## Case Study

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### Local Partner Organization

**Tanjung Pinang Municipality**

Tanjung Pinang is the capital of Riau Islands Province. Area: 239.5 km², Population: 229,396

### Geography and Population

### Contact Information

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### Summary

Roughly 230,000 people of Tanjung Pinang are producing 400 tons of solid waste per day but only 160 tons per day are collected.

The 10.8 Hectare landfill, Ganet TPA, has been in operation since 1999, and the only fully active landfill is Zone 4 with 0.69 Hectares.

Although there is a plan to expand the landfill into the available area (8.5 Hectares) adjacent to Zone 4, a holistic concept and a vision for the future for management and operation of the current and extended area is required.

An expert who designs and operates the Chiangmai Sanitary Landfill was contracted to study Tanjung Pinang Sanitary Landfill and 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. Moreover, Tanjung Pinang is facing power shortage and blackout occurs often daily. Therefore any additional power would be welcome.

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.

The recommendations and cost estimations of producing electricity have been elaborated in the study report. Detailed engineering study and study on relevant regulations will be done in parallel to
financial sourcing for project implementation.

Rationale

A city with roughly 230,000 residents, Tanjung Pinang is the capital and second largest city of Riau Islands. Tanjung Pinang is located south of Bintan island and has ferry connections to Batam (Indonesia), Singapore, and Johor Bahru (Malaysia).

The estimation of solid waste produced per day is 400 tons, but only 160 tons/day is collected and disposed at the Ganet Sanitary Landfill. The Ganet Landfill has been opened since 1999 until present, zone 1 to zone 3 are closed cells and zone 4 is an operating cell. It has already installed a small scale LFG collection system and is able to produce electricity via a small generator just enough to power a few light bulbs in the landfill buildings. The system also uses the collected LFG for occasional cooking. The small scale waste-to-energy project shows that Tanjung Pinang is on the right track in their environment and resource management. However, the TPA landfill gas has much more potential in terms of energy production from LFG. Moreover, Tanjung Pinang faces a shortage of electricity. Blackouts occur a couple of times daily, although they last only seconds or minutes during each occurrence. The Municipality is well aware of this power shortage and plans to purchase electricity from Batam Island via underwater cable. This implies high investment costs and perhaps is not a sustainable solution as Batam can only sell electricity to Tanjung Pinang during night time when the electricity demand in Batam is low.

As electricity can be produced from LFG, Tanjung Pinang will benefit from larger scale biogas collection and electricity production. At least 1 MW can be produce from 200 – 400 tons of solid waste per day. The electricity produced will contribute to the very much needed additional source of energy.

Tanjung Pinang in cooperation with GIZ Nexus therefore embark on Sanitary Landfill: Solid Waste to Energy Project.

Project Description

The Preliminary Feasibility Study of implementing Sustainable Sanitary Landfill to Energy System (SSLTES) in Tanjung Pinang has been elaborated and presented to the local 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
- And investment cost estimation.

Based on the study, in order for the TPA landfill to become a sustainable sanitary landfill and reach its highest potential in landfill gas collection and utilization, it is recommended that the TPA landfill adopts Bantan’s ‘Sustainable Sanitary Landfill to Energy System.’ The SSLTES concept allows for the excavation of the closed cell (after 15-20 years when all the organic waste have completely decayed). The excavated cell becomes a ‘new’ cell for dumping. By applying this method the excavation can be done in a series (one cell after another), and therefore, Tanjung Pinang landfill will never run out of land to dump garbage. The SSLTES concept also decreases open space during operation. The only open space at any given time is the area opened for garbage dumping. The rest of the space is either covered by HDPE, temporary plastic sheets, or daily cover (soil). By applying this method, less odor will be released into the atmosphere, less spaces for insects to use for colonization, as well as less leachate due to less rain penetration into the landfill. As a result, the nearby communities will be less affected by the landfill.

There are revenues from each step of the SSLTES solid waste management process; sale of
renewable energy from LFG, the excavated valuables, sales of trees grown by using treated leachate as fertilizers. These revenues can be used as additional budget to further improve the city’s solid waste management and in future, this budget could be used for other development purposes.

LFG can be collected from three parts of the sanitary landfill: 1. the existing landfill; 2. the planned future landfill and 3. the leachate from existing and future landfills. There is a need to install a proper leachate collection system and treat the leachate to decrease the probability of the nature being contaminated from untreated leachate disposal.

Tanjung Pinang Municipality can utilize the 559 Nm³/h of Landfill Gas collected in 2 ways:
- Produce 1 MWh of electricity from the LFG
- Produce Compressed Bio-Methane Gas (CBG) to replace fuel oil or LPG at 6 tons/day.

In the case of electricity production, based on data in the study, it can be projected that in 2016 there is enough LFG to produce 1 MWh of electricity, in 2020 there is enough LFG for 2 MWh, and in 2019 enough LFG to produce 2.7 MWh. This can be an additional source of energy for Tanjung Pinang.

The Indonesia Government has the policy to encourage the production of electricity from LFG by offering to purchase the electricity at 1,250.00 IDR/kWh. The total investment cost to produce 1 MWH of electricity from landfill gas in Indonesia would be 27.3 Billion IDR. The return on investment period is 6 years and 5 months.

The other alternative is to utilize LFG to produce CBG at 6 tons/day. CBG could be used as a substitute for diesel, petrol and NGV (natural gas for vehicles), both for vehicles and cooking. One ton of CBG is equal to 940 liters of Gasoline, 770 liters of Diesel or 760 kilogram of LPG. The total investment cost for producing CBG 6 tons/day is 20.3 Billion IDR. With the investment assumptions provided in the study report, the return on investment period will be 4 years and 3 months.

The recommendations and cost estimations of producing electricity and CBG have been elaborated in the Preliminary Feasibility Report. Should Tanjung Pinang see implementation possibilities, 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**
Tanjungpinang Municipality (Nexus Task Force consists of cross-sectoral agencies such as city planning agency, cleaning and parks department, public works agency etc)

**Regional Level**
Riau Islands 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
- Ministry of Housing and Public Works (Advanced Solid Waste Management Programme);
- State Electricity Company (PLN);

**Target Groups:**
The roughly 230,000 people living in Tanjung Pinang
**Costs / Financing**

The preliminary cost estimation for producing 1 MWh of electricity from the LFG is IDR 27.3 Billion. 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 possibility being explored is the “Advanced Solid Waste Management Programme”. Tanjung Pinang can request to be included in the program for financial support. There is also funding opportunity from Bappenas called National Urban Development Project (NUDP) and Transformative Actions Program (TAP) by ICLEI.

**Studies / Reports / Training**

Study Report and Recommendations for Tanjung Pinang 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 the possibility to achieve effective landfill management and landfill gas collection for electricity generation and/or fuelling cars.
- Tanjung Pinang 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 Tanjung Pinang’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 Tanjung Pinang city image
  - Concerns for future generations.
- LFG collection provides Tanjung Pinang Municipality opportunity to generate income through selling electricity to State Electricity Company (Perusahaan Listrik Negara, or PLN) and/or selling CBG as Diesel equivalent. This will also reduce methane gas’ impact on the ozone and global warming.