CASE STUDY

SHARING LESSONS LEARNT AT CUB

CARLTON & UNITED BREWERIES BIG ENERGY PROJECT

Big Energy Projects in the beverage and packaging sector are uncovering significant energy performance improvements worth millions of dollars in annual savings.

A key factor in the success has been the level of commitment by senior management.

The Department of Industry, Tourism and Resources' Energy Efficiency Best Practice (EEBP) program is working with the sector to help companies redefine best practice in energy management, and build their capacity to identify and implement continuous incremental improvements as well as 'big step' innovative advances.

This case study reports on the Big Energy Project at Carlton & United Breweries (CUB), the Australian beer business of the Foster's Group. At CUB's Abbotsford Brewery, the project identified savings through energy performance improvements to the plant's refrigeration system, worth around $500 000 a year.

A key factor in the success of the project to date has been the level of commitment by senior CUB management to consider and act on the findings and outcomes of the Big Energy Project. This commitment was sealed in the early stages, when CUB and the Department of Industry, Science and Resources (now Department of Industry, Tourism and Resources) signed a Partnership Agreement.

'Energy efficiency makes good business sense. It's a sound investment for the future, particularly in terms of greenhouse gas emissions and triple bottom line reporting. There's no argument on whether we should take action. If we run a clean, green set of businesses we fit in with our charter.'

Michael Brooks, Vice President—Operations, CUB

SETTING THE SCENE

Many organisations face efficiency problems as a result of changing production demands, particularly where existing plants have been designed to cope with specific production levels. Maintaining production efficiency is most challenging when plants have not been set up with the flexibility to respond to changing demands.

Through Big Energy Projects, which include innovation workshops, organisations are encouraged to look beyond daily operations to explore innovative, cutting-edge solutions, including accessing technologies and specialist expertise not previously used within their sector, to achieve significant improvements in energy efficiency.

The innovation workshops aim to generate ideas—based on information and data available prior to the workshop—and identify opportunities for improved efficiency. While solutions are expected to be developed based on workshop ideas, workshops are not expected to generate one solution for immediate application.

The Big Energy Project at the Abbotsford Brewery examined how approaching a key process from a fresh perspective could change the demand for energy. It generated ideas to help reduce the refrigeration load as well as exploring technology options for more efficient refrigeration.

THE CHALLENGE

The Abbotsford Brewery was initially designed with a production capacity significantly higher than its current level of production. The refrigeration plant's over-capacity has led to inefficiency in supplying cooling services to the brew house, fermentation areas and flash pasteurisation.

In particular, there is limited scope to modulate the energy use of the existing plant in response to actual load—leading to energy waste when the plant is running below maximum output, and during cooler times of the year.

The challenge for workshop participants was to design a refrigeration system that was efficient, flexible and responsive to variable production needs.

EXPLORING THE BOUNDARIES

The greatest opportunities for energy efficiency come from carefully considering the challenge and understanding its real boundaries.

Previous Big Energy Projects have shown that the greatest opportunities for energy efficiency come from carefully considering the challenge or problem, and understanding its real boundaries. They do not come from 'quick fix' solutions.

Prior to the Abbotsford workshop, EEBP and external consultants worked cooperatively with the company—recognising its internal expertise—to review existing operations and key energy flows. The team then drafted a background paper outlining energy use patterns and proposing areas for potential performance improvements.

Run over two days, the innovation workshop included key staff from CUB: Phil Browne, Manager, Infrastructure & Utilities Capability; Ian Broughton, Manager, Site Services; Pat Mitchell, Brewing Manager; and Mike Coffin, Senior Project Engineer. It also involved four external specialists, selected for their practical and theoretical knowledge of relevant technologies: Geoff Andrews, Genesis Automation; Frank Elefsen, Danish Technological Institute; Mike Westwood, Embedded Generation; and David Hudson, Gordon Brothers Refrigeration.

'I think the process was well thought out and would be applicable across a range of industrial situations. The experts were well chosen—a blend of practical brewing and other industry knowledge.'

Phil Browne, Manager, Infrastructure & Utilities Capability, CUB National Operations

CUB staff at the workshop (L–R) Mike Coffin, Pat Mitchell, Ian Broughton and Phil Browne.

The workshop team explored the over-capacity problem and its boundaries, and developed ideas for a more efficient refrigeration system.

Participants were initially tempted to find an efficient way of supplying refrigeration for the current load. However, this meant assuming that current demands on the refrigeration system, made by the beer making process, could not be altered.

It quickly became clear that parts of the brewing process could be managed differently to reduce demand for refrigeration.

In the first stage of the workshop, the team explored the nexus between the process of beer making and the supply of refrigeration to see whether, with current production levels, the demand for refrigeration could be reduced. In other words: could the same amount of beer be made differently, requiring less refrigeration, without impacting on product quality?

Exploring the answer to this question was critical to the success of the workshop. It quickly became clear that parts of the brewing process could be managed differently to reduce demand. Participants also realised that proposed new equipment for separating yeast from the beer could have major implications for how beer is chilled after fermentation.

Another assumption tested was whether changing air temperatures impacted on the demand for refrigeration: did beer require more refrigeration as air temperatures rose and, if so, could changes be made to reduce the need for refrigeration during the hottest parts of the day?

BREAKOUT GROUPS

Workshop participants formed two groups—one discussed load management issues and the other technology options. By the end of the workshops, these strands were drawn together in a range of options that addressed the process and the plant (efficient technology).

The load management group's task was to identify peaks in refrigeration load, and to find ways of reducing demand at those times.

The discussion around load management proved to be significant. By challenging how things could be done differently to avoid peak demands for refrigeration—such as during chillback after fermentation—significant opportunities for improvement came to light.

Looking at the beer making process and the supply of refrigeration together enabled the workshop to identify greater opportunities than would have been the case if the workshop simply focused on more efficient cooling in the beer making process as currently managed.

The technology group's task was to focus on more efficient ways to provide refrigeration. This included looking at how to provide a more flexible refrigeration system that would better accommodate varying loads over the year to cope with changes in production levels and seasonal variation in air temperature.

This group also looked at alternative refrigeration technologies, with a broad consideration of the cost/benefit of each. Participants examined the use of ice slurries, ejector and absorption chilling, and better control of refrigeration supply. An important result came from looking at the current system—in particular how refrigeration temperatures are matched to the load being cooled, and the operating conditions for various components.

RESULTS

Key outcomes of the workshop are outlined below.

1. Load management solution options:
    - optimising load, including staggering refrigeration of batches and varying refrigeration flow during chillback;
    - matching refrigerant temperature to cooling load temperature;
    - cooling the beer as it is transferred from the fermenter rather than in the fermentation vessel; and
    - allowing condenser temperature to float depending on ambient temperature, to minimise the temperature difference between the evaporator and condenser.

2. Technical solution options:
    - making condenser and receiver systems common to allow condensers and evaporators to be shared by all compressors. This will improve flexibility in handling loads and allow condensers to work effectively across the site. It will also have a significant advantage during winter months, where condenser temperatures drop as low as 15°C, saving considerable amounts of energy. Of all the options considered, this will deliver the most significant savings in energy for the plant;
    - combining heat and power: co-generation;
    - using ice slurries rather than the current CaCl2 brine system, in a manner similar to some European breweries; and
    - introducing ejector or absorption chilling (LiBr) for cooling to around 7°C, using surplus steam from co-generation or kettle vapour, boosted with steam from the current boiler system.

ACTIONS SO FAR

A planned approach ensures the most effective use of workshop outcomes. Since the workshop, the energy management team has met several times to plan a structured and coordinated approach to the improvement process, including planning the implementation of workshop outcomes and allocating activities to members.

Some activities have already been completed:

- cooling demand for fermentation (load, time profile) has been established;
- fermentation chillback loads have been managed to reduce demand;
- the refrigeration engine room has been limited to using only two compressors at a time;
- design and costing for the reconfiguration of refrigeration plant has been completed and a capital expenditure request submitted. When complete, this project alone is forecast to reduce Abbotsford's electricity consumption by seven to eight per cent, worth around $300 000 a year; and
- an economics and feasibility study is underway for combined heat/power generation on site.

NEXT STEPS

CUB is gathering data from the site to allow more detailed analysis of each option identified, to assess how to provide the best refrigeration solution. CUB will also research how similar technologies are used at sites run by other organisations, such as the use of ice slurries in European breweries and co-generation plant used by various local organisations such as hospitals and paper mills.

Examining how other organisations use similar systems provides examples of how technologies can be applied. This also allows CUB to evaluate issues associated with running alternative technologies, such as maintenance requirements, reliability and longevity.

BROADER APPLICATION OF WORKSHOP OUTCOMES

Examining how other organisations use similar systems provides examples of how technologies can be applied.

While the workshop focused on a problem at a particular site, some outcomes apply more broadly to other systems and organisations.

The focus on the Abbotsford brewery's refrigeration plant covered two issues common across the company. Firstly, the plant was no longer suited to production requirements (it was over-capacity) and secondly, the system lacked the flexibility to meet changing demands over the year (seasonal production and annual temperature variations).

Much of the workshop's success came from exploring two critical questions:

1. how could the system be designed to be more flexible?; and
2. can the demand for refrigeration be reduced by changing the way the process is managed?

By looking at the system as a whole rather than examining each of its components, the Big Energy Project identified opportunities that will lead to significant improvements in overall efficiency.

CUB Abbotsford's energy management team began EEBP's training modules shortly after the Big Energy Project innovation workshop. As a result, the team is now able to carry out much of the research and data gathering needed to translate the innovation workshop ideas into an energy efficient refrigeration system at the Abbotsford plant.

'The training program has revitalised our energy teams who are now working on projects of interest to their own sites including, where appropriate, implementing recommendations from the innovation workshop.'

Phil Browne, Manager Infrastructure & Utilities Capability, CUB National Operations

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Nationally, at its five breweries, CUB has also been building into its energy management programs the lessons learned from the EEBP workshops and team training.

From calendar year 2000 to calendar year 2001, CUB recorded a national improvement in power consumption of around two per cent, and in fossil fuel consumption of around four per cent. When savings from new capital expenditure are also included, this raises the projected savings from improved energy management—introduced since Abbotsford participated in EEBP's Big Energy Project, and training of energy teams began there and at other sites—to more than $500 000 per year.

Abbotsford's Big Energy Project innovation workshop was funded as a part of EEBP's focus on innovation, training and benchmarking, which is providing companies in the beverage sector with access to innovation workshops and workshop training modules in energy management.

EEBP's training modules are also leading to major improvements, by addressing organisational and cultural barriers and building internal capacity to apply and sustain effective energy management practices. The training involves all levels of the organisation, with a particular focus on providing a core energy management team with the skills required to manage internal energy issues.

'The introductory training module for workplace level employees was well received. It gave our people a clear understanding of the link between the way we use energy and the environmental issue of global warming. This can only have a beneficial impact on how we behave, both at work and home.'

Pat Mitchell, Manager Brewing at CUB's Abbotsford Brewery

WHAT EEBP CAN DO FOR YOU

EEBP supports industry sectors to identify and implement cost-effective solutions for a more sustainableand competitive future. The program has a combined focus on innovation, training and benchmarking and also offers practice tools, information and assistance. EEBP is working with a growing list of industry sectors, which includes aluminium production, beverage and containers manufacturing, bread baking and milling, dairy processing and wine making.

Through its work with industry, EEBP is learning valuable lessons that are contributing to policy development related to innovation and sustainable development.

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