

Overall Equipment Effectiveness

OEE - sweating manufacturing assets against the clock to maximise the output of prime quality product

This slideshow will briefly cover...

- Overall Equipment Effectiveness & the OEE metric
- The Six Big Losses
- The 'Hidden Factory'
- Theory of Constraints - *manufacturing bottlenecks & pinchpoints*

It's purpose is to merely place things in context.
Further reading is required for an in-depth understanding of OEE

OEE fundamentals

OEE is data driven

Good data collection and analysis are key requirements for a successful OEE project



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If you can't put a number on it, you can't measure it – and, if you can't measure it, you can't manage it!

OEE fundamentals

OEE is data driven

Good data collection and analysis are key requirements for a successful OEE project



...plus, if you're not keeping score, you're only practicing!

OEE fundamentals

Manufacturing assets must be sweated!



Manufacturing equipment must run **flat out at face plate rating** – with **vertical** start-ups and shutdowns, **minimal stops** and **no defects** in production output

OEE fundamentals

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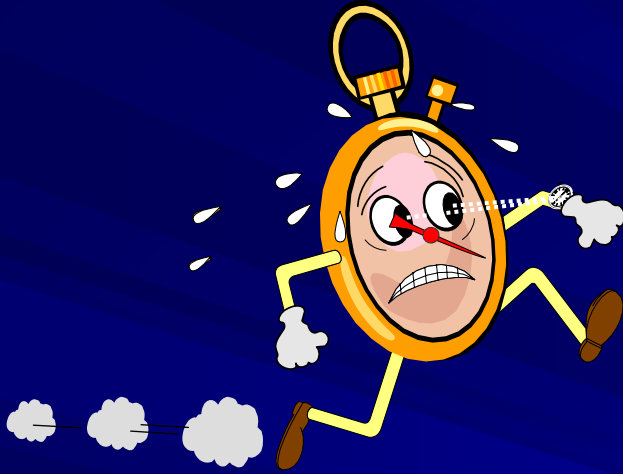
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The only rest is when the whistle blows...

OEE fundamentals

Manufacturing assets must be sweated!



Beware of 'twilight' production and reworking

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OEE fundamentals

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An IDEAL!
The world class
benchmark is **6 Sigma**

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3.4 defects
per million
'opportunities'

The OEE Metric



The OEE metric

As far as capital manufacturing assets are concerned...



- Time is money!
- Time 'lost' is money down the drain
- Time must be strictly accounted for



The OEE metric

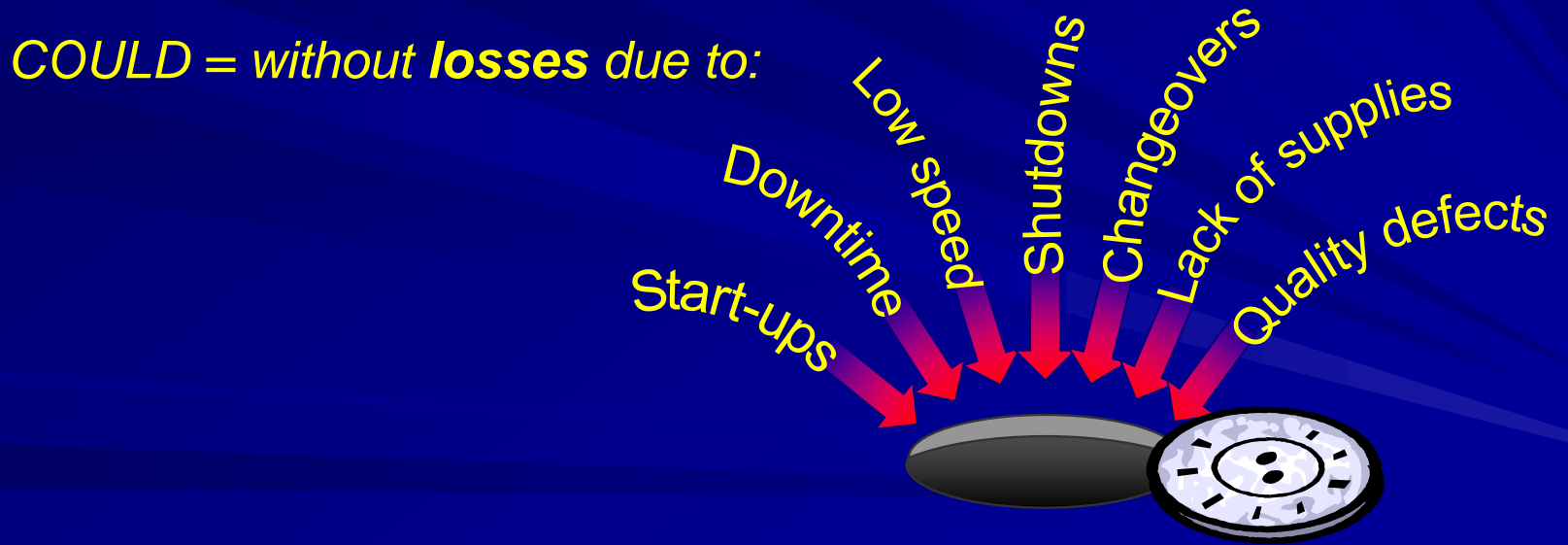
$$\text{OEE} = \frac{\text{ACTUAL quantity of good products produced} *}{\text{Total quantity that COULD BE produced}}$$

* *In the **scheduled production time**
(loading time)*

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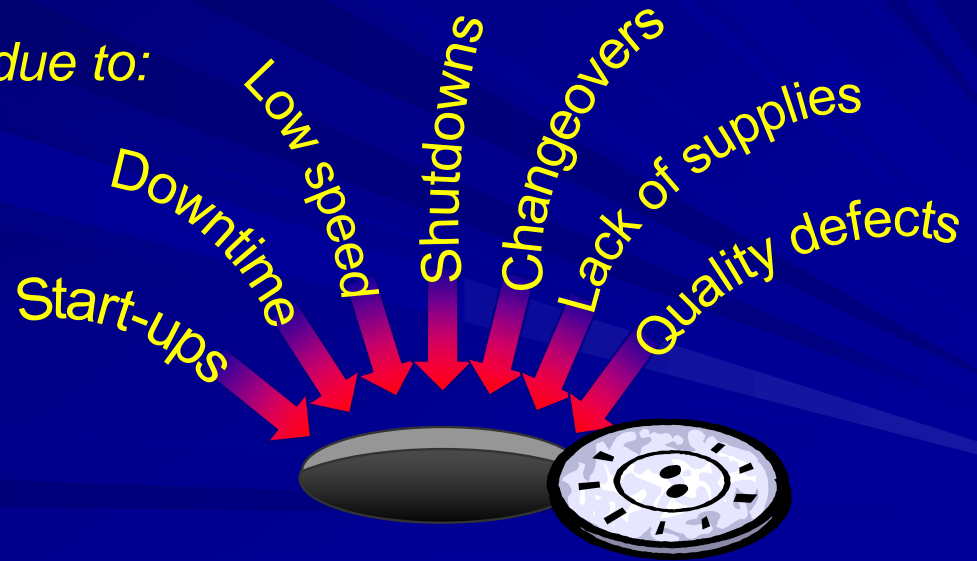


Resulting in **LOW**

- Output
- Overall efficiency
- Yield
- First-time pass rate
- Quality
- OTIF delivery
(*'on time & in full'*)

Scheduled production time
(*loading time*)

is due to:

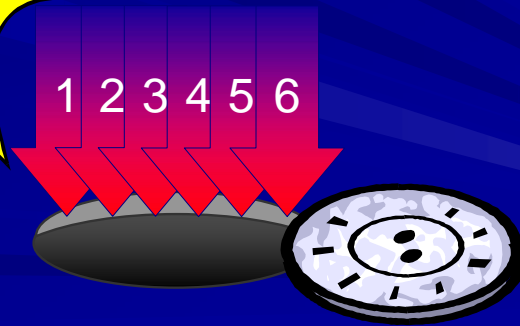


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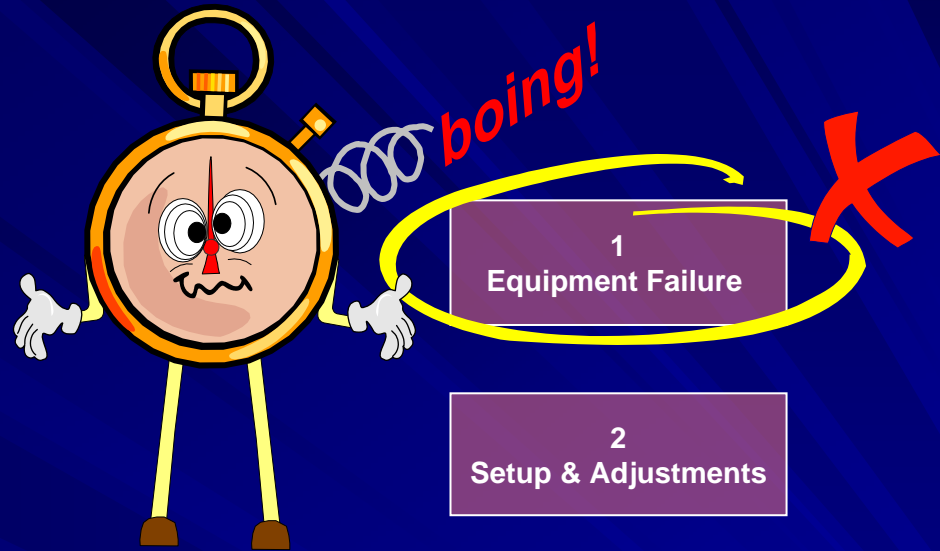
**OEE is calculated
by measuring the
'Six Big Losses'**



The Six Big Losses



The Six Big Losses



1
Equipment Failure

2
Setup & Adjustments

3
Idling &
Minor Stoppages

4
Reduced Speed

5
Scrap & Rework

6
Startup Low Yield

The Six Big Losses



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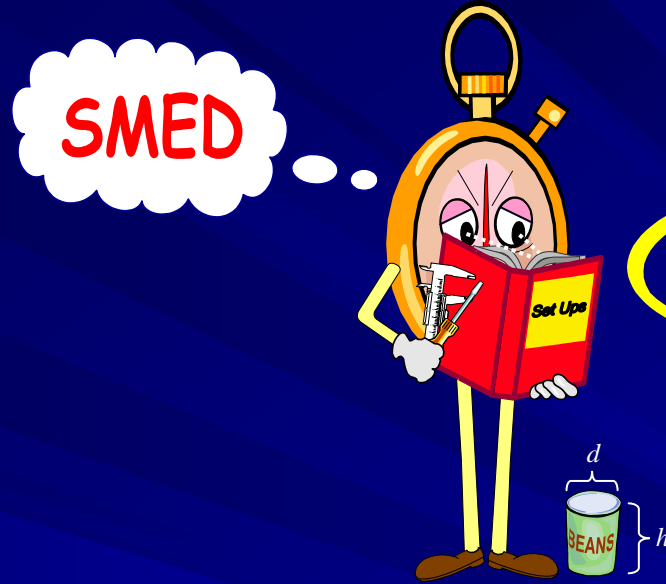
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Minimise

The Six Big Losses



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The Six Big Losses

SMED

'Single Minute
Exchange of Die'



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**Benchmark :
Formula 1
pit stop!**



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Idling & Minor Stoppages

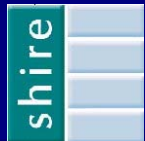
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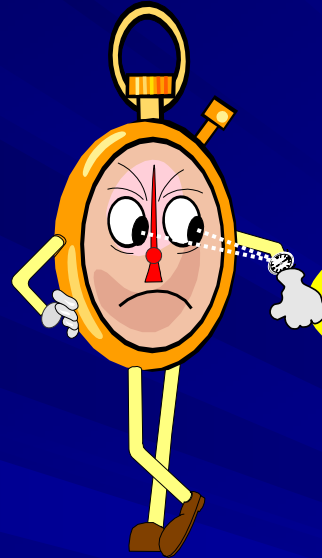
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Startup Low Yield

Minimise

F1 workflow also used to 'turnaround' Jumbo jets and plan complex surgical procedures



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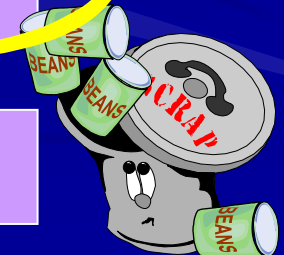
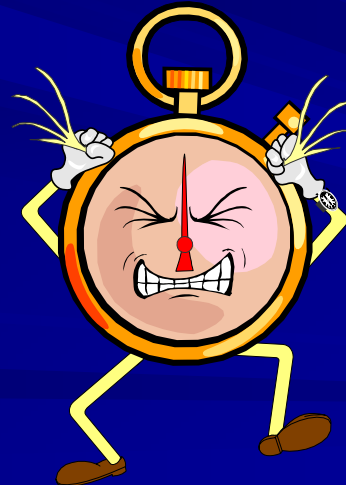
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The Six Big Losses

These are real killers – they combine insidiously to trash production performance - *and yet tend to be 'accepted'*

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The Six Big Losses

Computerised
Maintenance Management
(CMMS) helps with this



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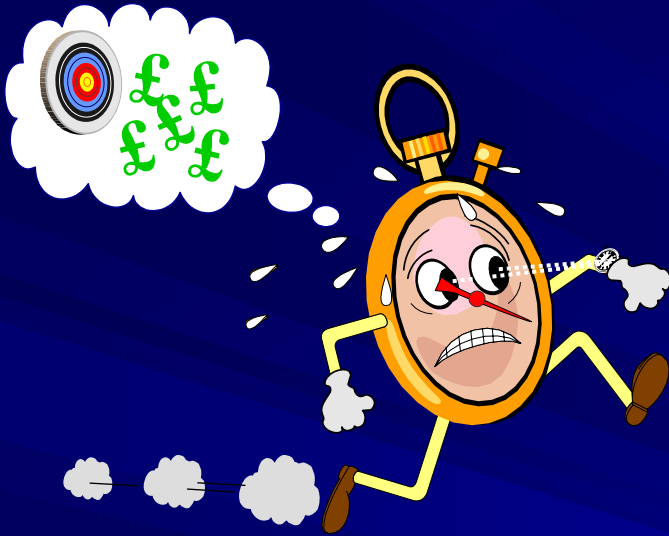
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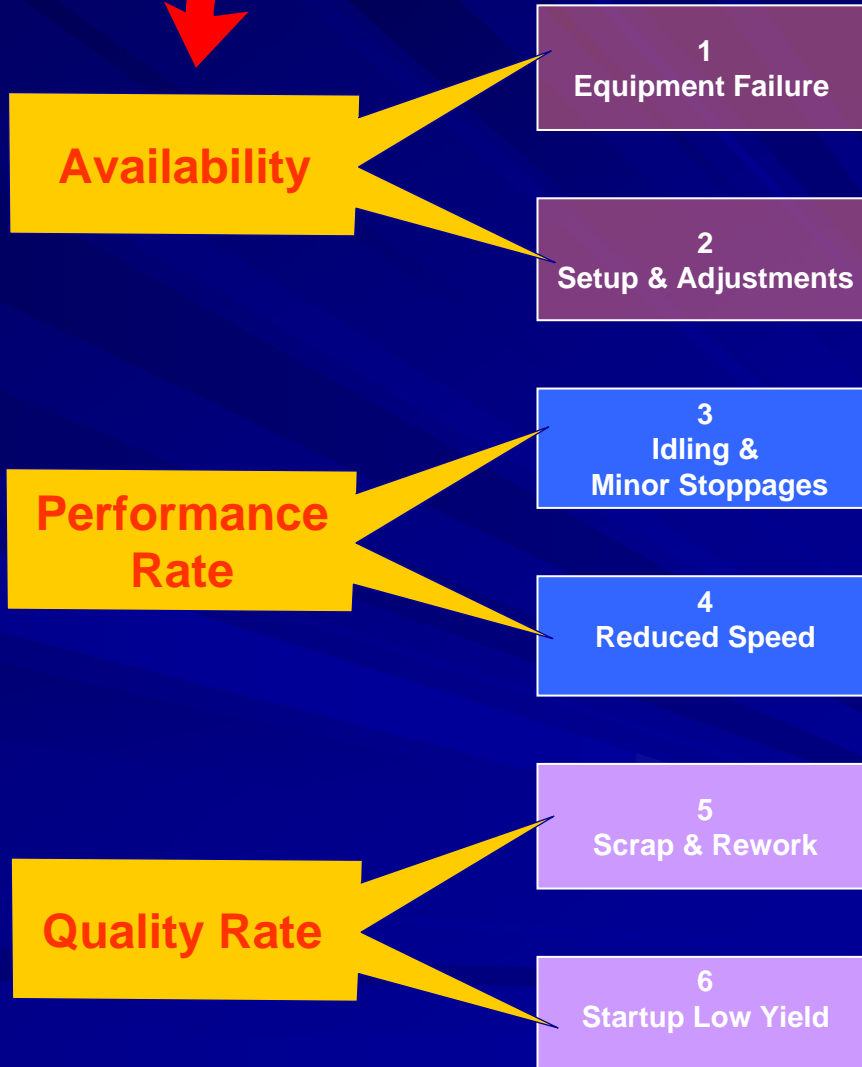
Not with these

These are real killers –
they combine insidiously
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The Six Big Losses



The OEE factors



The OEE Calculation



OEE calculation



**Overall Equipment Effectiveness =
Availability × Performance Rate × Quality Rate**

OEE calculation

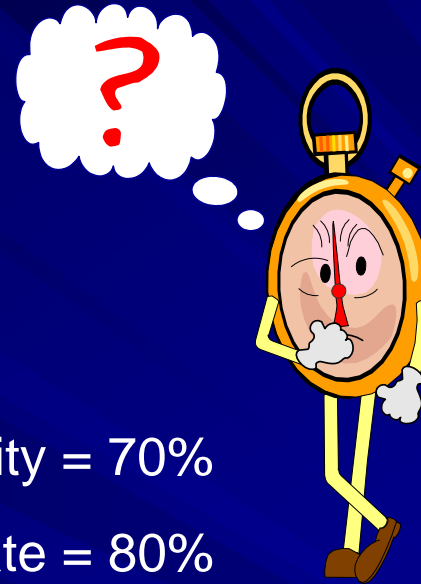
Consider an example

Say

Availability = 70%

Performance Rate = 80%

Quality rate = 90%



OEE calculation

Consider an example

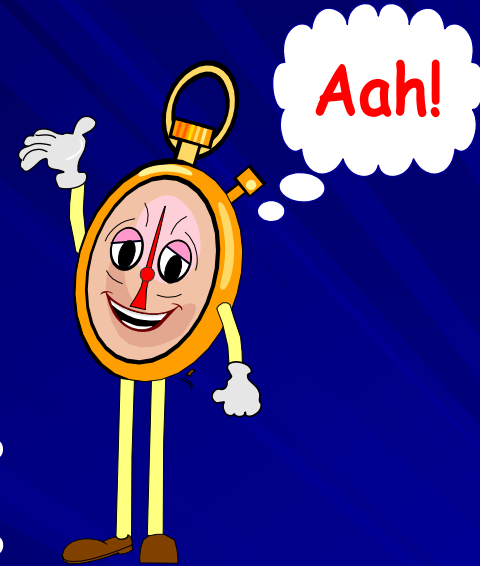
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Availability = 70%

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Quality rate = 90%

Then, **OEE = 50%**



OEE calculation

Consider an example

Say

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In reality this is towards the lower limit – OEE performance is generally in the range 40% to 80%

OEE calculation

Consider an example

Say

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Performance Rate = 80%

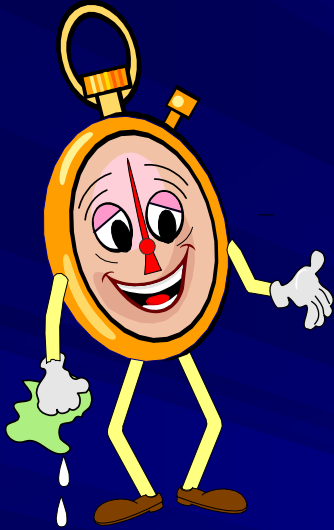
Quality rate = 90%

Then, **OEE = 50%**



This means that half the built and maintained factory isn't contributing

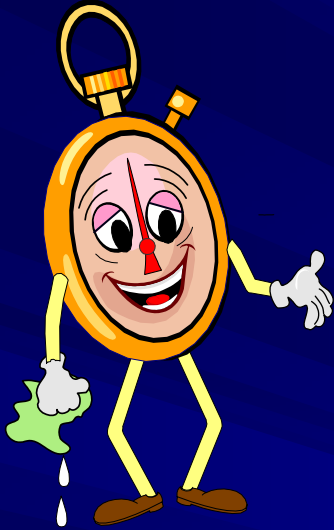
OEE benchmark targets - *World Class*



- Batch processes > 85%
- Continuous discrete processes > 90%
- Continuous processes > 95%

Best petrochem sites achieve 99.9%

OEE benchmark targets - *World Class*



- Batch processes > 85%
- Continuous discrete processes > 90%
- Continuous processes > 95%

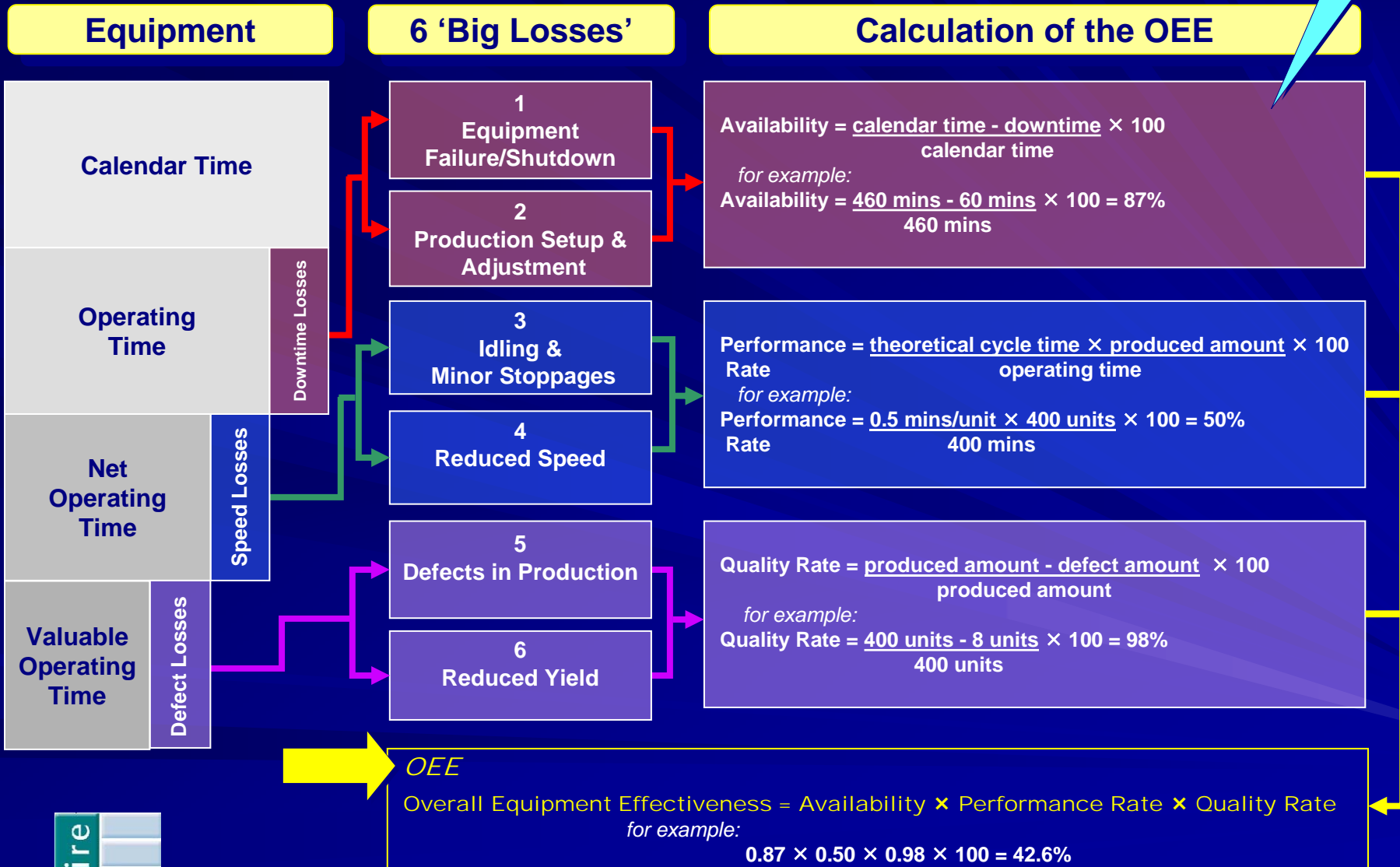
Best

1st tier suppliers to major companies are obliged to maintain a minimum OEE level as a condition of contract



OEE calculation example

8 hour shift with half hour break = 7½ production hours



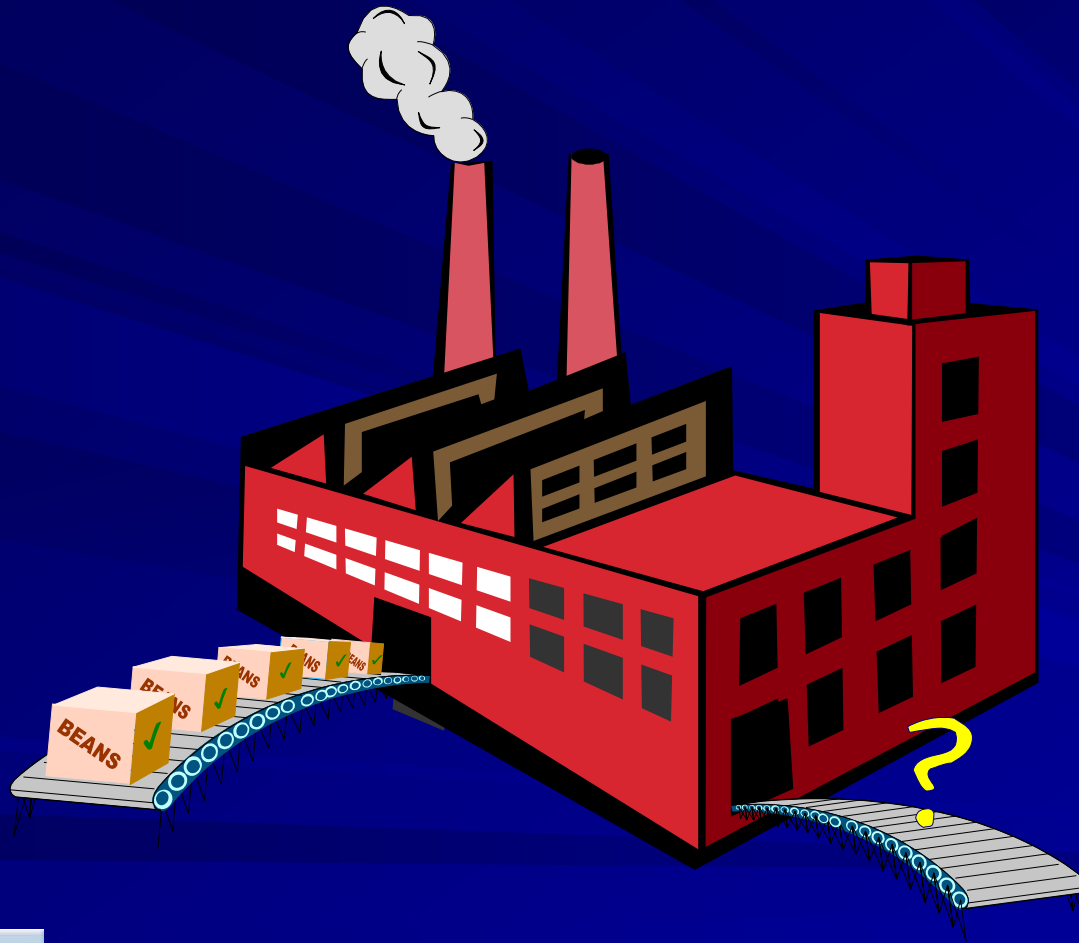
Ref: Nakajima, 1984

The Hidden Factory



The Hidden Factory!

OEE can quickly reveal the size of the 'hidden factory'...

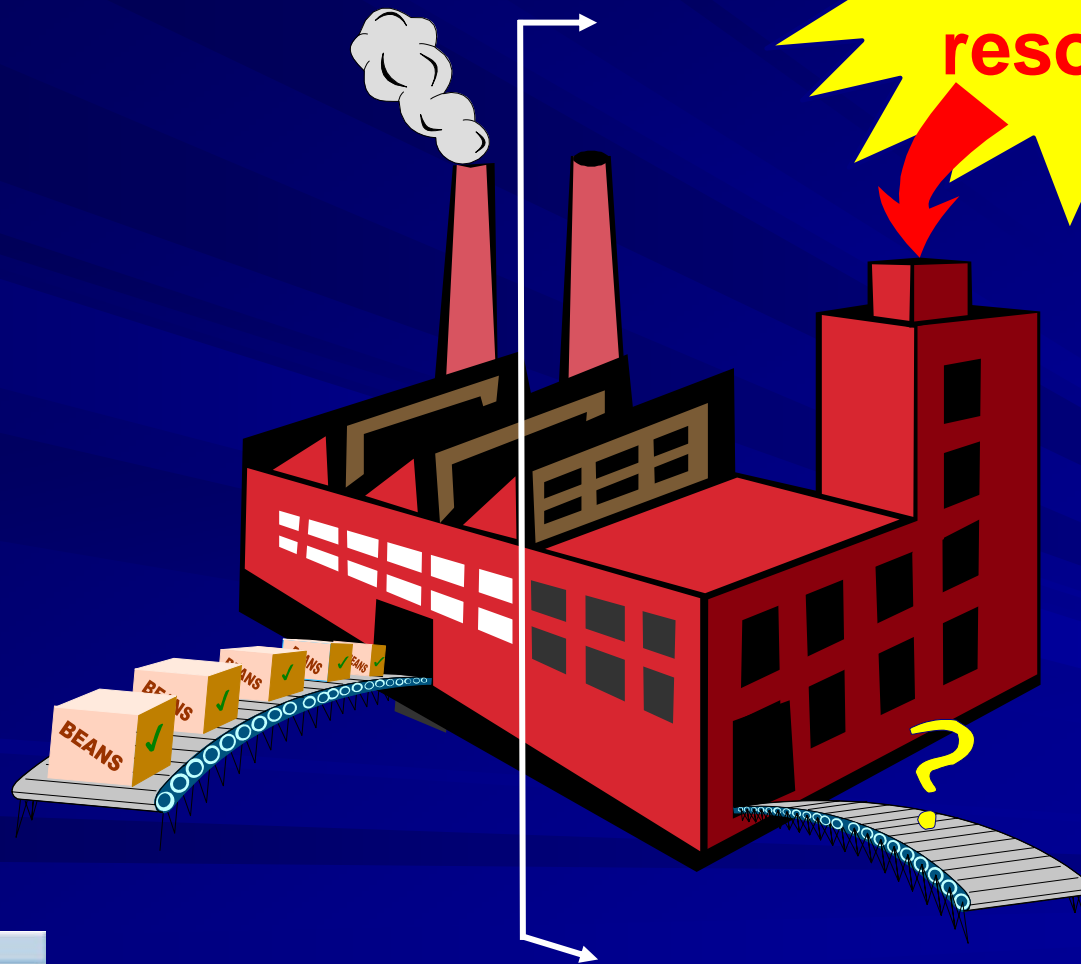


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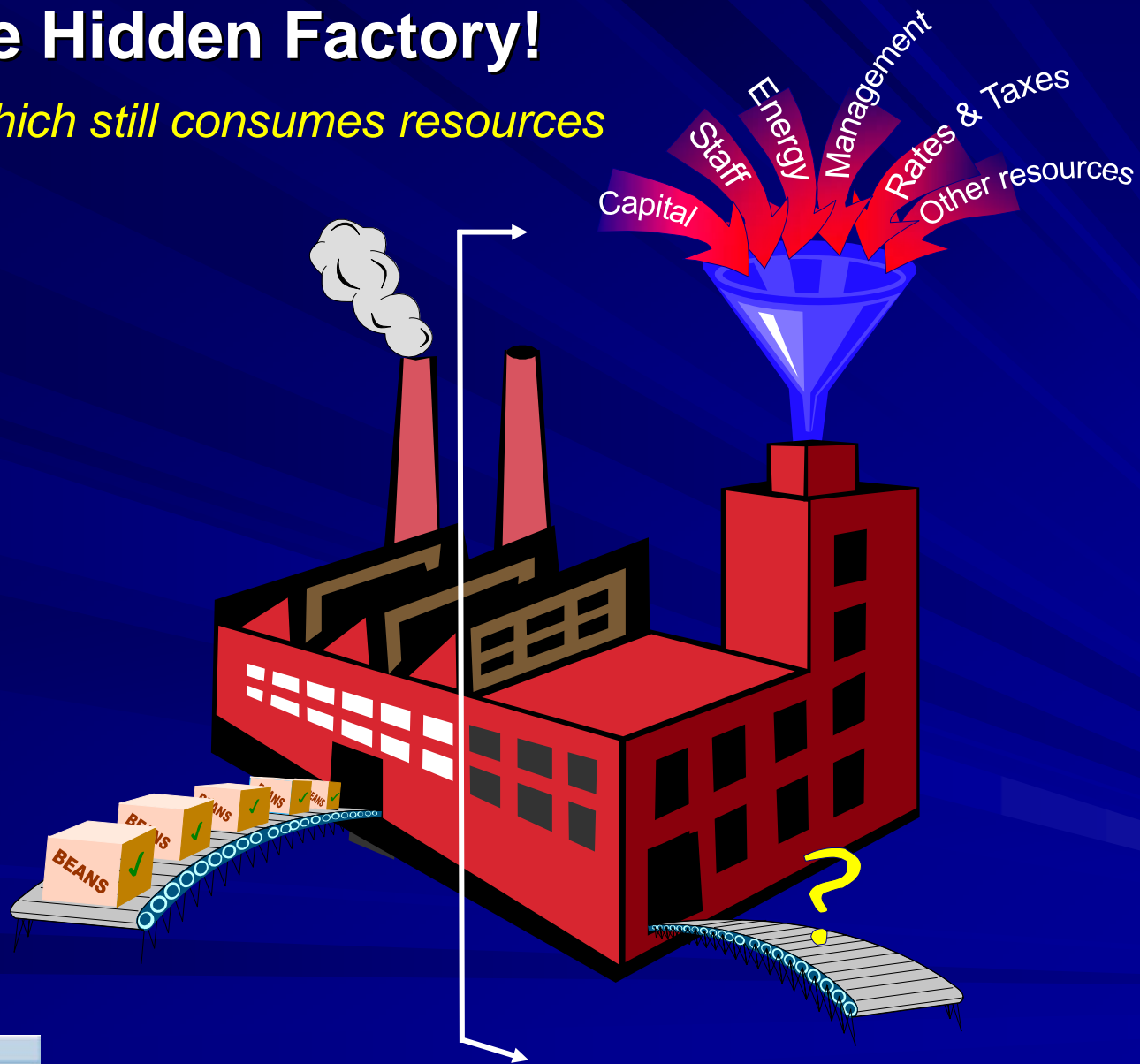
The Hidden Factory!



**...but still
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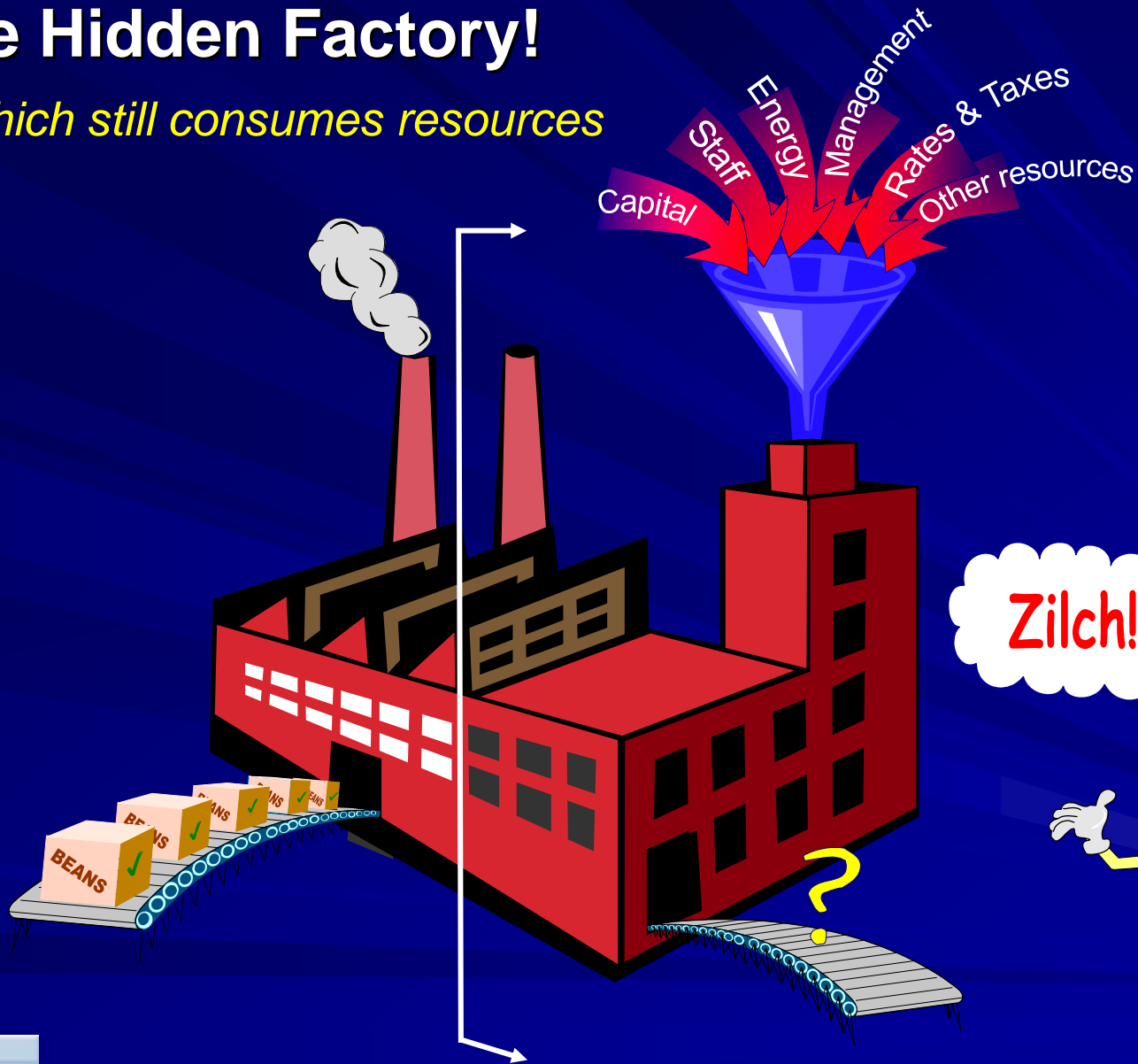
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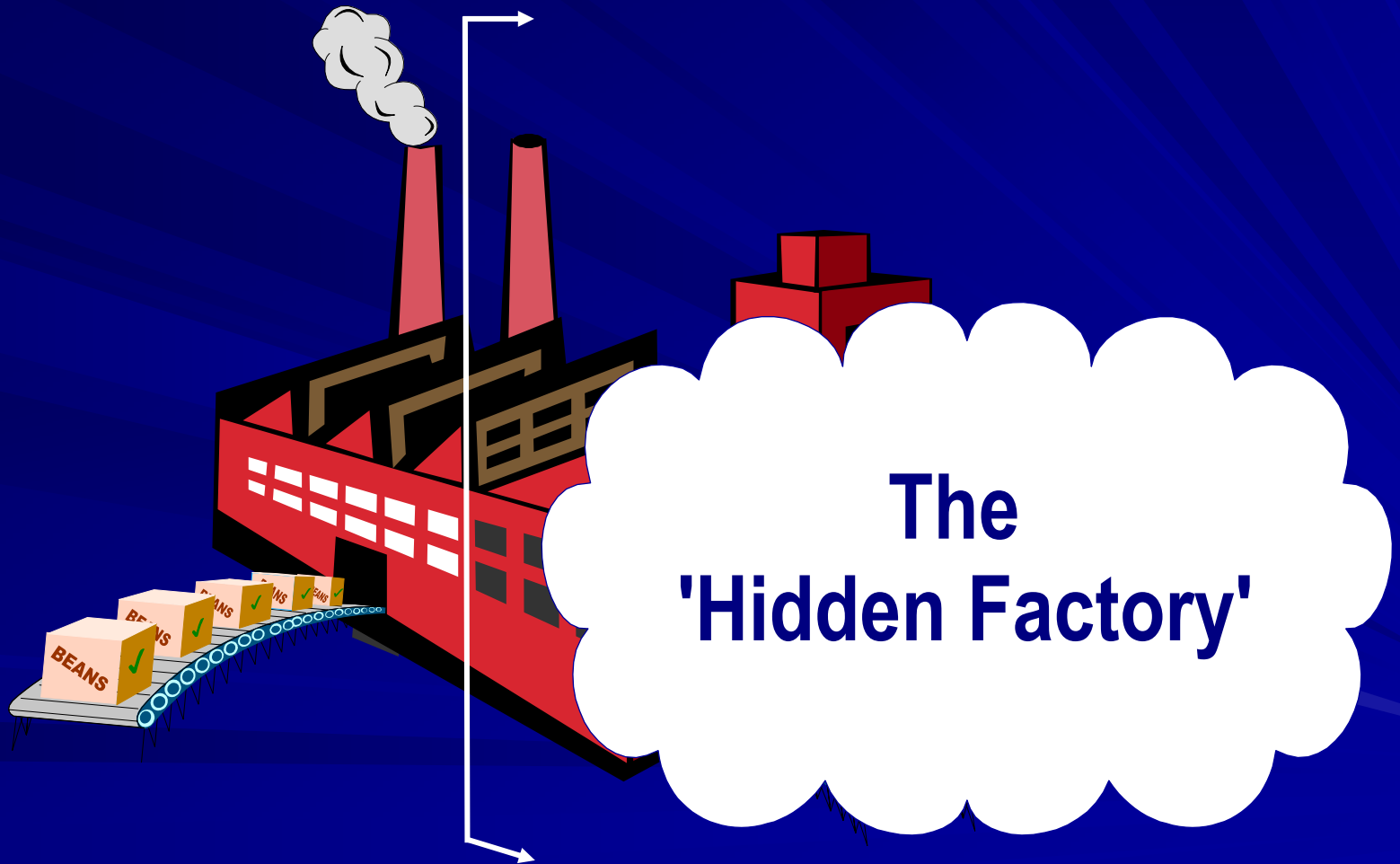


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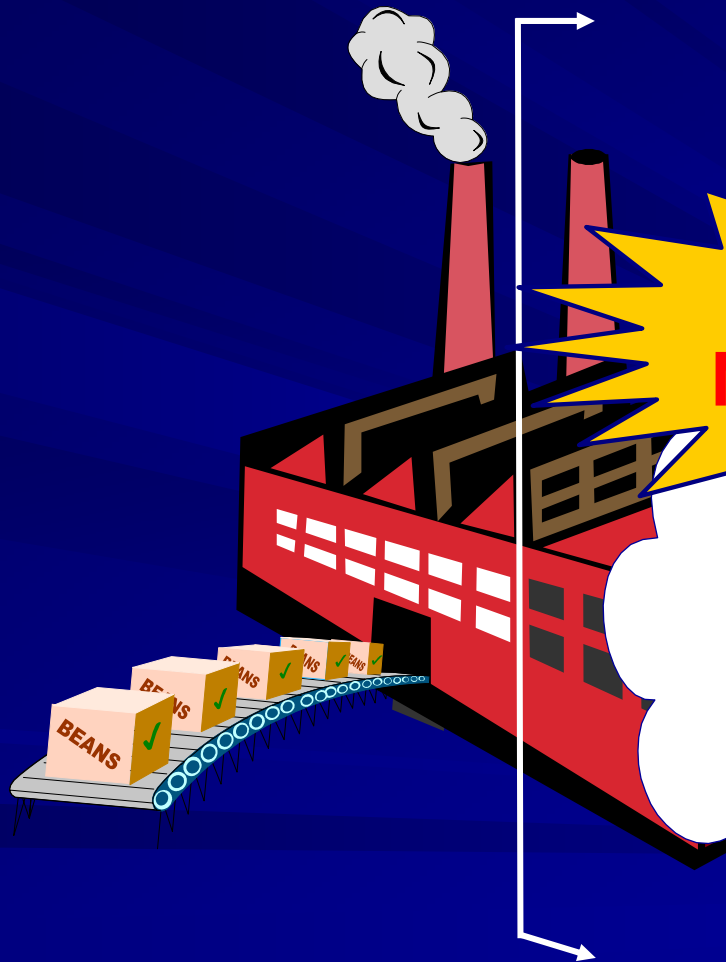
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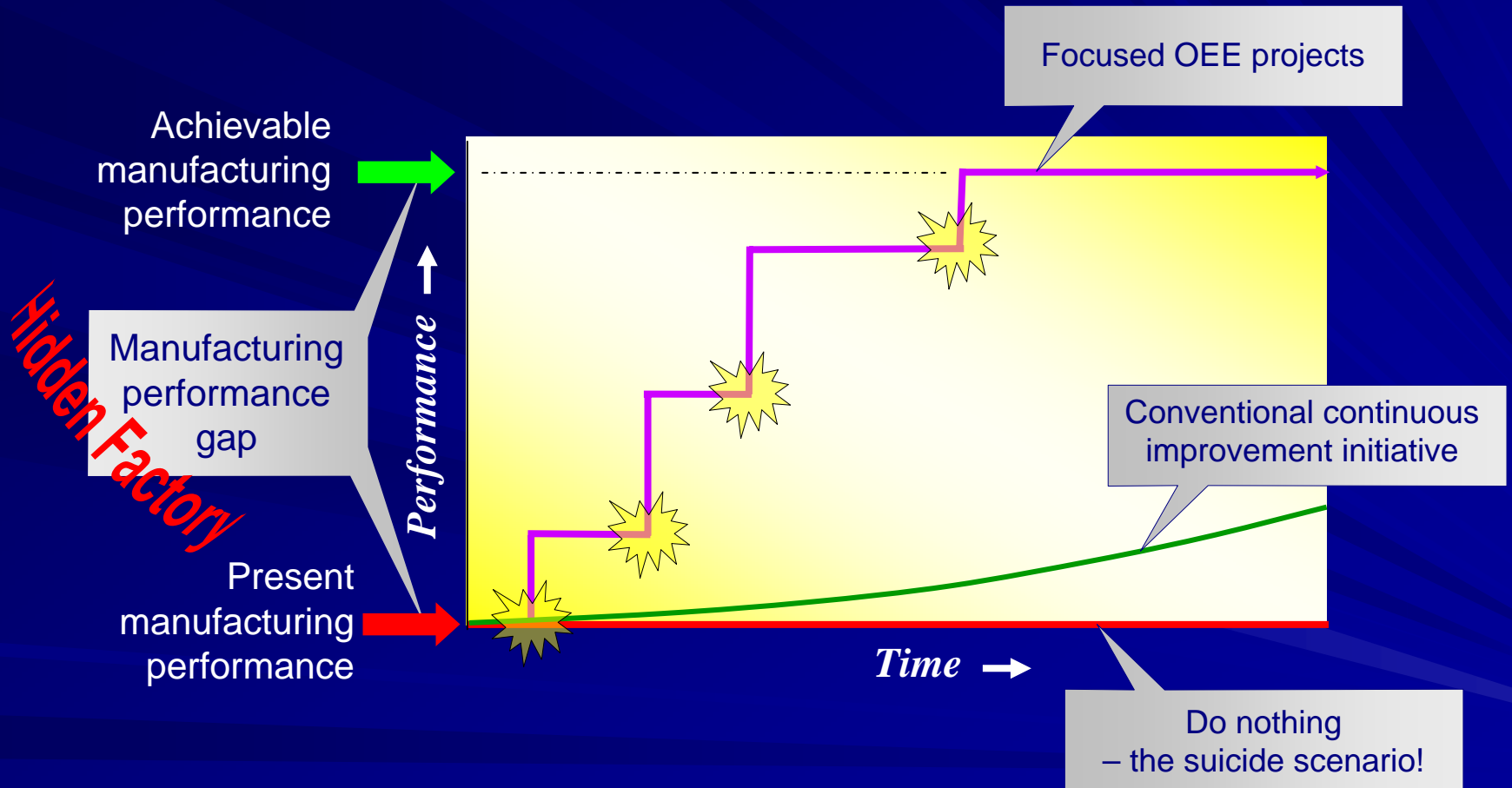


OEE and the Theory of Constraints

- OEE must be applied to manufacturing bottlenecks & pinchpoints – *not in general like with Kaizen*
- Define the hierarchy of critical processes and bottlenecks and attack in priority order
- As with RCM, beware of ‘analysis paralysis’ - *just get on with it!* – a bias for action is needed

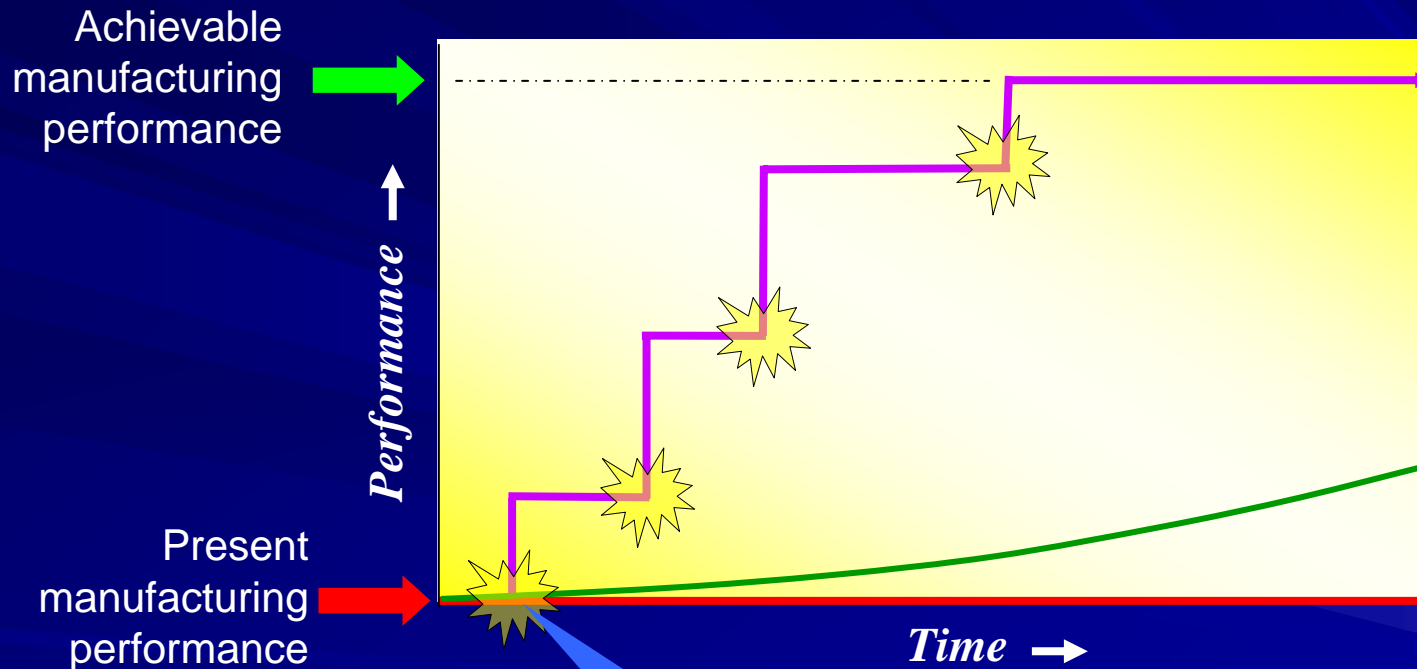
OEE and the Theory of Constraints

Attacking the Points of Constraint – the *manufacturing bottlenecks & pinch points* - to maximise performance



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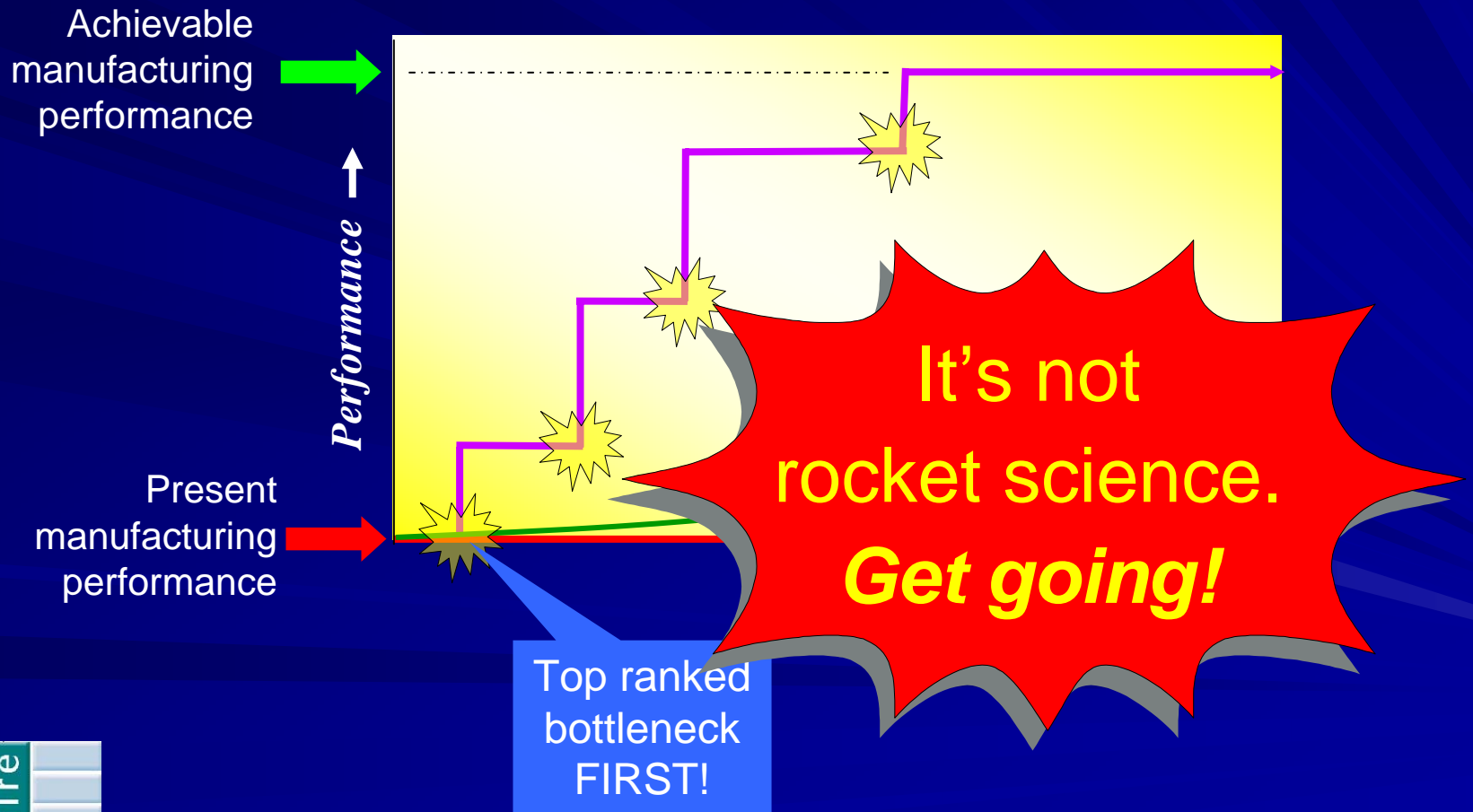


Top ranked bottleneck FIRST!



OEE and the Theory of Constraints

Attacking the Points of Constraint – the *manufacturing bottlenecks & pinch points* - to maximise performance



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