Industrial Energy Efficiency Project
In South Africa

ENERGY SYSTEMS OPTIMISATION

in an SME

(EnMS Implementation)

the dti
Department:
Trade and Industry
REPUBLIC OF SOUTH AFRICA

energy
Department:
Energy
REPUBLIC OF SOUTH AFRICA

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Economic Affairs FDEA
State Secretariat for Economic Affairs SECO

UKaid
from the Department for International Development

UNIDO

ENQUIRIES

NCPC
NATIONAL CLEANER PRODUCTION CENTRE
SOUTH AFRICA

For more information about the training workshops and participation opportunities:

www.iee-sa.co.za | Tel: 012 841 2768 (Pretoria), 021 658 3983 (Cape Town)
or 031 242 2365 (Durban)

For more information about partnership opportunities:

www.unido.org | Tel: 012 394 1567 (Pretoria)

THE ISSUE AND MAIN FINDINGS

Sundays River Citrus Company (SRCC) is located between Kirkwood and Addo in the Eastern Cape. The main activities of SRCC is the packing and selective degreening of citrus fruit destined for local and export markets. An Energy Management System (EnMS) was implemented at SRCC according to the guidelines of ISO 50001. The project was funded by UNIDO as part of the IEE project. The EnMS implementation was done between November 2013 and November 2014.

One would expect an improvement in energy efficiency during the first year of EnMS implementation, but in this case a 5% decrease in energy efficiency was measured in spite of the 2% increase forecast as per the opportunity list. In this case study we discuss the events that lead to this unexpected result and the lessons that can be learnt from that.

Key findings: After implementation of the EnMS the energy efficiency decreased by 5%.	-645,836 kWh/year

EnMS IMPLEMENTATION

SRCC has implemented quality and food safety systems such as EuropGap, Nature's Choice, HACCP and BRC. They have started with energy efficiency initiatives since 2007 and have attended to most of the obvious improvements already. The implementation of a quality management system will complement their management style for sustainable improvement into the future.

SRCC is operating from 3 facilities located in the Sundays River Valley, between Kirkwood and Addo. The operations at SRCC are highly seasonal and follow the citrus harvesting period between April and October each year. The EnMS project plan was compiled accordingly so that all the preparation and training could be done before the start of the 2014 packing season.

Energy sources for operations are electricity, paraffin, diesel and coal with a total consumption of 7,315,308kWh during 2014. The paraffin, diesel and coal are used for process heating and drying tunnels and is 16%, 13% and 26% of the total energy use respectively. The remainder of 45% is electricity obtained from Eskom and via the Kirkwood Municipality.

Working through the structured approach of ISO 50001, the energy team defined the scope and boundaries, significant energy users, energy drivers, energy performance indicators and eventually an opportunities list to achieve this objective. Critical operational and maintenance criteria were identified and appropriate training was provided to all the people according to their ability to influence the energy results.

The 5 SEU's are defined as the three packhouses and two degreening facilities. Having 4 energy sources (electricity, coal, diesel and paraffin) and up to 3 energy drivers for each SEU, the development of an energy information system was one of the crucial elements of the EnMS. This information provides energy performance measurement on a weekly basis.

ENERGY PERFORMANCE RESULTS

The energy policy contains an objective of an energy improvement of 30% over a 10 year period with 2007 as baseline. SRCC wants to use 2007 as a baseline in their EnMS because they have already implemented many improvement actions since then, and they want to recognize these achievements.

A very thorough trend analysis was done with available energy data from 2007 to 2013. Very little changes were made in the operations since 2007 and in only 2 cases some normalization of data had to be done due to operational changes. Energy performance from 2007 to 2013 is given in the graph below, with all data normalized on operational volume throughput per year.

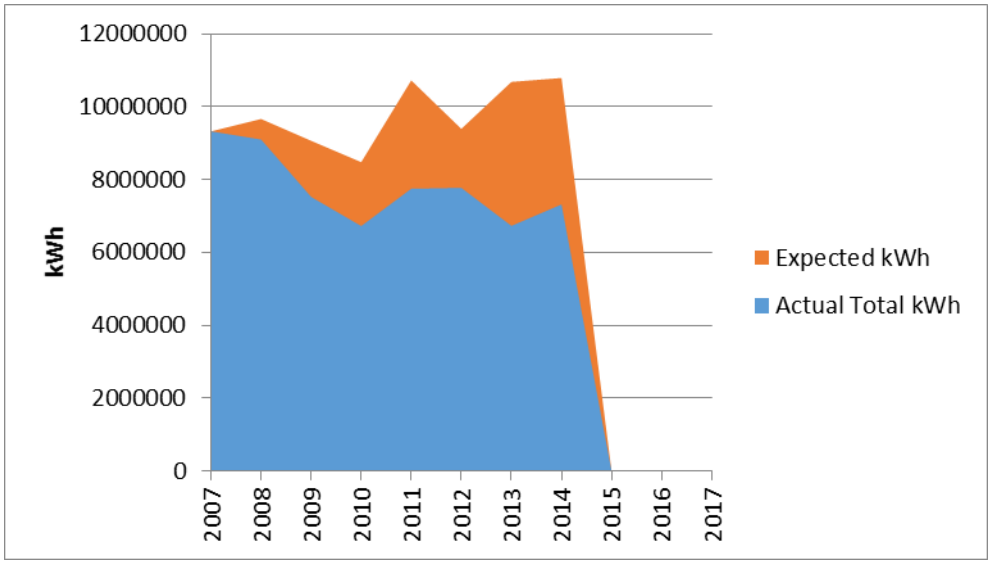

Figure 1 Trend analysis on annual energy performance results

The trend analysis in itself was a very valuable exercise for SRCC:

- It was the first time that they could see the actual energy performance since 2007 normalized on production volume.
- It was the first time that they could split energy consumption between the 5 processes.
- It was the first time that they could see a summary of all the energy sources (electricity, coal, diesel, paraffin) in their business.
- It was only then (after data review and normalization) that they could see that they already have achieved a saving of 37% at the end of 2013 against the 2007 baseline.
- The variations in trend analysis showed good examples of the impact that maintenance may have (coal burner cleaning), that purchasing may have (bad quality coal in 2012), the impact of volume changes and the need for calculating a baseload for each process.

These and other examples that were picked up during the trend analysis were used to explain the current shortcomings and the need for changes in their EnMS. This was a good motivation for SRCC to implement the changes and they were keen to do so.

The energy drivers for each SEU were defined and the EnPI's were established. Throughput volume in tons per week is the most dominant driver at all the SEU's, while temperature and fruit variety were

possible drivers. The following example shows the regression analysis at Kirkwood packing with volume as the only driver. A good correlation is achieved with R-square at 0,996.

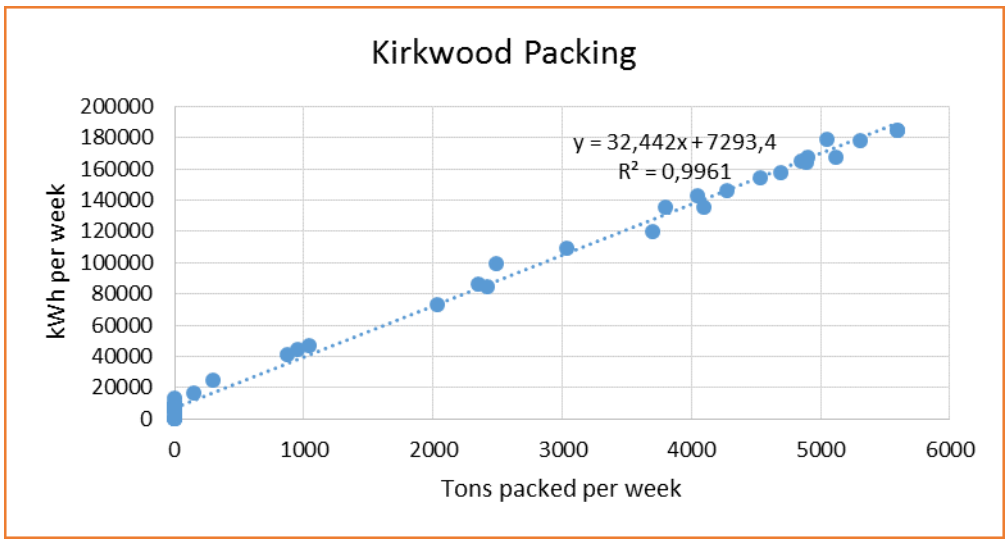

Figure 2 Regression analysis at Kirkwood packing

At the end of the 2014 season the collected energy data was used to establish the baseline for each SEU. The baselines for the packing SEU's have temperature and volume per fruit variety as variables, while the baselines for the degreening SEU's have temperature and volume throughput as variables. Due to the seasonal nature of the SRCC processes the full set of energy data for one season is needed to establish the baseline for each process. These baselines will now be used during the 2015 season for energy performance measurement.

The SRCC energy performance for the period 2007 to 2014 is summarized in the graph below. The annual performance is normalized on volume throughput as the only driver. (Regression analysis of the 2014 data has shown that environmental temperature and fruit variety are other possible drivers but with low impact on the annual summary). The target of 30% is according to the objective in the energy policy: A 30% energy saving in 10 years with 2007 as baseline.

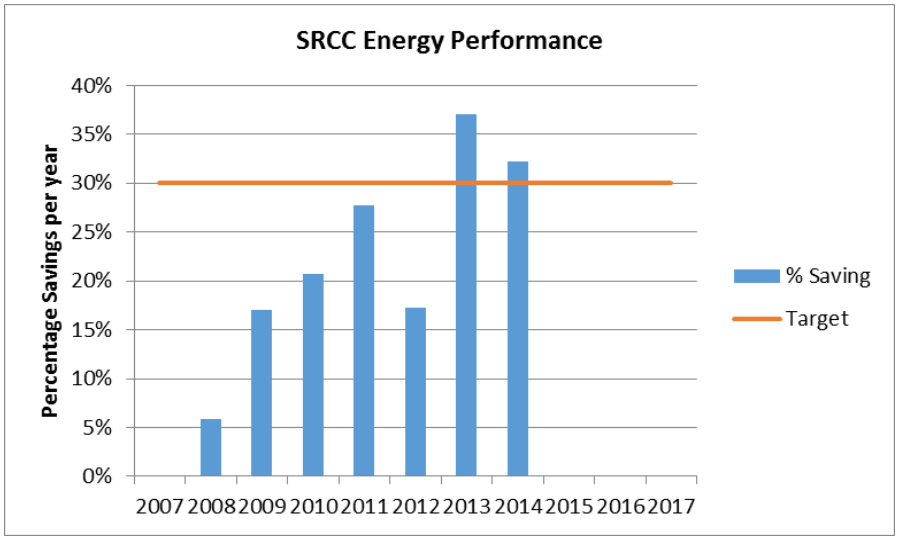

Figure 3 SRCC annual energy performance

The information shows that a good year-on-year improvement was achieved up to 2011 when a total saving of close to 28% was reached. During 2012 the performance dropped significantly with about 10% down on the previous year. Due to the absence of a formal energy management system at that time, all the reasons for this decline could not be uncovered. It was however determined that the purchasing of low quality coal and neglect of boiler maintenance were major contributors.

The year 2013 shows a good energy performance of 37% against the baseline. This good performance was not visible to SRCC in the absence of a formal energy management system at that time. It also shows a good trend in line with the previous years, excluding 2012.

The energy management system was implemented during 2014. Against all expectations another 5% drop in performance was experienced, with the cumulative total now at 32%. The action plan for 2014 was implemented successfully with an anticipated 2% increase in performance. That brings the total negative swing to 7% from 2013 to 2014.

This performance was discussed in the management review, and for the first time the newly installed energy management system could report on the energy performance and also provide reasons for the unexpected negative result.

One of the most concerning issues about the energy performance of 2014 was that the negative trends were detected too late to fix them before the end of the packing season in October. This shows a lack of checking in the system. The internal audits was also more conformance orientated with no attention given to energy performance. These issues were discussed in great detail in the management review and actions were formulated to correct it in the next season.

Reasons that contributed to the lack of management attention to checking during the 2014 are as follows:

- The threat of banning citrus exports to Europe due to blackspot has demanded a lot of attention on quality control issues as a priority.
- SRCC has experienced a bumper crop in 2014 and production capacity constraints needed priority attention.
- The EnMS data controller resigned at the peak of the season and the replacement also resigned a month later.
- The energy manager's sons was in a serious car accident and he was on leave for a few weeks during the peak period.

The above reasons are all part of business management and it is still the prerogative of management to work according to their own business priorities.

SUMMARY AND CONCLUSION

1. Energy data was available from 2007 to 2013, but due to the complexity of their operations (4 energy sources, 3 energy drivers) SRCC was unable to determine the true energy performance. By implementing the EnMS they were able to develop energy performance indicators to provide this insight to them.

2. Unfortunately the energy performance of 2014 was less than 2013, but then again the full implementation of the EnMS has provided SRCC management with reasons for the decline and actions could be formulated in the management review to improve the energy performance during the next season of 2015.

3. The poor energy performance of 2014 is a result of neglecting the checking part of the EnMS. Although the checking part of the system was considered as implemented, the execution of checking failed to highlight the lack of energy performance before it was too late.

4. The actions on the energy opportunities list were all implemented with a 2% of energy efficiency improvement. This case study demonstrates that focus on energy improvement alone is not enough for achieving targets: The total system should be managed to avoid unexpected losses.

5. The structured methodology of the EnMS implementation allows visibility on the SRCC energy performance in two ways: It shows the good improvement of 32% energy savings as a result of their efforts since 2007, and it shows the impact of financial losses during 2012 and 2014 due to poor energy management. Without the EnMS this type of information would not have been available to the SRCC management.

6. The implementation of the EnMS at SRCC can be considered as a great success and the appreciation and commitment of SRCC management is evidence that they will use this management tool to their advantage for future energy performance improvements.