



## CONTEXT

Beer-producing companies have a large water and wastewater footprint. Hence, optimising their water and wastewater resources by using wastewater treatment plants (WWTP) is high on their priority. Many established companies built WWTPs and have been operating them for years. However, during their planning and installation of the WWTPs, the optimisation or utilisation of the biogas produced from the WWTPs was not considered. Thus, without any alternate process in place, many beer companies simply burn large volumes of biogas generated at their WWTPs to dispose of it, without extracting any energy value from it.

In recent years, as resource efficiency has become more important both from a point of reducing its environmental impact, and increasing the economic profitability of companies, the need to optimise the use of all by-products from companies has been recognised. In addition, energy costs represent a significant expense in the beer brewing industry. In this context, it is proposed that beer manufacturing companies (or other companies with larger WWTP operations) must look into the potential of recovering and reusing the biogas generated at the WWTPs to produce heat – which can in turn replace at least a portion of the energy use at the production site.



Photo: DHPiZA Da Nang

## INDUSTRIAL SYMBIOSIS CASE STUDY

### PROBLEM

A large volume of biogas is generated at the Heineken Beer Company wastewater treatment plant: around 4,800m<sup>3</sup> biogas/day estimated with a production capacity of 240 million litres of beer per year<sup>1</sup>.

This biogas, composed of CO<sub>2</sub> (20~30%), CH<sub>4</sub> (60~70%) and trace amounts of N<sub>2</sub>, O<sub>2</sub>, and water vapour, is currently being discharged directly to the environment, without being utilized. Methane (CH<sub>4</sub>) is the only combustible portion and has a Gross Calorific Value (GCV) of 39.8MJ/m<sup>3</sup>. Thus, the Theoretical Calorific Value of biogas is around 0.65-0.7 times the GCV of CH<sub>4</sub> and equates to ~27.7MJ/m<sup>3</sup> <sup>2</sup>.

Green Energy ESCO Company, located nearby, uses a biomass boiler to supply steam (about 4,000 tonnes of steam/month) to Heineken Beer Company.

The existing boiler system consists of 2 boilers that utilise 1,000 tonnes/month of woodchips and 800 tonnes/month of rice husk per month as fuel. This results in a total cost of about 60,200 USD/month for fuel.

Green Energy is located approximately 350m from Heineken company.

### SOLUTION

The energy service company invests in a biogas-fired boiler with a capacity of 2 tonnes/hour, in which biogas recovered from the beer company is used to generate heat for steam. The produced steam is supplied back to the beer company.

### The objectives of this interventions are to:

- Valorise biogas generated by the wastewater treatment plant of Heineken Company other disposed into the environment, without being utilizing its reuse value.
- Substitute for current fuel use in the boiler of Green Energy Company, located nearby, with recovered biogas, to reduce primary fuel consumption and associated costs.

<sup>1</sup>. A typical brewery with production of 100 million litres per annum might produce waste up to 4.5 tonnes of COD equivalent per day, with a potential of 2000m<sup>3</sup> per day of biogas or 20 tonnes of steam." (Accessed online: <http://www.renewableenergyfocus.com/view/17518/from-beer-to-biogas/>)

<sup>2</sup>. Accessed online: <https://www.quora.com/What-is-the-biogas-calorific-value>

## CURRENT STATUS

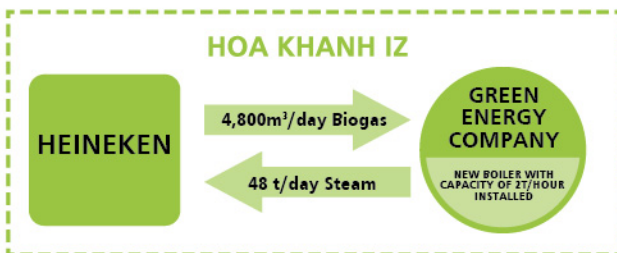
The IS opportunity was implemented in January 2019, a biogas powered boiler of a slightly smaller capacity at 1.5 tonnes/hour is installed at the Green Energy company.

With this installation, 30% of the steam supplied from Green Energy to Heineken from biogas recovery, helped in replacing existing biomass as fuel.



Location of Heineken and the Green Energy Company

- Energy service company (Green Energy ESCO): investment, operation, and maintenance of the biogas boiler
- Brewing company (Heineken): biogas supply



Industrial Symbiosis proposed for Heineken and Green Energy company

## ECONOMIC INDICATORS

CAPEX	2.1 billion VND (91,205 USD)
OPEX	1.19 billion VND/year (51,112 USD/year)
Revenues/ Savings	5.45 billion VND/year in biomass costs reduction
Payback period	6 months

## ENVIRONMENTAL AND SOCIAL ASPECTS



**Impact on resource consumption/energy savings:** Reduction in biomass consumption by ~30%.



**Impact on air emissions (inc. POP):** Reduction in emissions by about 10,675t CO2eq/year.



**Impact on waste production:** Reduction in solid waste (approx. 500t per year) due to less biomass use in the boilers at the Green Energy company.



**Impact on working environment:** Improved work environment and health conditions for workers due to reduced emissions.



**Organisational and technical capacity building:** Awareness building on environmental, resource efficiency, and monetary measures to be gained by installation of the new system.



**Impact on neighbouring communities:** Improved environmental and health conditions in neighbouring communities.

Training of workers on the management of the new installed system.



*Hoa Khanh Industrial Zone has the potential to leverage this IS opportunity in their journey to becoming an Eco-industrial Park*