CHAPTER 1
INTRODUCTION

1.1 Rational

At present, waste causes problems for city and town management in many places in Thailand, especially in Bangkok, big city such as in city municipality, town municipality where is increasing a number of population. The city area is expanded and located for several tourism attractions. Mostly from household, fresh market, business center, abundant waste seems increasingly augment in proportion of economic growth and population increment. Waste elimination in Thailand is operated by dumping in open space, providing for fertilizer, incineration and landfill that all cause impact to environment: soil, air and water unless an appropriate management [1]. Considering to physical component of the waste, organic waste is mostly found, averagely 40-50% [1] in the area of the country.

As the energy problem increasingly affects human living, alternative energy should be developed and biomass based is very important sources to solve. In the 15 EU-countries only, the level of biomass conversion to energy was 44.8 Mtoes in 1999 and target for year 2010 is 131 Mtoes [2]. Anaerobic treatment method is today one of the most attractive ways to waste disposal , especially bio-waste , and conversion to renewable energy e.g. bio-gas, contribute to the reduction of the emission of greenhouse gases by displacing fossil fuels and preventing pollution from traditional waste disposal by using that method. Not only obtaining bio-gas, bio-waste is as well eliminated with residual of bio-refuse that passes decomposed process and taken for organic fertilizer.

The sample cases of waste disposal with anaerobic treatment method are Organic Fertilizer and Energy Production in Rayong Province. The project can eliminate the waste with total of 70 tons/day and bio-gas electricity generating of 625 kW. The other is Waste Center Project of Chonburi Province, managed by Chonburi Provincial Administration Organization (PAO) with total capacity of waste elimination for 300 tons/day producing bio-gas electricity generating of 950 kW[3]. However, such operations encounter the problem of various waste components in the limited area. With anaerobic treatment method, the principle must separate organic waste from stack of garbage as much as possible for beneficiary on quantity of bio-gas production. The process of waste sorting is crucially necessary such as

installation of a belt conveyor of separator for waste sorting at garbage factory and equipment for separating the metal with electromagnets which cause higher project expenses on installation and management. Therefore, efficient waste sorting with lowest cost is wisely to select at the waste sources such as household and office etc. The operation is required from the stakeholders on project campaign, public relation, to enhance project understanding and community cooperation prior to waste separating at sources with appropriate collecting system to bring the bio-waste to reactor tank as much as possible.

However, It was found that some projects focus on the cooperation of community for waste disposal as a major activity. In 2006, Department of Alternative Energy Development and Efficiency (DEDE), Ministry of Energy, Thailand started the prototype project as "The development of biogas production from waste in community". The prototype system is anaerobic baffled reactor (ABR) system and supported for especially bio-waste around 5- 15 tons/day and composed of 5 areas for a prototype system in all regions in Thailand such as;

- Samchuk Sub-District Municipality, Samchuk District, Suphanburi Porvince
- Muang-Sakon Municipality, Muang District, Sakon-Nakorn Province
- Muang-Kumpang Municipality, Muang District, Kampaengphet Province
- Hua-Hin Municipality, Hua-Hin District, Prachuap Khiri Khan Province
- Tung-Song Municipality, Tung-Song District, Nakorn-Srithamaratch Province

A major problem of community's waste management in Thailand is composed of lacking knowledge, misunderstanding, and non-incentive specialty in waste separation and reuse. According to people's point of view, a benefit from waste separation should be good for community environment with reducing waste volume and pollution, is unclearly seen that causes lacking of people's contribution. So misconduct for waste separation often occurred such as waste separation at source is performed but usable waste is not reused or waste separation at source is not performed or lacking of an appropriate management and technology planning for waste disposal in each community, therefore, it will be affected on disposal efficiency and management scheme

This study is aimed at creation of community cooperation network on Bio-waste management, especially energy generation from bio-waste. So people participation is promoted and stimulated as well as enhanced knowledge and understanding of waste disposal procedure particularly on waste separation at source. The scheme makes clear that people

would obtain benefit from such waste management procedure which will be incentive for more people's contribution. In addition, the result of study will be key basic information for appropriate management pattern and technology planning of community in sustainable manner which could reduce investment cost of waste disposal but increase disposal efficiency.

1.2 Literature Review

Ying Zhuang and et al. [4]: A pilot program concerning source separation of household waste was launched in Hangzhou, capital city of Zhejiang province, China. This investigation of the composition and properties of household waste in the experimental communities revealed that high water content and high percentage of food waste are the main limiting factors in the recovery of recyclables, especially paper from household waste, and the main contributors to the high cost and low efficiency of waste disposal. On the basis of the investigation, a novel source separation method, according to which household waste was classified as food waste, dry waste and harmful waste, was proposed and performed in four selected communities. Overall this research has been successful in establishing a household waste separation and management system in the experimental areas of Hangzhou. Some key findings of the study and recommendations are (1) the high percentage and high moisture content of food waste in household waste are the main limiting factors in the recovery of recyclables and main contributors to the high cost and low efficiency of waste disposal and (2) active support and involvement of the real estate company and the community residential committee play a crucial role in achieving the fundamental goal of source separation by increasing public awareness and the participation rate and (3) the established household waste management system, which is based on a new source separation method, is a cost-effective system. It could be extended to the entire city and used by other cities in China as a source of reference.

Ruihong,Z and et al. [5]: Food waste collected in the City of San Francisco, California, was characterized for its potential as a feedstock for anaerobic digestion processes. The daily and weekly variations of food waste composition over a two-month period were measured. The anaerobic digestibility and biogas and methane yields of the food waste were evaluated using batch anaerobic digestion tests performed at 50 Celsius. The daily average moisture content (MC) and the ratio of volatile solids to total solids (VS/TS) determined from a week-long sampling were 70% and 83%, respectively, while the weekly average MC and

VS/TS were 74% and 87%, respectively. The nutrient content analysis showed that the food waste contained well balanced nutrients for anaerobic microorganisms. The methane yield was determined to be 348 and 435mL/gVS, respectively, after 10 and 28 days of digestion. The average methane content of biogas was 73%. The average VS destruction was 81% at the end of the 28-day digestion test. The results of this study indicate that the food waste is a highly desirable substrate for anaerobic digesters with regards to its high biodegradability and methane yield.

P.J. Shaw and S.J. Maynard [6]: Surveys of householders' attitudes in the London Borough of Havering, served by a kerbside co-mingled survival bag recycling scheme, showed they might be better encouraged to recycle more through improvements to structural and promotional aspects of the recycling scheme than through imposition of financial incentives. If financial incentives were to be imposed to enhance kerbside recycling, householders preferred: (1) rewards to penalties, and (2) community-based rewards and local taxation rebates to other or individual rewards. Given the attitudes of householders and the resources that would be needed to monitor their recycling behaviour as a basis for delivering financial incentives, it is suggested that the priority for enhancing recycling should be to make appropriate improvements in the infrastructure and support of the kerbside scheme and service.

R.E. Timlett and I.D. Williams [7] This paper reports on three projects each using a different behavior change based approach, which were all aimed to increase participation in the recycling collection scheme and to reduce inclusion of non-targeted materials ("contamination"). The three projects as one doorstepping-based, one incentives-based and one delivering personalized feedback to residents were carried out in Portsmouth between 2005 and 2006 during a period where there were no major changes to the collection infrastructure. The findings show that personalized incentives and feedback were highly effective at reducing contamination. Both methods resulted in a halving of the number of households setting out contaminants on collection day. The feedback approach was considerably more cost-effective than the other two approaches, costing ~£0.50 per household to implement the campaign and averaging ~£3.00 for every household which subsequently displayed behavior change. There was little improvement in the quality of collected materials attributed to doorstepping alone. None of the projects resulted in significant changes in recycling scheme participation; however, this may be because participation was initially high.

These findings suggest that behavior change is most effectively brought about using simple, low-cost methods to engage with residents at the point of service delivery, i.e. by the collection crews whilst emptying bins. The challenge now is to integrate this into service delivery as standard.

Grodzinska-Jurczak, M. and et al. [8]: In the City of Jaslo (Poland), a separate household waste collection system was introduced in 1993. The UK approach to public education ('the Recycling Roadshow' programe) has been modified and adopted by the City. The programe is based on visiting as many households as possible by home advisors-individuals selected from the local secondary schools and carefully trained in MSW management and communication principles. Besides the 'active method' of promotion (home advisors) several more traditional approaches were included in this project as meetings and talks on integrated waste management with the local public; leaflets and newsletters were distributed widely promoting and explaining segregation and waste minimization to the residents; information packs on waste management were available from the City Council and were directed at students; posters on local notice-boards; media campaigns (on local radio stations and in the local press); and school and kindergarten program on segregating wastes and its minimization. Home advisors inform residents about the local waste recycling system, conduct a short survey and provide people with specific educational materials. To date, advisors have visited 14% of the City's households including the tenement block estates. The survey results show that nearly 75% of respondents actively recycled at least one type of scrap material, whilst of those that did not, 50% claimed they would. The educational campaign produced not only an increase in recycled tonnage, but also in material types and recycling rates from both the tenement block estates and the private housing areas of the City.

1.3 Objective

1.3.1 Main objective

To establishment the community cooperation network prototype for bio-waste separation at source, effective in supporting the electricity generated by anaerobic digestion method.

1.3.2 Specific objective

- To analyses factors of waste management behavior and implementation for enhance waste management plan and appropriate operational system with harmonize to community cooperation network for bio-waste separation at source for energy production, are also studied by classifying type of city such as Agricultural city, Industrial city, Tourist attraction and Service city and Commercial city.

- To analyses and examine motivational mechanisms for establishment the community cooperation network prototype for Bio-waste separation at source to energy production.

1.4 Expect of outcome

1.4.1 Basic information and model for enhancing waste management behavior, management plan and appropriate motivate mechanism with harmonize to community cooperation network for Bio-waste separation at source to energy production, classified type of city such as Agricultural city, Industrial city, Tourist attraction and Service city and Commercial city.

1.4.2 Prototype of community cooperation network for bio-waste separation at source, effective in supporting electricity generation, by anaerobic digestion method.

Figure 1.1: Research Conceptual Framework and Steps