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## Small-Scale Biogas Plant from Swine Farm in Northern Thailand

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### Abstract

Biogas system and its pipeline network have been built in a small village in northern Thailand. About 50 households of the total of 257 households in the village get the benefits from biogas technology in many ways. The heat energy cost is reduced with the presence of biogas as a cooking fuel. Biogas not only is used as the source of energy for cooking, but also helps in the reduction of environmental concerns generated by swine manure. People gain new knowledge in biogas and its applications. Key success to this biogas project comes from the cooperation between the swine farm owner, households, and government sectors. Indeed, biogas energy offers an alternative source of heat energy for cooking fuel.

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### 1. Introduction

The alternative energy consumption in Thailand has increased due to the national policy of alternative energy development that aimed to increase the use of alternative energy consumption in all sectors. The plan focuses on the use of alternative energy produced in the country in particular in order to reduce the energy consumption from fossil fuel. In 2016 the alternative energy consumption in Thailand was 11,051 ktoe, which shared 13.83% of the total final energy consumption. This affected decreasing of energy imports and CO<sub>2</sub> emission. The recent national Alternative Energy Development Plan 2015 (AEDP 2015) sets the target that Thailand must increase the use alternative energy to 30% of the total energy consumption by 2036 and reduce dependency on fossil fuel and energy imports [1].

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Ampawan village is located in Taopon subdistrict, Phrae province in northern Thailand. There are some people in this area owning swine farms. Swine manure and wastewater initiate the environmental concerns, such as wastewater, bad smell, flies, and insect caused by the swine manure, to all people who live in this area. There are more than 100 households in this village. Most villagers are common farmers, while one of them is the owner of the swine farm named Jamlong Farm. This farm is located only 1 kilometer from a nearby local community. There are 2,600 pigs in this farm capable of generating biogas as many as 160 m<sup>3</sup>/day. Hence, a group of villagers, farm owner and government officials in this area made an effort to search for a proper solution to decrease pollutions caused by a swine farm. Finally, they came up with an idea of building the biogas system from swine manure to reduce pollutions, and at the same time to produce and distribute biogas to households for a cooking fuel in a nearby community. In Thailand, biogas technology has been developed and a successful renewable energy technology. Livestock farms frequently use biogas for heat and electricity generation [2-5].

Taopon Subdistrict Administrative Organization (TSAO), who was in charge for handling administrative work in the area, realized the problems and steps that must be taken to resolve the environmental concerns and make local people and a farm owner live satisfyingly together. TSAO acknowledged the important and development of the biogas system in Ampawan village. It received sufficient funds from some sources to build biogas plant along with its equipment and pipeline network from swine manure. Biogas would be distributed to 50 households who take part in this project for a cooking fuel. Since heat energy for cooking in households is typically LPG, biogas would be supplied to households as a cooking fuel to replace LPG. Ampawan Biogas Group (ABG) was established to manage biogas use among the members. Each household must pay \$3 per month for the right to use biogas. This payment would be used for management and maintenance of biogas system including biogas safety system as well. This biogas system not only helps the people in the village to trim down the cost of living, but also helps greatly in decreasing the environmental impact from the swine farm in long term.

## **2. Biogas program**

As a result of high energy prices in Thailand, the national alternative energy development plan aims to increase the production of alternative energy in the country in order to increase the alternative energy share of the total energy consumption to 30% by 2036. To reach that target, Thai government encourages all sectors to produce and use the alternative energy. For instance, financial subsidy for alternative energy projects and the introduction of feed-in tariff (FIT) program have been offered to entrepreneurs who produce electricity from alternative energy such as biogas and wind energy.

Pollutions from swine manure were huge concern to local community situated nearby the farm. Wastewater, bad odor and insects certainly affect the standard of living of people in the village. Biogas system plays a big part in problem-solving process with respect to pollutions from swine farm. Therefore, the principal focus of biogas system is on community-based biogas production for local use, and on cutting down the effect of pollutions generated by swine farm.

Regarding the supporting groups to this biogas project, Energy Conservation Promotion Fund (ENCON), Office of the Permanent Secretary (OPS) from Ministry of Energy, Taopon Subdistrict Administrative Organization (TSAO), Ampawan Biogas Group (ABG), and Jamlong Farm are responsible for providing amounts of funds to start up the biogas project. This funds were used for project management, construction of biogas plant and its equipment, pipeline network in the village, and biogas stoves for all households who took part in this project. Energy Technology for Environment Research Center (ETE) from Chiang Mai University was responsible for managing the project timeline from beginning to the end of the construction of the biogas system. The key to the success of this project was the common understanding and collaboration between swine farm owner, households in the area, and supports from government sectors.

The major source of heat energy used for cooking in households is Liquefied Petroleum Gas (LPG). To change from LPG to biogas, it is important that the biogas plant together with the pipeline network be constructed in the village. Hence, ENCON, OPS, TSAO, ABG, and Jamlong Farm gave \$51,000 for construction of the biogas plant and pipeline network, and for biogas stoves. Biogas pipeline network was 2,200 meters in distance. All main pipelines were put beneath the soil surface. With biogas used as a cooking fuel, new biogas stoves were given to all households who took part in this project to replace LPG stoves. In order to extend the life of biogas system,

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