Kerry Ingredients

COOL CHANGES, HOT SAVINGS

Kerry Ingredients is one of the leading manufacturers of application-specific food ingredients in the world. The company is part of the Kerry Group. Headquartered in Tralee, Co. Kerry, the group employs around 23,000 people globally. Through its acquisition programme, Kerry has established a global processing and technical network, with an ingredients portfolio of 9,000 products in over 120 countries.

In 2007, Kerry Ingredients, Charleville, Co. Cork changed its ice-bank refrigeration system to a more efficient, direct chilling (water) system. It previously ran the refrigeration system on night-rate electricity to build ice on coil bundles submerged in tanks of water. The ice was burnt off during the day when the chilled water was circulated to cooling applications throughout the facility. To build the ice, the ammonia refrigeration operated at -20°C.

Producing chilled water using ice banks is inherently less efficient than direct cooling; however, ice banks are more suitable where:

- cooling peaks greater than refrigeration capacity must be satisfied;
- there is a restriction in the power supply that can be given to the site from the grid;
- night-rate electricity can be used to offset the inherent inefficiency.

Put simply, it takes more energy to generate a kW of chilled water from melted ice than it does to chill that water directly. While it may make economic sense to use ice banks on low-rate electricity, ice banks will always produce more CO_2 emissions than direct chilling.

Instead of building ice, Kerry Ingredients is now generating water on demand at +4°C. This change also means that air blowers, previously used to agitate the water around the coils during the ice build and burn phases, are no longer needed.

The engineers also decided to use the opportunity to reconfigure the pump controls using variable-speed drives (VSDs) to increase efficiency.

PRESSURE TO CUT COSTS AND CO_2 EMISSIONS

The project was driven by several factors, including an increase in the cost of energy, the need to reduce the charge of ammonia in the refrigeration system, corporate social responsibility and concern about future carbon taxations.

The objective was to apply industrial best practice to achieve a significant reduction in energy costs and an associated reduction in CO_2 emissions.

One of the screw compressors operating on the Chilled Water System at Kerry Ingredients Charleville.

ENERGY USE INVESTIGATED

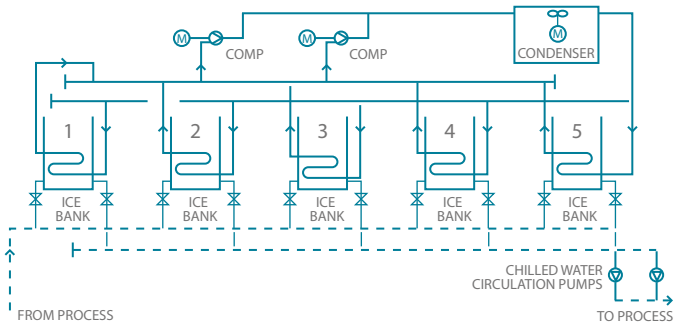
In 2007, Kerry Ingredients launched an investigation into the amount of electricity being used for refrigeration at its Charleville site and to identify areas where energy might be saved.

In the original ice bank system, the evaporating temperature of the ammonia at the end of the ice building phase is -20°C. The lower the evaporating temperature, the greater the energy expended by the compressors to achieve the refrigeration effect. At -20°C, the compressors must create a pressure lift of 11.5 BarG. This requires 217kW of electricity.

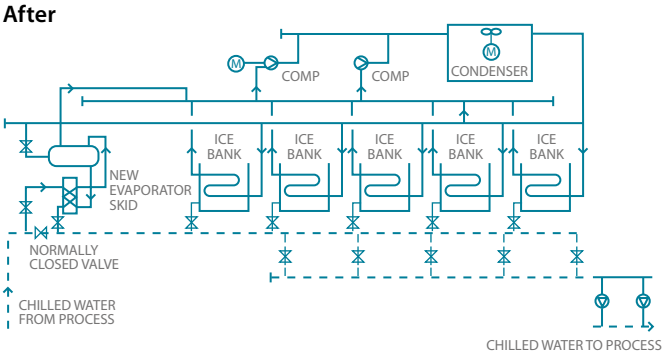
Poor agitation in the ice tanks in the past has caused the ice banks to freeze up. This was prevented by using blowers almost continuously. Four blowers were used, rated at 4 kW each.

The system used a variable speed drive (VSD) to circulate the chilled water around the plant. However, due to operational restrictions, this VSD was constantly operating at maximum frequency to achieve the required cooling.

Before



After



EED OPPORTUNITIES

In its assessment of the original system, Kerry Ingredients identified several energy-efficient design (EED) opportunities. The most significant of these arose with the ice bank, as it takes far more energy to produce ice than to produce chilled water directly. This inefficiency was offset by the fact that the plant used night-rate electricity to build up the ice bank. However, as the site now operates a combined heat and power plant, the savings that accrued from using night-time electricity rates no longer apply.

DRAMATIC CUT IN ENERGY USED FOR REFRIGERATION

Through their investigation, the consulting engineers calculated that the energy expended on refrigeration could be reduced dramatically by:

- installing a new Direct Chilling Skid;
- taking blowers offline;
- reconfiguring pump (VSD) controls;
- taking some of the ice bank storage tanks offline;
- decommissioning the ice-bank coils.

Direct chilling skid installed

At its simplest, the new direct chilling skid cools the water to the temperature required for the process, rather than generating ice to produce chilled water. The direct chilling was accomplished by integrating a new 2,000kW Plate Heat Exchanger evaporator skid into the existing ammonia refrigeration plant. The existing refrigeration compressors now operate at an elevated evaporating temperature of approximately 1°C.

Blowers taken offline

As the ice-bank coils will no longer be operating, the associated air blowers, previously used for agitation, can also be made redundant. This reduces further the energy consumption associated with chilled-water generation.

VSD controls reconfigured

The chilled-water pump, used to circulate water during the ice-build and ice-burn phases, was run at maximum speed 24 hours a day. Removing the ice-building phase allowed the plant operators to reconfigure the controls of the VSD and make substantial savings, especially at night-time when little cooling now takes place.

Ice banks taken offline

It is envisaged that, after the trial period — which includes peak conditions for summer 2008 — the ice banks will be decommissioned. As these large tanks of water were typically at 0°C taking them off line will reduce the heat gain on the system.

SAVINGS AND BENEFITS

The actions outlined above resulted in the following energy savings:

Area of savings	MWh per annum
Compressor power reduction	515
Blower elimination	58
Pump time reduction	110
Reduced heat gain	36
Total	**719**

These energy savings have resulted in a reduction of 500 tonnes in CO_2 emissions annually.

Much of the cleaning and maintenance costs associated with the ice banks (oil draining, blower maintenance, valve maintenance, etc.) have been eliminated.

The ammonia charge in the system has been cut by around 60%, and noise has been reduced by the elimination of the four external blowers.

MAJOR CUTS IN ENERGY USE AND CO_2 EMISSIONS

Kerry Ingredients objectives were met in full. Reductions were achieved in:

Energy consumption	719 MWh per annum
CO_2 emissions	450 tonnes
Ammonia charge	60%

This retrofit was part-funded under Sustainable Energy Ireland's Industrial Best Practice Initiative. Based on the energy savings calculated and measured, Kerry Ingredients has a payback timeframe of 2 years (excluding SEI funding) for this retrofit.

GOOD SAVINGS WITH MINOR INVESTMENT

Kerry Ingredients has realised notable savings with a relatively minor investment in time and money.

"This project is easily replicated. Kerry Ingredients is committed to disseminating the project throughout the Kerry Group and to a wider audience in SEI's Large Industry Energy Network and the Energy Agreements Programme".

Eric Flynn,
Engineering Manager,
Kerry Ingredients

Sustainable Energy Ireland

Glasnevin, Dublin 9, Ireland
Glas Naion, Baile Atha Cliath 9, Eireann
T. +353 1 8369080
F. +353 1 8372848
info@sei.ie
www.sei.ie

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