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Enhancing organic waste separation at the source behavior: A case study of the application of motivation mechanisms in communities in Thailand

K. Boonrod[a,b], S. Towprayoon[a,*], S. Bonnet[a], S. Tripetchkul[c]

[a] The Joint Graduate School of Energy and Environment, Center of Excellence on Energy Technology and Environment, King Mongkut's University of Technology Thonburi, Bangkok, Thailand
[b] Faculty of Humanities and Social Science, Phetchaburi Rajabhat University, Phetchaburi, Thailand
[c] School of Bioresources and Technology, King Mongkut's University of Technology Thonburi, Bangkok, Thailand

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ABSTRACT

This paper explores organic waste separation behavior at the source when various motivation mechanisms are implemented. Four mechanisms are applied in pilot areas to observe the differences in behavior. A traditional mechanism is introduced to the community as the first campaign followed by a voluntary mechanism, which is another non-economic incentive mechanism. Next, two economic incentive mechanisms, namely, a reward mechanism and a community business mechanism, are applied. These four mechanisms were applied in the Nakhon Ratchasima metropolitan area, one of the largest commercialized cities in northeastern Thailand, in 2010.

The study found that the traditional mechanism yields a 19% organic waste separation efficiency. When the voluntary mechanism is applied, the efficiency increases to 36%. The economic incentive mechanism further increases the waste separation behavior: the reward mechanism increases the efficiency to 51%, and the community business mechanism is the best mechanism, with an efficiency of 58% being observed. The study also found that housing style influences the quantity of organic waste separation, while community style influences the quality of organic waste separation. These results are helpful in devising appropriate management plans for enhancing waste management practices, which will directly improve the sustainability of using organic waste in future energy projects.

1. Introduction

Organic waste is a global problem that the world must be acknowledged and be aware of. It is not only a problem for Thailand where, according to the World Bank report in 2012, global municipal solid waste (MSW) is composed of 46% organic waste, but also a regional problem in many areas. When considering by region, the East Asia Pacific region (EAP) has the highest percentage of organic waste composition of 62%, followed by the Middle East & North Africa countries at 61% (Hoornweg and Bhada-Tata, 2012). Recycling organic waste is one of the approaches to handle this problem and there are various technologies appropriate for recycling organic waste such as the composting technology in order to produce fertilizers and anaerobic digestion (AD) technology for producing energy (Sang-Arun et al., 2011).

There are many failed cases in recycling organic waste such as the AD project in Lucknow, India, where the project lasted for less than 2 years due to lack of organic waste input into the system. It was found that the final system was highly contaminated with non-degradable waste (Kurian, 2007). Meanwhile, many large composting plants also tend to fail because of contamination and operating costs which is resulted from little waste separation at sources (Hoornweg and Bhada-Tata, 2012). However, not all the approaches failed, the successful cases in recycling organic waste are found, such as the implementation of the Daejeon Metropolitan City in Korea, Umea in Sweden and the Oxford City Council case in the UK. All these successful cases share an important key to success that is the participation from the communities in separating the organic waste at the source according to the designed schemes (Teodorita Al Seadi et al., 2013). This study aims at enhancing the practice of separation of waste at the source which is the main key to success, especially for recycling of organic waste in Thailand.

* Corresponding author. Tel.: +66 02 470 8309; fax: +66 0 2 872 6736.
E-mail address: Sirin@jgsee.kmutt.ac.th (S. Towprayoon).

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1.1. Organic waste management in Thailand

According to the Thailand State of Pollution Report 2012 produced by the Pollution Control Department (PCD), the total MSW was 24.73 million tons as of 2012. Surprisingly, in the same year, the recovery and utilization of MSW in various ways was just 21.36% (5.28 million tons). In total, 4.02 million tons of the MSW was separated and subjected to recyclable material recovery via a recycle shop or recycling community center. In particular, organic waste utilization was only 1.14 million tons or 5.82% of the total waste generation nationwide, being used as soil amendment materials, such as compost, and in the production of biomass as a renewable energy source (PCD, 2012). While, the main component of MSW is organic waste which contributes to more than 60% of total waste generated (PCD, 2003). It has been found that the recycling of organic waste is less practiced than that of other waste because organic waste has no market value in Thailand's recycling market. Although some farmers purchase organic waste for use as animal food, this activity is only carried out in small food shops and educational institutes, and no data are available on the exact amount of waste purchased. Because of its lack of market value and seemingly low recycling activity, almost of organic waste is disposed of through the landfill system.

At the present, PCD adopted the Cluster Group waste management scheme for their normal implementation. In this management scheme, Local Administrative Organizations cooperate by pooling their budgets, knowledge and relevant technologies. The location, size and inventory of organic waste generation are often considered. The scheme intends to increase householder participation, support the recycling market and, for cluster groups that generate at least 50 tons of waste per day, to emphasize energy production from waste. AD systems are a promising technology for all cluster groups. The AD strategic framework identifies that 28% of organic waste generation of each cluster group must be pushed forward into the system to convert waste to energy. The remaining amount is targeted to the compost industry (PCD, 2009a,b).

The generation of energy from waste is supported by the Thai government to decrease the energy import rate and solve the energy crisis problem. The Renewable and Alternative Energy Development Plan for 25 Percent in 10 Years (AEDP 2012–2021) of Thailand, created by the Department of Alternative Energy Development and Efficiency (DEDE), is a strategic framework that puts forth a target for the generation of alternative energy from MSW in 2021 of 160 MW, compared to the 2011 value of 13.45 MW. In addition, the targeted renewable energy generation from biogas is 600 MW, whereas the generation in 2011 was 138 MW (DEDE, 2012). These policy targets have been designed to improve waste disposal and energy management practices. In the past, projects have been designed based on these policies by applying anaerobic digestion systems. Examples include the Organic Fertilizer and Energy Production project in Rayong province, which could dispose of 60 tons of waste per day and generate of 625 kW of biogas electricity, and a community-level project for biogas production from organic waste in Samchuck Municipality, which could dispose of 15 tons of organic waste per day. These two projects confronted similar problems relating to the quantity and quality of organic waste generation before the collection system, which directly affects the project efficiency (PCD, 2011a,b). In addition to the acquisition of organic waste and the on-site separation of the raw material of the system by front-end treatment system, household participation also plays an important role in the process. Household participation simplifies the waste collection and transportation to the biogas generation facility and saves time and money. An example of the use of this method is the project at Samchuck Municipality, which currently acquires only 3 tons of organic waste per day. The problem of a low volume of incoming waste is found to result from a lack of public participation and public understanding of the importance of waste separation at the source. As a result, the use of a motivation mechanism is key to the success of future projects (PCD, 2011a,b). To achieve the system goals, means to increase the knowledge and understanding of the participating community as well as its interest in renewable energy generation from waste are needed. The activities include the enhancement of domestic biogas production and its development into a community biogas network. The sector development scale will provide the linkage and utilization under community-based management (DEDE, 2012).

1.2. Factors supporting waste separation behavior and participation

Public participation in recycling schemes is crucial for increasing recycling rates (Perrin and Barton, 2001), and a recycling program is only successful if it can trigger individual participation (Andrews et al., 2013). Access to a curbside recycling scheme is a key factor in a successful program when a household recycles its waste (Barr and Gilg, 2005). However, in designing or planning ways for the general public to participate in waste separation, a mixture of several methods that have been proven to work is better than relying on one single method (Martin et al., 2006; Noehammer and Byer, 1997). In most cases, it was found that mandatory recycling schemes achieve higher participation than voluntary schemes (Noehammer and Byer, 1997). At the same time, the most effective schemes involve active enforcement, i.e., increased education, financial incentives and socio-economic factors conducive to law-abiding behaviors (Everett and Peirce, 1993; Folz and Hazlett, 1991). Harder and Woodard (2007) followed a series of medium-scale trials carried out in the UK on various voucher-based incentive schemes for household recycling and found that these schemes increased participation rates by 10–20% in 3 months. During 2005 and 2006, Timlet and Williams (2008) applied three behavior modification methods in Portsmouth: door-stepping, incentivization and the delivery of personalized feedback. The study found that each method has different efficiencies, with some being higher than others under different operating budgets. The above-mentioned studies are examples of previous work that can be applied to practical situations according to area limitation factors. Campaigning can trigger participation, and other factors can also contribute to changing the behavioral norms for the separation of household wastes. Many past studies have identified factors that influence the separation of recyclables and non-recyclables. Simmons and Widmar (1990) noted that, among individuals with less environmental concern, it may be more effective to provide rewards to people who recycle. Those concerned about the environment are already motivated to recycle for their own reasons, such as gaining a sense of protecting the environment; thus, external triggers, such as rewards, are not important. Belton et al. (1994) noted that public participation in recycling is essential but that a market for recyclables must also be available, indicating that it is also necessary to build up the public's understanding and attitudes toward buying products made from recycled materials (Perrin and Barton, 2001). Recyclers are generally more mature and affluent homeowners, with higher levels of education (Vining and Embro, 1992; Oxford Brookes, 1999; Waste Watch and NOP Research Group, 1999). The most influential factor was found to be personal reward, loss and other non-monetary factors such as convenience and ease of use (Miller Associates, 1999). Additionally, from Miller Associates (1999), the typical socio-demographics of a recycler suggest that participation is more likely for well-educated, affluent, older home-owners, allowing local authorities to be more specific when choosing locations for their recycling schemes. Barr et al. (2003) came up with a framework for recycling behavior based on three groups of factors: environmental values, situational variables