

Public Perspective toward Waste-to-energy Applications in Thailand: An Opportunity on Biogas Production from Organic Waste

Boonrod, K.^{1,2+}, Towprayoon, S.¹, Bonnet, S.¹, Tripetchkul, S.³

¹The Joint Graduate School of Energy and Environment, Center of Excellence on Energy Technology and Environment, King Mongkut's University of Technology Thonburi, Bangkok, Thailand

²Faculty of Humanities and Social Science, Phetchaburi Rajabhat University, Phetchaburi, Thailand

³School of Bioresources and Technology, King Mongkut's University of Technology Thonburi, Bangkok, Thailand

Abstract. This paper studied the public perspectives towards the waste-to-energy (WtE) policy in Thailand, in particular, that of the Biogas Production from Organic Waste (BPOW) which has begun in some areas. The framework of the studies was built on 4 main issues that directly relates to the project which are public perception, public understanding, public participation and public concern. Surveys were performed on 1,600 cases from 19 municipality scattered throughout the different regions of Thailand.

The results indicated that public concern regarding the impacts from BPOW is at a very high level. Public understanding and public perception rated at high level while the opportunity for public participation in the BPOW was rated only at the medium zone. From the study, 2 alternative methodologies for mobilization of the policy in the future are, 1. Enhance the knowledge of BPOW in the areas of technology, investment and strengths and weaknesses of BPOW and 2. Scale up the practice in separating organic waste at source.

Keyword: Biogas, Organic waste, Separation at sources, Waste to Energy

1. Introduction

The Municipal Solid Waste (MSW) across Thailand has a very high portion of organic waste with recorded results as high as 63.57 % of total waste composition [1]. Organic wastes have high moisture content and elimination of this type of waste through the incineration process is not appropriate. Organic wastes must be separated out of the waste pile before the waste pile is sent into the incinerator in order to reduce the power required for the incineration process. Furthermore, the high content of organic wastes causes high investment cost both for the collection and transportation process and for finding areas for landfill [2]. Other than that, the practice of disposing of organic waste through landfills should be reduced or stopped because degradation of organic wastes from landfills are the major cause for emissions of CH₄ [3]. Eliminating organic wastes from landfills will also help to prolong the usable life of the pit [4]. The most appropriate option for handling organic waste is the Anaerobic Digestion system (AD) which is a process which requires only organic waste [2]. When the policy for waste management are considered by cluster groups, the Pollution Control Department (PCD) found that AD is the main technology that is advised for use by every cluster group [5]. AD is a robust process that is being widely applied in waste management process [6]. The popularity of AD is because it is feasible for application for both large-scale industrial installations and small-scale installations. Its adjustable compatibility makes AD applicable and an option with opportunities for many circumstances in developing countries and rural areas where energy supply is limited or even not available at all [7].

⁺ Corresponding author. Tel.: +66(0)32-493-300; fax: +66(0)32-493-308.
E-mail address: Kittinun.b@Gmail.com.

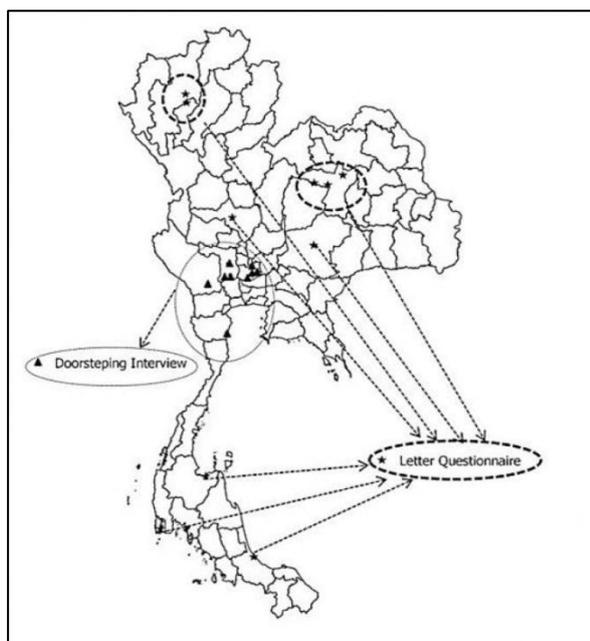


Fig 1: Distribution of the sample group surveyed for primary data collection.

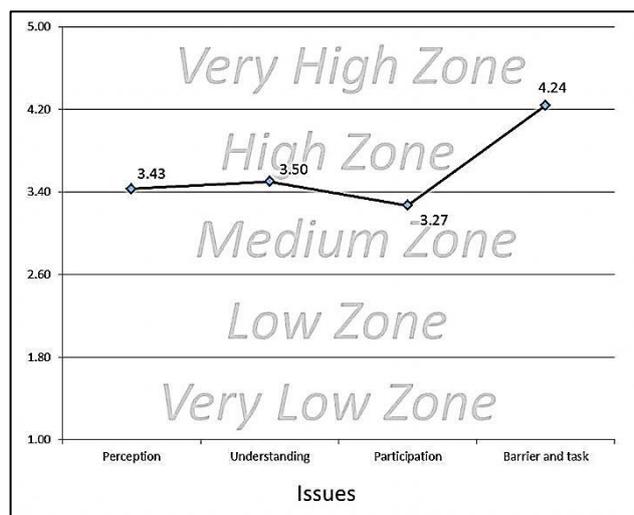


Fig 2: Average score for each Issue.

Table 1: Survey Questionnaire questions used in the study

Issue	Question
Public Perception	Q1.BPOW is useful at household level both in terms of thermal energy and for production of electrical current Q2.At the present, there are WtE projects in Thailand that focuses on producing Biogas for electrical current production. Q3. At the present, there are WtE projects in Thailand that focuses on producing Biogas for thermal energy production. Q4.Citizens or communities can earn an income from producing electrical current through BPOW. Q5.Using waste as the source for energy is an alternative that is becoming popular in many countries, especially for Thailand where there is a set of policy that was issued to support it.
Public Understanding	Q6.Implementation of BPOW and using it as a thermal energy is not an out of reach concept for people in general, everyone can invest in it and operate it right away. Q7.Implementation of BPOW for electrical current production is not limited to operations by government only, interested general public can also invest and implement the project. Q8.BPOW is highly appropriate for the Thai context as the waste composition has a high organic content. Q9.BPOW is clean energy that will help decrease the lack of energy crisis and it is also environmental friendly. Q10. Organic waste separation at source at household level is very important for the efficiency of the BPOW project, especially if it's a large scale project.
Public Participation	Q11.There is the potential that organic waste separation at source from households will receive voluntarily participation by the people in support of BPOW projects operated by the government sector. Q12. There is the potential that organic waste separation at source by the people in support of BPOW projects operated by the government sector if there is direct benefit to the community members such as income generation from separating. Q13. There is the potential that organic waste separation at source by the people in support of BPOW projects operated by the government sector if there are indirect benefits to the communities such as awards or some other facilities or utilities. Q14.There is potential that community members will implement BPOW by themselves. Q15.There is potential for joint BPOW projects with community members or as a business partnership.
Public Concern	Q16.There are health concerns from implementation of the BPOW in the community are or nearby. Q17.There are concerns for the environmental quality which may be impacted from the operations of the BPOW project in the community or nearby areas. Q18. There are concerns for the safety in the community and nearby areas during the operation of the BPOW project. Q19. There are concerns about the sustainability of the BPOW project which operated by the government offices. Q20. There are concerns about the knowledge and know-how about the BPOW project operations if the people are to implement the project by themselves.

Another policy movement in Thailand is found to be supporting the WtE application for decreasing the need to import energy from abroad and help solve the energy crisis in the country. This energy scheme is proposed as part of the national Renewable and Alternative Energy Development Plan for 25 Percent in 10 Years (AEDP 2012-2021) for Thailand. According to this plan, the target energy production from renewable energy from MSW in the year 2021 is set at 160 MW where the baseline production in 2011 is at 13.45 MW. In terms of alternative energy production from biogas, the target is much higher at 600 MW with the baseline for production in 2011 being 138 MW [8]. So far, there had been some projects which have been operating in line with the stated policy where AD is applied. Some of these projects include the Organic Fertilizer and Energy Production in Rayong province with a the waste disposal amount of 60 tons per day and biogas electricity generating capacity of 625 kW and the Samchuk Municipality Biogas production from community

organic waste which is a community level project. The Samchuk Municipality Biogas project is designed with the disposal capacity of organic waste at 15 tons per day.

However, both projects faces difficulties in operation as the composition of the wastes in the area is quite vast. For disposal through the AD process, it is necessary to separate the waste and only organic wastes can be input into the system. The more organic waste fed to the system, the better the efficiency of the biogas production. The method of collecting organic waste that is low-investment in operation but highly efficient is to have the waste separated at source or participation in waste separation from each household [2]. This problem is not only found in Thailand but the same nature of problem is also found in other countries trying out this system. An example of a difficult situation is the AD project in Lucknow, India where the project had to shut down after less than 2 years of operation from the lack of organic waste input into the system. A lesson learnt from this operation is that the final system was highly contaminated with non-degradable wastes [9].

Today, the general public is more aware of their surrounding environment and therefore, the widely discussed “Not In My Back Yard” (NIMBY) syndrome must be considered when planning for the development of required infrastructures, especial for WtE areas [10]. Similarly, waste management projects in some parts of Thailand are still being opposed by the public and the management team can not go in to the area. This is mainly because projects in the past failed to create knowledge and awareness of the project with the community members and the general public in the preparation phase [11]. AD is a new technology and it is still not widely used in Thailand, however, the project success is highly dependent of the participation from the community members. Therefore, the study of the perception of the people is a way to gain important insights that can be applied to support the WtE plan. The results of the study will be useful for policy makers in setting up their roadmap and management planning so that they can mobilize the actions to their future targets.

2. Methodology

2.1. Scope of study

This study is performed as a survey research with the objective to study the perception of the people towards the WtE project with specific interests for Biogas Production from Organic Waste (BPOW) project which have high tendency of being applied for use in Thailand continuously in the future. The first set of data collection was performed in 19 municipalities scattered across Thailand as shown in Fig.1. The study subjects identified for this survey is the head of the household or one of the representatives. A total of 1,600 cases were sampled. The primary data collection was performed using doorstepping interviews on 640 subjects and 940 letter questionnaires were sent out.

2.2. Research tool and data analysis

The tool used in data collection is the perception survey form. The survey form is divided into 4 issues with 5 questions per issue. The details of the survey form are as shown in Table 1. The scoring system applied is the 5 levels Likert Scale where each of the range are marked as <1.80 being very low, 1.81 – 2.60 low, 2.61 – 3.40 medium, 3.41 – 4.20 high and 4.21 – 5.00 very high. The information analysis will be performed for fully completed surveys only and then it will be weighted using descriptive statistics.

3. Result and Discussion

Overall results indicated that the public’s perception of the WtE project and BPOW project is at high level. However, with an average score of 3.43 (S.D. =0.92) it is quite close to being in the Medium Zone (Fig. 2). Going into more details, it is visible that the actual very high level perceptions came from the scores for Q3 and Q5. Whereas Q1, Q2, and Q4 all scored at Medium and Low Levels (Fig.3). These scores shows that the general public still low perceives the WtE and BPOW projects as electricity production projects only. This may be because of the available study cases and there has not been much promotions about the other areas of benefits. Most of the presentations about WtE and BPOW are on production of biogas and thermal energy as an alternative energy source for households.

In terms of Public understanding about BPOW, the overall score is similar with perception in that it scored at high level with an average of 3.50 (S.D.=0.78) (Fig.2). When concentrating down on the details, it is found that the sample group understands that biogas is clean energy which can be used as thermal energy;

with scores at very high level. At the same time, they have medium level of understanding about organic wastes (Q8 and Q10) which is the main raw material for the BPOW project. Moreover, the understanding of how biogas is related to or can be used for producing electrical current is still at low level. This is in line with the result for the perception stage (Fig.3).

The Public participation potential for BPOW received an average overall score of 3.27 (S.D. = 0.84) (Fig. 2). The key factor that will make the sample group interested in and would like to participate in the government-run projects is that if they will receive direct benefits such as rewards or income from organic waste separation (Q12), this question scored at very high level of 4.52 (S.D.=0.39). Voluntarily participation in BPOW scored only at low level of 2.14 (S.D. =0.45). However, there are still good chances of operating the BPOW project but it may be in terms of a community-based organization or a business cooperation which scored at a high level of 3.78 (S.D.=0.54) (Fig. 3).

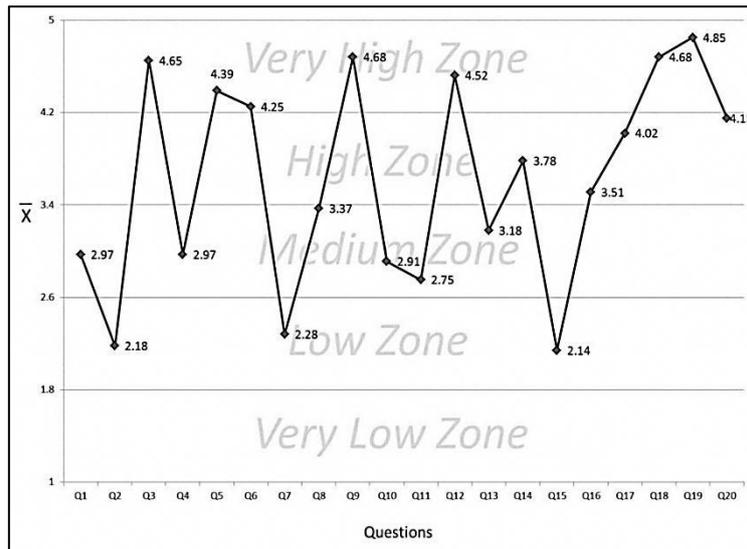


Fig 3: Average score for each question asked.

The public rated very high level on concern and awareness from the impacts of the BPOW operation with an average score of 4.24 (S.D. =0.48) (Fig. 2). This is the highest score in comparison to the other categories and it is the category that will be the most important barrier to the decision to participate in and support the BPOW project. The highest concern is for the sustainability of the project operation for government run projects. This issue of concern received an average score of 4.85 (S.D. =0.54) putting it at the very high level of concern. Second is the safety issues that comes with the operation of the project, still in very high level at 4.85 (S.D. =0.36). The concerns for health and environmental quality from the impacts of the project operation on the community and nearby areas are at high level, similarly with the concern for the knowledge and know-how on the operation of the BPOW project for self-implementation (Fig. 3).

4. Conclusion

The key findings from this study indicated that the implementation of the waste-to-energy (WtE) policy, namely through the Biogas Production from Organic Waste (BPOW) project as key indicators to success which can be categorized into 2 parts. One is the knowledge on the operation process of BPOW. By knowledge, it means that the project to enhance knowledge in the areas of appropriate technology, investment opportunities all the way to the strengths and weaknesses of BPOW. Although the surveyed results showed that perception and understanding of the project received scores at high level, it is still at the lower end of the zone. Hence, it can be said that the general public still lacks knowledge of the project and does not understand the relationship between organic waste, biogas and electricity currents. Other than that, the public is concerned about the potential possible impacts from BPOW in various topics with the resulting score at the “very high level” on the scale. If not taken-care of, this could lead to the NIMBY syndrome. The above stated are all barriers to participation and decision making of the project. Therefore, the responsible person or team should prioritize and plan for enhancing understanding and awareness raising as the main activity. This is to as quickly as possible create understanding and generate knowledge in various

dimensions. It is necessary to implement this session in order to ensure the success of the waste-to-energy policy.

The 2nd part is the enhancement of organic waste separation practice. In many areas, the BPOW project faces problems of finding raw materials, organic wastes. Since the operation cost for front-end system is high, it is not possible to operate at full efficiency and some project sites had to shut down as stated in the introduction. Organic wastes have not yet been marked with a market value. Some people may look for them and buy them to make livestock feed but that is only found in specific groups such as from restaurants, hotel businesses and academic institutions in some areas. There is no survey or value added propaganda for organic wastes like those for other recyclable wastes, therefore this may be the reason why the separation at source practice for organic waste is significantly different from recyclable waste [12]. This is consistent with the study results which indicated that the highest potential for enhancing public participation in separating organic waste at source depends on the direct benefits that they will receive such as a reward or payment for separating the wastes. Thus, studies in this area and development of a scheme to support this practice are necessary and if the results can be applied in actual practice, it will increase the opportunities for the development of the BPOW project into a better direction.

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