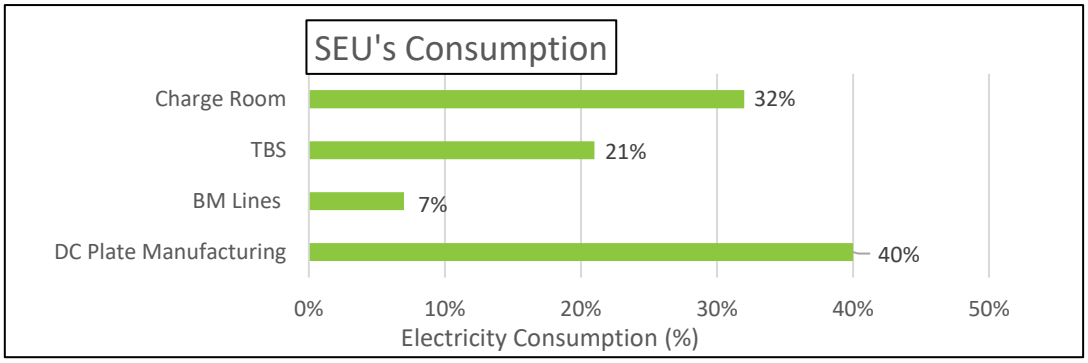
Case Study

Company name	AUTO-X (PTY) LTD					
Size of company (Based on energy bill)	**SMME** (R250k –R750k)		**Medium** (R750k –R24mil)	**X**	**Large** (Above 24mil)	
Sector	Battery Manufacturing					
Location	Port Elizabeth, South Africa					
Company Contact	Name: Y. Moola			Position: Head of Process and Projects		
	Email: yunusm@auto-X.co.za			Telephone: 041 401 4000		
Year joined Project	2018					
Date of Implementation	2018	**Duration:** 1 Year				
Utility Intervention	Energy Management System(EnMS) implementation as part of the EnMS Expert program					
Case Study Author	Mulanga Manenzhe, Noelene Jorgensen, Yunus Moola					
Project Manager	Adrian Rudolph					

1. BACKGROUND

1.1 Company profile

Auto-X (Pty) Ltd manufacturing plant is in Port Elizabeth. This system energy management system will include all buildings and equipment on the Auto-X property. Auto-X uses electricity has their main energy source. The plant has been sub-divided by production process into 4 SEU's namely DC Plate manufacturing, BM Lines, TBS and Charge Room. Majority of the energy efficient measures were implemented in the charge room.



1.2 Nature of the challenges

A lot of energy related work and projects have been done over the years and now Auto-X is in the process of implementing an EnMS system in preparation for ISO 50001 certification in 2019. EnMS involvement and preparation to date includes participation as a host plant and EnMS (2-day and expert level) training of key employees, through NCPC SA in 2018. An energy team has been appointed with its focus being change management. Implementation of this system will help influence this change.

1.3 IEE capacity building programme

A junior member in the projects department embarked on EnMS Expert Program. Auto-X Pty Ltd feels that the training given will allow him to help keep the system maintained. The three core energy team members, production department heads, attended module 3 of the EnMS Expert Level course.

2. KEY ACHIEVEMENTS

Key findings table

Implementation Period (yyyy-yyyy)	2018-2019
Total Number of project	6
Monetary savings in ZAR	R 282 368
Energy savings in GJ	781.94 GJ (217 206 kWh)
Total investment made ZAR	R 3 299 635
Overall % of total consumption saved	2.75% of Charge Room
Total Savings from no cost interventions	Cannot Determine
Payback time period in years	11.7 Yrs
GHG Emission Reduction (ton CO2)[1]	226.4 GJ
Number of females employed prior after to implementation	Auto-X Pty Ltd uses of a lot of lead in their process which poses a greater health risk for females. Thus there is a limited no. of female employees in the factory.

3. IMPLEMENTATION OF AN ENERGY MANAGEMENT SYSTEM

Module 1: Commitment and Planning

3.1.1 Scope

The energy management system will include all buildings and equipment on the Auto-X property. The section highlighted in red is rented out to an external company, although the two companies share one bill, Auto-X has no influence on the consumption of energy within this boundary. Auto-X uses electricity has their main energy source. The plant has been divided by production process into 4 SEU's which are DC Plate manufacturing, BM Lines, TBS and Charge Room.

3.1.2 Energy Team

A core energy team has been appointed. It comprises of the 3 heads of production. The energy management representative has also been appointed. Roles and responsibility have been defined and communicated.

3.1.3 Energy policy

The energy policy has been signed by the companies GRM02. A SHEEQ policy (Safety Health Environment Energy Quality) has been drafted and is with top management. This combined policy we look to incorporate all Auto-X Pty Ltd ISO systems into one policy, this is one of the steps Auto-X Pty Ltd will be going through to help link their ISO systems. Below is a summary of the commitments as written in the policies that relate to their EnMS.

Auto-X Pty Ltd is committed to:

- Reducing our environmental impact and carbon footprint.
- Ensuring continuous improvement in energy performance.
- Allocating resources to achieve set objectives and targets.
- Ensuring the EnMS at is documented and communicated to all levels.
- Ensuring the EnMS is regularly reviewed and updated.
- Effectively procuring and utilize energy efficient products, services and designs.
- Uphold legal and other requirements.

3.1.4 Legal and other requirements

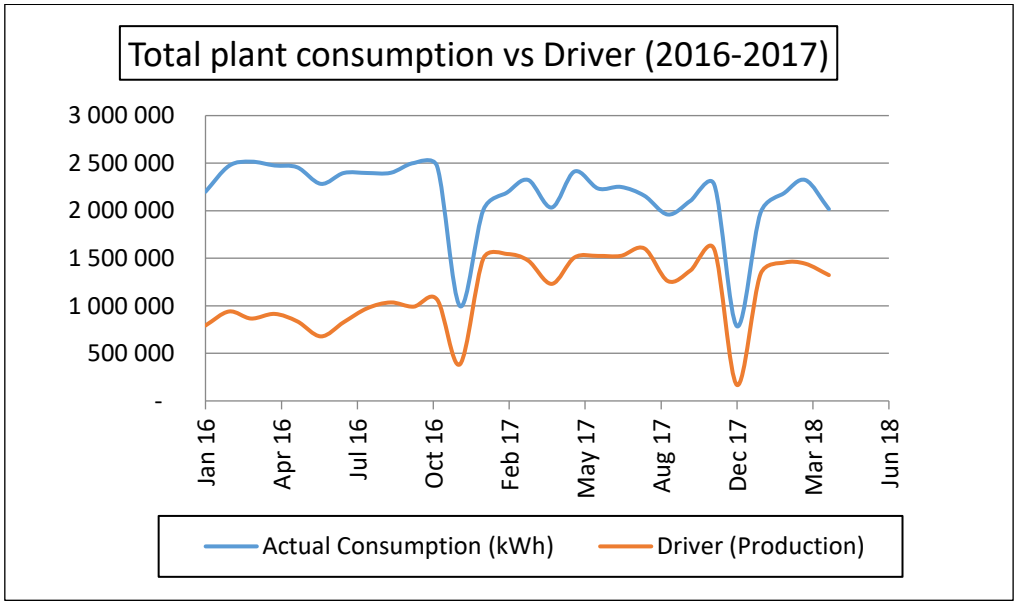
Legal and other requirements are identified and listed in the Auto-X integrated management system. However legal compliance audits to date have included, local, municipal and national

legislation including OHS, Environmental and business related legislation and requirements. Energy efficiency and related requirements will be assessed and included in future audits.

3.1.5 Energy Baseline

A number of baselines were established as there is sub metering in certain SEU's. BM line has a combined baseline which incorporates all lines, due to meters being offline for significant parts of the year we also established a baseline for the BM line 1.

In the Total Plant baseline, we used 2017 as the base year although one of our objectives is to improve electrical energy efficiency by 5% in 2018 from 2016 baseline. This is because 2016 was not a good year for our production with us having issues with our paste for the plates. There were high levels of scarp that resulted in high energy consumption as can be seen in the graph bellow. Thus using the 2016 baseline was not ideal.



Specific energy consumption had to be used for the charge room. We found this to be an acceptable measure as a credible baseline could not be established. SEC is a credible measure of performance for this SEU because the baseload is negligible and there is only one relevant variable (Production units).

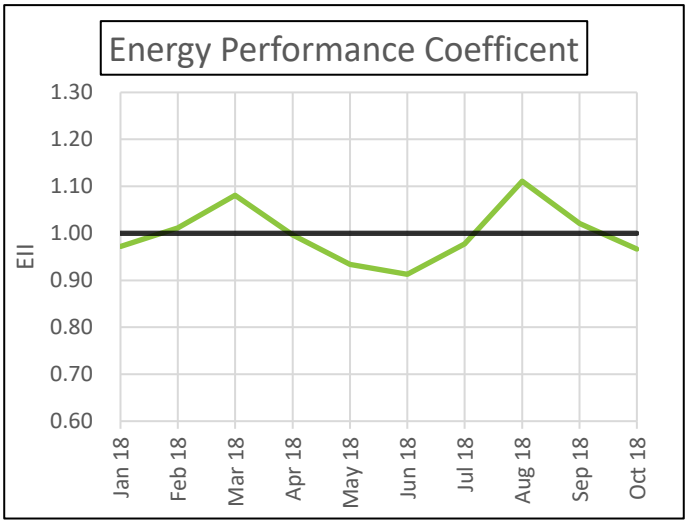
Below are the baselines and relevant data.

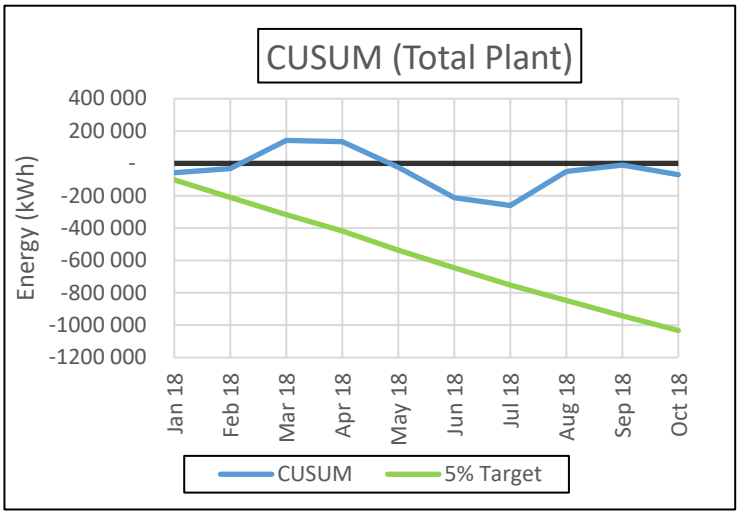
SEU	Relevant variable	Equation	R^2	P-value
Total Plant	Total lead used	Y=1.0363X + 653148	0.9287	0.000046
Plate Manufacturing		Y=0.0468X + 448012	0.8036	0.007
BM Lines Combined	Production	Y=0.6608X+ 85841	0.7943	0.021
BM Lines 1	Production	Y=0.6566X + 21350	0.8981	0.000021
Charge Room	-	4177Wh per battery	-	-

3.1.6 Energy Performance Indicators

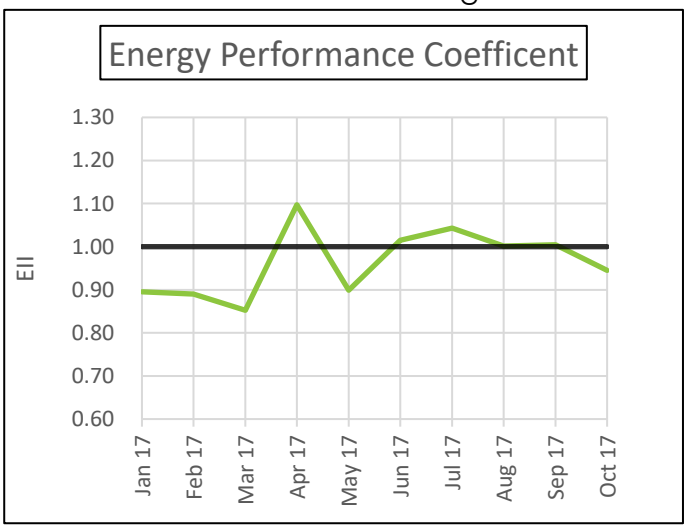
Due to issues Auto-X was having with its internal meters and online metering system compounded by a further delay to repair due to budget constraints. There was inadequate usable data for majority of the year for the plate manufacturing and BM lines (combined) baselines. Data for BM Line 1 was able to be retrieved and a baseline was established along with the total plant consumption baseline. Specific energy consumption had to be used for the charge room.

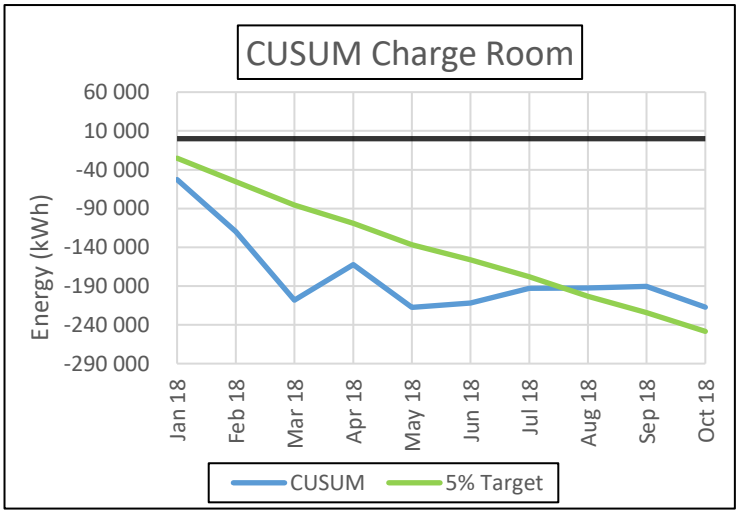
Performance indicators for Total plant baseline.





Performance indicators for Charge Room.





3.1.7 Energy Objectives, Targets and Action Plans

Below are the objective and targets set. An action plan was generated based on these objectives and targets. Focus was on the charge room (SEU) as well as competency and training.

Objectives

- Ensure management commitment to energy and resource efficiency
- Improve electrical energy efficiency by 5% in 2018 from 2016 baseline

Targets

- Training for core energy team (EnMS 2 day)
- Awareness training for all employees by 2019
- Reinforce energy team structure
- Increase charging efficiency by 5% from 2016 charge cycles in 2018
- Quantify and further reduce heat/cooling losses

Module 2: Implementation and Operation

3.2.1 Operational Control

Maintenance and operational control settings are essential in ensuring effective energy performance. The Auto-X team has identified operational controls particularly in the heating/cooling processes as it forms a large bulk of the factories baseload. Auto-X has 12 lead melting pots that make use of electricity as an energy source.

SEU	Eng. Units	Normal set point or value	Upper Limit	Lower Limit	Measuring Instrument Designation	Calibration Frequency	Who needs to be informed of these values?	Who needs to be informed of deviations?
Strip cast pre-melt pot (Neg.)	Deg.C	390	420	360	Thermocouple	Replacement when faulty	Operator	Maintenance
Strip Cast melt pot (Neg.)	Deg.C	390	420	360	Thermocouple	Replacement when faulty	Operator	Maintenance
COS1- Elbow	DegC	490	510	400	Thermocouple	Replacement when faulty	Operator	Maintenance
COS1- Feed line right rear	DegC	490	510	450	Thermocouple	Replacement when faulty	Operator	Maintenance
COS1-Feed Line Right front	DegC	490	510	450	Thermocouple	Replacement when faulty	Operator	Maintenance

3.2.2 Documented Procedures

Auto-X is committed to the purchasing of energy efficient products and services. The company has several good purchasing practices, which were not fully documented (e.g. Projects & Process Manager / Management Representative, reviews all technical related purchases for energy efficiency and approval) These where identified and procedures drafted.

3.2.3 Competency and Training

- 2 Auto-X Pty Ltd employees were sent on the Energy Management System Expert Training run by the NCPC in 2018
- The energy team core members are scheduled to complete RECP training in 2019.

3.2.4 Communication, Change Management and Suggestion Mechanisms

Communication was done through:

- Signatures on emails (Procurement and Projects department) communicating to suppliers that Auto-X Pty Ltd is committed to effectively procuring and utilize energy efficient products and services.
- QSB meetings where energy is discussed and communicated by core team

Change management is facilitated through Business Case development where a master business case template has been developed which considers energy and life cycle costing. This document is to form part of all capex related projects as per instruction from the Head of Engineering Projects Department (GRM02).

Awareness posters have been placed on large machines that display cost of running the machine. This was done on office doors to also create awareness on the costs of running the applications in the office.

Suggestions from both internal and external personal are taken through;

- Suggestion forms for visitors to the plant
- Notice boards outside the engineering office.

3.3 Module 3: Checking and Management Review

3.3.1 Monitoring, Measurement and analysis

Auto-X has sub meters that monitor the electricity consumption of its SEU's (Plate Manufacturing, Charge Room, BM Lines, TBS Lines) and its overall electricity consumption. These make use of production data and lead using data as relevant variables. Through the course of the year, some of these meters were found to be unreliable and thus have been replaced. This also highlighted the need to ensure that these meters are calibrated and tested regularly. Records of calibration and other means of establishing accuracy and repeatability will be maintained.

Auto-X monitors its EnPI's monthly and investigates any significant deviations. A Measurement plan has been developed and continues to be updated.

3.3.2 Internal audit

Auto-X was the host company for module 3 and has used the audit conducted at the time as its first internal audit. Findings at this audit have been highlighted and an action plan has been put in place to address these issues.

Below are some of the findings raised at the audit as well as the actions taken to address these findings.

Audit Findings	**Action taken**
Design activity records could not clearly demonstrate Energy Performance considerations.	Master business case template has been developed which includes/considers energy and life cycle costing.
No evidence of accurate EnPI's in place.	Faulty meters have been replaced. New baselines were set using available accurate data.

Some of the positive findings

- Appointment of management representative and formation of the energy team
- Evidence of creating awareness of energy
- Established management systems are in place to support EnMS

3.3.3 Management Review

Management review is expected to be done in January 2019 although a feedback presentation has been done to management highlighting the findings of the internal audit.

The inputs of this review will include (just to name a few);

- Review of energy performance and related EnPIs
- Opportunities for Continual Improvement (including development of competence)
- Status of corrective actions and preventive actions
- Projected energy performance
- Recommendations for improvement
- Results from internal and other related Audits
- Changes in external & internal issues associated with risks & opportunities relevant to EnMS
- Review of the energy policy
- Review of energy performance and related EnPIs
- Results of the evaluation of compliance with legal requirements and changes in legal and other requirements to which the organization subscribes
- Opportunities for Continual Improvement (including development of competence)
- The extent to which the energy objectives and targets have been met
- EnMS audit results

4. IMPLEMENTATION CHALLENGES

Below are some of the challenges that were faced as well as actions taken.

Challenge	Action (to be) taken
Establishment of working EnPI,s	Obtain available and relevant energy data. Metering plan developed.
Data availability. Faulty meters.	Faulty meters have been replaced. Meters to be calibrated regularly and records to be kept.
Start too many projects at the same time without detailed and accurate information	Increase communication between Energy team and other department.
Embark on uncoordinated efforts (everyone doing something, somewhere, unstructured, inadequate records)	Integrate efforts with existing Management Systems. Increase communication through QSB meetings and other platforms.

5. HIGHLIGHTS OF OPERATIONAL/ESO INTERVENTIONS

5.1 Summary of all interventions

Below is a summary of all interventions

SEU	Intervention	Savings (kWh/year)	Savings (ZAR/year)	Investment (ZAR)	Payback (Yrs)	Method of verification
Charge Room	Shut down volumetric filler conveyor during no production times	217 206	R 282 368	R 0	11.70	CUSUM
Charge Room	Reduce charge profile hours reduction			R 0		
Charge Room	Replacement of (1) inefficient 15A battery charges			R 1 097 745		
Charge Room	Replacement of charge room baths and charger with new acid recirculation system			R 2 195 490		
Charge Room	Charge bath warm up schedule			R 0		
TOTAL		**217 206**	**R 282 368**	**R 3 299 635**	**11.7 Yrs**	

Below is the new Digatron IGBT Rectifier (charger) which is replacing the old SCR and diode chargers. IGBT is much a faster and efficient switching device than SCR and diodes. These chargers will be used with the new Inbatec Acid Recirculation System Which Auto-X will be using to charge large truck batteries.

6. BENEFITS AND LESSONS LEARNED

6.1 Benefits and lessons learned

The savings contributed to the sustainability of the company. Even in a year where sales were low due to the struggling economy, these savings helped ensure that Auto-X remained profitable and thus did not have to consider retrenching any employees.

The project highlighted the fact that ISO systems (e.g. ISO 14001, ISO 9001) are closely link and thus efforts can be integrated. This lead to a proposal of a combined policy and now Auto-X Pty Ltd is working to bring its systems closer to each other.

A lesson that was learnt was that the company has a lot of things being done but due to low communication and documentation, some of this great work goes unseen. Auto-X will look to improve communication amongst departments and employees.

"You can only move forward once you know where you are" -Motivational Quote

7. FUTURE PLANS

The table below shows future planned savings and their expected completion date

Project Description	SEU	Estimated completion date	Estimated Savings (kWh)	Rand Savings (R)
HRD upgrade to eliminate cooling down and warming up of batteries	Charge Room	February 2019	80 252	R 104 328
Insulation of COS melt pot	BM Lines	June 2019	39 568	R 51 438
Insulation of strip cast melt pots	Plate manufacturing	June 2019	105 516	R 137 170
Replacement of (1) inefficient 15A battery charges	Charge Room	February 2018	156 000	R 202 800
Total			**381 336 kWh**	**R 495 736**

Auto-X will continue preparing itself to get ready for certification in 2019. The core energy team will be rolling out plans for change management, they will focus on energy awareness and training employees to ensure that the EnMS is sustainable and functional.