	ASTM D 93 -09 (Procedure A)	---	24.0
* 6. Water and Sediment,% vol.	ASTM D 2709 -96	---	0.03
* 7. Colour,ASTM	ASTM D 1500 -98	---	1.5
8. Corrosion Copper Strip (3h/50 °C),No.	ASTM D 130 -04[ε1]	---	1a
* 9. Micro Method Carbon Residue on 10% Distillation Residue,% wt.	ASTM D 4530 -00	---	0.08
* 10. Colour (Hue),	Visual	---	Yellow

Remark : * Test marked "Not TISI Accredited" in this Certificate are not included in the TISI Accreditation Schedule for our Laboratory

Approved by : Phurita Pothisak
Position Title : Quality Control Division Manager
Date of Issue : 21 Mar 2011

(This certificate relates only to the sample tested. Reproduction of it or any of its constituent part is not permitted without the consent of Quality Control Division manager)

ตัวอย่างน้ำมันดีเซลผ่านการกรอง**5µ**



PTT PUBLIC COMPANY LIMITED

Certificate of Analysis

Page 1 of 1

Product : Gasoline

Cert. No. T-11/07595
Sample Lab No. : OP-11/06356 — Delivery Date : 09 Mar 2011
Customer/Supplier : External Customer (Testing Service) — Date of Test : 10 Mar 2011
Sample Location : ถัง 200 ลิตร [illegible] 5 ไมครอน [illegible] — Date of Sampling : 04 Mar 2011
Sample Condition : Normal
Product Source : [illegible] 10230

TEST ITEM	TEST METHOD	LIMIT	RESULT
1. Appearance,	Visual	---	C&B
2. API Gravity @ 60 °F,°API	ASTM D 4052 -09	---	48.77
3. Density @ 15 °C,g/cm³	ASTM D 4052 -09	---	0.7846
4. Colour (Hue),	Visual	---	Yellow
5. Corrosion Silver Strip (3h/50 °C),Number	ASTM D 4814 (ANNEX A) -06	---	1a

Remark :

Approved by : Phurita Pothisak
Position Title : Quality Control Division Manager
Date of Issue : 21 Mar 2011

(This certificate relates only to the sample tested. Reproduction of it or any of its constituent part is not permitted without the consent of Quality Control Division manager)

ตัวอย่างน้ำมันเบนซินผ่านการกรอง**5µ**

การทดสอบคุณภาพน้ำมัน(ปตท)

Test Item (March 2011)	Test Method	Result (Diesel)	Result (Gasoline)
1.Appearance	Visual	Hazy	C&B
2.API Gravity@60°F	ASTM D 4052-09	47.35	48.77
3.Specific Gravity @15.6/15.6°C (Density@15°C,g/cm^3)	ASTM D 4052-09	0.7912	0.7846
4.Ash,%wt (ไม่สูงกว่า 0.05)	ASTM D 482-95	0.02	-
5.Flash Point,(P.M),°C	ASTM 93-09	24.0	-
		ตัวอย่างน้ำมันดีเซลผ่านการกรอง5µ	ตัวอย่างน้ำมันเบนซินผ่านการกรอง5µ

Test Item (March 2011)	Test Method	Result (Diesel)	Result (Gasoline)
6. Water and sediment,%vol (ไม่สูงกว่า0.05)	ASTM D 2709-96	0.03	-
7.Colour,ASTM /Colour(Hue)	ASTM D 1500-98	1.5 /Yellow	Yellow
8.Corrosion Copper strip(3h/50°C),No. (ไม่สูงกว่าหมายเลข1)	ASTM D 130-04$^{\varepsilon 1}$	1a	1a ASTM D 4814
9.Micro Method Carbon Residue,%wt (ไม่สูงกว่า 0.05)	ASTM D 4530-00	0.08	-

บทสรุป

- เทคโนโลยีในการแปรรูปขยะพลาสติกเป็นน้ำมันมีความเป็นไปได้ในการนำมาประยุกต์ใช้ในกระบวนการรีไซเคิลในประเทศไทยและประเทศอื่นๆในโซนอาเซียน
- เทคโนโลยีในการแปรรูปขยะพลาสติกเป็นน้ำมันช่วยในการประหยัดพื้นที่การฝังกลบขยะมูลฝอย การนำพื้นที่กลับมาหมุนเวียนใช้ใหม่ และยืดอายุการใช้งานของบ่อฝังกลบ รวมทั้งลดการปล่อยก๊าซเรือนกระจกก๊าซ CO_2 จากการเผาขยะมูลฝอยและขยะพลาสติก

31

บทสรุป

- คุณสมบัติและคุณภาพของน้ำมันไพโรไลติกคล้ายกับน้ำมันดิบและสามารถปรับปรุงให้มีคุณสมบัติคล้ายน้ำมันดีเซลและน้ำมันเบนซินได้ด้วยกระบวนการกลั่น
- นอกจากนี้ กระบวนการกลั่นน้ำมันดิบสามารถพัฒนาปรับปรุงคุณสมบัติและคุณภาพของน้ำมันดีเซลและน้ำมันเบนซินให้คล้ายและใกล้เคียงกับน้ำมันในท้องตลาดในเชิงพาณิชย์ได้ตามมาตรฐานและความปลอดภัยของเครื่องยนต์

32

กิตติกรรมประกาศ

● บริษัทเมืองสะอาด จำกัด และศูนย์ความเป็นเลิศในการจัดการสิ่งแวดล้อมและของเสียอันตราย มหาวิทยาลัยอุบลราชธานี ประเทศไทย สนับสนุนงบประมาณและองค์ความรู้ในการศึกษาวิจัยและพัฒนา

● รองศาสตราจารย์ธาราพงษ์ วิทิตศาสตร์ อาจารย์ประจำคณะวิทยาศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย ที่ให้คำแนะนำและข้อเสนอแนะในการพัฒนาปรับปรุงคุณภาพน้ำมัน

33

Plastic Recycle

"Workshop on Capacity Building on Accounting and Utilising GHG Emission Reduction Measures for Local Waste Management Actors in Developing Asian Countries, 4-6 September 2011, Vientiane, Lao."

MRS.SUTEE TUBNONGHEE
WARINCHAMRAP MUNICIPALITY
UBON RATCHATHANI PROVINCE,THAILAND

แนวทางการจัดการขยะพลาสติก

- ส่วนที่1การจัดการตั้งแต่ต้นทางแหล่งกำเนิด

  -การคัดแยกขยะมูลฝอยในชุมชนโครงการชุมชนปลอดขยะ หรือ Zero Waste Project

- ส่วนที่ 2การจัดการที่ปลายทางแหล่งกำจัด

  -การคัดแยกขยะมูลฝอย(โครงการนำร่องขยะฐานศูนย์)

  -การคัดแยกขยะที่บ่อฝังกลบประเภทขยะพลาสติก

  -การแปรรูปขยะให้มีมูลค่ารูปแบบต่างๆ เช่น การหลอมเม็ดพลาสติก และการแปรรูปขยะพลาสติกเป็นน้ำมัน

  -การฝังกลบแบบถูกหลักสุขาภิบาล

การจัดการขยะมูลฝอยที่ต้นทางแหล่งกำเนิด

-การคัดแยกขยะมูลฝอยในชุมชนโครงการชุมชนปลอดขยะ

การคัดแยกขยะที่บ้านเรือนในชุมชน

ขยะพลาสติก
จากครัวเรือน
-ถุงพลาสติก
-ถุงหูหิ้ว

สถานที่กำจัดขยะมูลฝอยแบบถูกหลักสุขาภิบาล

การจัดการขยะมูลฝอยที่ปลายทางแหล่งกำจัด

-การคัดแยกขยะมูลฝอย (โครงการนำร่องขยะฐานศูนย์)

การคัดแยกขยะมูลฝอยที่ศูนย์สาธิต (โครงการนำร่องขยะฐานศูนย์)

การคัดแยกขยะมูลฝอยวันละ 2-3 ตัน

ขยะบางส่วนที่เหลือ?

- พวกเศษอาหารนำไปหมักทำปุ๋ยและขยะอื่นๆ นำส่วนที่เหลือไปฝังกลบตามหลักสุขาภิบาล ซึ่งจะมีปริมาณลดน้อยลงมาก ลดค่าใช้จ่ายในการเก็บขนและกำจัดลดลง

การคัดแยกขยะที่บ่อฝังกลบประเภทขยะพลาสติก

ถุงพลาสติกเตรียมล้างทำความสะอาด

การแปรรูปขยะพลาสติกให้มีมูลค่า รูปแบบการหลอมเม็ดพลาสติก

กิจกรรมการจัดการขยะถุงพลาสติก(เดิม)


ถุงพลาสติกจากบ่อฝังกลบ


คลองวนเวียน


การล้างถุงพลาสติก


เครื่องสะบัดแห้ง


กิจกรรมการจัดการขยะถุงพลาสติก(เดิม)
การคัดแยกชนิดพลาสติก
ปั่นแห้งด้วยกรงกระรอก
แยกกองชนิดพลาสติก
เครื่องอัดก้อนพลาสติก


กิจกรรมการจัดการขยะถุงพลาสติก(พัฒนา)

กิจกรรมการจัดการขยะถุงพลาสติก(พัฒนา)

กิจกรรมการจัดการขยะถุงพลาสติก(พัฒนา)

กิจกรรมการจัดการขยะถุงพลาสติก(พัฒนา)

เครื่องสะบัดแห้ง

กิจกรรมการจัดการขยะถุงพลาสติก(พัฒนา)

การคัดแยกประเภทพลาสติก

กิจกรรมการจัดการขยะถุงพลาสติก(พัฒนา)
เครื่องปั่นแห้งแบบกรงกระรอก

พลาสติกที่รอการหลอมเม็ด
เศษพลาสติกนำไปแปรรูปน้ำมัน

กิจกรรมการหลอมเม็ดพลาสติก(เอกชน)

เครื่องหลอมพลาสติก

ตู้ควบคุมอุณหภูมิการหลอมเหลว

พลาสติกที่หลอมเหลว

ส่งต่อไปยังเครื่องรีดเส้น

กิจกรรมการหลอมเม็ดพลาสติก(เอกชน)

เครื่องรีดเส้นพลาสติก

หล่อเย็นด้วยรางน้ำ

เครื่องตัดเส้นพลาสติก

กิจกรรมการหลอมเม็ดพลาสติก(เอกชน)

เม็ดพลาสติก

เครื่องตัดเส้นพลาสติก

เครื่องชั่งน้ำหนัก

บรรจุกระสอบ

กิจกรรมการหลอมเม็ดพลาสติก(เอกชน)

กิจกรรมการบดย่อยและหลอมเม็ดพลาสติกถุงปุ๋ย


ถุงปุ๋ยพลาสติกPP


เครื่องบดย่อยถุงปุ๋ย


เครื่องบดย่อยถุงปุ๋ย


รางน้ำล้างถุงปุ๋ย

กิจกรรมการบดย่อยและหลอมเม็ดพลาสติกถุงปุ๋ย


รางน้ำล้างถุงปุ๋ย


สายพานเกี่ยวถุงปุ๋ยบดย่อย


ถุงปุ๋ยที่บดย่อยแล้ว


เครื่องหลอมพลาสติก

กิจกรรมการบดย่อยและหลอมเม็ดพลาสติกถุงปุ๋ย

ขั้นตอนการหลอมและตัดเม็ดพลาสติกถุงปุ๋ย(เช่นเดียวกัน)

กิจกรรมการบดย่อยและหลอมเม็ดพลาสติกถุงปุ๋ย

การนำผงพลาสติกรีไซเคิลผลิตผลิตภัณฑ์

การผลิตถังดักไขมัน

การนำผงพลาสติกรีไซเคิลผลิตผลิตภัณฑ์

การผลิตถังดักไขมัน

การนำผงพลาสติกรีไซเคิลผลิตผลิตภัณฑ์

การผลิตถังดักไขมัน

แผนการจัดการขยะพลาสติกระยะ 5 ปี
โครงการอนุรักษ์สิ่งแวดล้อม เทศบาลเมืองวารินชำราบ

ปี2549-2552	ปี2553	ปี2554	ปี2555	ปี2556
การคัดแยกถุงพลาสติก	เครื่องล้างแบบรางยาว	เครื่องเป่าถุงพลาสติก	เครื่องบดย่อยผงพลาสติก	เครื่องผลิตถังไบโอก๊าซ
เครื่องล้างถุงพลาสติก	เครื่องหลอมเม็ดพลาสติก	ถุงดำ ขยะทั่วไป	เครื่องผลิตถังขยะพลาสติก	เครื่องขึ้นรูปไม้พลาสติก
เครื่องสะบัดถุงพลาสติก	เครื่องผลิตถังดักไขมัน	ถุงแดง ขยะติดเชื้อ		เครื่องขึ้นรูปท่อพลาสติก
เครื่องปั่นกรงกระรอก	เครื่องแปรรูปขยะพลาสติกเป็นน้ำมัน			
เครื่องอัดก้อนพลาสติก				

1 2 3 4 5 6

Institute for Global Environmental Strategies

"ບົດຮຽນ ຈາກ ການປະຕິບັດຕົວຈິງ ຂອງ ຍີ່ປຸ່ນ ສໍາລັບ ການນໍາໃຊ້ເສດຂີ້ເຫຍື່ອ ຕົວເມືອງ

Yoshiaki Totoki
Sustainable Consumption and Production
Institute for Global Environmental Strategies
Contact: totoki@iges.or.jp

Workshop on Capacity Building on Accounting and Utilizing GHG Emission Reduction Measures for Local Waste Management Actors in Developing Asian Countries, Vientiane, Laos, 4-6 October 2011.

1. ຈຸດປະສົງ ແລະ ສະລະບານການບັນບາຍ

ຈຸດປະສົງ

- ເພື່ອຮຽນຮູ້ ການນໍາໃຊ້ ຂີ້ເຫຍື່ອ ຢູ່ຕົວເມືອງ ໂດຍການສັງເກດເຫັນ ພາກປະຕິບັດ ຢູ່ ປະເທດຍີ່ປຸ່ນ
- ເພື່ອພິຈາລະນາເບິ່ງວ່າ ຈະສາມາດເຮັດເປັນພະລັງງານໄດ້ແນວໃດ/ວັດສະດຸຕ່າງໆ ຈາກຕົວເມືອງ ຂອງ ປະເທດລາວ

ສະລະບານ

1. ຈຸດປະສົງ ແລະ ສາລະບານ ຂອງ ການສະເນີເຂດເນື້ອທີ່
2. ເນື້ອທີ່ ຂອງເມືອງໃຫຍ່ແລະ ການນໍາໃຊ້ ຊີວະມວນ
3. ເມືອງຊີວະມວນ
4. ກໍລະນີ ຂອງການບົ່ມຝຸ່ນ ຈາກຂີ້ເຫຍື່ອອິນຊີ
5. ກໍລະນີ ຂອງການເຮັດແກສຊີວະພາບ ຈາກຂີ້ເຫຍື່ອອິນຊີ
6. ກໍລະນີ ຂອງການເຮັດນໍ້າມັນຊີວະພາຍ ຈາກຂີ້ເຫຍື່ອອິນຊີ ກວດກາຄືນ
7. ຂີ້ເຫຍື່ອ ກໍລະນີ ການຜະລິດນໍາມັນຊີວະພາບຈາກ ນໍ້າມັນຄົວກິນທີ່ໃຊ້ແລ້ວ
8. ຂີ້ເຫຍື່ອ ໃນປະເທດລາວ
9. ຄວາມສາມາບົ່ມອຸ້ອນ ຂອງ ແກສຊີໄຟເອີ ຈາກ ຂີ້ແກບເຂົ້າ ໃນປະເທດລາວ
10. ສະຫລຸບສາຍເຫດທີ່ພາໃຫ້ມີຜົນສໍາເລັດ

2

2. ເຂດເມືອງໃຫຍ່ ແລະການນຳໃຊ້ ຊີວະມວນ

◆ເຂດຕົວ ເມືອງ ແມ່ນຄ້າຍຄືກັບເຄື່ອງຈັກຂະນິດໜຶ່ງ ທີ່ທຳການຜະລິດ ຂີ້ເຫຍື່ອ ຈາກກິດຈະກຳຕ່າງໆຂອງມັນ

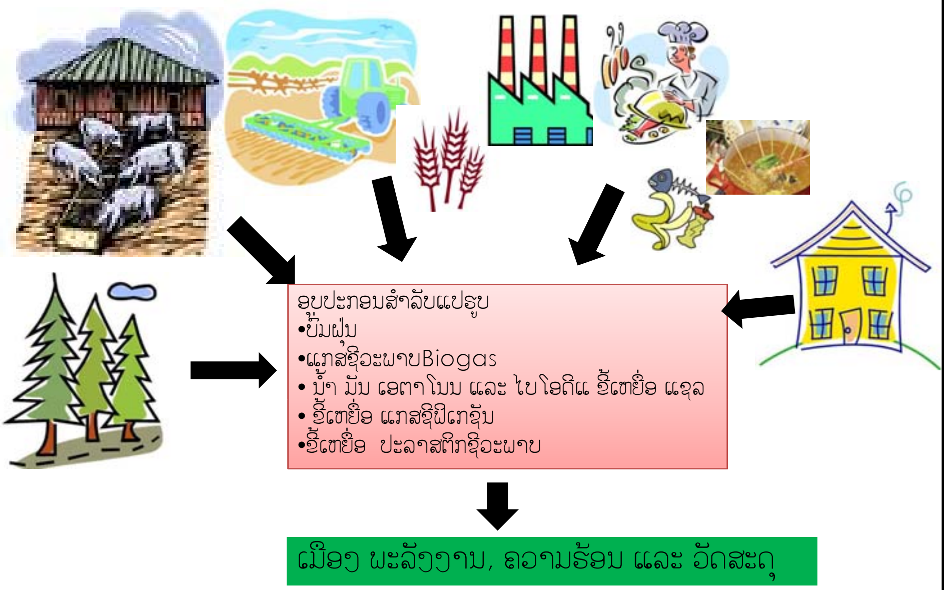
◆ໄດ້ມີຫລາຍໆກໍລະນີ ທີ່ຂີ້ເຫຍື່ອຈາກຕົວເມືອງ ສາມາດນຳໃຊ້ເປັນ ວັດສະດຸ ແລະ ພະລັງງານ ໂດຍການປະຕິບັດທັງການຈັດການຂີ້ເຍື່ອ ແລະ ການຫລຸດຜ່ອນແກາສ ເຮືອນແກ້ວລົງ

◆ການປະຕິບັດແບບຍີ່ປຸ່ນ: ເມືອງຊີວະມວນ, ຊຸມຊົນທີ່ມີການໃຊ້ຊີວະມວນ ຊຶ່ງມີສາຍສຳພັນກັນແບບແຂງແຮງ ກັບຊຸມຊົນ ແລະ ຜູ່ທີ່ມີສ່ວນຮ່ວມ 318 ຕົວເມືອງ (2011. ກໍລະກົດ)

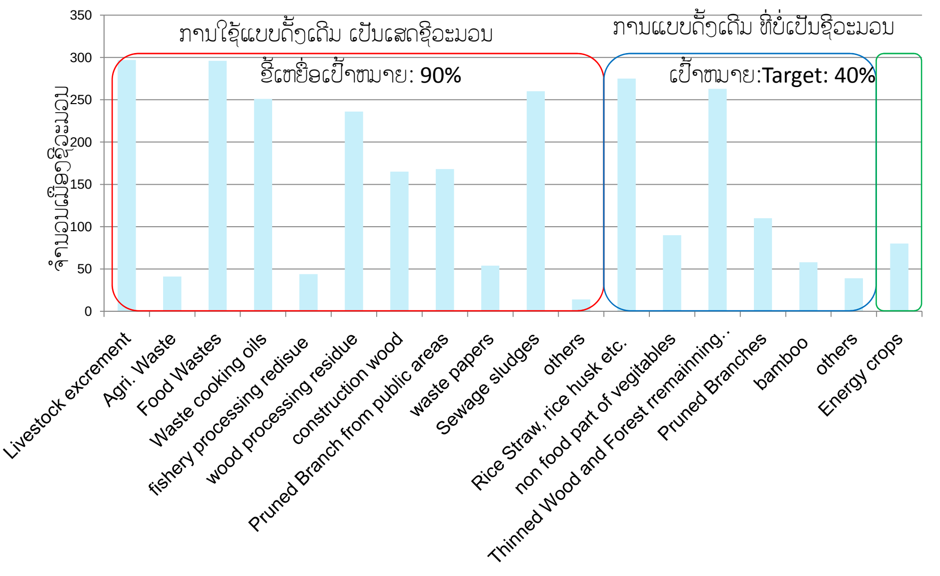
◆ຊີວະມວນ, ແມ່ນແຫລ່ງພະລັງງານທົດແທນ, ແມ່ນວັດສະດຸອິນຊີ ຈາກສິ່ງທີ່ມີຊີວິດ ຫລື ຈຳພວກອົງຄະທາດທີ່ມີຊີວິດຢູ່. ຊີວະມວນນີ້ ໄດ້ລວມມີ ຂີ້ເຫຍື່ອ ຈາກກິດຈະກຳຕ່າງຂອງຕົວເມືອງ ແລະ ເສດຈາກກະສິກຳ

3

3. ຂີ້ເຫຍື່ອ ແຫ່ງເມືອງຊີວະມວນ

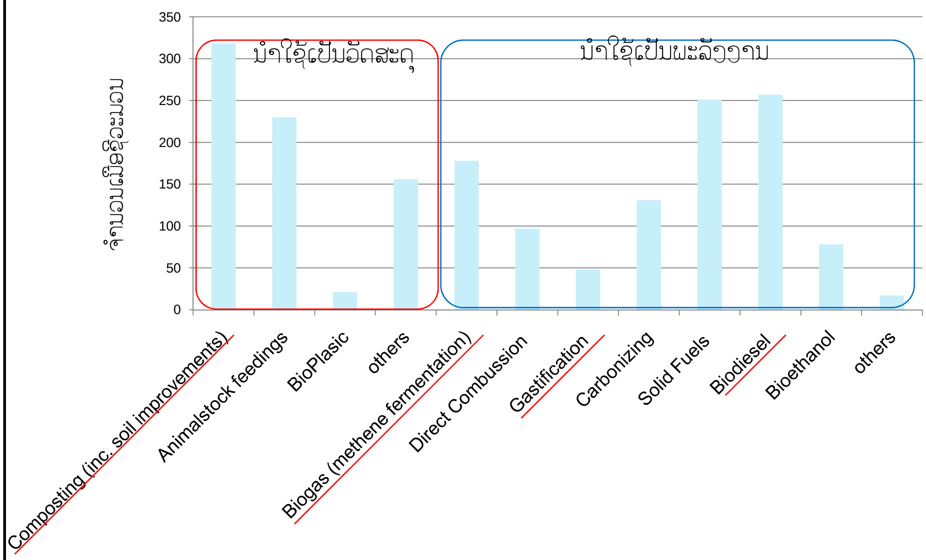


3. ຊີ້ເທຍື່ອ ເມືອງແຫ່ງຊີວະມວນ (ແຫລ່ງ ຊີວະມວນ)



5

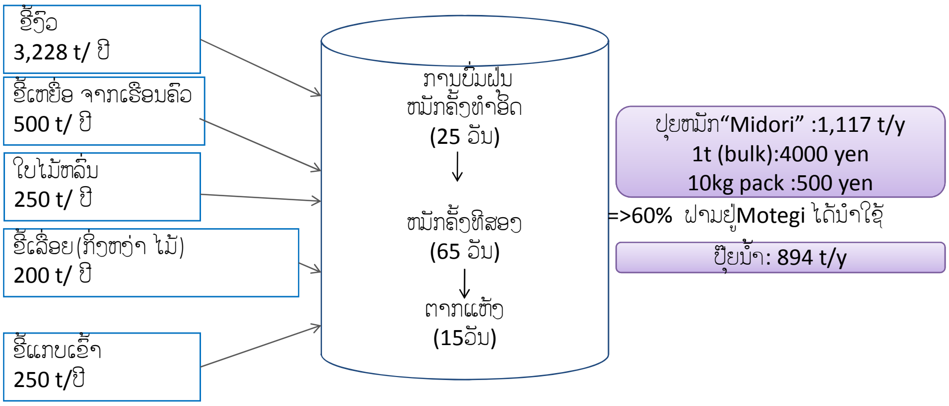
3. ເມືອງຊີວະມວນ (ຊີ້ເທຍື່ອ ເຕັກໂນໂລຢີແປຮູບ)



6

4. ກໍລະນີ ການບົ່ມຝຸ່ນ ຈາກ ຂີ້ເຫຍື່ອອິນຊີ

ເມືອງໂມເຕຍີ , ເທສະບານເມືອງ ໂຕຈິຍີ(ຂີ້ເຫຍື່ອ ປະຊາກອນ : 16,400, ເນື້ອທີ່: 172 km2)



ແຫລ່ງ:
ເມືອງຊິວະມວນ ໂມຍີ

7

4. (ຂີ້ເຫຍື່ອ ກໍລະນີ ຂອງການບົ່ມຝຸ່ນຈາກ ຂີ້ເຫຍື່ອອິນຊີ (ຕໍ່)

(ຂີ້ເຫຍື່ອ ຈາກເຮືອຄົວ 500 t/y	
ໃບໄມ້ຫລົ່ນ 250 t/y	
(ຂີ້ເລື່ອຍ 200 t/y	
(ຂີ້ແກບ 250 t/y	
(ຂີ້ງົວ 3,228 t/y	

(ລົບລ້າງການຈູດເຜົາ=> CO2 (ລຸຜ່ອນລົງ:
= (ປະລະມານຂີ້ເຫຍື່ອ [t/y]* (1- (ນ້ໍາ %[-])* (ຄາບອນ% [t-C/t]*44/12[t-CO2/t-C]
=[(ຂີ້ເຫຍື່ອ ຈາກເຮືອນຄົວ]+[(ໃບໄມ້ຫລ່ນ]+[(ຂີ້ເລື່ອຍ]+[ຂີ້ແກບ]
=([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]**

ຂີ້ເຫຍື່ອການລົບລ້າງ ການມັກໃຫ້ເກີດມີເທນ => CH4 ຫລຸດຜ່ອນລົງ:
= [ກໍລະນີບົ່ມຝຸ່ນ]-[ກໍລະນີ ການກອງຢູ່ທົ່ງ)
= (ປະລິມານຂີ້ເຫຍື່ອ [t/y]*(ປະສິດທິພາຍ((ກອງ) [t-CH4/t]- (ປະສິດທິພາບt(ການບົ່ມ) [t-CH4/t])
= 3,228(0.038-0.00044)
= **121[t-CH4/y]**

If you are interested, please see this.

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

8

5. ກໍລະນີ ແກສຊີວະພາບ ຈາກ ຂີ້ເຫຍື່ອອິນຊີ

ເມືອງ ຮິຕະ ເທສະບານ ໂອນຕາ ((ປະຊາກອນ: 72,000, Area: 666 km2 (82.8 %forest)
1.ບັນຫາຂີ້ເຫຍື່ອ ໃນເຕົາ ແລະ ສະໜາມ ຂີ້ເຫຍື່ອ
2. ໂລກຮ້ອນ
3. ບັນຫາແວດລ້ອມຂອງ ສັດລ້ຽງ

ຂີ້ແລະນໍ້າຫວ່ຽວໝູ
27t/ ວັນ (50t/ ວັນ)

ຂີ້ເຫຍື່ອຈາກເຮືອນຄົວ
22 t/day (24t/day)

ອຸດຈະລະຂອງຄົນ
5 t/day (6t/day)

ເກາເຫລົ້າຊະເກະ
16 t/ ວັນ (0 t/ ວັນ)

ອຸປະກອນ;ມັກເຮັດແກສມີເທນ

ຂະບວນການ:
ອຸນຫະພູມປານກາງ
ຂະບວນການປຽກ: (35)
Wet Process (35)
80t/ວັນ
340kw

ຜະລິດໄຟຟ້າ
5,620kWh/day (plan)

CO_2 rລຸດຜ່ອນລົງ ໂດຍການໃຊ້ເປັນສິ່ງຜະລິດໄຟຟ້າແທນ
= Ave. Ele Gen(kwh/d)*Day (d)* CO_2 emission coefficient (t-CO_2/kwh)
=4,891* 286* 0.000348 (2009)
= **487 t/y**

ຜະລິດຄວາມຮ້ອນ
8,300MCal/day

CO_2 reduction as an alternative heat source
= Heat Gen(Mcal/d)*Day (d)* CO_2 emission coefficient (t-CO_2/GJ)
=8,300* 286*0.057*4.2/1000
= **568 t/y**

ຝຸ່ນບົ່ມ 300t
50 yen/15kg

ປຸຍນໍ້າ 2,500t

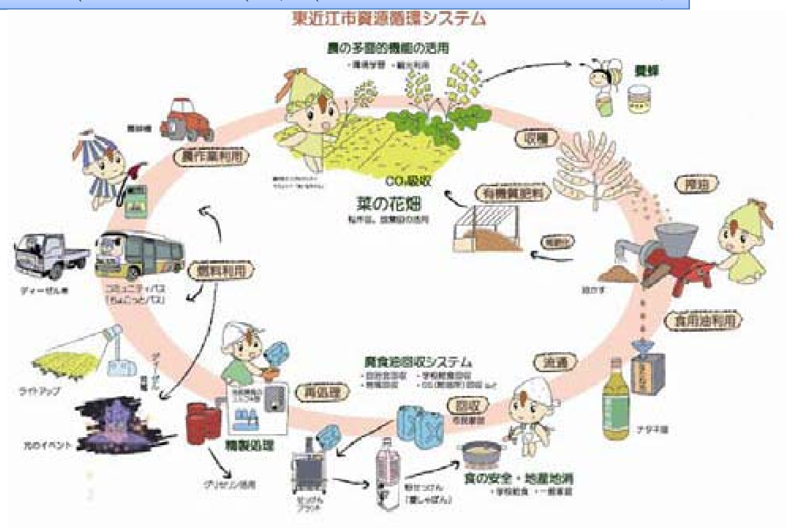
Source: Hita City

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

9

6. ກໍລະນີ ໄບໂອດີເຊນ ຈາກນໍ້າມັນຄົວກິນ

ເມືອງ ຫິກາຊິ ໂອມິມ ເທສະບານ ຊິກາ(ປະຊາກອນ: 116,797, ເນື້ອທີ່: 388.58 km2)

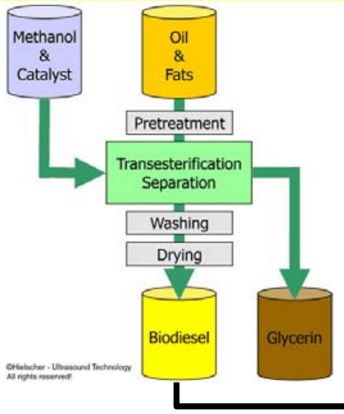


Source: Higashi Omi City

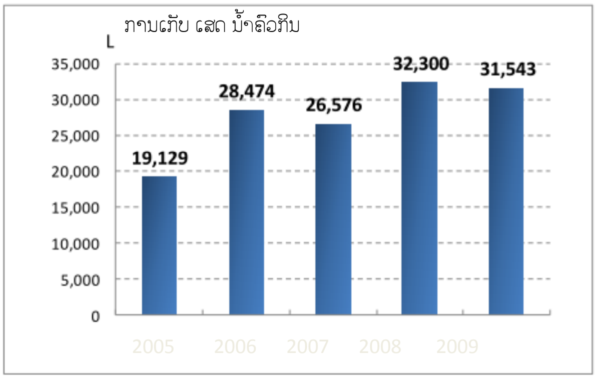
10

6. ກໍລະນີ ໄບໂອດີເຊນ ຈາກນ້ຳມັນຄືວກິນ(ຕໍ່)

$$\begin{array}{l} CH_2OCOR_1 \\ | \\ CHOCOR_2 + 3CH_3OH \\ | \\ CH_2OCOR_3 \end{array} \overset{KOH}{\rightleftharpoons} \begin{array}{l} R_1COOCH_3 \\ \\ R_2COOCH_3 \\ \\ R_3COOCH_3 \end{array} + \begin{array}{l} CH_2OH \\ | \\ CHOH \\ | \\ CH_2OH \end{array}$$



6. ກໍລະນີ ໄບໂອດີເຊນ ຈາກນ້ຳມັນຄືວກິນ (ຕໍ່)



Source:
Higashi Omi City

CO2 ລຸດຜ່ອນລົງ ໂດຍການໃຊ້ ນ້ຳມັນ ໄອດີເຊລ,
= ການຜະລິດໄບໂອດີເຊລ * ຕົວຄູນ ການປ່ອຍແກສ CO2 ຂອງການໃຊ້ດີເຊລ
= 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”

12

7. ຂີ້ເຫຍື່ອຢູ່ປະເທດລາວ

ມີຫຍັງແດ່ ໃນຕົວເມືອງຂອງລາວ ທີ່ສາມາດນໍາເປັນ ພະລັງງານໄດ້	ກໍລະນີຈະສາມາດນໍາໃຊ້ ຊີວະມວນໄດ້ແນວໃດ?
• ຂີ້ເຫຍື່ອຈາກເຮືອນຄົວ • ມູນສັດ ແລະນໍ້າຫງ່ຽວ • ເສດນໍ້າມັນຄົວກິນ • ຂີ້ແກບ ແລະເຟືອງ • ຂີ້ອ້ອຍ, • ອາຈົມ etc. • ກະໂປະຫມາກພ້າວ • etc.	• ອຸປະກອນທີ່ມີຢູ່ແລ້ວ • ໂຮງງານປົ່ນຝຸ່ນ • ເຄື່ອງກັ່ນຕອງແກສຊີວະພາບ • ອຸປກອນ ແກສຊີໄຟເອີ • etc.

13

8. ຄວາມສາມາດ ເຮັດ ແກສຊີຟີກເຄຊັນຈາກ ແກບເຂົ້າ ໃນປະເທດລາວ

ປີ (1000ton)	1996	1997	1998	1999	2000
ເຂົ້າ	1,413	1,660	1,675	2,103	2,155
ສາລີ	77	78	110	96	77
ມັນຝລັ່ງ	92	94	108	81	52
ຜັກ	117	132	150	269	288
ອອ້ຍ	87	95	170	174	174
ກາເຟ	10	12	17	18	23

Source: FAO

➢ເປີເຊັນການຜະລິດເຂົ້າ ຂອງລາວສູງ
➢ ການຜະລິດເຂົ້າ ເພີ່ມຂື້ນ
➢22% ສາລີ ໃນນັ້ນ 22% ແມ່ນ ແກບເຂົ້າ
2,000,000 t/y*0.22 => ຜະລິດແກບເຂົ້າ: 440,000t/y.

8. ຄວາມສາດ ເຮັດ ແກສຊີຝີເກຊັນ ຈາກ ແກບເຂົ້າ ໃນປະເທດລາວ

Heat(500- 600 ° C)

$(C_6H_{12}O_6)_m$ → $(H_2 + CO + CH_4 + ... + C_5H_{12})$:ແກສ

:Biomass + $(H_2O + ... + CH_3OH + CH_3COOH + ...)$:ຂອງແຫລວ

+ C : ຖ່ານ

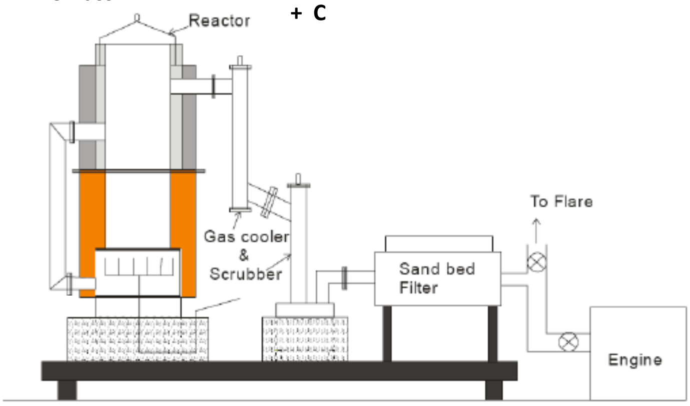


Figure 3 - Schematic representation biomass gasification

Source: www.bioenergy3.org

8. ຄວາມສາດ ເຮັດ ແກສຊີຝີເກຊັນ ຈາກ ແກບເຂົ້າ ໃນປະເທດລາວ

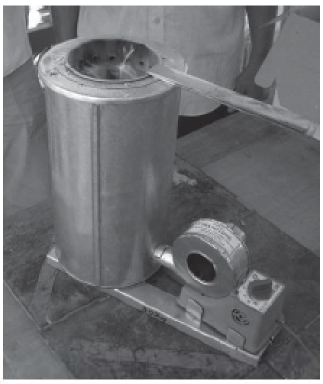


Figure 2 Reed's Woodgas Campstove (left) for sale on the Internet (US$55) and Anderson's Juntos B+ TLUD gasifier (with removable fuel canister) hand-made in Cambodia with GERES (estimated cost under US$20). For cooking, the pot can be placed on top of the unit or (better) be positioned on a simple pot support structure of any size so that the gasifier can be moved for refilling without disturbing the pot. (*photos: Tom Reed, left, Paul Anderson, right*)

Source: http://www.hedon.info

9. ສະຫລຸບ ແລະສາຍເຫດທີ່ພາໃຫ້ມີຜົນສໍາເລັດ

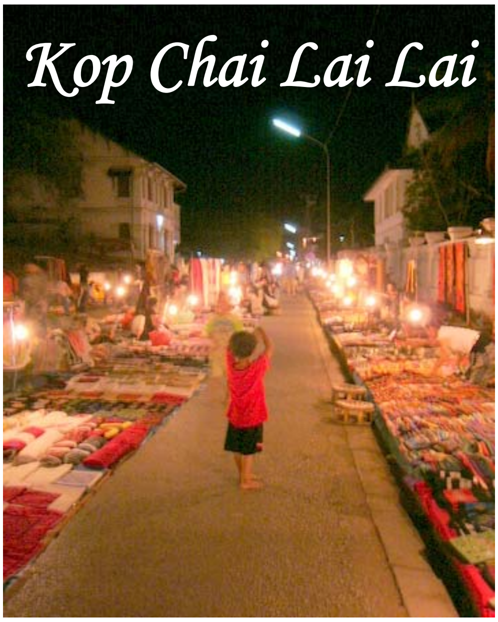
<u>ສະຫລຸບ</u>

- ໄດ້ມີ ເສດຊີວະມວນຫລາຍໆຢ່າງ ໃນເຂດຕົວເມືອງ ແລະ ປະກົດມີ ເຕັກໂນໂລຢີ ຫລາຍຢ່າງ ທີ່ສາມດນໍາມາໃຊ້ ກັບຊີວະມວນທີ່ມີຢູ່. ຊຶ່ງວ່າ ການປະສົມປະສານກັນ ການໃຊ້ ເສດຊີວະມວນ ຈະ ປ່ຽນໄປຕາມ ປະເທດ ເມືອງ
- ປະເທດລາວ ມີຄວາມບົ່ມຊຸອັນສູງ ໃນການນໍາໃຊ້ ຊີວະມວນ ເພື່ອຜະລິດພະລັງງານ ແລະໃຊ້ເປັນວັດສະດຸ

<u>ສາຍເຫດທີ່ພາໃຫ້ ປະສົບຜົນສໍາເລັດ</u>

- ອັນດັບທໍາອິດກ່ອນຫມູ ແມ່ນ ການຈັດການທີ່ຖືກວິທີ
- ການພົວພັນກັບ ຜູ່ມີສ່ວນຮ່ວມ
- ການນໍາໃຊ້ ອຸປະກອນ, ເຕັກໂນໂລຢີ, ຊັບພະຍາກອນມະນຸດ ແລະ ລະບົບການຈັດການ
- ການແຍກຂີ້ເຫຍື່ອຢູ່ບ່ອນຜະລິດ ແລະ ປະສິດທິພາບການເກັບ ແມ່ນຂໍກຸນແຈໄປສູ່ຜົນສໍາເລັດ

17



ການບຳບັດຂີ້ເຫຍື່ອ ແບບກົນຈັກ ຊີວະພາບ MBT
ເມືອງພິດສນຸໂລກ

Suthi Hantrakul   Deputy Mayor, Phitsanulok City Municipality

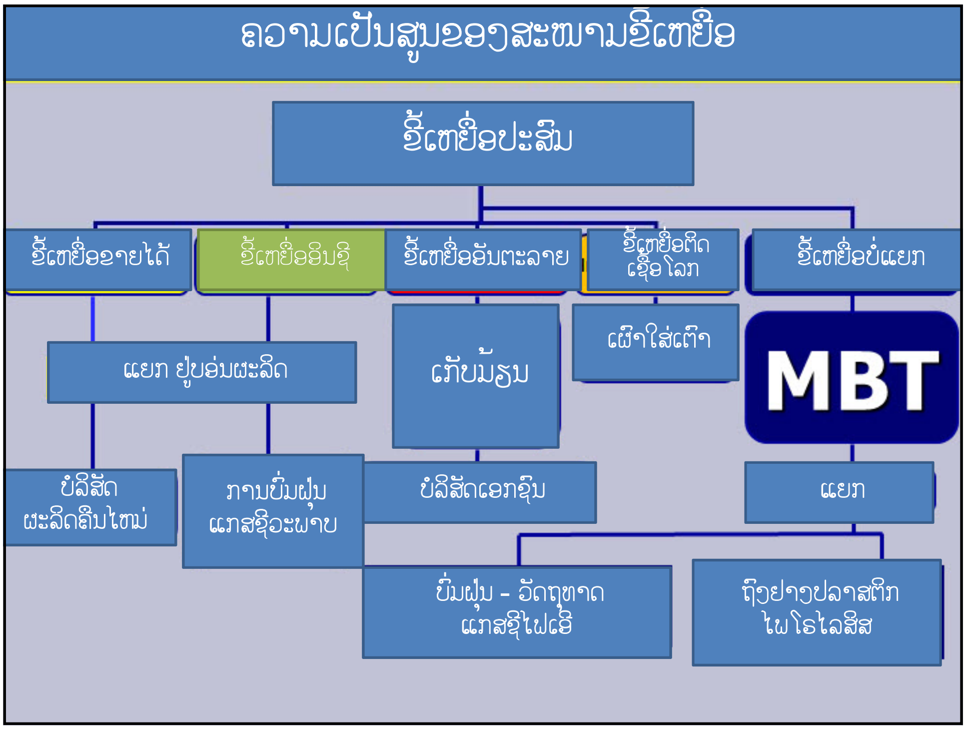
ເນື້ອທີ່ 18.26Km^2

32,000 ຄອບຄົວ

78,000
ຈຳນວນພົນ ທີ່ລົງທະບຽນ

50,000-100,000
ຈຳນວນພົນ ທີ່ບໍ່ລົງທະບຽນ

ງົບປະຈຳປີ
16.6 ລ້ານ USD



ຄວາມເປັນສູນຂອງສະໜາມຂີເຫຍືອ
ຂີ້ເຫຍື່ອປະສົມ
ຂີ້ເຫຍື່ອຂາຍໄດ້
ຂີ້ເຫຍື່ອອິນຊີ
ຂີ້ເຫຍື່ອອັນຕະລາຍ
ຂີ້ເຫຍື່ອຕິດ
ເຊື້ອ ໂລກ
ຂີ້ເຫຍື່ອບໍ່ແຍກ
ແຍກ ຢູ່ບ່ອນຜະລິດ
ເກັບມ້ຽນ
ເຜົາໃສ່ເຕົາ
MBT
ບໍລິສັດ
ຜະລິດຄືນໃໝ່
ການບົ່ມຝຸ່ນ
ແກສຊີວະພາບ
ບໍລິສັດເອກຊົນ
ແຍກ
ບົ່ມຝຸ່ນ - ວັດຖຸທາດ
ແກສຊີໄຟເອີ
ຖົງຢາງປລາສຕິກ
ໄພໂຣໄລຊີສ


ชุมชน
บรมไตรโลกนารถ ๒๑

ຂີ້ເຫຍື່ອ ອັນຕະລາຍ

ກອງໄວ້

ເກັບ

ເກັບຮັກສາ

ຂົນສົ່ງ

ກໍາຈັດໂດຍ ບໍລິສັດເອກະຊົນ

ຂີ້ເຫຍື່ອ ຕິດເຊື້ອໂລກ

ເຜົາ

ການບຳບັດ ແບບ ກົນຈັກ ຊີວະພາບ MBT

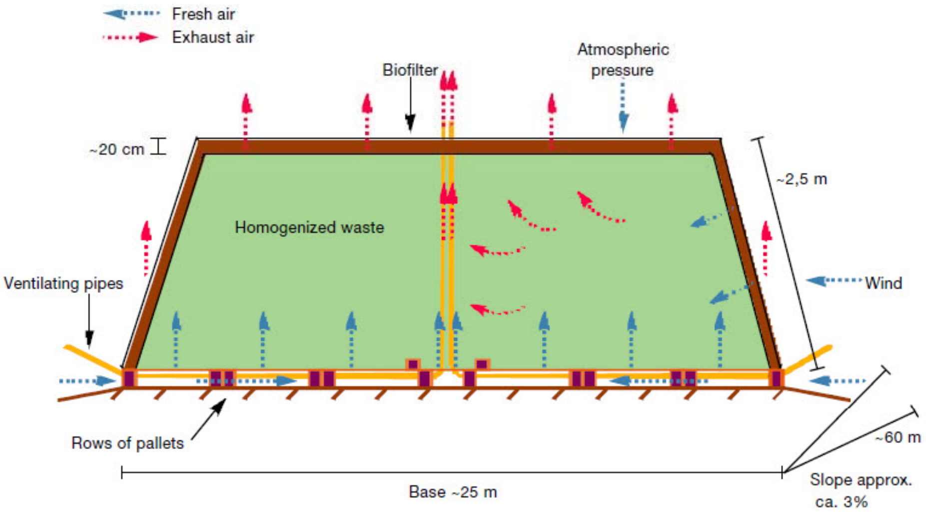
- ທາງກົນຈັກ ແມ່ນ ຂະບວນການ ແຍກ ເອົາສິ່ງທີ່ຜະລິດຄືນໄດ້ ອອກຈາກຂີ້ເຫຍື່ອປະສົມ, ເຊັ່ນ ໂລຫະ, ແກ້ວ, ເຈັ້ຍ ເຟີນີເຈີ ອື່ນໆ
- ຂະບວນການນີ້ ອາດ ປະຕິບັດໂດຍມື ຫລື ເຄື່ອງຈັກ ອດຕະໂນມັດ
- ການແກຂີ້ເຫຍື່ອ ທີ່ແຫລ່ງຜະລິດ

ການບຳບັດ ແບບ ກົນຈັກ ຊີວະພາບ MBT

ຂະບວນການທາງຊີວະພາບ ໄດ້ແກ່

- ການອົບແຫ້ງ (ຂີ້ເຫຍື່ອ ຖືກອົບແຫ້ງໂດຍ ອາກາດຮ້ອນ)
- ການຍ່ອຍສະລາຍແບບປິດອາກາດ
- ການບົ່ມຝຸ່ນ
- ຫລືແບບວິທີປະສົມປະສານກັນ

ຮູບສະແດງ ກອງທີ່ໃຊ້ປະຈຸບັນ ແລະລະບົບການລະບາຍອາກາດ

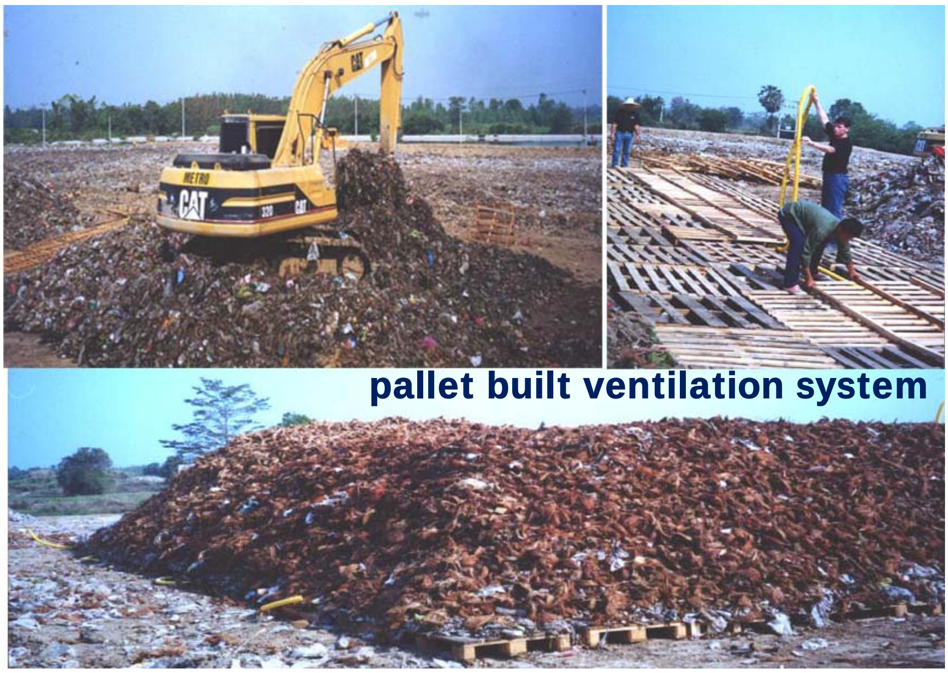


Dipl.-Bioi. Gabriele Janikowski, IKW GmbH


MBT on Landfill


FABER-AMBRA
Homoginizer

ລົດຈົກ ກໍ່ສ້າງ ກອງຂີ້ເຫື່ອ



Screening

ກາກມຸນ ຝຸ່ນ – ເປັນສານວັດຖຸ

ຊີວະມວນ: ສຳລັບ ແກສຊີໄຟເອີ

Refuse Derived Fuel :RDF

ໄພໂຣໄລຊິສ : ເປັນນ້ຳມັນເຊື້ອໄຟແຫລວ

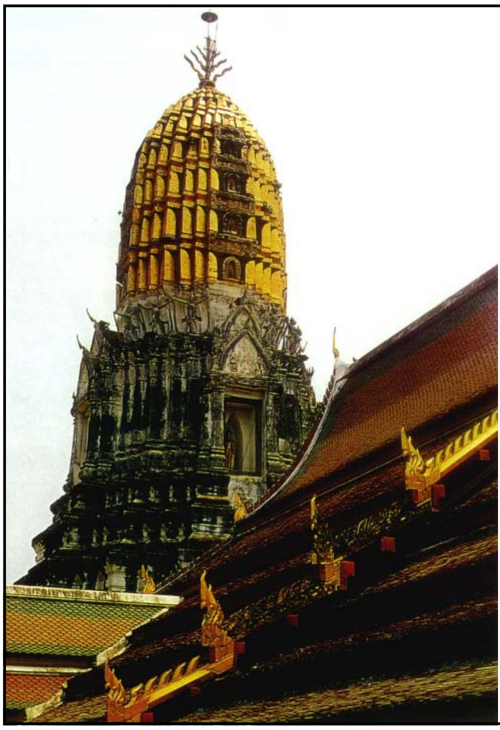
ສະຫລຸບ

- ມີສ່ວນເສດເຫລືອພຽງເຫລັກນ້ອຍ ເພື່ອໄປບຳບັດຂັ້ນສຸດທ້າຍ
- ມີເສດອາຫານຕ່ຳທີ່ສຸດ ໂດຍການໃຊ້ໃຫ້ມັນ ເປັນຕົວນຳ ໃນຂະບວນການ ການເກີດແກສຊີວະພາບ
- ການປ່ອຍແກສຂອງສະໜາມຂີ້ເຫຍື່ອນ້ອຍທີ່ສຸດ ຊຶ່ງ ຂີ້ເຫຍື່ອອິນຊີທີ່ໝັ້ນຄົງ ຖືກ ບຳບັດ ຢູ່ສະໜາມຂີ້ເຫຍື່ອ
- ມີຄວາມເປັນໄປໄດ້ ທີ່ຈະຂໍ carbon credits ເພື່ອໃຫ້ມີລາຍຮັບຕື່ມ
- ບໍ່ຕ້ອງການປົກຄຸມ ສະໜາມຂີ້ເຫຍື່ອປະຈຳວັນ
- ສາມາດຍືດອາຍຸການຂອງສະໜາມຂີ້ເຫຍື່ອ ຢ່າງນ້ອຍສອງເທົ່າ (ລຸດຜ່ອນບໍລິມາດລົງ ຢ່າງນ້ອຍສອງ 50% : ຄວາມໜາແໜ້ນ 1.3t/m3)

100 tons of unsorted waste

- 30 tons High Caloric Fraction (RDF)
- 30 tons Compost-like Subatance

*Per ton *Thai Baht	Landfill	MBT+Landfill	MBT+Pyrolysis	MBT+Pyrolysis+ Gasification
Investment Cost	100	100	100	100
Operating Cost	200	30	30	30
After Care	50	-	-	-
MBT		350	350	350
Pyrolysis			150	150
Gasification				100
Total	350	480	330	230



ຂໍຂອບໃຈ

ການປະມານຄ່າ ການປ່ອຍແກສເຮືອນແກ້ວ ຈາກການກຳຈັດ ແລະ ການບຳບັດຂີ້ເຫຍື່ອ

Baasansuren Jamsranjav, IPCC TFI TSU

Workshop on Capacity Building on Accounting and Utilising GHG Emission Reduction Measures for Local Waste Management Actors in Developing Asian Countries
4-6 October 2011, Lao People's Democratic Republic

ສາລະບານ

- ຄວາມເປັນມາ
- ຄູ່ມື IPCC ສຳບັນຊີການປ່ອຍແກສເຮືອນແກ້ວແຫ່ງຊາດ
- ວິທີຄິດໄລ່ການປ່ອຍແກສສູ່ເຮືອນແກ້ວຈາກ
  - ການກຳຈັດຂີ້ເຫຍື່ອເທິງໜ້າດິນ
  - ການບຳບັດຂີ້ເຫຍື່ອແບບ ຊີວະພາບ
  - ການຈູດເຜົາ ຂີ້ເຫຍື່ອຢູ່ເຕົາ ແລະ ແບບເປີດ
- ເຄື່ອງມື ແລະ ເຄື່ອງປະກອບອື່ນໆ ສະນັບສະໜູນໃຫ້ການ ຄິດໄລ່ ປະມານການປ່ອຍແກສ ເຮືອນແກ້ວ
- ສະຫລຸບ

ສະເໜີຄວາມເປັນມາ

- ການກຳຈັດ ແລະ ການບຳບັດຂີ້ເຫຍື່ອ ເກີດມີ ແກສເຮືອນແກ້ວ GHG
  – ໂດຍສະເພາະແລ້ວ ສະໜາມຂີ້ເຫຍື່ອ ເປັນແຫລ່ງໃຫຍ່ກວ່າ ໃນພາກສ່ວນຂີ້ເຫຍື່ອ
- ການປ່ອຍແກສເຮືອນແກ້ວ ຈາກການກຳຈັດ ແລະ ການບຳບັດຂີ້ເຫຍື່ອ ຄາດວ່າ ຈະເພີ່ມຂື້ນ ໃນບັນດາ ປະເທດກຳລັງພັດທະນາທັງຫລາຍ
- ການປະມານ ການປ່ອຍແກສ GHG ແມ່ນ ສ່ວນສຳຄັນຫລາຍ ຂອງສະພາບອຸນຫະພູມ
- ບັນຊີການປ່ອຍແກສ ແມ່ນກະປະມານ ຈາກ ການປ່ອຍທັງໝົດ/ການແຍກອອກ ຂອງແກສສະເພາະ ຈາກແຫລ່ງຜະລິດ ບ່ອນທີ່ກຳໜົດໃຫ້ ໃນໄລຍະເວລາທີ່ກຳໜົດໄວ້
  – ສະໜອງ ຂໍ້ມູນຂ່າວສານ ກ່ຽວກັບ ແນວໂນ້ມການປ່ອຍແກສ
  – ສາມາດມີທາງເລືອກນະໂຍບາຍ ເພື່ອລຸດຜ່ອນການປ່ອຍແກສ ທີ່ສາມາດສົມທຽບກັນ
  – ເປັນສິ່ງປ້ອນເຂົ້າຫລັກ ເພື່ອທຳການສຶກສາທາງວິທະຍາສາດ ໃນການປ່ຽນແປງພູມອາກາດ

ຄູ່ມື IPCC ສຳບັນຊີການປ່ອຍແກສເຮືອນແກ້ວແຫ່ງຊາດ

- ໂຄງການ PCC ສຳບັນຊີການປ່ອຍແກສເຮືອນແກ້ວແຫ່ງຊາດ (NGGIP) ສະໜອງວິທີຄິດໄລ່ ທີ່ສາກົນຮັບຮູ້ ໃຫ້ ບັນຊີGHG ແຫ່ງຊາດ ເພື່ອ ການກະປະມານ ການປ່ອຍແກສເຮືອນແກ້ວ ແຫ່ງຊາດ ແລະການແຍກອອກ. ທີ່ຊອກເອົາໄດ້ທີ່ (http://www.ipcc-nggip.iges.or.jp/)
  – 1995 ດັດແກ້ 1996 IPCC ຄູ່ມື ສຳລັບບັນຊີການປ່ອຍແກສເຮືອນແກ້ວແຫ່ງຊາດ
  – IPCC ຄູ່ມືປະຕິບັດທີ່ດີ ແລະ ການຈັດການຄວາມບໍ່ແນ່ນອນໃນ ບັນຊີ ແກສເຮືອນແກ້ວ ແຫ່ງຊາດ (GPG2000)
  – IPCC ຄູ່ມືປະຕິບັດທີ່ດີ ສຳລັບການໃຊ້ທີ່ດິນ, ການປ່ຽນແປງການໃຊ້ ທີ່ດິນ ແລະປ່າໄມ້ (GPG- LULUCF)
  – 2006 IPCC ຄູ່ມືສຳລັບບັນຊີ ແກສເຮືອນແກ້ວ
    - ປັບປຸງຈາກ ຄູ່ມືສະບັບກ່ອນ ໂດຍຜ່ານ GPG2000 and GPG-LULUCF
    - ດັດແກ້/ປັບປຸງແບບວິທີ ແລະ ຕັ້ງຂໍ້ມູນໄວ້

ຈະກະປະມານການປ່ອຍແກສເຮືອນແກ້ວໄດ້ແນວໃດ

- ແບບວິທີ ທີ່ໃຊ້ກັນທົ່ວໆໄປ

$$Emissions = AD * EF$$

AD (Activity data): ຂໍ້ມູນ ກິດຈະກຳຂະນາດໃຫຍ່ ຂອງມະນຸດ ທີ່ມີຜົນໃຫ້ການປ່ອຍ/ຍົກອອກມາ ຂອງແກສ ຢູ່ສະຖານທີ່ , ໄລຍະເວລາ (ເຊັ່ນ ການຈູດຂີ້ເຫຍື່ອ ແບບເປີດ Gg/ປີ

EF (Emission factor) ຕົວຄູນ ປະລິມານການປ່ອຍ ຫລື ການຍົກອອກ ຂອງ ແກສ ຕໍ່ຫົວໜ່ວຍກິດຈະກຳ (ເຊັ່ນ kg CH4/Gg ຂອງຂີ້ເຫຍື່ອທີ່ຈູດແບບເປີດ)

- ການເກັບກຳ ຂໍ້ມູນ AD ແລະ EF ແມ່ນສ່ວນຮ່ວມກັນກັບ ການປະມານການປ່ອຍແກສ
- ຂໍ້ມູນຂອກໄດ້ ກ່ຽວກັບ ຂີ້ເຫຍື່ອ (ຂໍ້ມູນ ກ່ຽວກັບ ການຜະລິດຂີ້ເຫຍື່ອ, ສ່ວນປະກອບ ແລະ ການຈັດການ ແລະອື່ນໆ
- ຄູ່ມື IPCC ສາມາດສະໜອງຂໍ້ມູນເດີມທີ່ຕັ້ງຄ່າໄວ້ ແລະ ລາຍລະອຽດຂອງການເກັບຂໍ້ມູນ

ການກຳຈັດຂີ້ເຫຍື່ອເທິງໜ້າດິນ: ການປ່ອຍ CH_4

- ດັດແກ້ 1996 IPCC ຄູ່ມື ສະໜອງໃຫ້ ສອງວິທີ : ການດຸ່ນດ່ຽງມວນສານ ແລະ ອັນດັບການສະລາຍເນົ່າເປື່ອຍ (FOD)
- ຕາມແບບວິທີດຸ່ນດ່ຽງມວນສານ
  - ສົມມຸດວ່າ ຄວາມບົ່ມຊ້ອນຂອງCH4 ທັງໝົດ ແມ່ນເກີດມີ ໃນປີທີ່ທຳການບຳບັດຂີ້ເຫຍື່ອນັ້ນ
  - ປະມານ ຄວາມບົ່ມຊ້ອນການປ່ອຍແກສ ຫລາຍກວ່າ ການເກີດມີຈິງໃນປີໜຶ່ງ

$$CH_4 Emissions(Gg/yr) = (MSW_T \bullet MSW_F \bullet MCF \bullet DOC \bullet DOC_F \bullet F \bullet 16/12 - R) \bullet (1 - OX)$$

MSW_T: total MSW generated, Gg/yr
MSW_F: fraction of MSW disposed to SWDSs
MCF: methane correction factor, fraction
DOC: degradable organic carbon, fraction
DOC_F: fraction of DOC dissimilated
F : fraction of CH_4 in landfill gas (default is 0.5)
R_T: recovered CH_4, Gg/yr
OX: oxidation factor, fraction (default is 0)

ການກຳຈັດຂີ້ເຫຍື່ອເທິງໜ້າດິນ: ການປ່ອຍ CH_4

- ວິທີ ອັນດັບການຍ່ອຍສະລາຍກ່ອນ(FOD) ສາມາດ ໃຫ້ຄວາມຊັດເຈນກວ່າ ໃນການປະມານ ການປ່ອຍແກສຂອງປີ
  - ການຄິດໄລ່ ສຳລັບການປ່ອຍຈິງແລ້ວ ແມ່ນຈະເກີດມີໄດ້ ໃນຫລາຍປີ
  - ປະມານການ ການປ່ອຍແກສຈິງຕໍ່ປີ ຂອງCH4
- ແບບວິທີ FOD ທີ່ປັບປຸງໃໝ່ ແມ່ນ ມີໃນ ຄູ່ມື IPCC 2006 volume 5
  - ຕົວແບບຕາຕະລາງຄິດໄລ່ FOD (IPPC waste Model) ປະກອບມີ ຄູ່ມື ເພື່ອ່ລະອ້າວ (http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol5.html)
- ແບບວິທີ FOD ຕ້ອງການມີຂໍ້ມູນ ປະຫວັດຂອງການກຳຈັດ ຂີ້ເຫຍື່ອ
  - 2006 ຄູ່ມື ມີ ການ ແນະນຳ ວິທີການປະມານຂໍ້ມູນປະຫວັດ ການກຳຈັດຂີ້ເຫຍື່ອ

ຕາຕະລາງຕົວແບບ FOD (IPCC ຕົວແບບຂີ້ເຫຍື່ອ)

- CH_4 ປ່ອຍອອກຕໍ່ປີ *T* ຈາກ ຂີ້ເຫຍື່ອ ບຳບັດ (Gg)

$$CH_4Emissions = \left[\sum_x CH_4generated_{x,T} - R_T\right] * (1 - OX_T)$$

T : inventory year

X : waste category or type/material

R_T : recovered CH_4 in year *T*, Gg

OX_T : oxidation factor in year *T*, fraction

- ການປະມານ ປະລິມານຂອງ CH4 ທີ່ຜະລິດອອກໄດ້ ໃນ ຂີ້ເຫຍື່ອບຳບັດ ແມ່ນອີງໃສ່ FOD
- ພື້ນຖານການຄິດໄລ່ ແມ່ນ ຈຳນວນທີ່ ຍ່ອຍສະລາຍໄດ້ ໃນ ຂີ້ເຫຍື່ອ – ພາກສ່ວນ ອິນຊີ ຄາບອນ ທີສາມາດຍ່ອຍສະລາຍໄດ້ ພາຍໃຕ້ເງື່ອໄຂບໍ່ມີອາກາດ ໃນ SWDS
- ຮັກສາ ການຄິດໄລ່ ໂດຍໃຊ້ ຈຳນວນລວມຂອງການຍ່ອຍສະລາຍໄດ້, ຄິດໄລ່ເອົາ ຈຳນວນສະສົມໄວ້ແຕ່ລະປີ ແລະ ຈຳນວນເຫລືອ ຂອງປີຜ່ານມາ

ຕາຕະລາງຕົວແບບ FOD (IPCC ຕົວແບບຂີ້ເຫຍື່ອ)

- ຕົວແປທັງໝົດ ຖືກປ້ອນເຂົ້າໃສ່ ແຊລ ທີ່ໝາຍເປັນສີເຫລືອງ ໃນຕາຕະລາງຄິດໄລ່ ທີ່ເປັນສີເຫລືອງ
- ຄ່າຕັ້ງໄວ້ ສຳລັບພາກພື້ນ AD ແລະຕົວແປ ລວມກັນເຂົ້າ ໃນຕາຕະລາງຄິດໄລ່ ແລະການ ເລືອກເອົາພາກພື້ນທີ່ແທດເໝາະ ໃນ “Parameters” ຕາຕະລາງ ຈະປັບປ່ຽນ ຄ່າທີ່ຕັ້ງໄວ້ ຂອງ IPCC ໃນຕາຕະລາງໃໝ່ຕໍ່ໄປ
- ສອງທາງເລືອກ ສຳລັບການຄິດໄລ່ປະມານການປ່ອຍແກສຈາກຂີ້ເຫຍື່ອຕົວເມືອງ ໂດຍຂຶ້ນກັບຂໍ້ມູນ ທີ່ອາດຂອກໄດ້:
  - ສ່ວນປະກອບຂອງຂີ້ເຫຍື່ອ
  - ຂີ້ເຫຍື່ອທັງໝົດ
- ອະນຸຍາດໃຫ້ເລືອກເອົາ DOC ແລະ ອັດຕາການຜລິດແກສມີເທນເປັນຄົງຄ່າ(k) ເພື່ອໃຊ້ໃນຕົວແບບ ເປັນສວ່ນປະກອບຂອງຂີ້ເຫຍື່ອ ຫລື ແບບ ຂີ້ເຫຍື່ອທັງໝົດ
- ອະນຸຍາດໃຫ້ ເລືອກເອົາຄ່າ (k) ທີ່ຕັ້ງໄວ້ສະເພາະເຂດພູມອາກາດ
- ອະນຸຍາດໃຫ້ ກຳນົດ ເວລາຊັກຊ້າ
  - ໄລຍະເວລາທີ່ສົ່ງຂີ້ເຫຍື່ອເຂົ້າໄປ ແລະ ເລີ້ມມີແກສມີເທນອອກມາ

Parameters

Country:

Region: Asia- Southeast

Please enter parameters in the yellow cells. If no national data are available, copy the IPCC default value.
Help on parameter selection can be found in the 2006 IPCC guidelines

	IPCC default value		Country-specific parameters	
			Value	Reference and remarks
Starting year		1950	1950	
DOC (Degradable organic carbon)	Waste by composition			
(weight fraction, wet basis)	Range	Default		
Food waste	0.08-0.20	0.15	0.15	
Garden	0.18-0.22	0.2	0.2	
Paper	0.36-0.45	0.4	0.4	
Wood and straw	0.39-0.46	0.43	0.43	
Textiles	0.20-0.40	0.24	0.24	
Disposable nappies	0.18-0.32	0.24	0.24	
Sewage sludge	0.04-0.05	0.05	0.05	
Industrial waste	0-0.54	0.15	0.15	
DOCf (fraction of DOC dissimilated)		0.5	0.5	
Methane generation rate constant (k)	Wet temperate			
(years^{-1})	Range	Default		
Food waste	0.1–0.2	0.185	0.185	
Garden	0.06–0.1	0.1	0.1	
Paper	0.05–0.07	0.06	0.06	
Wood and straw	0.02–0.04	0.03	0.03	
Textiles	0.05–0.07	0.06	0.06	
Disposable nappies	0.06–0.1	0.1	0.1	
Sewage sludge	0.1–0.2	0.185	0.185	
Industrial waste	0.08–0.1	0.09	0.09	
Delay time (months)		6	6	

Parameters / MCF / Activity / Amnt_Deposited / Recovery_OX / Results / HWP / Stored_C / Theory / Defaults / Food

Methane calculation from: Food waste

		National values
DOC	DOC	0.15
DOCf	DOCf	0.500
Methane generation rate constant	k	0.185
Half-life time ($t_{1/2}$, years):	h = ln(2)/k	3.7
exp1	exp(-k)	0.83
Process start in deposition year. Month M	M	13.00
exp2	exp(-k*((13-M)/12))	1.00
Fraction to CH4	F	0.500

Year	Amount deposited	MCF	Decomposable DOC (DDOCm) deposited	DDOCm not reacted. Deposition year	DDOCm decomposed. Deposition year	DDOCm accumulated in SWDS end of year	DDOCm decomposed	CH_4 generated
	W	MCF	D = W * DOC * DOCf * MCF	B = D * exp2	C = D * (1-exp2)	H = B + ($H_{last\ year}$ * exp1)	E = C + $H_{last\ year}$ * (1 - exp1)	Q = E * 16/12 * F
	Gg	fraction	Gg	Gg	Gg	Gg	Gg	Gg
1950	693	0.71	37	37	0	37	0	0
1951	693	0.71	37	37	0	67	6	4
1952	693	0.71	37	37	0	92	11	8
1953	693	0.71	37	37	0	113	16	10
1954	693	0.71	37	37	0	131	19	13
1955	693	0.71	37	37	0	145	22	15
1956	693	0.71	37	37	0	158	25	16
1957	693	0.71	37	37	0	168	27	18
1958	693	0.71	37	37	0	176	28	19
1959	693	0.71	37	37	0	183	30	20
1960	693	0.71	37	37	0	189	31	21
1961	693	0.71	37	37	0	193	32	21
1962	693	0.71	37	37	0	197	33	22
1963	693	0.71	37	37	0	201	33	22
1964	693	0.71	37	37	0	203	34	23
1965	693	0.71	37	37	0	206	34	23
1966	693	0.71	37	37	0	208	35	23
1967	693	0.71	37	37	0	209	35	23
1968	693	0.71	37	37	0	210	35	24
1969	693	0.71	37	37	0	212	36	24
1970	693	0.71	37	37	0	212	36	24
1971	693	0.71	37	37	0	213	36	24

Parameters / MCF / Activity / Amnt_Deposited / Recovery_OX / Results / HWP / Stored_C / Theory / Defaults / Food / Garden

ການບຳບັດຂີ້ເຫຍື່ອແບບ ຊີວະພາບ: ການບົ່ມຝຸ່ນ

- ຂະບວນການບົ່ມ ແລະ ອົງປະກອບສ່ວນໃຫຍ່ຂອງ DOC ຢູ່ ຂີ້ເຫຍື່ອ ແມ່ນ ປ່ຽນເປັນ CO2
  - ບໍລິມາດຫລຸດລົງ
  - ມີຄາບອນຈຳນວນໜຶ່ງ ປະປົນຢູ່ ເສດຂອງການບົ່ມຝຸ່ນ
  - ໂດຍຂຶ້ນກັບ ຄຸນນະພາບຂອງມັນ ຝຸ່ນບົ່ມສາມາດນຳມາຜະລິດໃໝ່ ເປັນປຸ່ຍ ຫລືດິນ (ເພີ່ມພວກອິນຊີ, ສາມາດຊຶມຊັບນ້ຳຫລາຍຂຶ້ນ ແລະ ອື່ນໆ)
- CH_4 ແລະ N_2O ທັງສອງສາມາດ ກໍ່ຮ່າງຂຶ້ນ ໃນເວລາບົ່ມ
  - CH_4 ສາມາດກໍ່ຕົວຂຶ້ນໃນເຂດຂອງການບົ່ມທີ່ບໍ່ມີອາກາດ
  - ຖ້າການບົ່ມຝຸ່ນບໍ່ດີ ຈະກໍ່ໃຫ້ເກີດມີ CH_4 ແລະ N_2O ຫລາຍ

ການບຳບັດຂີ້ເຫຍື່ອ ແບບຊີວະພາບ: ການບົ່ມແບບປິດ(ເຮັດແກສ)

- ການຍ່ອຍສະລາຍທາງທຳມະຊາດຂອງວັດສະດຸອິນຊີ ປາສະຈາກອອກຊີເຢນ
- ຜະລິດ ແກສຊີວະພາບ(CH_4+CO_2) ແລະ ອິນແຂງ
  - CH_4 ທີ່ຜະລິດອອກມາໄດ້ ສາມາດ ຜະລິດເປັນຄວາມຮ້ອນ ແລະ/ ຫລື ກະແສໄຟຟ້າ
  - ອິນຊີແຂງສາມາດໃຊ້ ເຮັດປຸ໊ຍ ຫລືປັບສະພາບດິນ
- N_2O ການບຳທີ່ປ່ອຍອອກ ໃນຂະບວນການບົ່

ການບຳແບບຊີວະພາບ ຂອງ ຂີ້ເຫຍື່ອ: ການປ່ອຍ CH_4

- ປະມານການປ່ອຍCH_4 :

$$CH_4 Emissions = \sum_i \left(M_i \bullet EF_i\right) \bullet 10^{-3} - R$$

CH_4 Emissions: ການປ່ອຍ CH_4 ທັງໝົດ ໃນບັນຊີ ຕໍ່ປີ Gg CH_4
M_i : ມວນສານ ຂອງອິນຊີ ທີ ນຳມາບຳບັດ ແບບຊີວະພາບ , Gg
EF_i : ແຟກເຕີ ການບຳບັດ, g CH_4/kg ຂີ້ເຫຍື່ອບຳບັດ
i : ການບົ່ມຝຸ່ນ ຫລື ການເຮັດແກສຊີວະພາບ
R : ຈຳນວນ CH_4 ທັງໝົດ ທີ່ ຍ້າຍອອກໄປຕໍ່ປີ, Gg CH_4

ການບຳບັດແບບຊີວະພາບຂອງຂີ້ເຫຍື້ອ: ການປ່ອຍ N_2O

- ການປະມານ ການປ່ອຍ N_2O

$$N_2OEmissions = \sum_i (M_i \bullet EF_i) \bullet 10^{-3}$$

N_2O Emissions: ການປ່ອຍN_2O ທັງໝົດໃນບັນຊີແກສຕໍ່ປີ , Gg N_2O
M_i : ມວນສານ ຂອງອິນຊີ ທີ ນຳມາບຳບັດ ແບບຊີວະພາບ *i*, Gg
EF_i : ແຟກເຕີ ການບຳບັດ, g N_2O/kg ຂີ້ເຫຍື່ອບຳບັດ
i : ການບົ່ມຝຸ່ນ ຫລື ການເຮັດແກສຊີວະພາບ

ການເຜົາຂີ້ເຫຍື່ອໃນເຕົາເຜົາ ແລະ ເຜົາເປີດ: ການປ່ອຍ CO_2

- ອີງໃສ່ປະລິມານຂີ້ເຫຍື່ອທັງໝົດທີ່ນຳມາເຜົາ:

$$CO_2Emissions = \sum_i (SW_i \bullet dm_i \bullet CF_i \bullet FCF_i \bullet OF_i) \bullet 44/12$$

CO_2 Emissions: ການປ່ອຍCO_2 ໃນບັນຊີຕໍ່ປີ Gg/yr
SW_i : ປະລິມານຂີ້ເຫຍື່ອທັງໝົດປະເພດ i / ນໍ້າຫນັກປຽກ ທີ່ນຳມາເຜົາຢູ່ເຕົາ ຫລືເຜົາເປີດ *Gg/yr*
dm_i : ວັດຖຸແຫ້ງປະກອບຢູ່ໃນຂີ້ເຫຍື່ອ (ນໍ້າຫນັກປຽກ) ເຂົ້າເຕົາເຜົາ ຫລືເຜົາແຫ້ງ (fraction)
CF_i : ສວ່ນຂອງຄາບອນ ໃນສວ່ນວັດຖຸທີ່ແຫ້ງ (ຄ່າຄາບອນທັງໝົດ), (fraction)
FCF_i : ສ່ວນຂອງ ຄາບອນຈາກໂຟຊິລ ໃນຈຳນວນຄາບອນທັງຫມົດ, (fraction)
OF_i : ແຟກເຕີ ອອກຊິເດຊັນ, (fraction)
44/12 : ແ ຟກເຕີ ປ່ຽນ C to CO_2
i : ປະເພດຂີ້ເຫຍື່ອທີ່ນຳມາເຜົາ ໃນເຕົາ ຫລື ເຜົາແບບເປີດ ເຊັ່ນ ຂີ້ເຫຍື່ອຈາກຕົວເມືອງ, ຂີ້ເຫຍື່ອຈາກອຸດສະຫະກຳ,ຂີ້ເຫຍື່ອຫ້ອງນໍ້າ, ຂີ້ເຫຍື່ອອັນຕະລາຍ, ຂີ້ເຫຍື່ອຈາກ ໂຮງໝໍ.

- ການປະມານ ປະລິມານ ຂອງ ຄາບອນ ຈາກ ໂຟສຊິລ ແມ່ນ ແຟກເຕີສຳຄັນຫລາຍ ໃນການຄິດໄລ່ຊອກຫາ ການປ່ອຍ ແກສ CO_2 . ເຊັ່ນດຽວກັນການປ່ອຍ CO2 ຂອງໂຟສຊິນ ແທ້ (e.g., plastics, certain textiles, rubber, liquid solvents, and waste oil) should be included

ການເຜົາຂີ້ເຫຍື່ອໃນເຕົາເຜົາ ແລະ ເຜົາເປີດ: ການປ່ອຍ CO_2

- ສໍາລັບ ຂີ້ເຫຍື່ອຕົວເມືອງ:

$$CO_2 Emissions = MSW \bullet \sum_j (WF_j \bullet dm_j \bullet CF_j \bullet FCF_j \bullet OF_j) \bullet 44/12$$

CO_2 Emissions: ການປ່ອຍCO_2 ໃນບັນຊີຕໍ່ປີ Gg/yr

MSW : ປະລິມານຂີ້ເຫຍື່ອຈາກຕົວເມືອງທັງໝົດປະເພດ i / ນໍ້າຫນັກປຽກ ທີ່ນໍາມາເຜົາຢູ່ເຕົາ ຫລືເຜົາເປີດ *Gg/yr*

WF_j : ສ່ວນຂອງປະເພດຂີ້ເຫຍື່ອ/ອົງປະກອບວັດສະດຸ j ໃນ MSW (ນໍ້າຫນັກປຽກ ໃນເຜົາຢູ່ເຕົາ ຫລືເຜົາເປີດ

dm_j : ວັດຖຸແຫ້ງປະກອບຢູ່ໃນຂີ້ເຫຍື່ອ j ເຂົ້າເຕົາເຜົາ ຫລືເຜົາແຫ້ງ (fraction)

CF_j : ສວ່ນຂອງຄາບອນ ໃນສວ່ນວັດຖຸທີ່ແຫ້ງ(ຄ່າຄາບອນທັງໝົດ) ***j***

FCF_j : ສ່ວນຂອງ ຄາບອນຈາກໂຟຊິລ ໃນຈໍານວນຄາບອນທັງຫມົດ ***j***

OF_j : ແຟກເຕີ ອອກຊີເດຊັນ, , (fraction)

44/12 : ແ ຟກເຕີ ປ່ຽນ C to CO_2

j : ປະເພດຂີ້ເຫຍື່ອທີ່ນໍາມາເຜົາ ໃນເຕົາ ຫລື ເຜົາແບບເປີດ (e.g., plastics, certain textiles, rubber)

ການເຜົາຂີ້ເຫຍື່ອໃນເຕົາເຜົາ ແລະ ເຜົາເປີດ: ການປ່ອຍ CH_4

- ການປ່ອຍ CH_4 ການເຜ ມີຜົນມາຈາກການເຜົາໄຫມ້ບໍ່ສົມບູນຂອງຂີ້ເຫຍື່ອ ແລະສາມາດ ມີຜົນ ຈາກ ອຸນຫະພູມ,ເວລາ ແລະ ອັດຕາສວ່ນອາກາດຕໍ່ຂີ້ເຫຍື່ອ

$$CH_4 Emissions = \sum_i (IW_i \bullet EF_i) \bullet 10^{-6}$$

CH_4 Emissions: CH_4 emissions in inventory year, Gg/yr

IW_i : amount of solid waste of type ***i*** *incinerated or open-burned, Gg/yr*

EF_i : aggregate CH_4 emission factor, kg CH_4/Gg of waste

10^{-6} : conversion factor from kilogram to gigagram

i : category or type of waste incinerated/open-burned (MSW, ISW, hazardous waste, clinical waste, sewage sludge, etc.)

- ປະລິມານ ແລະ ອົງປະກອບຂອງຂີ້ເຫຍື່ອ ຈະຕ້ອງ ປະກອບ ມີຂໍ້ມູນກິດຈະກໍາ ທີ່ໃຊ້ ໃນການ ຄິດໄລ່ປະມານການປ່ອຍ CO_2 and N_2O ຈາກການເຜົາໃນເຕົາ ຫລື ເຜົາເປີດ

ການເຜົາຂີ້ເຫຍື່ອໃນເຕົາເຜົາ ແລະ ເຜົາເປີດ: ການປ່ອຍ N_2O

- ການປ່ອຍ N_2O ແມ່ນການຊອກຫາ ໂດຍເຕັກໂນໂລຍີ , ອຸນຫະພູມຂອງການເຜົາ, (ມີການປ່ອຍໃນເມື່ອ ອຸນຫະພຸມການເຜົາຕໍ່າທີ່ສຸດ 500 – 950˚C) ແລະ ອົງປະກອບຂອງຂີ້ເຫຍື່ອ

$$N_2OEmissions = \sum_i (IW_i \bullet EF_i) \bullet 10^{-6}$$

N_2O Emissions: N_2O emissions in inventory year, Gg/yr

IW_i : amount of incinerated/open-burned waste of type *i* , *Gg/yr*

EF_i : N_2O emission factor (kg N_2O/Gg of waste) for waste of type *i*

10^{-6} : conversion from kilogram to gigagram

i : category or type of waste incinerated/open-burned (MSW, ISW, hazardous waste, clinical waste, sewage sludge, etc.)

ເຄື່ອງມື ແລະ ເຄື່ອງປະກອບອື່ນໆ ສະນັບສະໜູນໃຫ້ການ ຄິດໄລ່ ປະມານການປ່ອຍແກສ ເຮືອນແກ້ວ

- IPCC EFDB
  - ສະໜອງ EF ຢ່າງກວ້າງຂວາງ ແລະ ຕົວແປ ອື່ນ ທີ່ເປັນເອກສານຢັ້ງຢືນ ແລະອ້າງອີງທາງເຕັກນິກ, ຊຶ່ງວ່າ ຜູ່ໃຊ້ ສາມາດເລືອກໃຊ້ຂໍ້ມູນທີ່ແທດເໝາະ
  - Accessible at http://www.ipcc-nggip.iges.or.jp/EFDB/ and also available in CD ROM
- 2006 IPCC Guidelines Software
  - Complete version available by end of 2011 or early 2012
- Information on TFI website
  - FAQ
  - Presentations
  - Documents (meeting reports, brochures etc.)

ສະຫລຸບ

- ການປະມານການປ່ອຍແກສ ຫລື ບັນຊີການປ່ອຍແກສ ໄດ້ ສະໜອງຂໍ້ມູນຂ່າວສານ ເຖິງລະດັບ ແນວໂນ້ມ ຂອງການປ່ອຍແກສ ແລະ ສາມາດຕິດຕາມກວດກາການປະຕິບັດ ນະໂຍບາຍ, /ມາດຕາການ ໃນການຫລຸດຜ່ອນ.
- ຄູ່ມື IPCC ສໍາລັບບັນຊີ ການປ່ອຍແກສເຮືອນແກ້ວ ໄດ້ ສະໜອງ ໃຫ້ທົ່ວໂລກ ການນໍາໃຊ້ ວິທີ ການປະມານ ການປ່ອຍແກສແລະ ການຍ້າຍອອກ ແຫ່ງຊາດ
- ວິທີທີ່ປັບປຸງ ໃຫ້ທັນສະໄໝ ສໍາລັບປະມານ ການປ່ອຍແກສເຮືອນແກ້ວຈາກ ການ ບໍາບັດ ແລະການ ກໍາຈັດ ຂີ້ເຫຍື່ອ ແລະ ນໍ້າເປື້ອນ ແມ່ນ ມີຢູ່ Volume 5 ຂອງ ຄູ່ມື IPCC 2006
- IPCC TFI ໄດ້ ສະໜອງເຄື່ອງມື ແລະ ສິ່ງອໍານວຍ ສໍາລັບ ການ ປະມານຄ່າການປ່ອຍ/ຍ້າຍອອກ ຂອງແກສ (EFDB, software and other materials on TFI website)

Thank you