Case Study: Qualitative (Eberspaecher Port Elizabeth, SA)

Company name	Eberspächer South Africa (ESA)					
Size of company (Based on energy consumption bill)	**SMME** (R250k –R750k)		**Medium** (R750k –R24mil)	X	**Large** (Above 24mil)	
Sector	Automotive Manufacturing					
Location	Port Elizabeth					
Company Contact	Name: Brett Lindhorst			Position: Senior Manager - Operations		
	Email: Brett.Lindhorst@eberspaecher.com			Telephone: 27 (0) 41 408 5377		
Year joined Project	2019					
Date of Implementation	July 2019	**Duration**		(8 months)		
Utility Intervention	ISO50001:2018 aligned EnMS Implementation					
Case Study Author	Dawie Fourie					
Project Manager	**Lindelani Mkhize**					

1. BACKGROUND

1.1 Company profile

The Eberspächer Group is one of the world's leading system developers and suppliers of exhaust technology, vehicle heaters and bus air-conditioning systems and is also a professional innovation partner for the automotive industry in air-conditioning of special-purpose vehicles and in automotive electronics. Eberspächer South Africa (ESA) has plants situated in Pretoria and Port Elizabeth (PE). For the purposes of this EnMS implementation the focus will be the ESA plant in PE.

Eberspächer is a world-renowned technology company with more than 155years of experience and has been technology partner for many industry leading automotive companies in the world. The company was started in 1865 in a tiny workshop and kept growing its innovative solutions until it entered into the automotive sector in 1931 with the production of Mufflers and in 1933 the production of Automotive Heating systems.

In South Africa, just after the new millennium in the year 2000 Eberspächer bought a company that started ae a small engineering company in the Transkei in 1975. Today Eberspächer is one of the largest suppliers of automotive climate control and exhaust technology systems, supplying all major OEMs in Southern Africa.

Further information is retrievable at www.eberspaecher.com

1.2 Plant profile

The Eberspaecher plant is located in Port Elizabeth. This is where the automotive exhaust systems are manufactured. The Port Elizabeth plant stretches over a total site area of 33,800m2 with a production facility with an area of 29,700m2.

Taken from the 2019 data, the plant has Electricity as its only energy source with a total annual energy supply to this manufacturing facility of around 4,06million kWh. Since sign-up as a candidate plant to the IEE Project in June 2019, the ESA plant has implemented some technical and behavioral energy efficiency measures that will be discussed later in this report. Soon after the start of the EnMS implementation, plant leadership decided not to go for full certification in the short term and opted for an overview of and alignment to the standard.

1.3 Nature of the challenges

The Eberspächer plant has committed to the implementation of an ISO50001 aligned Energy Management Systems (EnMS) with participation through the NCPC program to achieve the certification by end of 2019. This plant, however, has had many challenges recently, some of these challenges being so severe that it enforced a period of short time working for the employees and staff at the Port Elizabeth operation. This also prohibited the focus on and committing resources to the EnMS implementation. Notwithstanding all these challenges, the collection of necessary data to investigate opportunities for efficiencies kept continuing. The support of a few committed individuals within the energy team assisted in developing a roadmap that could easily be used to switch over to a full EnMS implementation in a very short time.

1.4 IEE capacity building programme

Although no training has yet commenced through the IEE program, a training plan has been put in motion to upskill some of the engineering and maintenance staff in relation to energy and resource efficiency. The Safety, Health and Environmental lead of the plant, in his capacity as the Energy manager has also indicated that he will be doing some of the IEE program training as soon as the opportunity in PE becomes available.

2. MEASURES IMPLEMENTED

Energy management is a culture for continual improvement of energy performance and efficiency that is integrated within an organization's everyday business practices. Energy is a critical component to many organization's operations. It is important to realize that energy can be managed and controlled.

Managing energy use in any facility is a team effort and needs to be structured to ensure the journey reaches all in the organization. At ESA the implementation did not reach the necessary lower levels due to a decision that was taken by the Leadership that the certification to the ISO50001 will be done at a later stage. This effectively retracted the focus for resources to other competing priorities. However, the implementation support team continued with data collection and support, and as per the IEE program guidance used the EnMS tool (Excel EnMS-Expert_Implementation-Tool_SA_v0.3), as the central document for the EnMS implementation. This gave structure and flow to the process and aligned the PDCA and key concepts for ease of implementation.

Through this implementation process many documented milestones were defined but not achieved effectively, especially for the systems elements. Contrary to the previous version of the ISO50001 that only focused on energy performance improvements, the 2018 version has 3 main objectives. Firstly, you have to ensure continual energy performance improvement, secondly, to ensure continual improvement of the EnMS system elements for suitability, adequacy and effectiveness while in alignment with the strategic direction and thirdly, ensure achievement of other related outcomes such as cost, carbon etcetera.

The Energy review was done which highlighted, through data collection and analysis, the SEUs and relevant variables for ensuring that correct EnPIs were set-up. This was done using meter data and relevant variable data at plant level and RETScreen Energy Modeling software at an SEU level, as no SEU level metering is in existence at this point. This gave rise to the Opportunities list, which was used to create an action list in line with the objectives and energy targets.

3. RESULTS, BENEFITS AND LESSONS LEARNED

1.1. Results

During the EnMS implementation, 6 projects had been identified. Due to limited time of implementation and resource constraint, no current project had any electrical energy saving, but the potential for savings in low and no cost initiatives remain high.

1.2. Benefits

Impact of Energy Savings can have far reaching benefits, not only for the organization, but also for the individuals (employees) at work and at home. For the organization, these savings could be accumulated and be plowed back for use as funds for other energy projects. This would alleviate the pressure on limitations to capital budgets and create a source of income that continuously feeds energy improvement within the organization. Other non-energy benefits (NEB) such as Carbon emissions reduction would be a direct effect in this case.

For the employee at home, with the knowledge gained from the program, the same capability can be of assistance in managing their energy at home. This would result in monetary savings, which is a positive economic benefit on a personal level. At Work, the employee with this new knowledge can also use the same to record improvement suggestions, which could realize incentives, as for most suggestion schemes, and would have a positive morale spin-off. The benefits, sometimes direct and sometimes indirect, is difficult to measure and verify, but can makes significant contributions to climate change.

Many non-energy benefits (NEB) eg, safety and reducing cost and skills upliftment was also highlighted to the energy team during this project. One of significant benefit was the 12B tax benefit (rapid depreciation of renewable energy projects) that would see a credit in the tax for the organization of over R3million, if the organization would go ahead with the Solar PV roof installation. Another non-energy benefit (NEB) also related to tax is the 12I tax incentive for sizable energy efficiency projects that could be savings-verified to predetermined precision and confidence levels. These benefits are enabling to sizable projects and should be communicated early enough to enable pre communication with the treasury department, in the event that organizations would like to apply for such benefits.

1.3. Lessons

Throughout the implementation process there are many key moments where the initiative could go wrong. Keeping focus on a few points should prevent this from happening. The bullet points highlighted below are what we've found to be the major drivers of success for the ESA EnMS implementation:

- Align the EnMS with the strategic direction and organizational context.
- Ensure commitment from Leadership team is not just words (lip service).
- Integrate EnMS with existing management systems.
- Ensure resources are allocated from the onset
- EnMS and energy performance targets should be linked to leaderships team and energy team's individual performance management objectives and targets
- Ensure efforts for implementation are streamlined to current organizational design/culture.
- Assign appointment to individuals with authority within the organization.
- Use correct data collection and analysis protocols and define correct SEUs.
- Energy Team to meet regularly and coordinate/communicate effectively.
- Be positive and always look for improvement opportunities.
- 100% employee engagement, with 80% focus on the energy influencers.

4. FUTURE PLANS AND CONCLUSION

1.1 Future Plans

The table 1 below shows opportunities identified, but not fully implemented. Some of the opportunities are still under investigation, while others have been started already. The total value of these opportunities is significant enough to ensure correct implementation of the ISO aligned Energy Management System (EnMS). The ESA plant team has a budget constraint but could allow for time during weekends for the maintenance team to slowly implement the low and no cost savings opportunities. These opportunities are all low accuracy quick scan developed, so accuracy should be improved by deeper analysis.

Table 1: Identified opportunities

Project Category	**Project Description**	**Savings Electricity** (kWh)	**Savings Cost (R)**	**Savings CO2e (tCO2e)**	**Other Benefits**
Electricity	Meter installation for SEUs	TBC	TBC	TBC	Knowledge of consumption per SEU
Electricity	Reduce compressed air leaks and consumption	155 536	138 386	162.1	Improve Safety
Electricity	Ensure Exhaust Fans are off during times of no production (est 8hrs per week)	33 138	29 439	34.5	
Electricity	Continue lighting replacements with LED	59 136	52 631	61.65	Less heat generation included
Electricity	1MW AC Rooftop Solar to further reduce brown kWh	1 829 469	2 559 071 Net Energy Benefit - Tax deduction of 3,080,000	1 907	Green Energy and Tax incentive (100% rapid depreciation in year1 - 12B) Net Energy Benefit - Tax deduction of 3,080,000
Electricity	Profile Analysis - Baseload reduction eliminate 145kW baseload over 4500hours	625 500	874 350	680.2	

Meter installation for SEUs

For any well-functioning EnMS, it is important to know where to locate and how to acquire energy data. Requirements will vary depending on the data to be collected. Energy bills are generally readily available and easy to collect, so site level analysis should not be problematic in this case, however, some other data (eg. SEU consumption) may require more effort. Metering does not exist at SEU level for ESA, hence the necessity for the evaluation of SEU metering requirements to enhance the data collection process for determining the most advantageous methods to collect the required data for purposes of analysis.

This lack of submetering at ESA makes it difficult to analyze performance at SEU level, and therefore sets a demerit against the requirement for SEU performance according to the ISO50001:2018 standard. For this reason, it was identified that one of the first focus areas to improve on the EnMS should be the acquisition and installation of submeters for strategic SEUs.

Reduce compressed air leaks and consumption

With the Compressed Air system being around 35% of the overall Consumption at ESA, it is prudent for the ESA team to look into efficiency measures to reduce unnecessary losses on the Compressed air system. There are 3 compressors at ESA of which1 is a standby unit. The smaller compressed air unit (45kW, 115 liters per second) is a highly efficient R-series compressor with variable speed control and hybrid permanent magnet motors. The system connected to this smaller compressor was estimated to have a 10-12% leak rate. The larger compressor (75kW, 350 l/s) set on load/unload capacity control is estimated to have a system leak rate percentage of around 15-25%.

Leak rate reduction is one of the simplest forms of energy efficiency control strategies on a compressed air system and does not cost a lot of money. During the analysis of the compressed air systems at ESA, it was suggested that compressed air leak control, aside from the normal find-a-leak-and-repair method, could be enhanced by 2 methods. Firstly, by installation of isolation valves at the entrance of each robot bay and secondly, the installation of vacuum ejectors to shut compressed air once the necessary gripping pressure inside the welding bay is reached, thus minimizing the air requirement at each vacuum application.

Figure 1: Compressed air leaks

These two methods should assist the team at ESA to reach a high efficiency state on its compressed air system.

Ensure Exhaust Fans are off during times of no production

Several Exhaust fans are working in unison to successfully clear volatiles from the production floor to the outside of the process facility. The total capacity of the exhaust fans is about 30kW. These fans are estimated to run constantly throughout the week and the weekend. Manual control of these fans is seen to be high risk, as the ease to forgetting the switch-on of the fan could have negative safety implications.

With auto control for each exhaust fan to run only when the Welding bay is in operation, efficiency gains of around 5-10% could be achieved.

Continue lighting replacements with LED

Lighting replacements from older technologies to LED was started in 2018 and although many had been completed, some areas still have old technology lights. The process of exchange to LED lights should remain ongoing until this project has been completed.

1MW AC Rooftop Solar to further reduce brown kWh

ESA is a very progressive global organization and sets their expectations high on environmental impact reduction, and for this reason, carbon reduction is very high on their agenda. Since 2017, the organization looked at various means of reducing carbon, which formed part of their focused strategy for the years 2018 and 2019. Many opportunities had been investigated including Solar PV and the purchasing of Green Power through PPA's. Although Solar PV Proposals over the last few years have become more lucrative, the decision to go ahead have not been made yet by the approvers.

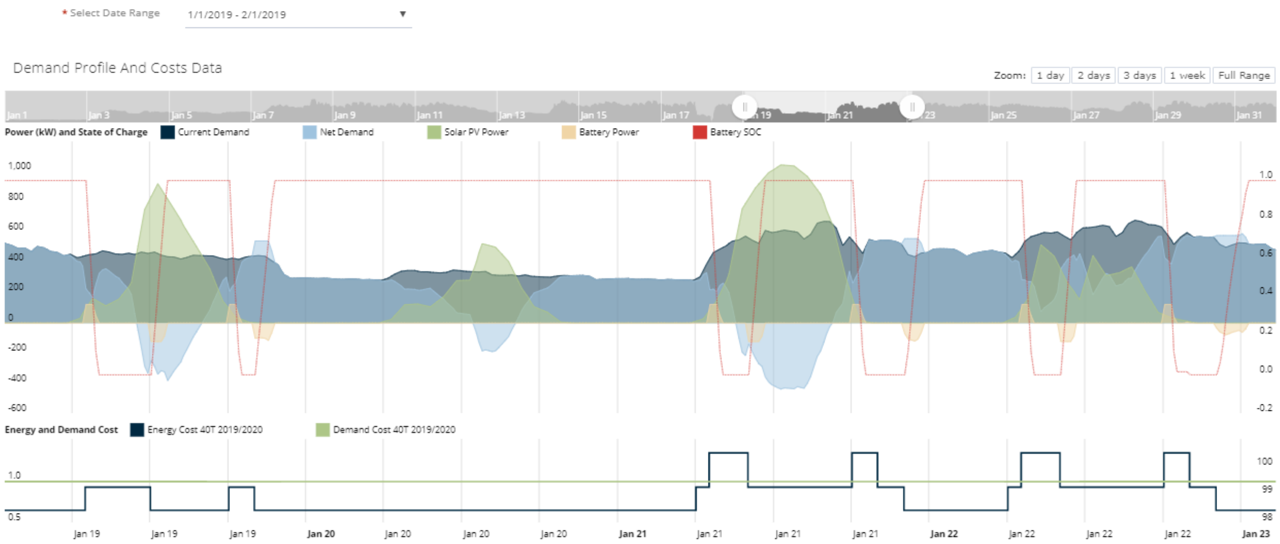

Figure 2: 4-day Solar PV analysis using Energy Toolbase simulation software.

Solar PV systems analysis are complex and requires correct data inputs of 1) the daily plant kWh profile 2) the sun hours for the location, 3) the tariff rate and 4) a simulation tool with the capability of simulating these variables accurately while including a variety of incentives, Solar array and Battery (Energy Storage Systems - ESS) systems scenarios to give the optimal project output that would be suitable for the organization.

The graphic above depicts a graphical view of the ESA PV system analysis over a 4-day period (included Saturday, Sunday, Monday and Tuesday). The full analysis runs over a 365-day period, but this 4-day extract was included merely for purposes of explanation. This simulation shows the grey daily profile overlaid with the green Solar production, which results in the light blue net demand profile. The red line is depicting the battery SOC (State of Charge) which is aligned to the dark blue stepper line graph at the bottom of the graph, which depicts the tariff rate at the specific hourly time interval. The battery in this setup only discharges when the tariff charge is at peak and starts charging again only of the tariff rate is at standard or off-peak time. This setup is done in this way to take advantage of the cost periods of the tariff and to maximize arbitrage.

The latest solar PV analysis for ESA have shown that a 1MWpeak Solar PV plant could offset their electricity consumption by 44%, and reducing the annual electric bill from R5,232,934 to R3,421,102. This would constitute a 35% reduction on the electric bill and a further 12B rapid depreciation tax incentive of R3,360,000 could translate to a return on investment of 4.3years, an IRR of 25.25% and an NPV of R18,646,004 over a 25-year period.

Profile Analysis - Baseload reduction (eliminate 145kW baseload over 4500hours)

When analyzing the daily profile at ESA, it becomes evident that there are opportunities for baseload reduction. The Weekend baseload as well as December shut periods were analyzed for purposes of evaluating the size of the opportunity of such a reduction and the investigation in this regard highlighted a 145kWh reduction.

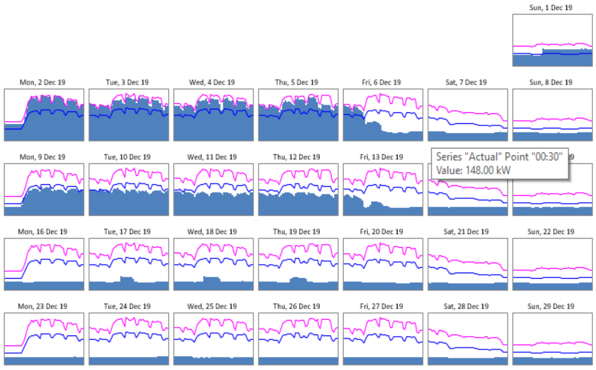

Figure 3: December 2019 Shut period baseload.

The graph depiction (fig. 3) shows the December 2019 baseload. This shows that more than 100kW is still being consumed during periods when no-one is at the plant. A brainstorming session revealed a few opportunities for consideration and an action plan for seek-and-finding the causes of this baseload had been instigated by the energy manager.

This report discusses the Performance of the ESA plant in Port Elizabeth. The performance was specifically discussed in light of Electricity to highlight the future improvement initiatives to the Process and utilities of the ESA PE site. The main benefit of the latter being to encourage the Leadership team of the ESA PE facility to work to the objective of implementing an ISO50001 aligned EnMS system and to seek certification towards the ISO 50001 Standard. This would steer the correct resources in the direction necessary to affect the future improvements mentioned in this report.

1.2 Conclusion

This case study report discuss the potential improvements for Electricity savings. No savings are seen after the selected baseline for electricity (2019). The main reason for this is due to a lack of resources allocated for the process of implementing the EnMS. This was based on the decision from the Leadership team to move the resources to competing operational focus areas after the decision that certification to the ISO50001 will be done at a later stage.

The lack of meters/ data loggers for collection of SEU energy related data makes it difficult to measure, verify and track smaller improvements (less than 5% of total consumption). This is due to the already high variability in consumption due to variation in product and process and the December shut period. The implementation of SEU level sub metering should be considered as a priority and with urgency by the energy team.

Good Electricity savings ideas are planned in Silos, and no tracking of savings as a result. The energy team needs to bring all initiatives to one platform for communication, implementation, tracking and reporting. This is a huge opportunity for ESA.