

SUSTAINABILITY: A MAJOR ASPECT IN BREWERY DESIGN – ENGINEERING AND DESIGN FOR THE NEXT LEVEL

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ABSTRACT

Re-organising all brewery processes with respect to energy consumption and beer quality is the challenge a brewing engineer has to endure in the future. Increasing cost of production and public pressure demanding respect to the environment are the driving forces.

Starting from the current state-of-the-art of the brewing process and considering energy savings and energy recovery the paper presents an outlook to the next level for a 1 million hectoliter Greenfield brewery. The next level of design requires a careful and detailed analysis of all links between process and utilities and a holistic approach to a brewery as a complete unit. As a result, a significant reduction of thermal and electrical power made from fossil fuels is possible and must be considered as the next level. It is recommended that two temperature levels in the brewery for using recovered energy and energy from alternative sources, be defined. The 'hot' area in a state-of-the-art brewhouse is where steam is provided and the 'medium' area is where hot water at a temperature level ($\pm 85^{\circ}\text{C}$ - 95°C) is used for supplying required thermal energy. Using this definition as a guideline for engineering provides access to solutions for low consumption of fossil fuels for thermal energy. Process requirements are discussed in detail and an implementation strategy is presented. In this scenario the thermal use of spent grains becomes a key element for the future because of its perfect match in peak and low peak situations.

The strategy for supplying thermal energy on two different levels opens a wide range in the use of co-generation, photovoltaic and fuel cells in the brewing industry. Even for large motors, modern control philosophies are self-evident.

Installing separate networks for brewing liquor and process water opens the possibility to reuse the water. An anaerobic wastewater treatment, including RO and UF, supplies high quality water for selected tasks. In addition these units are able to supply $\pm 8\%$ of the thermal energy demand, if the methane is used in a steam boiler.

The paper concludes with emissions from the brewhouse and bottle washers because they are often considered as off-odours. A selection of available methods to reduce the olfactory relevance within a range from 50% reduction to 'zero emission' is presented and discussed.