



METHODS do you have in **DESIRED**
What **& TOOLS** place to drive the **RETURNS?**

EFFECTIVELY the success of
Can your company **MEASURE** capital investment?

IDENTIFY your **HIDDEN** factory
Can you **LOSSES?**

Asset Optimization



Process Optimization

Can your company effectively measure the success of capital investment?

What methods and tools do you have in place to drive the desired returns?

Can you identify your hidden factory losses?

Rising global pressures such as foreign competition and market expansions are forcing manufacturing companies to answer an important question: how can they become the low cost producer while driving the highest return on investment?

Commissioned benchmark studies give a compelling and realistic understanding of asset management and process performance within various industry verticals. Best in Class Performers in each vertical demonstrate the ability to optimize both asset management and process performance delivering significant, sustained Returns On Investment (ROI).

The Best in Class Performers have realized these returns on asset and process reliability from four primary sources:

- Reduction in Maintenance Costs
- Lower Inventory Requirements
- Lower Energy Consumption
- Higher Productivity (Asset/Process Optimization)

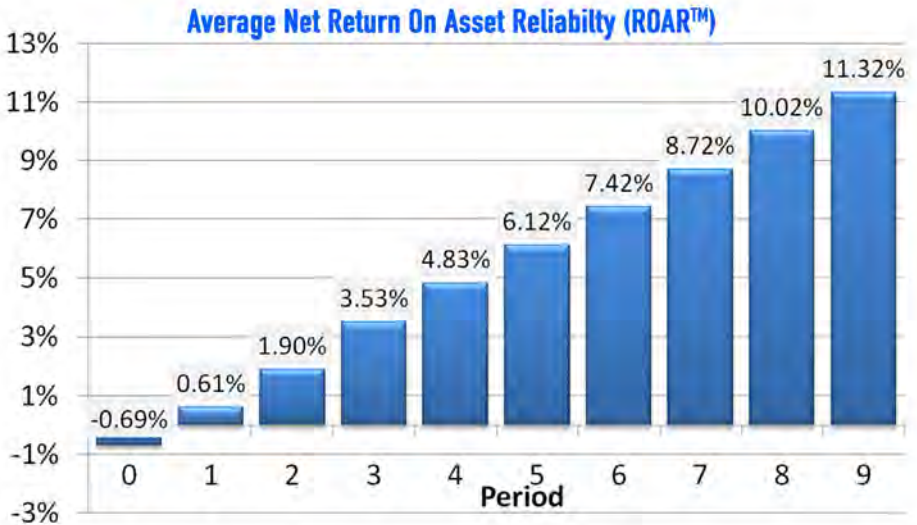


Figure 1

But... how do you effectively measure these returns?

GPAllied's Return On Asset Reliability (ROAR™) is an innovative method of reliably measuring return on capital investment in asset management. Utilizing Life Cycle Costing methodology, ROAR™ gives insights on how capital investments impact overall



returns. In doing so, ROAR™ substantiates tangible returns obtained from reallocating new asset investment capital and redirecting it into a total reliability offering (an effective asset reliability system).

The application of ROAR™ modeling can be utilized on many levels: Enterprise, Business Unit, Plant, Process, System, Asset, Component, and Failure

| ELEMENT | LEVEL 1 NOT ENGAGED | LEVEL 2 EXPERIMENTING | LEVEL 3 ENLIGHTENED | LEVEL 4 GOOD PRACTICE | LEVEL 5 BEST PRACTICE |
|-----------------------------------|---------------------|-----------------------|--|-----------------------------------|-----------------------------------|
| ROI | Negative to zero | Minimal to no ROI | 4:1 | 8:1 | 16:1 |
| % Failure Maintenance | >70% | >50% | <40% | <25% | <15% |
| PM/PdM Balance | <25% Overall | <35% Overall | >50% Overall 15% PdM 35% PM | >65% Overall 25% PdM 40% PM | >80% Overall 45% PdM 35% PM |
| Asset Health | Not measured | Not measured | Exists on critical assets > 65% Green | Exist on all assets >75% Green | Exist on all assets >80% Green |
| Adherence | Not measured | <50% | >70% | >85% | >90% |
| % PdM Recommendations Implemented | <15% | <30% | >50% | >75% | >90% |

Figure 2

Mode. At the Enterprise level, ROAR™ allows us to compare a strategy of historical capital investment and its impact on Return On Assets (ROA) versus a strategy that includes investing a percentage of the earmarked non-base capital dollars on asset reliability.

The ROAR™ modeling process has shown that virtually any company can substantially improve their (ROA) by investing in the reliability of their existing assets. (Figure 1)

- Low-end ROAR™ (1:1) shows 34% NPV improvement over Capital Alone
- Average ROAR™ (4:1) shows 202% NPV improvement over Capital Alone

What methods and tools are available to support the ROAR™ model?

GPAllied's endorses three Reliability Engineering Methods designed to support ROAR™ modeling and optimal investment returns: 1) Maintenance, 2) Design and 3) Operations. When ROAR™ is diligently applied to all three, companies are able to effectively and accurately measure return on investment.

Reliability Engineering in Maintenance

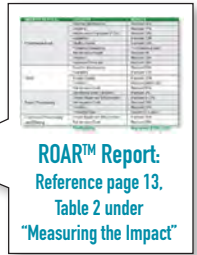
There are five key Reliability Engineering Maintenance elements that can be applied to support a company's continuous improvement initiatives:

- Optimized Preventive Maintenance (PM)
- Failure, Reporting, Analysis and Corrective Action System (FRACAS)
- Work Procedures/Job Plans
- Maintenance Materials
- Computerized Maintenance Management System (CMMS)

Benchmark studies indicate that Best in Class Performers use Best Practice Behaviors to deliver Best Practice results. (Figure 2)

The following pharmaceutical case study is an example. Prior to a reliability initiative, the company's product was coming off patent. After implementing a reliability initiative across several plants, the following results were realized:

- Reactive Maintenance 71% >>> 7%
- Overtime 22% >>> 5%
- Availability increased 12%
- Healthy Assets 35% >>> 85%
- Production Deviations to 1/10th of previous levels
- Maintenance Budget reduced 40%
- Inventory reduced 33%
- Insurance Premiums reduced 30%



| Asset Health Report | | | | | | | | | | | | |
|---|------------|------------|----------|--------------|------------|-------------|----------|------------|-------------------|----------------------|-----------------------|--------------|
| Equipment Type versus Technology Application(s) | MECHANICAL | | | | ELECTRICAL | | | | STATIONARY | | | |
| | Vibration | Ultrasound | Infrared | Oil Analysis | MCA Online | MCA Offline | Infrared | Ultrasound | Visual Inspection | Ultrasonic Thickness | Dye Penetrant Testing | Eddy Current |
| Chiller 2 | G | | R | G | G | R | R | | R | R | | R |
| Pump 5 | R | R | | | R | R | | | R | G | R | |
| Compressor 1 | R | G | | R | G | | | G | R | | | |

Figure 3

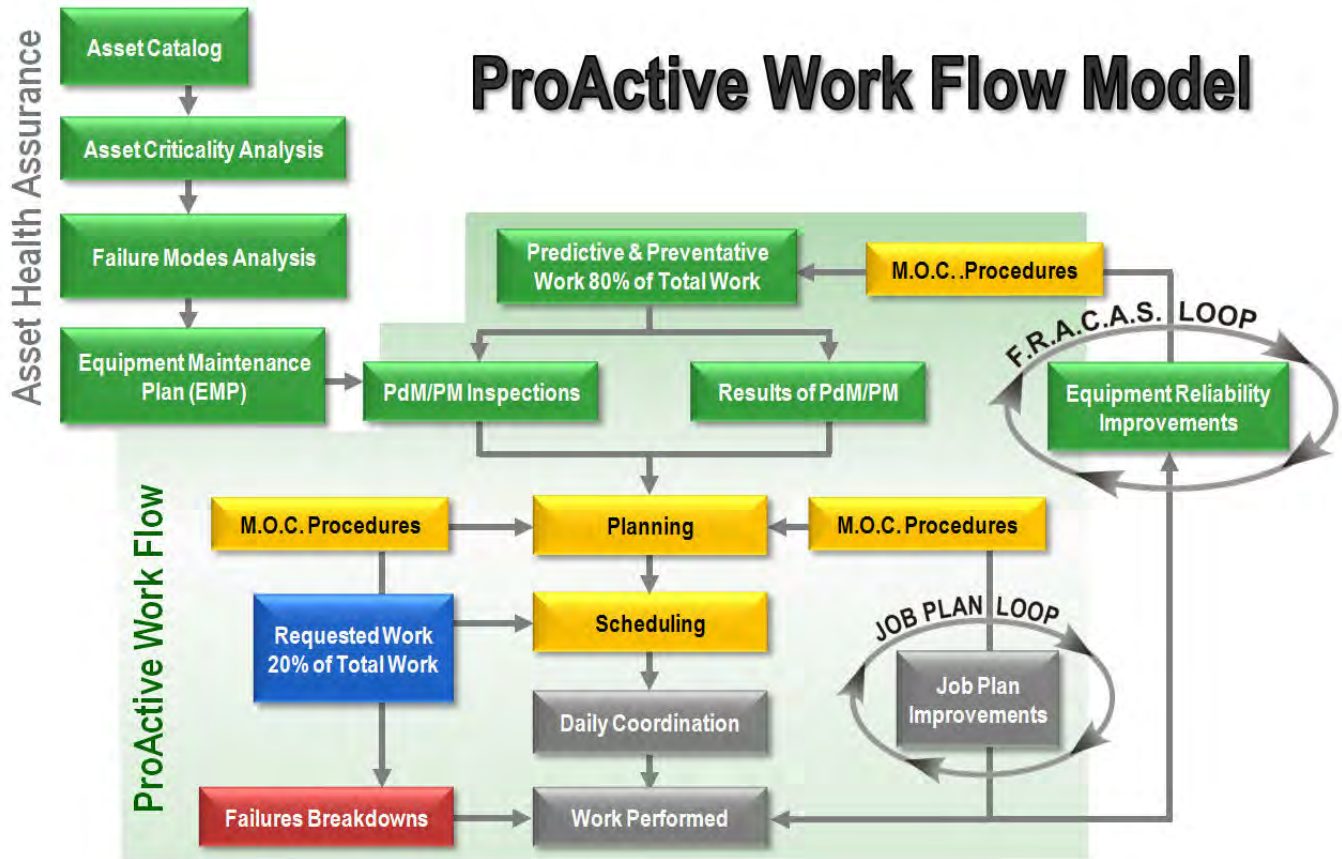


Figure 4

Focusing on Asset Health allows Best in Class Performers to achieve these types of results. Asset Health is defined as a metric that quantifies the overall state of a piece of equipment relative to presence of an identifiable defect. Defects identified by using an Optimized Preventative Maintenance or Integrated Condition-based Monitoring are coded “Red”. Assets with no defects are coded “Green” (Figure 3). By applying a Failure Mode Driven Strategy, defects can be exposed

earlier and subsequently eliminated which reduces costs and ultimately helps maintain a healthy asset.

Asset Health is on a short list of reliable indicators for plant maintenance expenditure. As demonstrated by the ProActive Workflow Model (Figure 4), planning, scheduling and precision execution of operations coupled with a consistently maintained continuous improvement process are hallmarks of Best in Class Performers.

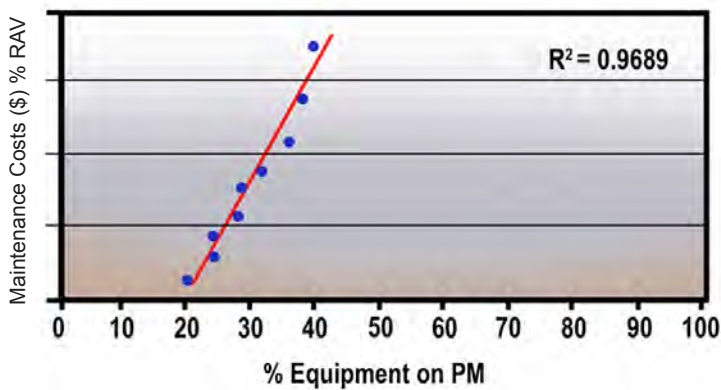


Figure 5

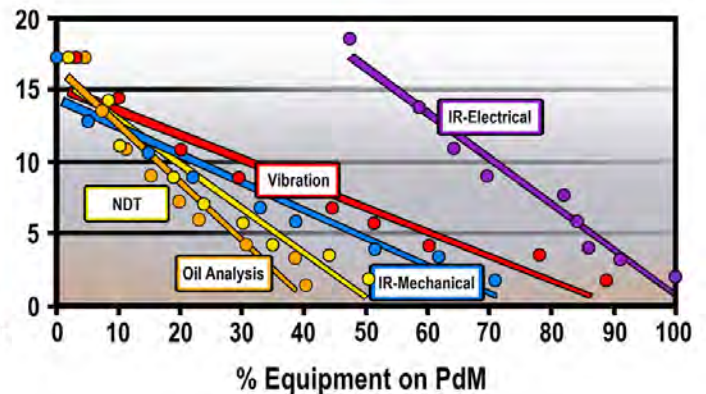


Figure 6

It is notable that benchmark data reveals Best in Class Performers lowered “Maintenance Cost to %RAV” with less Preventative Maintenance activities (Figure 5) while applying more Predictive Maintenance activities (Figure 6). The lifetime cost of an asset (over a 40 year period; Figure 7) can be significant depending on which Maintenance strategy is deployed (Run to Failure, PM only, PdM only, or Optimized PM/PdM).

Lifetime Costs – Total Costs (GTC)

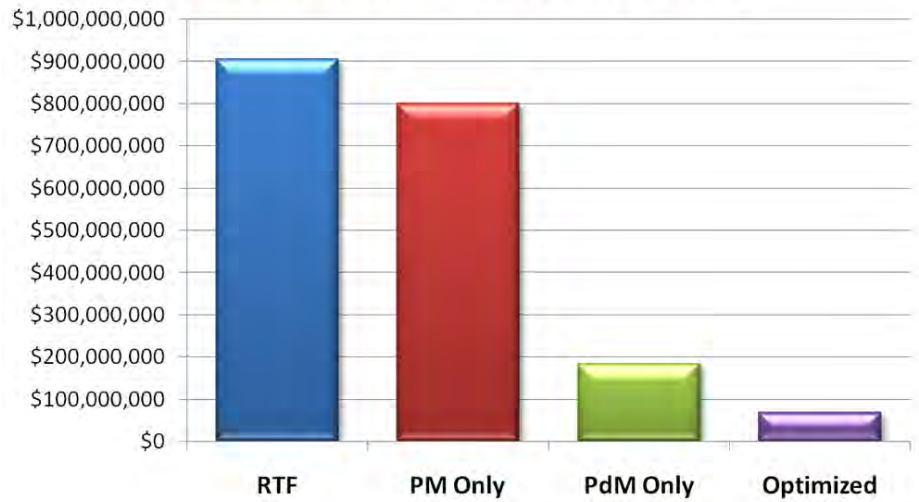


Figure 7

Reliability Engineering in Design

Best in Class Performers effectively implement Reliability Engineering in Design for assets. This method has proven to be essential in minimizing the total Life Cycle Cost while maximizing capacity, profits and return on asset reliability.

Consider the following:

- A Society of Maintenance and Reliability Professionals (SMRP) survey estimates over 80% of manufacturers do not utilize lowest life cycle modeling when designing new capital equipment projects.

Stages of Life Cycle Commitment

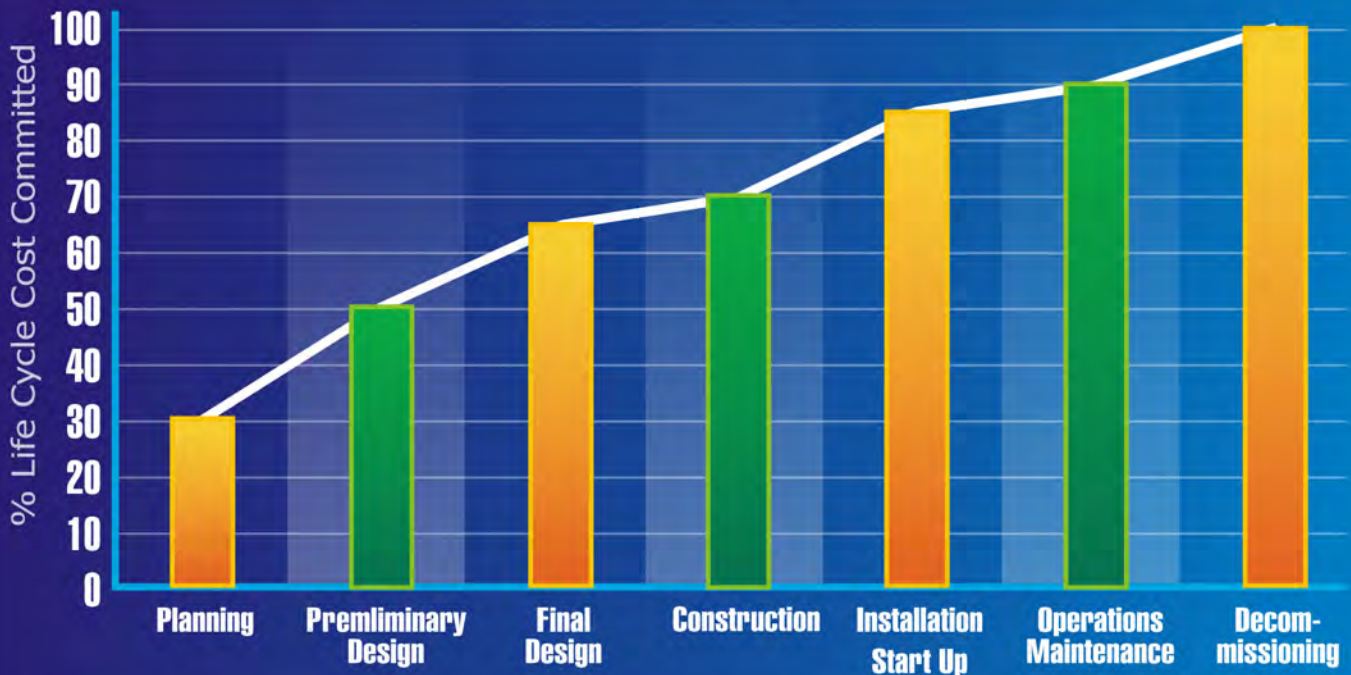


Figure 8

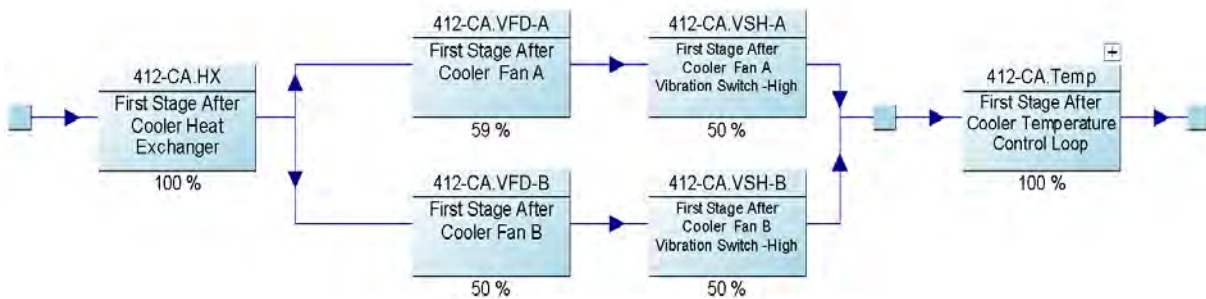


Figure 9

- Similar studies have shown that nearly 90% of the life cycle cost of an asset has been committed prior to its intended operating and maintenance activities (Figure 8)

There are seven Reliability Engineering in Design elements that can be applied to help maximize the return on asset reliability:

- Equipment Maintenance Plan (EMP)
- Reliability, Availability and Maintainability (RAM) Modeling
- Life Cycle Costing (LCC)
- Design for Maintainability
- Purchasing Specifications
- Human Factor Engineering
- Commission Procedures

Using Availability/Capacity Modeling tools, we can isolate equipment improvement gains from asset utilization improvement gains (equipment available to perform its intended function). The Reliability Block Diagram (RBD) (Figure 9) is the basis for capacity modeling.

Inputting data about equipment failures and the resulting consequences can produce a model that generates capacity expectations. The relative losses caused by equipment (Assets) versus losses caused by underutilization and inefficiency

(Process) can be examined using the Process Reliability Analysis (Figure 10).

Can you identify your hidden factory losses?

Reliability Engineering in Operations

What is a 1% loss in Overall Equipment Effectiveness (OEE) worth to an organization's profit margin?

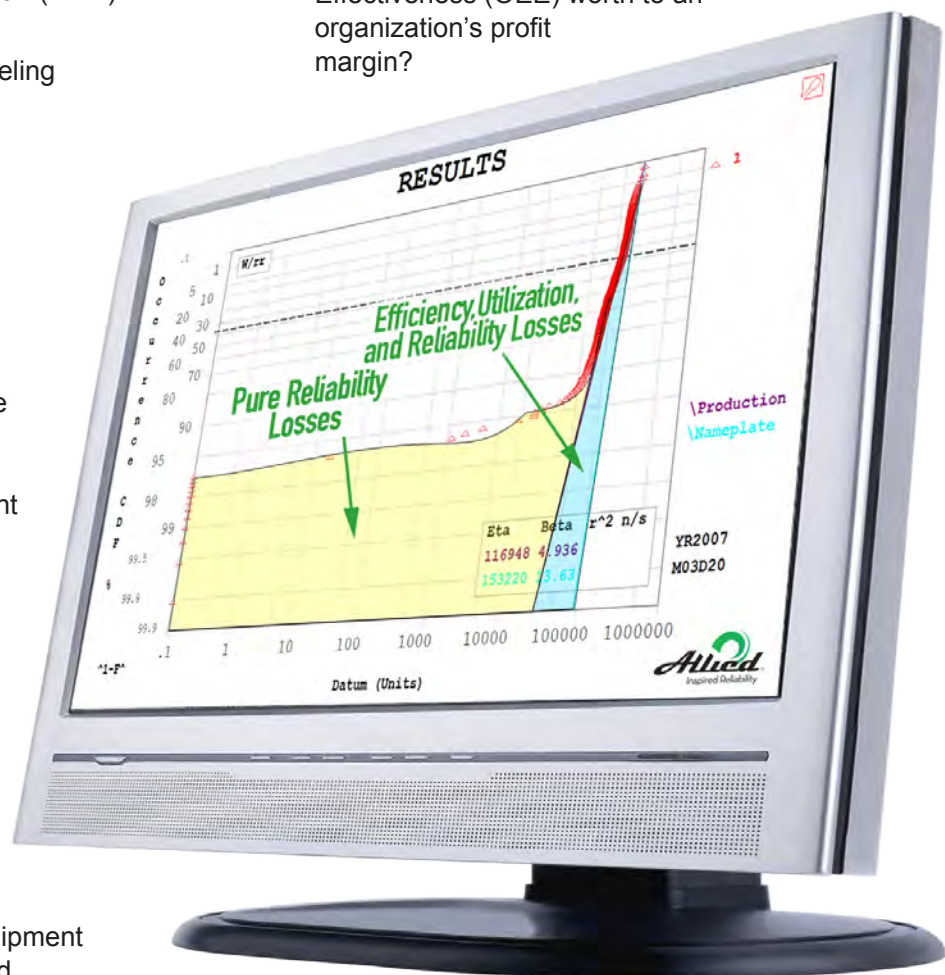


Figure 10

One million dollars? Five million?
 Many companies have no effective tool/method in place to measure the true economic impact of unreliability on their balance sheet. It is estimated that 60% have significant management driven issues of inefficiency and underutilization, as opposed to popular belief that asset reliability is the major cause. It is imperative to identify where the specific process losses are occurring, target them to reduce the variability, and uncover the hidden capacity – the “hidden factory”.

| Value Lever | Value Potential | Financial Statement Indicator |
|-------------------------------|-----------------|-------------------------------|
| Labor Savings | \$423,077 | COGS / SG&A |
| Inventory Savings | \$333,013 | Inventory / COGS |
| New Revenue Margin Contrib. | \$462,962 | Gross Profit |
| Expected Revenue Uplift | \$1,851,851 | Revenue |
| One Time Incr. in Working Cap | \$2,220,088 | CapEx / Assets |
| Just a 1% Increase in OEE... | \$6,510,048 | ...to the business |

Source: Informance International

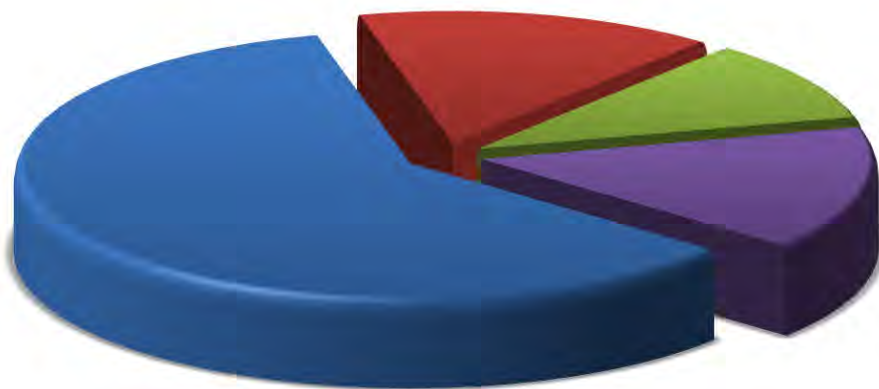
There are five elements of Reliability Engineering in Operation that can be applied to help build and implement a corrective action plan around maximizing the Return On Asset and Process Reliability:

- Process Reliability Analysis
- Overall Equipment Effectiveness/Loss Elimination (OEE)

- Alarm Philosophy & Strategy
- Lean Manufacturing
- Six Sigma

According to Informance International's benchmark data, thorough analysis of capacity reveals opportunity for best-in-class performance.

The Hidden Factory



- Uptime (60%)**
Average manufacturers operate below 60% OEE
- Planned Downtime & Setup (15%)**
Factories can lose up to 15% utilization to setup and planned downtime due to miscalculated effort times
- Catastrophic Downtime (10%)**
Up to 10% of factory utilization, receives considerable focus – not usually well quantified
- Hidden Downtime (15%)**
Opportunity for Best In Class performance; Over 15% of equipment and personnel losses can be attributed to hidden down time

- 5 minutes and less
- Difficult to quantify
- Unnoticed
- Unaccounted
- Pre-startup
- Unplanned breaks
- Shift interruptions
- Shift changes
- Minor maintenance issues

Source: Informance International



Sustained Reliable Operations

- Business Case Development
- Management Systems
- Leadership and Change Management
- Performance Improvement
- Enterprise-Wide Transformation

Reliable Maintenance Execution

- Strategy Development
- The Maintenance Work Cycle
- Work Measurement and Execution
- MRO and Lubrication Management

Sustained Reliable Operations

- Design/Build Services
- Engineering Services
- Installation, Commissioning and Operational Services
- Workforce Selection and Development Services

Training

- Lean/Six Sigma/5S
- Asset Health Assurance
- Reliability Engineering
- Change Management
- Planning, Scheduling and Turnaround Management
- Maintenance Craft Skills Management
- Operator Care

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