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Case Study: Energy Efficiency Best Practice

Steam Systems

Amcor Fibre Packaging Plant Scoresby

Sustainability Victoria
State Government Victoria

Improving performance and saving energy

By making simple and smart changes to their steam systems, Amcor's Fibre Packaging Plant in Scoresby saved over 6% of their total gas use, reduced electricity use by more than 115,000 kWh per annum and abated more than 412 tonnes of carbon per annum.

The opportunity: save money and energy

With over 200 factories in more than 30 countries, Amcor is a leading global packaging manufacturer, offering a range of plastic, fibre, metal and glass packaging products, and packaging-related services. Amcor's Fibre Packaging group manufactures corrugated boxes, folding cartons, recycled and industrial papers, carton board and point-of-sale displays.

The Scoresby plant has a 6 MW output steam boiler supplying steam to the plant at a pressure of 1,375 kPa. The steam pressure is reduced to 1200 kPa before being used in various processes throughout the plant.

As part of its aim to achieve best practice environmental management across all of its operations, the engineering group at the Scoresby plant realised the scope to improve their steam systems.

The solution: review and upgrade the current system

An energy and production audit of the steam generation and distribution system was undertaken to confirm usage and identify inefficiencies. The following solutions were identified to improve resource efficiency:

Step 1: Steam system upgraded
The steam system was upgraded to improve the energy performance of the thermal system in the plant. A new boiler control system was combined with a new flash steam recovery system, pressurising the steam condensate return system. The efficiency of the thermal system was substantially improved through optimal combustion control and recovery of flash steam from the condensate return. The energy and water recovered by reducing the flash steam losses was used to replace make-up water at the boiler de-aerator.

The condensate from the steam traps in the system is returned by two pipes, low- and high-pressure condensate. The condensate is returned to a header, where the pressure is dropped to atmospheric pressure. This pressure drop causes steam to flash from the condensate, which passes through a vent in the header and out through the roof of the building. The condensate is then pumped via three parallel mechanical condensate pumps to the de-aerator before being returned to the boiler.

This modification entailed removing the condensate pump and its associated return header and then allowing the condensate and flash steam to return to the de-aerator under pressure from the mains steam. For this to be viable, all sections on the process were required to run at around the same steam temperature to prevent process flooding. Plant pressures were therefore reconfigured to facilitate this requirement.

Step 2: Boiler system upgraded
Whilst the initial boiler was a modern, unattended water-tube type and inherently efficient, Amcor technical staff identified that further efficiencies could be gained by improving control of the burner and associated boiler control systems. The boiler control system was upgraded to reduce losses from the combustion process and power losses from the throttling of the combustion air fan.

These modifications include:

- A precision combustion control was installed, which incorporates optimal air-fuel ratio control through stack oxygen trimming. Combustion control is an important control function for any burner, as it has advantageous effects on efficiency as well as reducing pollution.
- A variable-speed drive was installed to replace air damper control on the combustion fan, including incorporating this into the burner control system. This system was incorporated into the safety management system of the boiler. Excess air trimming is one variable which can be controlled combustion. The reduction of oxygen closer to the stoichiometric ratio results in a higher flame temperature, better heat rate and less heat loss in stack flue gas. Excess air trimming is achieved through oxygen and carbon monoxide control of the stack.
- The high and low fire burner control on the boiler was replaced with a fully modulating system. This fully proportioning controller allows the burner firing rate to more closely match the steam demand load required by the plant's steam users.
- The original boiler, which was controlled by a conventional boiler management system, was replaced with a modern digital controller, which incorporates the oxygen trim control, the burner modulation, safety system, water and steam system management as well as the other control parameters for improved monitoring and optimal control.

The benefits: leaner, greener production

The project cost of $116,000 is expected to reap a 100% return on investment in 3.8 years (at the boiler's current output). Funding assistance of $58,000 was provided by the Department of Innovation, Industry and Regional Development.

The modifications to the steam system reduced the running cost of the process by eliminating the three condensate pumps, but also by reducing the amount of make-up water required in the de-aerator, saving on gas used by the boiler as well as make-up water and its treatment costs.

The precision combustion control, combined with oxygen trimming modulated control, reduced stack oxygen from 5.5% to 1.5%, increasing boiler efficiency by around 3.6%.

The modulated burner control has further improved the boiler efficiency. The pressurised condensate return system has improved gas, water and chemical costs for the system.

The variable-speed drive for combustion air fan on the boiler has resulted in power savings of 115,000 kWh per year.

The technologies are not new. However, the project demonstrates that, through innovative application of known technologies, real energy and carbon savings can be achieved:

- about 412 tonnes of greenhouse gas abated
- 6% reduction in gas use
- new system pays for itself within 3.8 years.

For more advice

The Energy Efficiency Best Practice Guide to Steam Systems, Hot Water Systems and Process Heating Systems is a step-by-step guide to gaining maximum efficiency from your heating system.

Sustainability Victoria helps businesses across Victoria improve resource efficiency and manage the risks and opportunities presented by climate change. For further information, visit www.sustainability.vic.gov.au or call 1300 363 744.

The Energy Efficiency Best Practice Guides and accompanying case studies are available from: www.sustainability.vic.gov.au/eebp

"The changes we have made to the boiler and the condensate systems were not revolutionary, but it did prove that even with a modern boiler plant real savings in energy and water are possible if energy systems are controlled more accurately. I believe this type of upgrade is readily repeatable at many other manufacturing plants in Victoria or elsewhere."

Ian Weppner, Site Manager, AMCOR