case study

ENERGY SYSTEMS OPTIMISATION (ESO)

AMKA Products

Fast Moving Consumer Goods – Steam System Optimisation Candidate Plant 2014

BACKGROUND

AMKA Products manufactures more than 400 products that include shampoos, lotions, skin creams, hair relaxers, bubble baths, cleaning chemicals and dishwashing liquids. Products are distributed throughout South Africa, as well as to 34 other countries in Africa. The company employs more than a 1000 people. Currently four manufacturing facilities exist with a new facility commissioned.

Its Sunderland Ridge, Centurion, facility was the Candidate Plant for a Steam System Assessment. The factory manufactures hair care and personal care products, comprises a blending facility and several high-speed packaging lines. This site employs 500 people.

AMKA Products operates in a competitive market where cost leadership is key to market share. Energy efficiency in the steam area was seen as an opportunity to reduce these costs and mitigate the company's emissions. Participation in the Industrial Energy Efficiency (IEE) Project was considered a way to access expert support.

IEE Project capacity building programme

Three AMKA employees attended the Advanced Steam Systems Optimisation training through the IEE Project: an Industrial Engineer, the Environmental and ISO Systems Manager, and a Projects Technician.

KEY FINDINGS

During 2014, eight projects were undertaken, resulting in a total energy saving of 1 261 827 kWh, valued at R1 260 181. With a total investment of R437 000, the estimated average payback period was less than four months. A reduction of 330 tonnes CO_2 was achieved.

IMPLEMENTATION OF ENERGY SYSTEMS OPTIMISATION

The site was assessed using the Steam System Scoping Tool, and measurements were taken. These included ultrasonic and thermal analysis of steam traps, surface temperature measurements, boiler flue gas analysis and boiler forced draft fan power measurements. Mass and energy balances were used to allow modelling of steam consumption and condensate recovery rates. Individual elements of the steam system were evaluated followed by a systems-level analysis using the Steam System Assessment Tool. Opportunities were identified and potential savings were quantified, with the most attractive options prioritised for implementation.

The site repaired all steam leaks identified over the course of the assessment during a planned shutdown of the steam system. Passing and blocked steam trapped were removed and either repaired or replaced. Routine steam trap surveys have now been included in the maintenance programme for the site. Condensate return lines were installed to allow for the recovery of condensate from hot water production and from water heating in the reverse osmosis water treatment facility.

Insulation opportunities were handled as a single project in order to limit costs. In total, six vessels were insulated with mineral wool and cladded. This reduced heat losses from the steam system, and hence reduced required heat input. During the assessment an attempt was made to reduce excess air by modulating airflow using the forced draft fan damper valve. This exercise showed that the fan was oversized, and hence a variable speed drive was recommended to reduce airflow. The variable speed drive was used to reduce fan speed, and flue gas oxygen could be reduced to 3%, thereby significantly reducing stack losses.

PROCESS CHALLENGES

- It was not possible to insulate the tops of the Petroleum Jelly Storage Tanks since workers stand on these during the offloading process. It has been proposed that platforms be constructed at the tops of each tank to allow them to be insulated.
- The increased condensate recovery rate and the insulation of the hotwell led to an increase in the water temperature of approximately 20 °C inside the hotwell. This caused cavitation of the existing boiler feedwater pumps. The pumps had to be replaced with a new multistage centrifugal pump to meet net positive suction head requirements.
- The initial excess air reduction recommendations aimed to reduce the oxygen concentration in the boiler flue gas. The existing force draft fans were too large for the duty. It was recommended that the speed of these fans be reduced to reduce the airflow. This was achieved through the use of a variable speed drive.
- It was initially recommended that the steam flow supplied to the shrink-labelling tunnels be stopped when each packaging line was stopped to save steam. However, the time required for the tunnels to warm up was too long to make this recommendation practical, and hence it was not implemented.

SUMMARY OF INTERVENTIONS

System	Intervention	Investment ZAR	Savings ZAR/annum	Payback Yrs	Energy saving (kwh)	GHG Emission Reduction (Kg CO2/year)
Boiler Forced Draft Fan	Installation of a variable speed drive and optimisation of excess air	30,000	175,000	0.17	185,223	48,531
Petroleum Jelly storage tanks	Insulation of the three tanks to reduce heat losses, thereby reducing steam requirements.	150,000	293,000	0.51	299,533	78,481
Hot water production	Installation of a condensate recovery line to allow collection of condensate from hot water production	2,000	35,000	0.05	28,577	7,488
Reverse Osmosis Plant	Insulation of the reverse osmosis water storage tanks and recovery of condensate from the concentric pipe heat exchangers used to heat the water	120,000	458,000	0.26	439,244	115,087
Boiler Feedwater system	Insulation of the hotwell used to store returned condensate and make-up water	80,000	90,181	0.88	185,223	25,008
Steam distribution system	Repair passing steam traps and steam leaks		209,000	0.51	299,533	78,481

LESSONS LEARNED

- Key performance indicators - and understanding how these relate to actions taken throughout the steam system to drive efficiency - are required for ongoing steam system management.
- Energy efficiency should be integrated into everyday decision-making; however, this might require a significant shift in company culture.
- Energy efficiency is about systems. Not just the technical systems involved in the use of energy, but also the broader system encompassing markets, technology, people, shop floor work practices and management processes.