

Energy management with renewables achieves sustainable savings

by Gysbert Niesing and Prof. LJ Grobler, North West University

Sustainable energy management in South Africa does not require expensive interventions for it to succeed. Starting with a foundation of basic principles can deliver sustained savings, providing a platform for optimal utilisation of renewable energy. Local citizens and businesses need to prioritise reducing their current electricity consumption in order to mitigate the risk of running out of this scarce commodity.

This case study demonstrates a local business that reduced energy consumption in a sustainable manner through the implementation of energy efficiency to provide a viable foundation for a renewable energy installation.

The installation utilises an energy management system based on ISO 50001 and change management principles. Led by top management and supported by employees, this project validates how implementing basic principles with the correct support achieves optimal continuous energy management so that renewable energy investments can become viable.

The Roots lifestyle centre (Fig. 1) is situated in Potchefstroom in the North West Province. It is a commercial facility with a restaurant, event house and various small shops. The centre contracted an energy consulting firm to assist in the reduction of electricity consumption of the facility. The drive towards this initiative was motivated by a couple of factors: Eskom's request to reduce energy consumption to avoid possible load shedding in the winter periods, and the impact of the facility's energy consumption on the environment.

The importance of saving energy was confirmed by the Department of Energy which set a target reduction of 15% as stated in the country's energy efficiency strategy [1]. Other factors, which incentivise businesses to take energy efficiency measures seriously, are the risk of supply shortages from Eskom, the increase in

electricity tariffs and the introduction of a carbon tax, which will all negatively affect a business' profitability.

This study demonstrates a successful energy management initiative following basic implementation principles and inexpensive interventions to provide a platform for viable renewable energy to achieve long term sustainable energy savings. The success of most energy saving initiatives depend largely on the ability to "keep it simple" whilst having the end-goal in mind during day-to-day operations. Stephan Covey confirmed this philosophy by stating, "Begin with the end-goal in mind", and Henry Ford's claim, "Obstacles are those frightful things you see when you take your eye off your goal". The initial consultation with the facility was a strategic session with top management where the end-goal was identified as:

- To reduce electricity consumption to ensure lower electricity bills
- To establish a niche market promoting an energy efficient company

Setting the foundation

To provide a foundation for effective results the consultants recommended establishing a basic framework before implementing electricity metering, investing in more efficient equipment, or investing in renewable energy. Consequently, basic change management principles and an energy management system (EnMS) in accordance with ISO 50001 will be implemented to become the framework to [2]:

- Develop a policy for more efficient use of energy
- Determine targets and objectives to meet the policy
- Utilise data to better understand energy consumption trends for decision-making purposes
- Measure the results
- Review the effectiveness of the policy
- Continually review and improve the system

The energy consultants used a change management model called the ADKAR model. This method is effective when implementing awareness as well as other energy strategies [3]. Through a series of five building blocks, energy change management can be successfully implemented as illustrated by Fig. 2.

Top management commitment

An energy policy was formulated during the second meeting, which stipulated the commitment and support from management to ensure that the centre strives to:

- Reduce its current electricity and carbon footprint
- Ensure the commitment from all tenants towards the continual improvement in energy performance
- Deploy information and resources to achieve objectives and targets set
- Uphold all legal and other requirements regarding energy standards and regulations



Fig. 1: The Roots lifestyle centre.

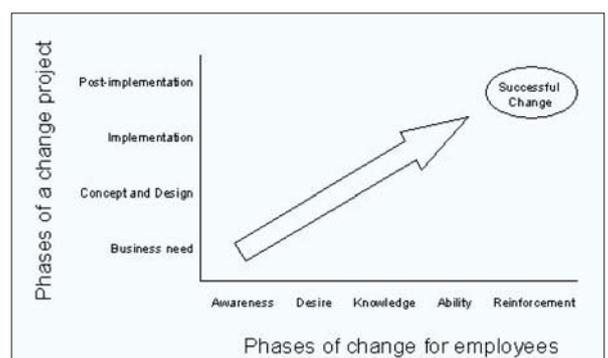


Fig. 2: ADKAR change model.

- Consider energy performance in the procurement of equipment before purchase

The energy policy was signed by top management and displayed in a way for all employees as well as customers to see. An energy management team with an energy representative responsible for facilitating all the energy efficiency initiatives was established. Using existing employees to drive an energy management initiative inherently poses the challenge of time constraints due to existing responsibilities of the employee or lack of commitment because this is not part of original key performance criteria [4]. To mitigate such barriers, roles and responsibilities were identified and communicated to the energy team members with the correlating accountability.

Energy review

The consultants, together with the energy team, conducted an energy review assessment to understand the facility's operational criteria and determine energy consumption levels and times of use. Working together with the team during the assessment to identify energy savings opportunities the consultant enabled skills and knowledge transfer. This specific methodology promotes awareness and a desire for the energy team to participate in the change initiatives [5].

The energy team members were responsible to submit the following information to the consultants:

- Twelve months of historic electricity bills
- A list of electricity equipment and appliances
- Stating each unit's operation time and pattern
- Develop a list of saving opportunities at each business unit

Fig. 3 illustrates the significant energy users (SEU) identified at the centre which resulted in accounting for 92% of all energy consumed.

The energy review allowed the energy team members to understand the consumption patterns and where the significant energy use was at the facility. This information was used by the consultants to explain the importance of focussing on SEUs in order to make an effective impact.

The SEUs provided a basis to establish an opportunities register estimating the potential amount of savings that could be achieved.

The findings during the assessment

The opportunities found during the assessment were prioritised in the opportunities register according to low cost, no-cost to long-term ROI interventions. This, in turn, formed a basis to establish action plans with targets, roles and responsibilities assigned to it, with the corresponding accountability.

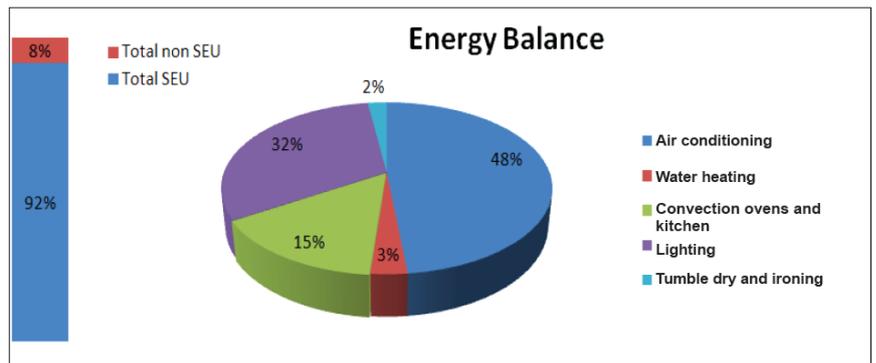


Fig. 3: Significant energy users.



Fig. 4: Awareness creation.



Fig. 5: Roof insulation installation.



Fig. 6: 15 kW PV grid tied system.

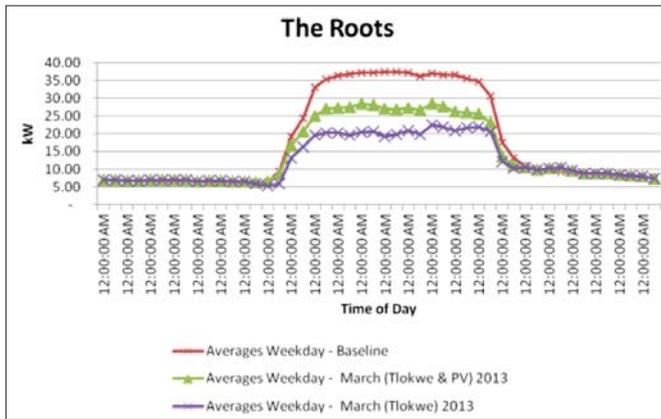


Fig. 7: Savings results – March 2013.

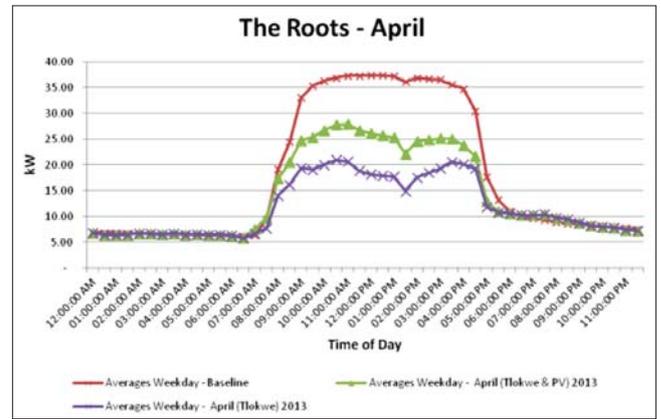


Fig. 8: Saving results – April 2013.

Some of the savings opportunities included:

- Switching lights off in the event of no occupancy
- Reducing the number of light fixtures in some areas
- Switching the air conditioning units off in the event of no occupancy
- Optimising the effectiveness of the air-conditioning by closing doors and windows during operation
- Sun-drying laundry instead of tumble-drying when the weather permitted
- Implementing control measures to ensure that only essential appliances are in use when on generator supply
- Installing more efficient roof insulation to reduce the high temperature levels at some offices
- Conducting energy awareness training to all employees (Fig. 4).
- Installing a pressure timer switch in the store rooms.
- Limiting the use of tumble-drying by encouraging sun-dry laundry.
- Installing a remote metering solution to measure the main incoming supply of the site.
- A conscious effort to use electricity sparingly and not using the air-conditioning units before 10h00 in the morning in peak times.
- Installing roof insulation with an efficient r-value (Fig. 5).
- Installing solar PV to supplement its energy supply from a renewable resource.

- During the first management meeting, an energy team was established from the existing employee base. However, during the second meeting it was clear that some members chosen were not performing as anticipated. This resulted in changes to the energy team. The team realised the importance of recruiting employees who were receptive to be part of a change initiative.
- Some employees did not participate in switching lights and air-conditioning units of when not needed
- Some employees failed to reduce demand by only using the essential loads during generator operation

These challenges were mitigated by conducting awareness training for all employees. The consultants made the employees aware of the impact they should and could make on energy consumption. Factors such as the impact a generator has on the cost of energy were explained. Other impacts such as peak time versus standard time was demonstrated, as well as the simple task of switching off lights when not needed were discussed.

Results and impact

A baseline was established to enable measuring the effect of the energy management programme and the PV installation. Through keeping it simple using a systematic approach the centre managed to save more than 30% after four months. As illustrated in Fig. 7, the energy team reported savings of 18% on behaviour change and the energy efficiency interventions. The 15 kW PV system contributed another 15% saving on the electricity bill in March 2013.

The total saving of 33% was achieved in March 2013, followed by a 30% saving in April 2013, which resulted in reaching the monthly target in just four months. If the energy team can manage to sustain these saving on a monthly basis they will reach their end-goal.

Setting objectives and targets

As stated in ISO 50001, top management has the responsibility to establish the energy savings objective of a company. However, first the energy team needs to establish the saving potential of the facility and then assist top management to determine a sustainable and reachable objective, which is in-line with the end-goal. Top management set an energy reduction target of 30% relative to the base year. The period to reach this target was twelve months. In order to reach this, the energy team used the savings opportunities register to establish action plans identifying where savings interventions needed to be implemented first.

Action plans and interventions for energy efficiency

During this 12-month period, the energy team conducted the following energy efficiency initiatives. The energy team first focussed on the low-cost and no-cost initiatives followed by medium payback and longer ROI interventions.

These action plans consisted of the following:

- De-lamping of some fluorescent lighting fixtures.

Investing in a renewable energy system

One of the end goals was to establish a niche market lifestyle centre through promoting an environmentally conscious facility. Hence a 15 kW solar photovoltaic (PV) system, (Fig. 6) was suggested by the consultants. This system is grid-tied and supplements the current grid supply with approximately 15% of its total consumption. Although a PV solution is a long-term investment, renewable energy does promote environmental responsibility and creates awareness amongst staff and clients of the commitment to a sustainable existence.

The payback period for this PV system is approximately between 10 to 13 years, while the lifetime of the system is 25 years, thereby delivering supplementary renewable energy beyond the system's ROI period.

The centre's marketing department incorporates the use of renewable energy in their campaigns to assist them in creating a niche market facility for their clients and are setting an example for similar businesses in its industry.

Challenges faced

The consultants experienced the following challenges during the project:

In the month of April 2013, the energy representative of the energy team started to train employees to switch off all the lighting between 13h00 and 14h00. The impact of this intervention is shown in Fig. 8. During the monthly management review meeting, the energy representative illustrated this saving to employees which reinforced the importance of the employees' participation in the daily energy savings activities.

This intervention did not only result in saving energy, but it managed to motivate the employees to take part in this initiative. Through awareness, training skills were developed, with the resultant behaviour change.

These saving interventions and change management initiatives resulted in the energy team creating a niche market at the centre, that markets its business as a green initiative that contributes positively to the environment through its energy efficient operation.

Conclusion

This case study demonstrates that energy efficiency targets can be met and exceeded by applying the foundation of basic principles without expensive interventions. It showcases how renewable energy can supplement energy supply

once energy efficiency is successfully implemented, resulting in further energy savings and a reduced reliance on grid supply. The rule-of-thumb of required energy savings is widely publicised and has been decided to be between 10 and 15%. However, this paper demonstrates that with no-cost, and low-cost interventions, coupled with a level of awareness creation and management dedication, the minimum reduction targets set can be met. An additional energy investment initiative could result in the achievement being doubled and sustained.

The energy team at Roots used basic change management principles and the ISO 50001 energy management system framework to reduce its energy consumption in a sustainable manner.

The consultants used the ADKAR change model to initiate effective change.

The desire to change to a greener operation came from the need to reduce energy consumption and thereby benefit from the lower cost, to comply with Eskom's call to reduce consumption by 10%, and governments' to reduce by 15%, and to reduce its impact on the environment. Together with the consultants, the centre's energy team exceeded the required target by saving over 30% a month, and benefits from marketing its operations as a

green initiative thereby gaining credibility within its industry and increasing future profitability.

Acknowledgement

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Contact Prof. Grobler,
North West University,
Tel 018 299-1328,
lj.grobler@nwu.ac.za ❖



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