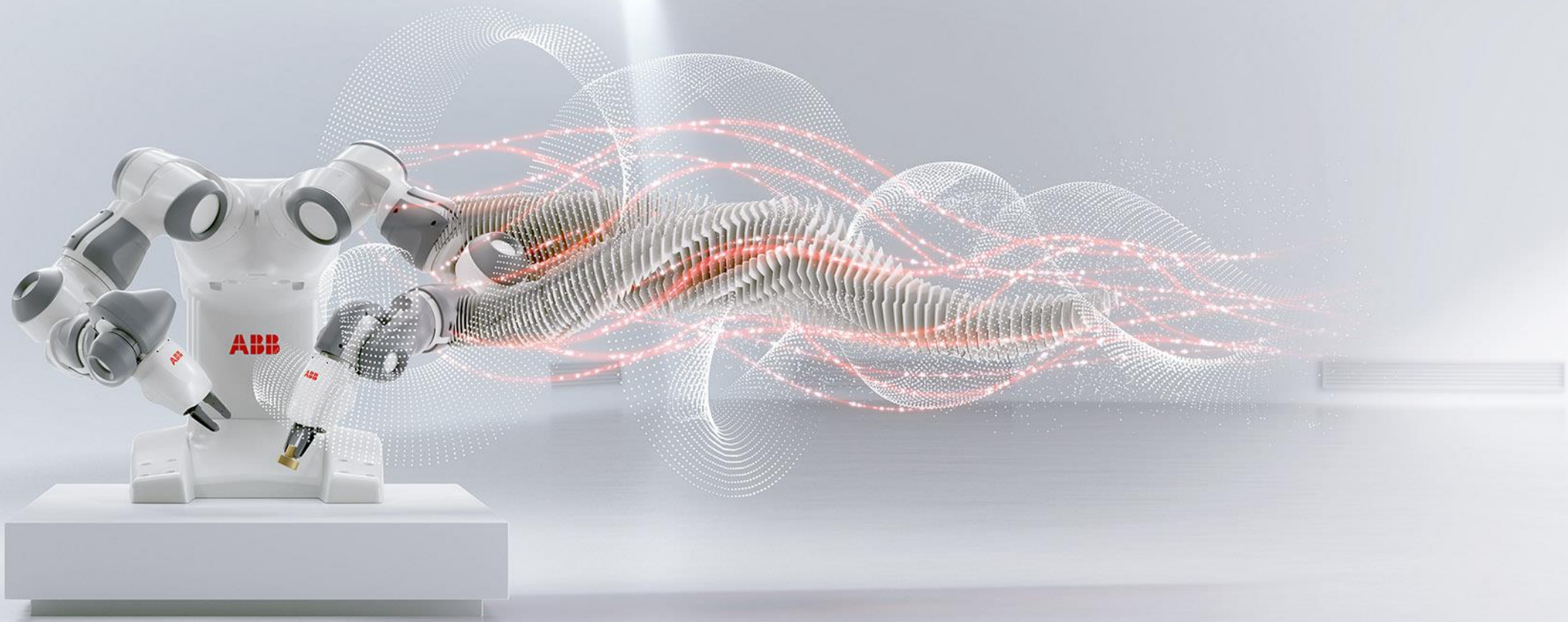


KALYAN KUMAR MALLICK– ABB INDIA – NOV 2018

Digital Sample Handling System – An Introduction

Changing the Maintenance Paradigm

Starting point – the customer's problem

What do these customers have in common?

Customer 1

Wants to power a plant and sell beer, not buy and maintain electrification equipment

Customer 2

Wants to provide EV charging stations to their customers, but not own, operate and maintain the stations

Customer 3

Wants to measure and improve pollution, not buy sensors

Customer 4

Wants to scale up production capacity, but does not want to own robots

These customers want to focus on their core competence, not own and maintain equipment!

Market Drivers for Smart Sample Handling System

We see a customer demands for DigiSampler in Power, Cement, Steel Industries

Customer Markers

- Analyzer Systems are technically complex; Technical expertise is expensive and in short in availability
- Sample handling systems are maintenance hungry
- Systems to monitor the system are capex intensive
- Understanding analyzer systems is not really core to cement/steel/power industry

Solution

Use the digital transformation to enable a business model that:

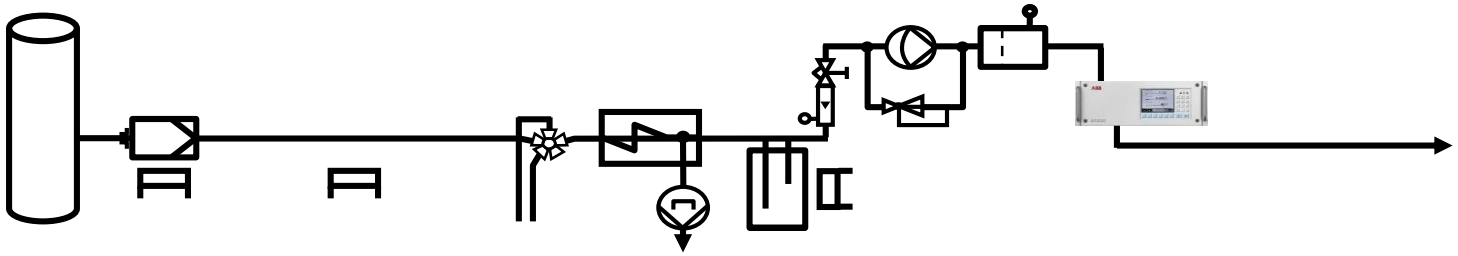
- Move the customer from a reactive to a predictive maintenance paradigm
- Allow customer access to ABB expertise in handling Analyzer systems proactively than on-a-call basis

Proposal

Build a pay-for-performance model that allows customer to reduce maintenance overhead while allowing ABB to have better control and share of the savings

ABB Ability™ Collaborative Operations

Digital Condition Monitoring of Analyzer Systems : Changing the Maintenance Paradigm



~ 70%
of faults occur in the sample handling system

~ 30%
Related to analyzer

Corrective Maintenance Practice

- After fault condition occurred
- Negative impact on availability, production

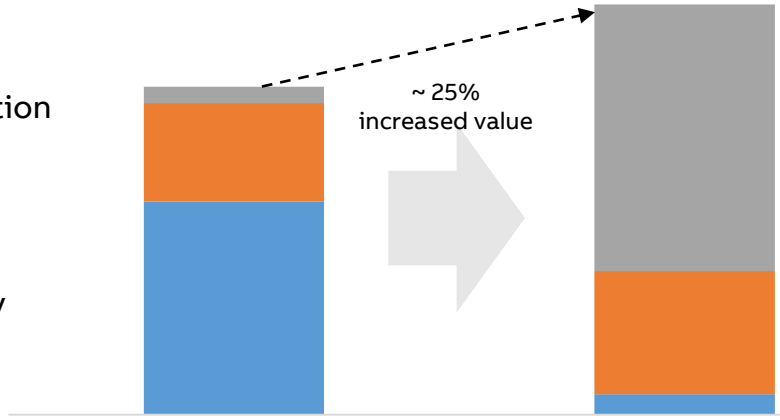
Preventative Maintence Practice

- Based on schedule
  (60% not really necessary)
- Negative impact on cost and availability

Predictive Maintence Practice

- before fault condition occurrs

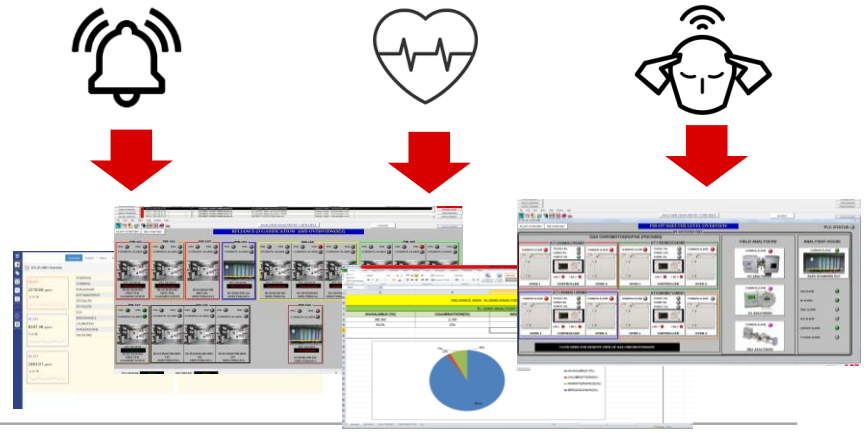
Changing the Maintenance Paradigm from corrective to Predictive



Data Acquisition System

Analyzer Intelligence Engine

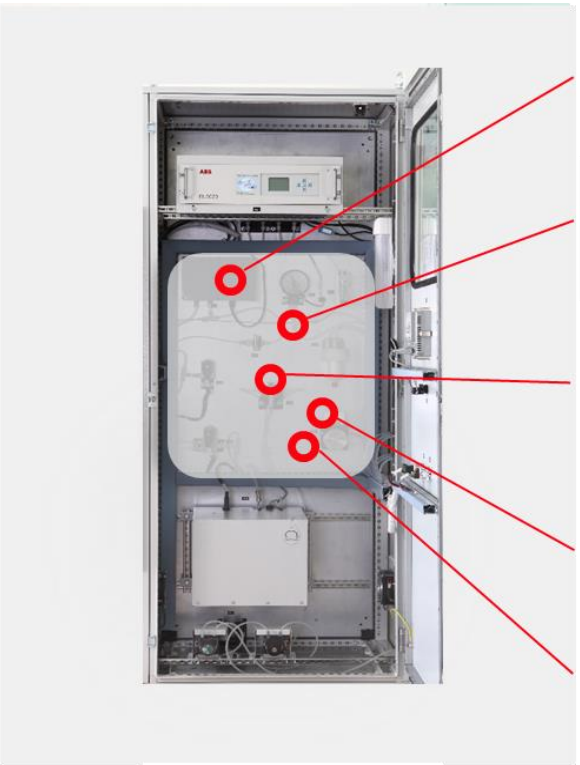
AMADAS (Analyzer Manager System)	Analyzer System Health Monitor	Analyzer System Predictive Indicator
• Database and historian • Reports Generation • Alarm Management • Maintenance manager	• Unique Insights on critical health and functioning of Analyzer systems • Indicative trends of performance of parts	• Specific derived indicators of future faults • Suggestions to prevent downtime



Predictive Maintenance

ABB Ability™ Collaborative Operations

Analyser Intelligence Engine for Analyzer Health Monitoring and Predictive Diagnostics



Data Acquisition System

Analyzer Intelligence Engine

- Ring Heater life detoriating
- Probe Filter Healthiness dial
- Sample Line is near choking
- Sample cooler overloaded
- Back pressure start building at vent
- Pump prone to failure
- Solenoid valve life chart
- Real Time Lag calculations
- Time left to change the cal cylinder

ABB Ability™ Collaborative Operations

Digital Condition Monitoring of Analyzer Systems

Accurate, real-time predictive information ensures higher availability, reliability and lower maintenance

Features:

- "**Analyzer Intelligence Engine** for health monitoring & predictive diagnostics
- Supports multiple Analyzer system
- Addresses faults from both measurement module and sample handling system.
- Proactively monitors the change of sample parameters & analyzer diagnostic information
- Converts system from an passive field element into a smart & connected element
- Prediction of sample line choking, sample line leaking, cooler failure, probe tip choking, probe choking
- Control charts based analyzer drift history analysis to predict accurate scheduling of calibration
- Email & Mobile notification sent out for critical conditions
- Statistics based display of top 10 alarms
- Modular offering to enable easy upgrade of existing system
- User friendly intuitive interface for quick learning & adoption

Benefits

- Reduce maintenance and operating cost up to ~15%
- Reduce downtime of the analyzer system
- Immensely boosts the trouble-shooting procedure
- Help manage the deficiency of skilled labor
- Better planning of maintenance schedule
- Ease of access with Cloud Connectivity

Key parameters analyzed

- Pressure trend at multiple points
- Flow trend at multiple points
- Temperature trend at key points
- Digital counts of switching components

Wieless

Inernet
Modem

Piloting ABB-as-a-Service

Digital Sample Handling System – DigiSampler 2.0

Offering

Upgrading existing Process Sample Handling System to extract **real-time data digitally**

Predictive intelligence that triggers optimal maintenance

Key product / process alerts to allow **early failure detection**

Customer pays for

One time **fee for Digital Upgrade**

Monthly frequency based **Status Updates**

Number of predictive intelligence/ early warning suggestions resulting in reduced reactive maintenance

Customer **pays for intelligence**

Value for the customer

Shift from a reactive/frequency-based maintenance to a higher degree of predictive maintenance

Saves on capex spending, No need to invest in specialized technical staff

Reduced downtime and maintenance cost

Value for ABB

Access to critical data related to functioning of analyzer sample handling systems

Ability to create **data for analytics**

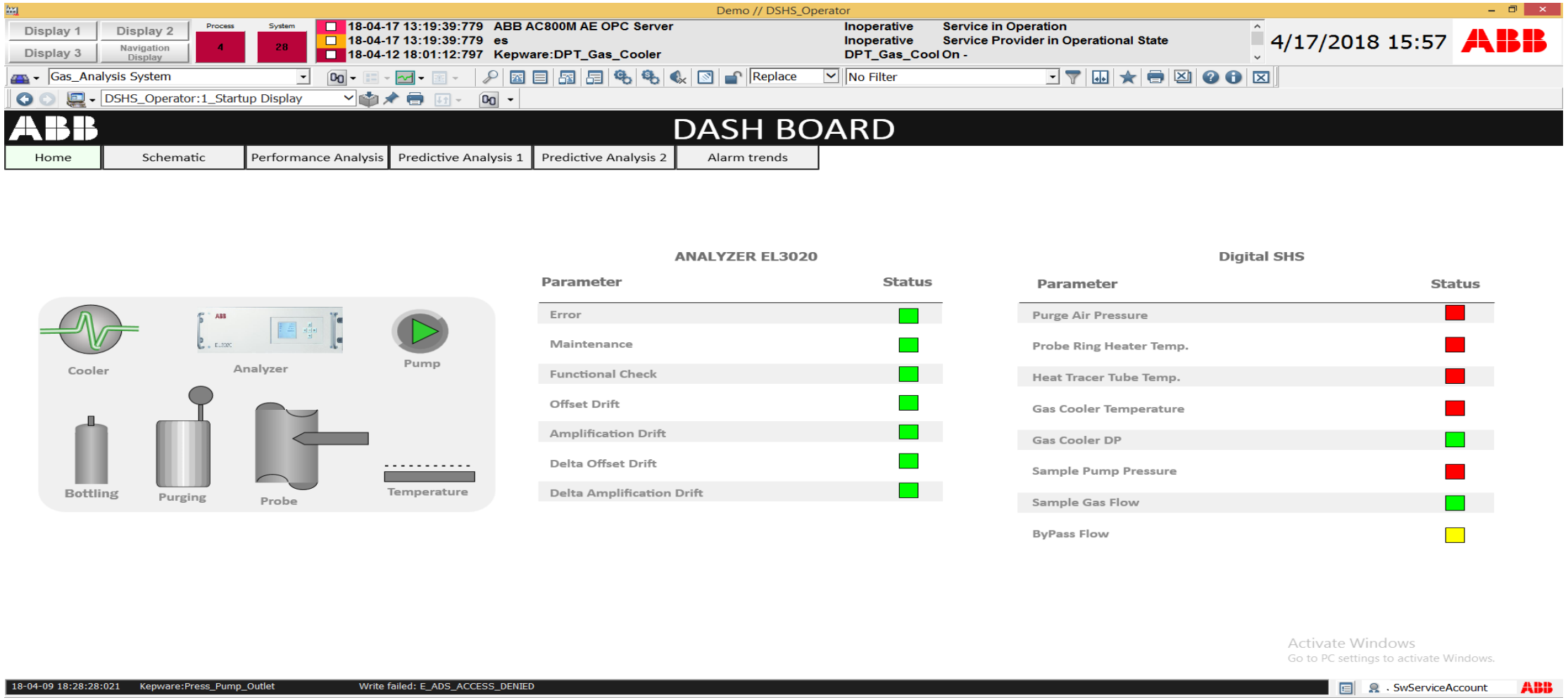
Share of the maintenance savings of the customer

Continuous data access, better control

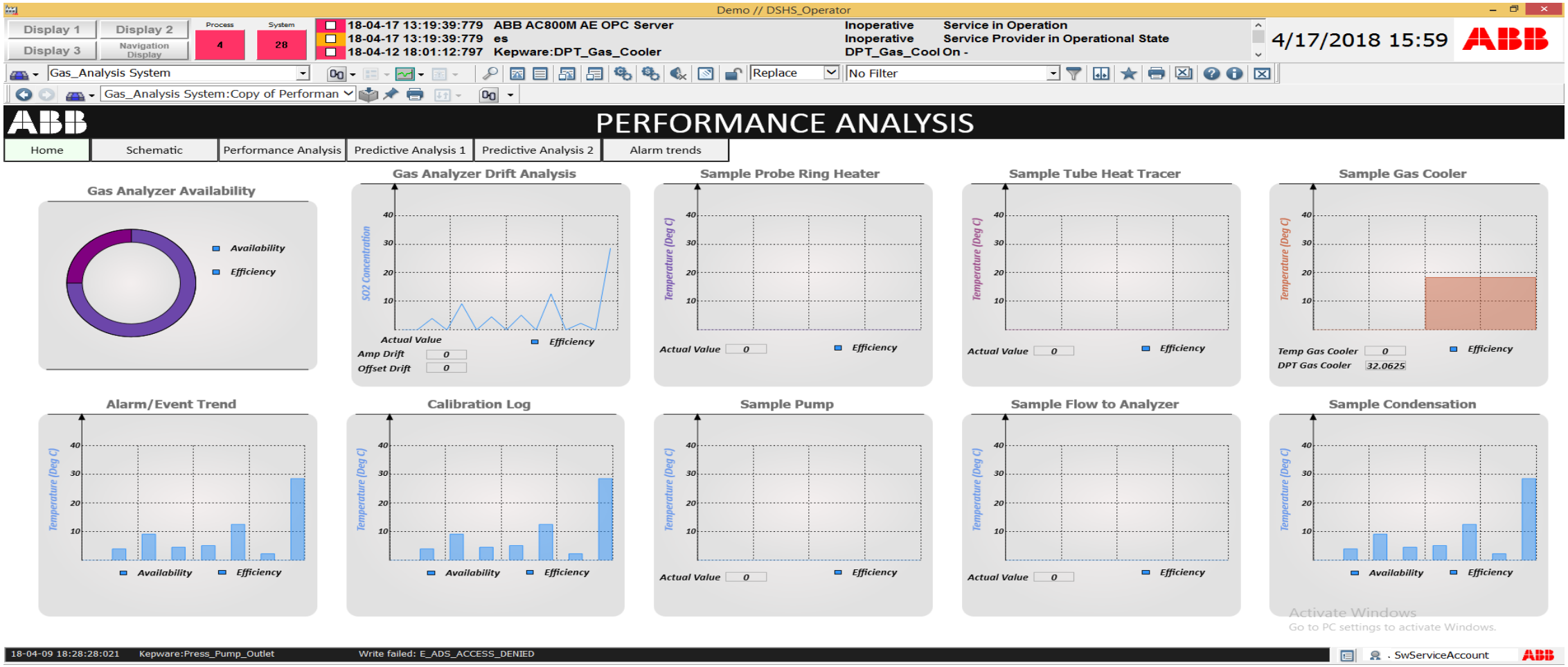
~25% customer savings

~15% more ABB profit

DigiSampler 2.0 Dashboards



DigiSampler 2.0 Dashboards



Digital Sample Handling System- DigiSampler 2.0

Example : Daily Conventional Maintenance practice Vs DigiSampler 2.0

	Conventional Daily Maintenence		DigiSampler 2.0
Check Point details	**How to check**	**Action to be taken**	**DigiSampler 2.0**
Probe Heater Temperature	Visually check for temperature reading in the analyzer panel	Check for the power in the MCB at the analyzer Panel, ring heater probe, Coil resistance at ring heater	Continuous monitoring of alarms at different level ensure healthy ness of probe heater. Analysis of the trend to provide most meaningful information for predictive maintenance
Gas Cooler Temperature	Visually check for the proper Reading of Gas Cooler	In the Gas cooler increase/decrease the knob as per requirement to cool as per requirement.	Alarm will be generated once beyond LCL & UCL. Notification will be sent one cooler temperature start deviation from set point
Heat Traced Temperature	Visually check for temperature reading in the analyser panel	Check for the power and current in the MCB at the analyzer Panel Check for the Temperature switching unit contacts in the heat traced circuit.	Continuous monitoring , alarm at different level ensure healthiness of heat tracer Analysis of the trend to provide most meaningful information for preventive maintenance
Gas Flow and By pass flow of Sample gas	Physically check in the Rotameter	Check the purging System if flow rate, leakage check, choking of the filter	System will automatic generate the possibility of various action to be taken in case any deviation from LCL & UCL . It will also predict the tendency of deviation .
Gas Flow and By pass flow of N2 Purge Gas	Physically check in the Rotameter	Check the pressure setting of the of the N2 of the Purge Gas.	
Level of the Condensate in the Glass Vessel	Visually check for the level and drain it.	Remove the condensate and again fit it in the line. Check for proper functioning of the peristaltic pump and its tubing	Pump functioning will be monitored Alarm will be generated for physical checking of the condensate vessel checking


ABB