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OEE

Agenda

1. OEE: What is it ?
2. OEE purpose and benefits
3. The Six Big Losses
4. Availability
5. Performance
6. Quality
7. TEEP
8. Takeaways

Introduction

What is it ?

Overall Equipment Effectiveness (OEE) is a KPI that **identifies the percentage of planned production time that is truly productive**.

Introduction

Purpose and Benefits

The OEE **keeps track** of how things are going, and identify where they are experiencing **excessive downtime** or **other inefficiencies**.

Understanding what these areas of loss are can help us to identify them and **take action** to have them **minimized** or **eliminated**.

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The Six Big Losses :

1. Breakdowns
2. Setup & Adjustments
3. Small Stops
4. Reduce Speed
5. Startup Rejects
6. Production Rejects

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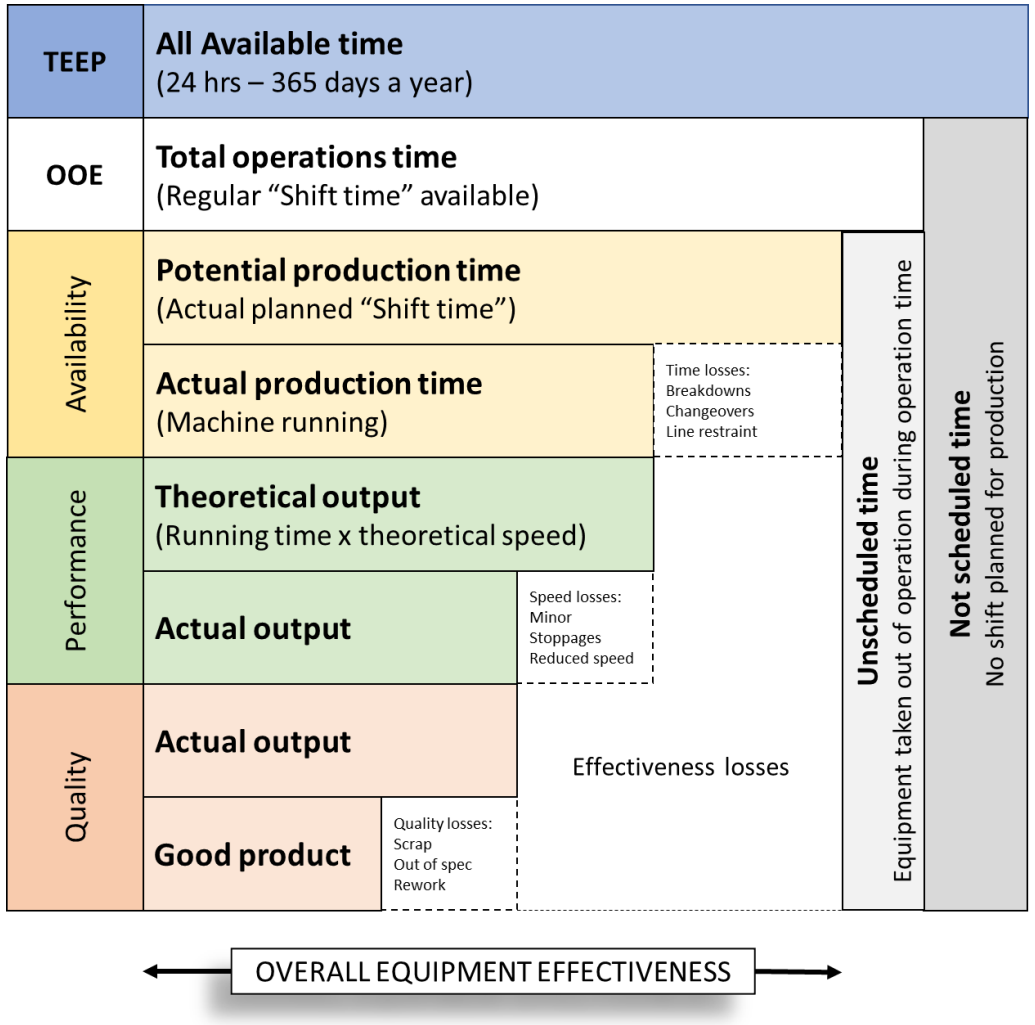
The Six Big Losses:

… and its relation with OEE



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The Six Big Losses:

1. **Breakdowns:**

Are one of the most frustrating types of efficiency loss because **they are unexpected** and can often result in a complete stoppage of work.

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The Six Big Losses:

1. Breakdowns Countermeasures:

- Regularly Scheduled Maintenance (TPM)
- Replacements
- Replacement Parts

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The Six Big Losses:

2. Setup & Adjustments:

This type of loss is also caused by shortages in materials or inventory, or even insufficient staffing to get specific jobs done.

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The Six Big Losses:

2. Setup & Adjustments Countermeasures:

- Planning for Future Orders
- Like Order Scheduling
- On Site Inventory Planning

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The Six Big Losses:

3. Small Stops

Small stops are all the little things that cause a facility to slow their production. Some examples of this would include blocked sensors, conveyor belts backing up, jams in components, mis-feeds into or out of machines, and any number of other similar problems.

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The Six Big Losses:

3. Small Stops Countermeasures

- Standardize Best Practices
- Immediate Notification
- Authorize Intervention

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The Six Big Losses:

4. Reduced Speed

This is perhaps the type of loss that can be the most difficult to identify or even notice while it is happening. Things can appear to be running smoothly throughout the facility, but when things are not operating at optimal speed, there is a significant loss in productivity.

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The Six Big Losses:

4. Reduced Speed Countermeasures

- Evaluate Best Practices
- Keep Machines Well Maintained
- Avoid Intentional Speed Reductions

The Six Big Losses:

5. Startup Rejects

Occurs when switching over to a new product or when other changes are made.

In many cases the first set of products made have some sort of issue, so they cannot be used.

This results in a lot of scrapped products, or items that need to be fixed or even rerun through the manufacturing process.

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The Six Big Losses:

5. Startup Rejects Countermeasures

- Small Initial Runs
- Improve Startup Procedures
- Implementing Improved Problem Monitoring

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The Six Big Losses:

6. Production Rejects

Production rejects are like the startup rejects, but they can occur at any time. These are often more difficult to fix because of this reason.

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The Six Big Losses:

6. Production Rejects Countermeasures

- Reject Tracking
- Downtime Inspections
- Active Monitoring

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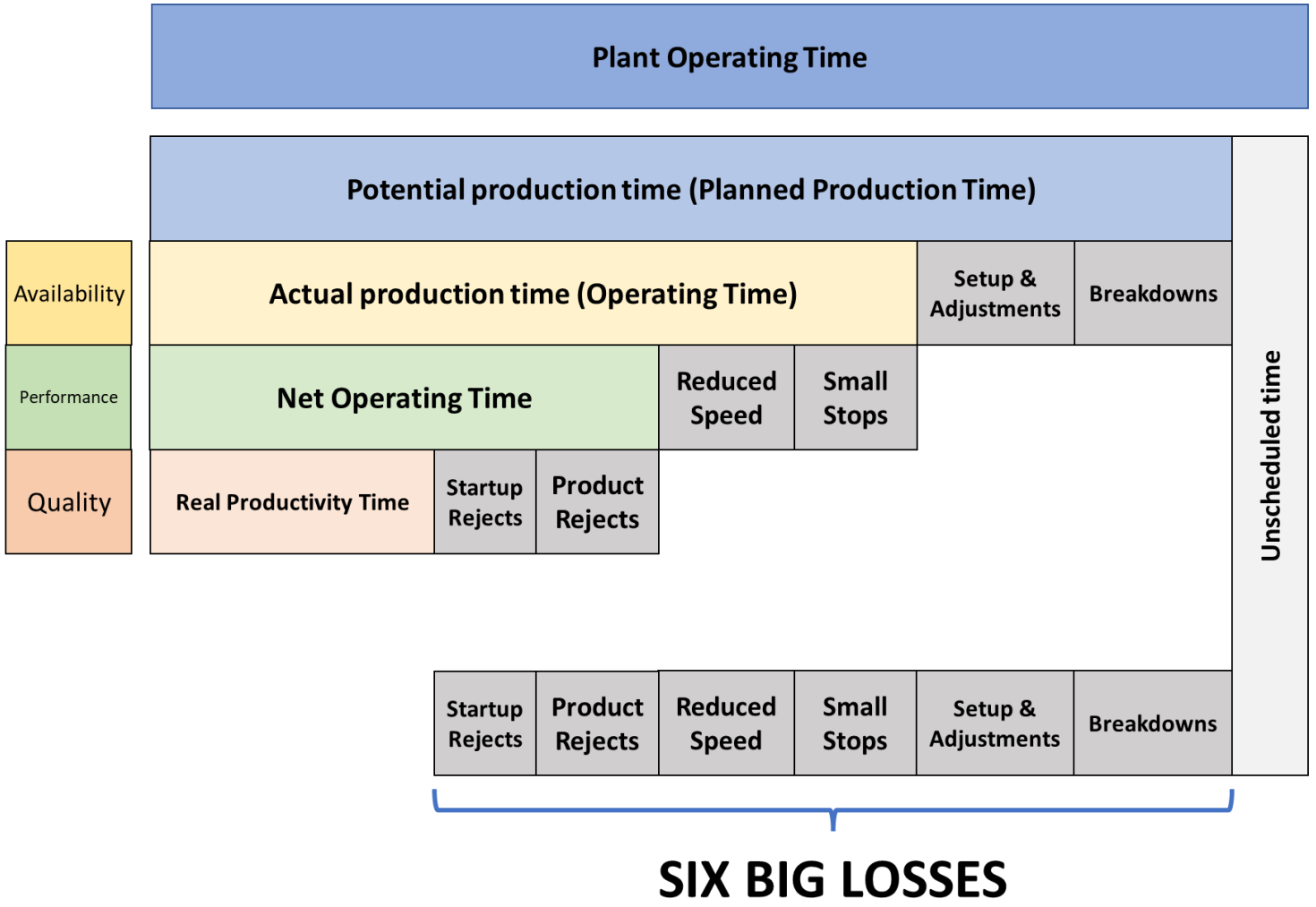
The Six Big Losses:



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OEE METRIC	SIX BIG LOSSES	EXAMPLE
Availability	Breakdowns	Tooling failure, equipment failure, unplanned maintenance
	Set Up and Adjustments	Changeover, material shortage, warm-up line
Performance	Reduced Speed	Rough running, equipment wear, operator inefficiency, incorrect settings
	Small Stops	Obstructed flow, jam, misfeed, sensor blocked, cleaning, checking
Quality	Start up rejects	Scrap, rework, in process damage, incorrect assembly
	Production rejects	Same as above but during steady-state production

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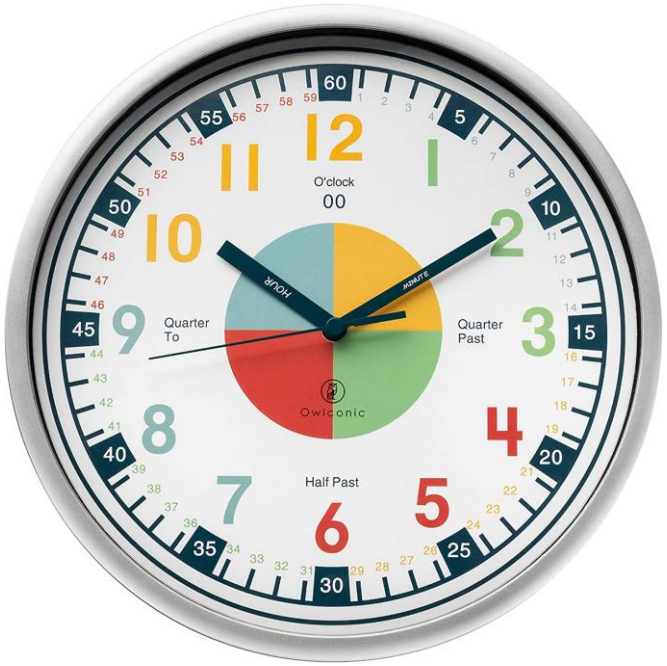
Availability:

An Availability score of 100% means the process is **always running during planned production time** (it is never down).

Availability Loss includes all events that stop planned production for an appreciable amount of time (usually several minutes).

Examples include equipment failures, unplanned maintenance, material shortages, and changeovers.



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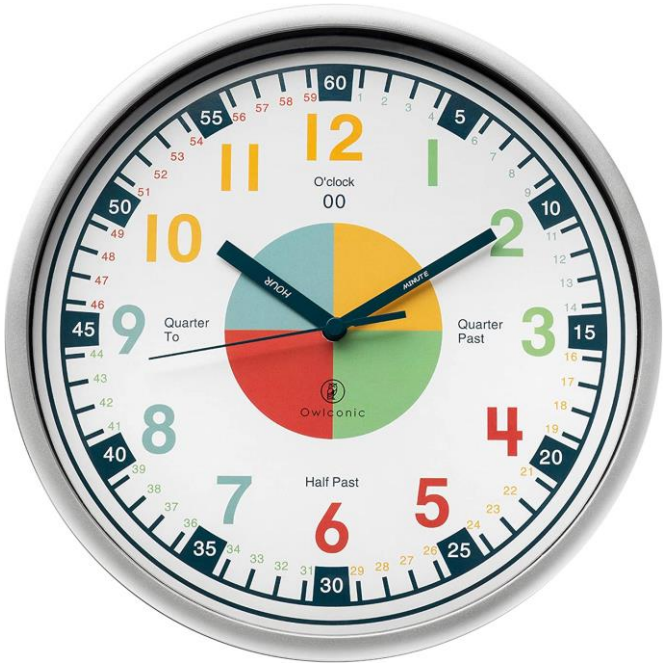
Availability:

Planned Production Time is the total time that the manufacturing process is scheduled for production.

Run Time is simply Planned Production Time less Stop Time, where Stop Time is defined as all the time where the manufacturing process was intended to be running but was not due to Unplanned Stops (e.g., Breakdowns) or Planned Stops (e.g., Changeovers).



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Availability:

The actual amount of time the production was happening. Naturally, stops like equipment failures and changeovers reduce this number.

$$\text{Availability} = \frac{\text{Run time}}{\text{Planned Production time}}$$

Represent production schedule, e.g. one 8-hour shift. It doesn't cover planned stops like lunch breaks

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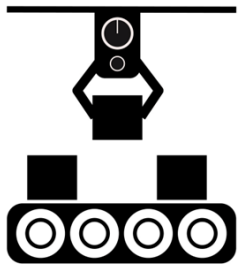
Availability:

Time available for January:
25 days * 8hr * 2 shifts =
400 hr



Actual Run time for January:
Produced 78,200 units at
230 units/hr average =
340 hr

AVAILABILITY

85%

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Performance:

A Performance score of 100% means when the process is running as **fast as possible** (at the theoretical maximum speed; each part at the Ideal Cycle Time).

Performance Loss includes all factors that cause the process to operate at less than the maximum possible speed when running including both slow cycles and small stops.

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Performance:

Ideal Cycle Time is the theoretical minimum time to produce one part (it is NOT a 'budget' or 'standard' time). It is important that Ideal Cycle Time be a true and honest measure of how fast the process can run.

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Performance:

The fastest possible time to manufacture one piece (in theory)

Total number of produced pieces (including the defective ones)

$$\text{Performance} = \frac{\text{Ideal Cycle time} \times \text{Total count}}{\text{Run time}}$$

The amount of time the machine spent running

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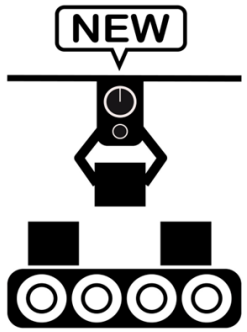
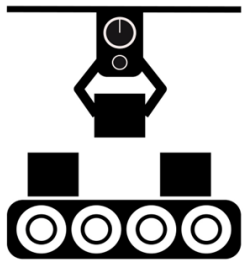
Performance:



Maximum rated productivity
450 units/hr



Actual Productivity for January:
230 units/hr

PERFORMANCE

51%

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Quality:

A Quality score of 100% means there are **no defects** (only good parts are produced).

Quality Loss includes productivity lost from manufacturing parts that do not meet quality standards after the first pass (like the concept of first pass yield). This includes scrap and parts that require rework.

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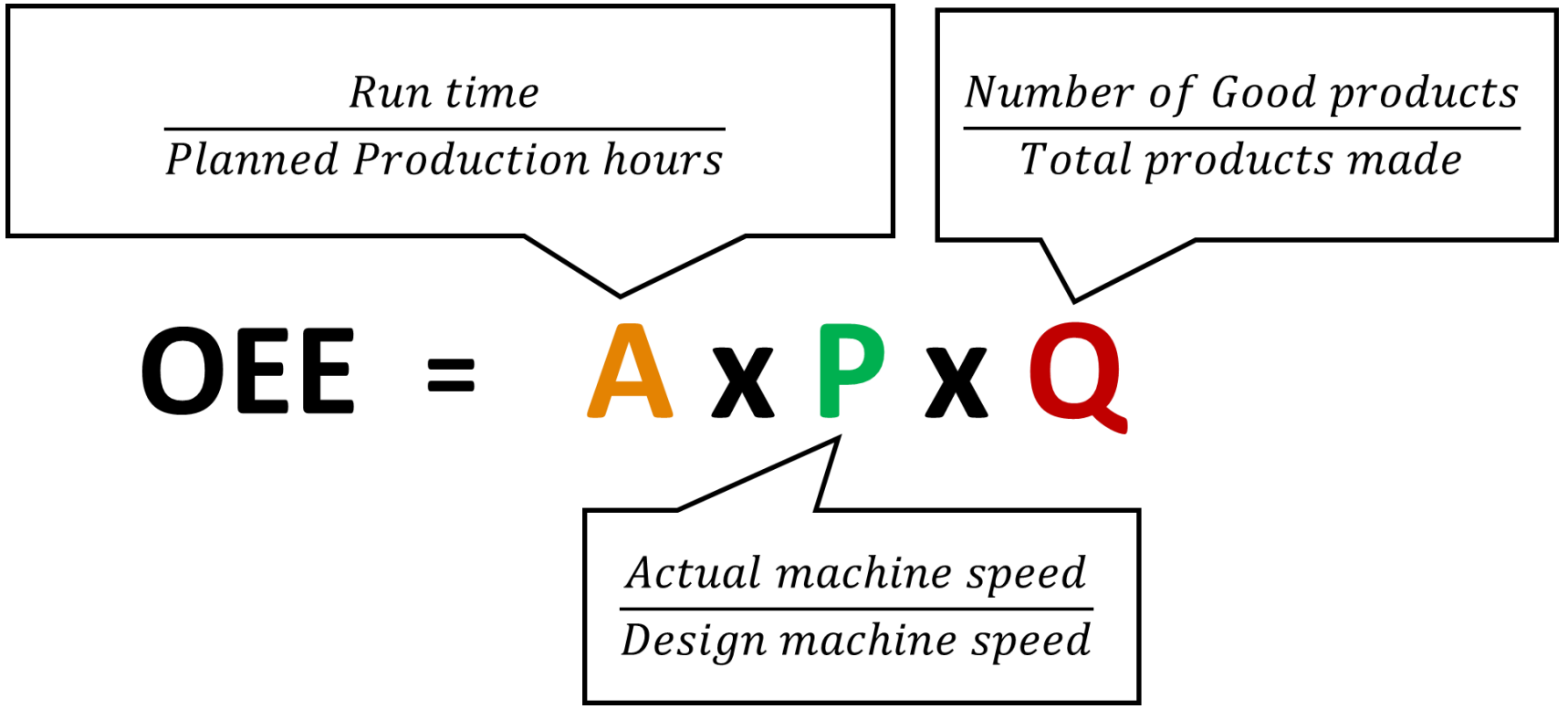
Quality:

Number of manufactured pieces that meet specification requirements

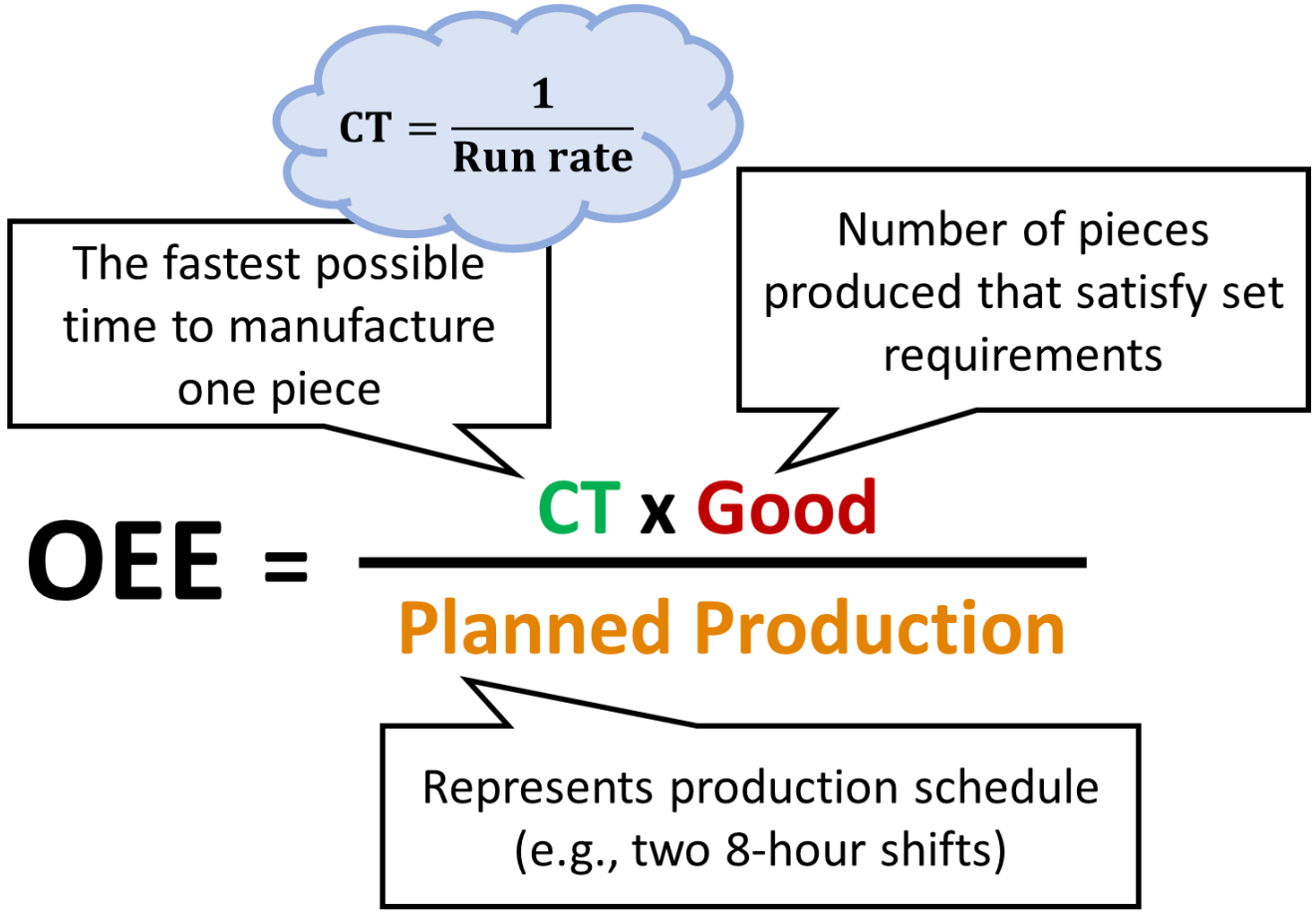
$$\text{Quality} = \frac{\text{Good count}}{\text{Total count}}$$

Total number of produced pieces (including the defectives ones)

Calculating OEE



Shortcut Calculating OEE



OEE Technology

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> 95%	World class for continuous stream processes
> 90%	World class for continuous discrete processes
> 85%	World class for batch processes
75% - 85%	Pretty good
65% - 75%	Acceptable if quarterly trends are improving
< 65%	Need to initiate a process improvement initiative

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Total Effective Equipment Performance (TEEP):

TEEP is a performance metric that provides insights as to the **true capacity of the manufacturing operation**.

It takes account both **Equipment Losses** (as measured by OEE) and **Schedule Losses** (as measured by Utilization).

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Total Effective Equipment Performance (TEEP):

- OEE measures the percentage of Planned Production Time that is truly productive.
- TEEP measures the **percentage of All Time** that is truly productive.

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Total Effective Equipment Performance (TEEP):

Capacity can be defined as "**the amount that can be produced**". From a discrete manufacturing perspective, we can define capacity as "the maximum number of parts that can be manufactured".

Capacity is fundamentally a part-based metric (example, our current capacity is 24,000 red widgets per hour).

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Total Effective Equipment Performance (TEEP):

Utilization can be defined as "**how much something is used**". From a discrete manufacturing perspective, we can define utilization as "the proportion of time that manufacturing equipment is used".

Utilization is fundamentally a percentage-based metric (example, our current utilization is 47.62%).

Total Effective Equipment Performance (TEEP):

TEEP is the ratio of Fully Productive Time to All Time. It considers schedule losses and OEE losses (the Six Big Losses).

TEEP is calculated as:

$$TEEP = OEE \; x \; Utilization$$

Utilization is calculated as:

$$Utilization = \frac{Planned \; produciton \; time}{All \; time}$$

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Total Effective Equipment Performance (TEEP):

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Total Effective Equipment Performance (TEEP):

- TEEP indicates how much capacity is **waiting to be unlocked** in the "hidden factory".
- It shows how much potential the operation has to increase throughput with our current equipment.
- In many cases, reclaiming time from the hidden factory is a faster and less expensive alternative to purchasing new equipment.

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Total Effective Equipment Performance (TEEP):

- TEEP can also be used to get a sense of our potential sales capacity as it considers the full capacity of our manufacturing plant.

- Even a world-class manufacturing plant operating around the clock typically achieves only 80% to 90% Utilization of total capacity.

LEARNING HUB

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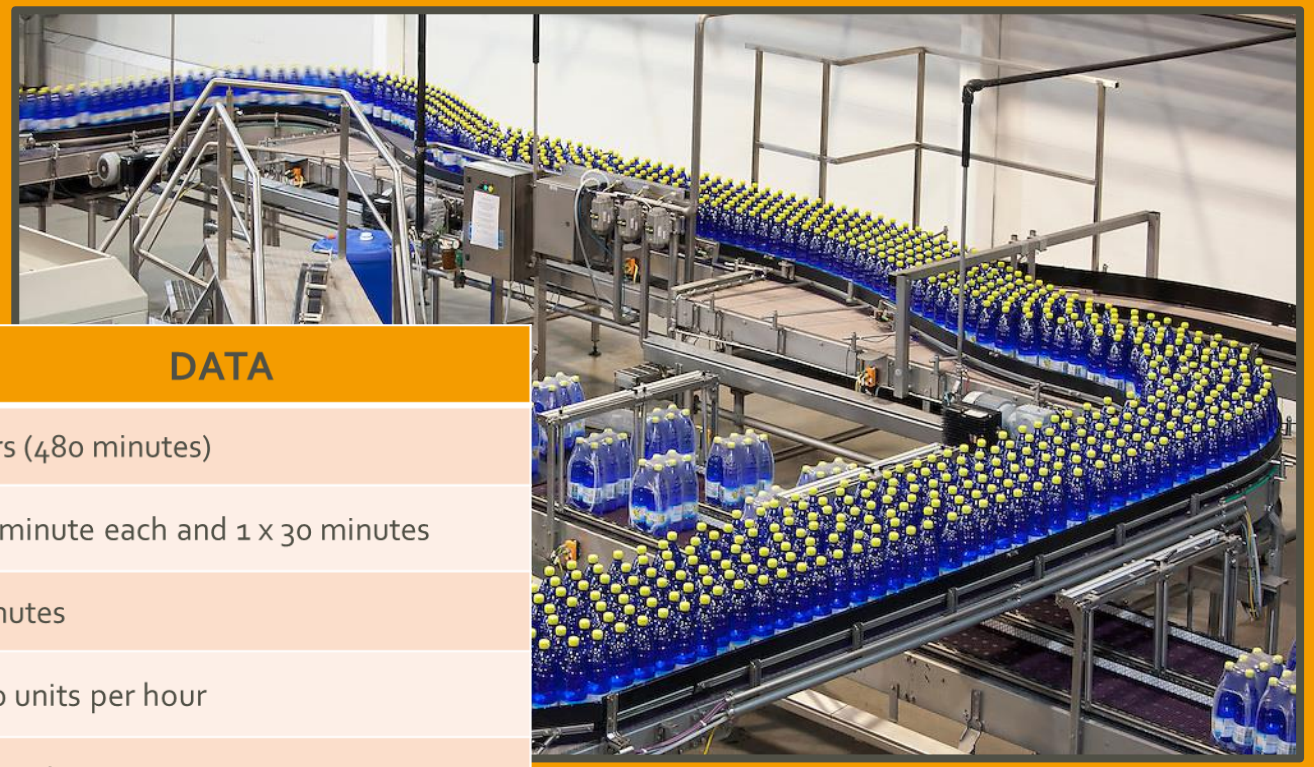
Fresh Water Inc



ITEM	DATA
Shift Length	8 hours (480 minutes)
Breaks	2 x 15 minute each and 1 x 30 minutes
Downtime	92 minutes
Ideal Run Rate	14,000 units per hour
Total Count	59,972 units
Reject Count	5,204 units

TOOLBOX

Production Report with OEE

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PRODUCTION CONTROL AND OEE

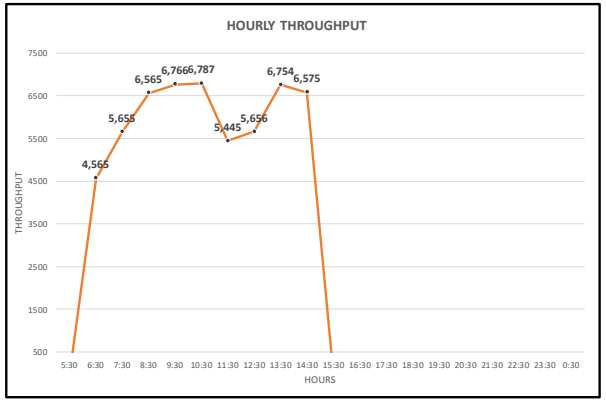
PRODUCTION NUMBER	BATCH	OPERATION	TOTAL UNITS PLANNED	UNITS/ CASE	TOTAL CASES TO PRODUCE	DOWNTIME (min)	PLAN PRODUCTION TIME (minutes)	RUNTIME (min)	TODAYS SHIFT LENGTH (min)	BREAKS	Break length (min)	Lunch length (min)
234	222DG	Cigar Line	234,000	2340	100	92	420	328	480	2	15	30

OEE	AVAILABILITY	QUALITY	PERFORMANCE
55.9%	78.1%	91.3%	78.4%

TODAY TARGET	ACTUAL	BALANCE	TARGET (u/hr)
234,000	54,768	179,232	14,000

SPECIFICATION (PART TEST)				SPECIFICATION			
Start up sample test				< 5%	<10%	>75 %	< 10%
< 0.5 mm	0.5 - 1.0 mm	1.0 - 2.0 mm	> 2 mm	<0.5mm	0.5 - 1.0	1.0 - 2.0	>2mm

HOURLY THROUGHPUT

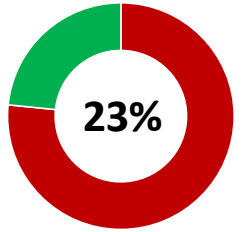


DAILY PRODUCTION

TEMP: RH: LOD:

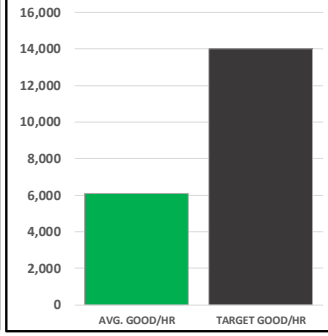
TIME	CUMMULATIVE TOTAL	HOURLY	GOOD	BAD	% YIELD
5:30		0			
6:30	5343	5343	4565	778	85%
7:30	11784	6441	5655	786	88%
8:30	18784	7000	6565	435	94%
9:30	25983	7199	6766	433	94%
10:30	33004	7021	6787	234	97%
11:30	39113	6109	5445	664	89%
12:30	45534	6421	5656	765	88%
13:30	52832	7298	6754	544	93%
14:30	59972	7140	6575	565	92%
15:30	59972	0			
16:30	59972	0			
17:30	59972	0			
18:30	59972	0			
19:30	59972	0			
20:30	59972	0			
21:30	59972	0			
22:30	59972	0			
23:30	59972	0			
0:30	59972	0			
TOTAL		59972	54768	5204	91%

TOTAL ACTUAL VS TOTAL TARGET

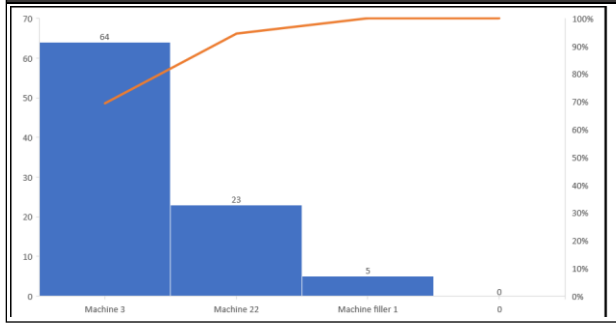


YIELD 91%

ACTUAL/HR VS TARGET/HR



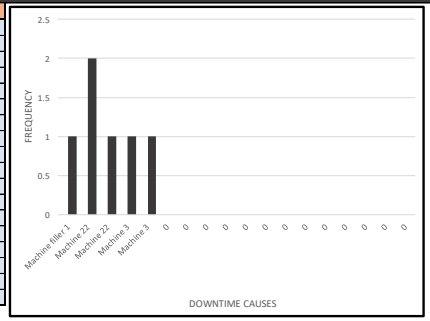
DOWNTIME DURATION



DAILY DOWNTIME

DOWNTIME CAUSES	DURATION (n	FREQUENC	COMMENTS
Machine filler 1	5	1	clean up
Machine 22	10	2	startup and resets
Machine 22	13	1	auger blocked
Machine 3	19	1	jam, had to reset
Machine 3	45	1	Major conveyor fault
TOTAL DOWNTIME (MINS)	92		

DOWNTIME DISTRIBUTION



START UP CHECK LIST

	Item	☑	Resolution
1			

PRODUCTION ORDER

INVENTORY ID	WEIGHT	PR NUMBER

END OF SHIFT CHECKLIST

	Item	☑	Resolution
1			

Takeaways

- What is most beneficial about measuring OEE and TEEP in this format is they can very easily lead the improvement team to the correct tool for reducing or eliminating the loss.
- One should **only begin to implement lean manufacturing once there has been a sustained OEE and TEEP for three to six months**.
- Lean manufacturing techniques can further eliminate process-based operational and planned losses.

Thank You

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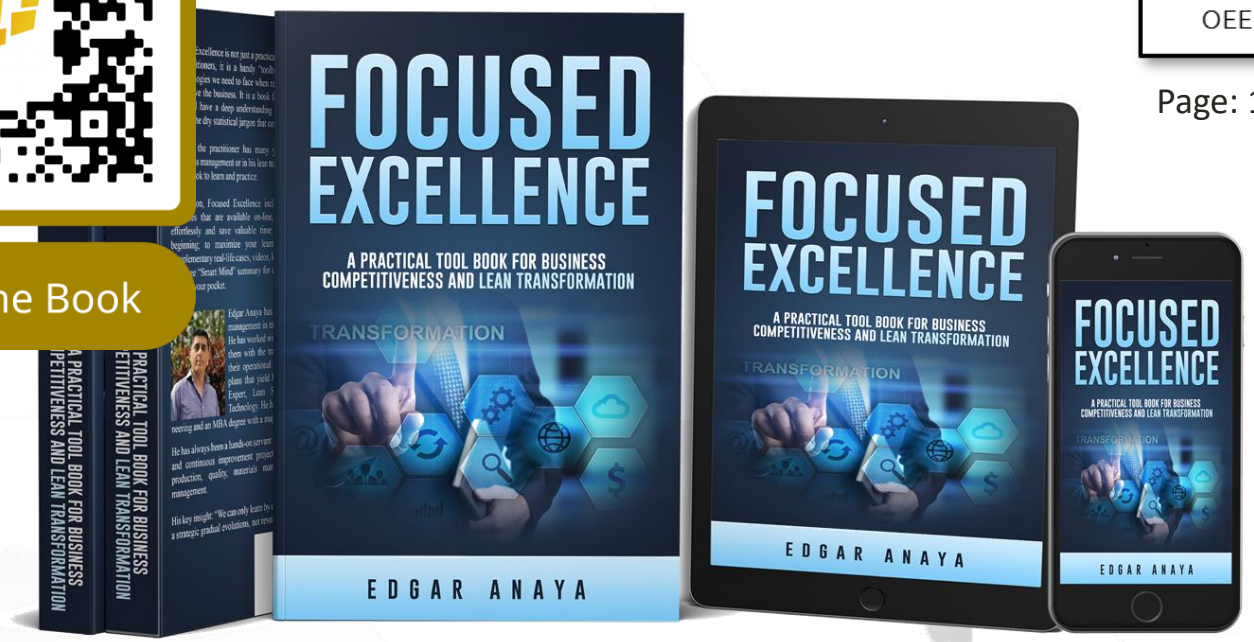
Get the Book



TOPIC

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Reference: Focused Excellence
by Edgar Anaya

A Practical Tool Book for
Business Competitiveness and
Lean Transformation