case study

ENERGY SYSTEMS OPTIMISATION (ESO) IN AN SME

SOCKIT MANUFACTURING

Steam and compressed air energy systems intervention

April 2014

BACKGROUND

Sockit Manufacturing (Pty) Ltd was established in 2008 to produce socks for major international brands such as Nike and Adidas. The company employs around 50 employees at its factory in Parow Industria, Cape Town.

THE ISSUE AND MAIN FINDINGS

As is the case for most small to medium enterprises (SME's), the scale of the operation could not justify the recruitment of a maintenance engineer responsible for the efficient management of the services of the plant. Maintenance was thus conducted reactively, resulting in a steady deterioration in efficiencies over time. In addition, the operation had limitations in the total amount of electrical power available, which was constraining growth.

The managing director attended one-day awareness raising workshops, realising the significant scope for savings in his operation and an IEE Project SME energy audit was conducted in December 2011, following which three recommended projects were implemented.

KEY FINDINGS

92 000 kWh p/a of energy was saved through three optimisation projects, with GHG reduction of 90 ton CO_2.

In addition, there was a 15% increase in production capacity, a 30% reduction in electrical energy demand and four (4) people were employed. The initial investment of ZAR 550 000 realised an annual saving of ZAR 140 000 (4 year payback)

ENERGY CONSERVATION OPPORTUNITIES IDENTIFIED

Of the five energy optimisation recommendations (fuel switch, steam system optimisation, compressed air leaks, compressor intake and vacuum system optimisation) made, the top three were implemented, resulting in energy savings of 92MWh per annum.

The implementation also resulted in the following:

- 30% reduction in electrical energy demand (~70kVA)
- 15% increase in production capacity
- Savings realised in excess of R140 000 per annum
- Additional 4 people were employed

Sockit Manufacturing factory in Parow Industria, Cape Town employs around 50 people – including 4 new employees since production increased due to energy optimisation

HIGHLIGHTS OF IMPLEMENTED MEASURES

2012 - 2013

Fuel switch for boiler

- Electrode boilers were replaced with a liquid fuel (paraffin) water tube boiler and the distribution system was optimised, because electrical demand on the plant routinely breached the supply (350Amp) resulting in the power tripping. A 25% reduction in electrical demand enabled 7 additional knitting machines to be procured, leading to a 15% increase in production capacity and an annual electricity saving of R50 000.
- The system interventions saw a 15% reduction in electrical energy consumption, while there was an increase in the process requirement of 20% through the introduction of additional knitting machines.
- The operation will be installing 9 more knitting machines to increase production capacity by 15% without breaching the electrical supply constraints and without needing any additional services infrastructure.

Steam system optimisation

- Poor steam and condensate distribution losses were estimated at 20% of input energy.
- The steam system was optimised through effective insulation, leak repair and installation of a new condensate tank with partial flash recovery capability. Improvements in the steam distribution and condensate return systems reduced energy distribution losses and increased the boiler feed water temperature to over 90^{o}C.

Compressed air optimisation

- The compressor operated on a load / unload cycle and could barely attain the 8 bar set-point at the top of the load cycle. The system leakage rate was calculated at 60% of system capacity. The compressor was also running at 95% of its rated capacity and was reaching temperatures of over 100^{o}C.
- A new 45kW variable speed air compressor was installed, reducing system pressure to the required 7 bar set-point. This reduced electrical energy required for the compression cycle and the system leakage rate due to lower system pressure.
- Many system leaks were as a result of failed open solenoid valves on the knitting machines, which were replaced. The 7 new knitting machines installed resulted in a 20% increase in air required, yet electrical demand had still dropped by 5 amps (3.5kW). The savings are estimated to be in the vicinity 6000 kWh per month.

PROCESS CHALLENGES AND LESSONS LEARNED

- Limited sub-metering was in place at all of the major electrical users. Bills were erratic, with some months estimated. Measurement and verification of savings were thus estimated via snapshot measurements and first principles.
- Significant energy savings are attainable through energy management. While financial savings were significant, the real benefit was the ability to expand the process production capacity without needing to invest in significant infrastructure upgrades.
- The IEE Project interventions have effectively allowed the company to increase its production output by an additional 30% while operating within the electrical supply constraints of the facility.

THE FUTURE

Vacuum systems in the plant have also been identified for additional energy reduction opportunities. A fan system assessment will be conducted to quantify the opportunity. Additional sub-metering will be installed to measure key service energy use.