



Benefits of an Energy Management System

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Overview of Presentation

- **Background to AAL**
- **Selection and Implementing the System**
- **Getting Benefits**
- **Lessons for Other Plants**
- **Energy MAP Option from SEI**
- **Summary**



Approaches to Energy Management

- Rising energy costs and concerns about global warming compel us to reassess all aspects of how we use energy.
- An important option in this process is to improve the efficiency with which we use energy.
- A formalized Energy Management System can give significant benefits but requires a lot of effort to implement and administer it.
 - **In general, this is only realistic for big energy users.**
- A structured approach to energy management can also bring benefits to smaller firms.
 - **General principles are broadly similar.**
 - **Administration effort is much less**
 - **No formal external audits are required**



Aughinish Alumina

- **Aughinish Alumina Limited (AAL) produces about 1.85 Mt/year alumina from the raw material bauxite.**
- **Alumina refining is an energy intensive process.**
 - **In 2005 we used 350,000 t fuel and 360,000 MW-hr power**
 - **This amounts to almost 30% of our operating cost**
- **Because we are such a large energy user we participated in SEI's 2003 Pilot Negotiated Agreement program as an individual company.**
- **One of the agreed points was that AAL would install an Energy Management System.**



Selecting DS 2403

- In early 2004 we discussed the options for energy management with SEI.
- SEI identified 3 possible routes
 - The UK Energy Efficiency Accreditation Scheme
 - The US Standard ANSI/MSE 2000
 - The Danish Standard DS 2403
- We opted for DS 2403 because it was structured along the lines of ISO 14001 which we use. It also has been in operation for many years in Denmark.



Preliminary Assessment

- In March 2004 we invited auditors from DNV to visit AAL and assess if it was realistic to achieve certification by October 2004.
- The auditors concluded that it was possible to achieve certification in the time period.
- In April 2004 an AAL/SEI team visited sites in Denmark to assess how they found the system
 - **A/S Dansk Shell Refinery in Fredericia**
 - **Dansk Leca in Hingevaert**
 - **Aalborg Portland A/S in Aalborg.**
- The site visits confirmed DS 2403 as a useful tool in improving energy efficiency.



Basic Elements of DS 2403

- The standard is similar to ISO 9001 & ISO 14001.
- It has 5 main steps comprising
 - **Energy Policy**
 - **Planning**
 - **Implementation and Operation**
 - **Checking and Corrective Action**
 - **Management review**
- The standard commits top management to continuous improvement so the 5 basic steps are repeated again and again



Schematic Illustration of Process





Implementing the System - 1

- **An Energy Management System, like Quality and Environmental systems, must have appropriate resources if it is to be implemented successfully.**
- **The most significant resource is people's time. Establishing the system is time consuming, as is the day to day operation of the system.**
- **The main tasks involved are:**
 - **Compiling the Energy Reviews, Targets, and Programs**
 - **Effective monitoring of energy efficiency**
 - **Organizing monthly Energy Reviews**
 - **Coordinating non-conformance reports and follow-up**
 - **Organizing Management Reviews**
 - **Internal and External audits**
- **Ultimately, the benefit is in proportion to the input.**



Implementing the System – 2

- In Sep 2004 the DNV auditors did a pre-audit check.
- The first formal audit was in Oct 2004.
 - This conformed that the system structure was correct.
 - AAL was certified as being compliant – the first firm outside Denmark to achieve this.
- Throughout 2005 AAL used the system to improve energy efficiency.
- In Nov 2005 the auditors returned and certified AAL as remaining compliant.
- The next audit is scheduled for Feb 2007.

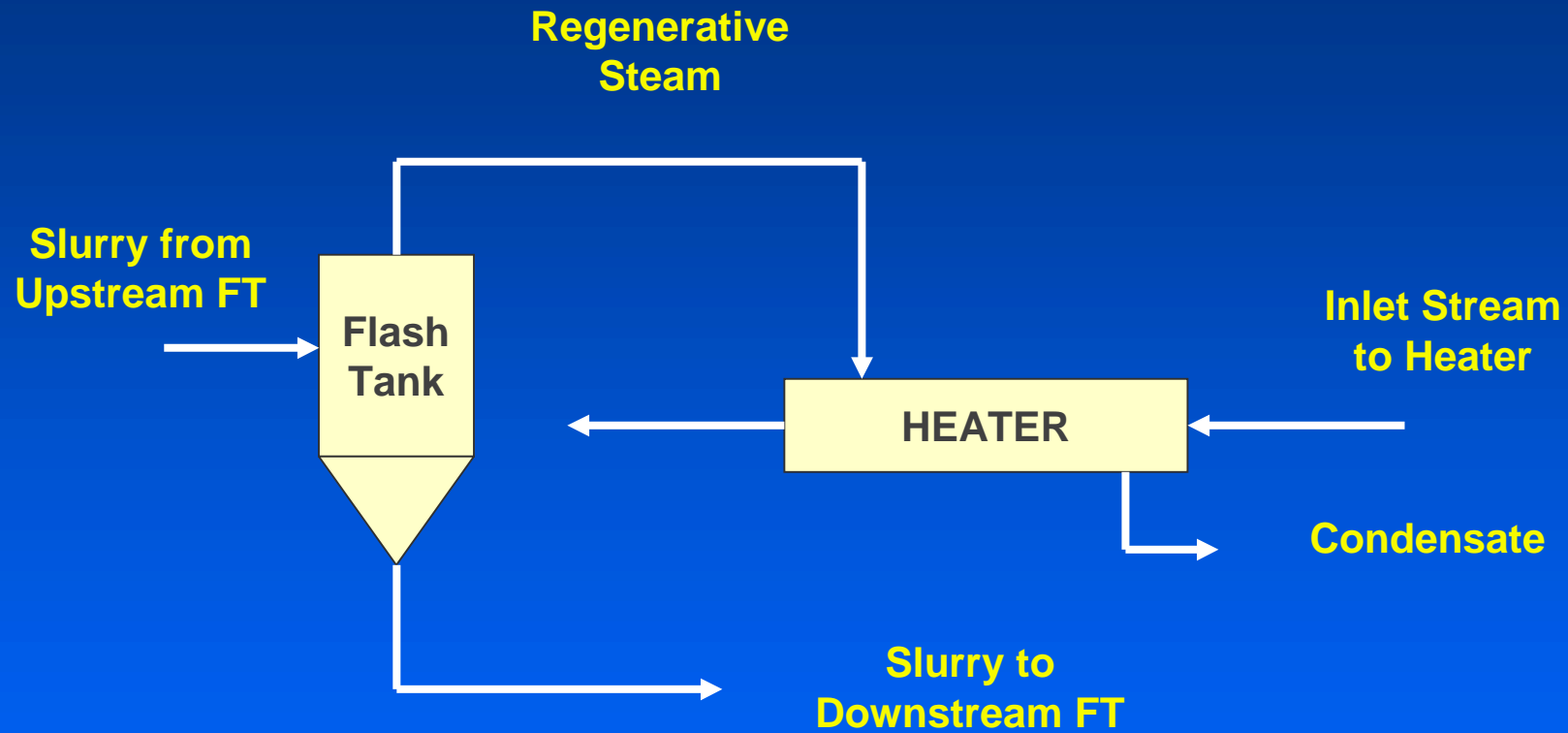


Getting Benefits from the System

- The most significant benefits came in heat recovery for boiler feed water and spent liquor heating.
- The key in 2005 was to set challenging targets.
- The targets were based on the original equipment design, adjusted to account for current production.
- The investigation concentrated on two aspects:
 - Temperature measurements identified flooded heaters
 - Pressure measurements identified steam line restrictions
- This approach resulted in significant benefits
 - Problems with flooded heaters eliminated
 - The cause of poor feed water heater performance was identified and an action plan implemented
 - The cause of poor liquor heater performance was identified and an action plan implemented



Regenerative Heat Recovery





Conclusions from Scaling Issues

- For several years after start-up AAL de-scaled the regenerative steam lines at each FT turnaround.
- However, the amount of scale removed was too little to make a measurable impact on performance.
- Because of the cost of de-scaling we abandoned the practice in the early 1990s.
- This allowed enough scale to deposit over time to have a significant impact on performance.
- The mistake was not the abandonment of the de-scaling but rather the failure to set suitable criteria to determine when we should resume the practice.



Impact on Other Areas

- The cause of low bauxite slurry temperature was identified more rapidly and a solution implemented.
- A non-conformance on low lime temp brought a simple solution that might otherwise not have been found. Further investigation revealed a simple method of increasing temp.
- Various problems with power measurement were identified and resolved.
- Evaporator steam economy is now accepted as a good indication of unit performance.
- A non-conformance on high power usage in the boilerhouse identified excessive air usage as the problem. The investigation found that a 500 kW compressor that should have been on standby was continuously online.



Lessons for Other Plants – 1

- **Implementation**
 - **Setting up an effective system requires a lot of effort.**
 - **In practice it will require one experienced individual to work full time on it for 6-12 months.**
 - **However, if you already have a system such as ISO 9001 or ISO 14001 the workload is significantly reduced.**
- **Management Commitment**
 - **Full commitment from the Top Management is an essential prerequisite for success.**
- **Significant Benefits are Achievable**
 - **Plants tend to set targets based on past performance.**
 - **Inefficiencies the creep in are thereby embedded.**
 - **Project design often starts from this basis and this exacerbates the situation.**



Lessons for Other Plants - 2

- The system will deliver benefits if you set realistic targets and follow up conscientiously whenever non-conformances occur.
- You must take care in setting targets
 - Adopt a “back to basics” approach: refer to the design conditions for heaters pumps etc.
 - Don’t use recent performance as a guideline – it includes any inefficiencies that may have crept into the process.
- Simple measurements will often identify problems
 - Heat transfer coefficients etc are fine as overall indicators but generally don’t pinpoint the problem.
 - Pressure drop is a key issue in steam systems.
 - Temperature can indicate flooded heaters etc.
 - A simple spreadsheet based on nominal motor size and estimated running hours gives a lot of information.
- Effective follow-up is the final step – you will need the full commitment of the Management to achieve this.



Energy MAP

- Last week SEI launched its web based tool for energy management, Energy MAP
 - Available at www.sei.ie/energymap
- This is aimed primarily at the SME sector but larger firms will also find it useful as a starting point.
- The general principles are very similar to those of the formal standards.
- The difference is that it is up to the individual firms to take action – the system is not audited.



Summary

- **An Energy Management Systems can deliver significant benefits by reducing energy usage.**
- **Any such system must have the active support of the Management Team, who must receive regular updates on the progress of the system.**
- **The key to success is to set challenging but realistic targets and use non-conformance reports to identify how to achieve the targets.**
- **To be effective, the system requires a significant input of people's time, both in set-up phase and in full implementation.**
- **The results will match the input!**



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Energy Policy

- The Energy Policy is the core of the system and ultimately drives the other aspects.
- The standard states that “top management shall establish and maintain the energy policy of the organization”.
- An energy policy should include the following:
 - Identify the processes that influence energy efficiency
 - Commit to continual improvement in energy efficiency
 - Provide a framework to set and assess targets
 - Comply with relevant legislation
 - Identify any requirements to which you subscribe
 - Must be documented and communicated to all employees
 - Must be available to the public



Planning

- **The standard requires an Initial Energy Review which must be updated regularly.**
- **These reviews identify the main energy aspects and what steps are being taken to improve efficiency.**
- **The key to effective energy management is to set targets that are realistic but challenging.**
- **An Energy Management Program shows how these targets are to be achieved. This must identify the projects to be implemented, their expected impact on energy usage, who is responsible, and the project timescale.**
- **AAL compiled an Energy Manual to give an overview of the system and link its elements.**



Implementation & Operation

- This covers day to day plant operation as well as issues such as training, communication, and document control.
- Operation & Maintenance
 - We have procedures for operation and maintenance of equipment having a significant energy consumption
- Energy Conscious Design Activities
 - We must consider how all projects and process modifications affect energy efficiency.
- Energy Conscious Purchasing
 - We must consider energy efficiency in purchasing equipment and materials.



Checking & Corrective Action

- **Monitoring & Measurement**
 - **Having set targets it is essential to track performance against them. AAL tracks performance monthly.**
- **Non-conformances & Corrective Action**
 - **A non-conformance occurs if a monthly averages is adverse by more than an allowable deviation.**
 - **Performance is reviewed at monthly Energy Reviews.**
 - **Non-conformance reports must identify the cause of the problem and recommend action to prevent recurrence.**
- **Audits**
 - **Internal audits track performance each quarter.**
 - **An external audit is done each year to ensure that we are following the DS 2403 requirements correctly.**



Management Review

- **The standard requires that top management review the performance of the system and the plant.**
- **A quarterly review is held which updates the Management team on all aspect relating to energy efficiency.**
- **The Q4 review discusses energy related targets for the following year.**
- **The Q1 review assesses performance against for the previous year and also looks at how the Energy Management System contributed to improving energy efficiency.**



Energy Conscious Purchase/Design

- The standard requires that energy efficiency is integrated into our purchasing & design systems.
- At the scope stage the Project Engineer must identify the likely impact on energy.
- If the project installs a motor in excess of 55 kW a Technical Assessment is required.
- The Technical Assessment has 2 elements:
 - Justification of the requirement for using this size of motor and consideration of alternatives.
 - Justification of the selected motor over alternatives.
- A Single Report covers both aspects.
- A Purchase Order cannot be issued unless the Technical Evaluation is completed and signed.