



How TransCanada uses SQC Analytics and PI AF to build and grow their Enterprise Anomaly Detection platform

Presented by

Brendan Bell & Keary Rogers

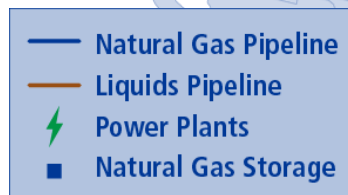


One of the Largest Natural Gas Transmission Companies in the U.S.

- ~31,000 miles (50,000 km)
- Transports ~20% of U.S. demand

Connected to High-Demand Markets

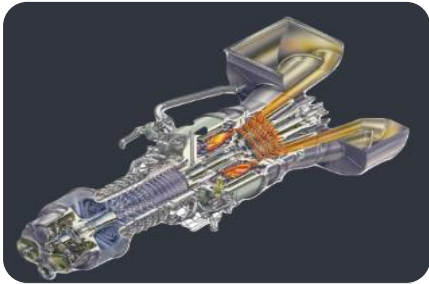
- LDC demand
- Electric Power Generation
- Growing LNG Market



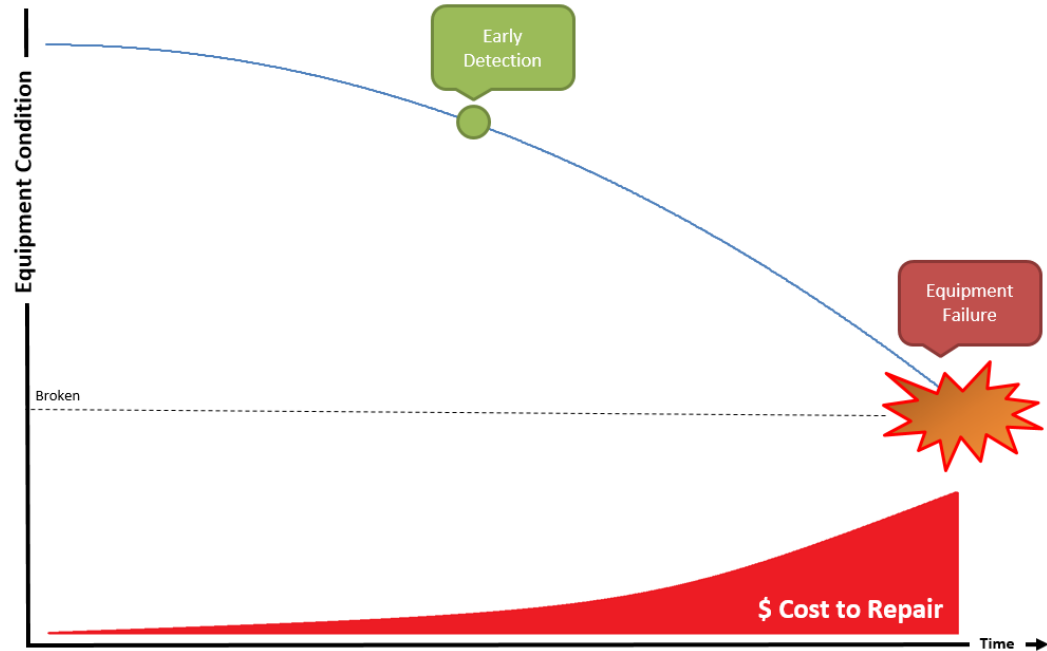
What is Enterprise Analytics



Reciprocating



Gas Turbine

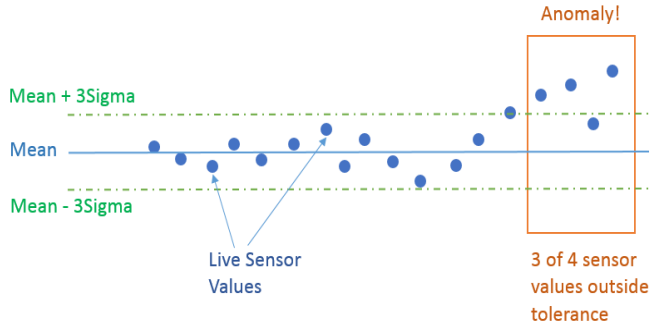


Enterprise Analytics (EA) is a real time monitoring system that detects and prevents functional failures on large rotating equipment.

Enterprise Analytics – Anomaly Detection

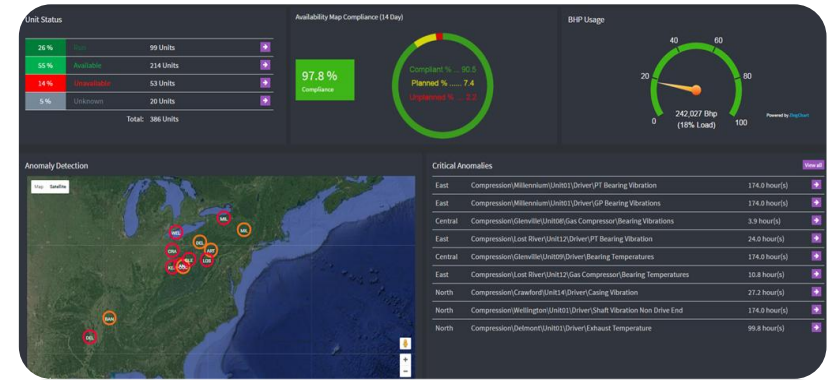
Advanced Algorithms

Over 16,000 Data Streams



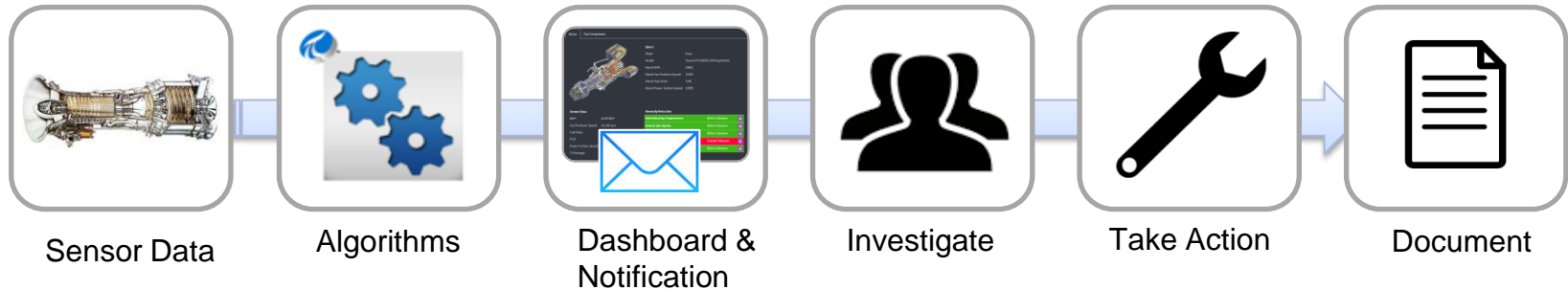
Executive Dashboard

Critical Anomalies



EA Process

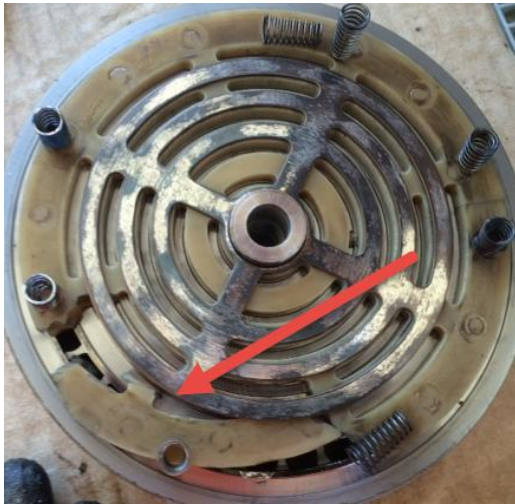
Alert, Investigate, Inform



Enterprise Analytics – Anomaly Detection

Compressor Discharge Valve

Broken valve plate found on tier 1 facility comparing Discharge Temp to Nominal (calculated).

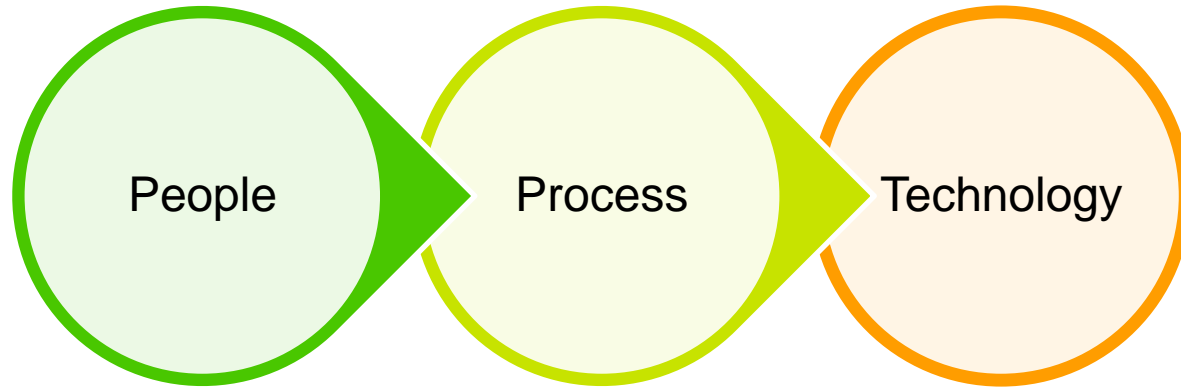


Main Shaft Bearing

Cracked bearing #9 on large reciprocating unit (12,000 BHP) identified after rise in bearing temp. Run to failure on bearing potentially catastrophic



Business Challenges – Build & Grow Enterprise Analytics Program



Business Challenges - People



Limited Resources

High Expectations

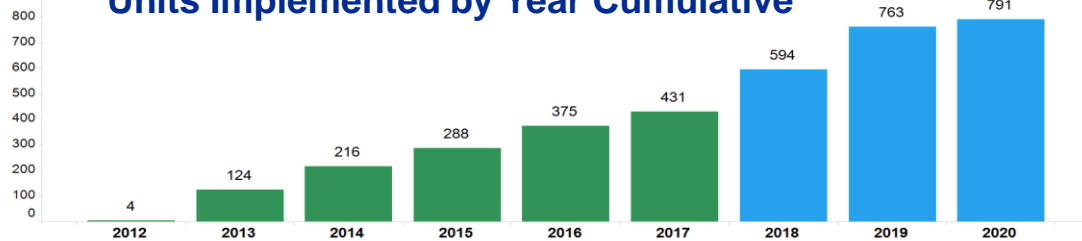


Cultural Change

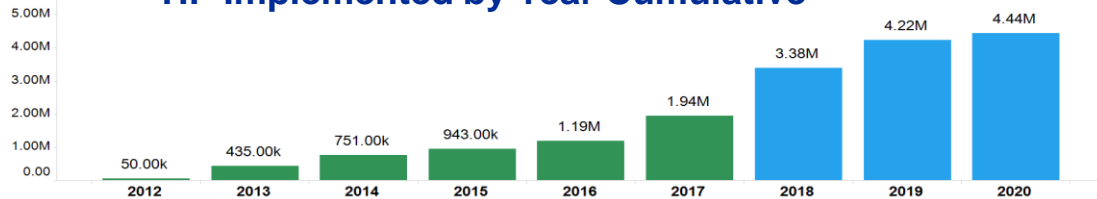
Business Challenges - Process



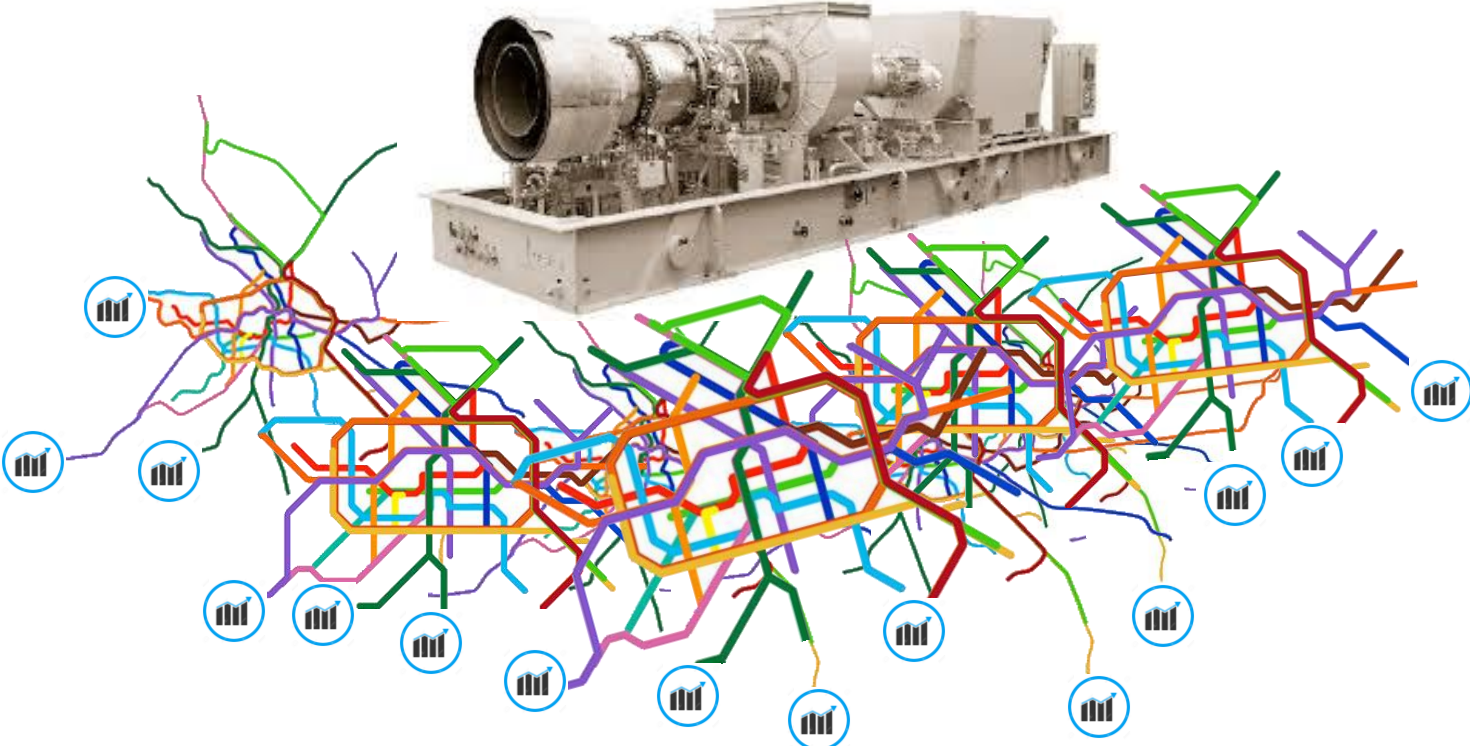
Units Implemented by Year Cumulative



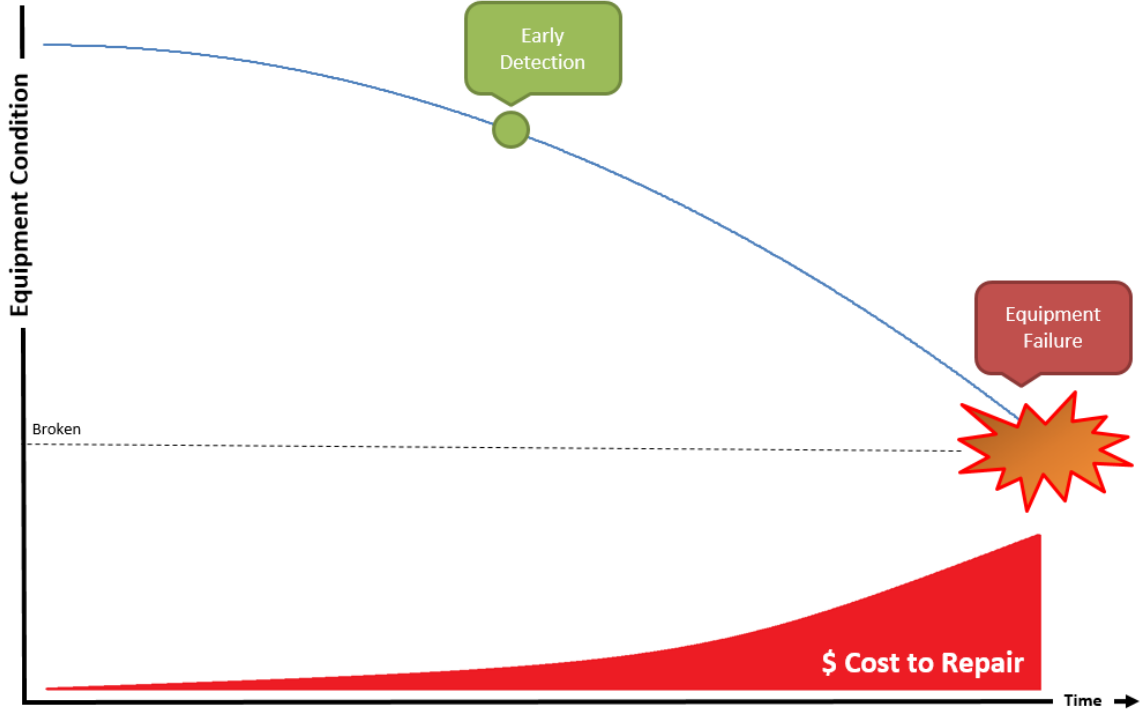
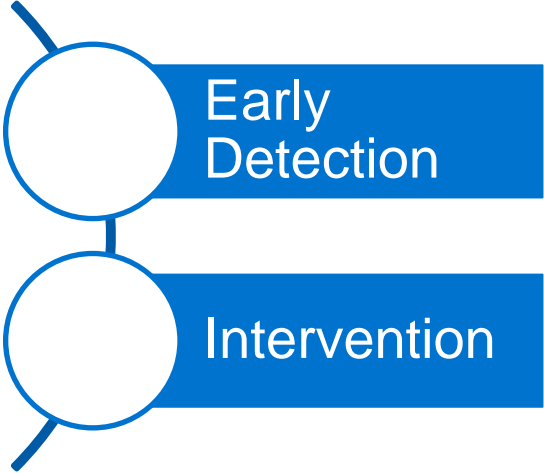
HP Implemented by Year Cumulative



Business Challenges - Technology

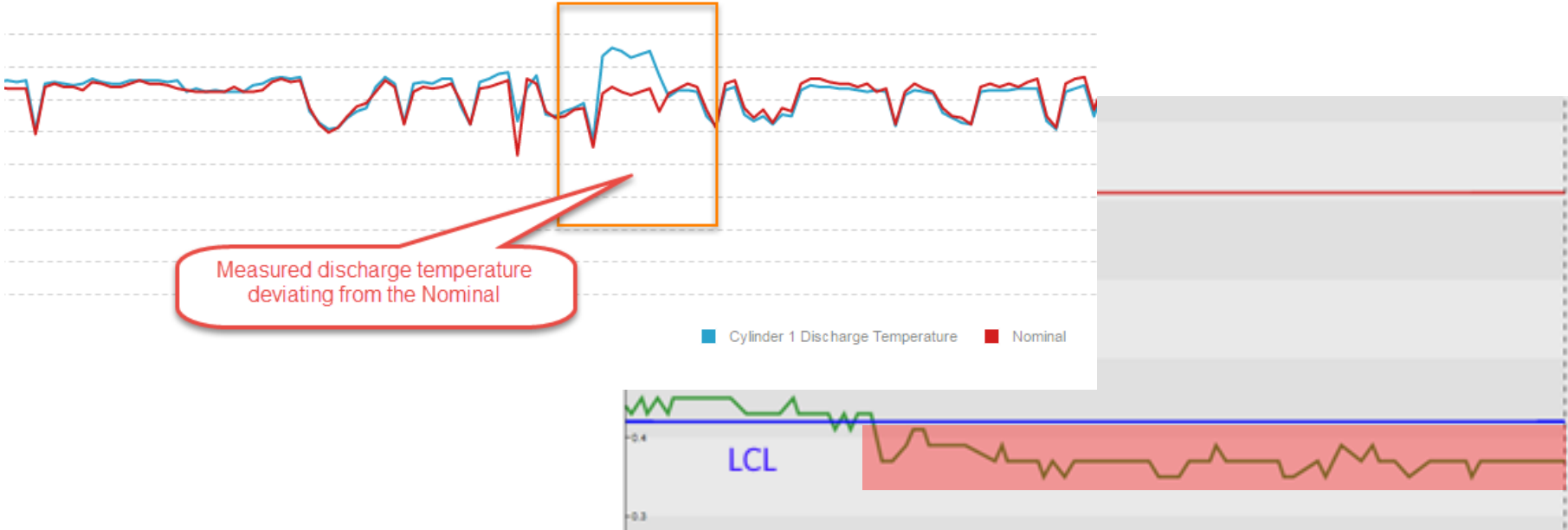


Goal of Enterprise Analytics

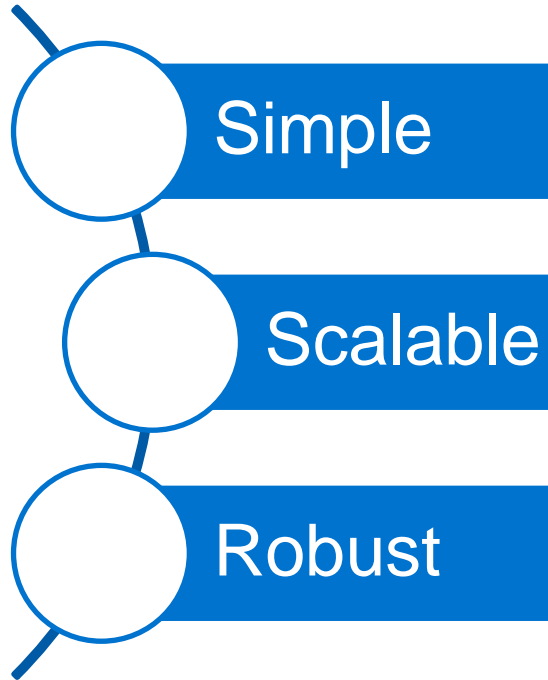


Strategy for Anomaly Detection

Physics Model



SQC Modeling for Analytics



MonitoringModule_BearingTemps_Compressor_Centrif

General Attribute Templates Ports Analysis Templates Notification Rule Templates

Name
SQC Jm Disc Bearing Lwr Temp
SQC Jm Disc Bearing Uptr Temp
SQC Jm Suct Bearing Lwr Temp
SQC Jm Suct Bearing Uptr Temp
SQC Outbd Bearing Lwr Temp

Inputs

Source:

Upper Control Limit:

Center Line:

Lower Control Limit:

Output

Event Frame

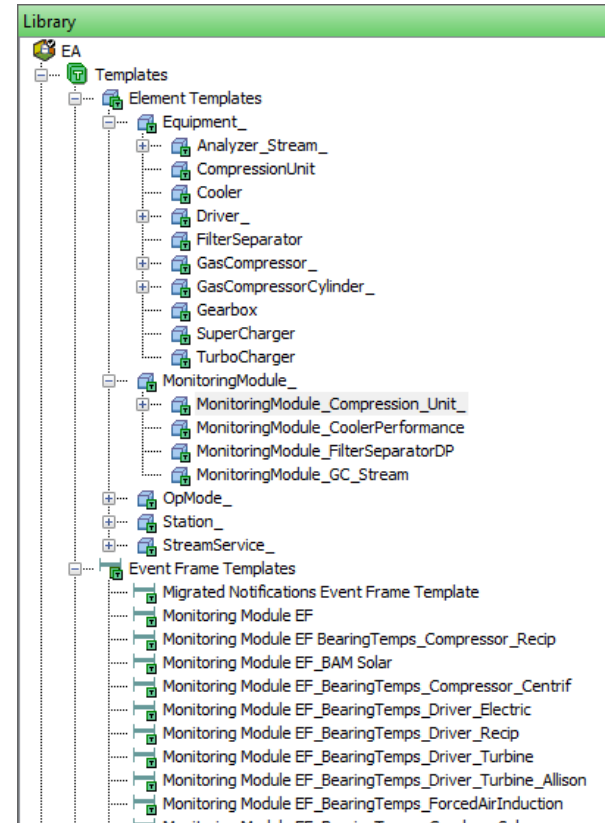
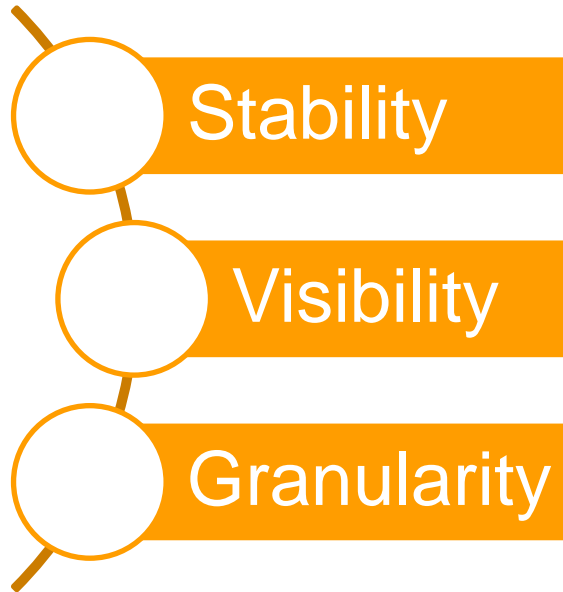
AF Attribute

Pattern Tests

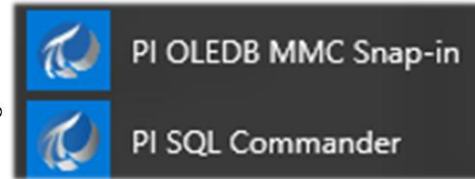
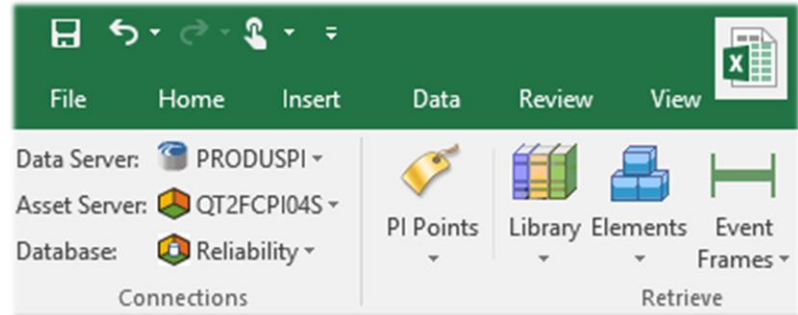
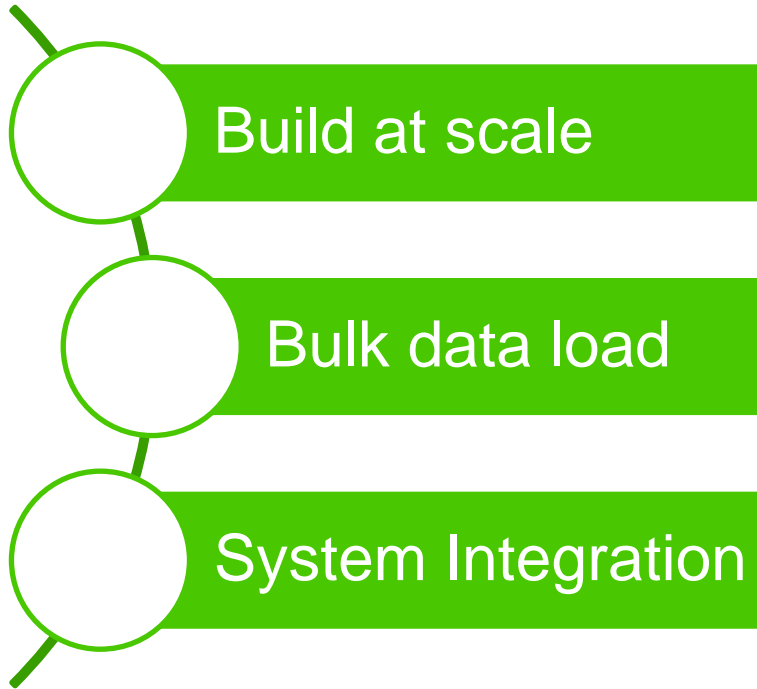
Clear on Control Limit Change

	Pattern	X of Y	Limit
<input checked="" type="checkbox"/>	Outside Control	8 of 8	Both
<input type="checkbox"/>	Outside 2 Sigma	2 of 3	Both
<input type="checkbox"/>	Outside 1 Sigma	4 of 5	Both
<input type="checkbox"/>	One Side Of Center Line	8 of 8	Both
<input type="checkbox"/>	Stratification	15 of 15	NA
<input type="checkbox"/>	Trend	8	NA
<input type="checkbox"/>	Mixture	8 of 8	NA

PI AF Server 2017 Analysis Framework

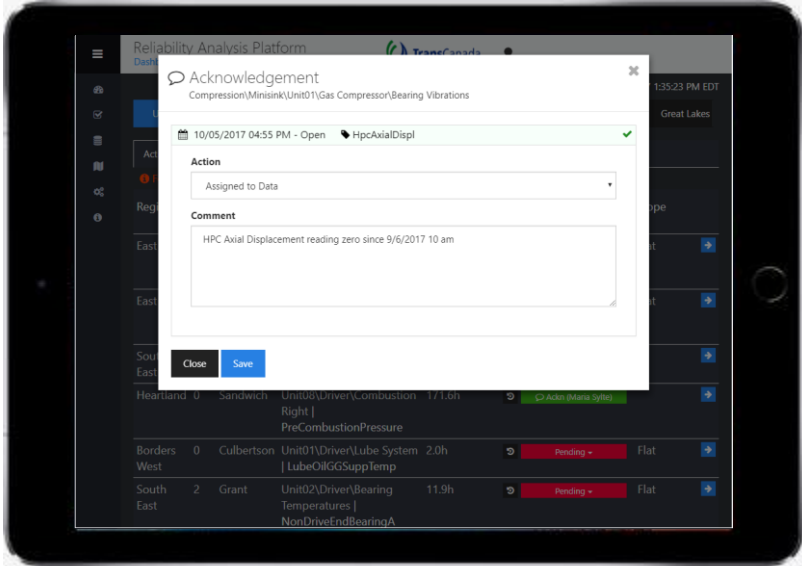


PI AF For Rapid Deployment



TC USGO Compressor Book

User Interface & Scalability



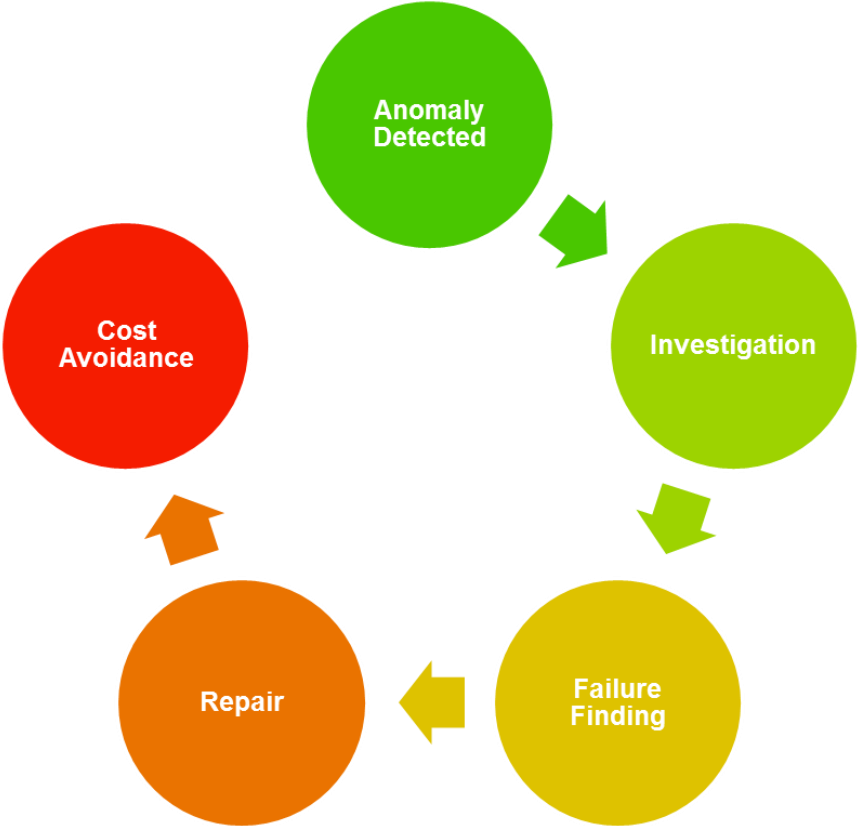
Anomaly Management Process



Alert



Investigate

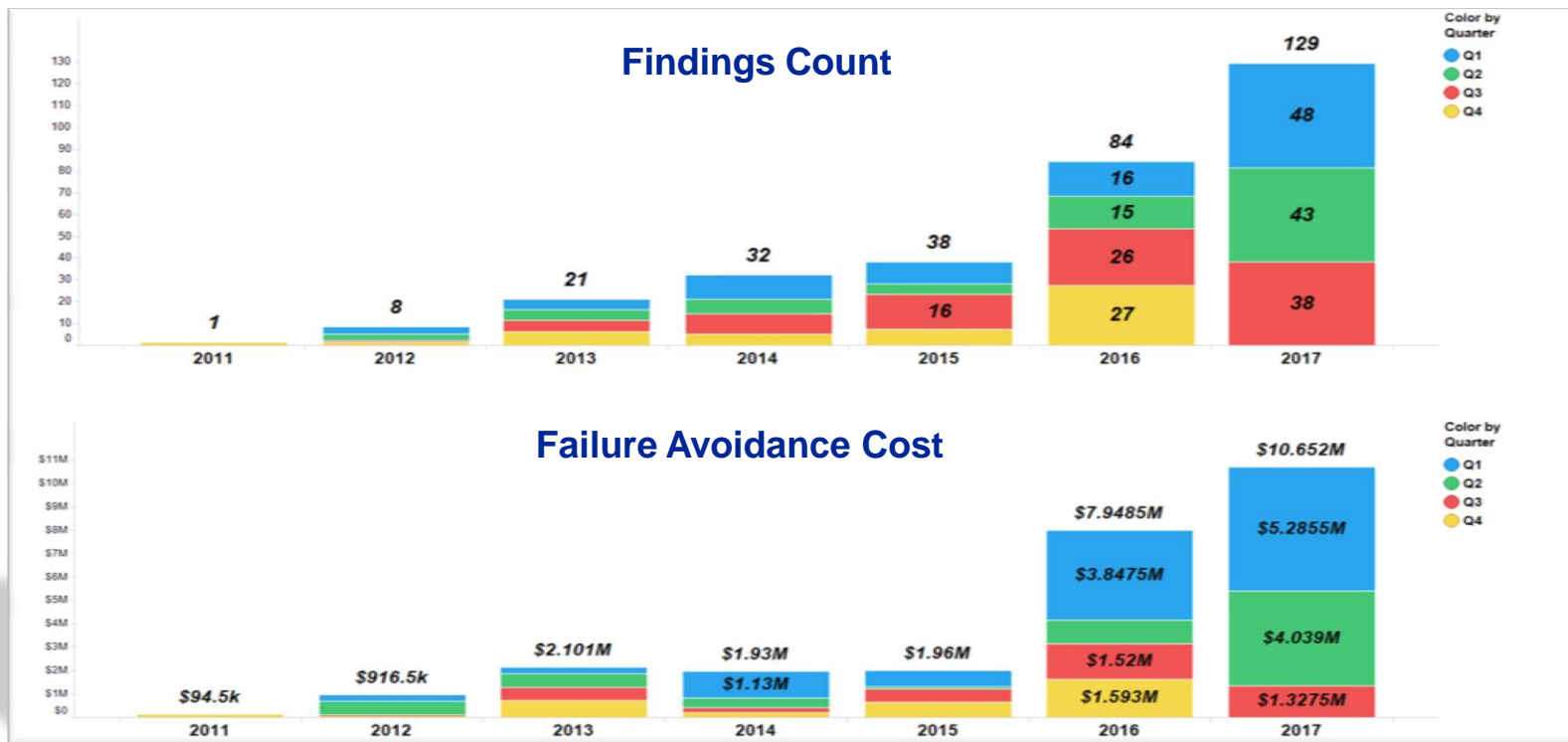


Take Action

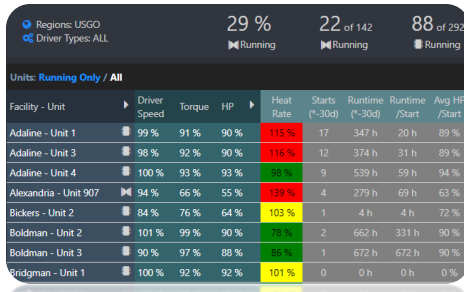


Document

Anomaly Findings Results

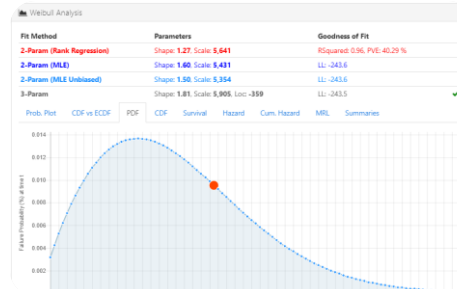


Major New Initiatives



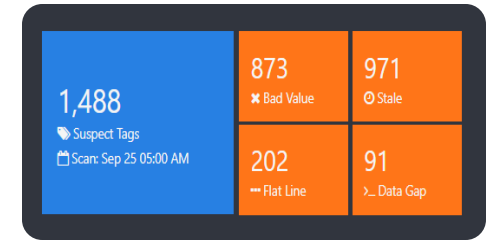
Fleet Dashboards

- Optimization
- Alike Units Comparison



Growth Modeling

- Weibull Analysis
- Reliability Projections



Data Quality Management

- Identify Data Problems
- Track & Manage

Summary

COMPANY and GOAL

“The term Enterprise Analytics refers to a program aimed at leveraging leading technology tools to analyze data to enable the execution of proactive actions intended to avoid a negative event entirely or minimize the impact of such an event.”

Be Safe, Be Available, Be Optimized



CHALLENGE

- Managing people, process and technology at scale for Enterprise Analytics program

SOLUTION

- Well defined anomaly detection strategy
- PI AF for Analysis, flexibility & scalability
- Process driven tools & interface

RESULTS

- Implemented additional 800K BHP
- 120% Anomaly findings increase 2015-2016
- 100% Anomaly finding increase 2016-2017
- 2017 Failure avoidance (Q3) costs of \$10.6M

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Questions

Please wait for the **microphone** before asking your questions

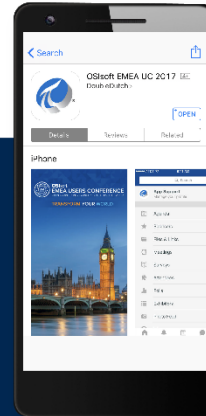


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감사합니다

Danke

谢谢

Merci

Gracias

Thank You

ありがとう

Спасибо

Obrigado