

HAFFMANS LIQUIVAP GUINNESS ANCHOR BERHAD

CASE STUDY



KEY FACTS

Location

Petaling Jaya, Malaysia

Application

CO₂ recovery plant in Sungei Way Brewery

Capacity of the brewery

1 million hectoliter per year

CO₂ recovery system

Two separate CO₂ systems, each 500 kg/h

«WE HAVE NOT HAD TO PURCHASE ANY MORE CO₂»

Approximately 60 percent of the costs associated with carbon dioxide (CO₂) recovery are attributable to the cooling stage of the process. If less energy is required for cooling, it translates to a reduction in running costs. This is precisely what the LiquiVap system from Pentair Haffmans offers. For CO₂ recovery systems undergoing expansion or retrofitting, recovery yield can be improved. The Sungei Way Brewery owned by Guinness Anchor Berhad (GAB) in Malaysia is a representative case as this brewery had two existing systems simultaneously retrofitted with LiquiVap.

GAB operates the Sungei Way Brewery in Malaysia, which was commissioned in 1965. The brewery is located in the city of Petaling Jaya in the state of Selangor, where it produces Tiger, Guinness, Heineken, Anchor Smooth, Anchor Strong, Kilkenny, Anglia Shandy, and Malta. The plant's capacity is approximately one million hectoliter per year. GAB occupies the leading position in the Malaysian beer market with a market share of approximately 57 percent.

The Sungei Way Brewery is the only one of its kind in the world. It consists of two production lines, completely separate from one another, in which only APB (Asia Pacific Breweries) or only Guinness beers are brewed. The maxim here is: The products are not allowed to be mixed, not even the gases liberated from fermentation. Consequently, the brewery has two separate CO₂ systems in operation that were both supplied by Pentair Haffmans approximately 20 years ago. Chuah Chong Sheng, project engineer for the CO₂ supply at GAB, shares his reflections on the past.

"We simply weren't able to produce enough of our own CO₂ with the existing systems," he said. "Each month, we had to purchase supplemental CO₂, which is complicated and expensive. Also, the refrigerant R22 was still used in this system, which is less than ideal from an environmental perspective.

"We were won over by this concept"

In order to find an optimal solution for this problem, the brewery contacted Pentair Haffmans. Initially, several completely different concepts were developed and their respective advantages evaluated. Replacement with a new plant would have brought the highest efficiency, supplying both brewing plants at a rate of 1,000 kg/h simultaneously. However, this could not be implemented at the time due to certain aspects of the brewery's strategic planning. Instead, the decision was made to retrofit the existing 500 kg/h systems with the alternative presented by the innovative unit known as the LiquiVap.

"This idea was very convincing, since the existing plants were also manufactured by Pentair Haffmans," Chuah Chong Sheng recalled. "We were already familiar with the products they are capable of delivering and also the high level of service from Pentair Haffmans. Furthermore, we already have a LiquiVap unit at APB in Singapore, providing us with a means for comparison. It has been in operation there for more than a year."

Evaporating CO₂ cools fermentation gas

LiquiVap – a term created from abbreviations for liquefaction and evaporation – is an energy saving system for CO₂ recovery plants.

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OPTIMAL ENERGY EFFICIENCY

During recovery, the gaseous CO₂ must be cooled and liquefied prior to storage in tanks at a temperature of -24 °C and a pressure of 18 bar. In order to be able to utilize this stored liquid CO₂ in the brewing process, the liquid CO₂ is heated with air or steam and evaporated.

This “energy of evaporation” can be captured very efficiently from this process with the LiquiVap system. As the CO₂ evaporates, it liquefies the gaseous carbon dioxide coming from the activated carbon filters and dryers. In this manner, the energy is recovered that would otherwise be electrically fed into the refrigeration system.

Additionally, the cooling capacities required of the refrigeration systems are significantly lower. When undertaking the expansion of a CO₂ recovery system’s overall capacity, one can forego a complete expansion of the refrigeration system’s capacity in favor of installing a LiquiVap unit.

If less energy is required for cooling, this directly results in lower total costs associated with CO₂. Yet another advantage of the LiquiVap is that it does not contain any mechanical parts, making continuous operation possible over long periods without interruptions for maintenance. Reducing the hours of operation of an existing refrigeration system as well as its maintenance costs are certainly not the least of these advantages, which also include increased reliability.

Optimal energy efficiency all of the time

However, with LiquiVap the amount of cooling that takes place directly corresponds to the amount of evaporation. To integrate it into realworld applications, system operation is important.

During the cooling stage to assure operations are within the most optimal range, the cooling capacity needs to adjust to production variables. For example, if the system is dimensioned for 500 kg/h but production only requires 400 kg/h, then only 400 kg/h can be cooled using the LiquiVap. Separate cooling capacity is required for the remaining 100 kg/h must be cooled by the existing refrigeration system. But, it is essential to understand that the control system precisely regulates the refrigeration process so that the energy required to cool the 100 kg/h is consumed – no more and no less. In this manner, energy efficiency always remains at an optimal level.

Four percent makes a difference

At the GAB Brewery, in addition to retrofitting with a LiquiVap unit and the installation of the latest control system, the entire final stage of CO₂ treatment was redesigned. The previously employed means for cooling the CO₂, in which the less desirable refrigerant was used, was replaced and modernized with one designed to meet future environmental requirements. Using the innovative LiquiVap system, very low process temperatures are possible. As a result, gas at an initial purity of 95 percent can be recovered, compared to the situation before retrofitting, in which it was only feasible with gas at an initial purity of 99 percent. The difference of four percent means that the fermenters can be connected earlier, and, therefore, a greater volume of CO₂ can be recovered.

“For over a year, both of our plants have proven their value under the challenging production conditions we experience on a daily basis,” Chuah Chong Sheng explained in summarizing this successful project. “Since commissioning these units, we have indeed become self-sufficient and have not



Chuah Chong Sheng, project engineer at GAB and responsible for the CO₂ supply.

had to purchase any CO₂ – not to mention that we have achieved this in conjunction with savings through utilizing sustainable energy as well. We are completely satisfied with all aspects of retrofitting with the LiquiVap.”

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