Welcome to the OEE 2.0 Module! In this section, we will walk through some of the help documentation to familiarize ourselves with the OEE 2.0 module framework and features. Then we will continue building out the Nuts Unlimited project by adding a packaging line for the nuts, scheduling operations on it and capturing OEE and production data.

Help Manual - What Is OEE?

OEE stands for Overall Equipment Effectiveness and is used to monitor manufacturing effectiveness. The resulting OEE number, represented as a percentage, is generic and allows comparisons across differing industries.

Efficiency is not simply the ratio of machine run time to scheduled time. For example, look at the situation of a manufacturing line or process running at half speed with 0 downtime. This is truly only 50% efficient. Or what if 10% of the product being produced does not meet the minimum quality and must be reworked. This equates to 90% efficiency, which does not take into account the effort to rework or the losses of raw material.

There are three factors, all represented as a percentage, taken into consideration for the final OEE result:

**OEE Availability**

OEE Availability is the ratio between the actual runtime and planned production time. The planned production time does not included breaks, lunches and other pre-arranged time a production line or process may be down.

\[
\text{Availability} = \frac{\text{actual runtime}}{\text{production time}}
\]

**Example:** If a line is run for one 8 hour shift with two 15 minute breaks and one 30 minute lunch, then the planned production time is 7 hours (determined from 8 hours - 15 minute break - 15 minute break - 30 minute lunch). If during the production run, there are 25 downtime events totaling to 45 minutes of downtime, then the run time is 6 hours and 15 minutes (derived from 7 hours of scheduled time - 45 minutes). The OEE Availability of 89% is calculated by actual run time divided by scheduled run time, or 6 hours 15 minutes divided by 7 hours.
OEE Performance

OEE Performance is the ratio between the actual number of units started (not the number that have been produced) and the number of units that theoretically can be processed based on the standard rate. The standard rate is the rate that the equipment is designed for. Performance is not based on the number of units produced, but, on what the line was designed to process over a given period of time.

\[
\text{Performance} = \frac{\text{actual number of units started}}{(\text{standard rate} \times \text{actual runtime})}
\]

**Example:** If a work cell is designed to process 10 units per minute we can calculate the theoretical amount of units it can process in a given amount of time. Using the 6 hours and 15 minutes of actual run time from the above example, a total of 3750 units would be processed (or started). Calculated by taking 6 hours and 15 minutes (375 minutes) times 10 units per minute. If the actual number of units processed is 3000, then the OEE Performance is 80% (calculated by 3000 / 3750).

Note that OEE Performance does NOT take into account rejected parts. Those will be accounted for in the OEE Quality number (see below).

OEE Quality

OEE Quality is the ratio between good units produced and the total units that were started.

\[
\text{Quality} = \frac{\text{good units produced}}{\text{actual number of units started}}
\]

**Example:** Taking the number of units produced from above of 3000, if 200 units were rejected at the quality inspection station, then 2800 good units are produced. The OEE Quality is 93% calculated from 2800 divided by 3000.

OEE

The final calculation is:

\[
\text{OEE} = \text{Availability} \times \text{Performance} \times \text{Quality}
\]

**Example:** Using all the numbers from above, 89% x 80% x 93% = 66%.

This may seem like a low number but it is important to keep in mind that the OEE is not to be compared to 100%. The OEE result from this production run is compared to other production runs; however, using Sepasoft's OEE Downtime and Scheduling module allows much more than just comparing OEE results between production runs. It allows you to compare OEE results between operators, viscosity, mechanics, products, raw material vendors and any user defined factor you can think of.

OEE is a well-established performance metric that takes into account Equipment Losses usually broken into the categories of Availability Loss, Performance Loss, and Quality Loss. It measures performance with respect to Planned Production Time.

Applying OEE

OEE scores may be compared across divisions, sites, assets, or products and can be used to compare production lines that produce different products and plants of different sizes in a meaningful way. Even small increments in OEE can boost the efficiency of a manufacturing plant and, when combined with analytics such as SPC, will result in high performance.
Six Big Losses

To be able to better determine what is contributing to the greatest loss and therefore which areas should be targeted to improve performance, these categories (Availability, Performance and Quality) have been subdivided further into what is known as the ‘Six Big Losses’ to OEE.

These are categorized as follows:

<table>
<thead>
<tr>
<th>Availability</th>
<th>Performance</th>
<th>Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planned Downtime</td>
<td>Minor Stops</td>
<td>Production Rejects</td>
</tr>
<tr>
<td>Breakdowns</td>
<td>Speed Loss</td>
<td>Rejects on Start up</td>
</tr>
</tbody>
</table>

What Is TEEP?

Where OEE represents the equipment efficiency during a production run, Total Effective Equipment Performance (TEEP) represents the equipment utilization against a calendar period. For example, 365 days a year, or 24 hours a day. It can also be thought of as asset utilization and will help in the decision making process of purchasing new equipment.

The calculation for $TEEP = Loading \times OEE$.

Loading

If a production line is scheduled for 5 days, 24 hours each day, over a 7 day period, then the Loading is 71% calculated by \( \frac{5 \times 24}{7 \times 24} \).

Example: During the same time period that was used to calculate the Loading, we will make up an OEE result of 82%. The actual OEE value used must be the OEE result for all production runs of the same calendar time period that were used to calculate the Loading value. TEEP is 71% \times 82% = 58%

Downtime Tracking

OEE provides a method to monitor the efficiency of your production facility and tracking downtime provides information of where to focus efforts to improve efficiency. Think of it this way, if your production line typically runs at 69% OEE, what actions do you take to increase it? OEE alone doesn’t tell you what factors are preventing your efficiency from being higher than 69%.

In the simplest form, downtime tracking will identify the production cell (machine or process) that is preventing your production line from producing product. This can be done manually, but history has shown that manually collected downtime information is inaccurate. In addition, if it is manually collected on paper log sheets, then someone has to further enter the details into a program or spreadsheet to be able to organize it into actionable information used to focus your efforts to make improvements. Putting recording inaccuracies, extra labor and typos aside, by the time the information is available, it is old.

Tracking downtime automatically or semi-automatically solves the issues associated with manual tracking. In a perfect world, monitoring all downtime reasons automatically is the ideal solution. But in the real world, this can be difficult, pricey, or just not practical. For this reason, it is important for downtime tracking software to support an automatic reason detection with a manual override.

For example: if an operator presses the stop button because they see a bottle laying on its side feeding into a filler, then the only automatic reason that can be detected is “operator pressed stop button”. Now the operator should be able to override this reason with more specific information.

Once the period of time that production cells were not producing product and the associated reasons are recorded, analyzing the summary of the reasons will identify where effort should be focused to improve efficiency.