

IMPLEMENTATION OF AN EFFECTIVE ENERGY MANAGEMENT PROGRAM SUPPORTED BY A CASE STUDY

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Abstract

Effective energy management programs require commitment and leadership from Upper Management supported by an experienced Energy Manager. The vehicle for change is the Energy Management Working Party. The Working Party will be led by a Senior Manager and include other line managers under the technical guidance the Energy Manager.

The first step is to use historical data to calculate an energy management performance indicator called Specific Energy Consumption [SEC] and then continue the calculations using real time data.

The Working Party will initiate programs to achieve a continuous improvement in the SEC and in conjunction with Upper Management agree long term targets. Techniques will include evaluating base load data (energy consumed when not in production), targeted projects on energy inefficient equipment and a review of the various manufacturing processes to develop low energy solutions.

This presentation is supported by a case study of the KB Alloys facility at Wenatchee WA

Introduction

This paper outlines a method of implementing an effective Energy Management Program in a manufacturing facility. The paper focuses on the need for leadership and commitment from Upper Management and its appointment of the Energy Management Working Party which is the vehicle for driving the process forward. The paper addresses the organization of the Working Party and the work programs to be undertaken with the first priority being the setting up of a metric to calculate an Energy Performance Index which is called Specific Energy Consumption.

The paper concludes with a progress report on the results achieved at KB Alloys, LLC facility Wenatchee WA using the Energy Management Working Party as the method of implementing an Energy Management Program

Management Commitment

For an Energy Management Program to be effective it requires leadership and commitment from Upper Management with the following being crucial:

- Publish an Energy Management Policy demonstrating the Company commitment to energy management and the methodology to be implemented
- Provide resources (both people and finance)
- Appoint the Energy Management Working Party

- Work with the Working Party to identify and provide training, review data and set and monitor targets

This paper contends that an Energy Management program not driven by Upper Management has a high risk of failure.

Energy Management Working Party

This is the team charged with developing and implementing the Energy Management Program. The following are considered to be key appointments:

Chairman

- This role should be undertaken by a Senior Operational Manager for example the Plant Manager

Energy Manager

- Clearly an important appointment – in the absences of anybody with Energy Manager skills and experience the Engineering Manager or Maintenance Manager would be good choice although some training may be appropriate

Other Members

- Depending on the size of the company it would be appropriate to add two or three members who should be managers or supervisors who run energy consuming departments – for example Production Manager
- Additional members can be added as required as the Working Party begins to make progress

Meetings should be held at least monthly and they must be formal with appropriate notes or minutes reporting progress, results and actions planned (by whom and by when)

Energy Management Working Party – Work Program

1 - Measure Energy Management Performance

The first task of the Working Party is to measure the existing energy performance of the facility and then put in place programs to continuously improve that performance. To achieve this we need a meaningful metric in the form of an Energy Performance Index and as energy is used to produce things we are looking for a metric that relates the energy consumed to the saleable production produced. This Energy Performance Index is typically called Specific Energy Consumption or SEC for short and is calculated by dividing the total energy consumed by the total saleable production – Typical units are kWh/#

Calculating SEC

- Step 1 – Identify the types of energy to measure
- Step 2 – Identify means of recording the energy used [probably from invoices and or meters]

Step 3 – Determine a method of measuring saleable production

Step 4 – Record both sets of data regularly [probably monthly]

Step 5 – Calculate SEC [total energy ÷ total saleable production]

Step 6 – Develop an effective reporting system [graphical is recommended]

Once the SEC reporting system is in place you have achieved the following:

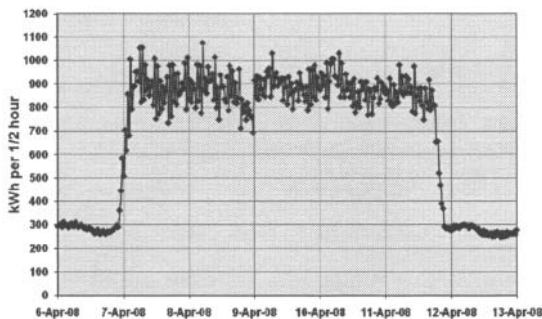
- A base or reference performance
- A means of measuring the effects of your improvement programs
- A frame work against which targets can be set and monitored

2 – Minimize Base Load Energy

Having established a measure of a site's Specific Energy Consumption the Working Party can now turn its attention to identifying opportunities to reduce energy consumption. The first Project is to investigate Base Load which is the energy being used by each energy stream when there is no production for example over a weekend or between shifts. The costs can be minimal but the rewards can be significant.

Each plant will have to assess the best way of monitoring its consumption but if energy usage can be reported on say a half hourly basis such data can make some interesting reading particularly during non productive periods.

As an example the following is a chart showing ½ hour electrical consumption for a site operating a 24 hour shift system 5 days per week. The weekend can clearly be seen.



In any typical plot of half hour data don't initially look at the peaks but look at the energy being consumed when not in production and ask some questions

- What is running?
- Why is it running?
- What can be done minimize energy consumption?

Some issues worth considering:

- Make sure that anything that is left running is necessary.
- Design well thought through Start-up and Shutdown procedures and make somebody is responsible for supervising and monitoring.

When action is taken the benefits will be seen as a reduction in Specific Energy Consumption.

Once you have a monitoring system in place keep it going as it is all too easy to let things drift and the benefit gained will be lost.

3 - Specific Projects

This is where the specialized knowledge of the Energy Management Working Party will come to the fore. They clearly know your plant, equipment and infrastructure and should be able to target areas where energy management programs can be implemented. Nevertheless anything that uses energy can become the focus of an energy management project and the following may be relevant:

- Air compressors and compressed air
- Furnaces
- Dedicated process equipment
- Lighting
- Large motors
- Hydraulic systems
- Air handling equipment
- HVAC systems

For each of the subjects above you will probably need a measure and monitor program with the objective of producing a dedicated SEC for the equipment or process. This will almost inevitably lead to the need for sub-metering which are essential tools in the fight to eliminate waste. As each subject will require a slightly different approach the exact way forward is best addressed by the Energy Management Working Party under the leadership of the Energy Manager.

There are, however, other issues that are worth considering. Downtime

- by reducing downtime you reduce the amount of energy wasted and improve your SEC

Reject Rate

- When you produce a reject its energy is wasted. Reducing reject rate will improve your SEC

Capital Investment

- Every capital investment should consider energy implications and where practical opt for low energy opportunities.

4 – Review Manufacturing Processes

So far the Working Party has been looking at opportunities to improve the energy performance of the infrastructure. It is now time to look at your manufacturing methods and processes to identify or develop lower energy solutions. As a starting point you need to produce an energy profile of your processes so that you know exactly the energy consumed for a particular process. Thereafter it's a case of investigation, process engineering and development.

This is likely to be a significant challenge but the rewards could be significant. It will also be the time to consider adding additional specialists to join the Energy Management Working Party:

KB Alloys, LLC – Case Study of Wenatchee Facility

1 – Management Commitment

The Company published a Company Policy on Energy Management and in September of 2008 set up Energy Management Working Parties at its manufacturing facilities.

The Working Party at Wenatchee followed the structured approach as outlined above and within 2 months and using historical data produced a Base Year SEC.

2 – The Energy Management Working Party – The team

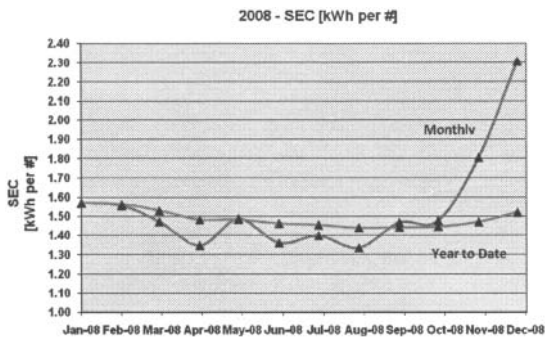
The Wenatchee Plant Manager was appointed Chairman of the Working Party and the Production Manager and the Maintenance Manager were added to the team. I was appointed as Energy Manager but in the fullness of time that role will be transferred to the Maintenance Manager.

Subsequently the Technical Manager was added to the team as the work programs required specialist knowledge.

3 – SEC Measurement and Reporting

3.1 – SEC Base Year [2008]

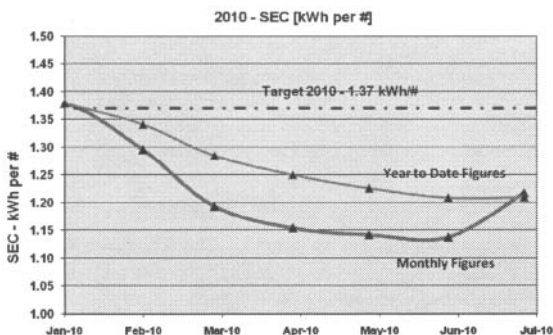
The calculation of SEC data followed the guidelines as shown above and the following is a chart of the results for 2008.



The red line reports the Monthly SEC and the Green reports the Year to Date Figure. The reason for the sharp upturn in the red line at the end of the year is the effect of the recession.

At the end of the year the average SEC was 1.52kWh/# of net product. The CEO reviewed the data published and set a target for the Working Party to achieve a 10% improvement in SEC for 2010 [target for 2010 is 1.37kWh/#].

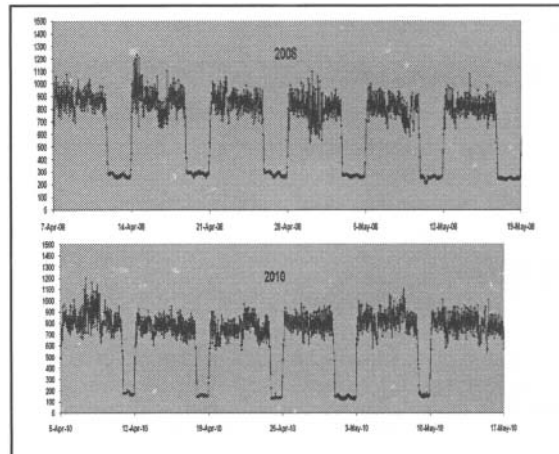
3.2 – SEC 2010



The blue dashed line is the target for the year of 1.37kWh/#. The red line reports monthly SEC and the green reports the Year to Date Figure. It can be seen that the performance is better than target.

4 – Base Load

The chart below shows ½ hour electrical consumption for a week in 2008 and a corresponding week in 2010. The area of interest is the weekend consumption. In 2008 the typical energy consumption over a weekend was 300kWh per ½ hour. In 2010 that figure had been reduced to about 100kWh per ½ hour. This came about as a result of an investigation into what was running and what could be done to minimize the energy consumed. There is still work to do to drive that figure lower and the engineering work is in hand.



5 – Specific Projects

5.1 - Reverb Furnace

Relining Program

In 2009 we completed a relining program in which we had worked with a specialist refractory vendor to improve the energy performance of the furnace. The program was successful and we achieved a 10% improvement. We support this program with regular measurements of heat loss.

Operational Monitoring

SEC data is reviewed weekly and action taken if trend indicates a deterioration of performance. We also monitor gas consumption at weekends when the furnace is full of molten metal but in an idle state. In comparison with other similar furnaces in the Company its performance is good and has become a benchmark.

Future Projects

Initial investigations indicate that a burner up-grade could deliver a 30% improvement which is clearly an opportunity for the future.

5.2 – Compressed Air

Leaks

With the plant shut down we measured a leakage rate of 16.4% of compressor output
Following repair of leaks reduced leakage rate to 4.6%.
Regular monitoring is carried out.

Weekend demand

There is minimal demand over weekends and we installed a small compressor to meet demand and shut down the main compressor

Compressed Air Demand

We have a program to minimize demand and look for alternative lower energy technologies

Size of compressor

The compressor is 60% bigger than we need. Perhaps an opportunity for the future

5.3 – Rod Mill

The DC drive system was due for an up-grade. As a part of the project we included in the specification the objective to reduce to reduce the mills' SEC. Following successful completion of the project we have reduced SEC by 14.5%

5.4 – Lighting

Mindful of the advances in low energy lighting we took advantage of an opportunity to have a survey of both our lighting and the associated control. We now have a new project in the pipe line that will reduce our total electrical energy by 7% and plan to complete this project in the next 6 to 9 months

Factors outside the Control of the Working Party

The Working Party is charged with delivering the Energy Management Program and meeting jointly agreed targets. However not all factors that can effect SEC are under the control of the Working Party and such issues may need to be taken into account when setting and monitoring targets.

Weather

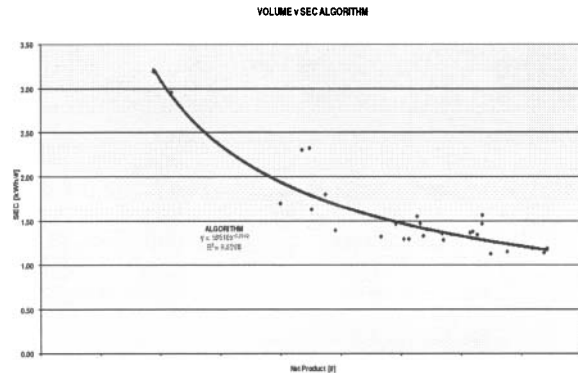
This is not the difference between summer and winter but the differences between summer and summer and winter and winter when the energy used to heat and or cool could be significantly different year to year. To date this has not been an issue at Wenatchee but if it is a problem it may be necessary to consider this when targets are set.

Product Mix

If you make a range of products with widely differing energy demands the mix of products will affect you ability to achieved target. This relationship will need to be understood. To date this has not been an issue at Wenatchee but if it is a problem it may be necessary to consider this when targets are set.

Volume

It is almost inevitable that volume will be a factor in setting and monitoring targets. This relationship will need to be understood which was achieved at Wenatchee by plotting monthly volume against monthly SEC as follows:



As can be seen there is a natural reduction in SEC as volume increases. When that curve is understood it can be used in target setting and monitoring with actual target set being adjusted relative to volume.

Involving Others

The impression may have been given that that the Energy Management Working Party is an exclusive club working behind closed doors. This could not be further from the truth.

The Working Party needs to be open and transparent and to engage with and encourage everybody working in the Company to get involved. To achieve this it needs to communicate and the following are subjects that could well be included:

- Company Energy Policy
- Energy Management Program
- Progress report and future plans

In addition it should consider:

- Seek ideas for energy management opportunities from the workforce at large
- Establish dedicated working groups to address specific issues
- Regular Publication of energy management data relevant to the audience

In Finality

The plan outlined above works for KB Alloys and it will work for you. However as reported above it is unlikely to be successful unless the driving force comes from the most senior management.

Projections indicate that energy prices will increase significantly - if you are not running an energy management program to-day there is no better time to start. The concept outlined above is an effective method of implementing energy. Maybe now is the time to embrace it and reap the benefits.