IMPROVING ENERGY **EFFICIENCY OF WATER HEATING** FOR THE FOOD MANUFACTURING INDUSTRY

Introduction

Among manufacturing sectors in Australia, food makers trail only behind the mining industry as the biggest spenders on energy.

According to the latest figures available from the Australian Bureau of Statistics, the food manufacturing industry pays a staggering $706 million a year on its electricity bills, accounting for 17 per cent of the entire manufacturing industry's energy expenditure. What's even more alarming is that this spending does not match consumption – with the segment accounting for just 10 per cent of total energy consumption.[1]

The combination of inefficient energy spending and high usage becomes increasingly problematic when taking into account rising energy costs and insecurity of energy supplies.

So what can a food manufacturer do? Fortunately, advances in one of the most energy hungry processes – hot water heating – is providing a viable solution in the form of industrial heat pumps, with the ability to slash overall energy bills in a single equipment upgrade. The following whitepaper will look at the energy requirements of hot water usage in the food manufacturing sector, the future of energy supplies and prices in Australia, and at how industrial heat pumps are helping food manufacturers decrease their energy bills, and increase competitiveness.

Hot Water usage

Along with energy, food manufacturers also count for the lion's share of hot water usage. Collectively, the food, beverage and tobacco industries use 39 per cent of water from across the entire manufacturing sector.[2] This cost translates into an ongoing expense of $1.13 per kilolitre, which rises to an astounding $5.13 per kilolitre for water that has been heated to 80 °C using traditional boiler facilities.[3]

Food businesses have little choice but to use hot water in their food processing. Water is used in processing applications such as pasteurisation and washing in-process materials.[4] The biggest need for hot water is sanitation. Food Standard's 'A Guide to Food Safety Standards' clearly sets out that all food surfaces need to be sanitised using either hot water or chemicals. The baking industry uses up to 70 per cent of its water for cleaning, while even the soft drink industry uses 48 per cent of water to clean up.[5]

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Limits to sustainability

Many food manufacturers continue to use inefficient gas- or electricity-powered boilers to produce the hot water needed for food processing. Boiler systems require a large amount of electricity, as they need to produce direct heat and burn fuel to produce hot water. In addition to their high energy consumption, many boiler systems will require more energy if they are not maintained to the highest quality care. The NSW Government reports that a poorly maintained industrial boiler can consume 10 per cent more energy than one that has been well maintained. Gas boilers also continue to represent major safety issues, with gas leaks an ongoing concern for plant managers.[6]

This use of outdated and poorly maintained equipment has limited that ability of food manufacturers to remain efficient in their energy usage. A study by the Australian National University looked at the overall sustainability of food manufacturing, and its findings were grim. It noted that: “Australia has experienced a long-term trend of using more energy for food provision across the whole food supply chain”.[7]

The sector’s inability to embrace more effective equipment has been further exacerbated by public policy. Although government efforts to limit electricity prices present a short-term gain, they may be hurting the industry in the long run. A report by the Queensland Government noted that efforts to keep energy prices low were “the main factors inhibiting the adoption of more energy-efficiency practices.”[8]

The inefficient use of energy will have consequences on the food processing industry’s long-term economic sustainability. A study by the Office of the Chief Economist found that businesses who took a short-term view on energy cost are risking their long-term export competitiveness. The paper, released this past February, supported the Queensland Government’s finding that inefficient price mechanisms made it difficult for businesses to change their energy use behaviour. The authors concluded that energy intensive sectors – like the food manufacturing industry – will need to change their behaviour over longer periods of time to remain competitive against international rivals.[9]

This means that the future of Australian industry will depend on increasing energy productivity. And while the food manufacturing industry may be lagging behind, the fact that Australia as a whole is improving is a promising sign that improvement is possible. The Office of the Chief Economist found that from 2000 to 2015, energy productivity – gross domestic product/energy consumption – rose by 28 per cent.[10]

Preparing for renewables

In addition to increasing energy productivity, Australia's use of renewables in its energy mix seems increasingly inevitable, even if its scale is still being debated.

The Australian Government's Climate Commission reported in its landmark report "The Critical Decade 2013" that 80 per cent of Australia's fossil fuel resources needed to stay in the ground if there were any hope of reaching global emissions reduction targets.[11]

Although the government recently rejected recommendations by its chief scientist Alan Finkel to implement a Clean Energy Target, it does have a current Renewable Energy Target (RET) aiming to ensure that 20 per cent of the country's electricity from renewable energy by 2020.[12]

As renewables continue to make their way into political discussions, food manufacturers would be well placed to invest in equipment that can be run from renewable energy sources, and not risk having to upgrade equipment following on from changes in the political tide.

If environmental concerns aren't enough to convince food manufacturers to improve their energy use, then the economic argument should be. The NSW Government Office of Environment & Heritage has published a number of case studies showing how food processing businesses that implement energy efficiency programs have funded their upgrades without the need for additional financing. For instance Crafty Chef, who supply major supermarkets with convenient ready-made meals, was able to produce an annual electricity savings of 58 per cent, leading to annual savings of $65,000 a year.[13] In many cases, businesses can apply for Australian Government funding for equipment upgrades, available for up to $499,999. In other cases, certain lenders provide specific leases for energy-efficient loans.[14]

Start with a heat pump

For food manufacturers, hot water systems are a logical starting point to improve energy efficiency. The not-for-profit Australian Alliance for Energy Productivity (A2EP) recently published the Opportunities Assessment on Heat Pumps for the Australian Food Industry. The findings concluded that heat pump could indeed "play an important role in the Australian industry to recover heat and displace steam/ hot water generated from natural gas". The study found that heat pumps can deliver efficiencies of 300 per cent. A2EP supported that a major advantage of heat pumps was their ability to be powered by Renewable Sources, such as solar PV systems.[15]

Mitsubishi's Heavy Industries Q-ton is an industry leading heat pump that utilises natural refrigerant and is currently available in the Australian market. The Q-ton absorbs heat contained in the air and then the world's first patented rotary scroll (2 stage) compressor, compresses the CO2 refrigerant then transfers this absorbed heat to the water instantaneously supplying hot water from 60°C to 90°C.

The integration of two compression cycles has produced high efficiency under every operating condition, while concurrently achieving enhanced performance and reliability by reducing the pressure gap. Through the introduction of a gas injection system in the medium-pressure housing, MHI has increased the circulating volume of the refrigerant and succeeded in maintaining outstanding performance even under low outdoor temperatures.

If Q-ton is operated on a lower priced tariff, the ongoing operational cost can be reduced significantly. Where by with this system, food manufacturers for example can produce hot water during the off peak electricity tariff times, and store it in a tank for daytime use. It can be used as a direct boiler replacement, as it controls the water supply and storage temperature, as well as the output capacity.

The Q-ton is well placed to meet the high hot water demands of food makers. It can be connected in modular configuration with up to 16 units, providing from 3000 to 100,000 litres of safe hot water daily. The entire system can be controlled from a single, programmable control panel installed remotely for ease of access and operation.

The energy efficiencies experienced by food manufacturers using the Q-ton vary depending on previous systems, and how the new system is configured and used in operations. The A2EP study shows that manufacturers using the system to its full potential could see up to 300 per cent improvements, leading to a remarkable reduction in energy bills.

For food manufacturers looking to immediately improve their environmental footprint, the Q-ton is a strong starting point. By using refrigerant such as carbon dioxide (R774), the Q-ton helps preserve the ozone layer, and has the lowest Global Warming Potential (GWP = 1) among refrigerants. The Q-ton meets the stringent requirements of the world's most foremost environmental assessment method and rating system BREEAM.

With the future of Australia's energy mix still unknown, food manufacturers need to remain aware of the risks of using energy-intensive equipment, making them dependant on government efforts to keep electricity and gas prices low. By upgrading their equipment today, manufacturers are putting themselves in a better position to immediately increase their bottom lines, and prepare themselves for the future.

For more information about Mitsubishi Heavy Industries Q-ton, follow this link.

Q-ton Air to Water

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