Overall Equipment Effectiveness (OEE) Overview
How can we get more output?

Availability

More time

More production

Performance

More speed

More production

Quality

More quality

More production
OEE – Overall Equipment Effectiveness (Efficiency)

What is OEE?

- **OEE** is a single measure which shows how much of a product has actually been produced as a percentage of how much could have been produced.

- It combines all the standard performance measures - including *availability, performance and quality*. It should be thought of as the top measure in a cascade of measures.
OEE – Overall Equipment Effectiveness (Efficiency)

Availability Definition

• **Availability** is the time the equipment is scheduled to run divided by the time the equipment is available to run, expressed as a percentage.

\[
\text{Availability} = \frac{(\text{Total available time} - \text{Downtime})}{\text{Total Available time}}
\]

• The goal should be at least **90%**.

(To calculate availability, do not use only maintenance shutdowns, use all downtime.)
OEE – Overall Equipment Effectiveness (Efficiency)

Net & Gross Availability Definition(2)

- Some companies don't like to use the total time available to run, since the equipment might be capable of running on a 7 x 24 schedule, and they are only running it on a 5 x 24 schedule.

- **Gross Availability** should indicate when there is excess capacity in the equipment, in case it is needed. Knowing about excess capacity might keep a company from purchasing additional equipment and, thereby, needlessly increasing its investment in assets. Doing the latter negatively impacts corporate financial indicators such as return on net assets. It is best to understand the true availability of the equipment, rather than hiding it behind spurious calculations.

- **Net Availability** use the scheduled (excluding external causes) run time divided by the actual run time, realizing that the equipment has unused capacity. This allows personnel to concentrate on maximizing the equipment performance during the scheduled time, always realizing that there is additional capacity if it is ever needed.
Performance Efficiency Definition

• **Performance efficiency** is the rate the equipment is operating divided by the design rate of operation (Best demonstrated practice), expressed as a percentage.

  \[
  \text{Performance} = \frac{\text{Actual Machine Rate}}{\text{Best Demonstrated Practice}}
  \]

• The goal here should be at least 95%. 

OEE – Overall Equipment Effectiveness (Efficiency)
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Performance Efficiency – common mistakes

• First, some companies will re-engineer the equipment or otherwise raise performance standards and not reflect this by changing the design rate of operation. This gives them a performance efficiency of more than 100%, which is misleading and subsequently could hide other areas of weakness in the OEE.

• The second mistake consists of not really understanding the design specifications of the equipment. This often is a problem with older equipment. No one remembers what the design performance specifications originally were. So, the equipment performance is accepted as the level at which someone remembers what it "used to do." Typically, this level is far below its design performance level and, again, the OEE calculation is affected. The lack of data hides the true potential of the equipment.
OEE – Overall Equipment Effectiveness (Efficiency)

Quality Rate Definition

- **Quality rate** is the product produced minus the off-spec product divided by the product produced.

\[
\text{Quality rate} = \frac{\text{Total Production} - \text{out of specs}}{\text{Total Production}}
\]

- This percentage should be above **99%**.
- The most common mistake in calculating quality rate centres around defining what constitutes a defect. A defective item is one that is not first-pass quality. In other words, any item requiring rework, re-filtering, re-packaging, or re-formatting is not first-pass quality.
OEE – Overall Equipment Effectiveness (Efficiency)

Putting all together

• A sample calculation of equipment efficiency might look like this:

  Availability = 85%,
  Performance efficiency = 90%,
  Quality rate = 95%.

\[
\text{OEE} = 0.85 \times 0.90 \times 0.95 = 72.6\% 
\]
OEE overview

What are Production Most Common Losses?

Overall Equipment Efficiency = Availability \times Performance \times Quality

- Breakdowns
- Setups
- Adjustments
- Lunch breaks
- Other

- Minor stoppages
- Idling
- Material differences
- Defects and rework
- Startup and yield loss
OEE – Overall Equipment Effectiveness

Quick review

6 big losses

(1) major breakdowns, stoppages, maintenance stoppages (>1min), lack of material

(2) set ups, changeovers & adjustments

(3) idling & minor stoppages (<1min)

(4) rate losses (including ramp up)

(5) quality defects in process, rework

(6) start up losses

AVAILABILITY
(time available – downtime)/time available

PERFORMANCE
(actual output / max output in time running)

QUALITY
((actual output – defects)/actual outputs)

World class manufacturers = or > 85%  OEE
OEE – Overall Equipment Effectiveness (Efficiency)
Chart Example
Stillstandzeiten 03.03. bis 25.05.03

Schneidmaschinen Gesamt

Bereich Schneidmaschinen
Werk: LAS

Stillstände

Monday, 26. March 2003
### Establishing the maximum machine rate (BDP*)

*Best Demonstrated Practice*

#### Key performance criteria

- What is the manufacturers rated maximum speed of the bottleneck machine (per product if possible)?
- What is the accepted maximum / target?
- What is best demonstrated performance over the last 3 months / 6 months (running hours) per product?

#### If there are big discrepancies

- Why are there differences between accepted maximum / best demonstrated and manufacturers maximum?
- What are the BDP differences between the main products selected?
- Are the issues solvable in the short / medium term or do they rely on major capital expenditure to relieve physical or technical constraints?

#### Result

Agreed maximum performance rate for machine / asset

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**The maximum rate will be**

- **Probably** higher than planned rate currently used
- **Possibly** higher than best reported performance (as it may includes minor stops)
- **May** differ depending of the discrepancies