Case Study


Local Partner Organization

Pekanbaru Municipality

Geography and Population

Pekanbaru is the capital of Riau province on the island of Sumatra. Area: 632.26 km²  Population: 950,571 12 Sub districts, 58 urban villages, 617 village clusters (RW), and 2521 neighborhood institutions (RT).

Contact Information

Department of Planning

Mr. Todi Kurniawan

Contact: Tel: +6281268526136
todikurniawan@pekanbaru.go.id

Project Coordinator

Nisa l’istiqomah Nidasari ICLEI SEAS

Contact: Tel: +6285695277764 Nisa.nidasari@iclei.org

Summary

Roughly 1 million people of Pekanbaru is producing 700 tons of solid waste per day. The landfill in Rumbai District has been operating for 20 years and is quickly running out of land for disposing the waste and will only be in operation up to 5 years from now. The city is in the process of purchasing land for the future environmentally friendly management of solid waste with innovative technologies. Officers from Pekanbaru visited a Waste to Energy model site in Bantan Sanitary Landfill in Chiangmai, Thailand. The privately-ran sanitary landfill is producing 2 Mw/h of electricity from 600 tons/day of solid waste. The private company makes profit from selling electricity to Provincial Electricity Authority. Officers wishes to apply a similar model in Pekanbaru. The expert who designs and operates the Chiangmai Sanitary Landfill was contracted to study Pekanbaru Sanitary Landfill explore the possibility of improving the management of the existing and future sanitary landfill as well as installation of efficient methane gas collection and energy production system.

The two possibilities of energy type to be produced are Electricity or Compressed Bio Gas (CBG) as fuel for vehicles.

Investment to produce Electricity would cost 27,3 Billion IDR and the return of investment period is 6 years and 5 months. Investing in CBG production could be financially viable as it is relatively less investment than electricity production. Moreover, the total amount of LFG collected can produce 6 ton/day of CBG which is equivalent to 4,620 liters/day of diesel. Based on the investment assumptions elaborated in the study, The return on investment period for producing CBG will be 4 years and 3 months. The recommendations and cost estimations of both alternatives of producing electricity and CBG has been elaborated in the study report. Once Pekanbaru chooses the preferred alternative the detail
engineering study and study on relevant regulations should be done, in parallel to financial sourcing for project implementation. As Pekanbaru is entitled to purchase very little space of and, innovative technologies (Mass Yield Technology/MYT) might be a solution recycling up to 90% of the waste requiring little space. Respective options with little space of land and high recycling potential will be studied in more detail in the near future.

### Rationale

Pekanbaru is a large city of around 1 million people. It is Sumatra's third largest municipality and the 8th-largest city in Indonesia. It is producing 700 tons of solid waste per day and collecting about 70% (500 tons/day) to be disposed at the landfill in Rumbai District. The Landfill has a total area of only 8.6 Hectare and has been operating since 1997. The landfill has almost reached its full capacity and between 3 to 5 years from now will no longer be able to receive anymore solid waste. The existing land fill has pipes installed but merely for releasing the methane gas into the atmosphere to prevent explosion, but no methane gas is collected. There is a leachate treatment system conveying the leachate by gravity through the drainage system down to the leachate treatment ponds. After the aerobic treatment, EM chemical is added to the water to reduce odor, after which the treated water is released into natural water ways. The municipality is in the process of purchasing a new landfill which is about 2 km to the north of the existing landfill. The new landfill will have 14 ha. In October 2014, by invitation from GIZ Nexus project, two officers from Pekanbaru visited a Waste to Energy model site in Bantan Sanitary Landfill in Chiangmai, Thailand. The privately-ran sanitary landfill is producing 2 Mw/h of electricity from 600 tons/day of solid waste (the gas used for electricity production is from both the landfill and leachate treatment). The private company makes profit from selling electricity to Provincial Electricity Authority. With the possibility of 700 tons of solid waste coming into the diminishing landfill space, Pekanbaru needs urgent solutions for landfill management and how to make use of the (LFG) Land Fill Gas and bio gas from leachate treatment. Pekanbaru Municipality and GIZ Nexus therefore agreed to cooperate on the ‘Sanitary Landfill: Solid Waste to Energy Project’ to explore the possibility of improving the management of the existing and future sanitary landfill as well as installation of efficient methane gas collection and energy production system. Innovative technology (Mass Yield Technology/MYT) might be a solution recycling up to 90% of the waste. Only very little space of land is required for this solution which will be studied in more detail in the near future.

### Project Description

The Pre-liminary Feasibility Study of implementing Sustainable Sanitary Landfill to Energy System (SSLTES) in Pekanbaru has been elaborated and presented to the Authorities. The study focuses on the following:

- Possible application of new landfill management concept: landfill preparation, pipe and drainage installation, daily cover methods, dumping and compacting methods
- Capturing of LFG (Land Fill Gas) and capturing gas from leachate treatment with appropriate and efficient technology
- Production of either electricity from biogas or fuel (for vehicles) from Compressed Bio Gas (CBG).
- And investment cost estimation

To be able to capture the methane gas from the existing site and the new site which is 2 km away, the study considers installing a piping system to convey the gas from the new site to the existing site. Once the methane gas from both sites is collected, the decision is to be made on which type of energy is to be produced from the collected gas.
The preparation of the new landfill will apply a new concept to decrease open area for rain reception, less open area for odor emission, compaction of solid waste into a slope shape, horizontal landfill expansion, top covering with HDPE, and re-use of biogas depleted landfill. The concept promotes efficient use of the available land as well as efficient LFG collection.

The study’s technical analysis shows the potential amount of methane gas that can be captured from Muara Fajar landfill, the New Landfill, and the leachate treatment from both landfills. By accumulating all the gas produced, the Municipality has the choice of either producing VBG or electricity. For electricity, the Government of Indonesia has the policy to encourage the production of electricity from LFG by offering to purchase the electricity at 1,250 IDR/kWh.¹ It is assumed that the investment cost would be 27.3 Billion IDR and the return on investment period is 6 years and 5 months. The return on investment period of Muara Fajar landfill is longer than that of Bantan landfill because the Thai Government buys the electricity at a higher price – more favorable incentive mechanism. The alternative is then to produce Compress Bio Gas (CBG) that would yield the return on investment (20.3 Billion IDR) period after 4 years and 3 months.

The recommendations and cost estimations of both alternatives of producing electricity and CBG has been elaborated in the study report. However, huge amounts of land are required to implement these proposals. As Pekanbaru is entitled to purchase very little space of land, innovative technologies (Mass Yield Technology/MYT) might be a solution recycling up to 90% of the waste requiring little space. Respective options with little space of land and high recycling potential will be studied in more detail in the near future.

**Stakeholders / Target groups**

**Stakeholders:**

**City Level**
Pekanbaru Municipality (Sanitation Task Force consists of cross-sectoral agencies such as city planning agency, cleaning and parks department, environmental agency, public works agency etc).

**Regional Level**
Riau Provincial Government

**National Level**
- BAPPENAS - Badan Perencanaan Pembangunan Nasional (National Planning Agency);
- Ministry of Energy and Natural Resources (ESDM) – Sub Directorate of Bio Energy Business Service and Supervision;
- State Electricity Company (PLN);
- Ministry of Housing and Public Works

**Target Groups:**
The roughly 1 Million people living in Pekanbaru.

**Costs / Financing**

The preliminary cost estimation for producing 1 MWh of electricity from the LFG is 27.3 Billion IDR. Meanwhile the total investment cost for producing CBG 6 tons/day is 20.3 Billion IDR.

- Therefore, it is essential to seek for external financial support. One of the possible financial support being explored is the “Advanced Solid Waste Management Programme”, implemented by the Ministry of Housing and Public Works financed by KfW, National Urban Development Project (NUDP) by Bappenas and Transformative Actions Program by ICLEI.

¹ Ministry of Energy and Mineral Resources of The Republic of Indonesia No. 19 of 2013, article 4.
Study Report and Recommendations for Pekanbaru Sanitary Landfill improvement and Energy Production, January 2015
3 Days Comprehensive Landfill Management, Chiangmai, Thailand, February 2015

Results (Impact)

- Decision makers and management are made aware of innovative solid waste management technologies with a high percentage of recycled materials for reuse and the possibility to achieve effective landfill management and landfill gas collection for electricity generation and/or fuelling cars.
- Pekanbaru Municipality officers were capacitated via peer to peer learning on Landfill site management Waste to Energy production in Chiangmai Sanitary Landfill.
- Applying SSLTES concept to the landfill will enable the city to protect the environment, produce energy and other valuable products from waste, as well as achieving sanitary landfill sustainability. This will also alleviate Pekanbaru’s pending issues such as:
  - Lack of budget for solid waste management
  - Odor and insects problems
  - Landfill space limitation
  - Electricity shortage
  - Leachate disposal
  - Unhealthy working environment for waste segregators
  - Job creation for the locals
  - Improvement of Pekanbaru city image
  - Concerns for future generations.
- Methane gas collection provides opportunity to generate income through selling electricity to State Electricity Company (Perusahaan Listrik Negara, or PLN). As well as the opportunity to reduce gasoline expenditure by fuelling their trucks/car with Compressed Bio Gas.