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Case Study: Energy Efficiency Best Practice Industrial Refrigeration

Nestlé Pty Ltd Pakenham Food Processing Plant

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Improving performance and saving energy in industrial refrigeration

By making simple changes to their refrigeration systems, Nestlé Pakenham reduced their overall site energy consumption by 6%, abating around 840 tonnes of carbon per annum and recovering the costs of the project within six years.

The opportunity: save money and energy

Nestlé Pakenham produces a variety of lasagne, frozen meals and pizzas, with household brand names including Maggi and Lean Cuisine.

Nestlé Pakenham's largest refrigeration system was operating at below optimum levels, with significant efficiency and cost improvement opportunities.

The plant consisted of five compressors operating in a two-stage refrigeration system. The low stage operated with a suction temperature of -42°C for all low temperature process and storage applications, whilst the high stage operated at -12°C. The electrical load for the installed compressors for both stages varied from 75 kW to 330 kW. The control system was almost fully automatic and used conventional step logic.

More compressors were running than were required, there were many unnecessary start/stop operations and some compressors were running only part loaded. This meant below optimum energy efficiency, increased running hours and more start/stop operations.

The solution: review and upgrade the current system

At Nestlé Pakenham, energy use within their refrigeration plant was reduced by 16% with a whole-systems approach when reviewed after upgrading the existing system. Improvements to technical elements of modern refrigeration systems have the potential to reduce energy consumption by 15% to 40%.

The solution involved upgrading the energy management and control system of the main refrigeration plant at Nestlé's Pakenham site.

The existing step-based control was replaced with a control system capable of implementing mathematically based optimal control logic.

Step 1: An energy usage audit of the refrigeration system identified that there was only one process that required a suction temperature of -42°C.

Step 2: The low-stage system was separated into two distinct systems (-42°C and -36°C), reducing the energy consumption required to operate the entire system at the lower suction pressure.

Step 3: The plant control system was changed to a programmable logic controller system that would regulate the loading and unloading of the compressors. The controller would also manage the start and stop function and provide optimal control of condensing pressures depending on ambient temperature.

Step 4: Variable-speed drives were installed onto the condenser fans, improving process control and creating further energy savings. The condenser pressure was set as a function of the ambient conditions, providing minimum combined power consumption by compressors and fans but still meeting the minimum pressure in order to provide enough back pressure to the cooling system – as well as enough hot gas temperature to defrost the freezers.

The benefits: leaner, greener production

The cost of implementing the new control system was $265,000. Based on energy cost savings alone, this resulted in a project payback of 6 years. Funding of $100,000, provided by the Department of Innovation, Industry and Regional Development, assisted the project.

The project also demonstrated that an old refrigeration plant can be optimised to save energy as well as improve process operating temperatures if system operating parameters are analysed and appropriate modifications planned in a whole-systems approach.

The combination of enhanced control of operating parameters, now possible with modern control systems, combined with reconfiguration of refrigeration circuits to improve load matching, has resulted in productivity and energy efficiency improvements:

- About 840 tonnes of greenhouse gas per annum has been abated.
- The overall power use at the site has been reduced by 6%.
- The refrigeration plant uses 16% less electricity.
- The run hours of the compressors have been reduced by 18%, increasing the potential life of the asset and reducing maintenance costs.
- Unnecessary start/stop operations of the compressors have been reduced by over 90%.
- The new system pays for itself within six years.

For more advice

The **Energy Efficiency Best Practice Guide to Industrial Refrigeration** is a step-by-step guide to gaining maximum efficiency from your refrigeration system.

The ResourceSmart Business program helps businesses across Victoria improve resource efficiency and manage the risks and opportunities presented by climate change. For further information on making your business ResourceSmart, visit www.resourcesmart.vic.gov.au or call 1300 363 744.

"The system reliability and the energy performance of the plant has been greatly improved since the implementation of this project."

Graham Ellis, Engineering Manager