

ALTERNATIVE METHODOLOGIES SPECIAL WORKING GROUP

# Case Study: Connacht Gold

## Overall Equipment Effectiveness Improves Energy Efficiency Connacht Gold, Shannonside Plant, Co. Roscommon

### Connacht Gold Mines OEE Value

Connacht Gold signed up to Sustainable Energy Ireland’s Energy Agreements programme as part of its corporate policy to reduce energy consumption and CO<sub>2</sub> emissions, while simultaneously improving its operational energy efficiency.

Its decision to pursue certification to the IS393 standard has directed attention to the Alternative Methodologies Special Working Group, one of four SWG initiatives in 2008, each designed to address significant energy users in large industry and to apply methodologies that can greatly influence long-term energy performance.

Nine companies are taking part in the Alternative Methodologies Special Working Group. It was established to demonstrate the viability and strategic benefits of integrating improvement methodologies, traditionally used in Quality and Operations Management into the Energy Management Programme. The methodologies include Lean Enterprise, 6-Sigma, Lean-Sigma & Total Quality Management (TQM), as well as the multitude of derivative tools that make up each of these approaches.

Through the group, Connacht Gold was selected as a suitable candidate for an Overall Equipment Effectiveness (OEE) project. This methodology is well suited for application to the manufacturing processes at its Shannonside facility.

#### KNOWING YOUR UNKNOWNNS

OEE is a methodology for monitoring and improving the effectiveness of a manufacturing system. It provides an overall framework for measuring production efficiency. It is an analytical process based on data collection and interpretation.

Connacht Gold initiated an OEE project after identifying its manufacturing operations as particularly suited for this methodology. It allowed them to determine bottlenecks and ascertain if processes contain excess capacity, which inevitably causes unnecessary wastage.

The Shannonside plant takes in around 1.5 million to 2 million gallons of unprocessed whole milk per week during the peak season. This milk is processed into a number of products. Monitoring plant performance is mainly performed based on product throughput. With annual energy consumption in excess of 100GWh, it was envisaged that introducing OEE to the site would produce tangible savings and operational improvements.

Connacht Gold has recognised that, to increase production efficiency and overall plant productivity, steps must be taken towards using alternative methods in analysing its activities. This decision was focused on developing metrics to provide consistent means of measuring and quantifying effectiveness and efficiency. Two of the manufacturing

processes at Shannonside were considered for this project: the milk separation/pasteurisation and evaporation processes. Both processes were investigated under the remit of the OEE methodology.

#### DEFINITION AND DIRECTION

The OEE metrics were applied to the separators and evaporators. These metrics allow efficiency and effectiveness to be measured in terms of three pillars: availability, performance and quality. Operator logbooks were interrogated to extract the information necessary for OEE calculation. It was decided that this route would yield the most beneficial information with the least intrusion on the production process. Collection of data was critical in gaining an understanding of the systems and processes in question. Alterations were made to the monitoring and interpretation of production data to ensure that the most beneficial data sets are gathered on a regular basis.

Operating times and equipment/service supply status were the main parameters scrutinised. Analysis of the two processes in terms of these three metrics allowed calculation of the OEE figure. This is a combination of the three metrics and allows comparison to world-class OEE values.

The project team initially had to determine the metrics associated with both processes.

- **Availability rate** is determined by comparing actual output to theoretical output while taking into account scheduled downtime such as Cleaning in Place (CIP) and planned maintenance. The availability rates for both processes were seen to fluctuate according to production intensity.

$$\text{AVAILABILITY RATE} = \frac{\text{OPERATING TIME}}{\text{TOTAL AVAILABLE TIME} - \text{SCHEDULED DOWNTIME}}$$

- **Quality rate** is defined as the amount of ‘good’ product produced compared to the actual product output. Due to the regulatory nature of the processes carried out at Shannonside, neither the separation nor evaporation processes lend themselves to low-quality rates. Therefore the quality rate is always 100% during production.

$$\text{QUALITY RATE} = \frac{\text{(TOTAL PRODUCTION} - \text{SCRAP)}}{\text{TOTAL PRODUCTION}}$$

- **Performance rate** is the actual output compared to the theoretical output of the process. The output of each process was analysed over the production period and compared against the design throughput to gain an average daily throughput.

The performance rates for the separator process were found to vary throughout the production period, while the evaporator was seen to operate near peak performance at all times.

$$\text{PERFORMANCE RATE} = \frac{\text{ACTUAL PLANT PERFORMANCE}}{\text{DESIGN PLANT PERFORMANCE}}$$

Calculation of Overall Equipment Efficiency is found by combining the three metrics. It allows direct comparison with the world-class OEE and industry benchmarks.

**OEE = AVAILABILITY RATE x QUALITY RATE x PERFORMANCE RATE**

## Knowledge promotes action

Once the three OEE calculations were complete, the process OEE figures were calculated. Average values over the production period were calculated, giving a starting point for interrogations and analysis. It was assumed before initiation of the project that the equipment was being operated at or near peak efficiencies because of past initiatives and improvements.

Evaluation of the OEE rates identified areas of potential for improvement. The energy owners and OEE working group advisor were now able to launch investigations into these figures and identify possible sources of inefficiencies.

The separators presented opportunities to improve the operation of the process which will result in a higher OEE value. Investigation of the separator OEE rates and logs identified a misconception in run-in times which led to unnecessary non-production operation. It was ascertained that a minimum run-in period of 24 minutes is realistically achievable. Energy consumption associated with an unnecessary run-in period will be negated through reviewing the start-up procedures.

The working group advisor assessed the performance rates associated with the process and determined that a bottleneck exists upstream of the separator bank which limits production at peak times. Proposals for reviewing the piping regime at this stage were put forward for consideration. Variations in CIP operating times were also seen to occur across the production period. Recommendations were made in relation to optimising the CIP start-up and application to the process.

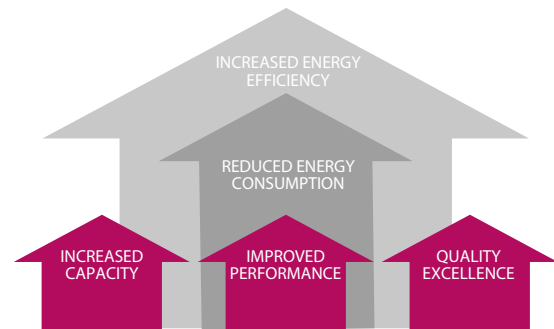
In the case of the evaporators, it was found that availability rate was the driving factor due to the high values of quality and performance. This focused investigations towards linking operation with milk throughput. Non-productive operating time was identified as the key inefficiency for the evaporators. The decision was made to take steps to improve the availability rate by eliminating non-productive operation and steam supply when no product throughput occurs.

## OEE leads to valuable insights

OEE indicators offer a valuable and easily understood metric to measure performance. The project team at Connacht Gold were quick to grasp the concept of the indicators and harness the potential for using the methodology in tandem with product requirements.

The outcomes of this project make it clear that the issues identified in the initial OEE calculation stage would not have presented themselves in the operation of the plant unless OEE had been implemented. While past initiatives had improved the operation of both processes, it was found that the alternative approach of OEE to the existing systems identified *significant* opportunities for improvement. These would be extremely difficult to realise using traditional engineering approaches.

The evidence indicates that OEE is an effective tool in assessing and improving the operation of equipment. It provided Connacht Gold with valuable insights into the performance of its equipment and how energy efficiency can be improved.



A number of opportunities for integrating the indicators into the existing MIS system presented themselves. This would further ingrain the onsite monitoring and targeting of energy consumption. It is the next step in developing a multi-faceted energy-management system that integrates an array of methodologies and systems. Developing the OEE into a performance indicator for future use is under consideration for implementation.

The barriers encountered and lessons learned have allowed an existing environment of refinement and streamlining to be developed further, in both data collection and energy management. Energy-saving opportunities originating from the project presented tangible savings and realistic objectives.

## Main lesson learned

The main lesson learned is that it is the responsibility of the energy owner to ensure that accurate, useful data is continuously collected as part of the production process.

The survival of the OEE methodology onsite hinges on Standard Operating Procedure (SOP) integration and training to ensure awareness and success.

Carrying the methodology forward can be achieved through applying established techniques and approaches during and after the project is handed over for onsite management.