CHAPTER 5
CONCLUSION

This study mentions on enhancing separation at sources especially Bio-waste which are obstacles to Bio-waste for energy project. 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.

5.1 Analysis factor to establish Bio-waste for energy project

This section is analysis factor 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. The results are used to creation of Model for enhancing waste management behavior and management plan with harmonizes to community cooperation network for Bio-waste separation at source to energy production.

The Interdisciplinary Research Approach is applied for investigation, such as (1) Documentary research step, study for created criteria to decided target study area in survey research and classified by type of city such as agriculture city, industrial city, tourism city and commercial city, (2) Survey research step, study primary data by used questionnaire with people in target study area which selected. Scope of study in overview i.e. (1) Collection primary data on target site selected as representative of Thailand model, classified by 4 types of city i.e. agricultural, industrial, tourist attraction and commercial, (2) 1,600 cases were collected and divided in to 400 cases/type of city by 2 methods as letter questionnaire and interview, (3) Application the Binary Logistic Model for analysis of Behavior i.e. Bio-waste separation and acceptance of Bio-waste to energy project. The results are as follows:

5.1.1 Model of agricultural city

(A) Enhancing of Bio-waste separation practice

The implementation of campaign for agriculture city which effectiveness to enhance Bio-waste separation practice namely (1) Campaign for improving basic knowledge of waste separation (2) Campaign for improving waste minimization practice and (3) Campaign for improving recyclable separation practice. These campaigns are suitable to concentrate with the person who has characteristics i.e. (1) income is under nation average or less than 84,000 Bath/ year, (2) independent or owner of occupation and (3) never been a membership of social group. This pattern is able to raise Bio-waste separation practice with people in agriculture city.

(B) Enhancing of acceptance with Bio-waste to energy project

The implementation of campaign for agriculture city which effectiveness to enhance acceptance with Bio-waste to energy project is only Campaign for improving attitude of people. This campaign is suitable to concentrate with the person who has characteristics i.e. (1) old comer or lived in area more than 10 years and (2) living in high space house such as trade building or detached house. This pattern is able to raise acceptation on Bio-waste to energy project with people in agriculture city.

5.1.2 Model of industrial city

(A) Enhancing of Bio-waste separation practice

The implementation of campaign for industrial city which effectiveness to enhance Bio-waste separation practice namely (1) Campaign for improving recyclable separation practice (2) Campaign for improving awareness of people and (3) Campaign for improving management and service system. These campaigns are suitable to concentrate with the person who living in low space house such as apartment or townhouse. This pattern is able to raise Bio-waste separation practice with people in industrial city.

(B) Enhancing of acceptance with Bio-waste to energy project

The implementation of campaign for industrial city which effectiveness to enhance acceptance with Bio-waste to energy project is only Campaign for improving economic incentive. This campaign is suitable to concentrate with the person who has employee occupation. This pattern is able to raise acceptation on Bio-waste to energy project with people in industrial city.

5.1.3 Model of Tourist city

(A) Enhancing of Bio-waste separation practice

The implementation of campaign for tourist city which effectiveness to enhance Bio-waste separation practice is only campaign for improving recyclable separation practice. This campaign is suitable to concentrate with the person who income is over nation average or more than 84,000 Bath/ year and (2) living in low space house such as apartment or townhouse. This pattern is able to raise Bio-waste separation practice with people in tourist city.

(B) Enhancing of acceptance with Bio-waste to energy project

The campaign which influential with practice is only Campaign for improving awareness of people but unnecessary to provided. In fact, this no impacted for practice because level of acceptance with Bio-waste to energy project in this city is in very high level or accounted for 80.50%.

5.1.4 Model of Commercial city

(A) Enhancing of Bio-waste separation practice

The implementation of campaign for commercial city which effectiveness to enhance Bio-waste separation practice namely (1) Campaign for improving awareness of people and (2) Campaign for improving economic incentive. These campaigns are suitable to concentrate with the person who living in low space house such as apartment or townhouse. This pattern is able to raise Bio-waste separation practice with people in commercial city.

(B) Enhancing of acceptance with Bio-waste to energy project

The implementation of campaign for commercial city which effectiveness to enhance acceptance with Bio-waste to energy project namely (1) Campaign for improving economic incentive and (2) Campaign for improving attitude of people. This campaign is suitable to concentrate with the person who has characteristics i.e. (1) income is under nation average or less than 84,000 Bath/year and (2) has employee occupation. This pattern is able to raise acceptation on Bio-waste to energy project with people in commercial city.

5.2 Analysis on community network prototype for energy production from Bio-waste

This section analyses and examines the motivate mechanism for establishment the community cooperation network prototype for Bio-waste separation at source to energy production. The results are received prototype of community and appropriate motivate mechanism with harmonize to cooperation network for Bio-waste separation at source, effective in supporting the electricity generating, with anaerobic digestion method.

The Interdisciplinary Research Approach is applied for investigation, such as (1) Documentary research step, study for created criteria to decided experimental area which for establishment a network of Bio-waste separation at source, effective in supporting the electricity generating, with anaerobic digestion method, (2) Operation research step, launch of motivates mechanism for establishment community network i.e. Voluntary Mechanism, Reward Mechanism and Community Business Mechanism. Then, collection data of each mechanism for examine the efficiency i.e. Volume of Bio-waste in Bio-waste collector tank, Proportion of components in Bio-waste collector tank and Percentage of Bio-waste reduction. The results are as follows:

5.2.1 Prototype area for study

The prototype area is purposive at Nakornratcha Srima Metropolitan. The rationale for selected this prototype are as follows:

(1) Nakornratcha Srima Metropolitan is located in surveyed area in chapter 3 which able to applied information for this study.

(2) Nakhon Ratchasima Metropolitan is processing in the waste disposal project by anaerobic digestion method. So, the result of study is likely to be useful for management in the future.

(3) Economic incentive is influential for improving behavior in Nakornratcha Srima Metropolitan, because of the study is aim to analysis and examine of motivate mechanism for establishment Bio-waste to energy project which based on economic incentive i.e. Reward Mechanism and Community Business Mechanism. So, this should be located on area where economic incentive is influential for improving behavior. According to the result of Chapter 3, industrial and commercial city are impacted by economic incentive. Then, Nakornratcha Srima Metropolitan, represented of commercial city which has many distributions around the country, has potential for prototype area of this study.

The study focused on the development of Bio-waste separation at source, which implementation at Nakornratcha Srima Metropolitan represented of commercial city. These launched on 4 pilot communities (1 community/zone). The communities are divided into 4 types classified by level of complexity i.e.

(1) Banrungruang-Bunruang as a representative of High Complex Community

(2) Banpakthahan-Nongbuarong as a representative of Low Complex Community

(3) 30- Kanya -Pathana as a representative of Moderate complex community

(4) Korat-Karuehat-Thong as a representative of Non-Complex Community

5.2.2 Efficiency of incentive mechanism for Bio-waste separated

(A) Efficiency of each community

- High Complexity Community (HCC): The efficiency of Reward mechanism is 20.59% and Community business mechanism is 26.74%.

- Low Complexity Community (LCC): The efficiency of Reward mechanism is 60.32% and Community business mechanism is 74.60%.

- Moderate Complexity Community (MCC): The efficiency of Reward mechanism is 57.53% and Community business mechanism is 73.97%.

- Non- Complexity Community (NCC): The efficiency of Reward mechanism is 16.67% and Community business mechanism is 80.56%.

Conclusion, Reward Mechanism is most effective with Low Complexity Community (LCC).Community business mechanism is most effective with Non-Complexity Community (NCC). In average, the efficiency of Reward mechanism is 46.00% and Community business mechanism is 66.0%.

(B) Estimation on Bio- waste separated of Metropolitan

In whole picture, Nakornratcha Srima metropolitan has 58,810 households and Voluntary Mechanism can be separated Bio-waste at sources 0.5 Kg/household/day. So, that can be separation around 29 tons/day. Reward Mechanism has 46.0% of efficiency which can be separation around 43 tons/day. Community Business Mechanism has 66.0% of which can be separation around 49 tons/day.

5.2.3 Efficiency of incentive mechanism for Food waste separated

(A) Efficiency of each community

- High Complexity Community (HCC): The efficiency of Reward mechanism is 16.13% and Community business mechanism is 22.58%.

- Low Complexity Community (LCC): The efficiency of Reward mechanism is 55.00% and Community business mechanism is 68.33%.

- Moderate Complexity Community (MCC): The efficiency of Reward mechanism is 53.62% and Community business mechanism is 69.57%.

- Non-Complexity Community (NCC): The efficiency of Reward mechanism is 14.71% and Community business mechanism is 76.47%.

Conclusion, Reward Mechanism is most effective with Low Complexity Community (LCC).Community business mechanism is most effective with Non-Complexity Community (NCC). In average, the efficiency of Reward mechanism is 42.55% and Community business mechanism is 61.70%.

(B) Estimation on Food waste separated of Metropolitan

In whole picture, Nakornratcha Srima Metropolitan has 58,810 households and Voluntary Mechanism can be separated Food waste at sources 0.47 Kg/household/day. So, that can be separation around 28 tons/day. Reward Mechanism has 42.42% of efficiency which can be separation around 39 tons/day. Community Business Mechanism has 61.19% of which can be separation around 45 tons/day.

5.2.4 Behavior of participation

The result show increasing of Bio-waste separated through incentive mechanism in significantly. These impacted from behavior change of people, divided into two situations such as (1) increasing of new participant and (2) enhancing of separation practice, especially when Reward Mechanism and Community Mechanism are added in project as follows:

(A) High Complex Community: This community has Bio-waste volume on pre-stage in moderately (56.43%).Voluntary Mechanism stage, the number of participant is not too much but highest ability of separated Bio-waste to collector tank when comparison with any community. Reward Mechanism and Community Business Mechanism stage, the number of new participants increased no significantly but the old participants enhance separated behavior when comparison with any community.

(B) Low Complex Community: This community has Bio-waste volume on pre-stage in relative high level (61.83%).Voluntary Mechanism stage, the number of participant is relatively high vice from Non Complex Community. Reward Mechanism stage, best of enhancing separated behavior when comparison with any community. Community Business Mechanism stage, still best of enhancing separated behavior when

comparison with any community and number of new participants increasing more than Reward stage.

(C) Moderate complex community: This has Bio-waste volume on pre-stage in the highest level (63.44%). Voluntary Mechanism stage, found that relatively high level of ability for separated Bio-waste to collector tank when comparison with any community (vice from HCC). Reward Mechanism stage, the number of new participants relatively high increased when comparison with any community (vice from NCC). Community Business Mechanism stage, highest increased of new participants when comparison with any community and number of new participants increasing more than Reward stage but low performance of separation Bio-waste.

(D) Non-Complex Community: This community has Bio-waste volume on pre-stage in the lowest level (54.68%).Voluntary Mechanism stage, the number of participant is in highest level when comparison with any community. Reward Mechanism stage, the number of new participants is highest increased when comparison with any community. Community Business Mechanism stage, the number of new participant is relatively high vice from Moderate Complex Community.

5.2.5 Policy implications for Bio-waste to energy project

The cost estimates of Bio-waste separation (at disposal site) for input to the disposal system approximately 450 baht/ton, including of labor and operation of machinery (Reference from expert). The study mentioned above will be seen that incentive mechanism able to increase efficiency on highest 17 tons / day. Total cost of incentive program is approximately 200 baht/ton which could decrease overall system costs for Bio-waste separation about 250 baht/ton. So, economic assessment from incentive program that could be saved cost around 1,500,000 baht per year. The cost savings could be implementation to planning for the incentive program which potency for enhance Bio-waste separation performance in the future.

Furthermore, the advantage from implemented by incentive mechanism such as increasing opportunity to establishment Bio-waste to energy project with small scale area , not need budget for created of separation mill which highly cost for set up. These able to esteem and distributed of Bio-waste to energy project around this country.

5.2.6 Management implications for implement on Bio-waste to energy

(A) Implemented by suitable mechanism

This implementation is appropriate with small municipality or less number of community in area which no readiness for integration all of mechanism to implemented. Initially, the study characteristic of all community in area is necessary, to classified type of community. These used to decision suitable mechanism to implement. According to result, Community business mechanism is most suitable to implement with commercial city for receives highest performance of Bio-waste and Food waste separation, all type of community. In case of not being ready for implemented by Community business mechanism, there have 2 optional for implemented by other mechanism under conditions which to supported decision making i.e.

- Commercial city which has Moderate Complexity Community and Non Complexity Community as a majority proportion in area is most suitable to apply voluntary Mechanism, as an alternative to implementation other than community business mechanism.

- Commercial city which has Low Complexity Community and Non Complexity Community as a majority proportion in area is most suitable to apply reward mechanism, as an alternative to implementation other than community business mechanism

(B) Implemented by integration mechanism

This implementation is appropriate with large municipality or high number of community in area which readiness for integration all of mechanism to implemented. Initially, the study characteristic of all community in area is unnecessary which able to study along with implementation i.e.

- Low Complexity Community is suitable to implement voluntary mechanism in the early of project which for attractive new participant, then followed by reward mechanism to enhance performance of separation.

- Moderate Complexity Community is suitable to implement voluntary mechanism in the early of project which for highest performance of separation. Then, followed by community business mechanism to increasing number of new participant to project which enhances efficiency of practice in future, if needed.

- Non-Complexity Community is suitable to implement voluntary mechanism in the early of project which for attractive new participant, then followed by community business mechanism to enhance performance of separation.

- High Complexity Community is suitable to implement voluntary mechanism in all period of project and unnecessary to implement by incentive mechanism.