Case Study

Country: Indonesia  
City: Pekanbaru  
Key Sectors: Sanitary Landfill: Solid Waste to Energy Project

Local Partner Organization

Pekanbaru Municipality

Geography and Population

Pekanbaru is the capital of Riau, a province in Indonesia on the island of Sumatra. It has an area of 632.26 km² with a population of 950,571

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Summary

Roughly 1 million people of Pekanbaru are 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. It will only be in operation up to 5 years from now. Although the city is planning to purchase a 14-hectare piece of land for a new landfill, a holistic concept and a vision for the future management and operation of the existing and new landfill is required.

Officers from Pekanbaru visited a Waste to Energy model site in Bantan Sanitary Landfill in Chiang Mai, Thailand in October 2014. 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 the Provincial Electricity Authority. The officer’s wishes to apply a similar model in Pekanbaru.

The expert who designed and operates the Chiang Mai 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 types to be produced are electricity or Compressed Bio Gas (CBG) as fuel for vehicles.

Investment to produce electricity is not financially attractive for Pekanbaru as the electricity selling price structure yields a long pay back period of 10 years. However, detail study of pricing structure should be done as there might be other incentive mechanism for renewable energy.
Investing in CBG production could be financially viable as it requires less investment than electricity production. Moreover, 700 tons/day of waste can produce an equivalent of 13,000 liters/day of diesel from CBG, while the requirement from Cleaning and Parks Department is only 3,000 liters of diesel per day. Which means that the Municipality could save USD 900,000 per year by using CBG to run its truck fleet instead of using diesel, and additional have 10,000 litre worth of diesel to be given out or sold.

The recommendations and cost estimations of both alternatives of producing electricity and CBG will be elaborated in the study report. Once Pekanbaru chooses the preferred alternative the detail engineering study and study on relevant regulations would be done, in parallel to financial sourcing for project implementation. One of the possible financial support being explored is the “Advanced Solid Waste Management Programme”, financed by KfW.

**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 landfill has pipes installed but merely for releasing the methane gas into the atmosphere to prevent explosion, but not for methane gas collection.

There is a leachate treatment system where the leachate is conveyed 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 Hectares.

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 Chiang Mai, 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 biogas 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.

**Project Description**

The study of existing and future landfill will be done and a Concept Master Plan for the 2 landfills will be produced.

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.

Although Indonesia’s Ministry of Energy and Mineral Resources has recently approved (October 2014) the selling price of electricity produced from biogas, the selling price structure (IDR 1,050/kWh * F or USD 0.08/kWh * F (where F value = 1.15 for Sumatra region)) is not attractive for investment because that price structure will yield a payback period of around 10 years for an investment to produce 1 Mkh of electricity from biogas.

The alternative is then to produce Compress Bio Gas (CBG) to be used as fuel for vehicles. The Cleaning and Parks department of Pekanbaru Municipality has a budget of USD 4.4 Million (IDR 55 Billion) per year. USD 2.4 Million (IDR 35 Billion) is allocated to Parks Section, and USD 2.0 Million is allocated to Cleaning Section. The Cleaning section uses almost 50% (USD 900,000) of its budget to run a fleet of 101 vehicles every year. On average, the Cleaning Section is using 3,000 liters of diesel per day. In theory, 700 tons of solid waste per day can produce an equivalent of 13,000 liters/day of diesel from CBG. Therefore, the Cleaning and Parks Department will be able to reduce diesel expenditure for its truck fleet by 100% and have additional 10,000 liters of diesel equivalent of CBG to be given out or sold.

The recommendations and cost estimations of both alternatives of producing electricity and CBG will be 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.

Stakeholders / Target groups

Stakeholders:

City Level
- BAPPEDA
- Cleaning and Parks Department
- The roughly 1 Million people living in Pekanbaru

National Level
- BAPPENAS
- Ministry of Public Works
### Costs / Financing

The preliminary cost estimation for producing 1 MW/h of electricity from the LFG is USD 3 Million. The amount is almost 70% of the yearly budget of Cleaning and Parks Department. The cost estimation for producing the CBG to run the fleet is estimated to be lower than producing electricity, but further study is required for proper cost estimation.

Therefore, it is essential to seek for external financial support. One of the possibilities being explored is the “Advanced Solid Waste Management Programme”, financed by KfW. In December 2014, additional Indonesian cities would be contacted by the Ministry of Public Works to be included in the programme. Pekanbaru could take advantage and request to be included in the program for financial support.

### Studies / Reports / Training

- **Study Report and Recommendations for Pekanbaru Sanitary Landfill improvement and Energy Production, January 2015**
- **3 Days Comprehensive Landfill Management, Chiang Mai, Thailand, February 2015**

### Results (Impact)

Decision makers and management are made aware of 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 Chiang Mai Sanitary Landfill.

Methane gas collection provides Pekanbaru Municipality 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.