

White Paper

# How to Reduce Downtime & Raise OEE

Learn what 5 questions you should be asking and how to get the answers to critical issues



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# 5 Questions

## You Must Answer to Decrease Downtime and Improve OEE

In today's economy the manufacturing industry is more competitive now than ever. You have to get every advantage you can to keep up with the competition. If you are already the leader amongst your competition, you must continually improve to stay ahead of the pack.

### To Stay Ahead, You Need to Measure OEE

One crucial area that every plant can improve on is efficiency, and one of the best measures of efficiency is OEE (overall equipment effectiveness). If you don't know your OEE, then you don't truly know how efficient you are. More importantly, you don't know how efficient you *could be*.

There is a lot that goes on at a manufacturing plant every day. Employees come in and out and work on the plant floor, machines need to be maintained, and production quotas need to be met. With so much happening all the time, it can be hard to see how things are all working together.

More specifically, it can be very difficult to determine if everything is working together efficiently, and what can be improved to increase the plant's overall productivity.

There is so much data to consider when trying to determine a plant's efficiency; it can be a daunting task. This is where OEE can help.

OEE, the overall equipment effectiveness, is a measure of the efficiency and effectiveness of the manufacturing processes (i.e. machines, cells, assembly lines, processes, etc.). OEE is a simple and powerful metric for tracking and improving a plant's efficiency.

OEE is calculated by *multiplying* each of these factors:

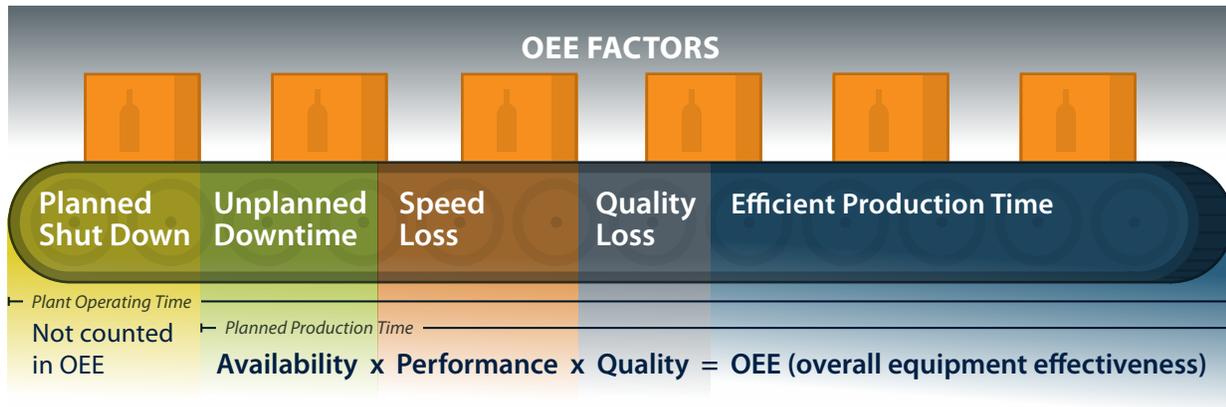
**Availability x Performance x Quality**

OEE works by breaking down the reasons for productivity losses into three main factors: Availability, Performance and Quality.

**Availability** - This factor measures productivity losses resulting from downtime. Downtime is any event that stops planned production for a period of time. Availability is determined by dividing actual production time by planned production time.

**Performance** - This is a factor that measures a loss in productivity due to slow cycles. Slow cycles occur when the manufacturing process is running at less than optimum speed. When you divide the current production rate by the ideal production rate, the result is the performance ratio.

**Quality** - This factor measures losses from manufacturing subpar products – those that do not meet minimum requirements. The Quality ratio is calculated by dividing the number of good units by total units started.



When you combine all these factors together you get the OEE. The OEE is calculated by multiplying each of these factors (Availability x Performance x Quality).

An OEE of 85% is considered a world-class performance but it can vary by industry. Achieving an OEE like this would require a plant to maintain around 90% Availability, 95% Performance, and 99.9% Quality. Considering that most manufactures average an OEE score of around 60%, improving to a world-class OEE rating would mean a huge improvement in productivity.

### Fix Your Equipment Availability Factor by Addressing Downtime

Determining your plant's availability is a huge part of calculating your OEE, and the biggest factor that affects availability is downtime. There are two types of downtime that affect OEE: planned downtime, and unplanned downtime.

**Planned Downtime** – Calculating OEE starts with determining your plant operating time. Plant operating time is the total amount of time that the plant is available for operation.

Planned downtime is operating time lost due to planned events. These are events where you have no intention of keeping the plant operational, such as breaks, scheduled maintenance, and holidays.

After subtracting planned downtime from plant operating time, the remaining time is called planned production time. This planned production time is the benchmark that unplanned downtime events are measured against.

**Unplanned Downtime** – This measures the loss of planned production time due to unplanned events

that cause downtime. These events can occur for a variety of reasons – operator error, mechanical problems, and lack of oversight are some of the biggest causes.

Each of these events results in time where operations are shut down; add all that time together and you get the total amount of unplanned downtime. When you divide the total unplanned downtime by the planned production time the result is the plant's availability.

**Unplanned downtime occurrences are the only events that affect your OEE in a negative way, so from here on out all references to unplanned downtime will simply be referred as "downtime".**

Downtime is one of the biggest culprits for bringing down a plant's OEE because it can take a huge chunk of time out of your planned production time. It is also one of the factors that is the hardest to fix, because there can be so many things that could be affecting it.

Whether the reasons for downtime are large or small, they can be improved or fixed altogether; but first you have to find them.

Tom Hechtman of Inductive Automation has been working with MES (manufacturing execution systems) for some time. He has worked together with manufacturers around the country to increase efficiency in their plants.

He explains how to take the first step toward improving OEE: "The first thing you have to do in order to eliminate downtime is to find it, and to find it you have to start asking questions."

Here are five question that Hechtman says you must answer to decrease your plant's downtime and raise your OEE.



# #1

## How are you currently tracking your OEE and downtime?

If your answer to this question is that you aren't tracking OEE or downtime at all, then chances are you are losing money every day.

The question is not whether or not you have downtime occurring – every plant does – the question is *how much* do you have, and how can you decrease it and improve OEE?

# Question #1 - How are you currently tracking your OEE and downtime?

Most production plants have some kind of method for tracking production data and downtime events. The larger the plant, the more essential tracking OEE and downtime becomes. The two main ways that OEE and downtime are tracked is manually or through MES (manufacturing execution executive system) software.

## Two Ways to Track OEE



**Manual Tracking** – This method of tracking production and downtime is widely used, but is rapidly shrinking as the quality and accessibility of MES software improves.

Tracking production and downtime information by hand relies heavily upon the expertise and diligence of your staff, particularly the line operators. As downtime events occur, line operators are in charge of recording the events and how they were resolved.

Later, this information is entered into spreadsheets, which are made available to management for review. At that point, management can make decisions on how to resolve issues that are causing downtime.

The benefit of this tracking method is that it uses the expertise of plant employees to diagnose problems. If it's streamlined to work effectively, problems can be discovered and resolved; but at best they will not be fixed for days, if not weeks or months after they happen. This method is also very dependent on your operators to accurately record problems. If they aren't clear and concise when entering data, the tracking information could be rendered useless.

Most companies that employ this method do so to save money or because they lack a viable automated solution. However, the reality is that most of the time, the costs saved by not purchasing and installing software is negated by the cost of undiscovered and unresolved downtime.

**MES Software** – Manufacturing execution system software is designed to bridge the communication gap between the plant floor and the management and executive levels. There are some MES software packages that specifically track and analyze OEE and downtime. Some of these packages are stand-alone applications and some can be fully integrated with current SCADA (supervisory control and data acquisition) software.

There are many advantages to a fully SCADA integrated MES downtime tracking application. The biggest advantage is speed. Data can be captured, collected, and stored automatically. This means that line operators don't spend time manually tracking and reporting production and downtime events; the automated system does that for them.

Another advantage to MES software is that the information is instantly available to staff as events happen. This allows operators, maintenance techs and production supervisors to fix efficiency and downtime issues as they happen, instead of weeks later.

Accuracy is another benefit. A good system can track exactly when, where, and why a downtime event occurs, all without relying too heavily on the operator for information. This kind of accuracy is crucial in quickly and effectively troubleshooting downtime problems.

## Choose the Right Tool for the Job

No matter how much a company wants to do the right thing to correct their downtime issues, without powerful tools the job won't get done. While hard work and dedication are a requirement to meeting any task, the right tool for the job is key to getting it done effectively and efficiently. Make a decision on which tools are right for you, then use that tool to its full potential to increase your plant's OEE.



# #2

## Which plant employees have the greatest effect on your downtime?

There are a lot of employees on a plant floor at any given time, and many of them are doing very different jobs. Understanding which employees are having the greatest impact on your downtime is one of the key factors in running more efficiently.

# Question #2 - Which plant employees have the greatest effect on your downtime?

## Three Employees That Affect Downtime

**Line Operators** – A cell refers to an individual machine or process on a production line. One or more line operators are responsible for every cell on their assigned production line. They work directly with the machines and therefore have a great impact on how those machines are used.

Every decision they make can have a positive or negative effect on downtime. A good line operator can spot problems before they happen, avoiding downtime events. A bad line operator may be inattentive to his line, leaving downtime problems unresolved and unreported.

**Maintenance Technicians** – Depending on the size of your plant there could be hundreds if not thousands of machines running on a daily basis. Machines break down, and when they do it can cause downtime. Maintenance technicians are responsible for the running of the machines on the plant floor.

A good maintenance tech will maintain a regular maintenance schedule for each machine, resulting in less machine-related downtime. An inexperienced tech will only confront problems when they occur. They may fix the immediate problem, but they make no effort to curb downtime in the future.

**Production Supervisor** – With so many things to keep track of on a plant floor, someone has to oversee it all. The production supervisor is in charge of all the production lines. He is critical in resolving issues that are causing downtime across the plant floor.

A good production supervisor will spend his time addressing the issues of the highest priority first, while delegating responsibility for the less important issues. An inexperienced production supervisor will simply run around from problem to problem. By not setting priorities to solve the larger efficiency-related issues, he doesn't make efficient use of his time.

A well-trained staff working toward a common goal is one of your biggest assets in the effort to increase your OEE. To get them all on the same page, train them in decreasing downtime and how it relates to the efficiency of the entire plant. Also, train them in the specific relevance of their role in the process and how they fit into your overall OEE strategy.

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*Keep in mind that those employees who have the greatest potential for causing downtime are also your first line of defense in the battle to improve your OEE.*

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## How to Train Employees for Success

Leverage the wisdom of your more experienced staff. After working on a plant floor for a significant amount of time they will be extremely knowledgeable about all the little quirks each line has. When having them train new employees make it a point that they pass that knowledge on.

Often this kind of information can help in diagnosing possible downtime problems before they even occur. Hechtman reports, "I've been on factory floors before where I've seen experienced line operators start walking to a problem machine before it even breaks down; they just knew what was going to happen."

Singling out certain employees and holding them accountable for the efficiency of an entire plant is not an effective approach to increasing OEE. Keep in mind that those employees who have the greatest potential for causing downtime are also your first line of defense in the battle to improve your OEE.



#3

# Do you know how much downtime is occurring that isn't being reported?

This seems like a trick question. Of course if you knew what downtime wasn't being reported then it wouldn't be unknown any more, and that's the point. If you are unaware of a downtime issue, you won't know how much it's costing you.

## Question #3 - Do you know how much downtime is occurring that isn't being reported?



This point is well illustrated by a couple of stories about manufacturers that Hechtman worked with. Both had recently added MES downtime tracking software, and both used that software to discover just how much they didn't know about their plants.

### Software Reveals Hidden Downtime Issues

**Case Study: Food Processing Plant** – Shortly after they began using their downtime software, a large food processor company began to notice a series of very small downtime events on one of their lines.

A sensor on the line was malfunctioning and as a result the line was stopping for a second or two before the line started again. The event was so small it was unnoticeable, but it was occurring hundreds of times a day, resulting in less production for the line.

Hechtman reports what happened once they found it: "The problem went unnoticed for a long time; they might have never found it without help from their software." Hechtman continues, "Once they found and replaced the faulty sensor they got more production from that line. In fact, they got a full four more pallets of product from that line every day, and that really adds up quickly."

**Case Study: Automotive Plant** – One of the largest and most diversified automotive suppliers in the world had started using MES downtime tracking

software at one of their plants. The software alerted them to a small downtime event occurring in an individual cell on one of their production lines.

Upon inspection, they discovered a pneumatic cylinder that was not functioning properly; causing the cell to operate slower than expected.

Hechtman explains the significance of this discovery: "The interesting thing is that no loss in production actually occurred, and maintenance replaced it the next time the line was scheduled to be down. But, if the cylinder had gone unnoticed until it broke down completely, the entire line would have shut down.

"By fixing the problem before it became a bigger problem they actively prevented a downtime event that would have resulted in reduced production."

### What You Don't Know Will Hurt You

The moral to both of these stories is simple; what you don't know is either hurting you now, or it will come back to bite you in the future.

Both of these companies wanted to correct their downtime issues, but they were unable to reach their full potential until they had all the information they needed. In the fight against downtime your most powerful weapon is information. You simply can't increase your OEE without it and the more you have, the better equipped you will be to improve it.



# #4

## How are you currently analyzing your downtime data?

No matter how much production and downtime information you collect, data without analysis is essentially useless. It's the story behind the numbers that you are looking for, and the only real way to find it is through the power of comparison.

# Question #4 - How are you currently analyzing your downtime data?

## How to Make Comparisons to Find the Right Answers

Analyzing production and downtime data is all about making comparisons. How is one machine running versus another? Which operator isn't keeping up with the production quota the other operators are meeting? Is one of the raw materials on the line causing more downtime than another?

These are all comparison questions, and these are the kind of questions that reveal factors that could be leading to increased efficiencies.

**Comparing Machines** – Comparing machines on a production line, will help identify the machine or machines causing the largest loss in efficiency. If your production environment supports it, you can even compare machines on a production line with the same type on other lines.

Comparing production lines that run at different production rates can be difficult, but OEE isolates the differences so that they can be compared on an apples-to-apples basis.

**Comparing People** – Sometimes downtime can be caused by a mechanical problem, and other times it's the operator. If you rotate different operators onto that line and they all experience a drop in production, then the source of the downtime is most likely a mechanical problem.

However, if an operator rotates to another line and the production of that line decreases as well, then most likely the operator is causing downtime on whichever line they are on. Management may need to intervene in this case to better train the employee or move them to a location that's better suited for them.

**Comparing Materials** – In any production plant, good raw materials are needed to produce a quality product. Raw material vendors can be compared to determine which raw material runs through production lines more efficiently.

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*Each comparison, no matter how big or small, could lead you to finding and resolving issues that are hurting your efficiency.*

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## Effective Analysis is Dependent on Visual Presentation

These comparisons are some of the more common ones to look for, but there is almost no limit to the amount of comparisons you could make with your OEE. Each comparison, no matter how big or small, could lead you to finding and resolving an issue that is hurting your efficiency.

The only real limits are the ability to collect data and the power with which that data is presented. The more you have, the more comparisons you can make, and the more avenues you have for finding potential issues. Be cautious that you don't get so carried away with an overwhelming amount of data that your comparisons become meaningless.

The methods you use to visualize the data also have an effect on your understanding and ability to diagnose downtime and its causes.

If you're trying to make comparisons on a spreadsheet or in your head, you are severely limiting what you can see. MES downtime tracking software can give you powerful tools to display data via charts and graphs. With it, users have the ability to easily see discrepancies and take action to resolve them.



# #5

## How confident are you when making decisions about increasing efficiency?

Once causes that reduce efficiency have been identified, then it's time to go about resolving them. This means it's time to make a choice. If your plant has the time, money, and man power to resolve all the efficiency-reducing causes, that's great. However, most companies must allocate their resources wisely, which means you will have to make a choice as to which causes to focus on first.

# Question #5 - How confident are you when making decisions about increasing efficiency?

When making the decision on which issues to focus your resources on, you'll want to be confident in your choice. If you lack confidence in your decision, then you are most likely missing one of three things: information, priorities, and a plan of action.

## Tools for Success

**Information** – As mentioned before, having easy access to the information about what is causing downtime on the plant floor is absolutely essential.

Not having a complete knowledge of OEE and downtime data for your plant is equivalent to driving in the dark. You will either move along slowly, not hitting anything but never arriving at your destination. Or, you move along quickly, making good time until you run into a wall.

Without enough information it is impossible to be confident in your decisions to reduce downtime and increase efficiencies.

**Priorities** – Through the power of comparisons you can assign your efficiency-reducing causes a priority. The causes that are costing you the most money should be given the highest priority. Causes that are the least damaging to your bottom line should go to the back of the line.

One thing to keep in mind is the frequency of the occurrence; small occurrences might not be costing a lot of downtime by themselves, but they can have a drastic cumulative effect. Knowing which problem to tackle first will give you confidence in your decision.

**Plan of Action** – If you have the information you need, and have your efficiency-reducing causes prioritized, you are now ready to form a plan of action. A plan of action is your strategy to increase efficiencies. It consists of a list of actionable items that need to be done and a time line for doing them.

Assign the right people to the right job, making sure they have the proper skill set to complete the task effectively and efficiently.

## Form a Winning Strategy

Be smart with your strategy; problems that are a high priority may not be the best ones to solve first. Do an evaluation of all the downtime events that need to be resolved to determine how much time and money they will take to fix. You may get a more cost effective result from fixing the smaller ones because they take less time to resolve, thereby resulting in an immediate increase to your OEE.

With a solid plan of action, set by your priorities and backed up with solid information, you can feel confident in your decisions to reduce downtime.

MES downtime software can be a huge benefit to you in acquiring these things. Real-time data acquisition, powerful data comparison tools, and clear analysis of important information can be a huge asset in forming your strategy to improve OEE – as well as be a big confidence booster when it's time to execute it.



*With a solid plan of action, set by your priorities and backed up with solid information, you can feel confident in your decisions to reduce downtime.*

## Conclusion

# Finding Answers to OEE Questions

Now that you know the questions you need to ask, the next step is finding answers. Each plant is different, with its own unique set of challenges, so there is no one answer that is going to solve every problem. In order to reduce downtime and increase your OEE you need at least two things: commitment and powerful tools.

**Commitment** – Reducing your downtime and improving your OEE is not a one-time fix. It requires a consistent and continued effort to find and eliminate efficiency-reducing causes. It can only be accomplished if you have a strategy for improving OEE, and that strategy needs to be followed through at every level of the plant. It's a team effort that requires cooperation and patience.

**Powerful Tools** – MES OEE downtime software is a great tool for tracking the factors that affect your OEE. It's simply the fastest and most accurate way to collect, track and analyze OEE data. There are several products on the market designed to help you improve your OEE.

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*OEE downtime tracking software can give you the confidence that your plan to improve your plant's OEE is backed up with solid information and analysis.*

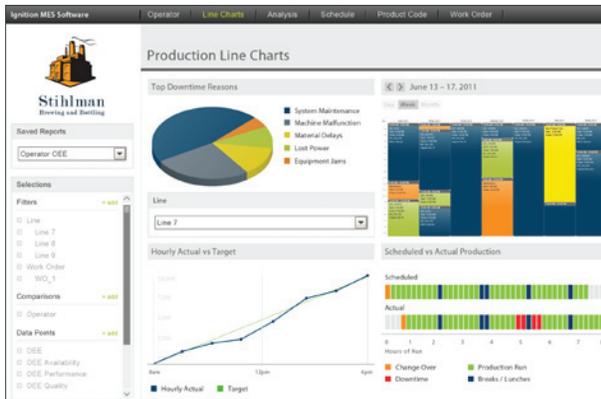
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### Moving Forward with Confidence

With powerful tools and a commitment to decreasing downtime at your plant, you will be ready to move forward. Increasing your OEE can be a difficult journey, but asking the right questions and obtaining the power to answer them is the path to getting there. OEE downtime tracking software can give you the confidence that your plan to improve your plant's OEE is backed up with solid information and analysis.

# Software

## Track, Visualize, and See Your OEE and Downtime Data



### At-a-Glance Executive Dashboard

Visual charts and graphs give a quick overview of real-time operations efficiency.



### Comparative Reports

Choose what data to compare to create reports that pinpoint information your facility needs to improve efficiency.

## OEE Downtime Software from Inductive Automation

Ignition is the database-centric, web-based HMI/SCADA/MES software package from Inductive Automation. The Ignition OEE Downtime Module is a powerful application that gives you the tools to analyze and present data in an easy-to-understand and actionable way.

**Automatic Downtime Tracking** – The Ignition OEE Downtime Module can be integrated with current SCADA systems, so it can automatically and accurately track production and downtime data.

It's quicker and more accurate than having employees tracking data by hand. It also frees up more time for employees to put energy into being productive in other areas.

**Option to Track Downtime Manually** – In a perfect world all production and downtime data would be tracked automatically, but sometimes that's not possible. For this reason the OEE Downtime Module was designed with the flexibility to also support hand-entered data collection.



**Real-Time Efficiency Management** – Track and display production and downtime data in real-time so you know what is happening on the plant floor right now. This gives you the ability to resolve issues as soon as they happen instead of days or weeks later.

**Downtime Analysis** – The OEE Downtime Module gives you powerful analysis tools to accurately and quickly find the source of efficiency loss. See the whole plant at once, and use customizable filters to compare production lines, cells, machines, operators, and other factors that may have an impact on efficiencies.

**Identify Top Downtime Reasons** – The Ignition OEE Downtime Module will identify and prioritize the main causes of unplanned downtime in your plant. Using this information, you can create a solid plan of action to get your downtime under control.