Segment Component Requirements

6.8 On-line Diagnostic Tools

Several options exist for on-line diagnostic tools: permanently attached and portable devices. The following measurements shall be included in FOUNDATION fieldbus diagnostic tools:

- Voltage per segment
- Segment noise
- Maximum fieldbus signal (communications) level
- Minimum fieldbus signal (communications) level
- Low resistance between shield and negative signal pole
- Low resistance between shield and positive signal pole

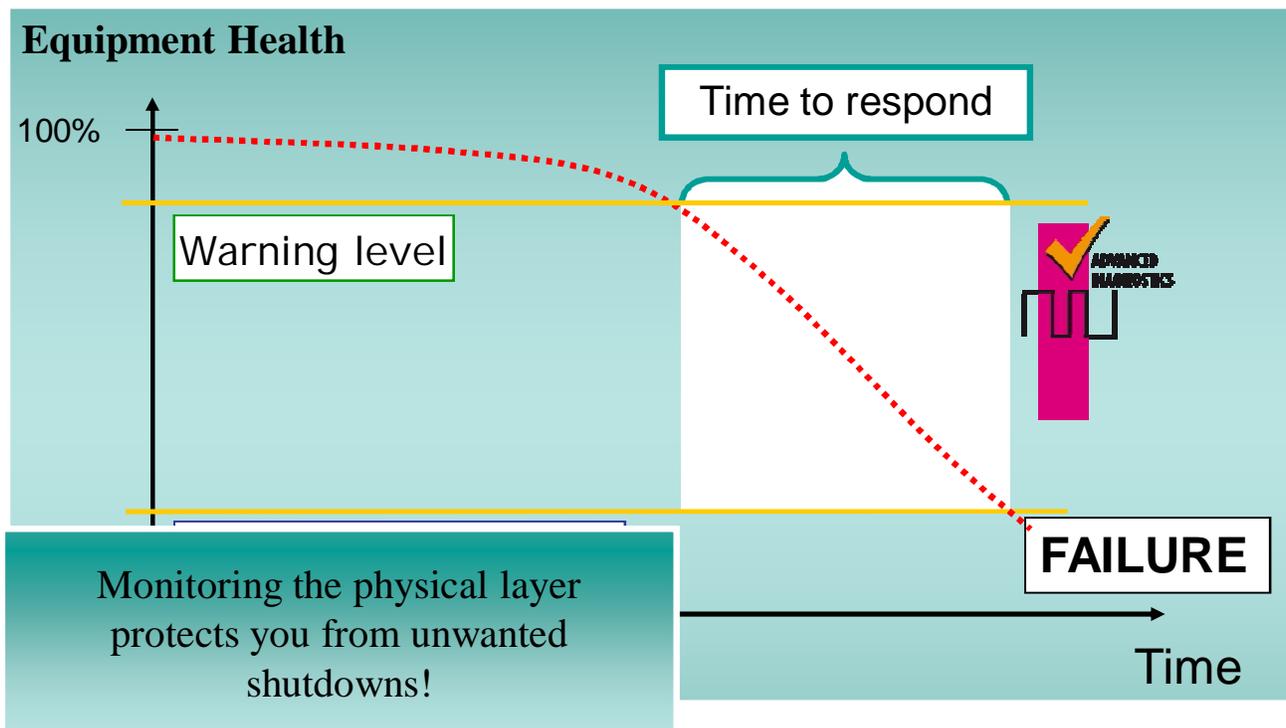Optional measurements include:

- Fieldbus jitter on the segment

If the on-line diagnostic tool is permanently installed as part of the FOUNDATION fieldbus power supply, additional information may be available, such as:

- Minimum, maximum and real time bulk voltage supply to the FOUNDATION fieldbus power supply
- FOUNDATION fieldbus power supply operational status
- Minimum, maximum and real-time FOUNDATION fieldbus current

Benefits of permanently installed diagnostic tools may include the ability to historize the data, and provide real-time alarming and trending of the data. Portable diagnostic tools assist in troubleshooting specific problems and may present additional data not available with permanent diagnostic tools. Permanently installed diagnostic tools shall only be considered if they are well integrated with the Host system.

Online monitoring of the physical layer

Equipment Health

Time to respond

100%

Warning level

FAILURE

Monitoring the physical layer protects you from unwanted shutdowns!

Time

Physical Layer Diagnostic during "Commissioning"

- Objectives
    - Fast track commissioning to reduce time and costs
    - Secure segment availability and reduce maintenance costs for plant operation

- Achievement of objectives
    - Automatic evaluation and identification of problem areas with the help of an expert system
    - Automatic documentation generation including all measured physical layer values
    - Physical layer baseline values storage in the Advanced Diagnostic Module" as input for plant operation survey

Physical Layer Diagnostic during "Plant Operation"

- Objective
  - Secure segment availability to reduce plant downtime and maintenance cost

- Achievement of objective
  - "Predictive Maintenance" due to real-time diagnostic where all parameters that may effect the operation are monitored.
  - Deviations from recorded data during commissioning will be alarmed
  - Problem areas are pinpointed quickly by a PC tool reducing the time to repair which improves system uptime and plant safety
  - History function for communication and physical layer values will allow to monitor long-term changes
  - Remote access capability (Internet) will allow fieldbus experts to evaluate a fieldbus segment remotely

Physical Layer Diagnostic during "Plant Operation"

- When an error message occurs go directly to the Diagnostic Menu "Expert Diagnostic window".

- Here you can find
  - probable causes of the message
  - Actions to be taken to solve the problem

- From there all other functionalities of the DTM could be chosen
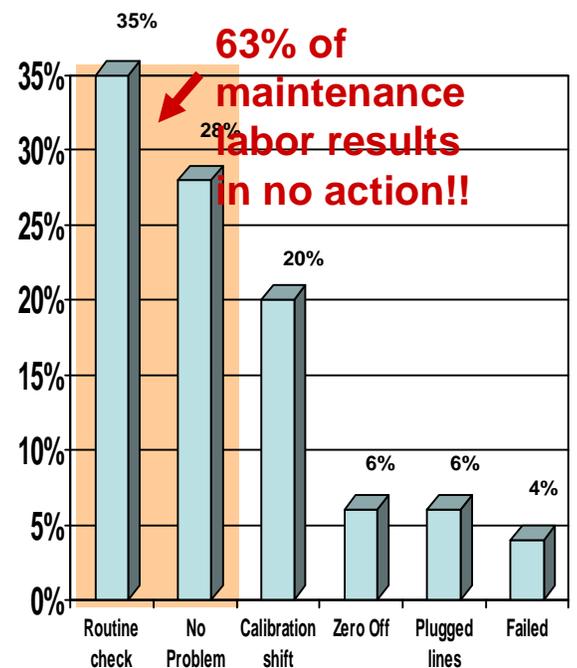 - Fieldbus oscilloscope
  - Commissioning wizard
  - History
  - …

Diagnostics during Operation

Maintenance activities over 1 year (typically initiated from operation due messages from DCS)	Technology		
	4-20mA	Fieldbus w/o diagnosis	Fieldbus with diagnosis
	15 minutes per loop	60 minutes per segment	8 minutes per segment
	18000 minutes	6000 minutes	800 minutes
	37.5 days	**12.5 days**	**1.6 days**

Reduced Maintenance Costs

- 40% of Mfg. Cost is Maintenance

- 50% of Maintenance Is Corrective

- Corrective is 10 times More Costly Than Preventative Maintenance

- Preventative Maintenance is Done 25% of Time and is 5 Times More costly Than Predictive Maintenance

- 60% of Preventative Maintenance is Unnecessary

63% of maintenance labor results in no action!!

Chart values:
- Routine check: 35%
- No Problem: 28%
- Calibration shift: 20%
- Zero Off: 6%
- Plugged lines: 6%
- Failed: 4%

Source: Shell Global Solutions

The Benefits of Predictive Maintenance are Documented

% Improvement vs.Traditional Maintenance
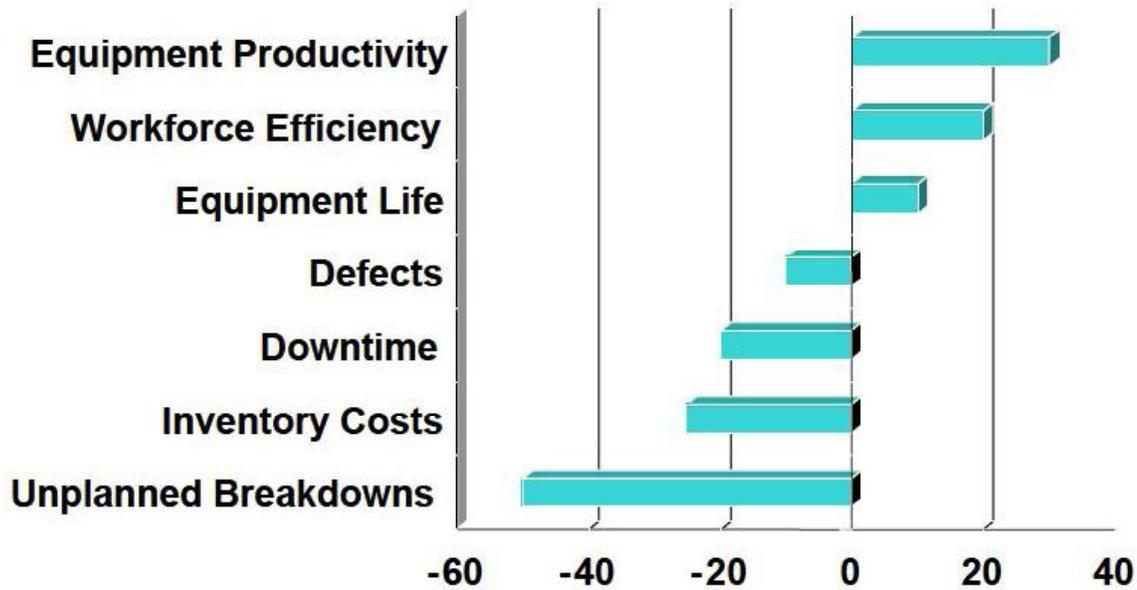
Total savings can exceed 20% of budget

Source Automation Research Corporation

Cabinet Control via Diagnostic Gateway

- Inputs for monitoring the control cabinet
  - Namur sensors / Frequency input (6x)
  - Analog input for temperature (2x)
  - Humidity sensor on board

- Power outputs (240 V, 2x)
- On/Off controller
- Configurable via Foundation Fieldbus H1
- Fan is not working
- Door not closed
- Water ingress

Typical Interface

Operator
station

Asset
Management

Ethernet (optional)

Relay contact
optional)

RS485
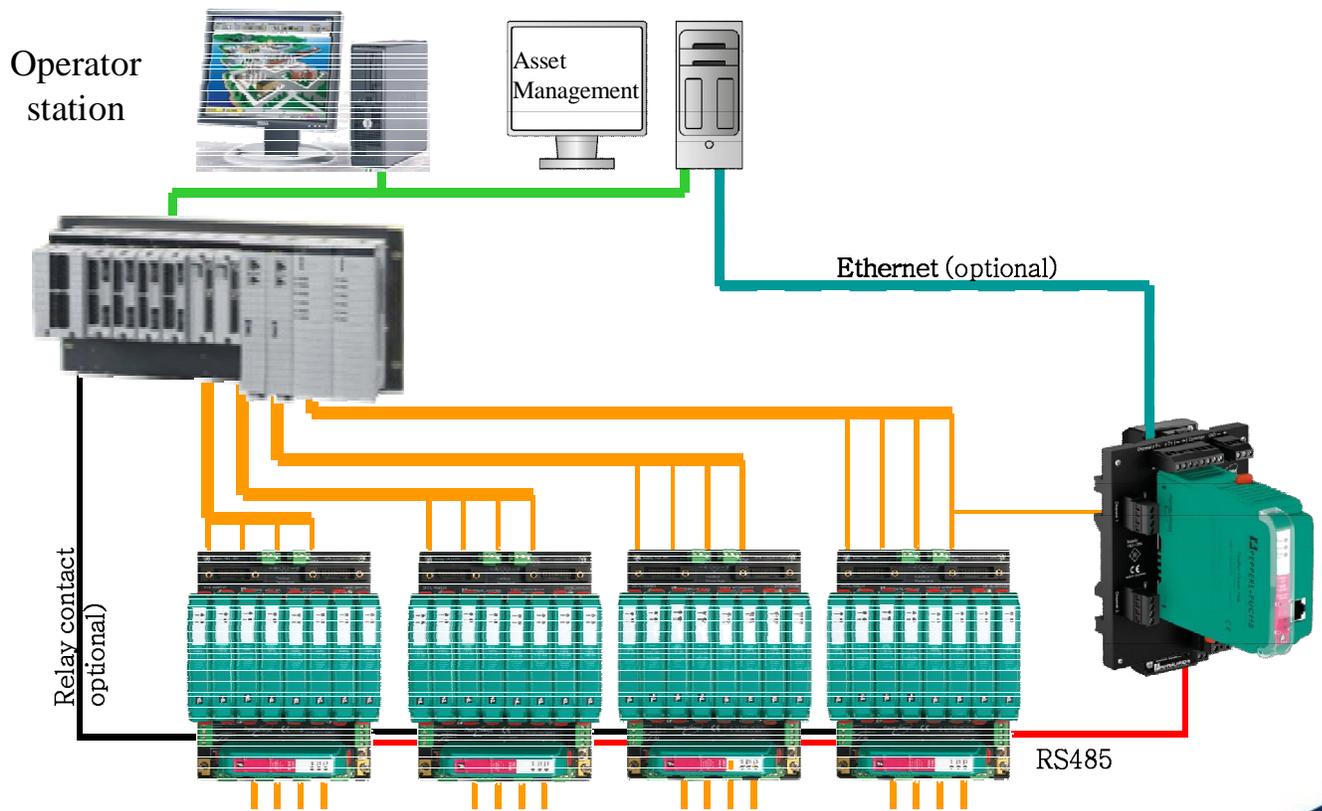
Asset Management Integration

- One Plant Asset Management
  - Includes fieldbus now as asset
  - Customary look and feel
  - Reduces required training
  - Reduces potential for errors

- Open Architecture Integration:
  - AMS Suite
  - PRM
  - FieldCare
  - FieldMate
  - PACTware
  - OPC Interface

Reduce Unplanned Shutdowns

- Unplanned Shutdown Accounts for 5 Percent of Production in the Process Industries

- One Unplanned Shutdown can Wipe Out your Entire Plant Profit for the Year

- Field Diagnostics Provide Advance Knowledge of Impending Problems

- FOUNDATION technology enables truly distributed and deterministic controls which are designed to function regardless of host issues

Automation is a Small Percentage of Total Project Costs, But a Big Influence
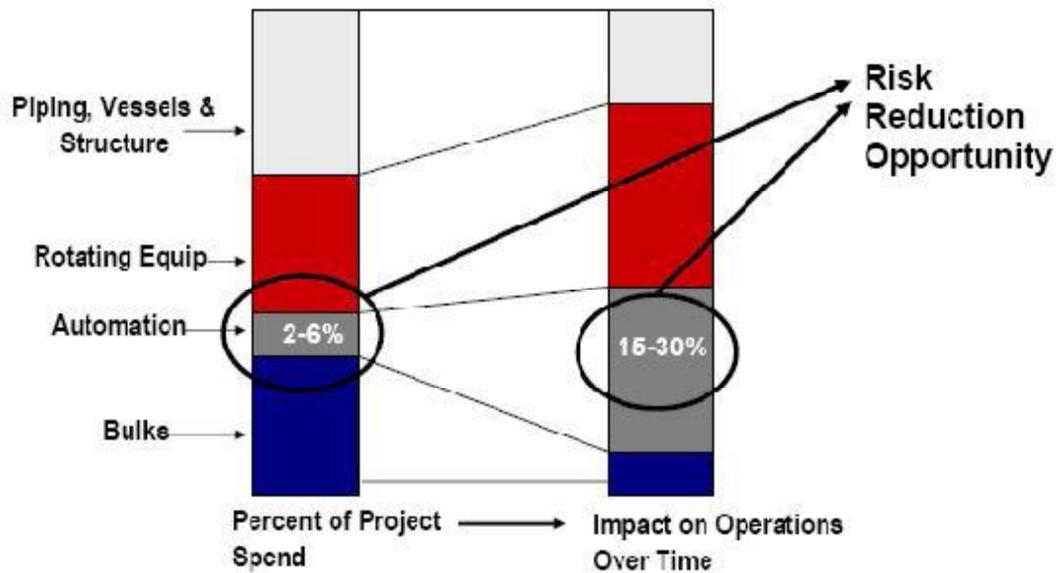
- The Success of Your Operations & Maintenance Strategy Depends on the FEED Phase

- Technology (HART/Fieldbus) and its impact should be considered in this phase, where it can create a more powerful return on investment

Early Involvement Means Better Risk Identification

44#
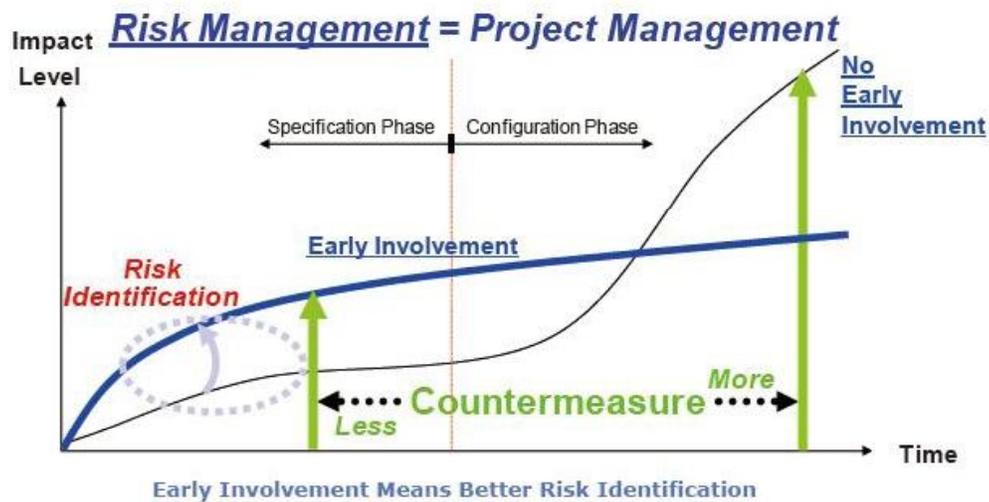
Think all Networks Offer the Same Diagnostics? Think again.

- **More Diagnostics, with better granularity**

- **Better Management of Diagnostic Data**

- **Data Quality and reliability**

- **Severity of Diagnostic Conditions per NE 107**

Summary

- **You can realize significant lifecycle cost benefits with proper ASSET MANAGEMENT SYSTEM integration of FOUNDATION fieldbus**

- **Fieldbus is different, not difficult**

- **Remember, the right partner, training and work processes are the keys to success**

Thank You

PEPPERL+FUCHS
PROTECTING YOUR PROCESS

Plant Solutions

Improve Safety, Reliability and Operations

With Essential Asset Health

EMERSON
Process Management

ASSET MANAGEMENT

Population Will Increase…
But The Workforce Will Shrink

2005
to
2050

Change in age-eligible workforce
as % of total population

India, Turkey, Indonesia, Mexico, Brazil, US, UK, Australia, France, Germany, Canada, China, Japan, Italy, Russia, Spain, Korea

EMERSON
Process Management

Source: United Nations (UN)
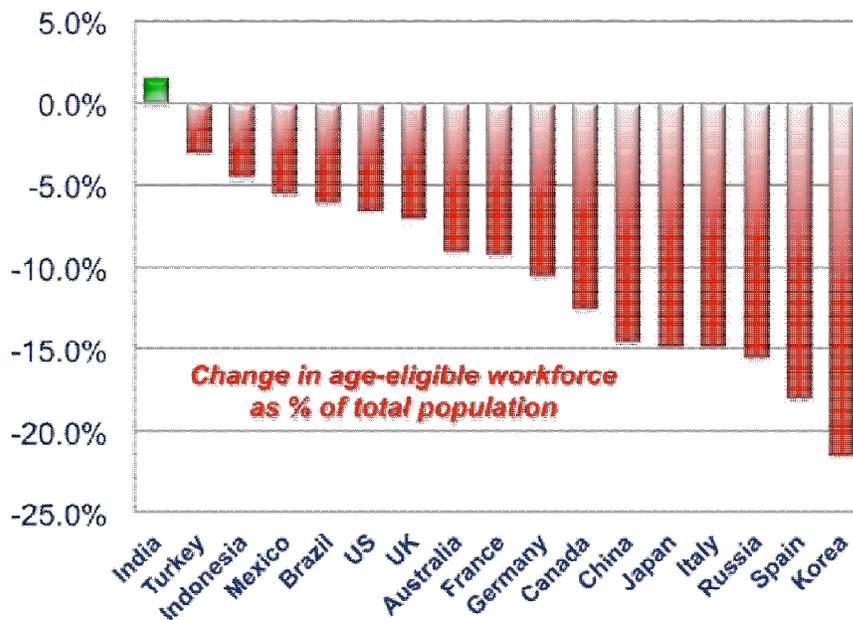
Our Customer's Business Challenges are highly Interdependent

Reliability
- Unplanned Shutdowns
- Capacity Utilization
- Maintenance Index

Financial
- Return on Capital Employed (ROCE)
- Income and Margin
- Capital

CRITICAL BUSINESS CHALLENGES

Efficiency & Throughput
- Throughput
- Energy Intensity
- Cash OpEx
- Crude Rate / Sour Crude Rate

Safety & Environment
- Incidents
- Spills / Emissions / Discharges
- Fines / Penalties

Personnel
- Headcount
- Training
- Critical Skills

Unplanned Shutdowns affect many areas

Global Downstream

Mike Wirth
Executive Vice President

Chevron

Addressing Your Challenges

Asset Monitoring Solution

Online Machinery Monitoring
with Digital Overspeed
Protection for SIS
(CSI 6300 SIS)

Asset Reliability
Services

Infrared
Thermography
(Integrated to
AMS Suite)

Online Machinery
Monitoring
(CSI 6500)

AMS
Suite

Lubrication
Analysis
(Spectro 5200)

AMS Suite
• Machinery Health Diagnostics
• Performance Monitoring
• Asset Graphics

Laser Alignment
(CSI 8225)

Portable
Machinery
Monitoring
(CSI 2600)

Advanced
Vibration Analysis
and Balancing
(CSI 2130)

Wireless Vibration
Monitoring
(CSI 9420)

Intrinsically Safe
Vibration Analysis
(CSI 2125-IS)

EMERSON
Process Management

Machinery Applications at Typical Plant

Turbines
Generators
Compressors

Motors
Pumps
Fans
Gearboxes

5%
Critical

25%
Essential

30%
Important

20%
Secondary

20%
Non-Essential

Online
Monitoring

Automated Data Collection
Periodic Data Collection

Portable/Manual

Portable/Visual

Run to Fail

EMERSON
Process Management
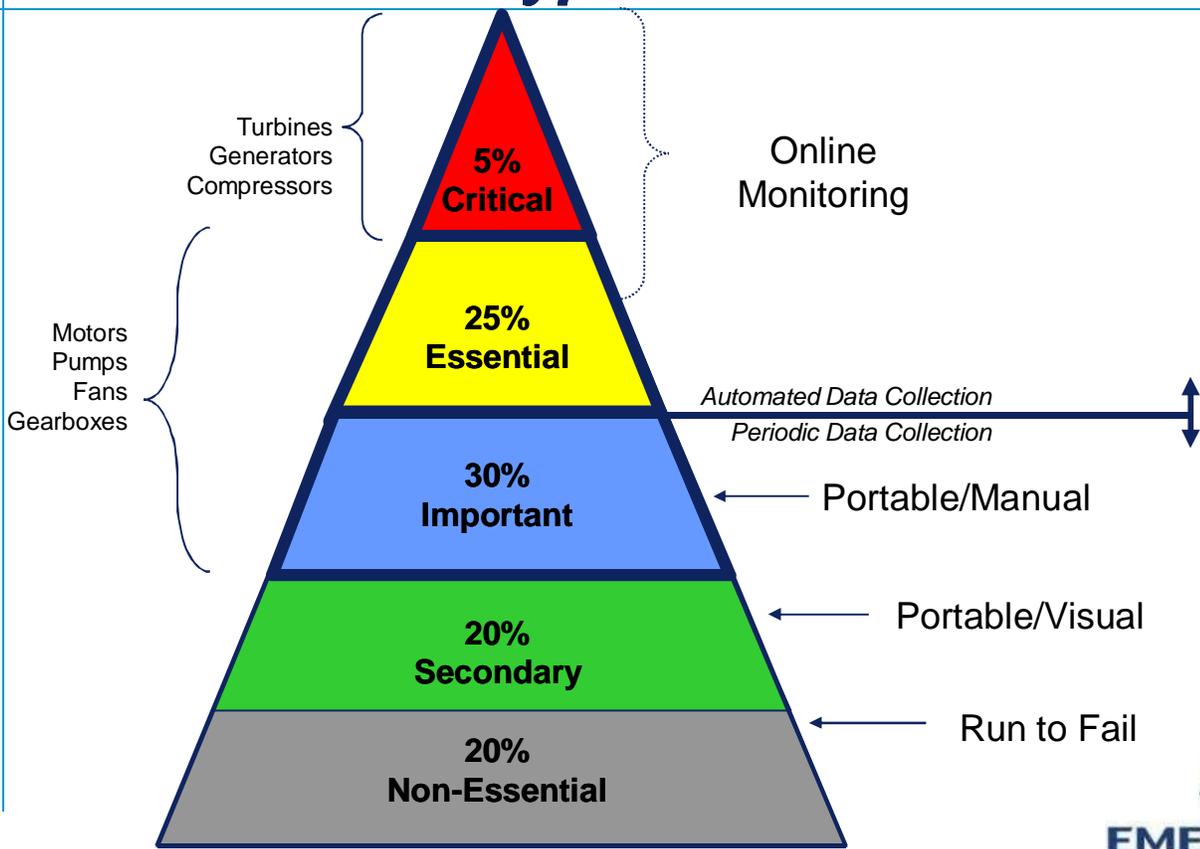
What are "Essential Assets"?

- Any asset whose outage could cause a significant process disturbance, slowdown or shutdown

- Not considered critical enough to have wired monitoring systems already in place

- Limited instrumentation for real-time monitoring

- Failures may be considered Low Probability–High Impact

Pumps

Blowers/Fans

Heat Exchangers
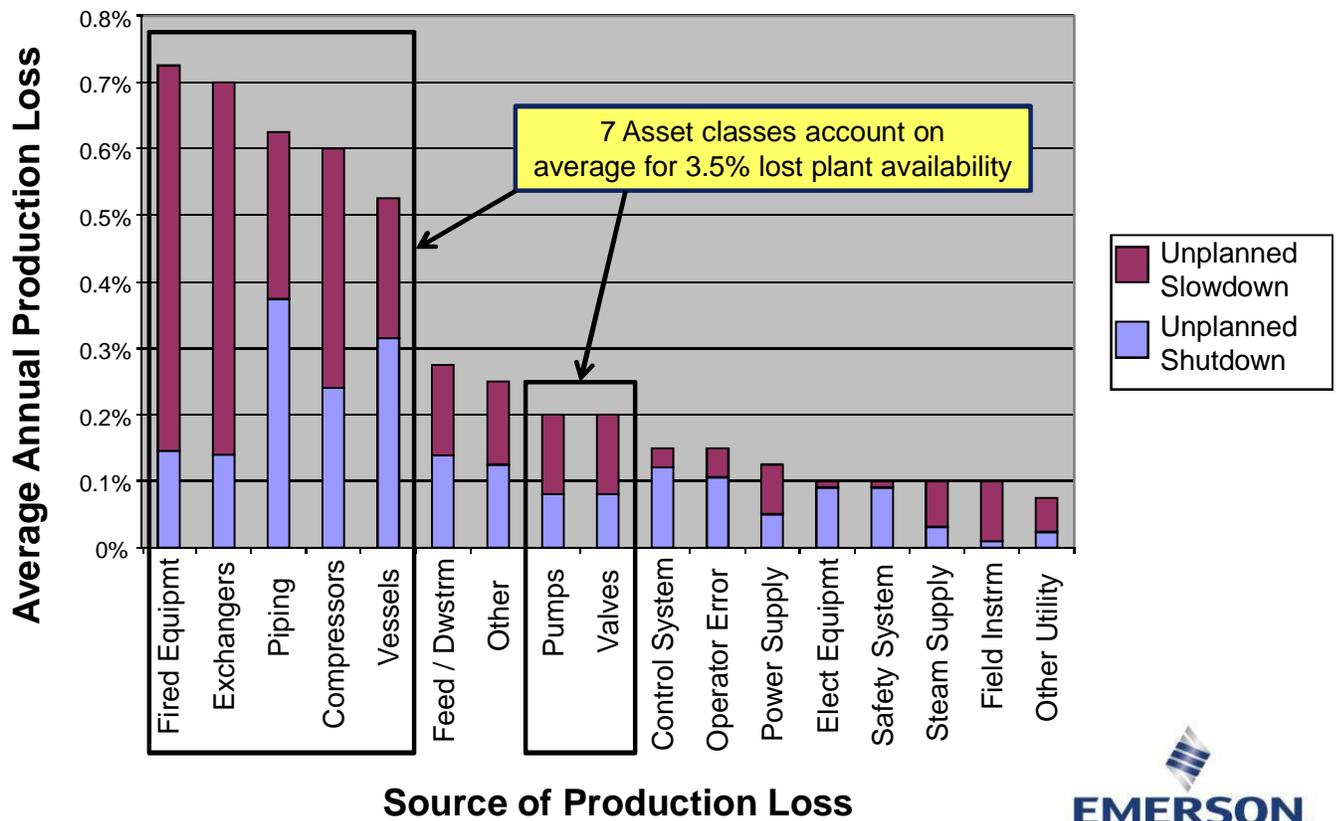
Vessels

Simple Compressors
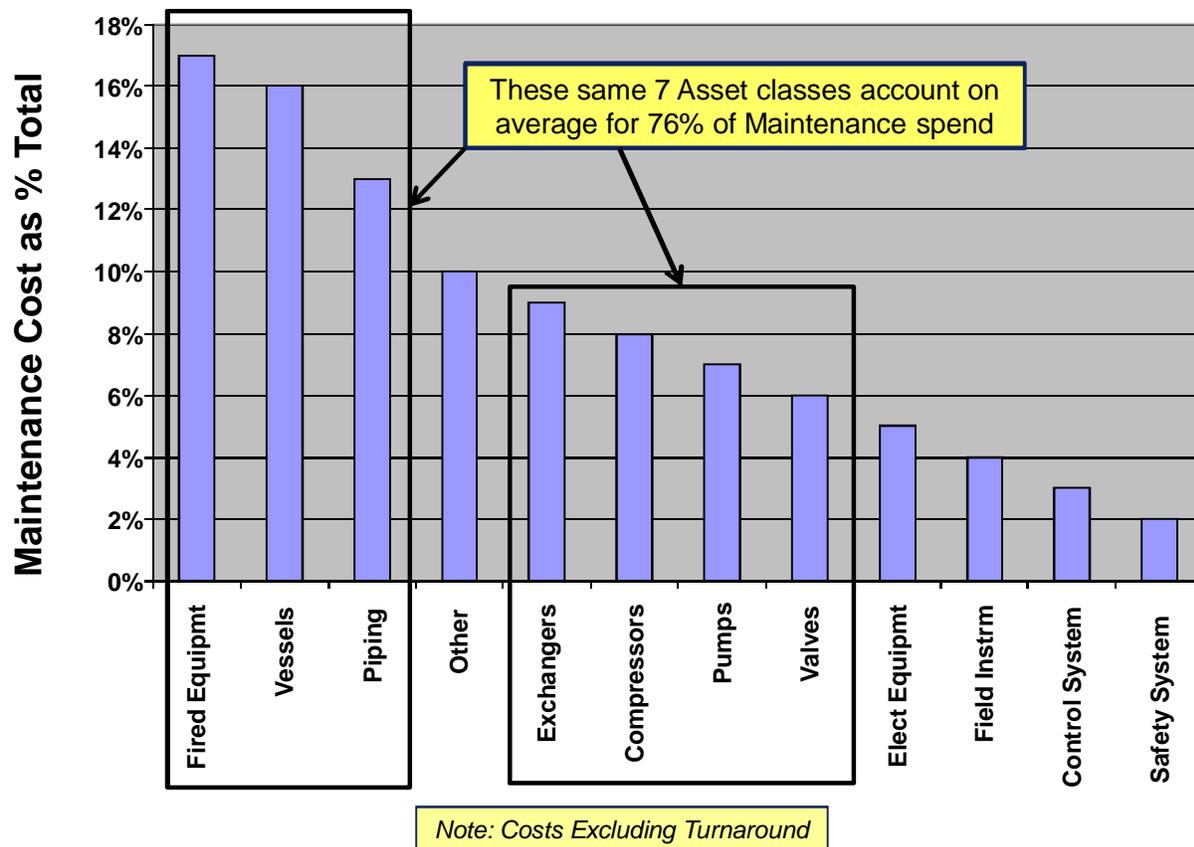
Fin Fans

Cooling Towers

Pipes

Research has identified a number of contributors to Reduced Plant Availability

Average Annual Production Loss vs **Source of Production Loss**

Y-axis: 0%, 0.1%, 0.2%, 0.3%, 0.4%, 0.5%, 0.6%, 0.7%, 0.8%

Categories: Fired Equipmt, Exchangers, Piping, Compressors, Vessels, Feed / Dwstrm, Other, Pumps, Valves, Control System, Operator Error, Power Supply, Elect Equipmt, Safety System, Steam Supply, Field Instrm, Other Utility

Legend:
- Unplanned Slowdown
- Unplanned Shutdown

7 Asset classes account on average for 3.5% lost plant availability

EMERSON
Process Management

Source: InTech, 2012." Improve reliability with essential asset monitoring"

Many of these contributors were also Primary areas of Maintenance Costs…

These same 7 Asset classes account on average for 76% of Maintenance spend

Maintenance Cost as % Total

Note: Costs Excluding Turnaround