What's your Overall Equipment Effectiveness ?

12:30 PM – 1:45 PM

John Sweeney SpencerMETRICS



Introduction to OEE

"In the Land of the Blind, the One-Eyed Man is King"





Introduction to OEE

What if you had a 'Tool' that could help increase manufacturing efficiency 10 - 50%



Profitability would increase 20 – 300% !



Introduction to OEE

OEE Defined



Overall Equipment Effectiveness (OEE) is a *quantitative way* of measuring how well a standalone or a flow-line production system operates in making good product relative to what the system could make if it operated perfectly, 100% of the scheduled time *based on specific products and processes*.

OEE is a **Key Performance Indicator (KPI)** used to define the Producutivity between Current State and 'World Class' *for your system*.

The goal is Continuous Improvement



"OVERALL EQUIPMENT EFFECTIVENESS: A Powerful Production/Maintenance Tool for Increased Profits"

Robert C. Hansen, PE., CMRP Industrial Press, New York, NY 2001

Owner: RC Hansen Consulting, LLC 970-490-1720 cell: 970-481-3145





"Total Production Maintenance" A Guide for the Printing Industry

Kenneth E. Rizzo GATF Press, 2008 www.printing.org

Win this book ! Drawing at conclusion of today's seminar.







All methodologies require data to support decision making

Lean 6S, OEE, TEEP, TPM, Takt Time, TQM, Kaizen, Continuous Improvement

Combine Machine Data with Operator Knowledge to prove the case

- → <u>Real-time machine visibility</u> with OEE metrics <u>on any Machine</u>
- Dashboard for ease of viewing reduce downtime
- Connect production floor to Production Analytics
- → Shop Floor to Top Floor
- Increase Productivity
- Embrace Manufacturing Efficiency





The OEE Industry Standard gives a guideline in order to find ALL potential losses in effectiveness.

An average machine in an average

factory runs about 35 to 45% OEE.

So it is losing 55 to 65% capacity!

While - not running

- running at reduced speed
- or producing parts out of spec

It is a matter of definition, What you are not looking for you will not find.



www.oeefoundation.org

To really reveal the hidden machines in your factory, ALL Losses need to be defined and visualized

Why use OEE?

Productivity Increases of 10-50%

- Reduce Unplanned Downtime
- Reduce Setup and Changeover Times
- Better Management of Resource Allocation, Planning and Scheduling
- Operator Productivity Increases
- Efficiency with Automated Data Collection
- Better Root Cause Analysis
- □ Improve Quality, Minimize Rejects
- □ Identify Bottlenecks and Constraints
- □ Improve On-Time Delivery
- Manage Operations Pre-emptively & Proactively
- Measurably Improve Profitability



Why is OEE so important?

- ➔ If you were told that your department was running flat out you might reasonably assume that the equipment was running efficiently and effectively.
- → What if the equipment only ran for 65% of the time?
- → What if when it ran it ran at 80% of its speed ?
- → What if only 90% of the print are good?

65% x 80% x 90% = 47%

- ➔ Individually these performance measures seem to indicate an OK piece of equipment, but is it a true picture?
- → What is having an impact on these performance figures?



Revenue Calculator

Each one percent improvement could mean \$110,880* additional annual revenue! Learn More

	Percent	Rev	enue Increase	
Press A/A4 PPM: 120	Improvement	per	Year	
	1 %	\$	110,880	
Press Operation Hours/Day: 16	2 %	\$	221,760	
Press Operation Days/Week: 5.5	3 %	\$	332,640	
	4 %	\$	443,520	
Print Sale Price (cents): 35	5 %	\$	554,400	
Calculate				

Interactive calculator at:

www.spencermetrics.com



How do we use OEE?

→ OEE is only a measure, its benefits will be lost if the shortfalls it identifies are not acted upon.

- → OEE is a total measure of performance but the data used to produce it must be used to prioritise improvement tasks.
- → The purpose of measurement is to identify losses, remove waste and drive improvement.
- → OEE should be used to support the Total Productive Maintenance (TPM) approach and the tools it supplies.



What does that mean?

OEE is a **Key Performance Indicator** *(KPI)* that can measure the impact of change on a process caused by eliminating process, or equipment losses

OEE is used to measure the performance of equipment and the process.



What does that mean?

Organizations that train and strategically use the OEE Tools and methods presented in the modules have a clear roadmap to quickly achieve "Top Quartile" competitive advantage in the Printing Industry.

'Top Quartile' Winning Teams have common best practices;

- → <u>Detailed Measurement</u> of their performance
- → Constantly improving their 'Best Ever' performance
- → <u>Synergizing</u> every player's contribution **OPERATOR KNOWLEDGE**
- → Effectively Communicating new ideas or conditions
- → <u>Being the Provider of Choice</u> re: Price and Delivery



How do I measure OEE?

Overall Equipment Effectiveness

OEE % = Availability x Performance x Quality

Shows each press output as a percentage of maximum capacity Example: 65% x 80% x 90% = 47%

Availability %

Percentage of scheduled time that the operation is actually operating. Availability % = Run Time / Scheduled Time

Performance %

Speed at which the Press runs as a percentage of its designed speed or ideal cycle time. *Reality vs. advertised "Feeds and Speeds".*

Performance % = (Parts Made x Standard) / Run Time

Quality %

Good Units produced as a percentage of the Total Units Started. Quality % = Good Units / Units Started



OEE Metrics

Productivity	Good Output Time						
Froductivity	Loading Time less Delays						
OFE Top	Good Output Time		_				
OEE TOP	Lo	ading Time (Work Load)	Ĩ				
Utilization	Good Output Time		-				
Othization		Sum of All Shift Times					

	Total Output Actual Time		
	Lo	ading Tim	ne (Work Load)
	Good Output		
QUALITI	Total Output		
	Good Output @Rate	_	•
PERFORMANCE	Good Output Actual Time		

OFF	Good Output @Rate		
UEE			
OEE Solitairo	Good Output @Rate		
OEE Solitaire		Loading Time less Delays	1
TEEP: Net	Good Output @Rate		
Utilization		Selected Measurement Duration 24/7	

Operations	Good Output @Rate W&R								
Effectiveness		Sum	of All Shift Times						
Assot Utilization	Total Output Actual Tim	е							
Asset Othization	Selected Measurement Duration 24/7								
Capacity	Loading Time (Work Load)								
Utilization	Selected Measurement Duration 24/7								



It's about Time !

Selected Measurement Duration 24/7									
Sum of All Shift Times No Shifts									
Loading Time (Work Load) No Work									
Loading Time less Delays Delays									
Total Outp									
Good Output A	ctual Time	Waste & Rework		-					
Good Output @Rated Speed	Performance Loss		-						

Applying OEE to Production Print



Make data available to all



Pareto Analysis -



Pareto Analysis is a data graphing analysis based on the Pareto principle which focuses on identifying the

20% of sources that result in 80% of the problems



Six Big Losses



The time lost due to key equipment breaking down or deterioration which causes the production to be stopped for more than 10 min.



Six Big Losses



The time lost through "*product change over and adjustment*" to the point where the production of the new product is completely satisfactory. "Makeready"



Six Big Losses



The time lost through key equipment being stopped for less than 10 min.

Time lost during the standard cycle when the equipment is not adding value.



Six Big Losses – What Are Six Big Losses 1 Breakdowns The time lost through key equipment not producing parts at its optimum rate.

2 Setup / adjustment

3 Idling / minor stoppages

 4 Speed
 5 Defects in process and rework

6 Start up losses

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Six Big Losses – What Are They? Losses

1

Breakdowns

Setup / adjustment 2

Idling / minor 3 stoppages

Speed

4

Defects in process 5 and rework

Start up losses 6

The time lost through key equipment not producing parts that meet the specified quality standard.

The time lost through key equipment being utilised to rework sub-standard parts.



Six Big Losses

Breakdowns

1

4

2 Setup / adjustment

3 Idling / minor stoppages

Speed

5 **Defects in process** and rework

6 Start up losses

The time lost through key equipment not producing parts to the specified quality standard, following start up and before the equipment achieves controllable production conditions.



OEE Overview

OEE (Overall Equipment Effectiveness) is the measure of :

the amount of **good product** produced compared to the amount of product that could have been produced if the manufacturing system operated **perfectly** for its entire **scheduled** time.

<u>Total Effective Equipment Performance (TEEP) is the measure of the</u> amount of *good product* produced compared to the amount of product that could have been produced if the manufacturing system operated *perfectly* for the <u>total time</u> (calendar time) over the time period under consideration.

24 x 7 x 365 = 100 asset utilization



How to collect data for OEE

Key Points:

- → OEE is a measure of the equipment or process, *not the operators.*
- → KISS ! Keep it simple.
- ➔ Ensure the process of measuring and applying OEE involves the people who use the equipment. OPERATOR KNOWLEDGE
- → Make data collection second nature not a hindrance.
- → Integrate Automatic and manual data collection.
- → Obtain the data on fixed frequency.
- ➔ Snap shot v continuous.
- \rightarrow Units of time (1 min, 10 mins, 30 mins, etc.).
- ➔ Regular communication of results.
- → Response to trends, peaks and troughs.



How to collect data for OEE

Example: Three Hourly Data Sheet

Machin	e No.			No. op	erators			AВ	СD	Day/	Night	Date /	
								Ma	chine Do	wntime			
Hour of the Day	Tape No.	Programme change inc. test piece	Tooling problem please specify cause	Machine problem - please specify cause	Cartridge Change	Calibration	Meetings (inc. team brief)	Clean up & SAP up	Post / fixture problem	Slaving Up	Other - please specify cause	Specified causes of machine downtime	Total Downtime every 3 hrs
7-8													
8-9													
9-10													
10-11													
11-12													
12-1													
1-2													
2-3													
3-4													
4-5													
5-6													
6-7													
TOTAL													
Hand Over N	Notes:												
												•	
1													I)

How to collect data for OEE



IIOT – Industrial Internet of Things

"Following the computer and the Internet, every machine tool will become a node on the network creating greater efficiency."







CONNECT^M Automatic Data Collection Enhanced with Operator Knowledge



spencermetrics LLC

A SPENCER ASSOCIATES GROUP COMPANY

member of the spencerLAB family-serving the industry for over 27 years

Combine Data & Operator Knowledge

SpencerMetrics Spencer Cutsheet	
Stopped in progress 10:43 min	
Job Setup 🙀 Paper Jam 🕒 Idle	
Consumables 🔨 Maintenance 🕒 Print Waste	
(⊕ Insert)	
Print Production Start: 21:40:29 Comment: Duration: 00:00:27 Job#:	
Consumables Magenta Start: 21:40:01 Comment: Duration: 00:00:28 Job#:	
Print Production Start: 21:39:34 Comment: Duration: 00:00:27 Job#:	
Paper Jam Engine Start: 21:38:53 Comment: Duration: 00:00:41 Job#:	
Print Production Start: 21:38:33 Comment: Duration: 00:00:20 Job#:	
Idle Waiting for Approval Start: 21:38:01 Comment: Duration: 00:00:32 Job#:	
Print Proof Start: 21:37:50 Comment: Duration: 00:00:11 Job#:	
Job Setup Paper Start: 21:37:41 Comment: Duration: 00:00:09 Job#:	
Press Startup U Startup Start: 21:37:33 Comment: Duration: 00:00:08 Job#:	
Shift Start Connectdemo Start: 21:37:32 Comment: Duration: 00:00:01 Job#:	Spencermetric.

Actionable Information!



PRODUCTIVITY INTELLIGENC

Actionable Information !





OEE Overview

Learning to 'see' OEE

- → As a Strategic Tool and a Monitoring Tool NOT BIG BROTHER
- ➔ As a Reliability metric and a Business metric
- → As a leading metric and a lagging metric
- → Using OEE as a 'fair' benchmarking metric
- ➔ Quantify the value of each OEE factor





Lean Thinking

Lean Thinking Management System Model

The Lean Management System Model reflects graphically, the integration of **Hoshin Kanri** (Strategic Deployment), **Deming's PDCA** Wheel (**plan-do-check-act**) four-step model for carrying out change with the **Toyota Way 2001** principles (Continuous Improvement and Respect for people), and how the lean management system is driven by customer requirements and level of satisfaction.



The Lean Thinking Management System is used to implement the 5 Elements of Lean Thinking.



The Deming Cycle



... Data based problem solving

- Typical PDCA: Plan quickly
 - Address Symptoms
 Do immediately
 - Jump to conclusions
 - Check roughly

Act pretty much the way you did before



High Velocity Organization PDCA: Plan deeply

- Discuss actual situation and target with everyone affected
- Really understand/model the problem and its root cause

Do many quick experiments

Validate your thinking

Check implications carefully

Act systematically

- Update and deploy standards and
- checklist disciplines

Current Condition – *What's your OEE ?*

... What do we already know ?

Specific, detailed, quantitative, concise

- → Tables, graphs, histograms, value-stream maps, diagrams
- → Highlight exactly where problem occurs
- Baseline to compare to metrics after countermeasures are applied

Engage everyone affected by or causing symptoms Build Consensus on what is

- → Symptoms / Undesirable Effects everyone can see
- ➔ Foundation of authority to experiment with countermeasures

Update as understanding improves



Goal – Next Target Condition

...Model what we expect

What baseline change is wanted

- ➔ What does "ideal" look like?
- ➔ What does the organization need?
- → What is **Realistically attainable** target condition?

Mentor ensures that the owner has both

Plausible Hypothesis

Based on best available model/understanding of how the system works/could work

Consensus among stakeholders

➔ Target is attainable and desirable.

Update as root cause and countermeasures developed



Root Cause

...Model Cause & Effect

Identify underlying problem(s) causing symptoms

→ Root cause is typically faulty thinking or assumptions Addressing the root cause(s) improves all levels of symptoms/ undesirable effects/visible damage.

Build consensus among stakeholders

- → Broad agreement on Cause & Effect network
- → Reflect best current knowledge about how things work

Some techniques:

- ➔ Fishbone Diagram
- → 5 Whys
- → Histograms
- → Pareto Analysis
- ➔ Root Cause Analysis



Root Cause Analysis





Compare

timeframes

PRODUCTIVITY INTELLIGENCE

OEE Overview

OEE for Leadership

OEE Value Stream Analysis as a Strategic Tool





Why?



WHO is your CI Manager ?



Resources

www.spencermetrics.com

Revenue Calculator SpencerMetrics CONNECT White Papers

www.ci.printing.org



CI (Continuous Improvement) comercine Milwaukee, April 10-13



Q & A

Book Drawing !



Kenneth E. Rizzo