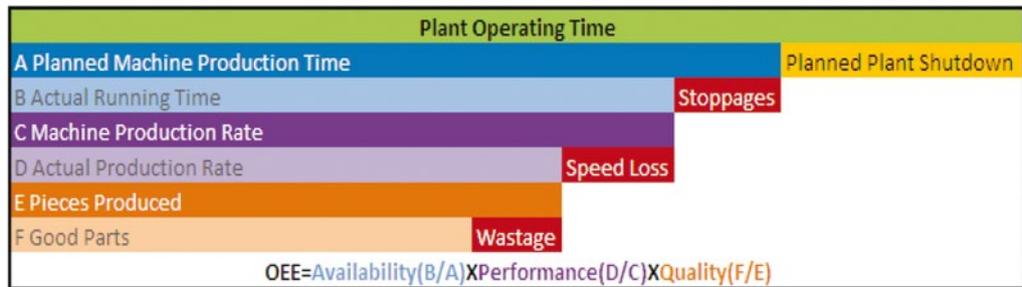# Overall Equipment Effectiveness (OEE)

Implementing OEE measures in the packaging hall to achieve operational excellence
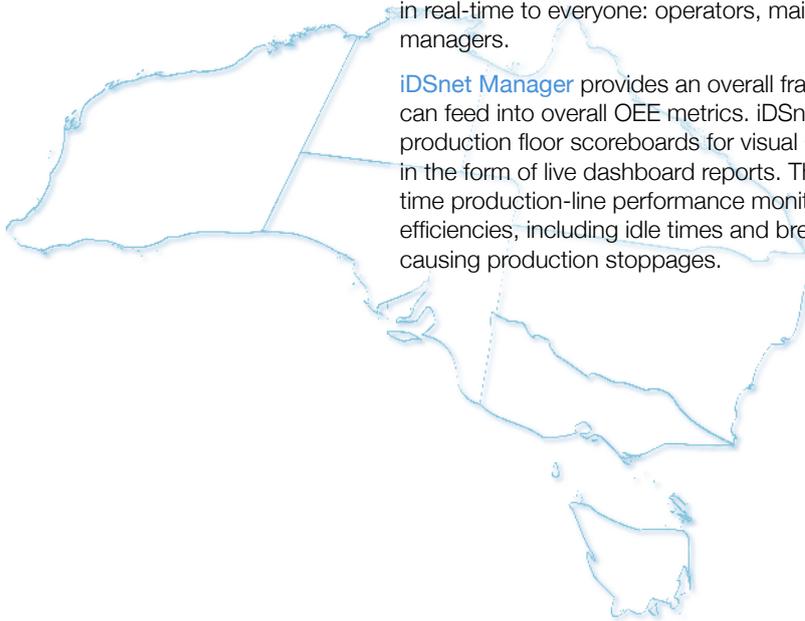
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Executive summary

On average, plants waste up to 40% of their capacity through stops, speed losses, interruptions and defects — yet often managers often don't know the reasons causing the downtime. Nor do they know the factory's true performance, or how to improve it.

Implementing Overall Equipment Effectiveness (OEE) measurement tools gives a much clear understanding of where improvements can be made. OEE is a globally recognised best practice measure to systematically improve processes for higher efficiencies and better productivity — ultimately leading to lower manufacturing costs and higher profitability.

This application paper examines OEE metrics and how to capture them. Not only must this data be captured, but performance data needs to be available in real-time to everyone: operators, maintenance personnel, supervisors and managers.

iDSnet Manager provides an overall framework for capturing data that can feed into overall OEE metrics. iDSnet Manager can also feed data to production floor scoreboards for visual OEE , and to the production office in the form of live dashboard reports. These reports show in-depth, real-time production-line performance monitoring, giving actual production efficiencies, including idle times and breakdowns, plus reporting on what's causing production stoppages.

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What is OEE?

OEE — or Overall Equipment Effectiveness — is a global best practice measure to monitor and improve the effectiveness of manufacturing processes (that is, machines, packaging halls, assembly lines, and so on).

OEE is frequently used as a key metric in TPM (Total Productive Maintenance) and Lean Manufacturing programmes to deliver operational excellence. It gives manufacturers a consistent way to measure the effectiveness of TPM, and other initiatives ("six sigma" and "world class manufacturing"), by providing an overall framework for measuring production efficiency.

OEE takes into account three factors:

i. quality
ii. speed
iii. downtime

It is simply the ratio of Fully Productive Time to Planned Production Time. In other words, it represents the percentage of production time spent making good pieces (no quality loss), as fast as possible (no speed loss), without interruption (no downtime loss).
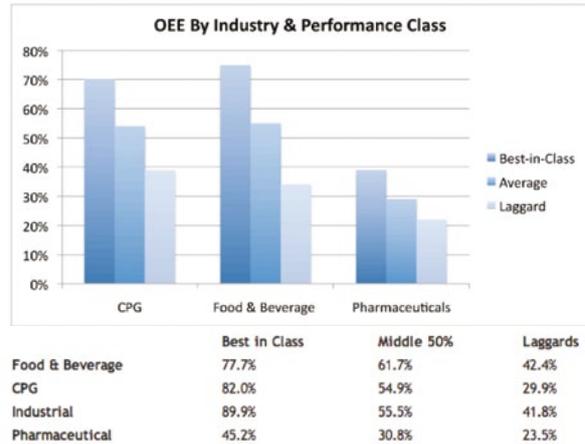
OEE benchmarks

As a benchmark, what is considered a "good" OEE score?

- An OEE score of 100% is perfect production: manufacturing only good parts, as fast as possible, with no downtime.

- An OEE score of 85% is considered world-class for discrete manufacturers. For many companies, it is a suitable long-term goal.

- An OEE score of 60% is fairly typical for discrete manufacturers, but indicates there is substantial room for improvement.

- An OEE score of 40% is not at all uncommon for manufacturing companies that are just beginning to track and improve their manufacturing performance. It is a low score and, in most cases, can be easily improved through straightforward measures (e.g. by tracking downtime reasons and addressing the largest sources of downtime — one at a time).

Industry specific OEE benchmarks

	Best in Class	Middle 50%	Laggards
Food & Beverage	77.7%	61.7%	42.4%
CPG	82.0%	54.9%	29.9%
Industrial	89.9%	55.5%	41.8%
Pharmaceutical	45.2%	30.8%	23.5%

Source: http://www.informance.com/benchmarks/

Why should you measure OEE?

"You cannot manage what you cannot measure."
— Bill Hewlett, Co-founder of Hewlett-Packard

With global organisations looking to achieve higher manufacturing efficiencies by consolidating operations and encouraging lean manufacturing, measurement has become critical because the operation's survival depends on the success of these programmes.

Even the most basic manufacturing operation is extraordinarily complicated. Factories have thousands, perhaps millions, of variables moving around at the same time. Just about every event has multiple drivers. Actions taken to optimise one variable often come at the expense of another. Performance metrics at the activity level can be traded off against other performance measures. Labour efficiency can be increased to the detriment of quality; machine utilisation can be maximised in the short term to the detriment of machine life; delivery performance can be increased to the detriment of inventory levels and overhead expenses… and so on.

Benchmark your OEE score against industry standards for discrete manufacturing and strive for world-class results. Source: http://www.leanproduction.com/oee.html

Management cannot possibly measure thousands of variables with equal attention and diligence. When one or two are elevated to the top — and treated as overall process outcome metrics rather than event metrics — then the motivation to optimise those few variables is created. However, this is usually to the detriment of variables that are not elevated to high-level status.

Your performance measurement system should:

• provide timely feedback to determine the operation's successes,

• determine improvement areas, and

• enable quick decision-making.

OEE measurement does just that.

How can you measure OEE?

The industry-standard OEE metric is defined as follows: Availability x Performance x Quality and is designed to quantify stoppages, speed losses and wastage.

The diagram below shows the required measurements to enable the OEE calculation.

Plant Operating Time: is the amount of time the facility is open and available for equipment operation

$$\text{Availability} = \frac{\textit{Actual Running Time}}{\textit{Planned Machine Production Time}}$$

Planned Machine Production Time: is the amount of time you intend to run production (Plant Operating Time minus breaks, lunch, scheduled maintenance, or periods where there is nothing to produce).

Actual Running Time: the amount of time the plant or line actually runs (Planned Machine Production Time minus stoppages)

Stoppages (breakdowns, setup and adjustments): these include any unplanned downtime, such as equipment failures, breakdowns, material shortages, changeover time, adjustment time, warm-up time and so on.

$$\text{Performance} = \frac{\textit{Actual Production Rate}}{\textit{Machine Production Rate}}$$

Machine Production Rate: is the plant's stated potential, or Ideal Cycle Time, being the theoretical fastest possible time to manufacture one piece. When multiplied by Total Pieces, the result is Net Operating Time — the theoretical fastest possible time to manufacture the total quantity of pieces.

Actual Production Rate: is the actual time that the plant or line is producing goods.

Speed Loss (small stops and reduced speed): this includes loss due to obstructed product flow, rough running, under nameplate capacity, under design capacity, machine wear, substandard materials, misfeeds, cleaning, checking and operator inefficiency.

$$\text{Quality} = \frac{\textit{Good Parts}}{\textit{Pieces Produced}}$$

Pieces Produced: is the total number of goods produced.

Good Parts: is the total number of "good" items produced (without rework) that can be shipped to the customer.

Wastage: goods that need to be re-run, need rework, received in-process damage, expired in process, were assembled incorrectly and so on.

Quality takes into account Quality Loss, which accounts for produced pieces that do not meet quality standards, including those needing rework.

The remaining time is called Fully Productive Time.

Out of all the above metrics, Quality is probably the hardest to measure and quantify. This is only because product is often re-run while on the line and therefore small wastage is hard to measure, as opposed to an entire batch being re-run, which is far more likely to be captured.

Rejects that are scrapped and not re-run is real Wastage.

The goal is to maximise Fully Productive Time.

How can iDSnet Enterprise and Manager capture OEE measures?

iDSnet Enterprise captures data from all coding and labelling machines, as well as all other end-of-line equipment such as vision systems, scanners and has the potential to collect data from other packaging equipment on the production line. iDSnet thus has a count of every primary product, every carton and pallet via the network, while vision systems and scanners help capture the measurement's quality aspect. Vision inspection checks elements like code presence, label position, tamper seals, label match, bar codes and so on, to ensure that the product is shelf ready. They can also verify that cartons have the right number of products, if orientation of products is correct, etc.. Scanners check if all barcodes are scannable, hence avoid products being rejected by the customer (or distribution centre).

Target run rates are easily set up in iDSnet Manager, hence it is easy to track production in real-time versus the targets.
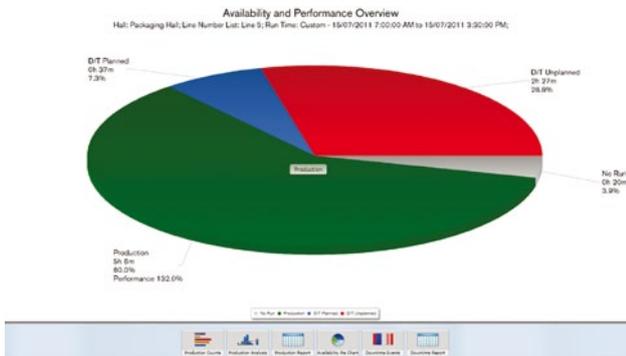
The above iDSnet Manager dashboard provides production efficiency, performance, planned downtime, unplanned downtime as well as no run time. (planned d/t: 7.3%; unplanned d/t: 28.8%; no run: 3.9%; production: 60%; performance: 132%)

Measuring 'downtime' not enough

It is not only important to know how much unplanned downtime your process is experiencing (and when), but also to be able to attribute the lost time to the specific source or reason for the loss (tabulated through reason codes). With downtime and reason-code data tabulated, root-cause analysis can be done, beginning with the most severe loss categories. iDSnet Manager allows the operators on the line to immediately select and put in fault codes/reason codes easily to assign the unplanned downtime, which ultimately helps in analysing the root cause.
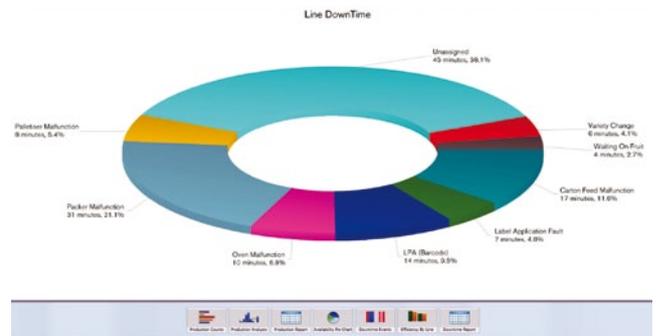
The above iDSnet Manager dashboard provides information on causes of unplanned downtime assigned by the operators via reason codes.

Micro stoppages and reduced speed are the most difficult to monitor and record. iDSnet automatically records them. Companies can set parameters of what a micro stoppage is and what needs to be accounted for with reason codes that the operators can easily enter via a Communication Interface Module (CIM) on the production line.

Eliminating unplanned downtime is critical to improving OEE: other OEE factors cannot be addressed if the process is down.

Tracking set-up time is critical to reducing loss, together with an active programme to reduce this time. By networking all coding, labelling and other devices back to a central database, product change-overs are effected down an entire production line with one simple operator action — thus reducing set-up time.

iDSnet can differentiate start-up rejects and production rejects via reason codes, since often the root causes are different between initial and steady-state production. Parts needing rework of any kind should be considered rejects, and can easily be picked up by scanners or vision systems. Tracking when rejects occur during a shift and/or job run, can

help pinpoint potential causes, and, in many cases, patterns will be discovered.
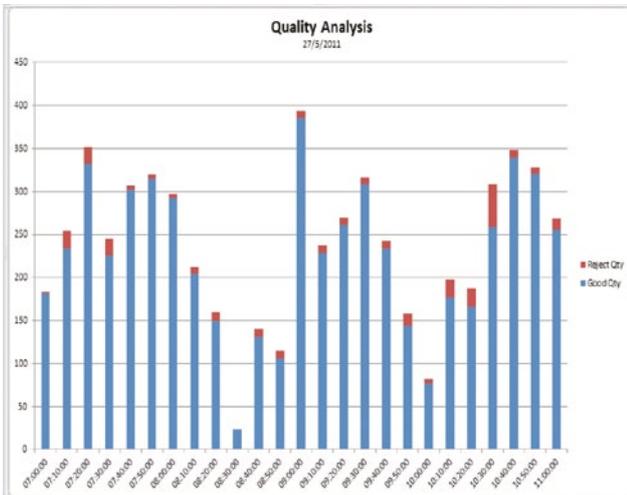

This chart includes a bar chart showing the Production Count for each time block across the selected period, split into Good Count and Reject Count (via iQVision system).

Categorising data makes reject analysis much easier. A key goal should be fast and efficient data collection, with data put to use throughout the day and in real-time. This is exactly what iDSnet is designed to do.

Clicking on one of the Reject sections of the Quality Analysis chart above expands it to show a breakdown by each Reject code.

Acceptable tolerance levels can be set up in the system, and if the reject rates go over the limit, an alarm can be raised or the line can be stopped. This gives operators the ability to take immediate action when there is a major quality issue, such as the wrong label roll has been loaded, so all products have the wrong label.

iDSnet Manager helps in the realm of "Continuous Improvement", and aids the faster flow of value by providing greater visibility of production data and product flow in the packaging hall in real-time through OEE metrics, charts and reports.
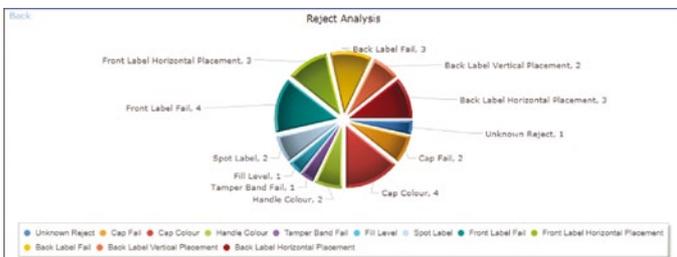
Scoreboards

iDSnet Manager produces live dashboards, with in-depth, real-time production-line performance monitoring. It gives actual production efficiencies, including idle times and breakdowns, plus detailed reports on what's causing production stoppages.
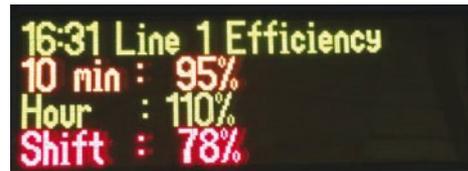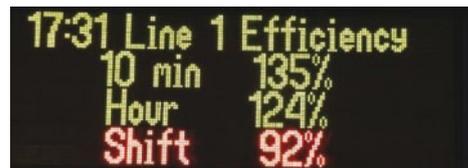
Along with these reports, iDSnet Manager connects with shop floor scoreboards for visual OEE. This real-time information makes operators and line supervisors instantly aware of current production efficiencies against known targets, as well as alerting them to issues, allowing the operators or managers to quickly address the issues and avoid any significant productivity losses.

The scoreboards are set up such that the data is in green means set targets are being met, orange denotes warning while red data reflects that performance is below targets.

This can be used to encourage competitiveness between lines and shifts leading to better performance from the shop floor.

Summary

Unplanned factory downtime impinges on profit. Measuring "downtime" is a beginning, but to really improve productivity, the plant must understand the reasons for each and every occurrence. Implementing OEE gives everyone in the factory a much clearer understanding of where these improvements can be made. iDSnet collects and analyses data quickly and efficiently, putting it to use throughout the day and in real-time.

iDSnet Manager does this by providing real-time reports and dashboards, as well as storing the data for historical analysis. The customised, web-based dashboards and reports give plant managers visibility and insight into production efficiencies, by date, by line and so on.

iDSnet Manager:

- provides real time feedback to enable quick decision-making

- highlights improvement areas

- determines the operation's successes

It gives operators and managers the ability to take immediate action to reduce downtime, as well as the confidence to make long-term strategic decisions to improve productivity based on the historical data by eliminating unplanned downtime.

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About Matthews Australasia

Matthews Australasia, a family business, is Australia's leading provider of intelligent product identification and product-traceability solutions, offering inkjet, thermal transfer, laser, label applicators, label print and apply systems, RFID, barcode-scanning solutions and machine vision inspection. All these solutions can be integrated with Australia's first identification networking and reporting software, iDSnet, winner of 2011 APPMA Design Award.

Solutions-focused, Matthews helps customers with business efficiencies and cost savings by providing production intelligence and increased automation.

Matthews' unmatched solution capability is backed by 24x7 technical support and customer service to support all installations across the country to give you peace of mind. Streamlining ensures less downtime for customers and Matthews' first-time fix rate is 97%.

No matter what your coding, labelling or data capture application, Matthews is the only company in Australia that can provide you with a complete range of end-to-end intelligent identification solutions.

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To find out more about how Matthews can be of service to you, call 1300 CODING (1300 263 464), visit www.matthews.com.au or email info@matthews.com.au.

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