The Path to Intelligent Maintenance with the PI System

Embracing Digital Transformation

Presented by **Vince Polsoni, Alectra Utilities**

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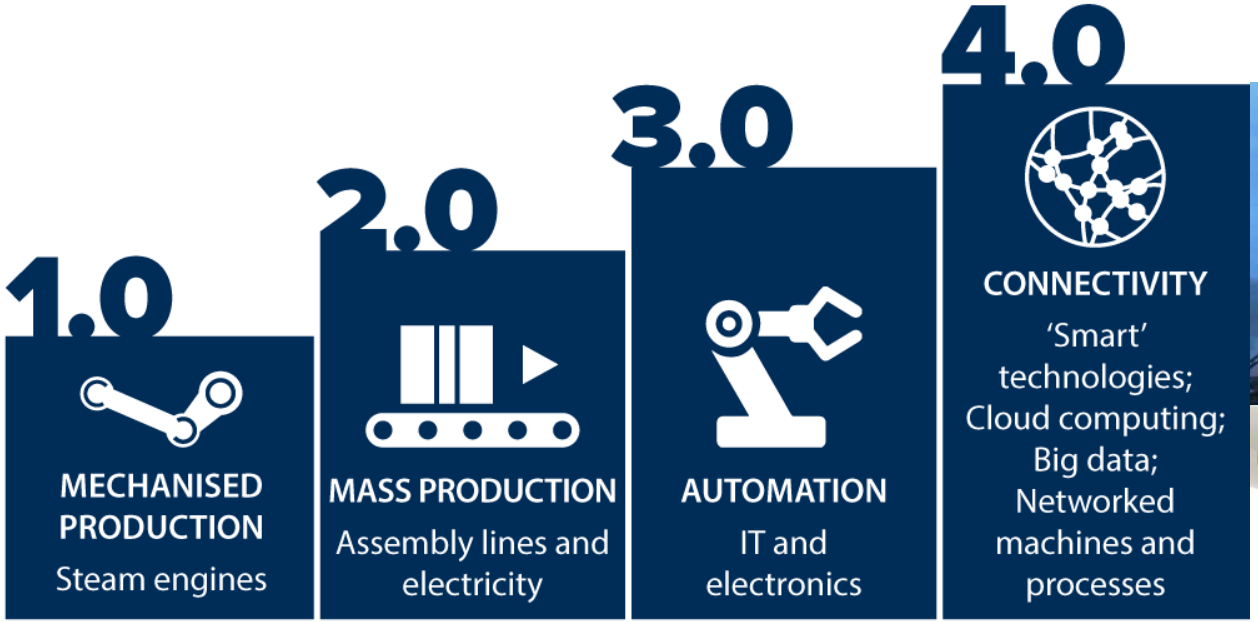
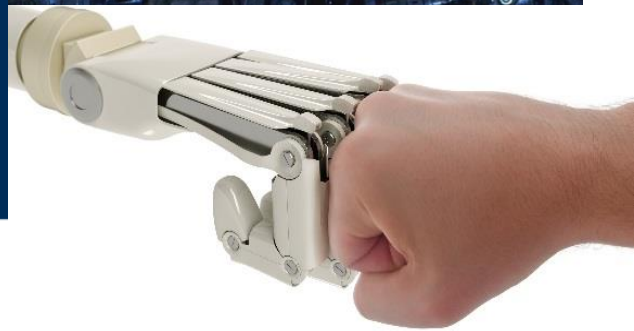
Industrial Development – Industry 1.0 to 4.0



The stages of industrial development



Digital Transformation Evolution / Big Data – Lego Style

- ~1.5 Billion sensors worldwide and growing
- +400 Billion Lego bricks










Agenda – Intelligent Maintenance with the PI System

- Intelligent Maintenance at Alectra
- IIOT and Condition Based Maintenance
- Technology and Innovation
  - PI System Data and Reporting Methods
  - PI System Dashboards

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Where are we?

Ontario
1,068,587 km2

2nd Largest Municipally owned Local Distribution Co. (LDC) in North America

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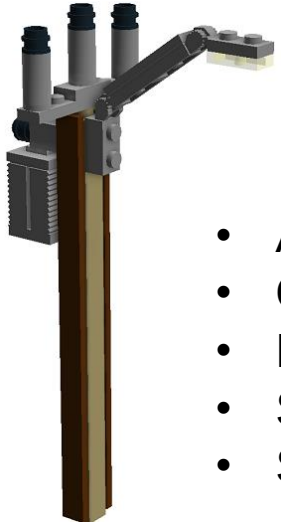
Alectra Service Territory

- Located just North and West of Toronto, Ontario, Canada
- 1800 km2
- 15 Communities
- 1 million Customers
- 3.1 million Population
- 4750 MW Peak Demand
- $3.56 Billion Total Assets

Masters at IIOT - Generation / T&D



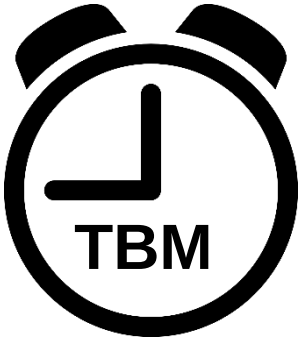
- Asset Management
- Operations
- Reliability
- Safety
- SCADA / OMS

OSIsoft.

Station Assets – “Transforming our World”

The Alectra Intelligent Maintenance Plan

The Plan



RCM2
(Reliability Centered Maintenance)

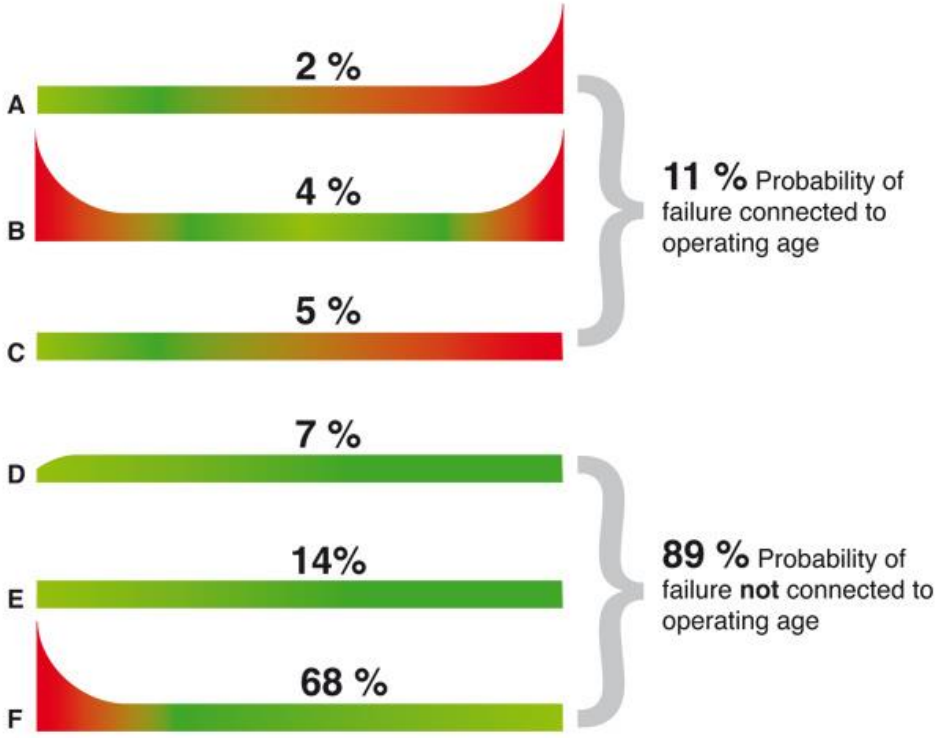
100% of work (PM)
is time based

On Condition Task
No Scheduled Maintenance
Scheduled Restoration/Discard
Failure Finding

Intelligent Station Maintenance at Alectra

- Leverage CMMS and PI System
- Risk Based - Condition Based Maintenance (PI System and CMMS)
- RCM2 methodology incorporated in CMMS
- Instant Information
  - PI Notifications (Real time)
  - Alerts from CMMS System
  - PI System Reports, Dashboards
- Automatic Triggered Maintenance Work
- Situational Awareness
- One source of data

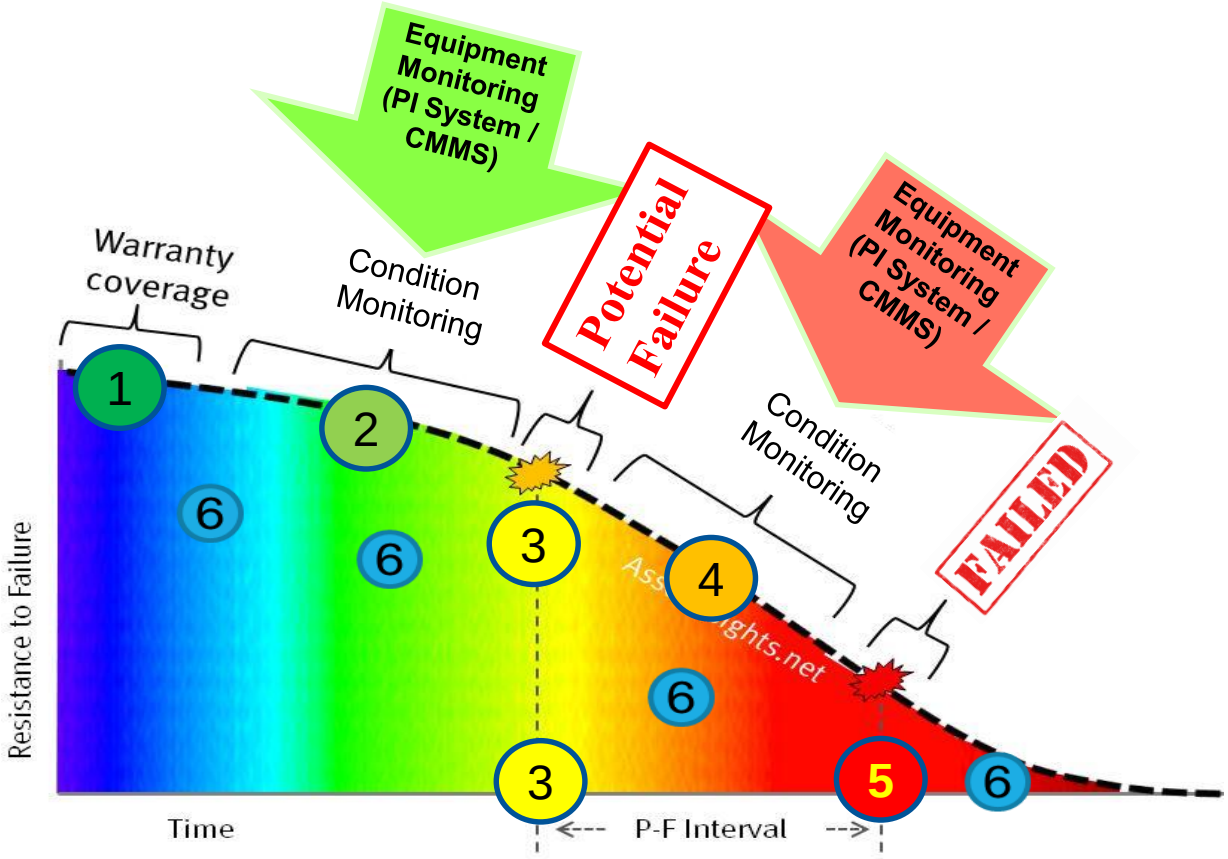
Understanding Failure Curves
The “F Curve” is the One to Watch



Source: RCM II by John Moubray, Industrial Press Inc, 1992

- Premature random failures
- Often after Human Intervention

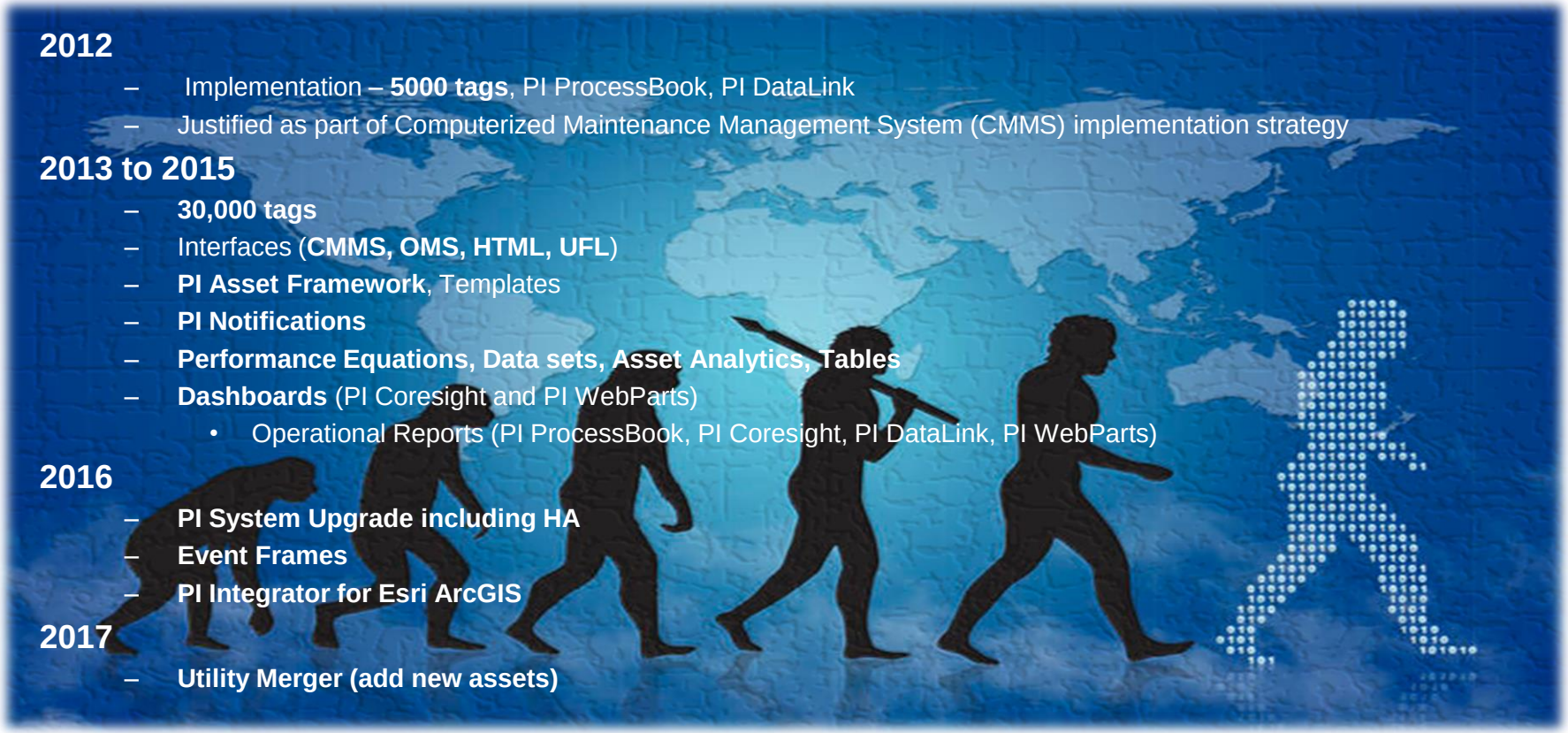
Condition Scoring Using Potential Failure “PF” Curve



Condition Scoring Matrix

1. New
2. Used
3. Potential Failure
4. Failed – Schedule Repair
5. Failed – Emergency Repair
6. Failed – Repaired Onsite

PI System at Alectra – Transforming Our World



2012

- Implementation – **5000 tags**, PI ProcessBook, PI DataLink
- Justified as part of Computerized Maintenance Management System (CMMS) implementation strategy

2013 to 2015

- **30,000 tags**
- Interfaces (**CMMS, OMS, HTML, UFL**)
- **PI Asset Framework**, Templates
- **PI Notifications**
- **Performance Equations, Data sets, Asset Analytics, Tables**
- **Dashboards** (PI Coresight and PI WebParts)
  - Operational Reports (PI ProcessBook, PI Coresight, PI DataLink, PI WebParts)

2016

- **PI System Upgrade including HA**
- **Event Frames**
- **PI Integrator for Esri ArcGIS**

2017

- **Utility Merger (add new assets)**

PI System Products used at Alectra

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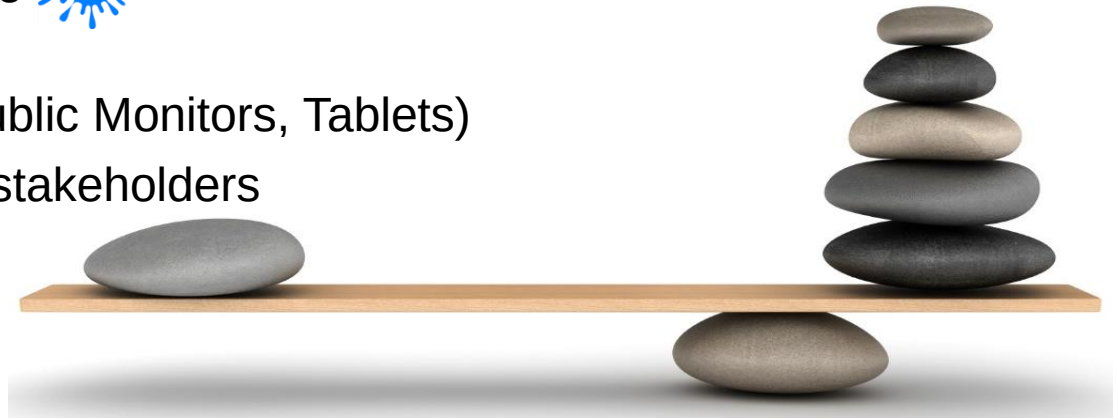
30,000 tags
(and growing)

- **High Availability "HA"**
- **PI Server 2016 R2 (x2)**
- **PI AF Server 2016 R2 (x2)**
- **PI AF Analytics 2016 R2**
- **PI Coresight 2016 R2**
- **PI DataLink 2016**
- **PI WebParts 2016**
- **PI Notifications 2016 R2**
- **PI System Management Tools 2016 R2**
- **PI System Explorer 2016 R2**
- **PI Asset Framework (AF)**
  - **Templates**
    - **Element, Notifications, Event Frames**
- **PI ProcessBook 2012 SP1**
- **PI HTML Interface**
- **PI UFL Interface**
- **PI RDBMS Interface**
- **PI Integrator for Esri ArcGIS 2015**

OSIsoft.

Leveraging PI System at Alectra

- Interface to multiple databases/systems
  - SCADA, OMS/CIS, CMMS, MicroGrid
  - Integrators: PI HTML, PI UFL, PI RDBMS
  - PI Integrator for Esri ArcGIS NEW!
- PI Asset Framework, Performance Equations and Asset Analytics
- Future Data and Forecasting NEW!
- Event Frames
- Operations Dashboards (Public Monitors, Tablets)
- PI Notifications to targeted stakeholders

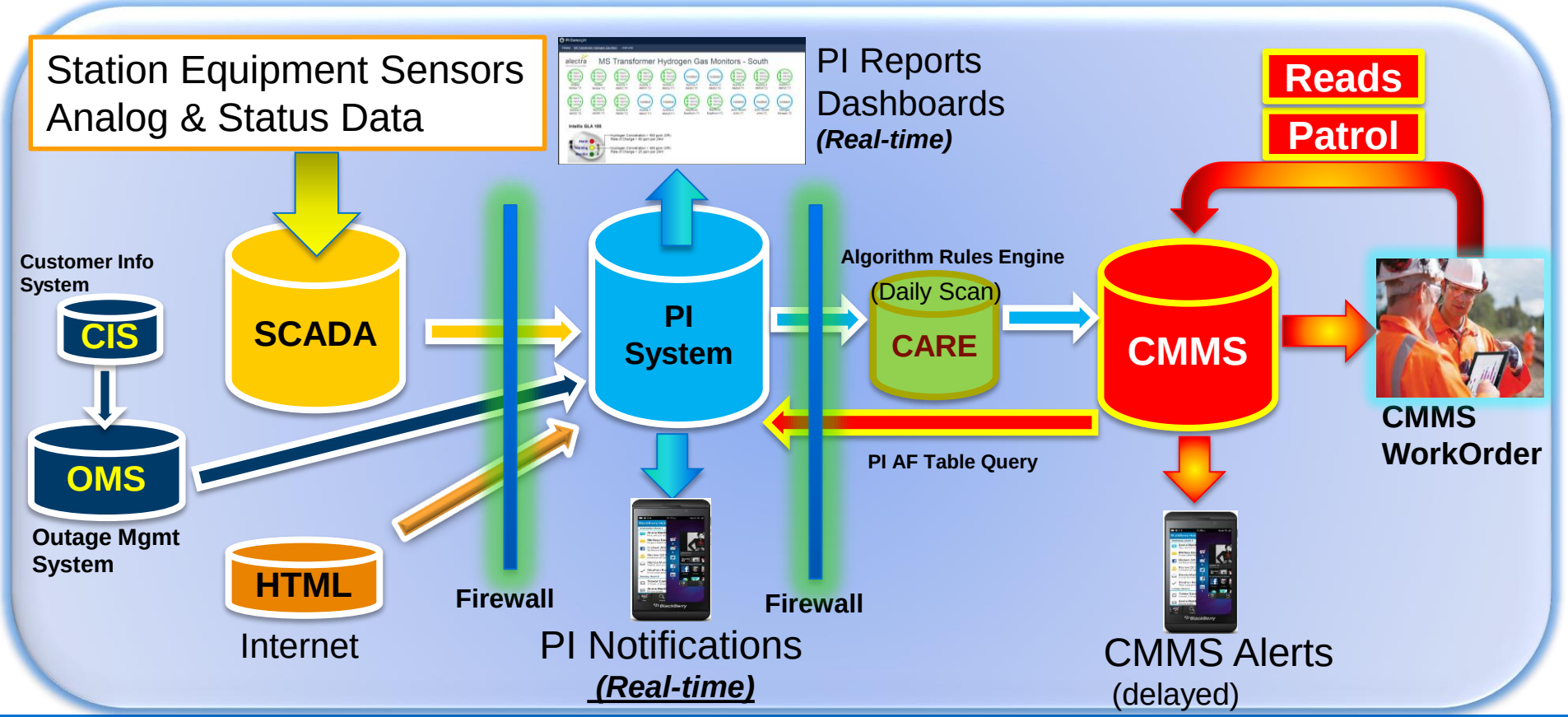


Improving T&D Maintenance with the IIOT the PI System Way

The Alectra Intelligent Maintenance System Key Components – A marriage made in Canada (Alectra)

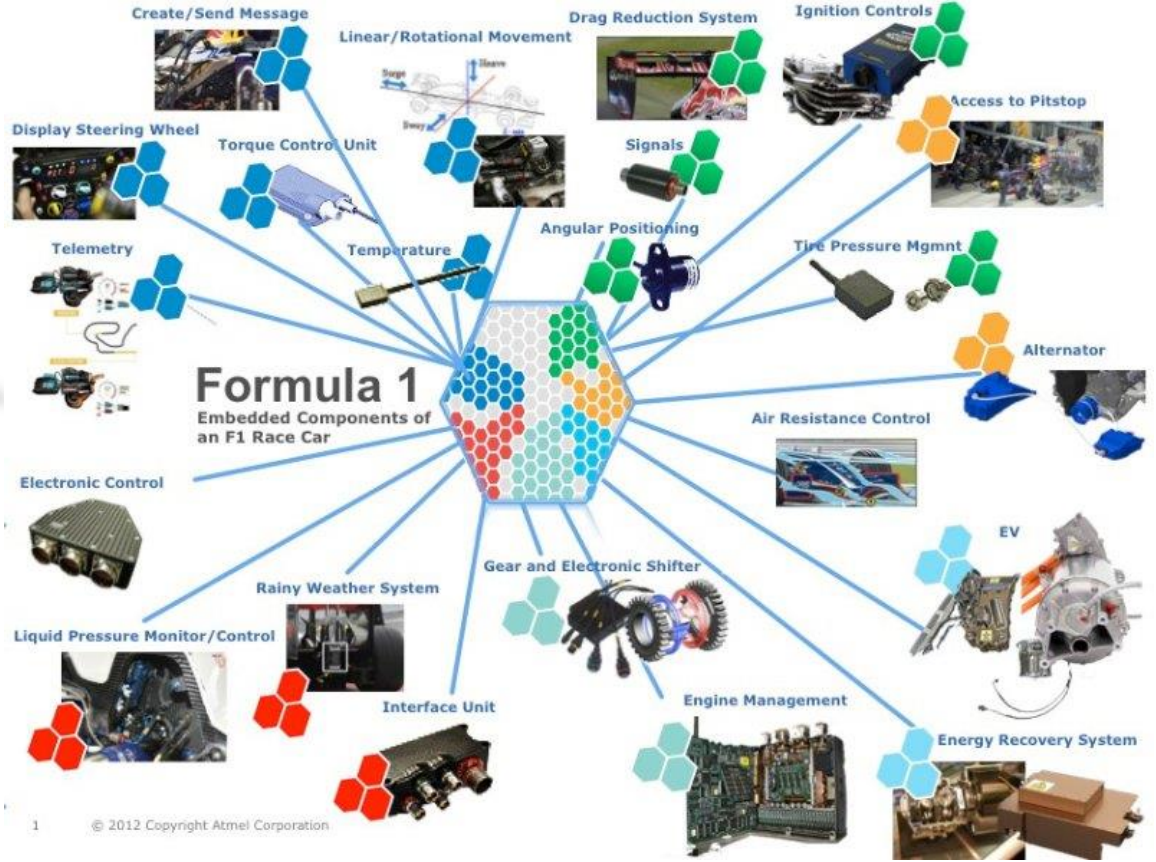
- Systems working together are key to IM Success
- CMMS
  - Tracks assets, Maintenance history and Costs
  - Trigger maintenance tasks based on condition or events
  - Interface with PI System
  - Prioritize maintenance work – Criticality, Health and Risk
- PI System
  - Data collector, Speed optimized
  - Real-time analysis
  - Easy reporting, easy interfacing, enabler of IIOT

IIoT - Condition Based Maintenance - Data Flow



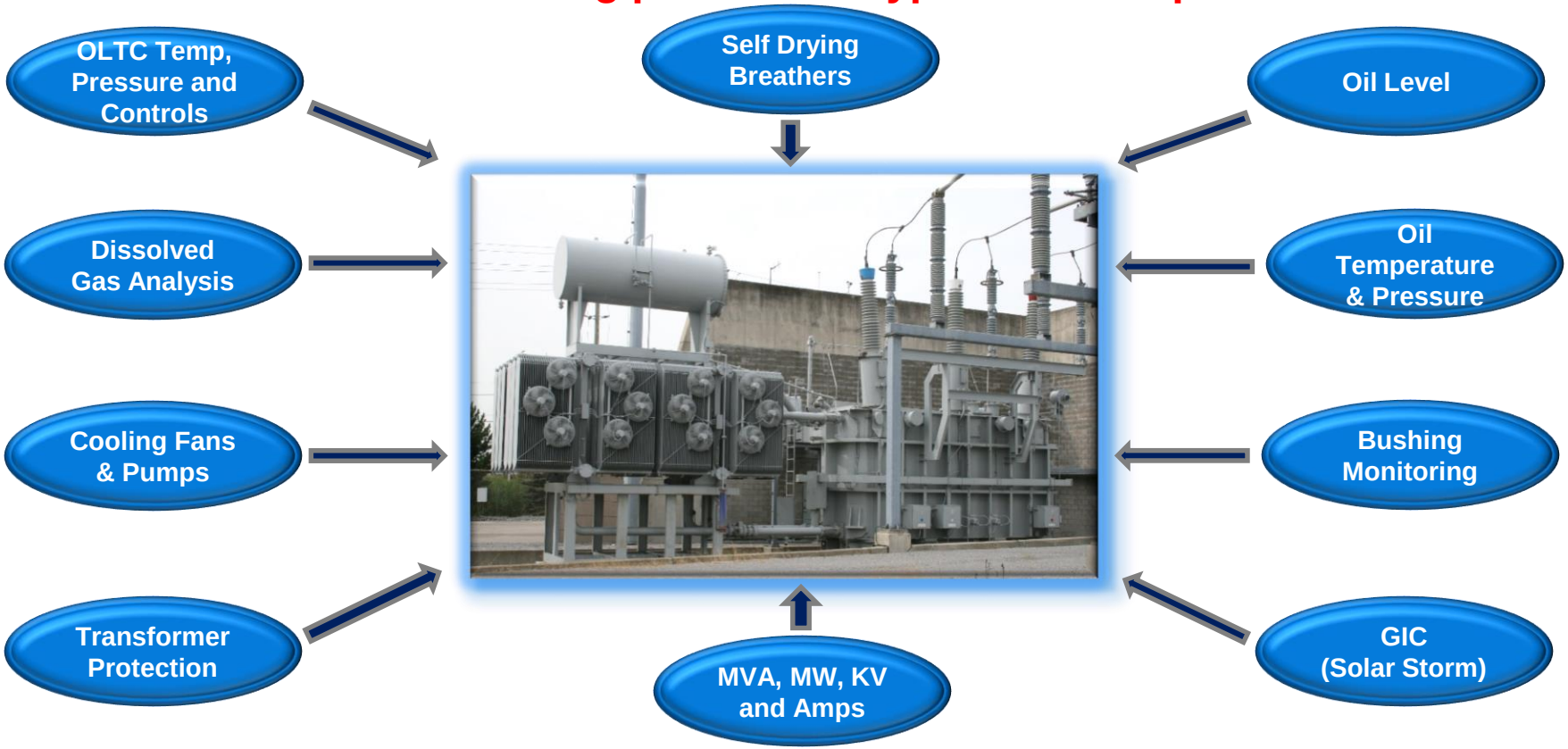
Embedded Sensors of an F1 Race Car – Optimization

HMI



Embedded Sensors of a Power Transformer at Alectra

Over 100 sensors/monitoring points on a typical station power transformer



Sensors - Equipment Monitoring – Key building block for successful Intelligent Maintenance (CBM)

Transformer Self Drying Breather

Bushing Monitoring Systems

Tap Changer Oil Filtration

Sensors - Equipment Monitoring – Key building block for successful Intelligent Maintenance (CBM)

7 Gas Dissolved Gas Analysis Monitoring Unit

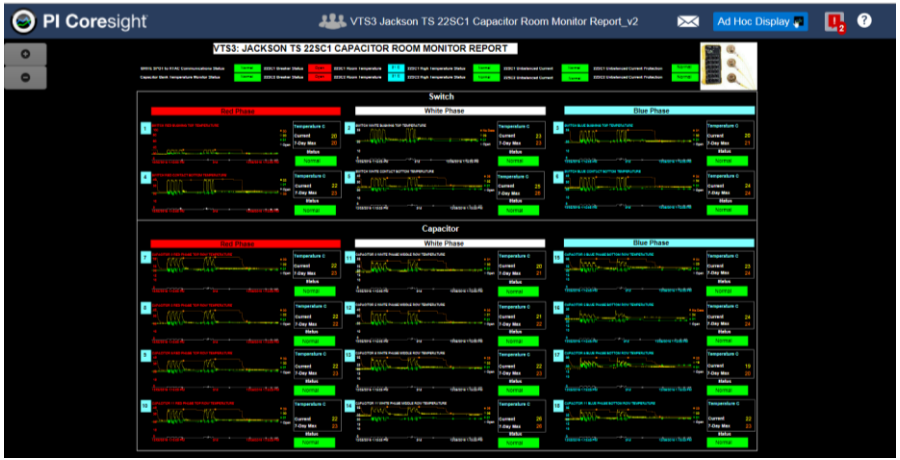
Temperature & Pressure

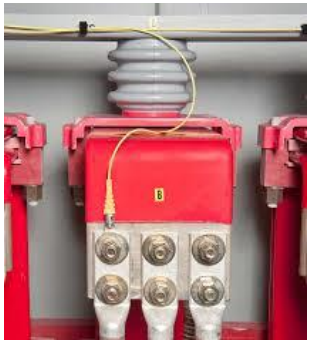
Protection Relay

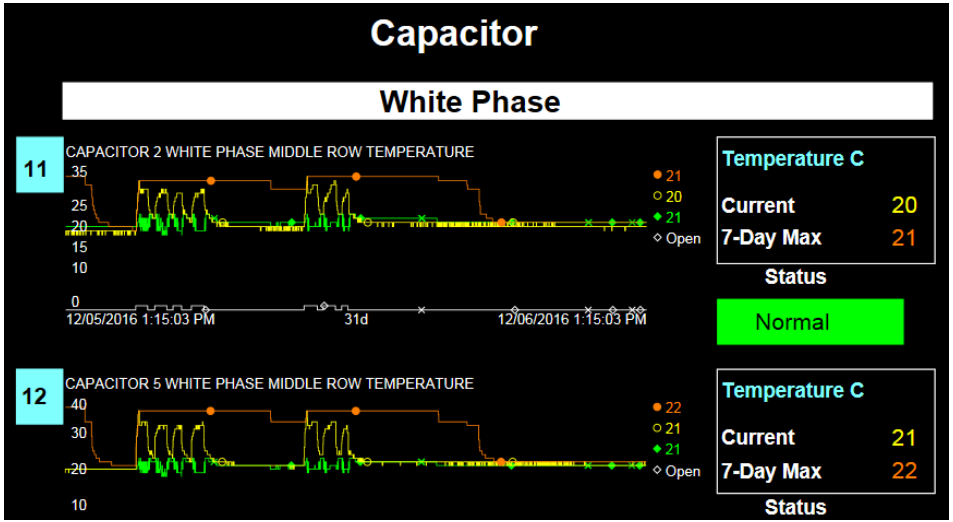
Transformer Monitoring Relay

Hydrogen Gas Monitor

Temperature Sensor Monitoring





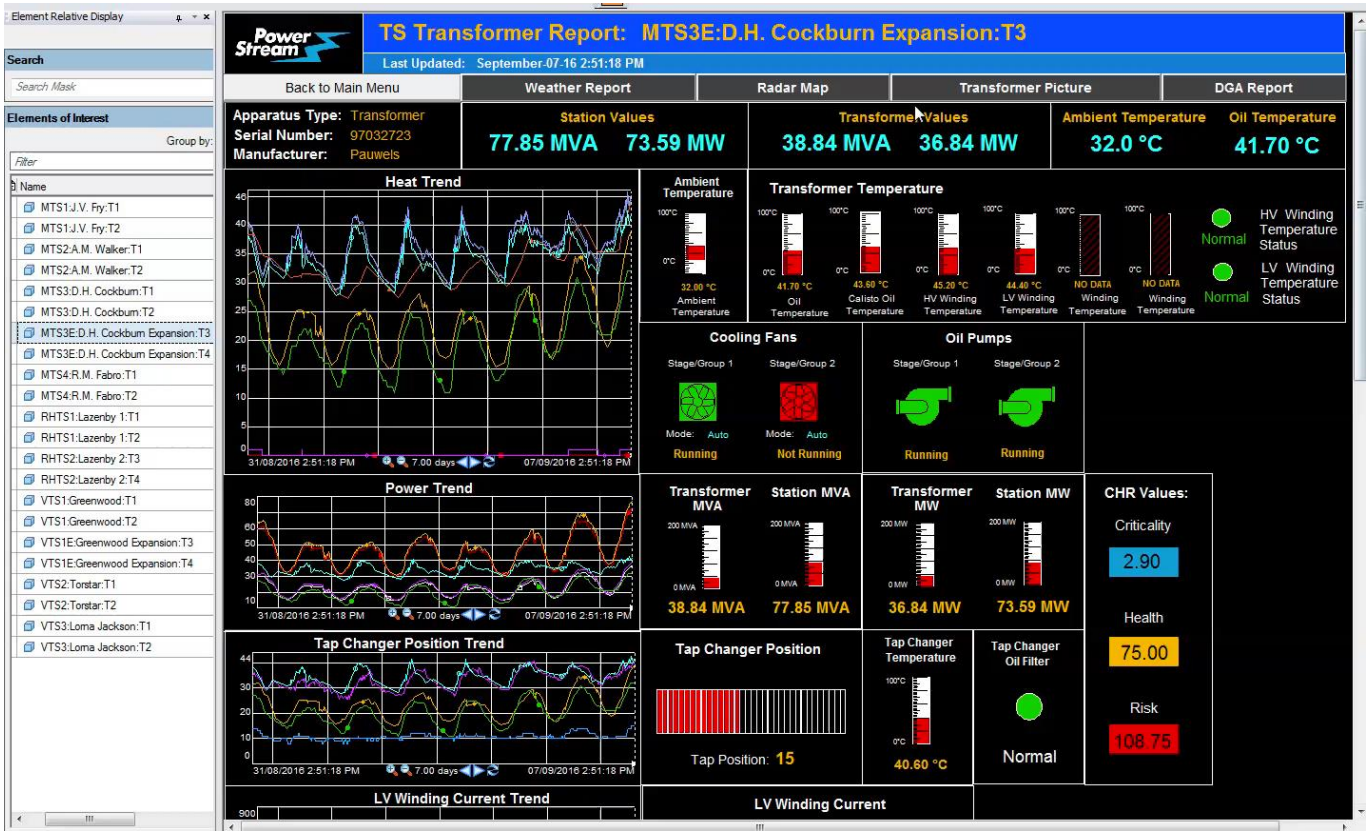


- **Monitors temperature of Switch Contacts, Switch Bushings, Individual Capacitors and Room**

Integrated Products

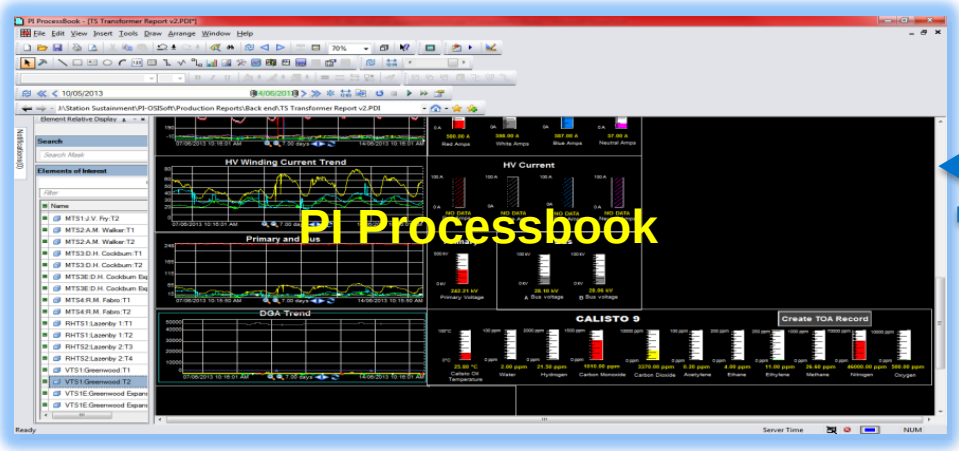
Integrated Expert Systems – Transforming our World

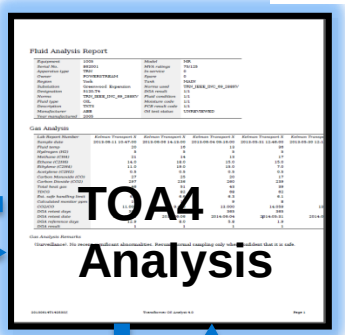
IIOT (Sensor data) - In action - Real-Time Transformer Oil Analysis



Intelligent Maintenance Example

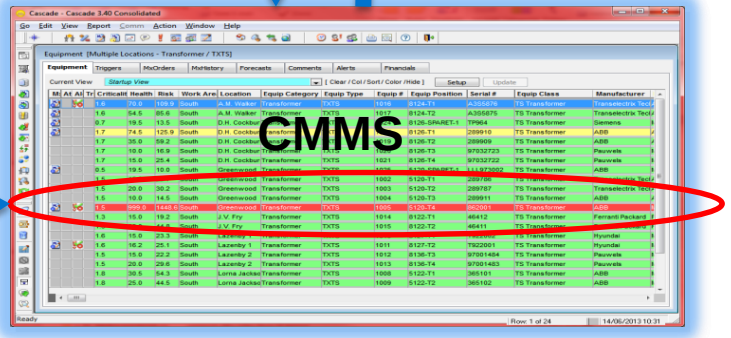
Dissolved Gas Analysis in Transformer





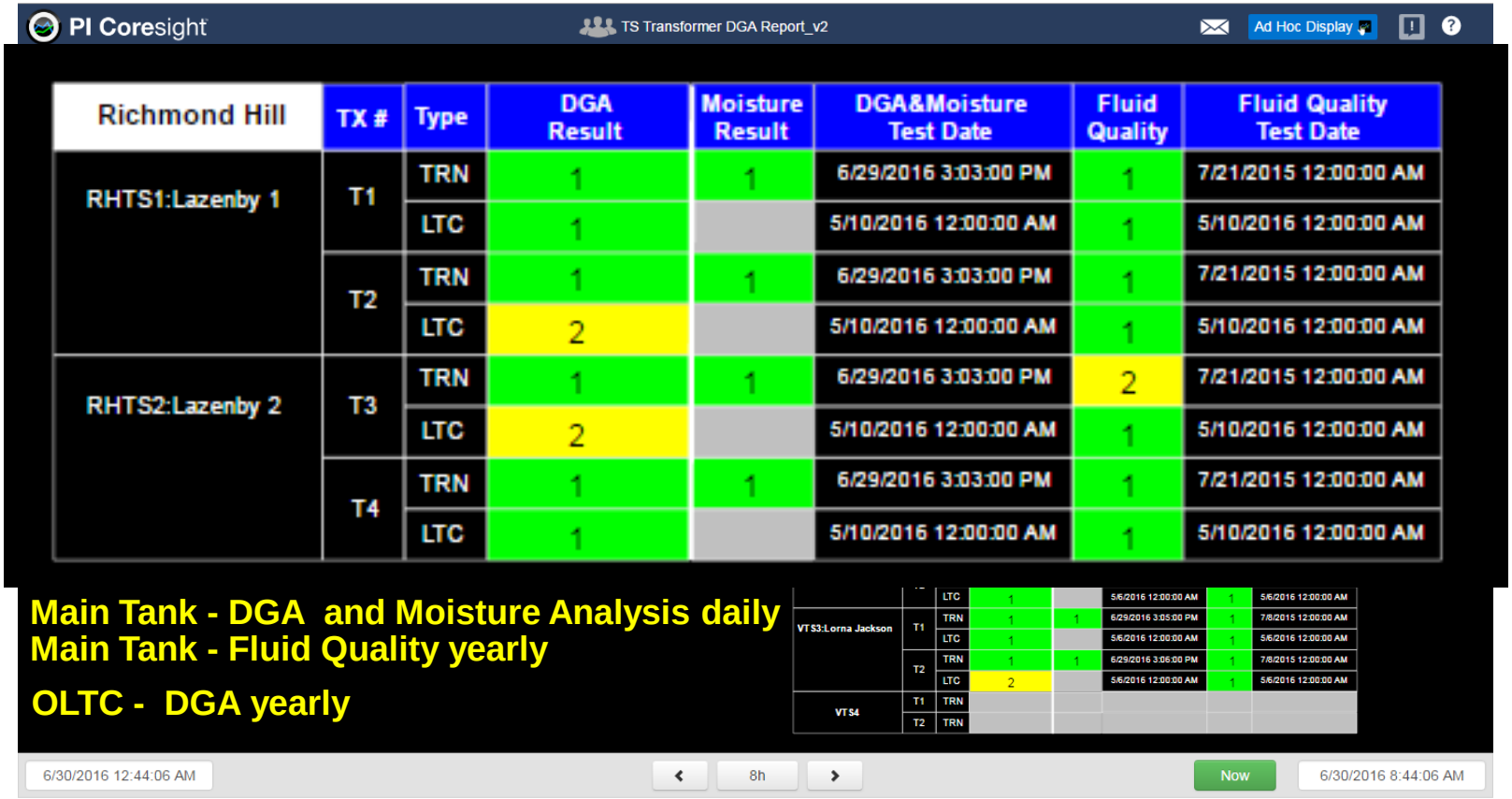
Daily Synch
or On Demand

Daily synch



Transformer Problem Identified
(Health and Risk Increase)
PI Notifications, CMMS Alert and
Auto Generated CM Work Order

TS Transformer Oil Condition Report



Richmond Hill	TX #	Type	DGA Result	Moisture Result	DGA&Moisture Test Date	Fluid Quality	Fluid Quality Test Date
RHTS1:Lazenby 1	T1	TRN	1	1	6/29/2016 3:03:00 PM	1	7/21/2015 12:00:00 AM
		LTC	1		5/10/2016 12:00:00 AM	1	5/10/2016 12:00:00 AM
	T2	TRN	1	1	6/29/2016 3:03:00 PM	1	7/21/2015 12:00:00 AM
		LTC	2		5/10/2016 12:00:00 AM	1	5/10/2016 12:00:00 AM
RHTS2:Lazenby 2	T3	TRN	1	1	6/29/2016 3:03:00 PM	2	7/21/2015 12:00:00 AM
		LTC	2		5/10/2016 12:00:00 AM	1	5/10/2016 12:00:00 AM
	T4	TRN	1	1	6/29/2016 3:03:00 PM	1	7/21/2015 12:00:00 AM
		LTC	1		5/10/2016 12:00:00 AM	1	5/10/2016 12:00:00 AM

Main Tank - DGA and Moisture Analysis daily
Main Tank - Fluid Quality yearly

OLTC - DGA yearly

		LTC	1		5/6/2016 12:00:00 AM	1	5/6/2016 12:00:00 AM
VTS3:Lorna Jackson	T1	TRN	1	1	6/29/2016 3:05:00 PM	1	7/8/2015 12:00:00 AM
		LTC	1		5/6/2016 12:00:00 AM	1	5/6/2016 12:00:00 AM
	T2	TRN	1	1	6/29/2016 3:06:00 PM	1	7/8/2015 12:00:00 AM
		LTC	2		5/6/2016 12:00:00 AM	1	5/6/2016 12:00:00 AM
VTS4	T1	TRN					
	T2	TRN					

Sensor Data used to Trigger Maintenance Tasks

- **Transformer:**
  - Dissolved Gas and Moisture (Oil Condition)
  - Loading, Oil Temperature
  - Tap Positions (monthly max and min and if passed through neutral)
  - Tap Changer Oil temperature vs main Tank Oil Temperature
  - Bushing Monitoring Power Factor & Capacitance
  - Geomagnetically Induced Currents (GIC)
- **Circuit Breaker:**
  - Operations in last 24 hours and last 6 months
  - Low SF6 Gas Alarm
  - Fault Current and Max Amps
- **DC System:**
  - Low Battery Alarm
- **Station:**
  - High Water Alarms

Visualizing Real-Time Asset Health - PI System and CMMS

Risk

Function of Criticality and Risk

Health

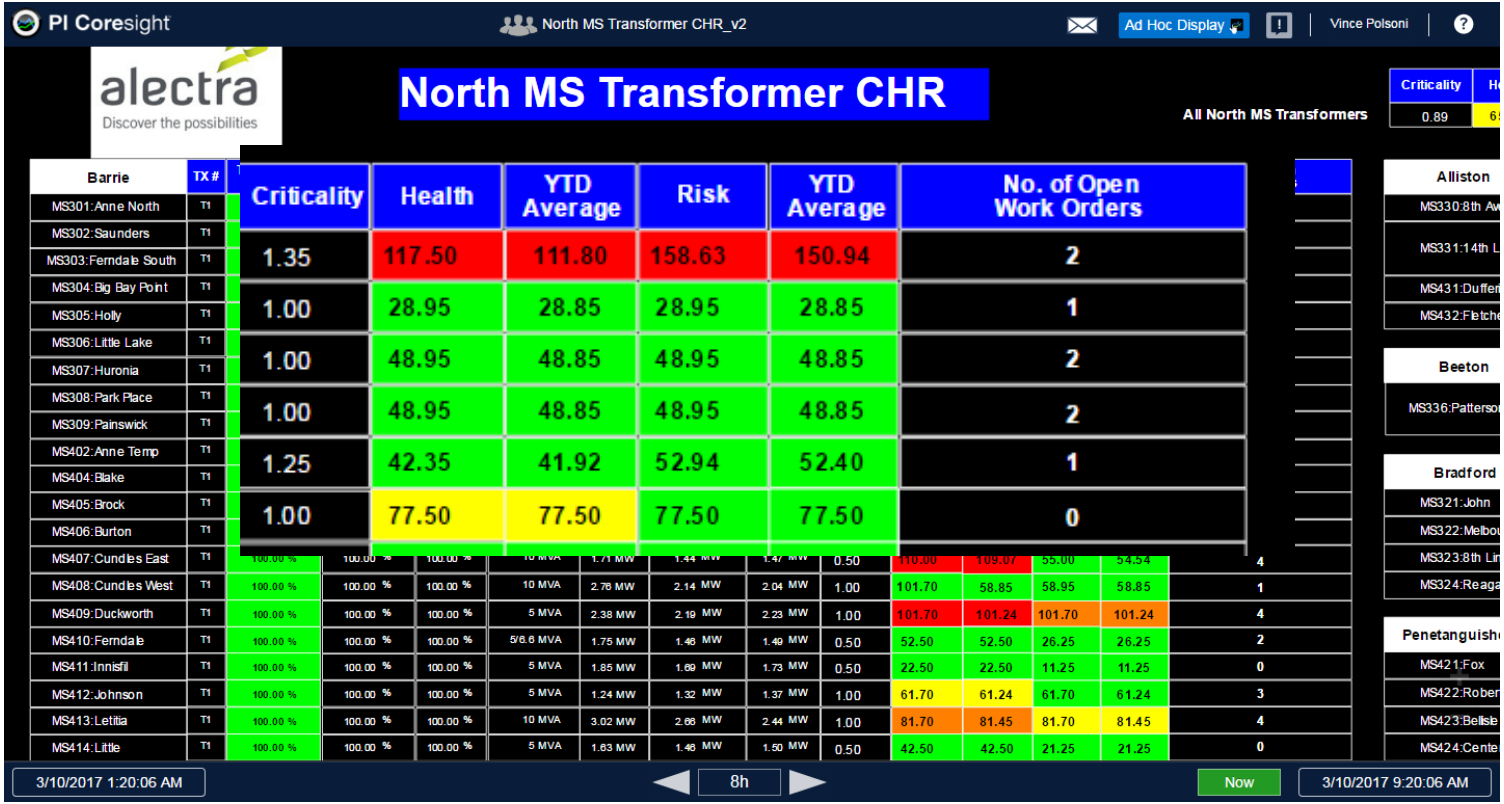
CMMS
- Maintenance Program Performance

PI System and CMMS Data
- Equipment Condition
- Failures, Equipment Status
- Number of Customers per Feeder/Station
- Number of Open Work Orders
- Age

Criticality

No of Transformers at Station (1, 2 or more)
Transfer Capability
Oil Containment
Key Customers
Total No of Customers per Station

TS Transformer - Criticality, Health and Risk



How PI Asset Framework is used at Alectra

PI Asset Framework (AF) (2016 Upgrade)

- Key Station Equipment and Distribution System Assets
- Outage and Other Event Information
- Maintenance Program Performance
  - Equipment Type and Maintenance Task

PI AF Elements

- Attributes from PI Tags, CMMS, OMS, CIS, Web pages (HTML) and UFL
- Longitude & Latitude (for ESRI Map Reports)

Library

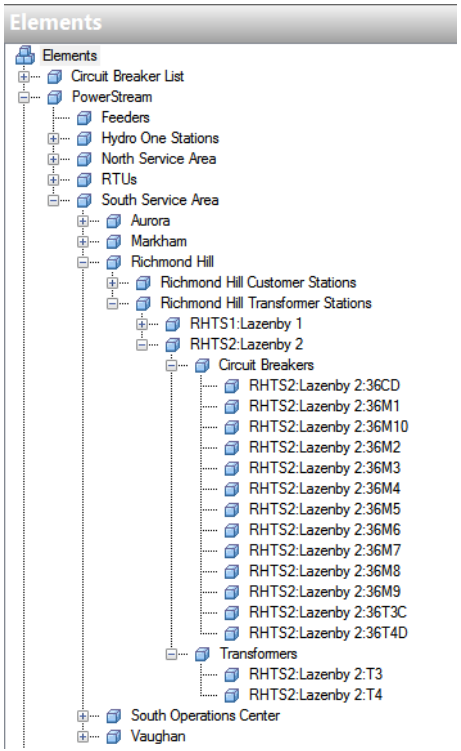
- Element Templates
- Notification Templates
- Event Frame Templates
- Tables (from OMS, CMMS)
- Analysis

Notifications

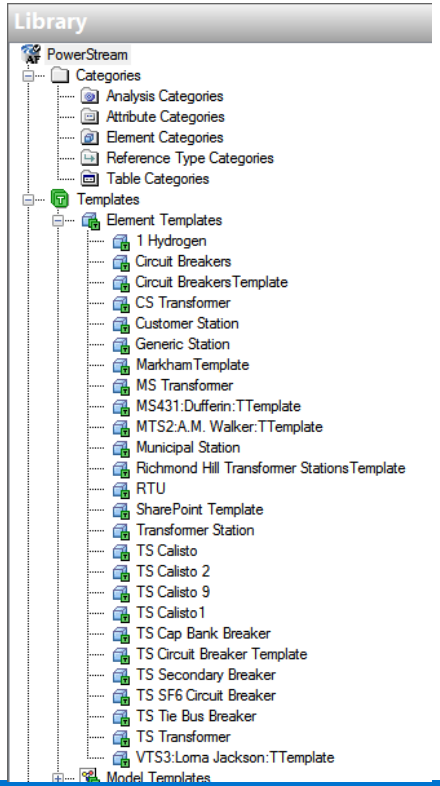
- Over 1600 notifications enabled and growing

PI System Explorer – PI Asset Framework (AF) – Alectra

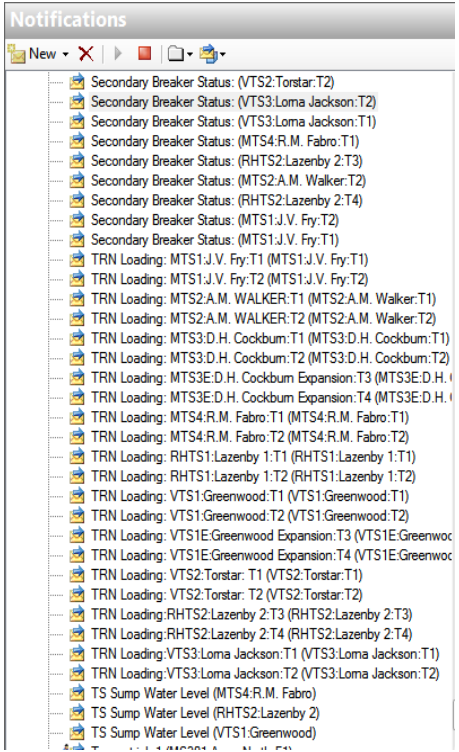
Elements



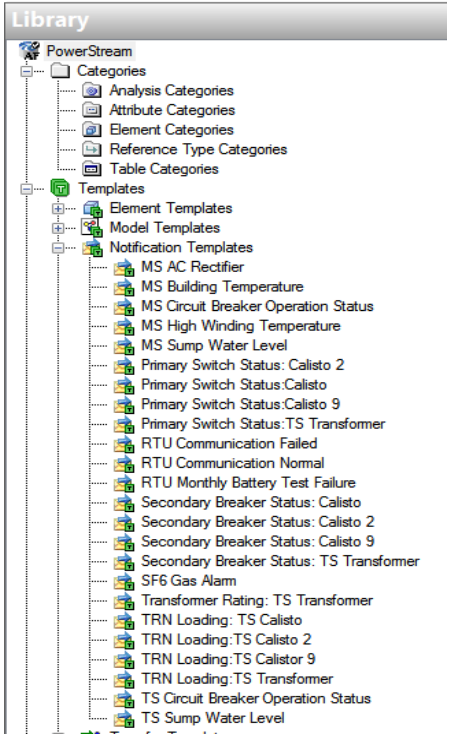
Element Templates



Notifications



Notification Templates



TS Transformer Report – PI ProcessBook

Links:
- Weather report
- Radar Map Link

Equipment Attributes

Pictures

External Database/App

AF Elements

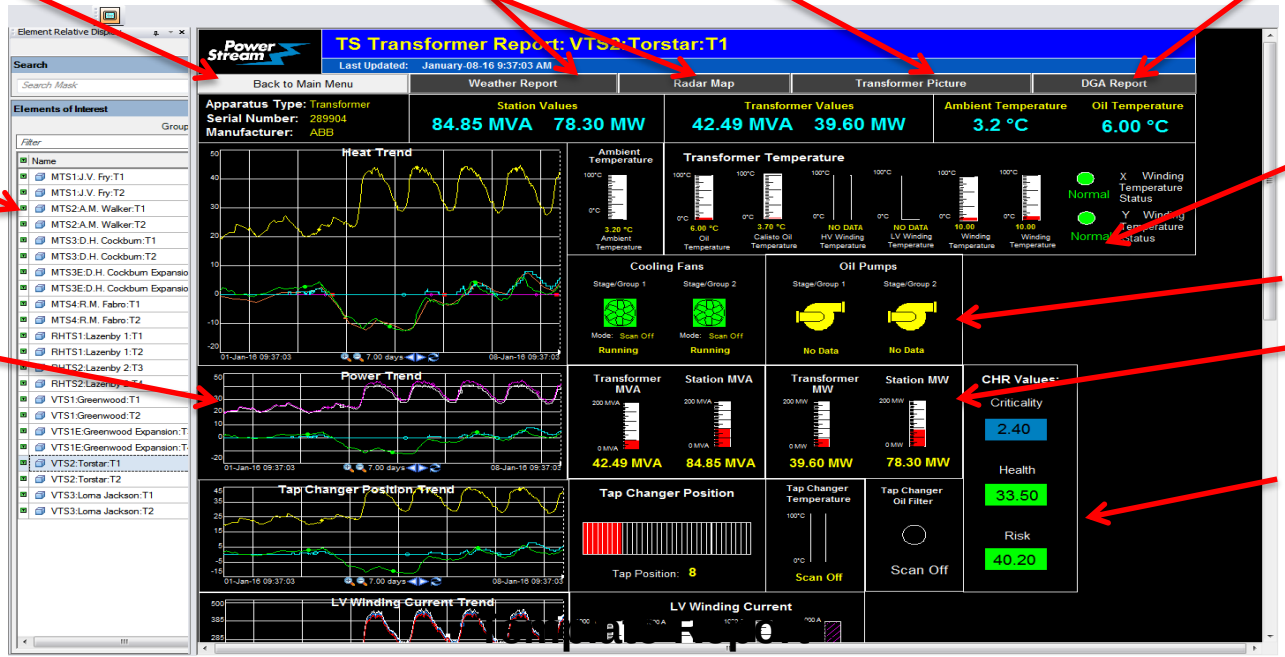
Status

Animations

Trends

Gauges

Heath and Risk Index

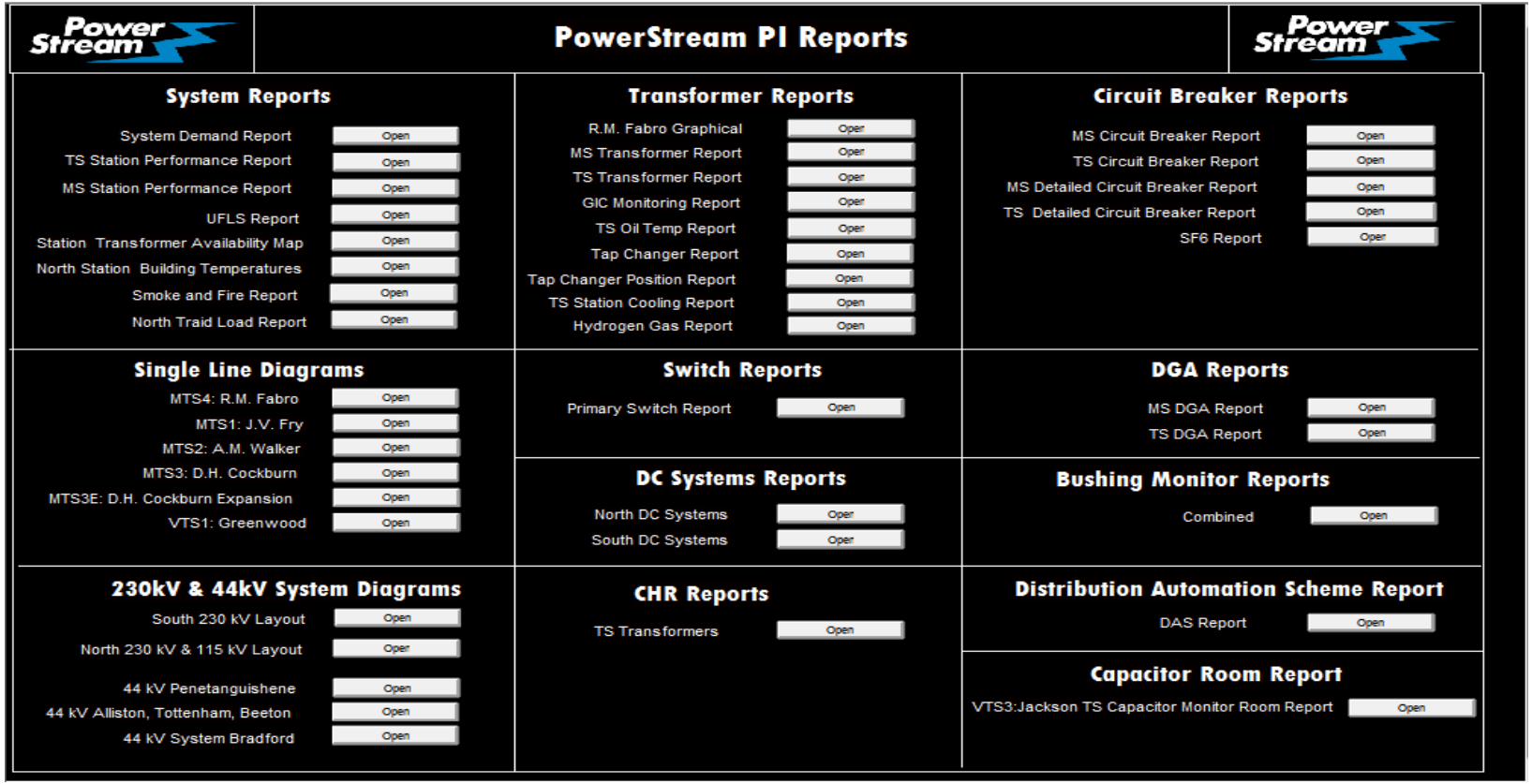


PI Coresight / PI ProcessBook Reports - Alectra

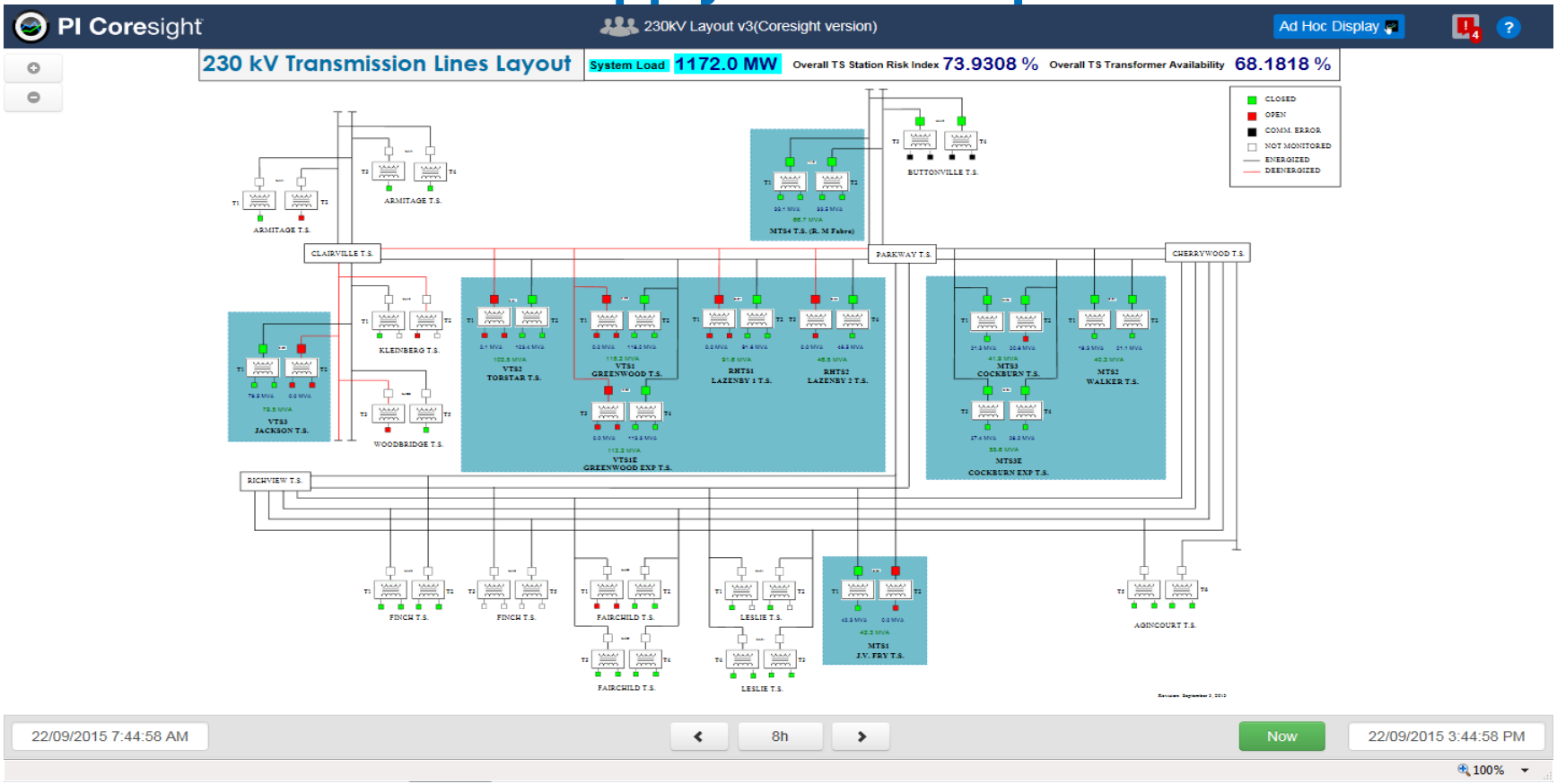
- System Demand
- System Outages (Regional)
- Station Performance (Risk)
- Station Loading
- Equipment Health & Risk
- Transformer
  - Loading
  - Winding temperature
  - Oil Temperature and Cooling
  - Dissolved Gas and Hydrogen
  - Cooling

- Bus Availability
- Circuit Breaker Status and details
- GIC Monitoring
- Sump Water level
- Station Building Temperature
- Primary Switches
- Equipment Failures (history)
- Maintenance Performance
- DC System Status
- MicroGrid

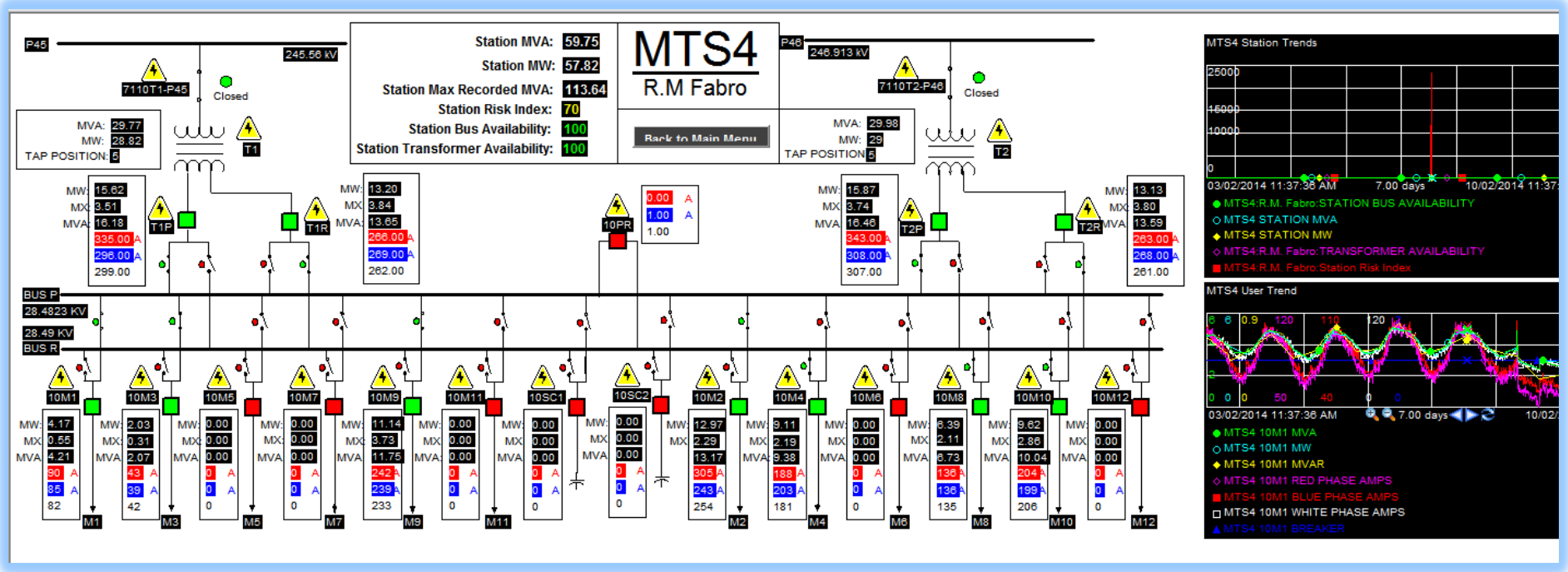
Real-Time Equipment Reports



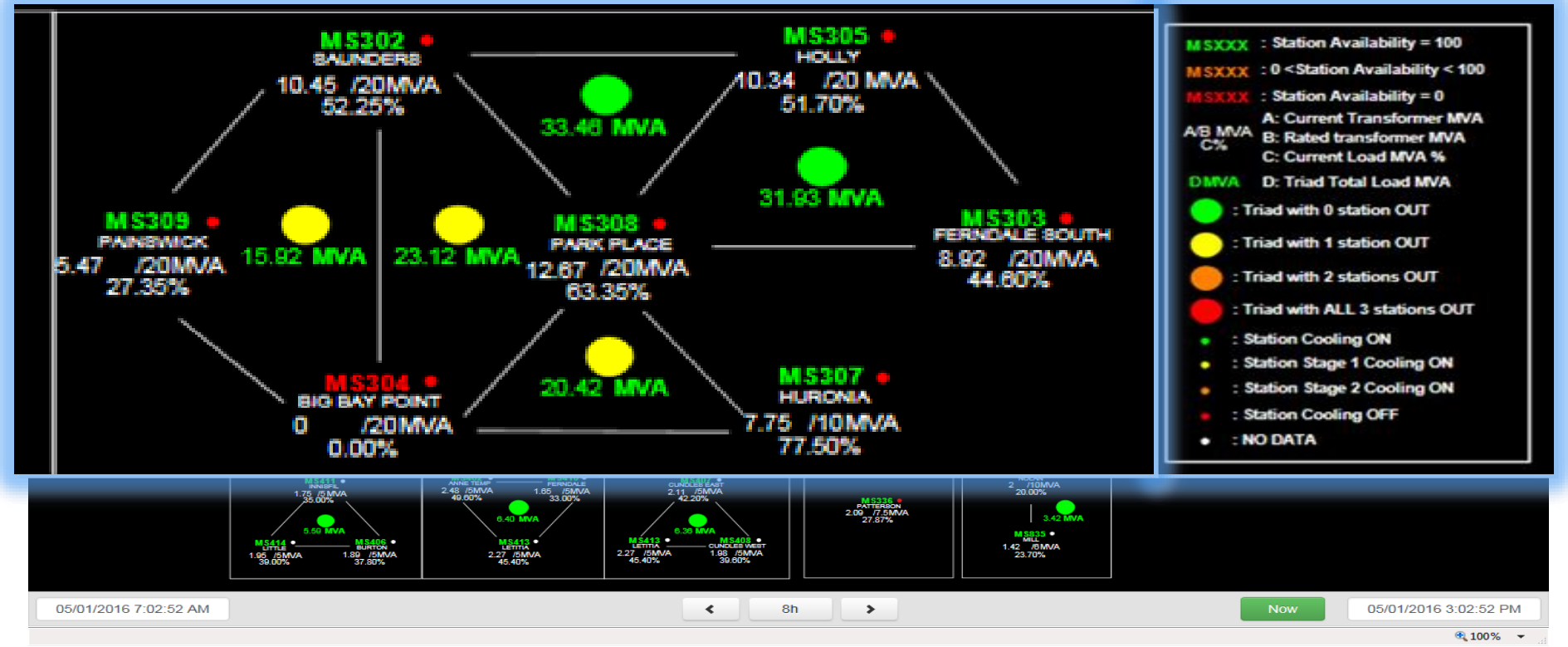
230kV Transmission Supply Status Report



PI ProcessBook – Station Single Line



Substation Interconnection – Load Transfer Report

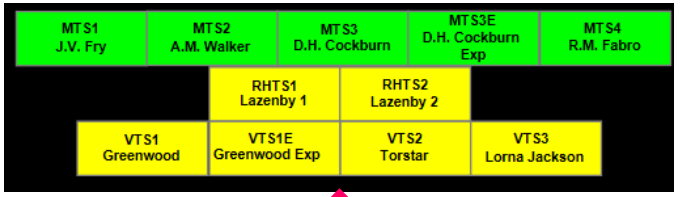


Station Performance Metrics (Example)

Overall TS Station Performance	
Overall TS Station Risk Index	79.61 %
Overall TS Transformer Availability	72.7273 %
Overall TS Bus Availability	100 %
Feeder TS Breakers "Closed"	92.36 %

MTS3:D.H. Cockburn	
Station Status	On
Station Risk Index	100
Transformer Availability	100
Bus Availability	100
Bus E Availability	LIVE
Bus E Voltage	28.65
Bus Z Availability	LIVE
Bus Z Voltage	28.67
Feeder Breakers Closed (%)	100

RHTS2:Lazenby 2	
Station Status	On
Station Risk Index	65.625
Transformer Availability	50
Bus Availability	100
Bus C Availability	LIVE
Bus C Voltage	28.32
Bus D Availability	LIVE
Bus D Voltage	28.28
Feeder Breakers Closed (%)	87.5

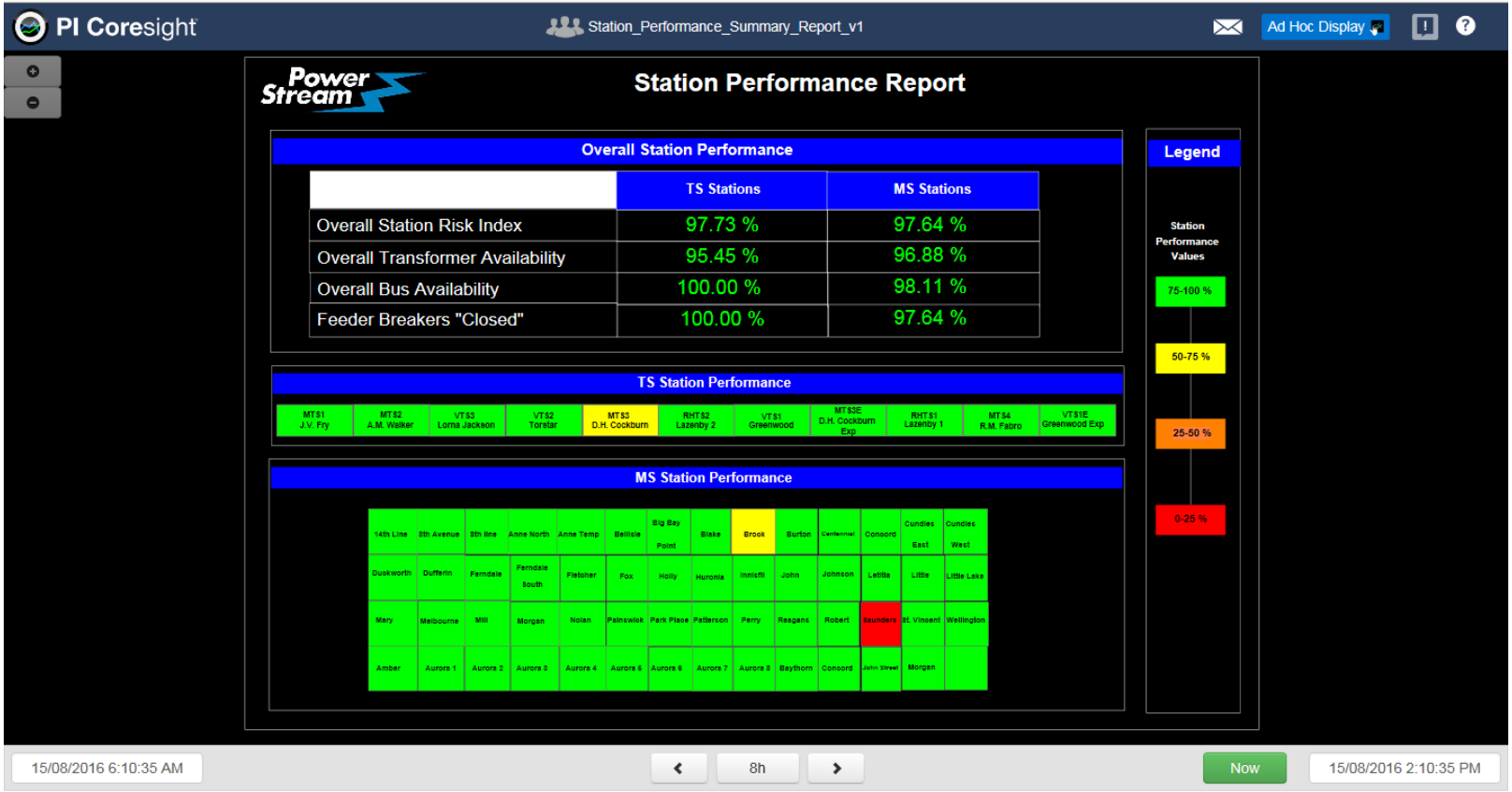


Multi States

Performance Indicators
(Performance Equations)

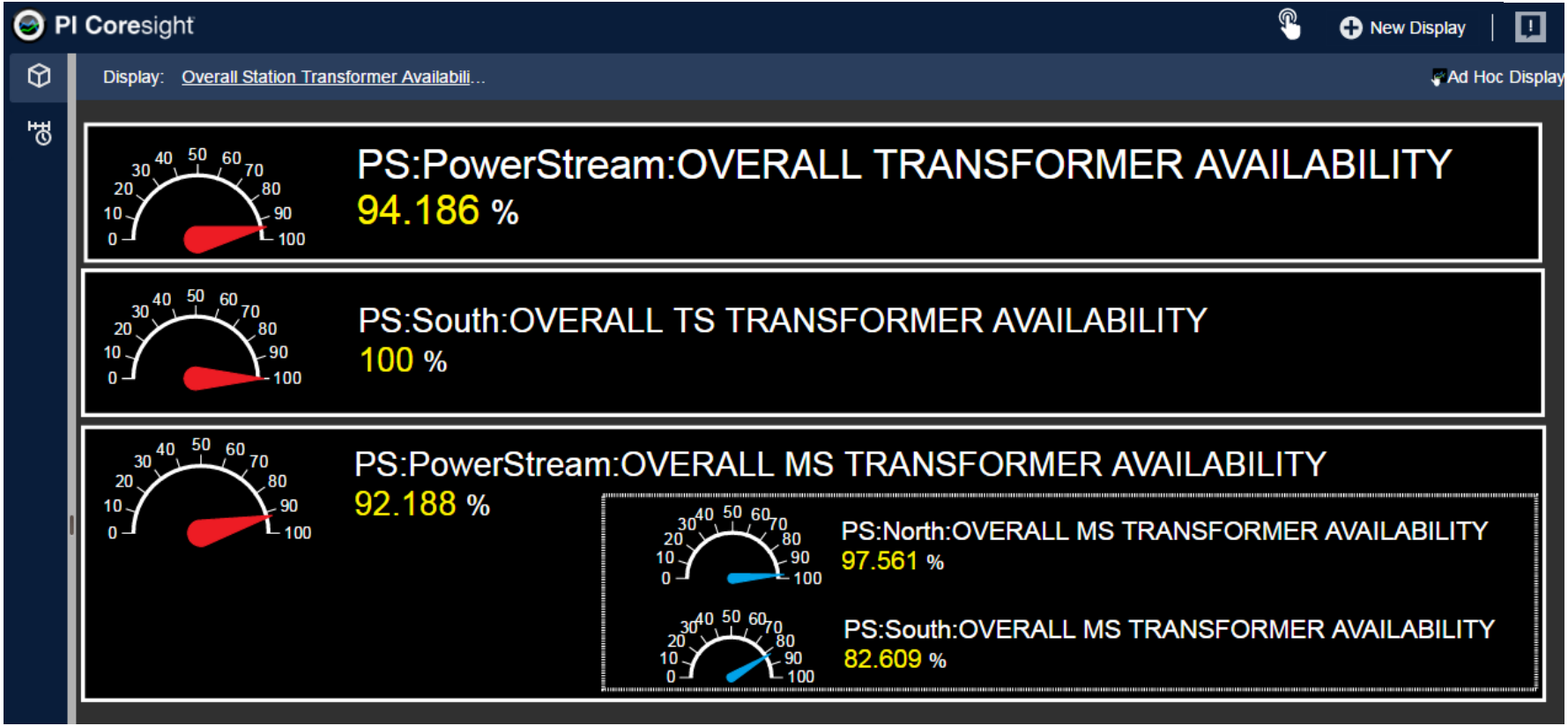
Algorithms
(Performance Equations)

Station Availability (Risk) Report

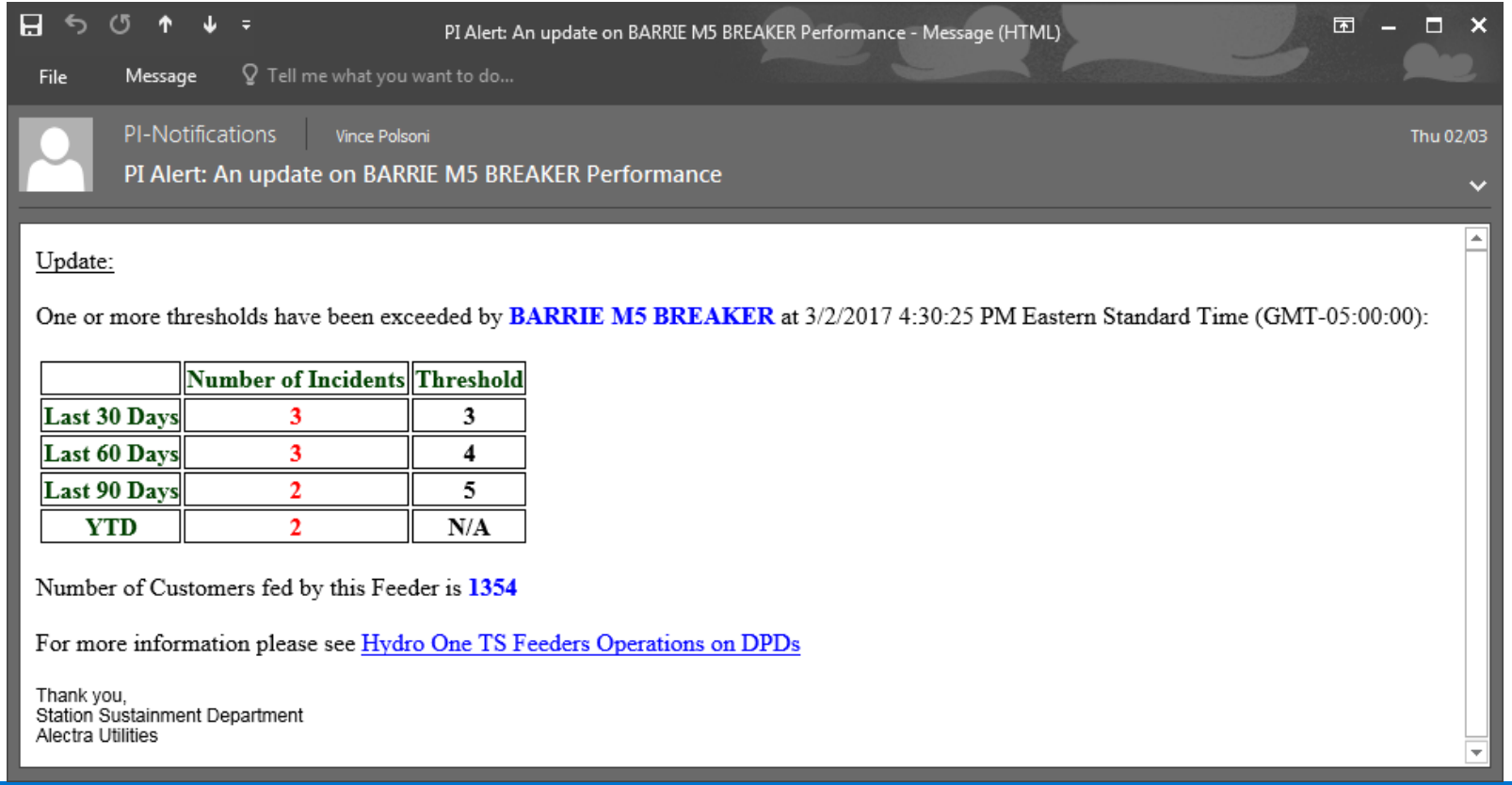


Station Transformer Availability

PI Coresight 2016 R2



Feeder Availability Report - Risk



PI Alert: An update on BARRIE M5 BREAKER Performance - Message (HTML)

File Message Tell me what you want to do...

PI-Notifications | Vince Polsoni Thu 02/03

PI Alert: An update on BARRIE M5 BREAKER Performance

Update:

One or more thresholds have been exceeded by **BARRIE M5 BREAKER** at 3/2/2017 4:30:25 PM Eastern Standard Time (GMT-05:00:00):

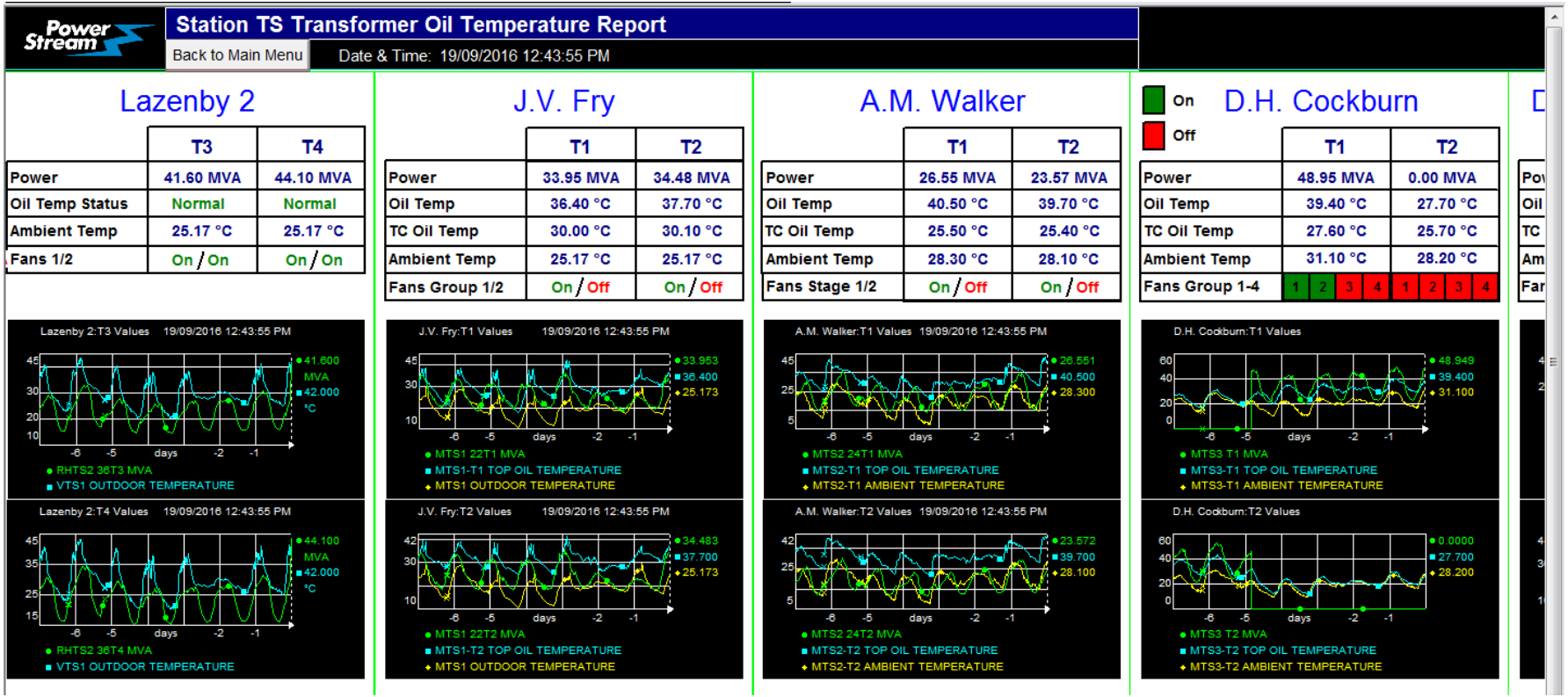
	Number of Incidents	Threshold
Last 30 Days	3	3
Last 60 Days	3	4
Last 90 Days	2	5
YTD	2	N/A

Number of Customers fed by this Feeder is **1354**

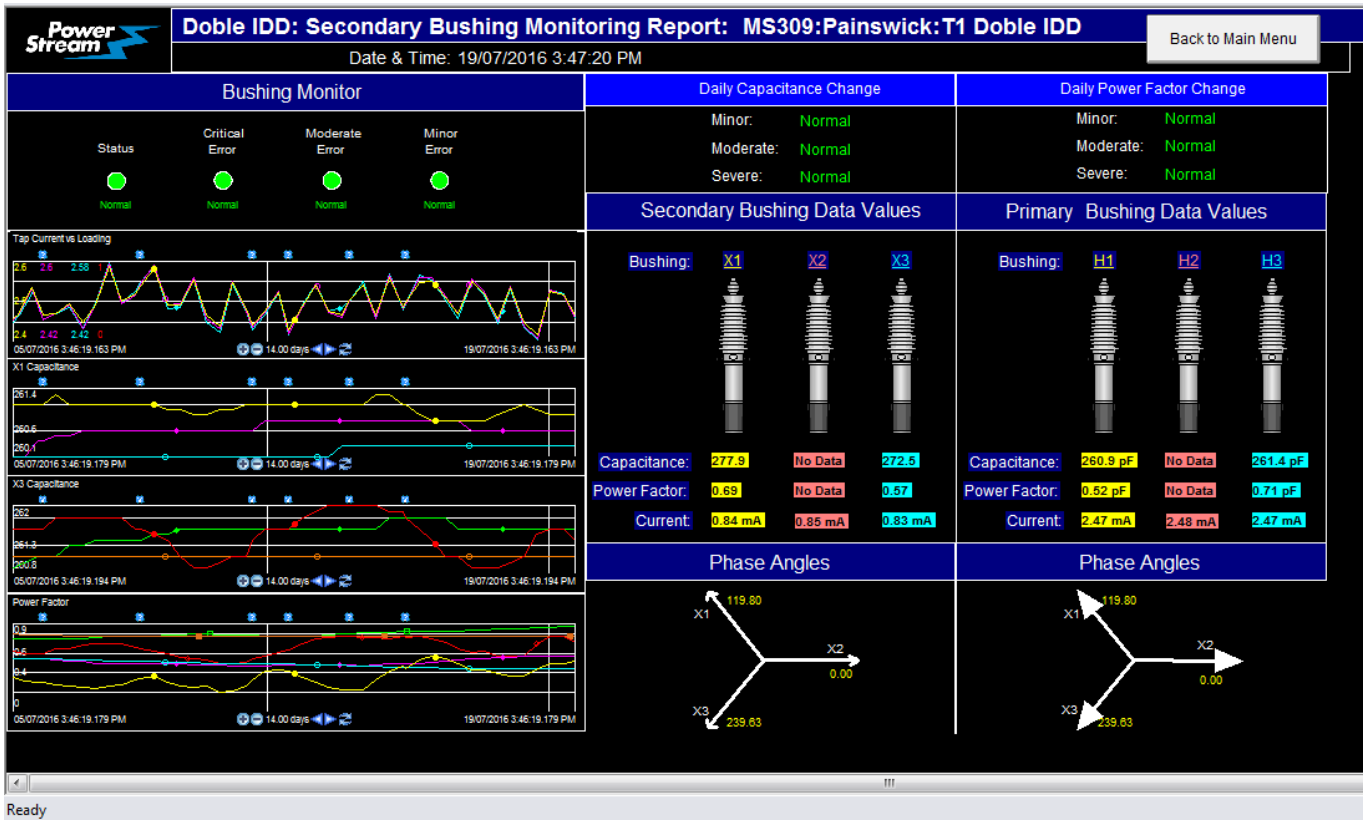
For more information please see Hydro One TS Feeders Operations on DPDs

Thank you,
Station Sustainment Department
Alectra Utilities

Station Transformer Oil Temperature Report

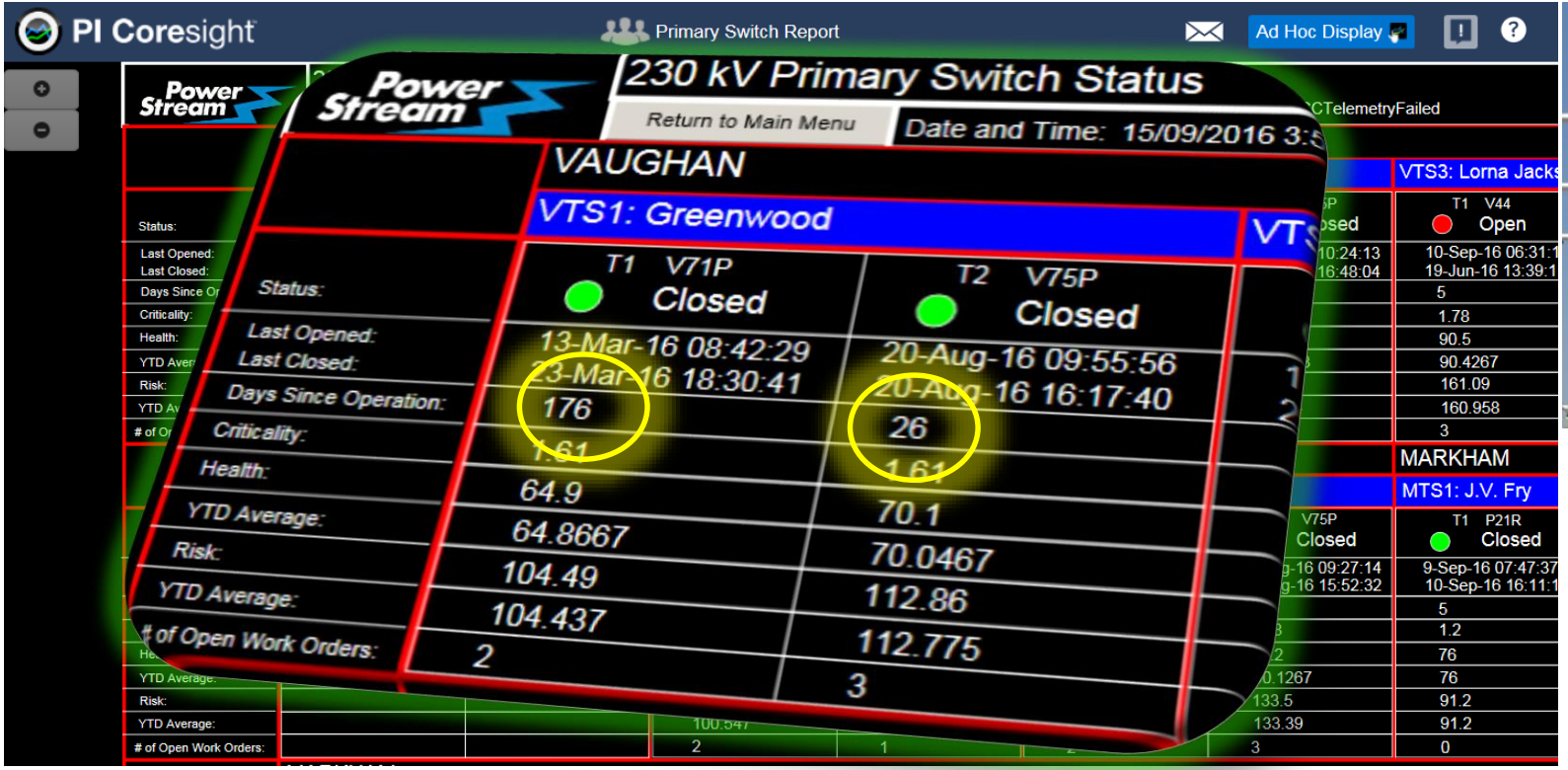


Transformer Online Bushing Condition Report



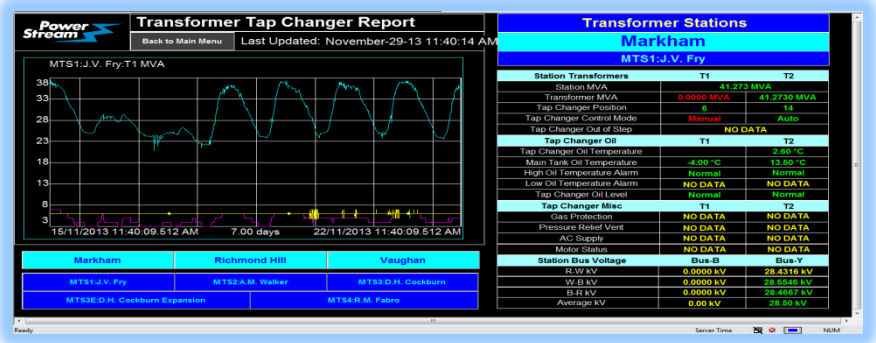
Bushing Monitor

230kV Primary Switch Performance Report



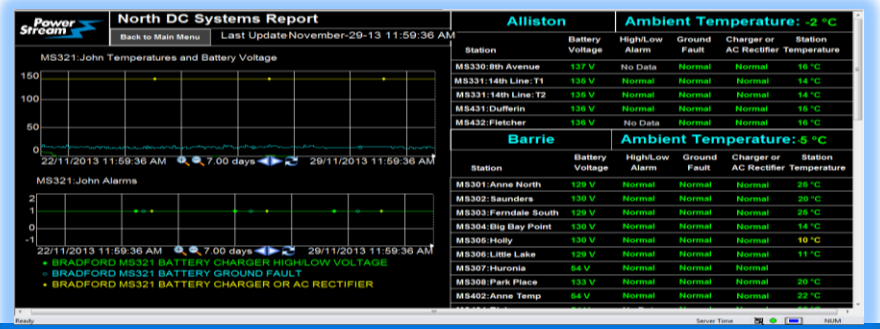
PI ProcessBook Reports

Tap Changer



Oil Containment & Sump Pump

DC Systems



Circuit Breaker Status

Substation Transformer Hydrogen Gas Alarm Report

NEW!

PI Coresight

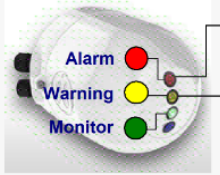
Display: MS Transformer Hydrogen Gas Moni... *(read-only)*

alectra
Discover the possibilities

MS Transformer Hydrogen Gas Monitors - North

Anne North MS301:T1	Saunders MS302:T1	Ferndale South MS303:T1	Big Bay Point MS304:T1	Holly MS305:T1	Little Lake MS306:T1	Huronia MS307:T1	Park Place MS308:T1	Painswick MS309:T1	Livingstone MS310:T1	John MS321:T1	Melbourne MS322:T1	8th Line MS323:T1	Reagans MS324:T1
8th Avenue MS330:T1	14th Line MS331:T1	14th Line MS331:T2	Patterson MS336:T1	Patterson MS336:T2	Anne Temp MS402:T1	Blake MS404:T1	Brock MS405:T1	Burton MS406:T1	Cundles East MS407:T1	Cundles West MS408:T1	Duckworth MS409:T1	Ferndale MS410:T1	Innisfil MS411:T1
Johnson MS412:T1	Letitia MS413:T1	Little MS414:T1	Mary MS415:T1	St. Vincent MS417:T1	Wellington MS418:T1	Perry MS419:T1	Fox MS421:T1	Robert MS422:T1	Bellisle MS423:T1	Centennial MS424:T1	Dufferin MS431:T1	Fletcher MS432:T1	Nolan MS834:T1

Intellix GLA 100

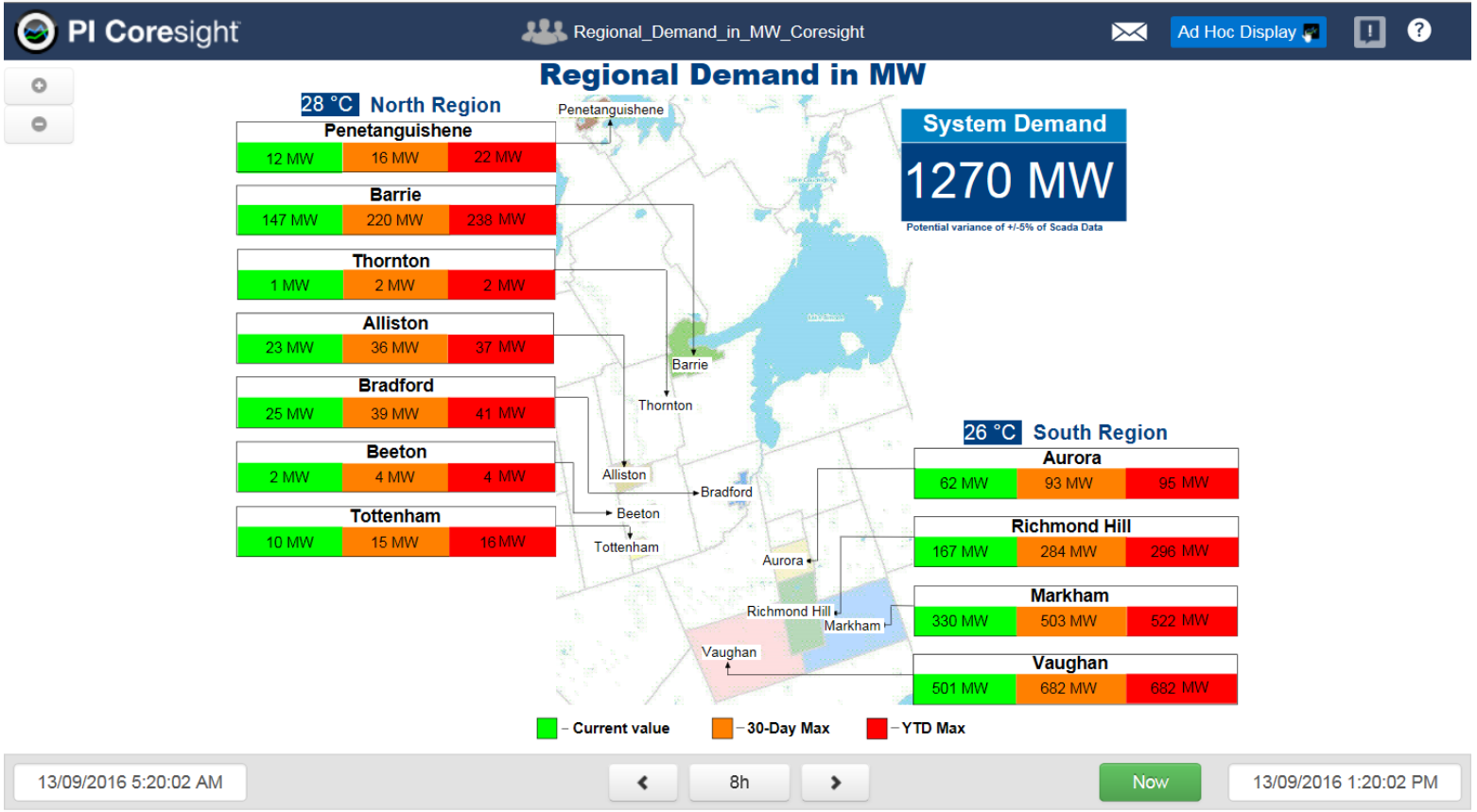


Hydrogen Concetration > 500 ppm (OR)
Rate of Change > 50 ppm per 24Hr

Hydrogen Concetration > 400 ppm (OR)
Rate of Change > 25 ppm per 24Hr

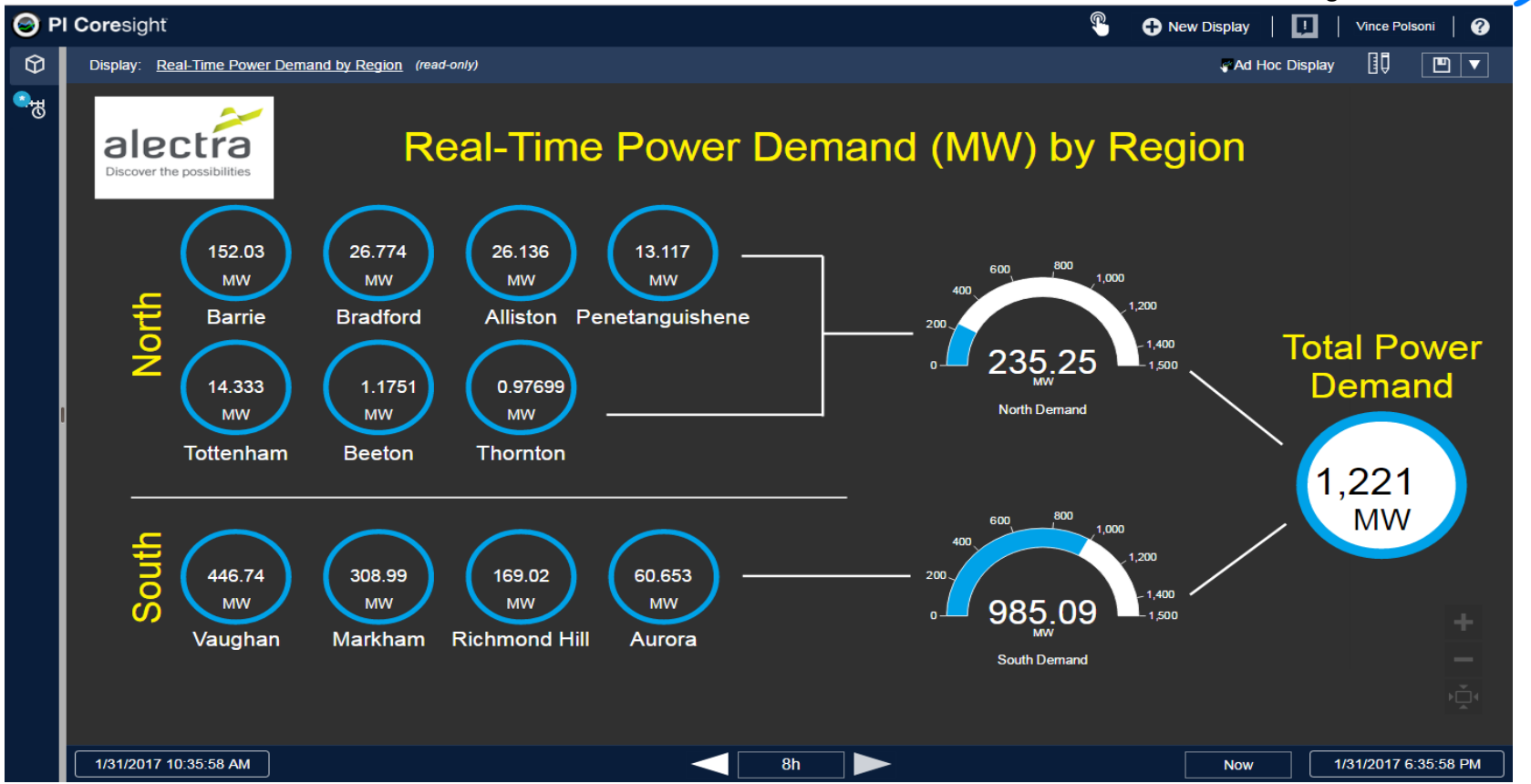
PI Coresight 2016 R2

Regional Demand: Current, 30 Day & Year to Date Maximums



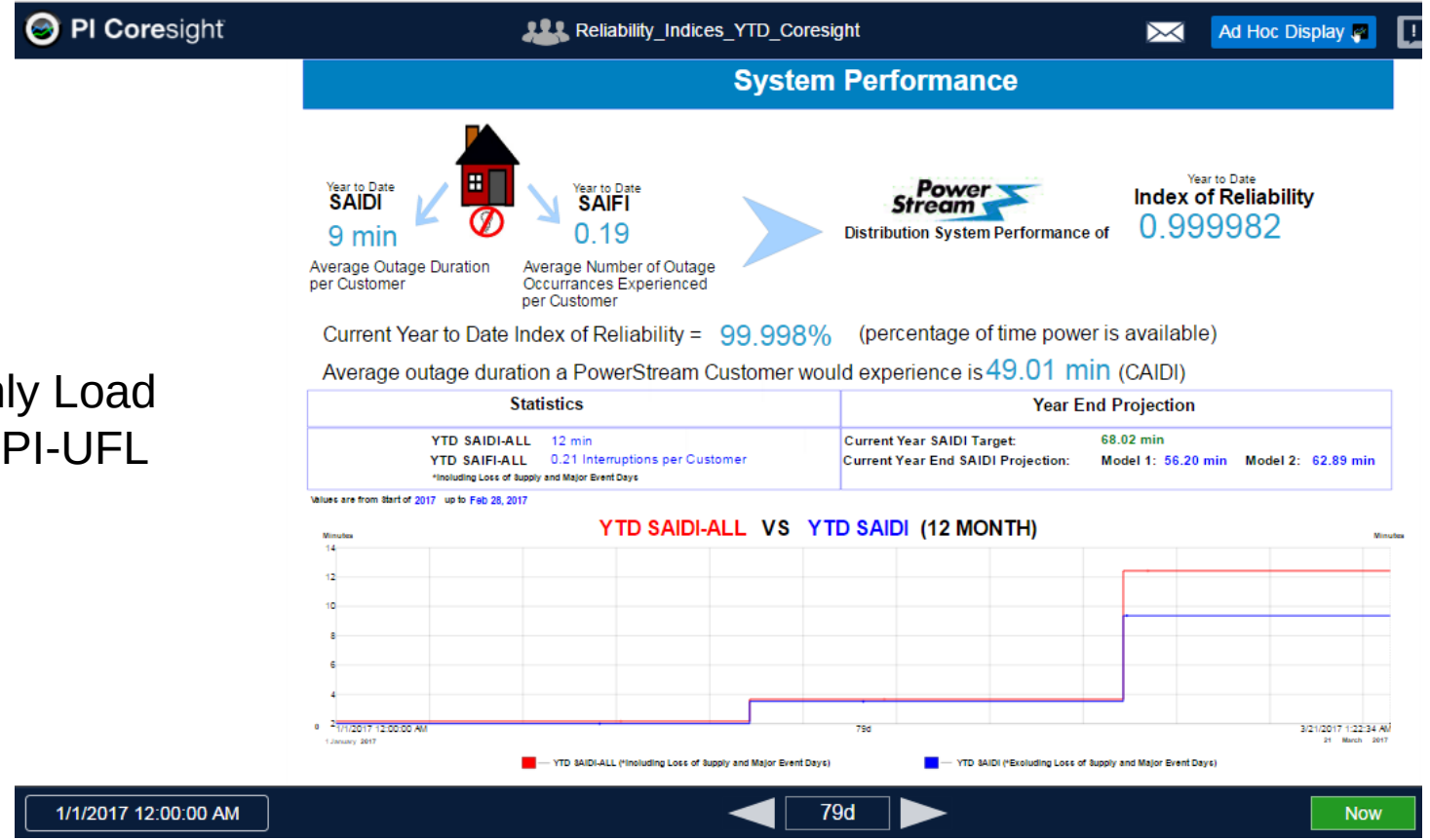
Power Demand By Region

PI Coresight 2016 R2

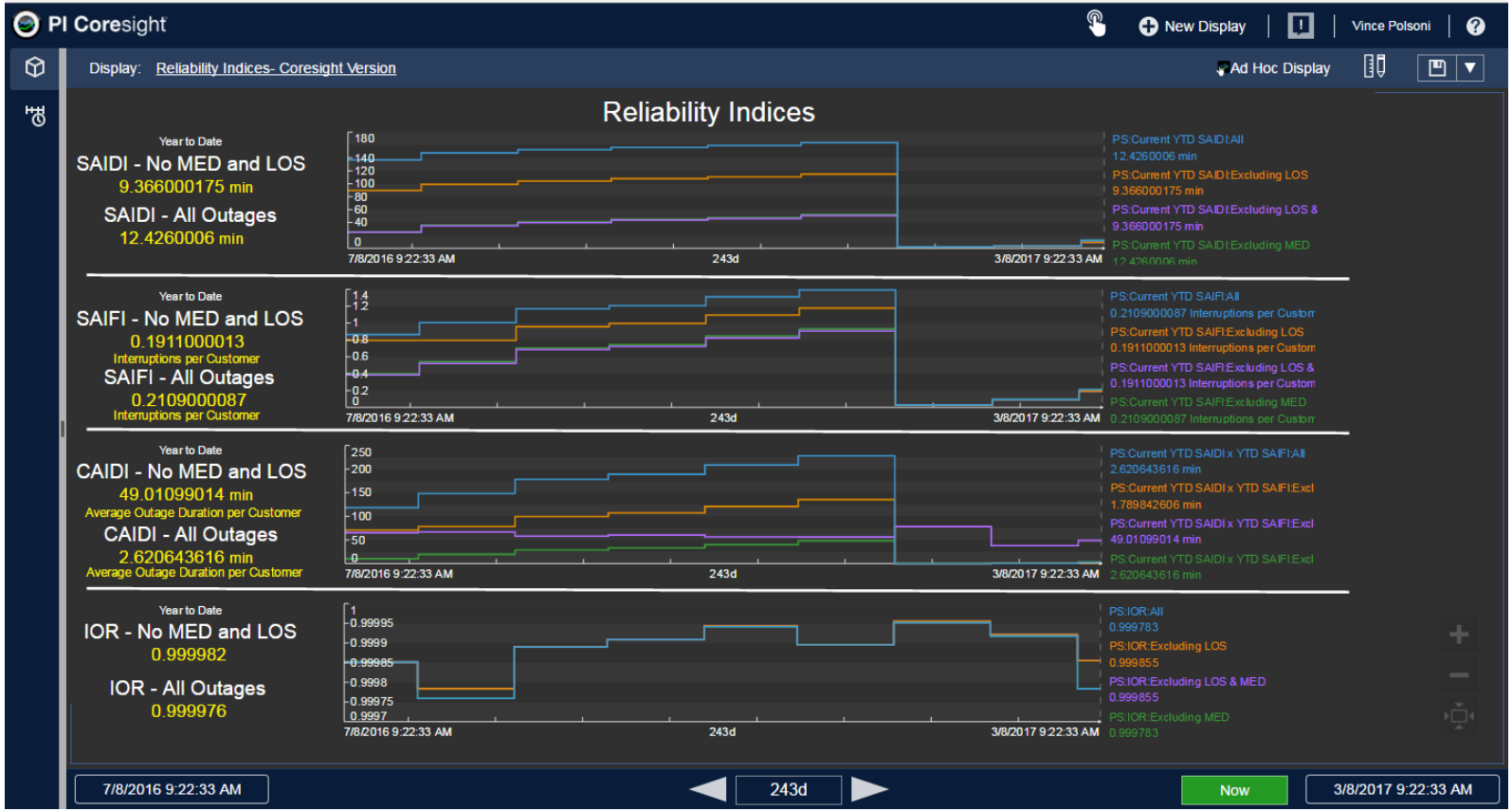


System Reliability Report using PI Coresight / PI ProcessBook

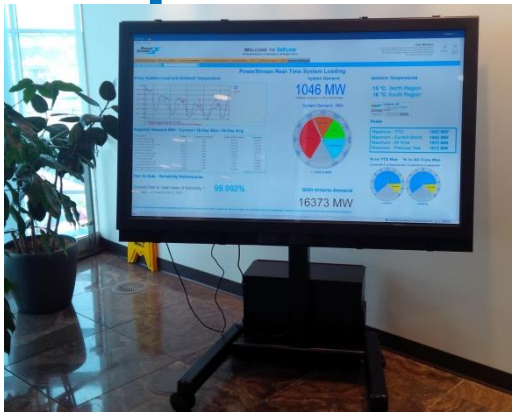
Monthly Load using PI-UFL



System Reliability Report using PI Coresight 2016 R2

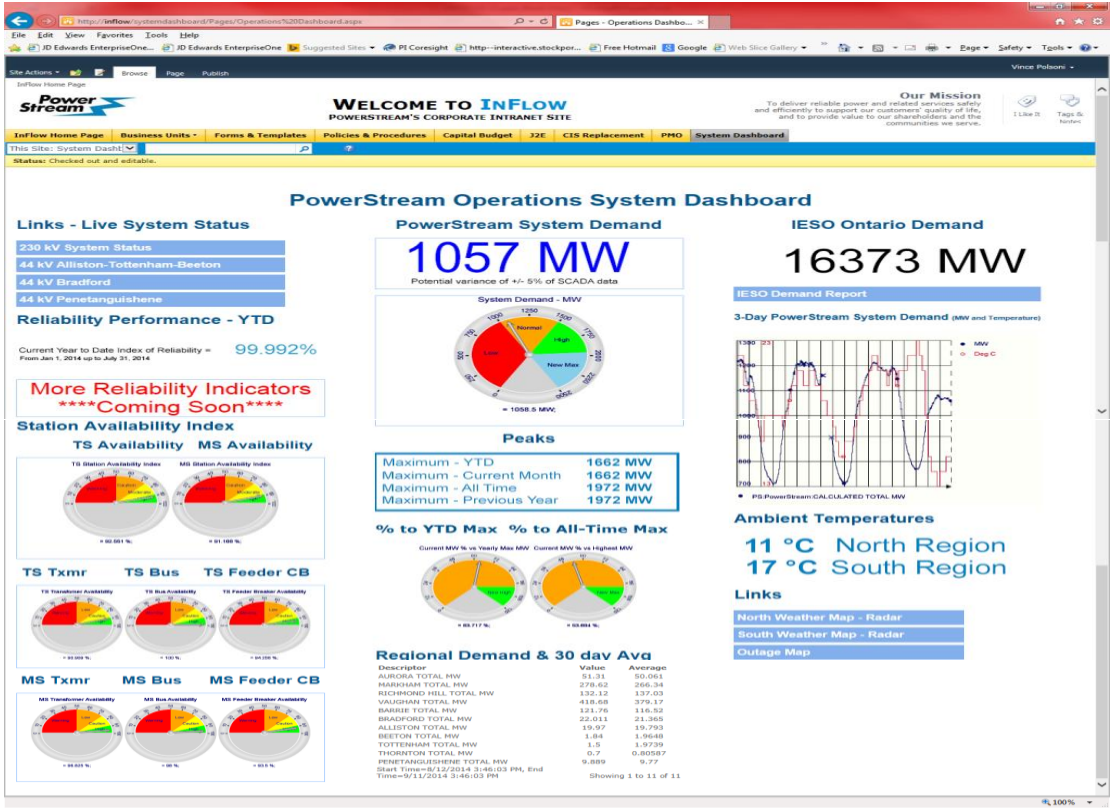


Corporate / Operations Dashboards



PITV – Public Area

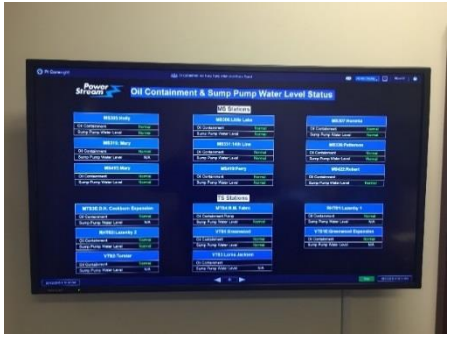
PITV – Office



PITV – Operations Reports

Operations South Public

Station Sustainment South



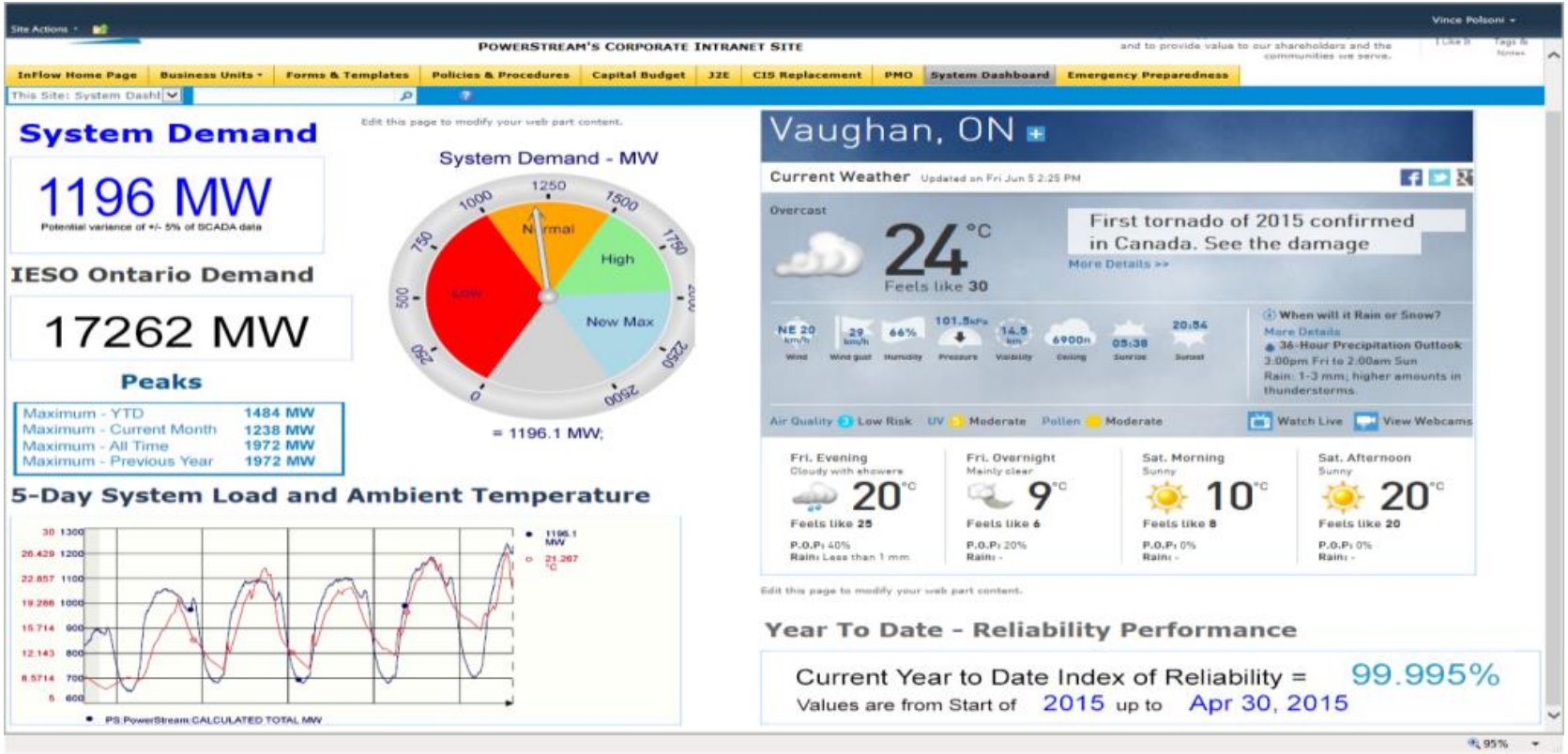
Station Sustainment North

Operations North Public

VP Operations

Executive Office

System Loading Dashboard



PI Notifications – Real-time Information

- Current Total Outages by Region
- Circuit Breaker Operation
- Low SF6 Gas
- Station Building Temp
- DC System
- Battery Low Voltage
- Calisto 9 General Alarm
- System Demand

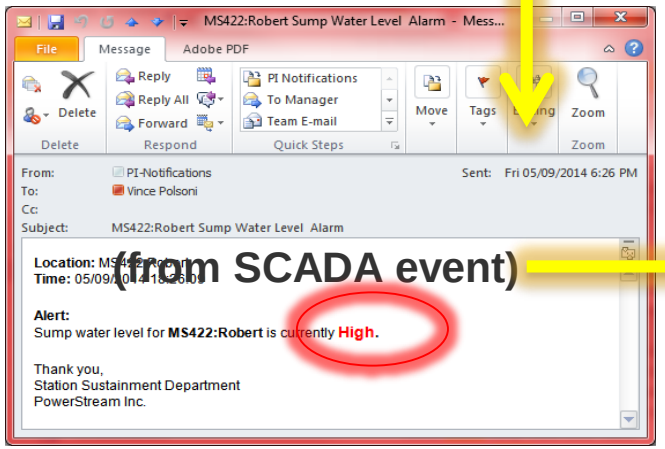
- Transformer Online / Offline
- Transformer Oil Temp/Cooling
- Transformer Bushing Alarm
- Tap Changer Oil Filtration Alarm
- Feeder Protection Trip
- Secondary Txmr Breaker Operation
- Primary Switch Operation
- High Sump Water Level

SCADA – PI System – CMMS working as One

PI Report (High Water Alarm)

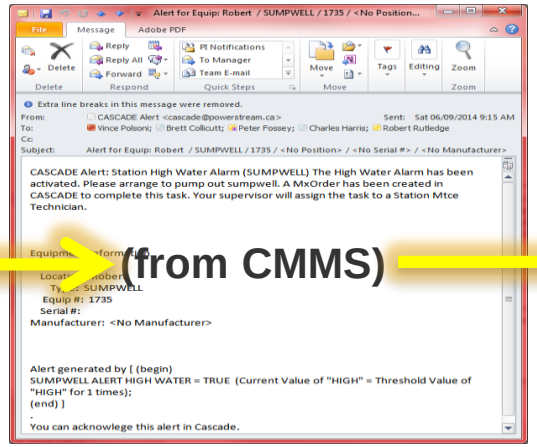
PI Report (High Water Alarm Cleared)

PI Notifications



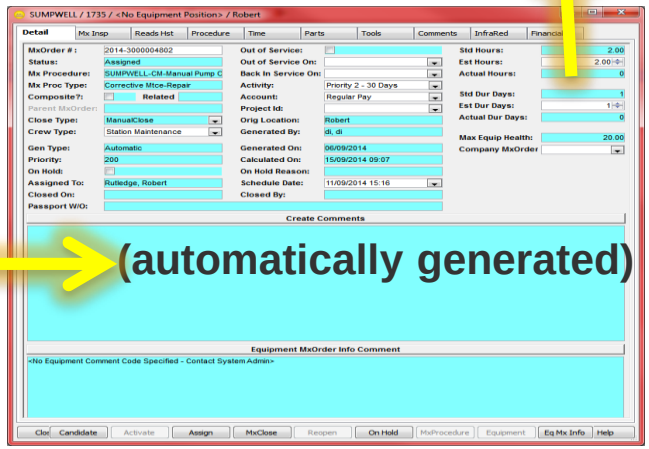
(from SCADA event)

CMMS Work Order Alert



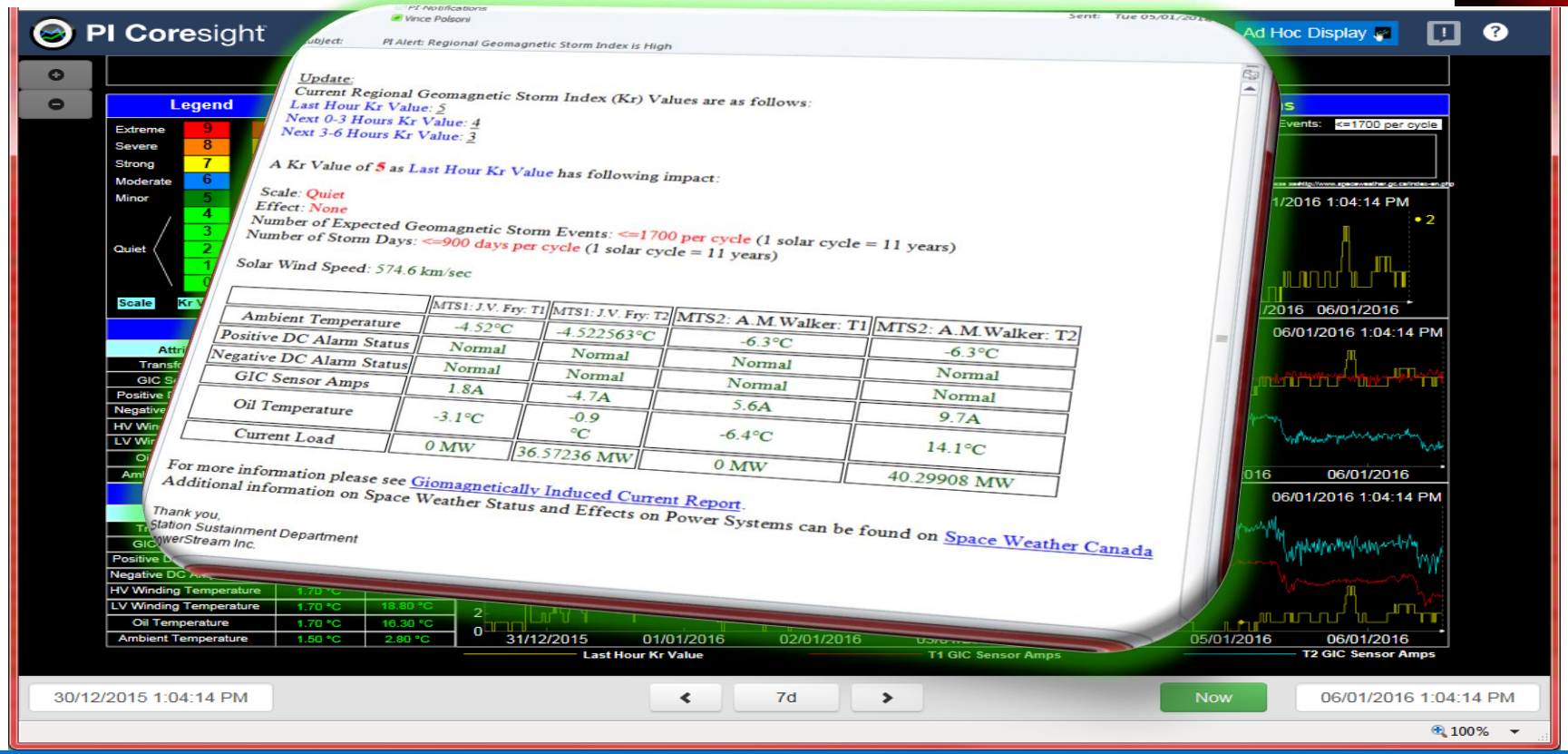
(from CMMS)

CMMS Work Order

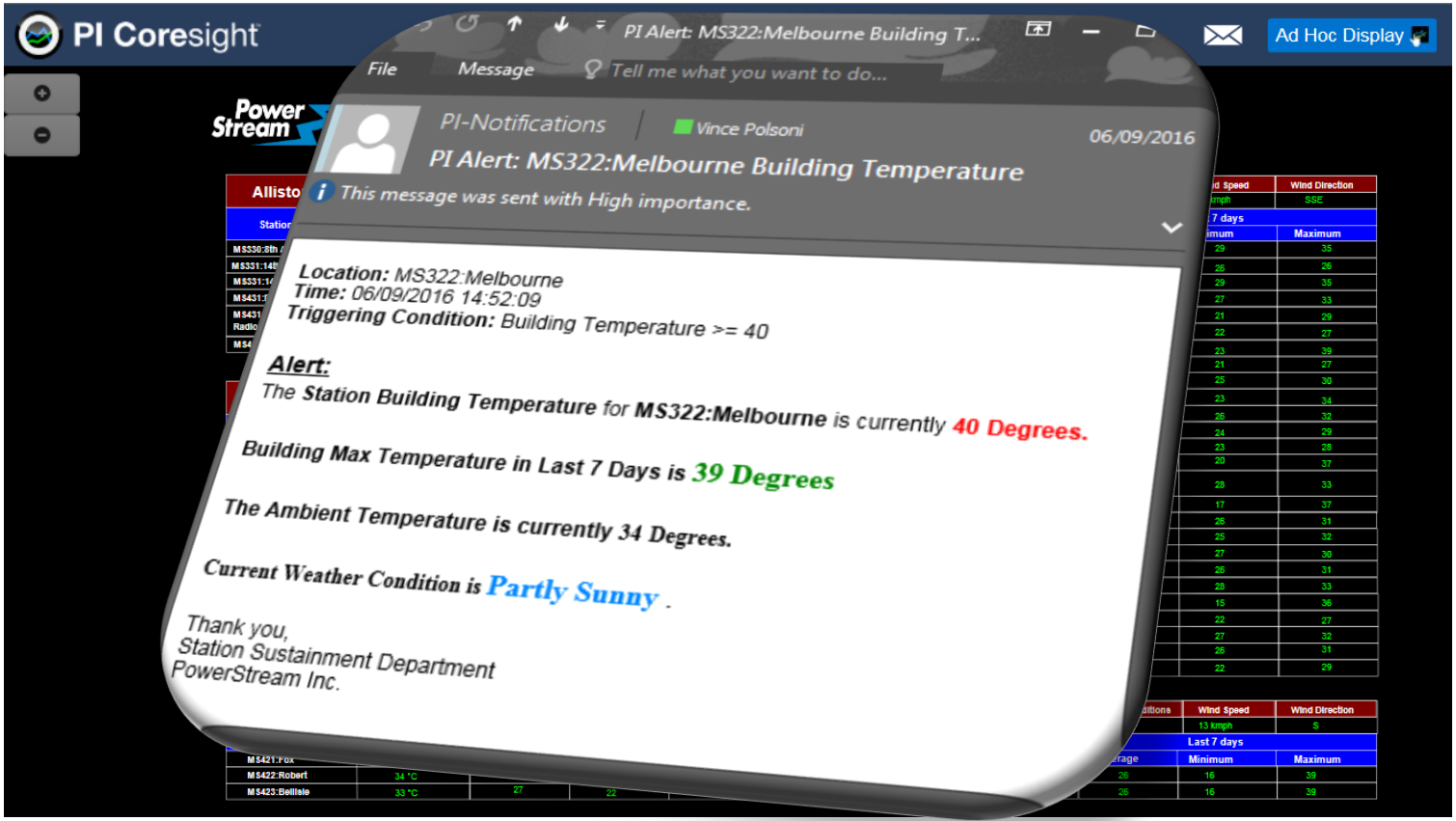


(automatically generated)

Geomagnetically Induced Current Report



Station Building Temperature Report



System Demand Report

Use PI System to monitor the System Demand as it approaches and reaches Alectra's "All-Time" peak and notify when it reaches >95% of all time peak

PI Coresight — Demand Report v4-1 — Ad Hoc Display

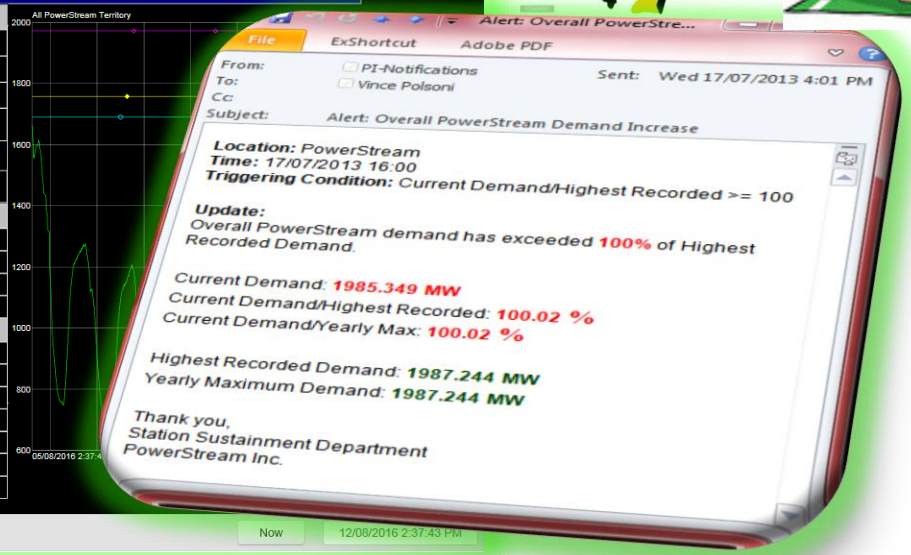
PowerStream Demand Report

Region	Real Time Demand	August Max Demand	2016 Max Demand	Highest Recorded Demand
All Territory	1867.1 MW	1866.3 MW	1866.3 MW	1972 MW
North Territory	325.7 MW	334.0 MW	344.9 MW	395.3 MW
South Territory	1542.7 MW	1542.4 MW	1542.4 MW	1642.8 MW

% Power Provided by PowerStream	64.02 %	% of Maximum Yearly Demand	100.00 %	% of Highest Recorded Demand	94.64 %
Current Temperature SOUTH Region	35.2 °C			Current Temperature NORTH Region	29.0 °C
Today's Max Temp	34.0 °C	Today's Min Temp	22.0 °C	Today's Max Temp	30.0 °C
Today's Min Temp	20.0 °C				

South Region	Real Time	August Max	2016 Max	PowerStream	Non-PowerStream
Aurora	90.5 MW	93.0 MW	94.8 MW	0.0 MW	90.5 MW
Markham	508.4 MW	508.4 MW	508.4 MW	407.8 MW	100.8 MW
Richmond Hill	276.6 MW	281.6 MW	296.1 MW	219.1 MW	57.0 MW
Vaughan	668.0 MW	671.8 MW	671.8 MW	568.0 MW	102.9 MW

North Region	Real Time	August Max	2016 Max	PowerStream	Non-PowerStream
Alliston	35.2 MW	37.0 MW	37.2 MW	0.0 MW	35.2 MW
Barrie	218.6 MW	225.2 MW	238.4 MW	0.0 MW	218.0 MW
Beeton	3.8 MW	4.3 MW	4.2 MW	3.8 MW	2.0 MW
Bradford	36.6 MW	38.6 MW	41.5 MW	0.0 MW	36.6 MW
Penetanguishene	15.9 MW	16.3 MW	22.1 MW	0.0 MW	15.9 MW
Thornton	1.6 MW	1.6 MW	1.6 MW	0.0 MW	1.6 MW
Tottenham	13.9 MW	14.6 MW	16.2 MW	10.8 MW	3.0 MW



Alert: Overall PowerStre...

File ExShortcut Adobe PDF

From: PI-Notifications
To: Vince Polsoni
Cc:
Sent: Wed 17/07/2013 4:01 PM
Subject: Alert: Overall PowerStream Demand Increase

Location: PowerStream
Time: 17/07/2013 16:00
Triggering Condition: Current Demand/Highest Recorded >= 100

Update:
Overall PowerStream demand has exceeded **100%** of Highest Recorded Demand.

Current Demand: **1985.349 MW**
Current Demand/Highest Recorded: **100.02 %**
Current Demand/Yearly Max: **100.02 %**

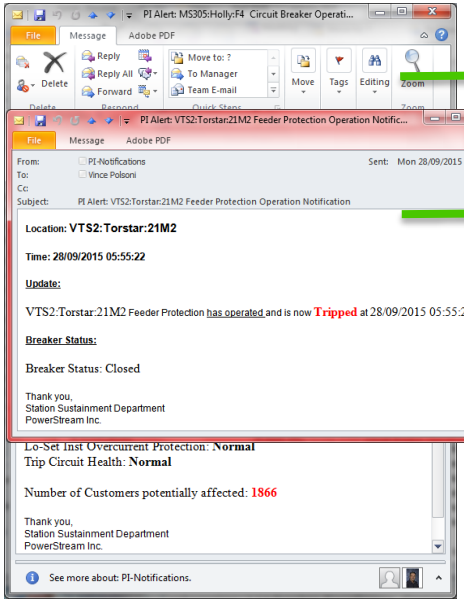
Highest Recorded Demand: **1987.244 MW**
Yearly Maximum Demand: **1987.244 MW**

Thank you,
Station Sustainment Department
PowerStream Inc.

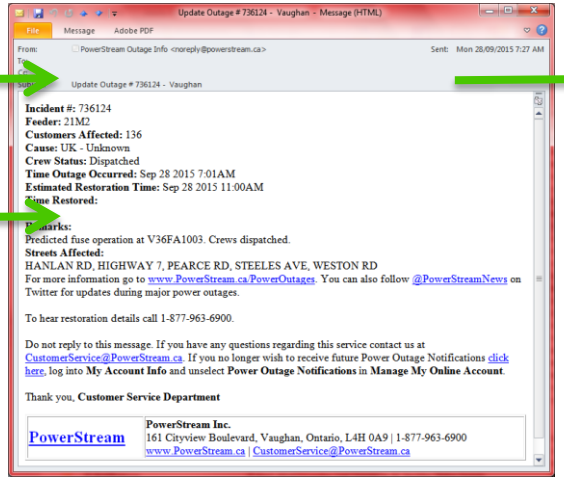
05/08/2016 2:37:43 PM — 7d — Now — 12/08/2016 2:37:43 PM

Outage Information Flow - PI System / OMS

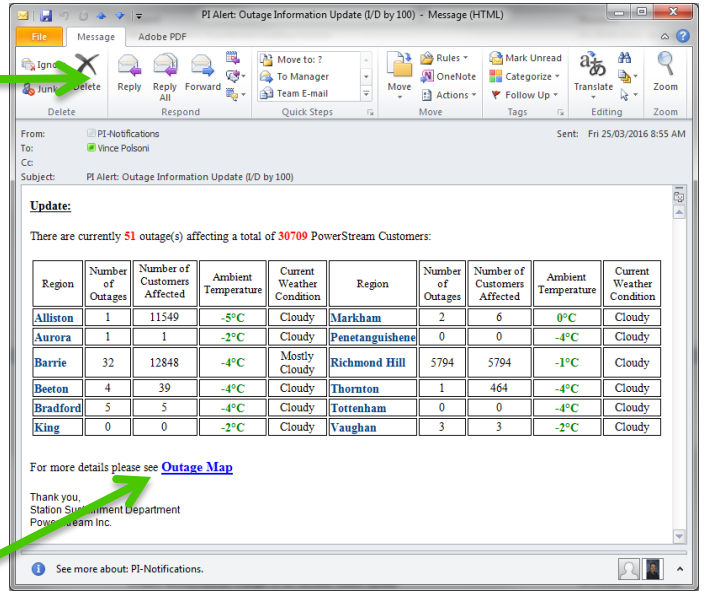
PI Notifications -
Feeder Protection Trip
& Circuit Breaker Operation



Outage Management System



PI Notifications
Outage Counts by Region



Region	Number of Outages	Number of Customers Affected	Ambient Temperature	Current Weather Condition	Region	Number of Outages	Number of Customers Affected	Ambient Temperature	Current Weather Condition
Alliston	1	11549	-5°C	Cloudy	Markham	2	6	0°C	Cloudy
Aurora	1	1	-2°C	Cloudy	Penetanguishene	0	0	-4°C	Cloudy
Barrie	32	12848	-4°C	Mostly Cloudy	Richmond Hill	5794	5794	-1°C	Cloudy
Beeton	4	39	-4°C	Cloudy	Thornton	1	464	-4°C	Cloudy
Bradford	5	5	-4°C	Cloudy	Tottenham	0	0	-4°C	Cloudy
King	0	0	-2°C	Cloudy	Vaughan	3	3	-2°C	Cloudy

Link to view PI Coresight Report

Current Outages By Region – Ice Storm March 24-25, 2016

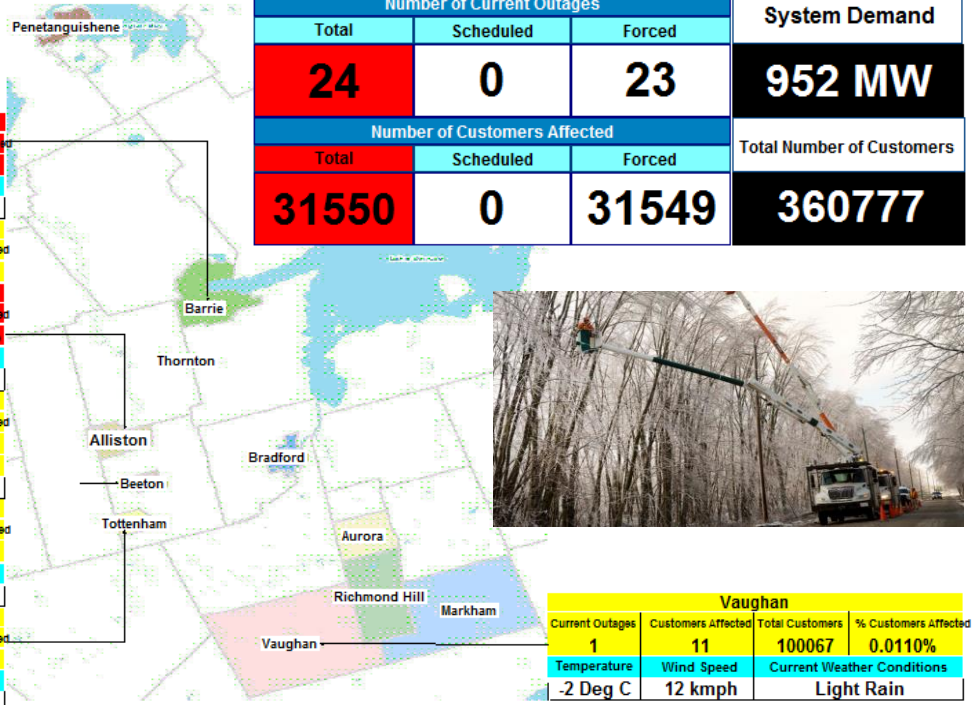
Current Outage Information

Number of Current Outages		
Total	Scheduled	Forced
24	0	23

System Demand
952 MW

Number of Customers Affected		
Total	Scheduled	Forced
31550	0	31549

Total Number of Customers
360777



Barrie

Current Outages	Customers Affected	Total Customers	% Customers Affected
13	23546	53652	43.8865%
Temperature	Wind Speed	Current Weather Conditions	
-2 Deg C	8 kmph	Snow	

Thornton

Current Outages	Customers Affected	Total Customers	% Customers Affected
2	2	464	0.4310%

Alliston

Current Outages	Customers Affected	Total Customers	% Customers Affected
4	7952	7722	102.9785%
Temperature	Wind Speed	Current Weather Conditions	
-2 Deg C	3 kmph	Snow	

Bradford

Current Outages	Customers Affected	Total Customers	% Customers Affected
1	1	9304	0.0079%
Temperature	Wind Speed	Current Weather Conditions	
-2 Deg C	8 kmph	Light Rain	

Beeton

Current Outages	Customers Affected	Total Customers	% Customers Affected
2	37	1521	2.4326%
Temperature	Wind Speed	Current Weather Conditions	
-1 Deg C	5 kmph	Light Rain	

Tottenham

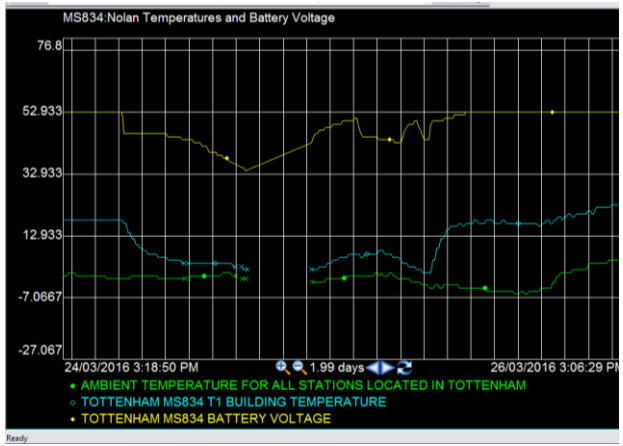
Current Outages	Customers Affected	Total Customers	% Customers Affected
1	1	2371	0.0422%
Temperature	Wind Speed	Current Weather Conditions	
-1 Deg C	5 kmph	Light Rain	

Vaughan

Current Outages	Customers Affected	Total Customers	% Customers Affected
1	11	100067	0.0110%
Temperature	Wind Speed	Current Weather Conditions	
-2 Deg C	12 kmph	Light Rain	

Ice Storm March 24, 2016 – PI System Benefits

- Up to 50,000 customers affected
- Used **PI System Reports** and **PI Notifications** to monitor system and station equipment
  - Number of outages and Customers affected by Region
  - Breaker Operations
  - Transformer de-energization/energization
  - Protection “trips”
  - Battery charger status and battery voltages



Alectra East Service Territory Weather Report

NEW!

PI Coresight | Weather_Map_V4 | Ad Hoc Display | Vince Polsoni

Powerstream Service Territory Current Weather

Current System Demand	Max Demand Forecast
1131 MW	1222 MW

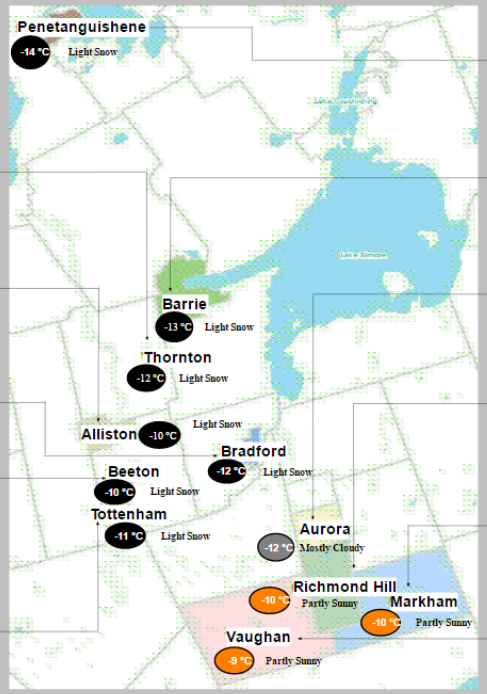
THORNTON -12 °C Max: -7 °C Min: -12.48 °C Light Snow Wind: NNW 16 kmph

ALLISTON -10 °C Max: -6 °C Min: -13 °C Light Snow Wind: NNW 8 kmph

BRADFORD -12 °C Max: -7 °C Min:11.6833 °C Light Snow Wind: NNW 19 kmph

BEETON -10 °C Max: -7 °C Min: -11 °C Light Snow Wind: WSW 12 kmph

TOTTENHAM -11 °C Max: -7 °C Min: -11 °C Light Snow Wind: WSW 12 kmph



PENETANGUISHENE -14 °C Max: -6 °C Min:-13.6417 °C Light Snow Wind: NW 11 kmph

BARRIE -13 °C Max: -8 °C Min:-12.6228 °C Light Snow Wind: NW 9 kmph

AURORA -12 °C Max: -6 °C Min:-11.4489 °C Mostly Cloudy Wind: NNW 17 kmph

RICHMOND HILL -10 °C Max: -6 °C Min: -10 °C Partly Sunny Wind: NNW 17 kmph

MARKHAM -10 °C Max: -6 °C Min: -10 °C Partly Sunny Wind: NNW 20 kmph

VAUGHAN -9 °C Max: -6 °C Min:-10.8683 °C Partly Sunny Wind: NNW 18 kmph

2/16/2017 2:14:11 AM | 8h | Now | 2/16/2017 10:14:11 AM

Feeder Outage Performance Notification

PI Alert: An update on BARRIE M5 BREAKER Performance - Message (HTML)

File Message Tell me what you want to do...

PI-Notifications | Vince Polsoni Thu 02/03

PI Alert: An update on BARRIE M5 BREAKER Performance

Update:

One or more thresholds have been exceeded by **BARRIE M5 BREAKER** at 3/2/2017 4:30:25 PM Eastern Standard Time (GMT-05:00:00):

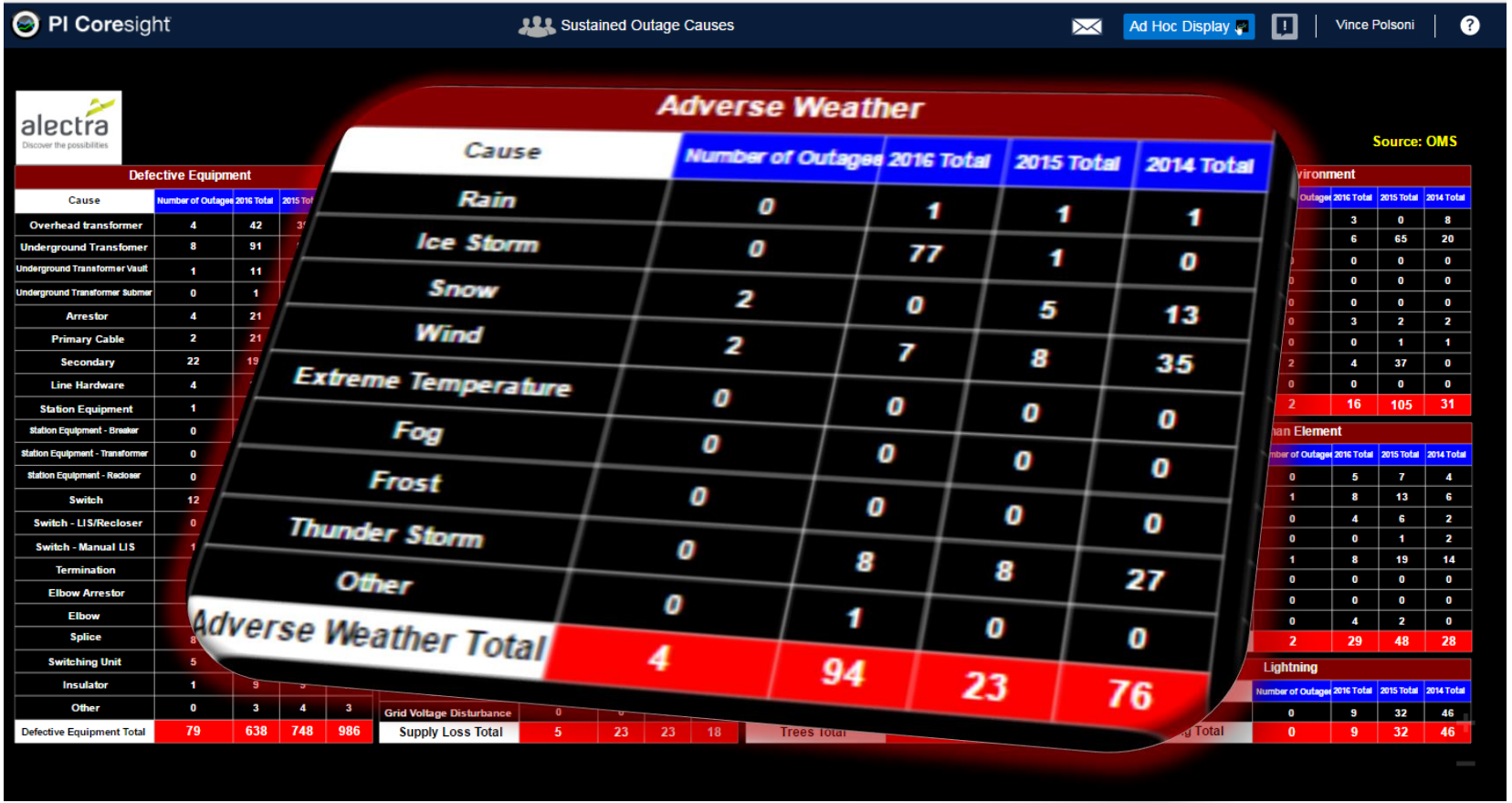
	Number of Incidents	Threshold
Last 30 Days	3	3
Last 60 Days	3	4
Last 90 Days	2	5
YTD	2	N/A

Number of Customers fed by this Feeder is **1354**

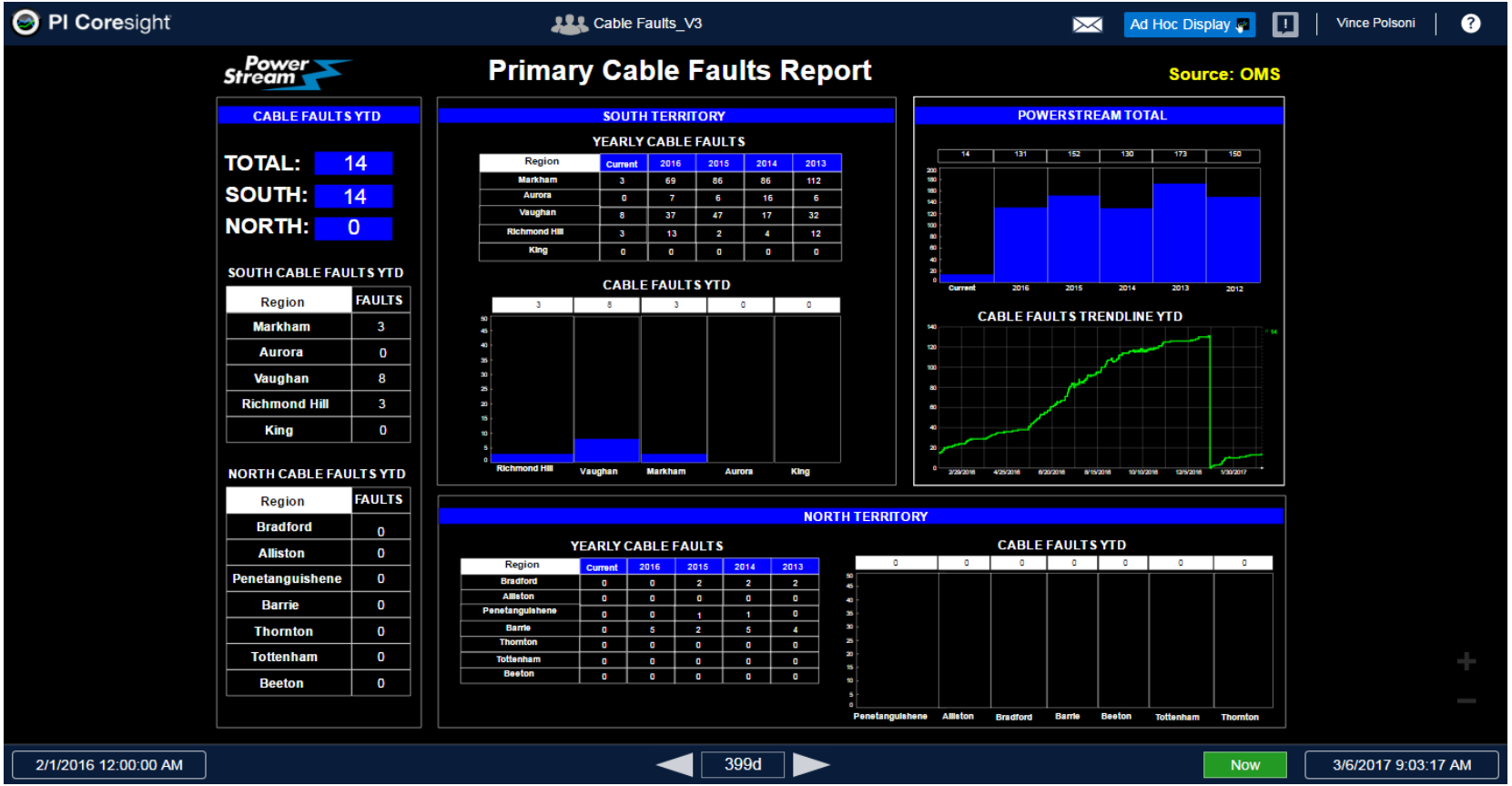
For more information please see Hydro One TS Feeders Operations on DPDs

Thank you,
Station Sustainment Department
Alectra Utilities

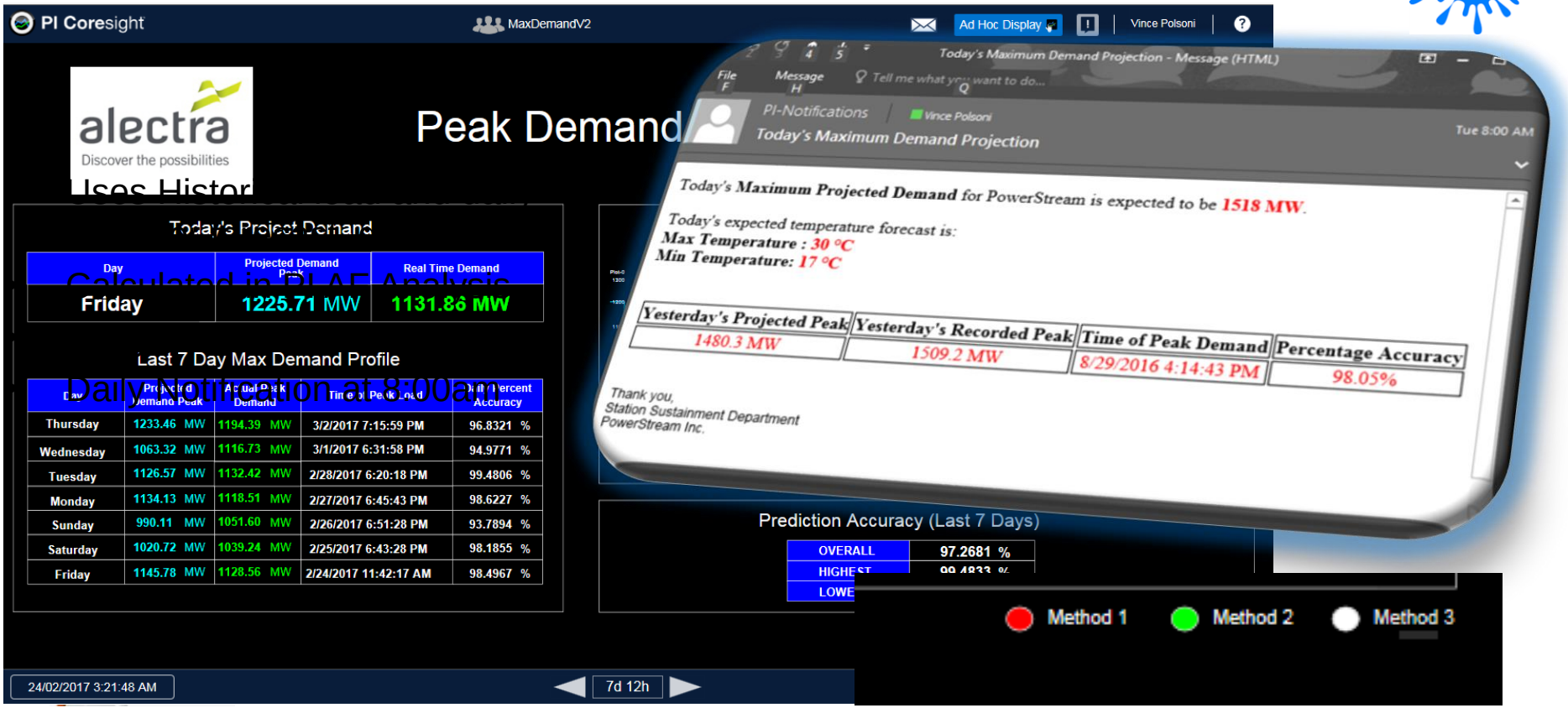
Sustained Outages By Cause Code - YTD and Historical



Primary Cable Fault Report



Daily Peak Projection Report

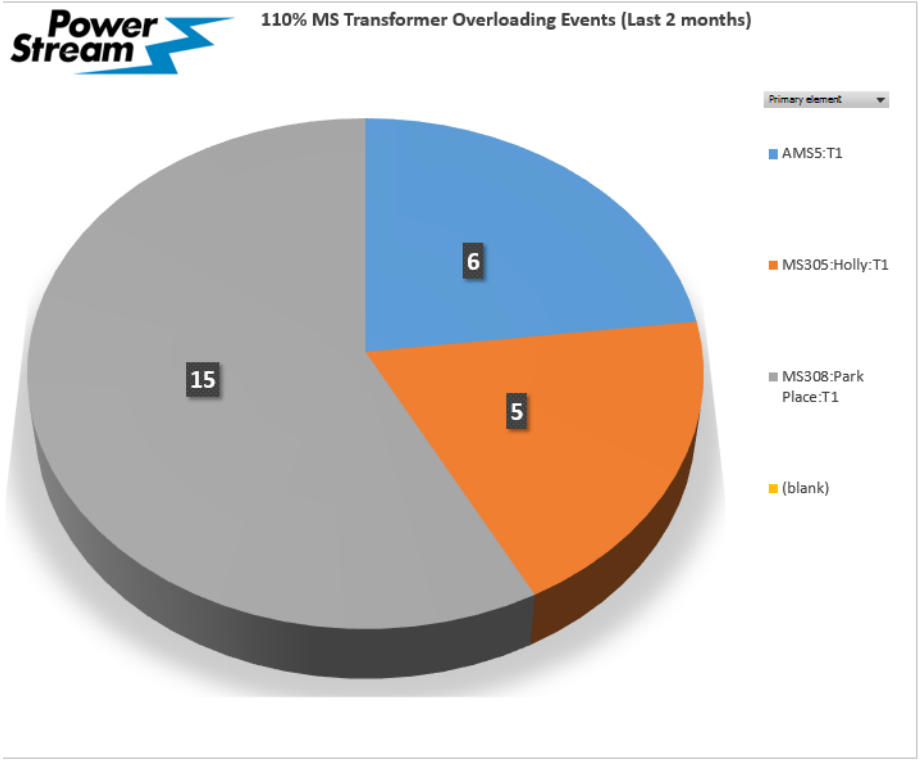


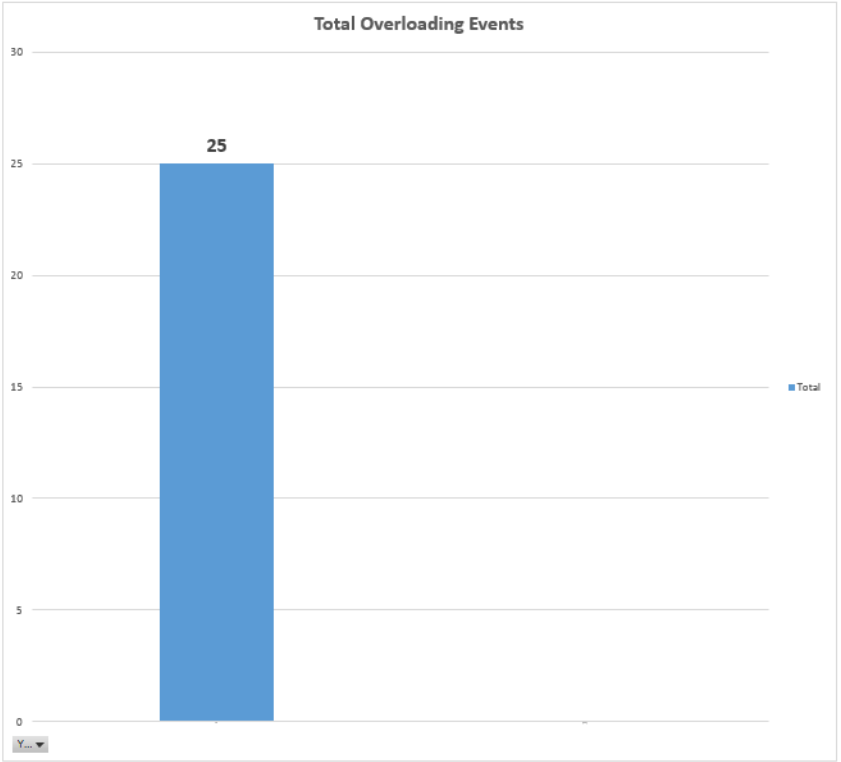
SubStation Maintenance Program Performance

Exploring Event Frames – Alectra

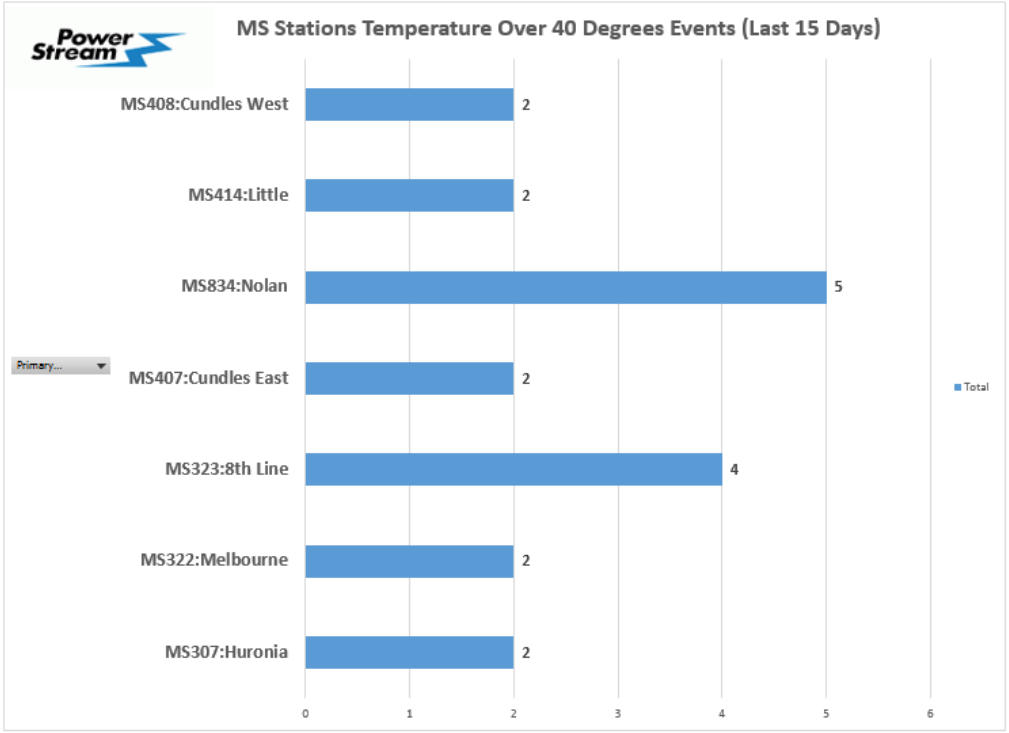
- Exploring Event Frames
  - Utilizing PI DataLink 2016
- Utilizing templates in PI AF
- Auto updating of Event Frame reports/charts for Dashboard’s

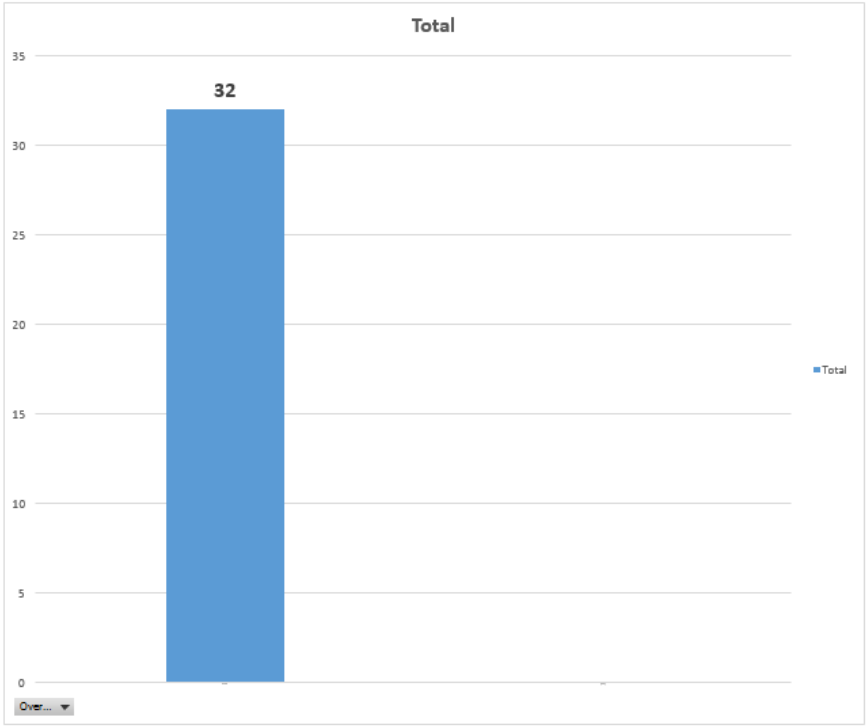
Substation Transformer 110% Overloading Events





Substation Building Temperatures Over 40°C Events



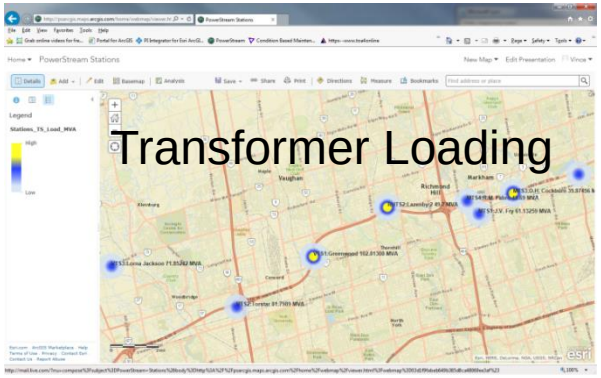


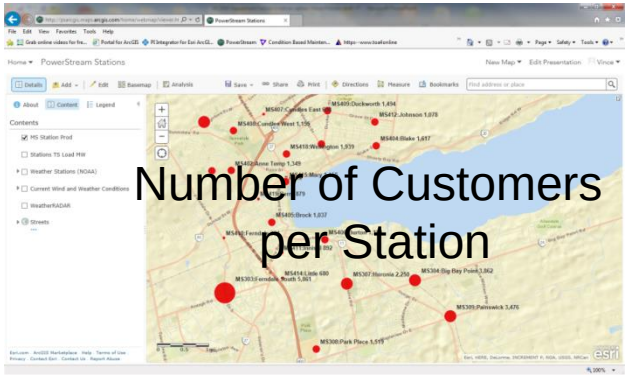
PI Integrator for ESRI ArcGIS

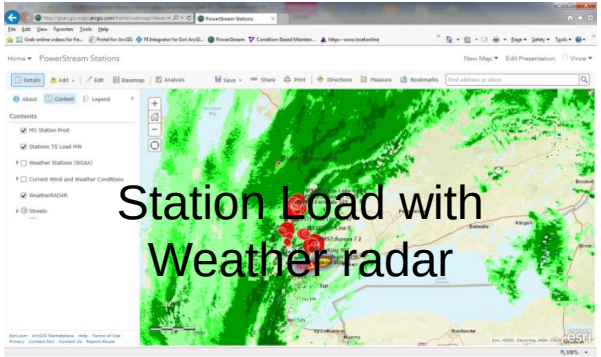
- Production – Dec 2016
  - Successful Pilot Project in 2016
  - Used to demonstrate capabilities of leveraging PI System and GIS system (ESRI)

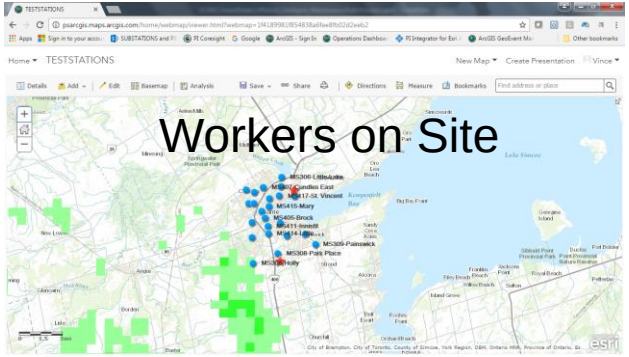
- Overall very satisfied, lots of potential
  - PI Integrator for ESRI ArcGIS easy tool to learn
  - Fast learning curve with excellent support by both OSIsoft and ESRI

PI System-ESRI Reports – A multitude of Reports







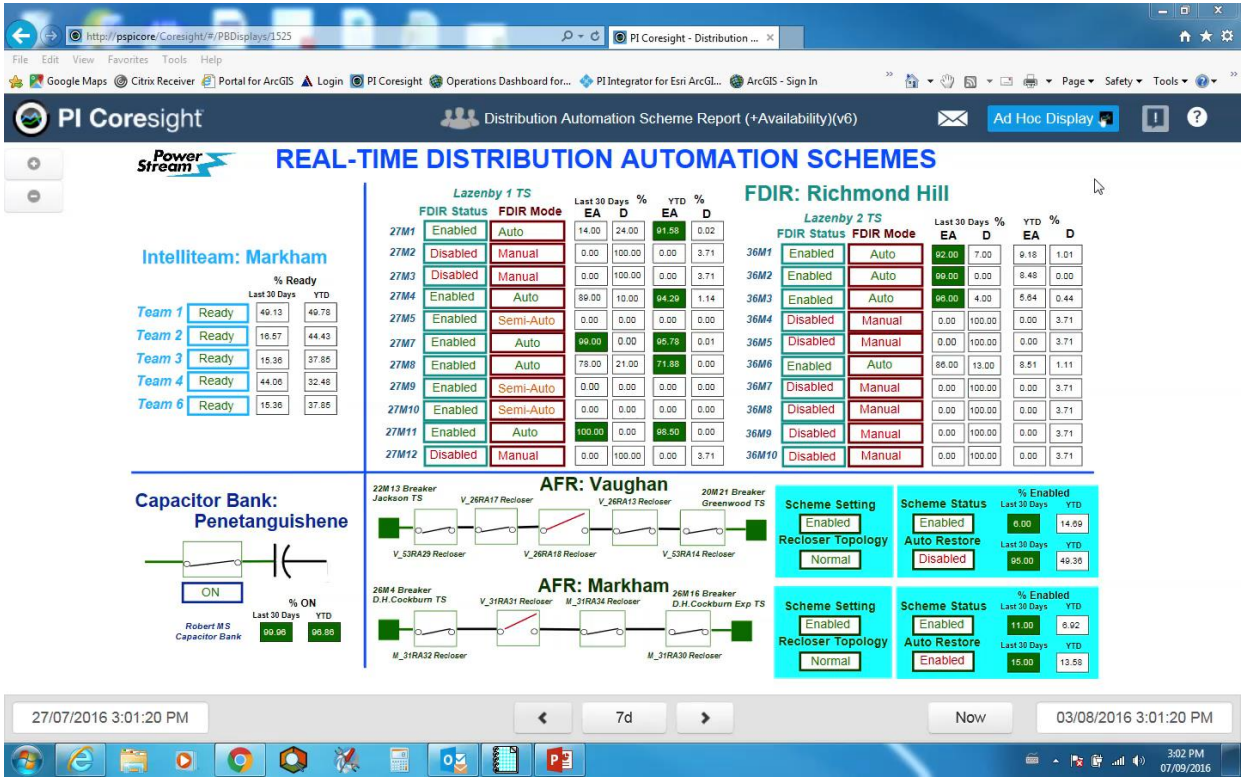


- ArcGIS Online
- ArcGIS Portal

- Users of ESRI reports:
  - System Planning
  - Engineering
  - Operations

- Other reports:
  - **Outages with Weather Radar and Wind**
  - **Transformer Health**
  - **High Water Alarms**
  - **Number of Circuit Breaker Operations in Last 30 days**

Distribution Automation Schemes Performance Report



NEW!

Increased Visibility - Maintenance Programs

- Dramatic Increase in Visibility and Awareness of Asset Condition and Program Performance
- Equipment Reliability (Availability/Uptime)
- Decrease Emergency Maintenance Tasks
- Increase Corrective Maintenance Tasks
- Decrease in Preventive / Predictive Maintenance Tasks
- Detective Maintenance
- Easy Reporting

$avings - Intelligent Maintenance - PI System

- Big Savings
- Failure Avoidance Costs – RCM – CBM
  - 2 Notable Catastrophic Transformer Failure Avoidances
    - $2 Million avoided Costs
- Many Reliability Improvements through CBM Identified Potential Failures
  - No missed failures no matter how small
- Better View of System Asset Condition (Health and Risk)

Benefits of PI System

- Easy to turn Real-time Data into Information
  - Stores Key Information for Asset Management Decision Making
- Enabler of Risk based Condition Based Maintenance
- Maintenance Optimizer
- Innovation stimulant
- Easy to learn
    - OSIsoft YouTube, Manuals, Support, Training

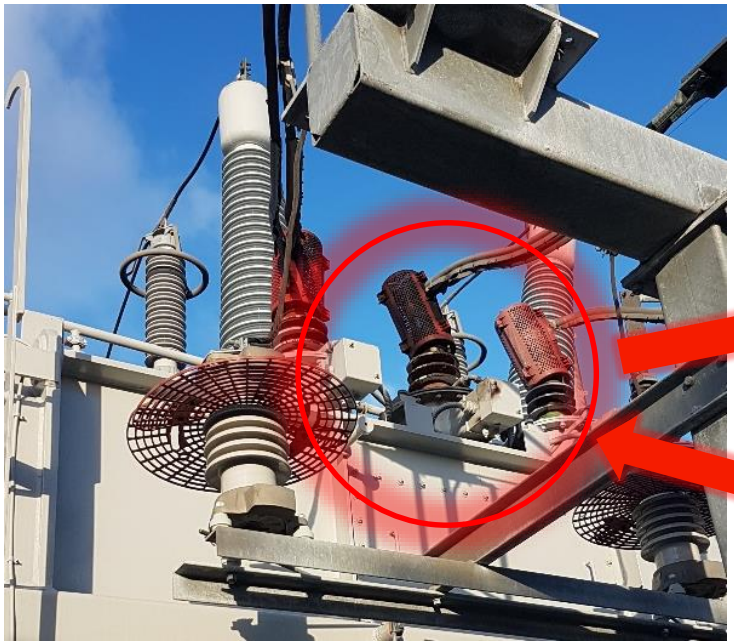
Expanding the Use of PI System at Alectra

- Recent Merger (PI System expansion)
  - Corporate and Operations Dashboards
- Work Force Performance / Failure Reporting
- Failure Cost Avoidance
- PI Integrator for ESRI ArcGIS
- Event Frames
- Asset Analytics (AF)
- Transition from PI ProcessBook to PI Coresight

Importance of Intelligence Maintenance

What do you think was the cause of the outage?

Not all Equipment Failures are Avoidable Even With Intelligent Maintenance…



Secondary bushing flashover

OSIsoft PI System: Intelligent Maintenance

COMPANY and GOAL

Alectra Utilities Inc. is a progressive distribution utility company that focuses on Innovation and Technology to achieve operational efficiencies that contribute to **maintenance optimization and reduction of equipment failures**.

alectra
Discover the possibilities

CHALLENGE

Implement an Intelligent Maintenance System that increases asset availability, improves reliability and provides Operations information to those who do not have access.

SOLUTION

Used the PI System as a means of enabling corporate system to enable Condition Based maintenance and publish Operational data via PI System Dashboards.

- Implemented PI System and built PI System Reports
- Integrated to CMMS system to enable True Condition Based Maintenance
- Developed PI Dashboards utilizing PI Coresight to for specific audiences.

RESULTS

System and equipment condition awareness across company. Improved Equipment availability and provided true status on maintenance program performance.

- Improved System Reliability
- Improved Response Time to Equipment Abnormalities
- Increased Equipment Availability
- Savings in OPEX Costs

Contact Information

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Alectra Utilities Inc.

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Questions

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

State your **name & company**

Please remember to…

Complete the Online Survey for this session

http://bit.ly/uc2017-app

감사합니다

谢谢

Danke

Merci

Gracias

Thank You

ありがとう

Спасибо

Obrigado

End of Presentation

Increased Visibility - Maintenance Programs

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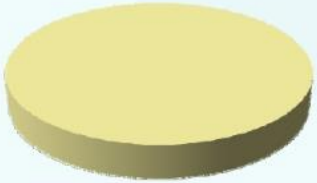
The Alectra Intelligent Maintenance Plan

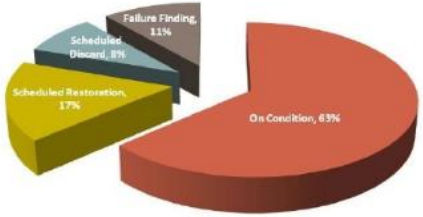
The Plan

Original Maintenance Program



100% of the work (PM) is time based

(Reliability Centered Maintenance)
RCM2



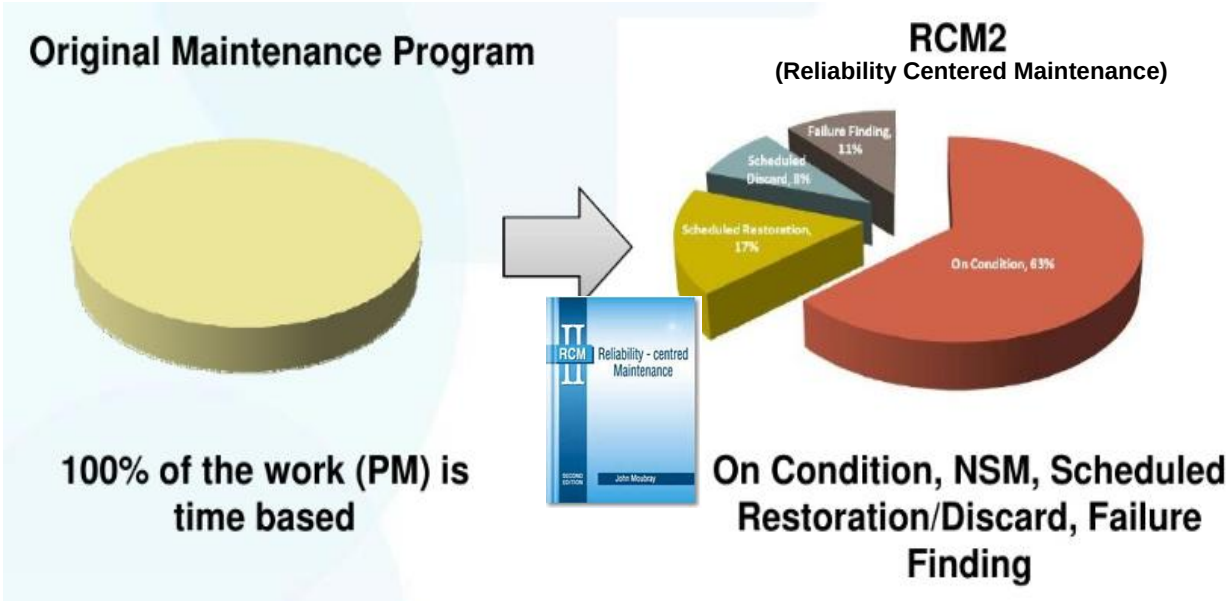
On Condition, NSM, Scheduled Restoration/Discard, Failure Finding

The Execution

- **Training RCM** methodology and **Conduct RCM analysis**
- Leverage **PI System, CMMS and Equipment Monitoring**
  - **Integrate** Systems
  - Install sensors and collect meaningful data
  - Leverage **Real-time Condition data** to drive maintenance tasks
  - **Prioritize** and **Optimize** maintenance tasks

The Alectra Intelligent Maintenance Plan

The Plan



Sensors - Equipment Monitoring – Key building block for successful Intelligent Maintenance (CBM)

Electric Utility Sensors

- Microprocessor Relays
- Online Transformer Oil Monitoring Units
  - (7 Gas) DGA monitors and Hydrogen
- Online Bushing Monitoring Systems
- Tap Changer Filtration Systems,
- Maintenance Free Dehydrating Breathers
- Station Equipment and Building Temperature Sensors

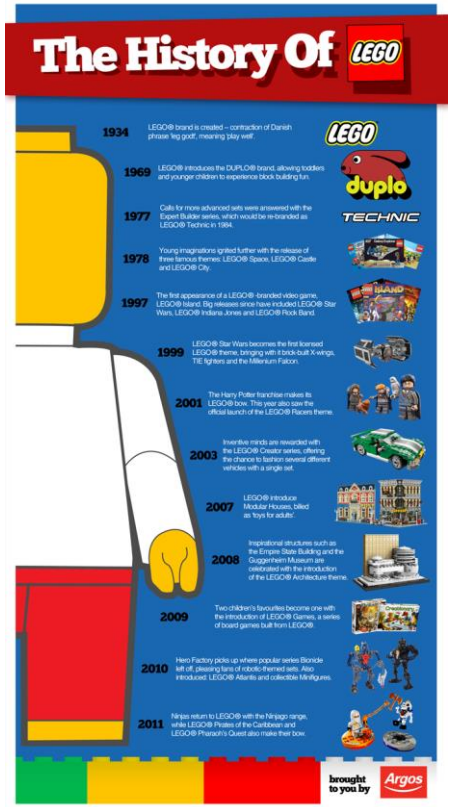
Event Frames - Examples

- 230 kV Switch Open Close duration and Number of times
- Station Uptime % (Monthly-KPI)
- Transformer Fleet Uptime % (Monthly-KPI)
- DC System Voltage below 45 VDC duration
- DC System Voltage below 90 VDC duration
- Sump Pump High Water Alarms YTD
- Station Temp < 5 degrees
- Station Temp > 40 degrees
- Station Temp <0 degrees
- Outages by region number and duration
- Station Feeder Protection Trip (number)

ESRI maps Examples

- Station Loading
- Station Customers
- Station Overall Health
- Station-Person On-site
- Station Deficiencies count
- Station Open Work Orders (WIP)
- Station Maintenance backlog
- Station Planned Work
- Station Equipment Failures
- Station Storm Damage

OSIsoft - PI System - Versatile like LEGO and been around a while…

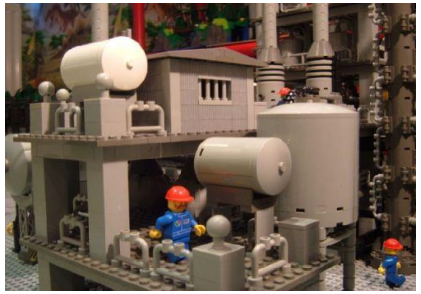


- World Wide user base
- Worldwide support 24/7
- Multiple languages

- Stores “mountains” of data
- Used as building blocks
- Build amazing innovative products
- Innovative stimulant for creative minds

Digital Transformation - Industries using IIOT with PI System (Lego Style)

Oil & Gas

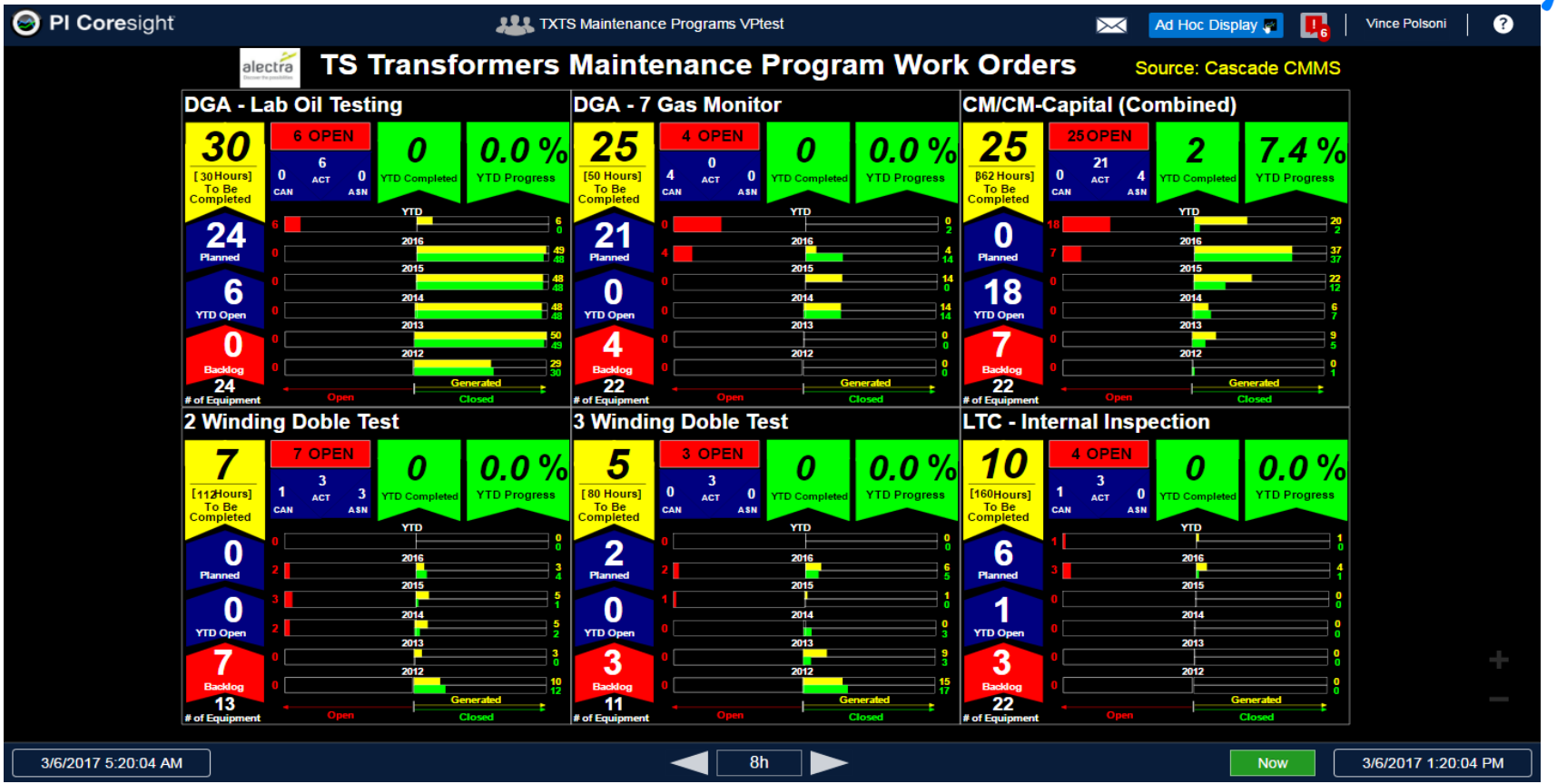


Pharma

- Asset Management
- Operations

- Production/Uptime
- Safety / Environment

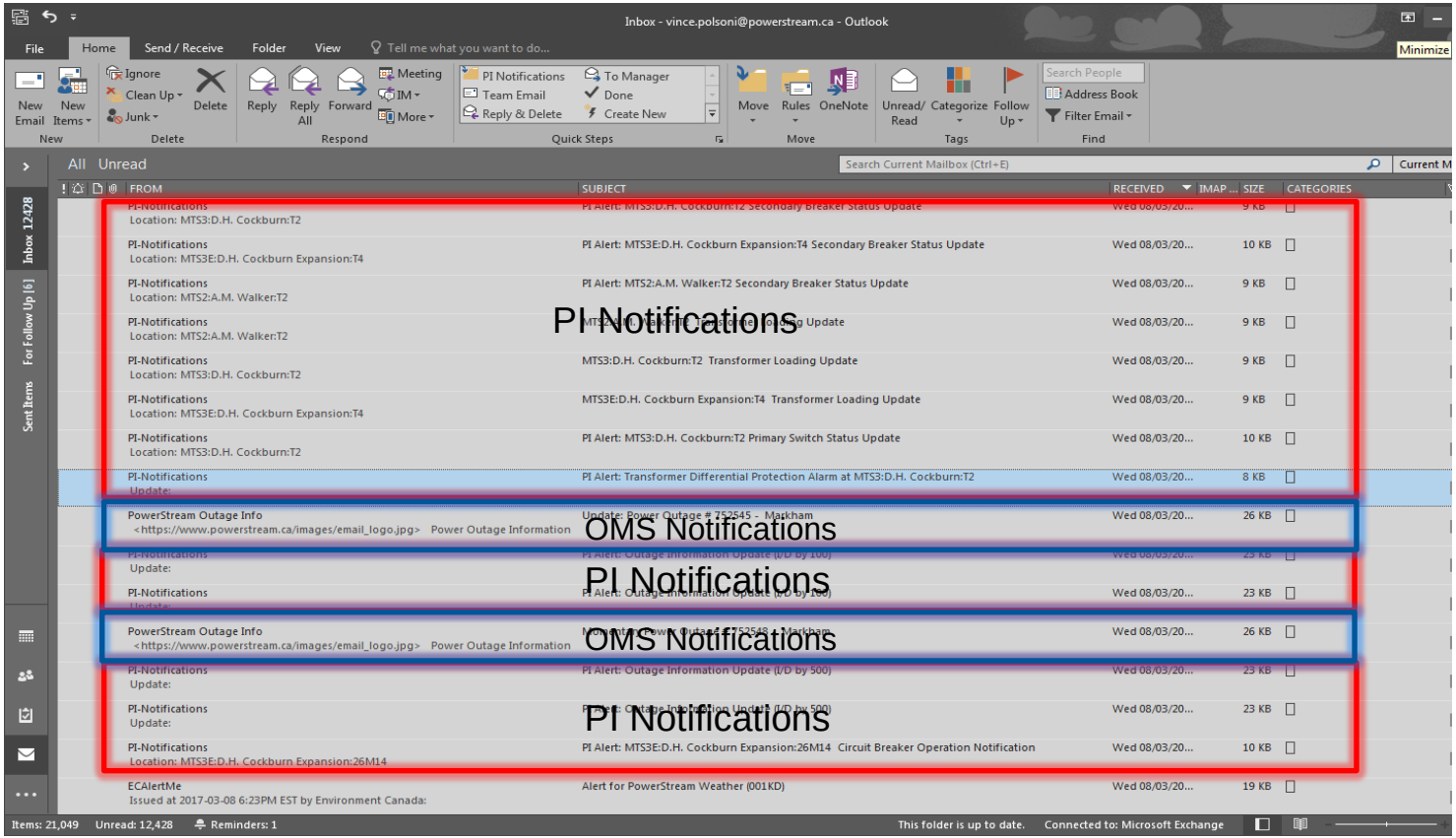
TS Transformer Maintenance Program Performance



Circuit Breaker Maintenance Program Performance

PI Notifications and OMS Notifications – Transformer Differential

Sequence of Events



Leveraging PI System for Risk Based Condition Based Maintenance

Integration	• Automatically Generate maintenance task in CMMS system from PI Data • Data from CMMS and OMS into PI System
Real-time Alerting	• Notifications and Alerts (Real-time) • Provide meaningful information to key Operations Staff
Asset Condition & Analytics	• Instant Asset Condition Assessment, Criticality, Health, Risk and Priority (in PI System and CMMS)
User Friendly Simple Tools	• PI Coresight / PI ProcessBook and PI DataLink • PI Asset Framework (AF) and Templates • Interfaces, Use various display tools