# Renewable Energy for Process Heat

# Feasibility Report - Case Study

# Lion – Beer, Spirits and Wine

This feasibility study was conducted as part of our Renewable Energy for Process Heat Opportunity Study – Phase 1. This project was undertaken in partnership with Climate-KIC Australia and in collaboration with Sustainability Victoria and the Department of Planning, Industry and Environment (NSW). The project was part-funded by the Australian Renewable Energy Agency (ARENA), more information here. A second phase of the project was commenced in early 2020, more information here.

The purpose of the feasibility study was to determine the technical and commercial feasibility of replacing some or all of the current fossil fuel process heating on the site with renewably powered alternatives, and to detail a pathway to implementation including technical and financial specifications and a business case for investment.

This case study summarises the findings of the study and is published with permission of the proponent. For more information about A2EP and the project, go to a2ep.org.au.

**SITE DETAILS**

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|---|---|
| Company: | Lion – Beer, Spirits and Wine |
| Site: | West End Brewery, Adelaide, South Australia |
| Application sector: | Brewery |
| Technologies featured: | Heat pump |
| Consultant engaged for this study: | pitt & sherry \| pittsh.com.au |

**Australian Alliance for Energy Productivity (A2EP)**

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# Case study – $CO_2$ Heat Pump for Brewery

**West End Brewery, Adelaide**

## Context


Lion – Beer, Spirts and Wine Pty Ltd is one of the largest brewers in Australia, with iconic beers and ciders such as West End, Boag's, James Squire, Little Creatures and 5 Seeds as part of their portfolio. The business also has a strong focus on sustainability and corporate leadership, with recently announced commitments to be Australasia's first large-scale carbon neutral brewer by 2020. Lion has also pledged to use 100% renewable electricity in its operations by 2025.

The site at Thebarton, Adelaide is a large brewery that produces West End and a variety of other beers and ciders based on business needs.

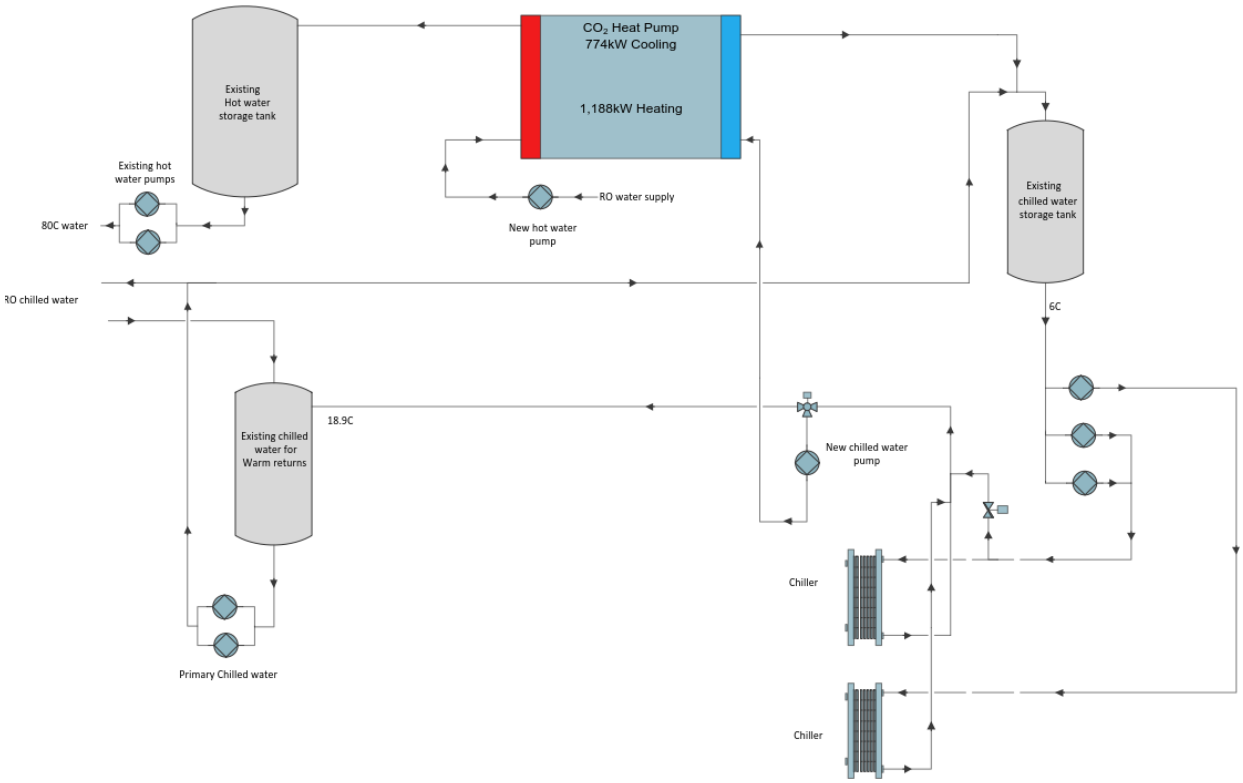
The site has a single heat utility system serviced by two (2) 10MW firetube boilers in a centralised steam plant that provides process heat for beer production, pasteurisation, as well as equipment cleaning. This classic type of brewery setup has been the standard for many years and can be found in breweries across the world. Whilst highly functional, this type of design does not respond well to the changing demands of the modern beer market and its shift to more craft beer that is produced in smaller batches. This results in low system efficiency and poor system utilisation. Addressing these issues is Lion's primary driver to investigate new and innovative technologies to replace their existing process heating needs with a more efficient, electrified and renewably sourced energy supply.

This feasibility study is centred on determining the operational and financial viability of the replacement of some or all of the existing gas fired boiler steam and heating supply with electric heat pump technology and consolidating the boiler heat demand to just a single unit.

## Proposal

The proposed project will utilise two large scale $CO_2$ heat pump systems:

1. A 357 $kW_e$ system providing 1188 $kW_t$ of heat and 774 $kW_t$ of cooling to the brewhouse operations. This system will use the chilled water (used for wort cooling) as the heat source and produces hot water for all brewhouse heating and cleaning needs with the exception of wort boiling and mashing. As this is a water sourced heat pump, the cooling side will benefit the system by producing chilled water on location, reducing the duty cycle for the ammonia refrigeration plant.




2. A 350 $kW_e$ system providing 1155 $kW_t$ of heat for the Clean in Place system at the bottling plant. This system will be air sourced due to the lack of refrigeration needs.

Whilst the $CO_2$ heat pumps proposed do replace most of the boiler duty, they do not replace all of it due to the high capital costs involved. The brewing process requires heating of the wort to over 100°C which is difficult to achieve using heat pumps. Direct electric heating can be used for this purpose though brewing equipment with this type of heating technology would need to be custom built.

However, the technical feasibility of replacing all other Clean in Place systems on site (which are the other large steam user at this facility) is established and is limited only by cost. We envisage that a brewery of the future would be built with these renewable, electrified, on demand heating systems with a biogas boiler to provide redundancy and additional peak heat demands.

This project's financial performance (excluding the planned installation and subsequent use of renewable energy) is as follows:

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|---|---|
| Capital cost ($, ex GST) | $3,430,000 |
| Simple payback period (years) | 4.4 |
| Net energy savings (GJ/year) and % of site total | >43,000 (32%) |
| Net energy savings ($/year) and % of site total | ~(24%) |
| Additional renewables deployed (GJ/year) | ~3,000 |
| GHG reduction (tonnes $CO_{2\text{-}e}$) and % of site total | >4,800 (27%) |
| Productivity benefits | Reduced boiler standby losses by using only a single boiler. Reduced maintenance costs due to lower boiler run times. Greater ability of the site to respond to partial loading of production levels. Reduced run times of refrigeration equipment |