OEE 101

Introduction to Overall Equipment Effectiveness

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- Calculating OEE
- Putting OEE to work

Overview

How efficient is my process?

In today's economy, you're expected to continuously improve your Return On Total Capital. And as capital to build new, more efficient plants becomes more difficult to obtain, you often have to meet growing production demands with current equipment and facilities — while continuing to cut costs.

There are several ways you can optimize your processes to improve profitability. But it can be difficult to understand the overall effectiveness of a complex operation so you can decide where to make improvements. That's especially true when the process involves multiple pieces of equipment that affect each other's effectiveness.

One metric that can help you meet this challenge is **Overall Equipment Effectiveness**, or **OEE**. OEE measures the health and reliability of a process relative to the desired operating level. It can show you how well you're utilizing resources, including equipment and labor, to satisfy customers by matching product quality and supply requirements.

This course provides a brief introduction to key concepts of OEE. The four courses that follow provide more detail on individual components of OEE, as well as sample calculations.

Hint: As you go through the topics in this course, watch for answers to these questions:

- *What are the three factors used in calculating OEE?*
- *Which groups in a plant can use the results of OEE calculations?*

What does OEE measure?

Overall Equipment Effectiveness (OEE) measures total performance by relating the availability of a process to its productivity and output quality.

OEE addresses all losses caused by the equipment, including

- not being available when needed because of breakdowns or set-up and adjustment losses
- not running at the optimum rate because of reduced speed or idling and minor stoppage losses
- not producing first-pass A1 quality output because of defects and rework or start-up losses.

OEE was first used by Seiichi Nakajima, the founder of total productive maintenance (TPM), in describing a fundamental measure for tracking production performance. He challenged the complacent view of effectiveness by focusing not simply on keeping equipment running smoothly, but on creating a sense of joint responsibility between operators and maintenance workers to extend and optimize overall equipment performance.

First applied in discrete manufacturing, OEE is now used throughout process, batch, and discrete production plants.

Calculating OEE

OEE is calculated by multiplying three factors: availability, productivity, and quality.

% OEE = (% Availability) * (% Productivity) * (% Quality)

The values used can reflect an entire processing plant, a process line, or an individual piece of equipment.

For individual equipment, the performance of the equipment is compared to earlier values for the same equipment or to similar pieces of equipment. Changes in OEE or its elements are tracked and trended over time.

OEE for a process line treats the entire line as a single unit, regardless of how much equipment it includes. For multiple-recipe or batch operations, OEE is calculated for each product produced.

Like a process line, a process plant performs as a whole, and OEE is therefore calculated for the entire plant as a unit.

Putting OEE to work

The OEE calculation provides focus and simplicity to aid in decision making. It can help you

- Identify areas for improvement
- Assess incremental revenue opportunities
- Benchmark your operation against similar or competitor processes

For example, by tracking the factors that determine OEE, you can determine whether your equipment experienced more downtime (planned or unplanned) than expected, or was running at a slower pace or with minor stops, or produced more defects.

Root cause analysis begins by focusing on the type and extent of loss, not the OEE percentage rating itself. Both Operations and Maintenance should be involved in making improvements — whether reducing unplanned downtime, increasing process productivity, or improving product quality.

Published benchmark values for the factors of OEE are also excellent indicators of a process's competitiveness in the market. For example, when measuring Overall Equipment Effectiveness for the first time, process plants may find they are only achieving around 40%-70% OEE (batch) or 50%-80% (continuous process). International best practice figures are recognized to be +90% (batch) and +95% (continuous process).

World-class Overall Equipment Effectiveneess	
Availability	>90%
Productivity	>95%
Quality	>99%
OEE	**>85%**

Source: Nakajima