

The Path to Intelligent Maintenance with the PI System

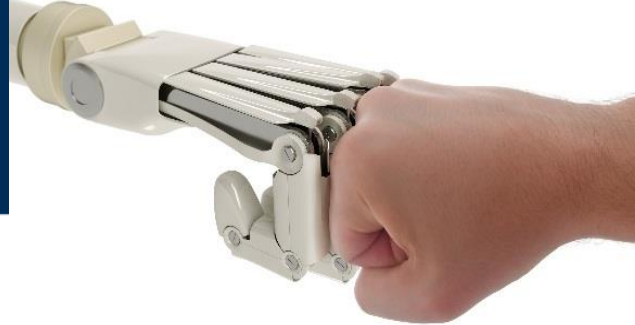
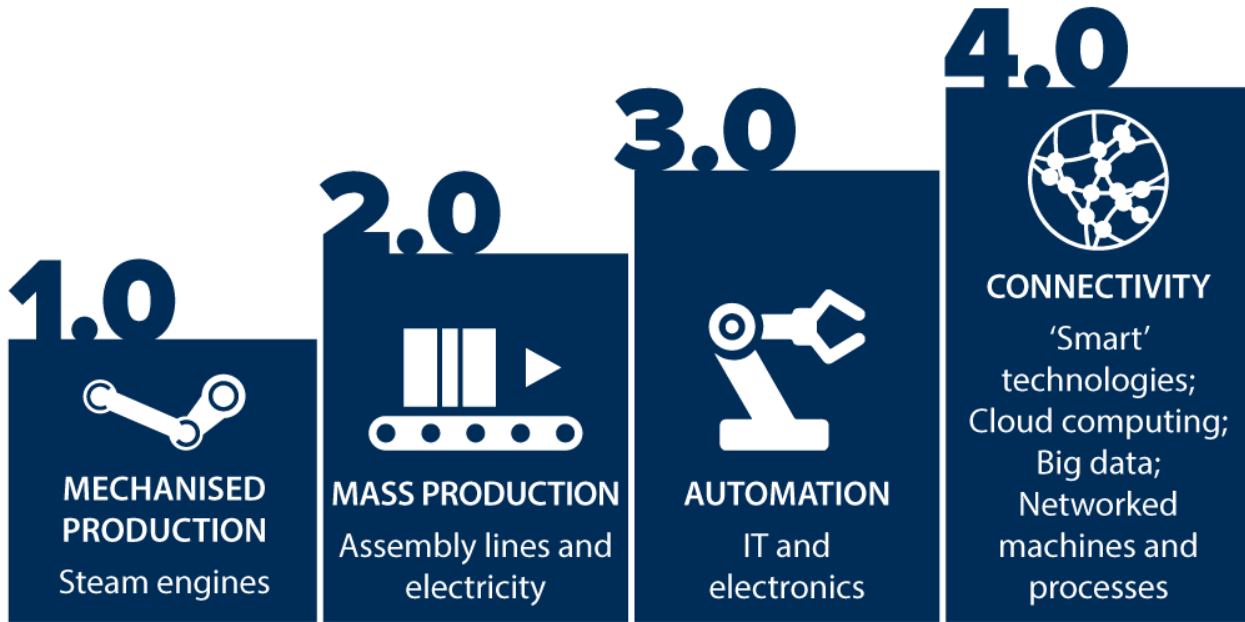
Embracing Digital Transformation



Presented by **Vince Polsoni, Alectra Utilities**



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



Where are we?



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



Ontario
1,068,587 km²



Alectra Service Territory

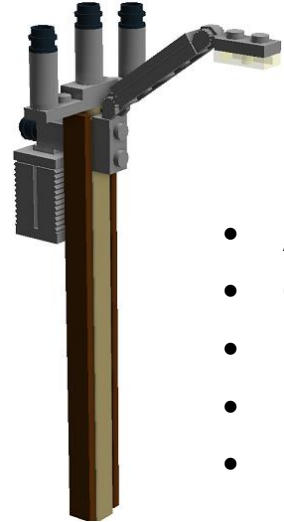
- Located just North and West of Toronto, Ontario, Canada
- 1800 km²
- 15 Communities
- 1 million Customers
- 3.1 million Population
- 4750 MW Peak Demand
- \$3.56 Billion Total Assets



Masters at IIOT - Generation / T&D



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

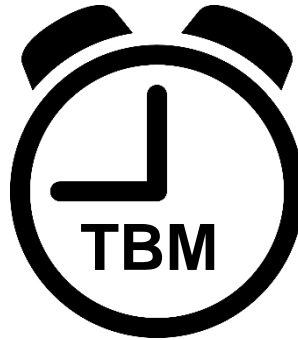


Station Assets – “Transforming our World”



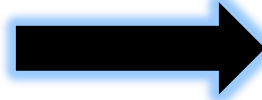
The Alectra Intelligent Maintenance Plan

The Plan



100% of work (PM)
is time based

RCM2
(Reliability Centered Maintenance)



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

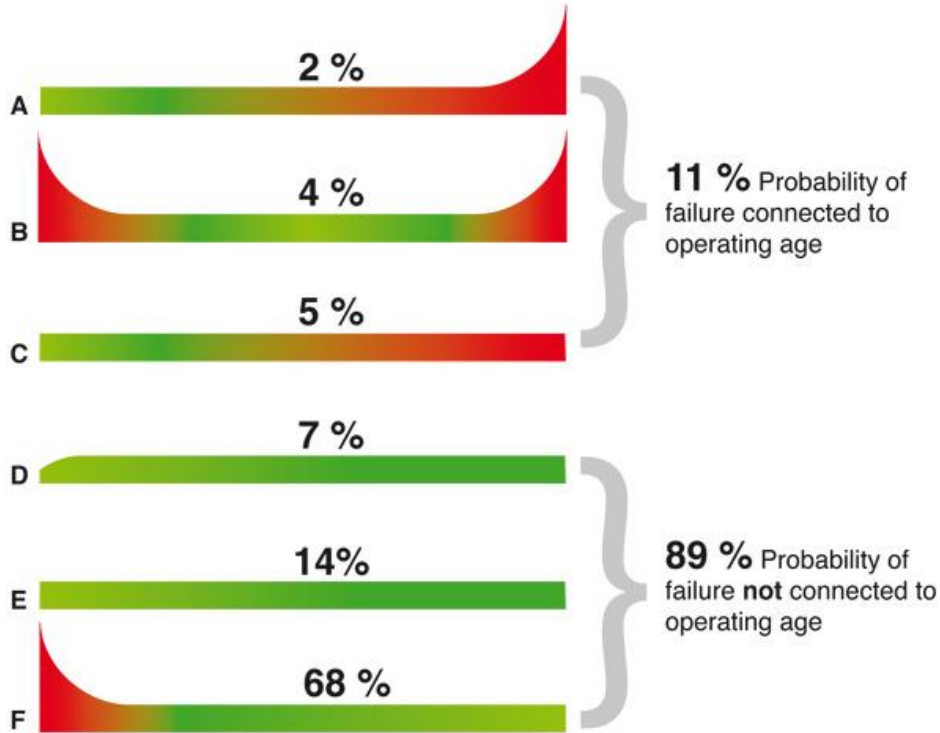
Intelligent Station Maintenance at Alectra

- 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

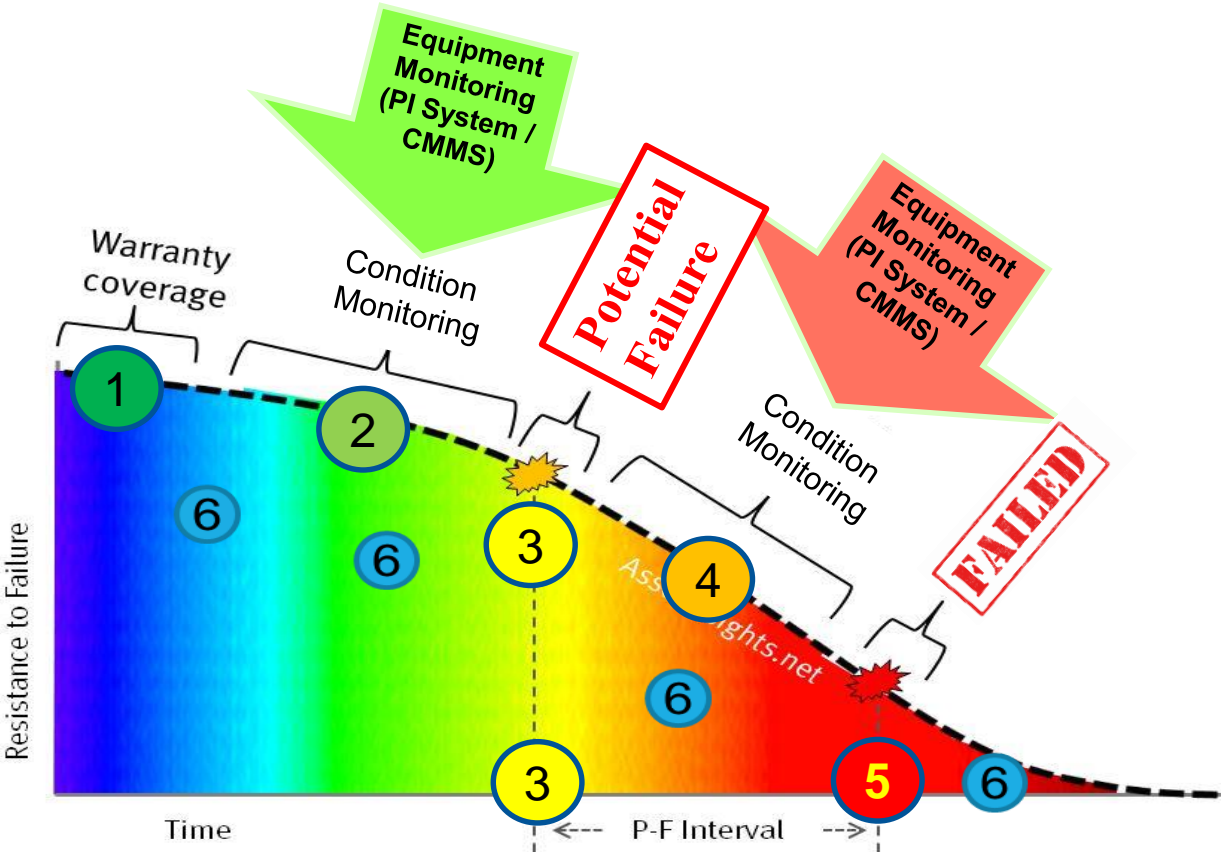
- Premature random failures
- Often after Human Intervention

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



30,000 tags
(and growing)





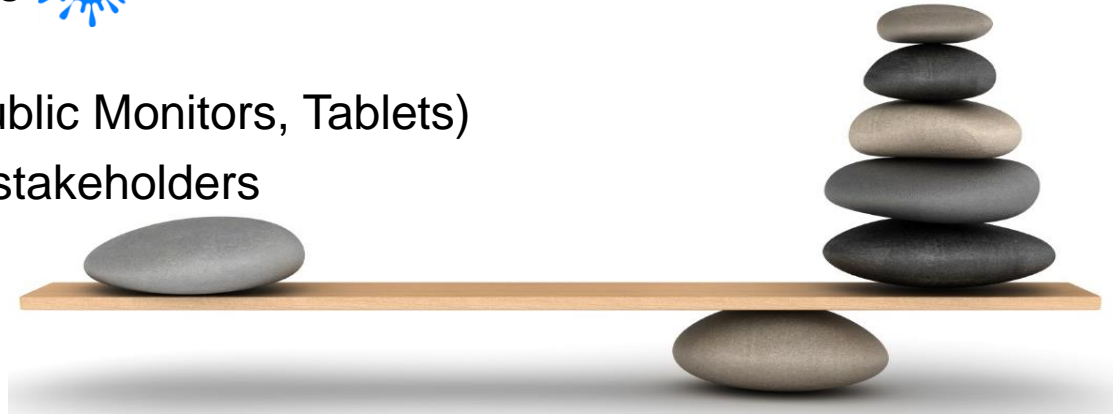
- **High Availability “HA”**
- **PI Server 2016 R2 (x2)**
- **PI AF Server 2016 R2 (x2)**
- **PI AF Analytics 2016 R2**
- **PI Coresight 2016 R2**
- **PI DataLink 2016**
- **PI WebParts 2016**
- **PI Notifications 2016 R2**
- **PI System Management Tools 2016 R2**
- **PI System Explorer 2016 R2**
- **PI 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**



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 
- PI Asset Framework, Performance Equations and Asset Analytics
- Future Data and Forecasting 
- 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

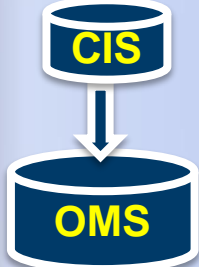
Station Equipment Sensors
Analog & Status Data



PI Reports
Dashboards
(*Real-time*)

Reads
Patrol

Customer Info System



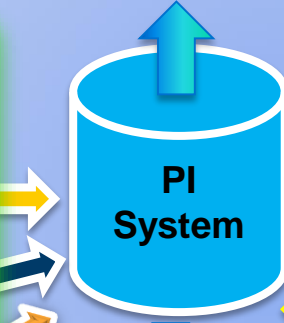
Outage Mgmt System



Internet



Firewall



PI Notifications
(*Real-time*)



Firewall

Algorithm Rules Engine



PI AF Table Query



CMMS Alerts
(delayed)

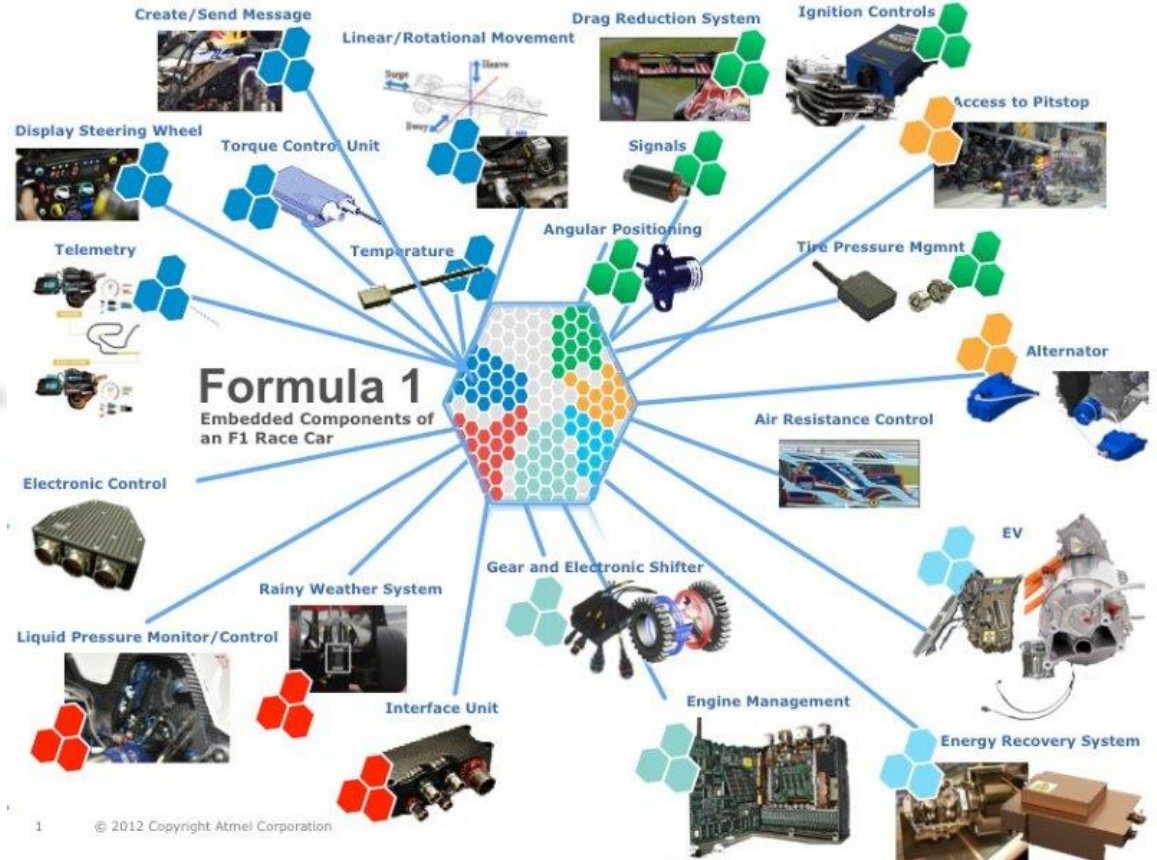


CMMS
WorkOrder

Embedded Sensors of an F1 Race Car – Optimization



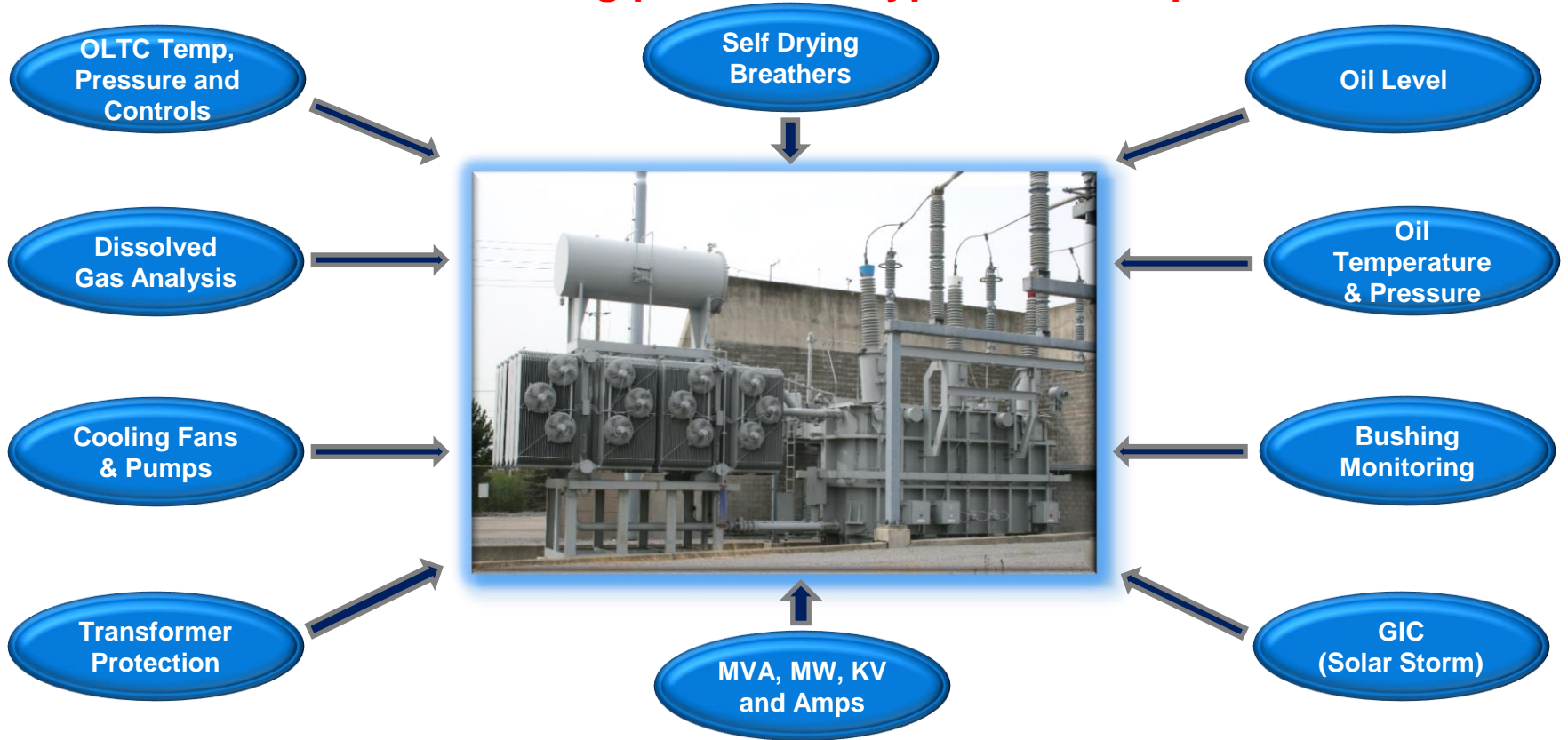
HMI



1 © 2012 Copyright Atmel Corporation

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

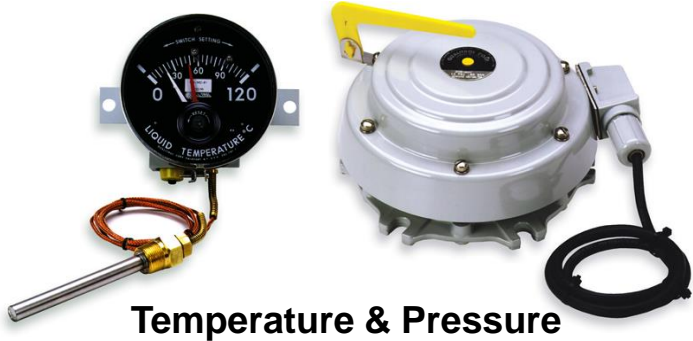
Bushing Monitoring Systems

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

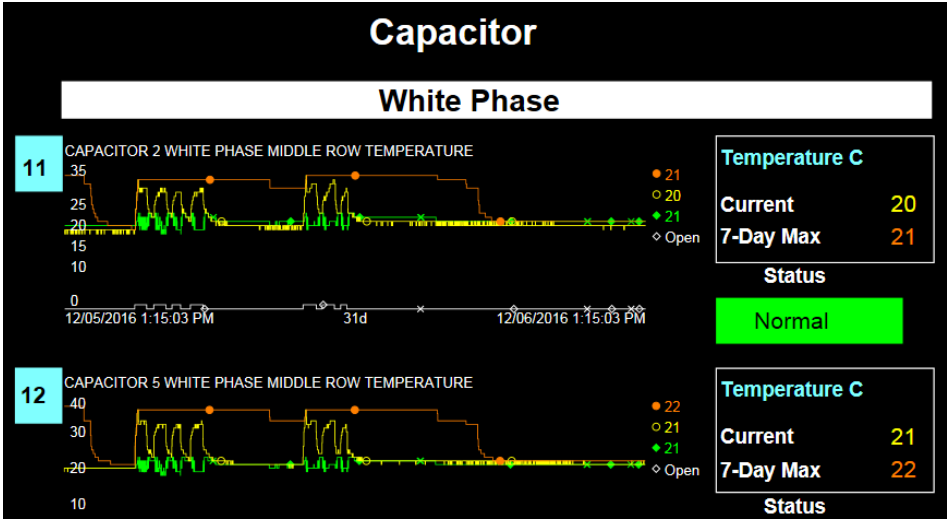
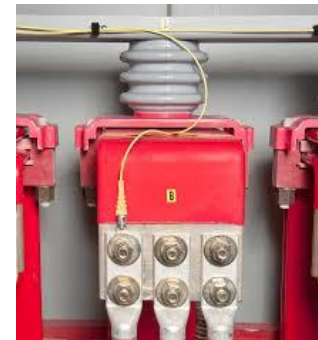
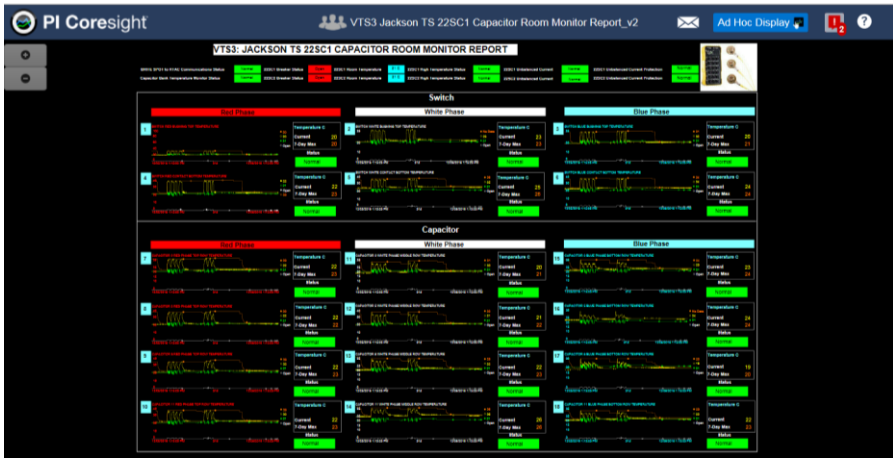


Transformer Monitoring Relay



Hydrogen Gas Monitor

Temperature Sensor Monitoring



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

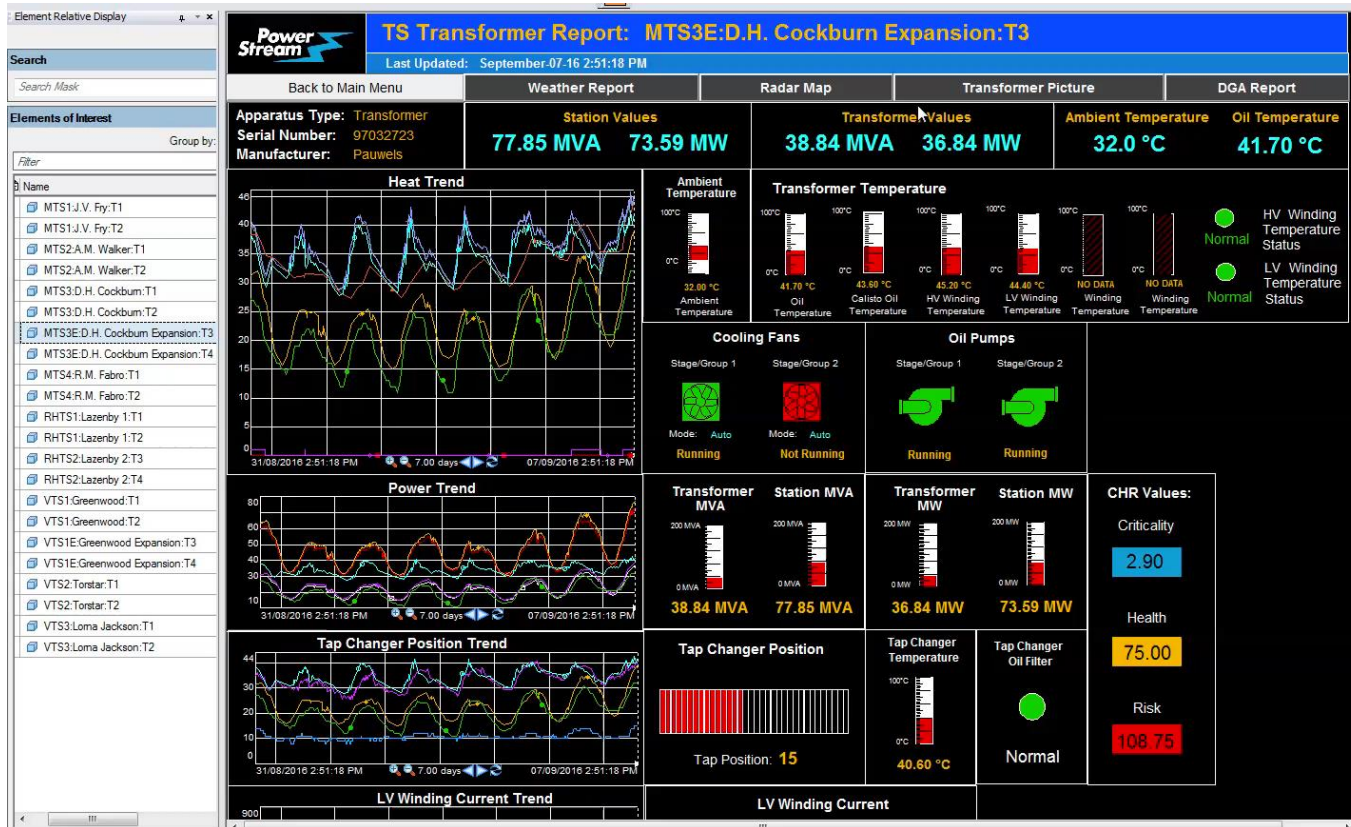
Integrated Products



Integrated Expert Systems – Transforming our World



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



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

VT33:Lorna Jackson	T1	LTC	1		5/6/2016 12:00:00 AM	1	5/6/2016 12:00:00 AM
		TRN	1	1	6/29/2016 3:05:00 PM	1	7/8/2015 12:00:00 AM
	T2	LTC	1		5/6/2016 12:00:00 AM	1	5/6/2016 12:00:00 AM
		TRN	1	1	6/29/2016 3:06:00 PM	1	7/8/2015 12:00:00 AM
VT34	T1	LTC	2		5/6/2016 12:00:00 AM	1	5/6/2016 12:00:00 AM
	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

PI Coresight North MS Transformer CHR_v2 Ad Hoc Display Vince Polsoni

alectra Discover the possibilities

North MS Transformer CHR

All North MS Transformers

Barrie	TX #	Criticality	Health	YTD Average	Risk	YTD Average	No. of Open Work Orders							
MS301: Anne North	TI													
MS302: Saunders	TI													
MS303: Ferndale South	TI	1.35	117.50	111.80	158.63	150.94	2							
MS304: Big Bay Point	TI													
MS305: Holly	TI	1.00	28.95	28.85	28.95	28.85	1							
MS306: Little Lake	TI													
MS307: Huronia	TI	1.00	48.95	48.85	48.95	48.85	2							
MS308: Park Place	TI													
MS309: Painswick	TI	1.00	48.95	48.85	48.95	48.85	2							
MS402: Anne Temp	TI													
MS404: Blake	TI	1.25	42.35	41.92	52.94	52.40	1							
MS405: Brock	TI													
MS406: Burton	TI	1.00	77.50	77.50	77.50	77.50	0							
MS407: Cundles East	TI	100.00 %	100.00 %	100.00 %	10 MVA	1.71 MW	1.44 MW	1.47 MW	0.50	110.00	109.07	55.00	54.54	4
MS408: Cundles West	TI	100.00 %	100.00 %	100.00 %	10 MVA	2.78 MW	2.14 MW	2.04 MW	1.00	101.70	58.85	58.95	58.85	1
MS409: Duckworth	TI	100.00 %	100.00 %	100.00 %	5 MVA	2.38 MW	2.19 MW	2.23 MW	1.00	101.70	101.24	101.70	101.24	4
MS410: Ferndale	TI	100.00 %	100.00 %	100.00 %	5/6.6 MVA	1.75 MW	1.46 MW	1.49 MW	0.50	52.50	52.50	26.25	26.25	2
MS411: Innisfil	TI	100.00 %	100.00 %	100.00 %	5 MVA	1.85 MW	1.69 MW	1.73 MW	0.50	22.50	22.50	11.25	11.25	0
MS412: Johnson	TI	100.00 %	100.00 %	100.00 %	5 MVA	1.24 MW	1.32 MW	1.37 MW	1.00	61.70	61.24	61.70	61.24	3
MS413: Letitia	TI	100.00 %	100.00 %	100.00 %	10 MVA	3.02 MW	2.66 MW	2.44 MW	1.00	81.70	81.45	81.70	81.45	4
MS414: Little	TI	100.00 %	100.00 %	100.00 %	5 MVA	1.63 MW	1.46 MW	1.50 MW	0.50	42.50	42.50	21.25	21.25	0

3/10/2017 1:20:06 AM 8h Now 3/10/2017 9:20:06 AM

Criticality	Health
0.89	6

- Alliston
 - MS330: 8th Ave
 - MS331: 14th L
 - MS431: Dufferin
 - MS432: Fitch
- Beeton
 - MS336: Patterson
- Bradford
 - MS321: John
 - MS322: Melbourn
 - MS323: 8th Lir
 - MS324: Rega
- Penetanguishen
 - MS421: Fox
 - MS422: Robert
 - MS423: Bellis
 - MS424: Cente

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 Process ReportBook

Links:

- Weather report
- Radar Map Link

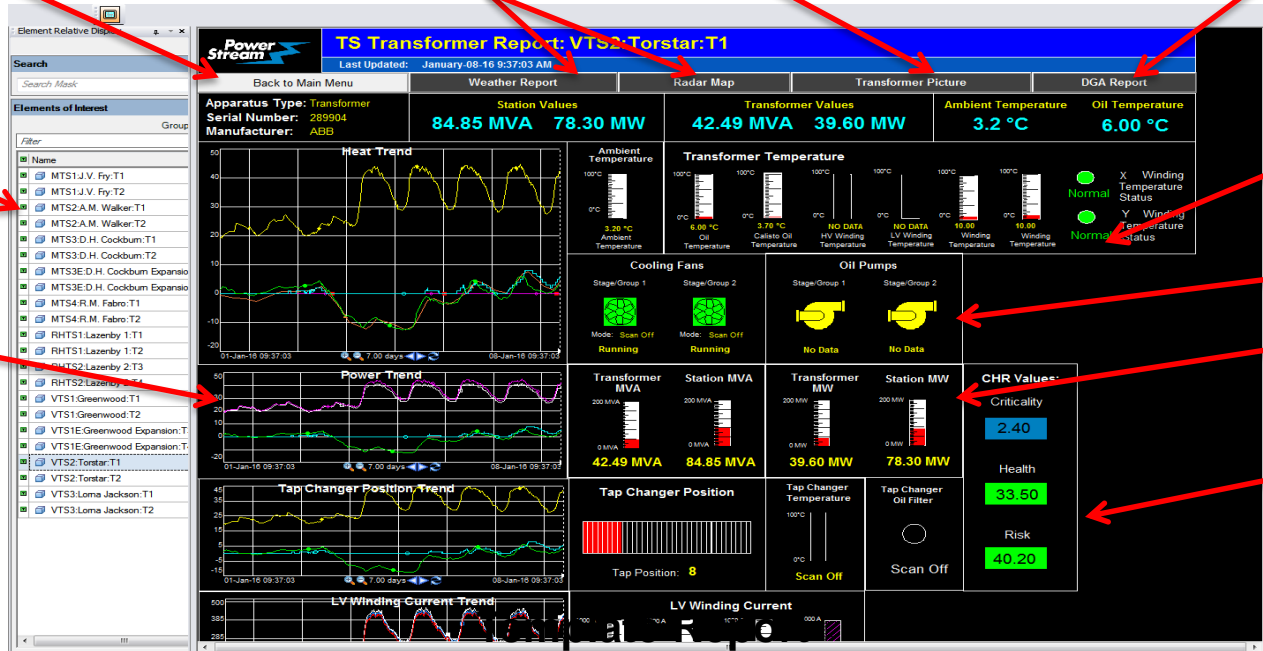
Pictures

External Database/App

Equipment Attributes

AF Elements

Trends



Status

Animations

Gauges

Health 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

PowerStream	PowerStream PI Reports		PowerStream
<p>System Reports</p> <p>System Demand Report <input type="button" value="Open"/></p> <p>TS Station Performance Report <input type="button" value="Open"/></p> <p>MS Station Performance Report <input type="button" value="Open"/></p> <p>UFLS Report <input type="button" value="Open"/></p> <p>Station Transformer Availability Map <input type="button" value="Open"/></p> <p>North Station Building Temperatures <input type="button" value="Open"/></p> <p>Smoke and Fire Report <input type="button" value="Open"/></p> <p>North Traid Load Report <input type="button" value="Open"/></p>	<p>Transformer Reports</p> <p>R.M. Fabro Graphical <input type="button" value="Open"/></p> <p>MS Transformer Report <input type="button" value="Open"/></p> <p>TS Transformer Report <input type="button" value="Open"/></p> <p>GIC Monitoring Report <input type="button" value="Open"/></p> <p>TS Oil Temp Report <input type="button" value="Open"/></p> <p>Tap Changer Report <input type="button" value="Open"/></p> <p>Tap Changer Position Report <input type="button" value="Open"/></p> <p>TS Station Cooling Report <input type="button" value="Open"/></p> <p>Hydrogen Gas Report <input type="button" value="Open"/></p>	<p>Circuit Breaker Reports</p> <p>MS Circuit Breaker Report <input type="button" value="Open"/></p> <p>TS Circuit Breaker Report <input type="button" value="Open"/></p> <p>MS Detailed Circuit Breaker Report <input type="button" value="Open"/></p> <p>TS Detailed Circuit Breaker Report <input type="button" value="Open"/></p> <p>SF6 Report <input type="button" value="Open"/></p>	
<p>Single Line Diagrams</p> <p>MTS4: R.M. Fabro <input type="button" value="Open"/></p> <p>MTS1: J.V. Fry <input type="button" value="Open"/></p> <p>MTS2: A.M. Walker <input type="button" value="Open"/></p> <p>MTS3: D.H. Cockburn <input type="button" value="Open"/></p> <p>MTS3E: D.H. Cockburn Expansion <input type="button" value="Open"/></p> <p>VTS1: Greenwood <input type="button" value="Open"/></p>	<p>Switch Reports</p> <p>Primary Switch Report <input type="button" value="Open"/></p>	<p>DGA Reports</p> <p>MS DGA Report <input type="button" value="Open"/></p> <p>TS DGA Report <input type="button" value="Open"/></p>	
<p>230kV & 44kV System Diagrams</p> <p>South 230 kV Layout <input type="button" value="Open"/></p> <p>North 230 kV & 115 kV Layout <input type="button" value="Open"/></p> <p>44 kV Penetanguishene <input type="button" value="Open"/></p> <p>44 kV Alliston, Tottenham, Beeton <input type="button" value="Open"/></p> <p>44 kV System Bradford <input type="button" value="Open"/></p>	<p>DC Systems Reports</p> <p>North DC Systems <input type="button" value="Open"/></p> <p>South DC Systems <input type="button" value="Open"/></p>	<p>Bushing Monitor Reports</p> <p>Combined <input type="button" value="Open"/></p>	
	<p>CHR Reports</p> <p>TS Transformers <input type="button" value="Open"/></p>	<p>Distribution Automation Scheme Report</p> <p>DAS Report <input type="button" value="Open"/></p>	
		<p>Capacitor Room Report</p> <p>VTS3:Jackson TS Capacitor Monitor Room Report <input type="button" value="Open"/></p>	

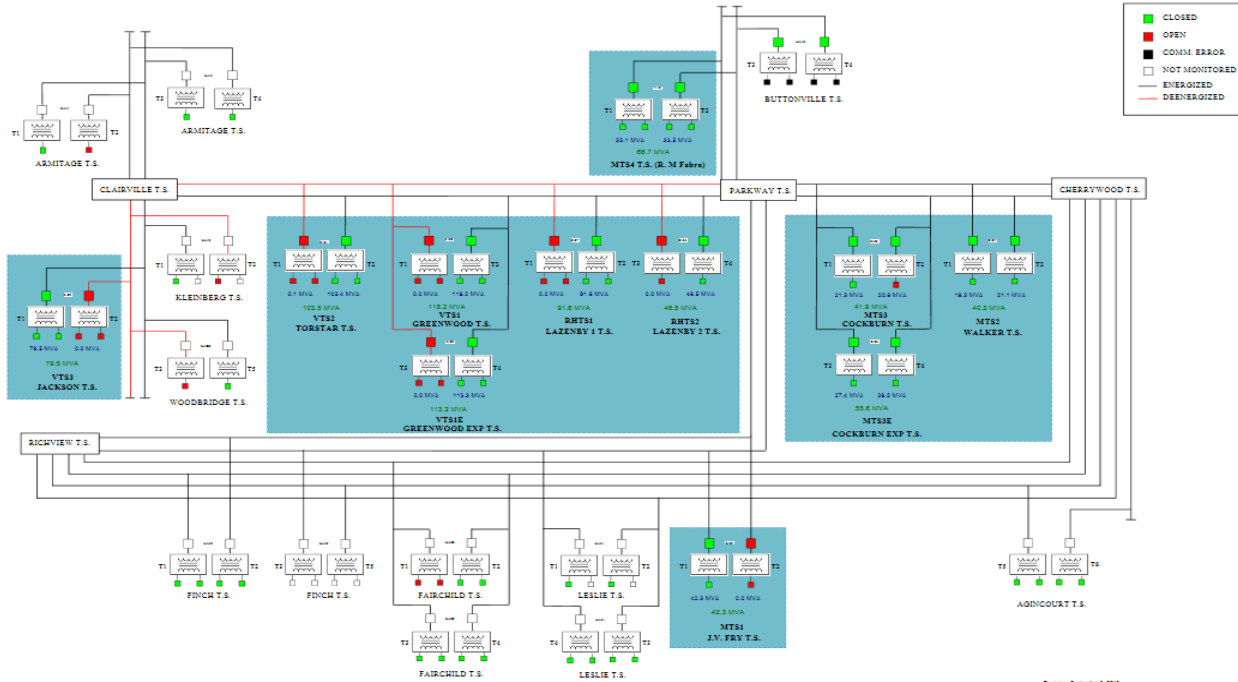
230kV Transmission Supply Status Report

230 kV Transmission Lines Layout

System Load **1172.0 MW**

Overall TS Station Risk Index **73.9308 %**

Overall TS Transformer Availability **68.1818 %**



Revision September 3, 2015

22/09/2015 7:44:58 AM

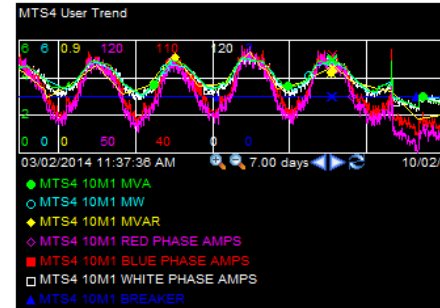
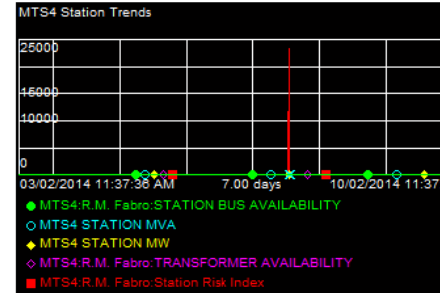
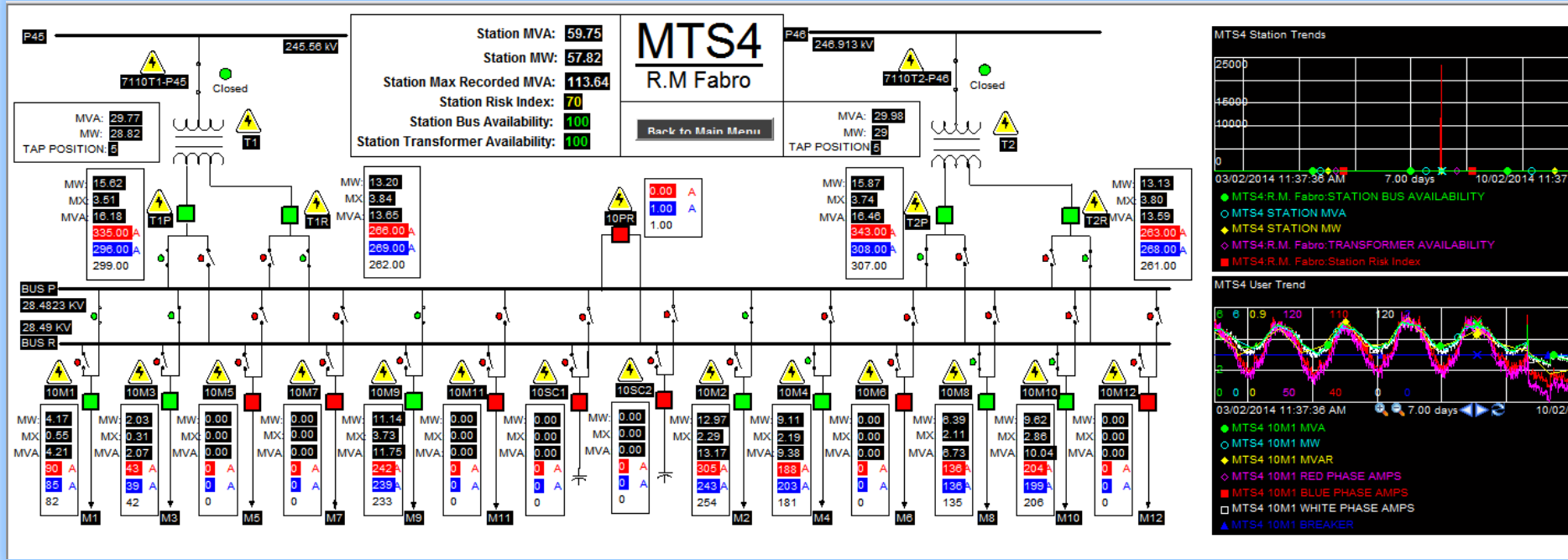
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Now

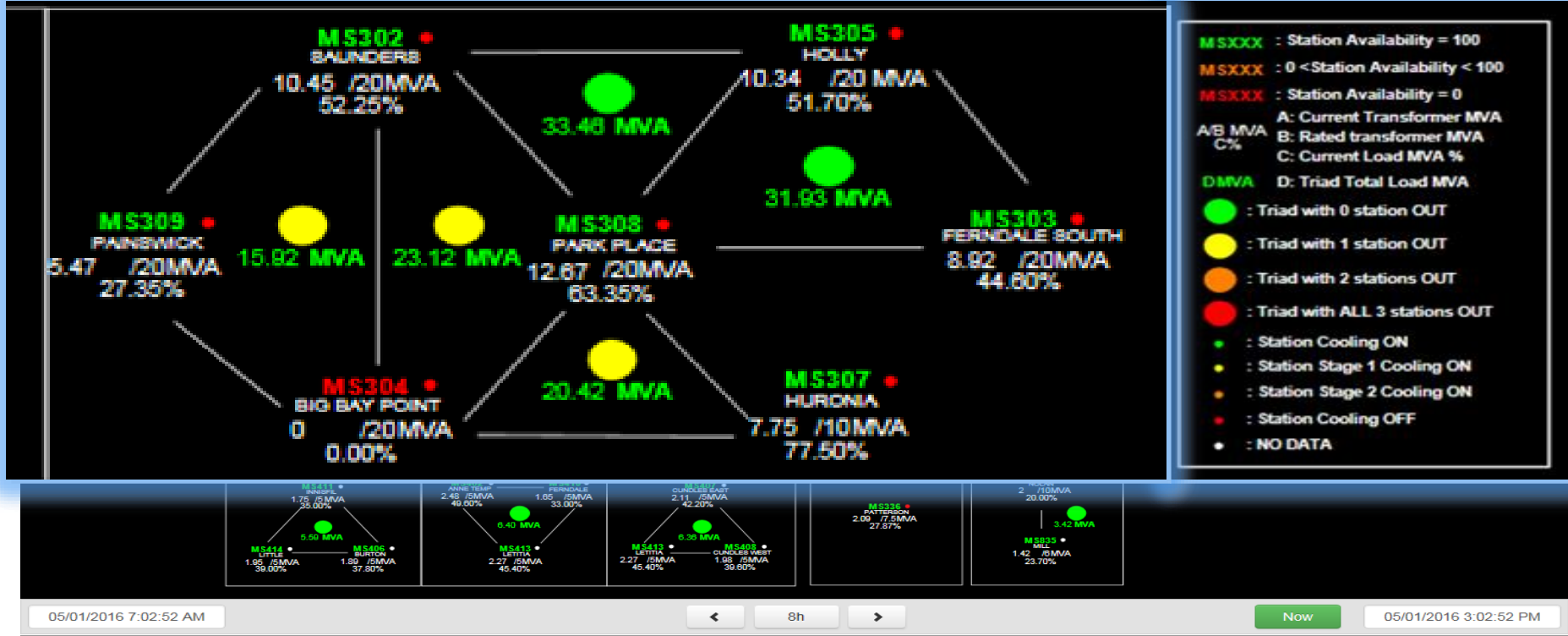
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100%

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 %



Performance Indicators
(Performance Equations)

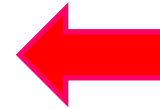


MTS3:D.H. Cockburn	
Station Status	On
Station Risk Index	100
Transformer Availability	100
Bus Availability	100
Bus E Availability	LIVE
Bus E Voltage	28.65
Bus Z Availability	LIVE
Bus Z Voltage	28.67
Feeder Breakers Closed (%)	100
RHTS2:Lazenby 2	
Station Status	On
Station Risk Index	65.625
Transformer 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

MTS1 J.V. Fry	MTS2 A.M. Walker	MTS3 D.H. Cockburn	MTS3E D.H. Cockburn Exp	MTS4 R.M. Fabro
		RHTS1 Lazenby 1	RHTS2 Lazenby 2	
VTS1 Greenwood	VTS1E Greenwood Exp	VTS2 Torstar	VTS3 Lorna Jackson	

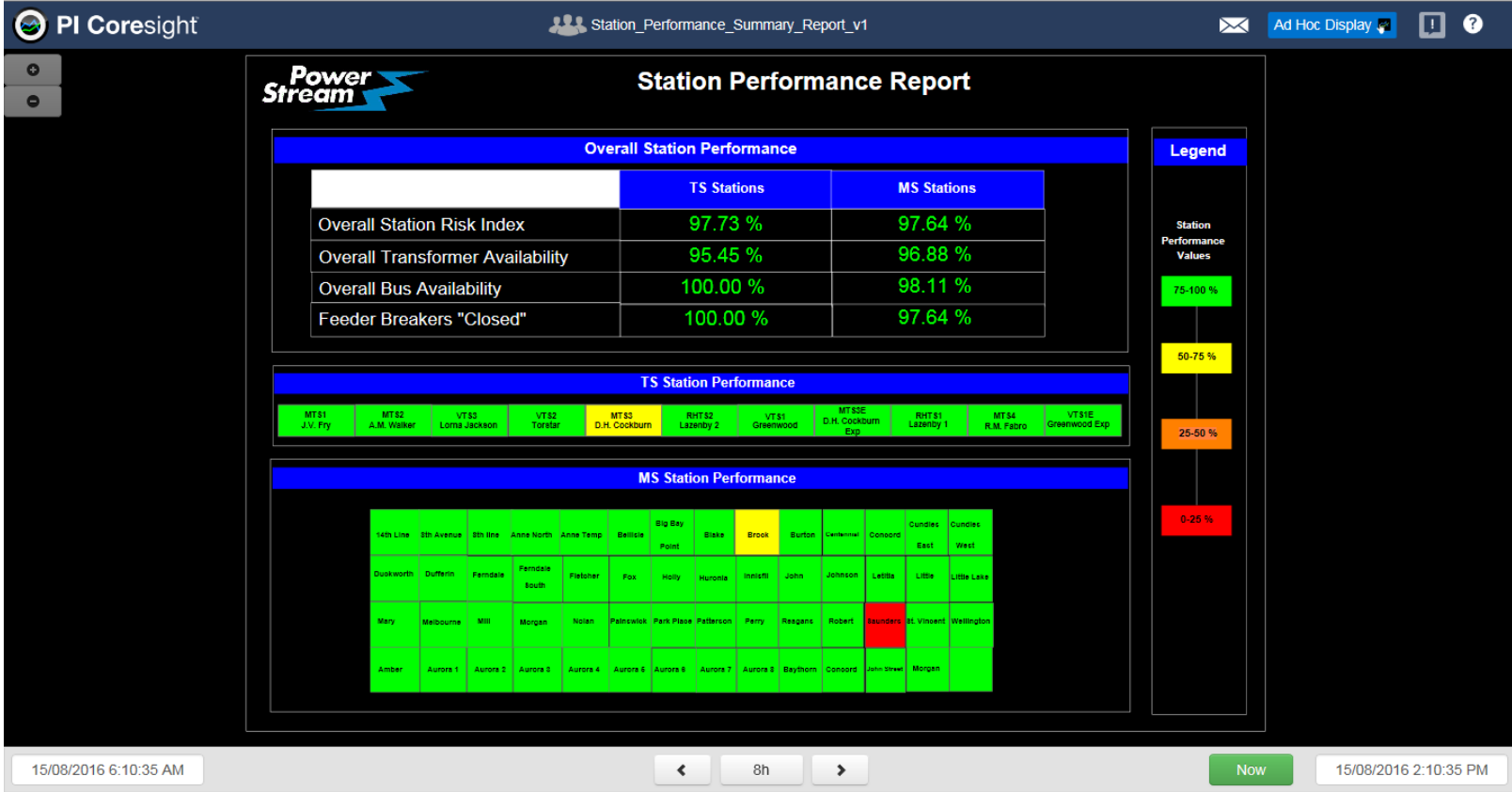


Multi States



Algorithms
(Performance Equations)

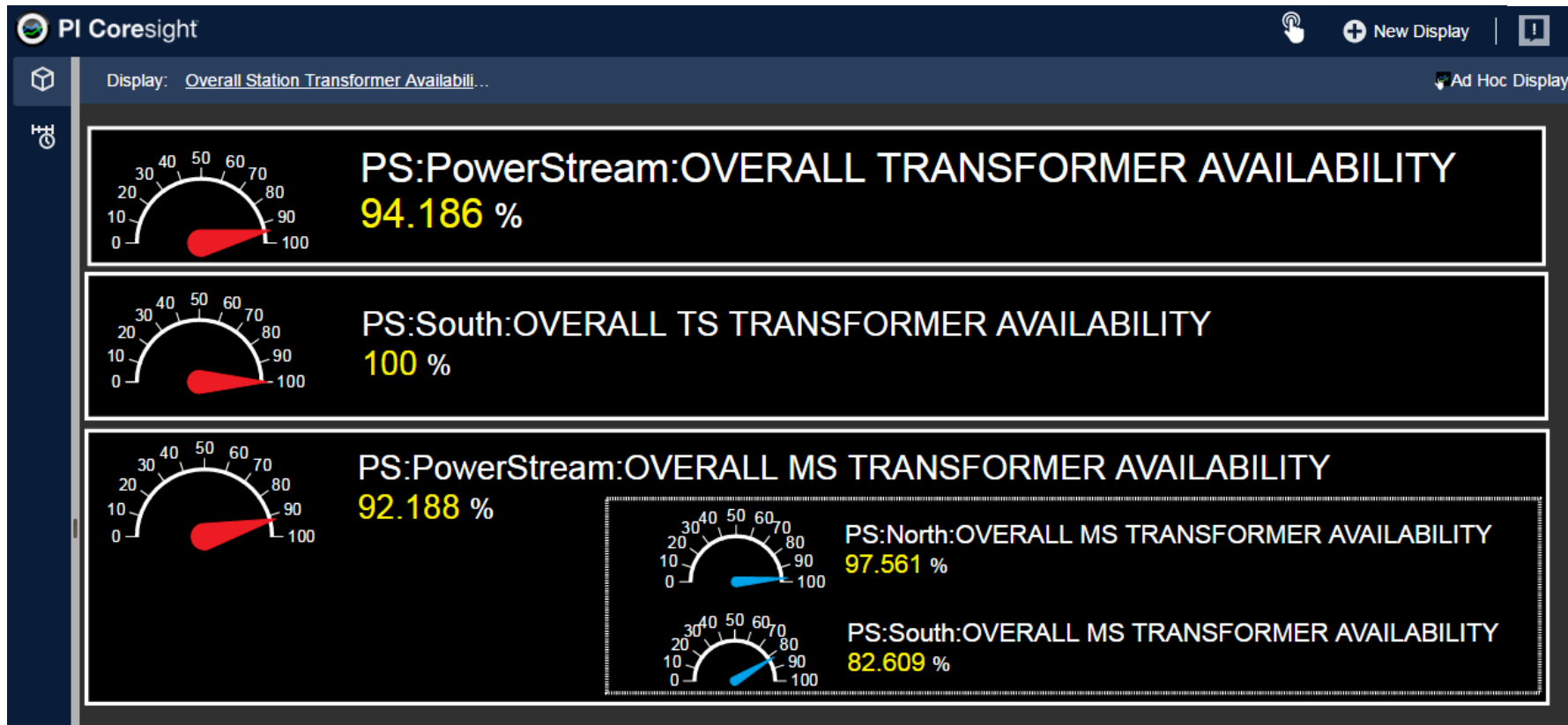
Station Availability (Risk) Report



Station Transformer Availability



PI Coresight 2016 R2



Feeder Availability Report - Risk

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](#)

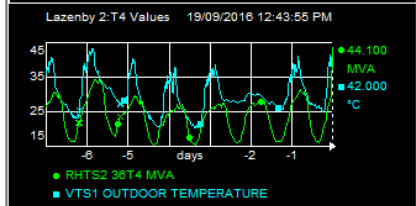
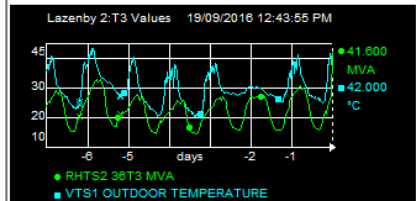
Thank you,
Station Sustainment Department
Alectra Utilities

Station Transformer Oil Temperature Report

Power Stream Station TS Transformer Oil Temperature Report
 Back to Main Menu Date & Time: 19/09/2016 12:43:55 PM

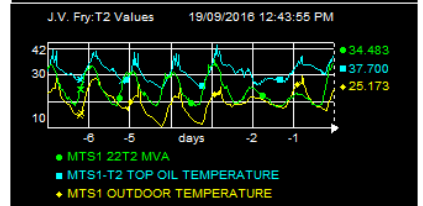
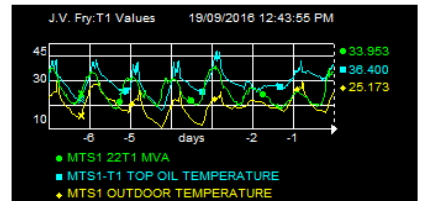
Lazenby 2

	T3	T4
Power	41.60 MVA	44.10 MVA
Oil Temp Status	Normal	Normal
Ambient Temp	25.17 °C	25.17 °C
Fans 1/2	On / On	On / On



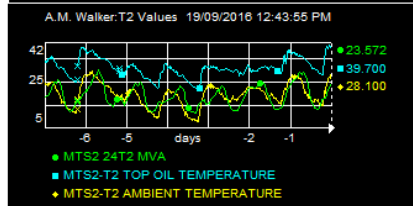
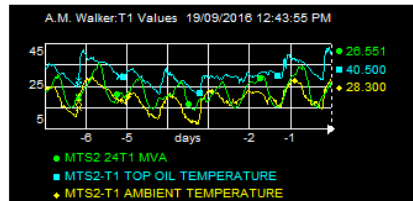
J.V. Fry

	T1	T2
Power	33.95 MVA	34.48 MVA
Oil Temp	36.40 °C	37.70 °C
TC Oil Temp	30.00 °C	30.10 °C
Ambient Temp	25.17 °C	25.17 °C
Fans Group 1/2	On / Off	On / Off



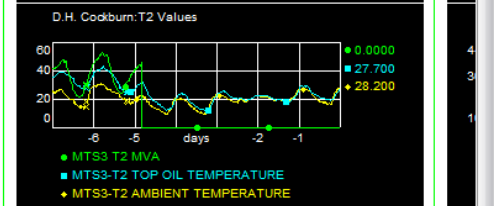
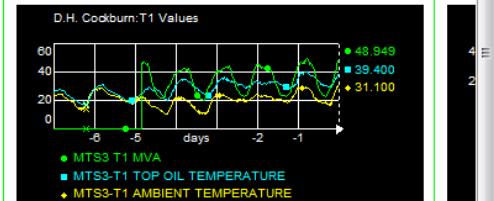
A.M. Walker

	T1	T2
Power	26.55 MVA	23.57 MVA
Oil Temp	40.50 °C	39.70 °C
TC Oil Temp	25.50 °C	25.40 °C
Ambient Temp	28.30 °C	28.10 °C
Fans Stage 1/2	On / Off	On / Off

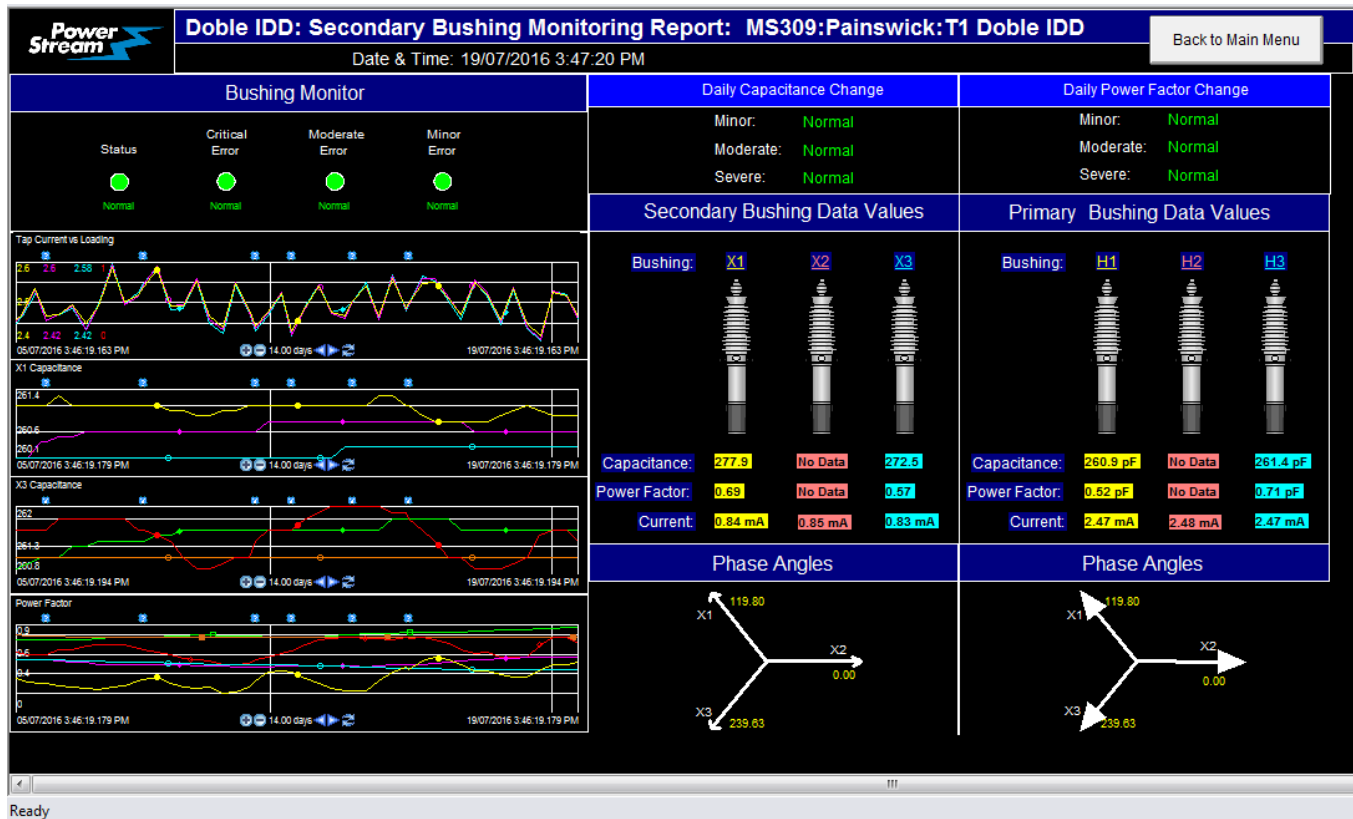


D.H. Cockburn

	T1	T2
Power	48.95 MVA	0.00 MVA
Oil Temp	39.40 °C	27.70 °C
TC Oil Temp	27.60 °C	25.70 °C
Ambient Temp	31.10 °C	28.20 °C
Fans Group 1-4	1 2 3 4	1 2 3 4



Transformer Online Bushing Condition Report



Bushing Monitor



230kV Primary Switch Performance Report

PI Coresight Primary Switch Report

Ad Hoc Display

230 kV Primary Switch Status

Return to Main Menu Date and Time: 15/09/2016 3:55

CT Telemetry Failed

VAUGHAN

VTS1: Greenwood

	T1 V71P	T2 V75P
Status:	● Closed	● Closed
Last Opened:	13-Mar-16 08:42:29	20-Aug-16 09:55:56
Last Closed:	23-Mar-16 18:30:41	20-Aug-16 16:17:40
Days Since Operation:	176	26
Criticality:	1.61	1.61
Health:	64.9	70.1
YTD Average:	64.8667	70.0467
Risk:	104.49	112.86
YTD Average:	104.437	112.775
# of Open Work Orders:	2	3

VTS3: Lorna Jack

	T1 V44
Status:	● Open
Last Opened:	10-Sep-16 06:31:11
Last Closed:	19-Jun-16 13:39:11
Days Since Operation:	5
Criticality:	1.78
Health:	90.5
YTD Average:	90.4267
Risk:	161.09
YTD Average:	160.958
# of Open Work Orders:	3

MARKHAM

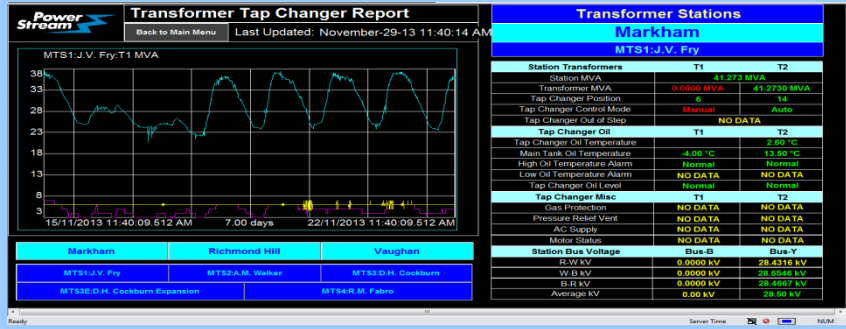
MTS1: J.V. Fry

	T1 P21R
Status:	● Closed
Last Opened:	9-Sep-16 07:47:37
Last Closed:	10-Sep-16 16:11:11
Days Since Operation:	5
Criticality:	1.2
Health:	76
YTD Average:	76
Risk:	133.5
YTD Average:	133.39
# of Open Work Orders:	0

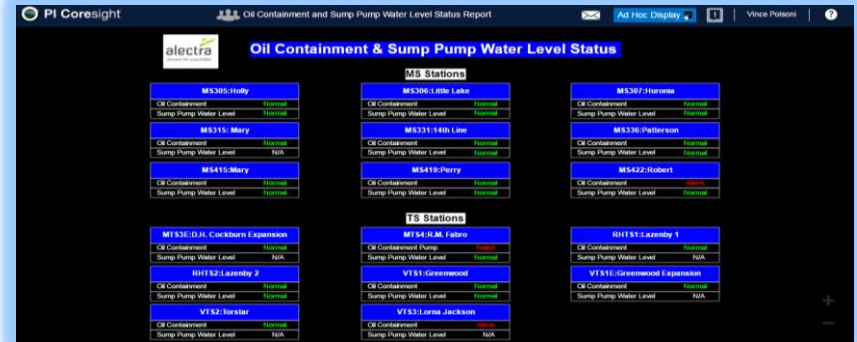


PI ProcessBook Reports

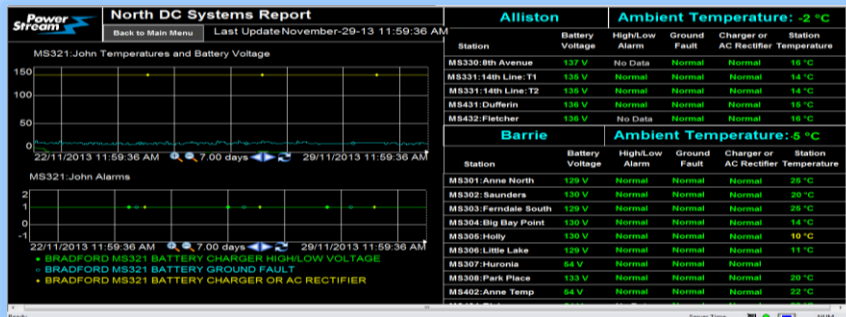
Tap Changer



Oil Containment & Sump Pump



DC Systems



Circuit Breaker Status



Substation Transformer Hydrogen Gas Alarm Report



PI Coresight

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

alectra
Discover the possibilities

MS Transformer Hydrogen Gas Monitors - North

Alarm Warning Monitor	Alarm Warning Monitor	Alarm Warning Monitor	Alarm Warning Monitor	Alarm Warning Monitor	Alarm Warning Monitor	Alarm Warning Monitor	Alarm Warning Monitor	Alarm Warning Monitor	Alarm Warning Monitor	Not Installed	Alarm Warning Monitor	Not Installed	Alarm Warning Monitor	Not Installed
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	
Installed	Alarm Warning Monitor	Alarm Warning Monitor	Alarm Warning Monitor	Alarm Warning Monitor	Not Installed	Alarm Warning Monitor	Not Installed	Alarm Warning Monitor	Not Installed	Not Installed	Alarm Warning Monitor	Not Installed	Alarm Warning Monitor	Alarm Warning Monitor
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	
Not Installed	Not Installed	Alarm Warning Monitor	Alarm Warning Monitor	Alarm Warning Monitor	Not Installed	Alarm Warning Monitor	Alarm Warning Monitor	Alarm Warning Monitor	Alarm Warning Monitor	Alarm Warning Monitor	Alarm Warning Monitor	Alarm Warning Monitor	Alarm Warning Monitor	Not Installed
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	

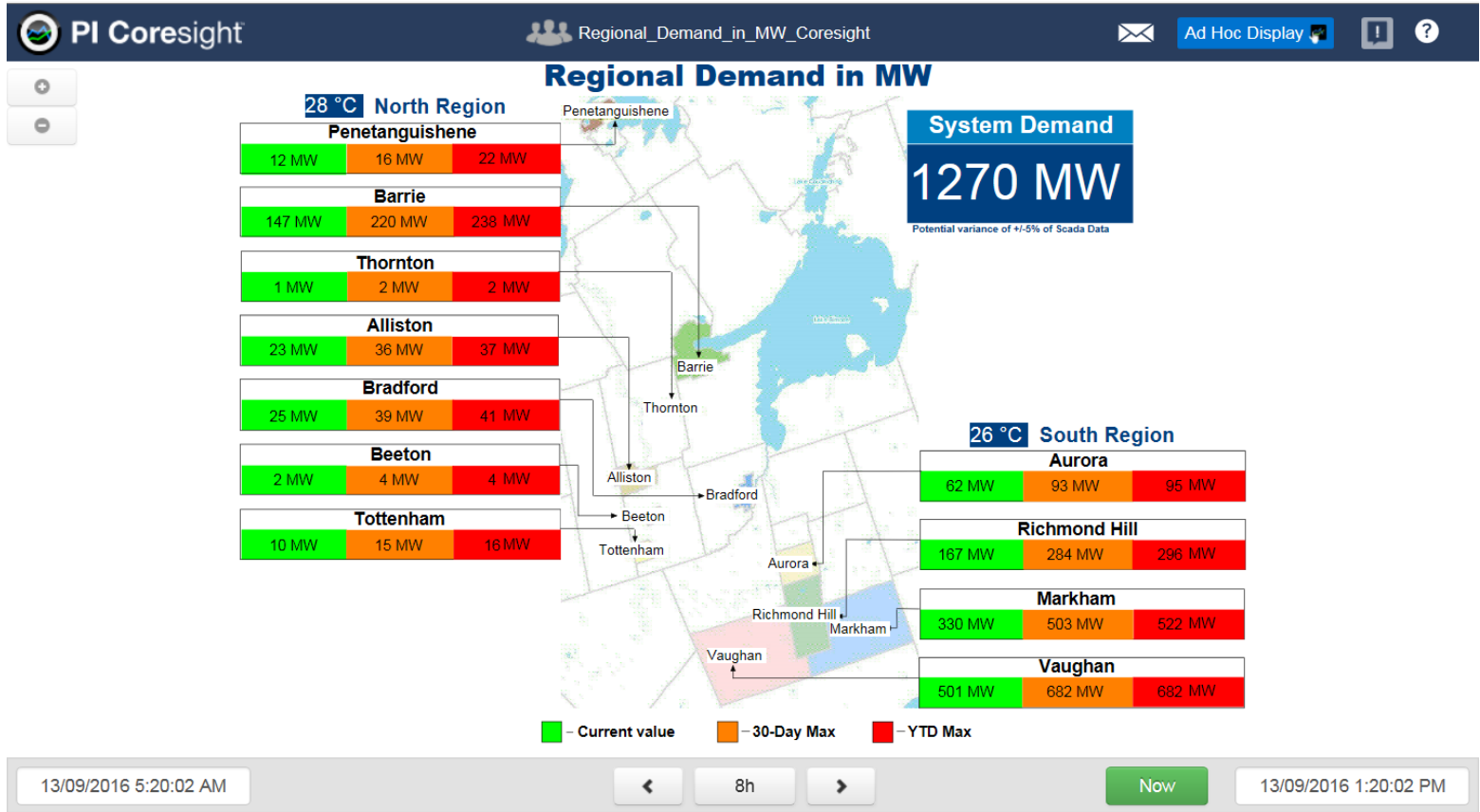
Intellix GLA 100

- Alarm (Red): Hydrogen Concentration > 500 ppm (OR) Rate of Change > 50 ppm per 24Hr
- Warning (Yellow): Hydrogen Concentration > 400 ppm (OR) Rate of Change > 25 ppm per 24Hr
- Monitor (Green):



PI Coresight 2016 R2

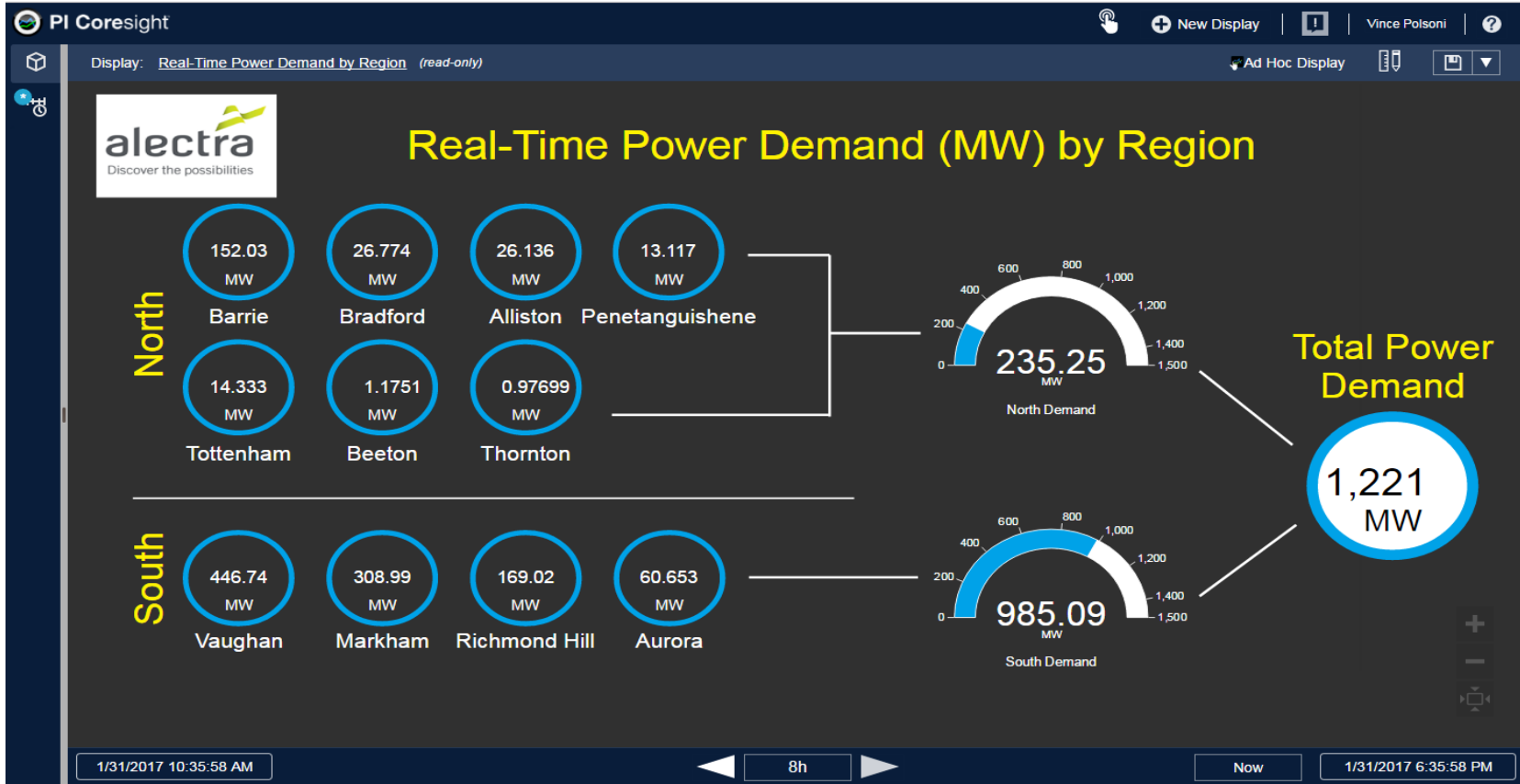
Regional Demand: Current, 30 Day & Year to Date Maximums



Power Demand By Region

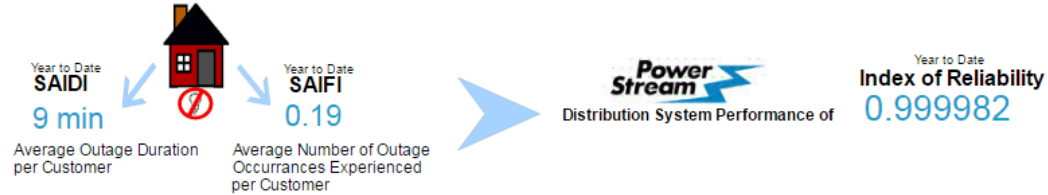


PI Coresight 2016 R2



System Reliability Report using PI Coresight / PI ProcessBook

System Performance



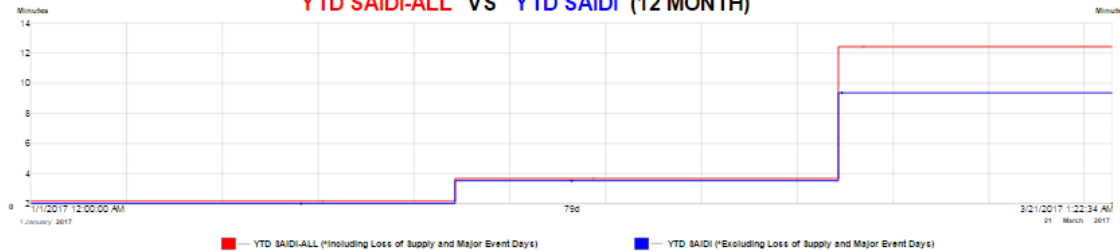
Current Year to Date Index of Reliability = 99.998% (percentage of time power is available)

Average outage duration a PowerStream Customer would experience is 49.01 min (CAIDI)

Statistics		Year End Projection	
YTD SAIDI-ALL	12 min	Current Year SAIDI Target:	68.02 min
YTD SAIFI-ALL	0.21 Interruptions per Customer	Current Year End SAIDI Projection:	Model 1: 56.20 min Model 2: 62.89 min
<small>*Including Loss of Supply and Major Event Days</small>			

Values are from Start of 2017 up to Feb 28, 2017

YTD SAIDI-ALL VS YTD SAIDI (12 MONTH)



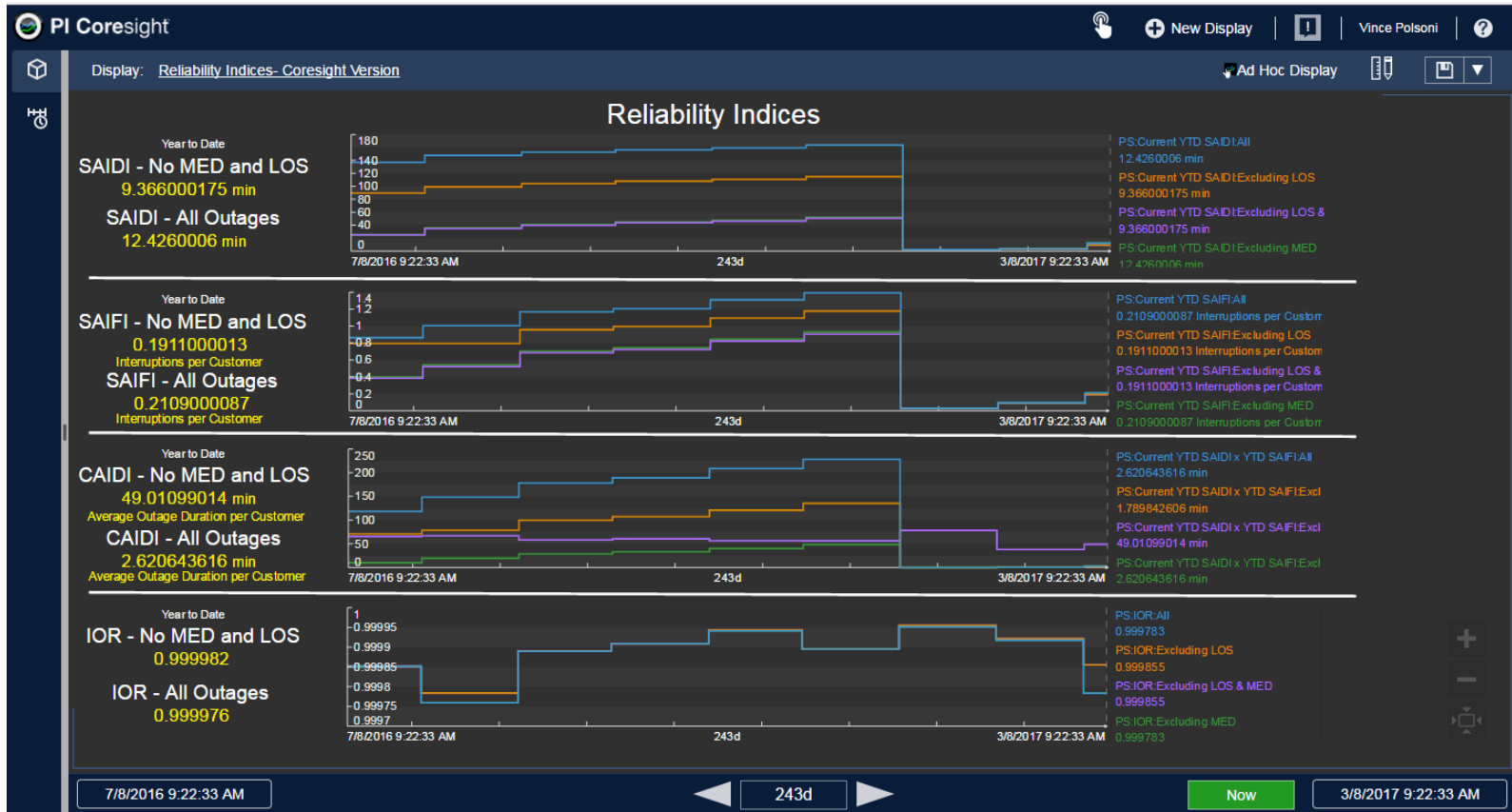
1/1/2017 12:00:00 AM

79d

Now

Monthly Load using PI-UFL

System Reliability Report using PI Coresight 2016 R2



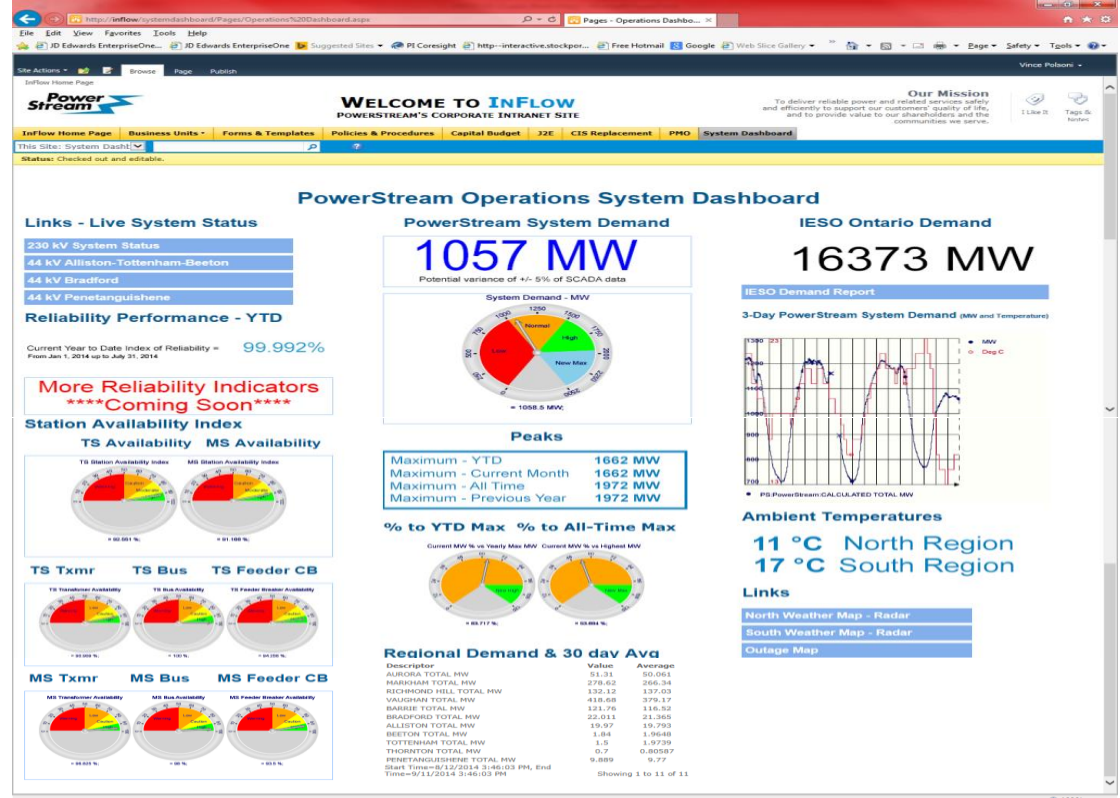
Corporate / Operations Dashboards



PITV – Public Area



PITV – Office



PITV – Operations Reports



Operations South Public



Station Sustainment South



Station Sustainment North



Operations North Public

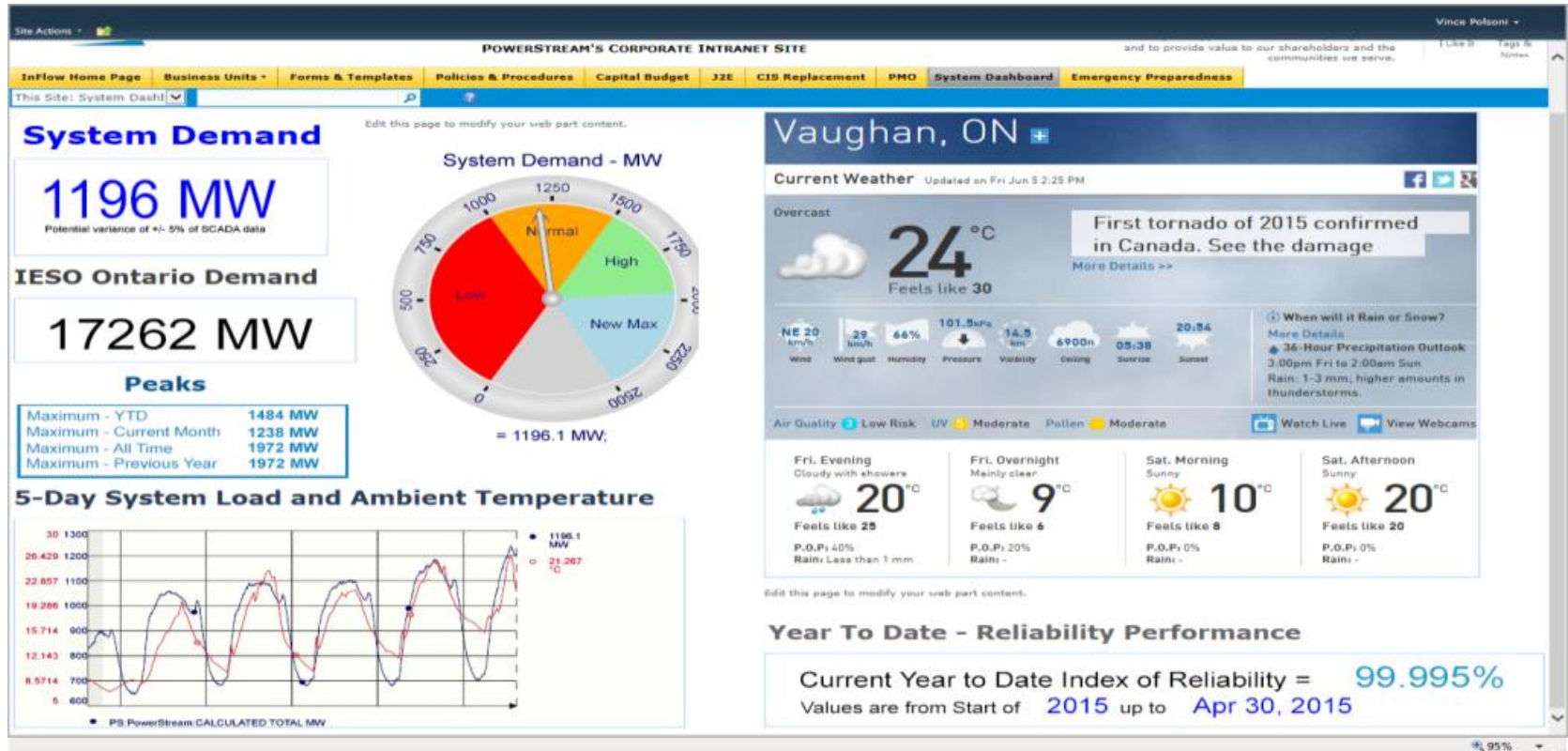


VP Operations



Executive Office

System Loading Dashboard



PI Notifications – Real-time Information

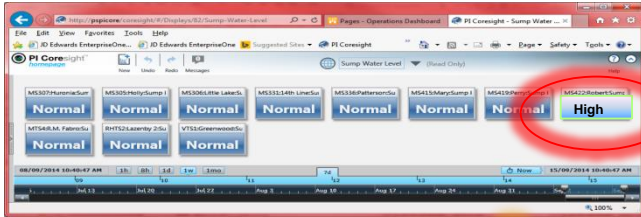


- Current Total Outages by Region
- Circuit Breaker Operation
- Low SF6 Gas
- Station Building Temp
- DC System
- Battery Low Voltage
- Calisto 9 General Alarm
- System Demand

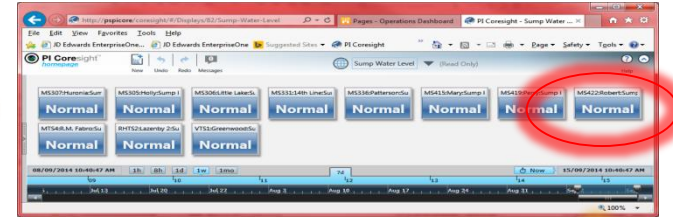
- Transformer Online / Offline
- Transformer Oil Temp/Cooling
- Transformer Bushing Alarm
- Tap Changer Oil Filtration Alarm
- Feeder Protection Trip
- Secondary Txmr Breaker Operation
- Primary Switch Operation
- High Sump Water Level

SCADA – PI System – CMMS working as One

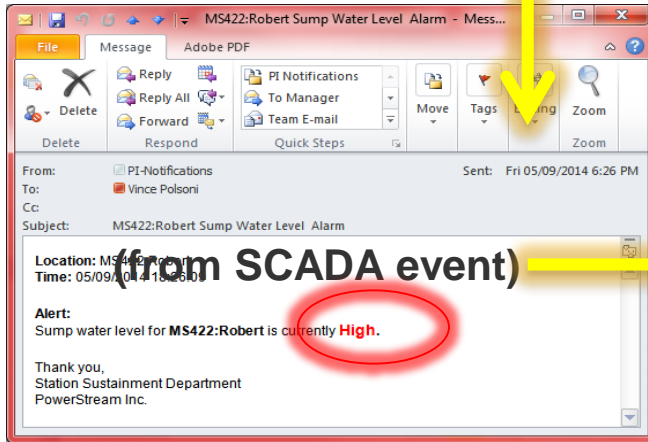
PI Report (High Water Alarm)



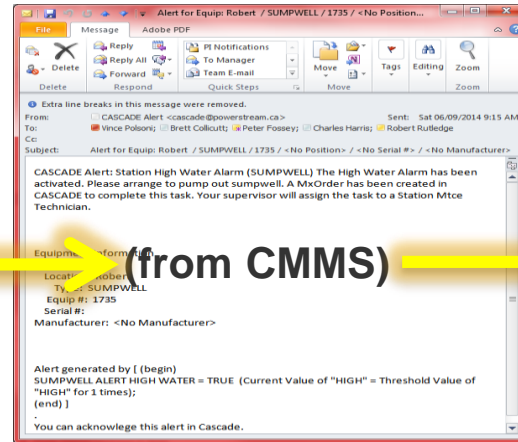
PI Report (High Water Alarm Cleared)



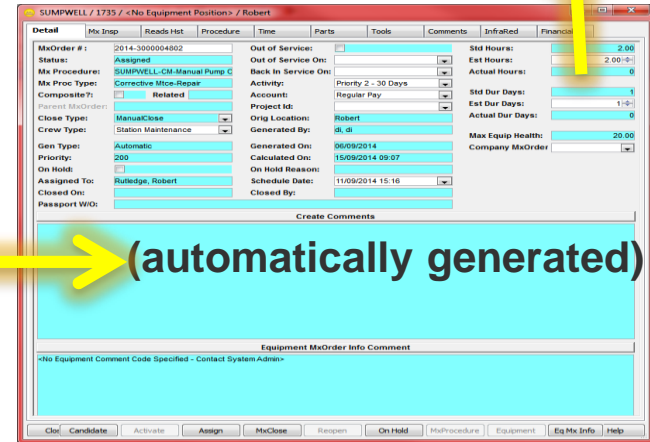
PI Notifications



CMMS Work Order Alert



CMMS Work Order



(from SCADA event)

(from CMMS)

(automatically generated)



Geomagnetically Induced Current Report



PI Coresight

Subject: PI Alert: Regional Geomagnetic Storm Index is High

Update:
 Current Regional Geomagnetic Storm Index (K_r) Values are as follows:
 Last Hour K_r Value: 5
 Next 0-3 Hours K_r Value: 4
 Next 3-6 Hours K_r Value: 3

A K_r Value of 5 as Last Hour K_r Value has following impact:

Scale: **Quiet**
 Effect: **None**
 Number of Expected Geomagnetic Storm Events: **≤1700 per cycle** (1 solar cycle = 11 years)
 Number of Storm Days: **≤900 days per cycle** (1 solar cycle = 11 years)
 Solar Wind Speed: 574.6 km/sec

	MTS1: J.V. Fry: T1	MTS1: J.V. Fry: T2	MTS2: A.M Walker: T1	MTS2: A.M Walker: T2
Ambient Temperature	-4.52°C	-4.522563°C	-6.3°C	-6.3°C
Positive DC Alarm Status	Normal	Normal	Normal	Normal
Negative DC Alarm Status	Normal	Normal	Normal	Normal
GIC Sensor Amps	1.8A	-4.7A	5.6A	9.7A
Oil Temperature	-3.1°C	-0.9°C	-6.4°C	14.1°C
Current Load	0 MW	36.57236 MW	0 MW	40.29908 MW

For more information please see [Geomagnetically Induced Current Report](#).
 Additional information on Space Weather Status and Effects on Power Systems can be found on [Space Weather Canada](#).

Thank you,
 Station Sustainment Department
 PowerStream Inc.

Legend

Scale	K _r Value
Extreme	9
Severe	8
Strong	7
Moderate	6
Minor	5
Quiet	4
	3
	2
	1
	0

30/12/2015 1:04:14 PM

Last Hour Kr Value

T1 GIC Sensor Amps

T2 GIC Sensor Amps

Now

06/01/2016 1:04:14 PM

100%

Station Building Temperature Report

The screenshot shows a mobile notification window titled "PI Alert: MS322:Melbourne Building Temperature" from "Vince Polsoni" on 06/09/2016. The notification text includes:

- Location: MS322:Melbourne
- Time: 06/09/2016 14:52:09
- Triggering Condition: Building Temperature \geq 40
- Alert:** The Station Building Temperature for MS322:Melbourne is currently **40 Degrees**.
- Building Max Temperature in Last 7 Days is **39 Degrees**
- The Ambient Temperature is currently 34 Degrees.
- Current Weather Condition is **Partly Sunny**.
- Thank you,
Station Sustainment Department
PowerStream Inc.

The background shows a dashboard with a "Power Stream" logo, a station list on the left, and data tables on the right. One table shows "Last 7 days" temperature data with columns for "Minimum" and "Maximum".

Day	Minimum	Maximum
29	29	35
28	26	26
27	29	35
26	27	33
25	21	29
24	22	27
23	23	38
22	21	27
21	25	30
20	23	34
19	25	32
18	24	29
17	23	28
16	20	37
15	28	33
14	17	37
13	28	31
12	25	32
11	27	30
10	26	31
9	28	33
8	15	36
7	22	27
6	27	32
5	28	31
4	22	29

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

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	94.8 MW	0.0 MW	90.5 MW	90.5 MW
Markham	508.4 MW	508.4 MW	508.4 MW	508.4 MW	407.8 MW	100.8 MW	100.8 MW
Richmond Hill	276.6 MW	281.6 MW	296.1 MW	296.1 MW	219.1 MW	57.0 MW	57.0 MW
Vaughan	668.0 MW	671.8 MW	671.8 MW	671.8 MW	568.0 MW	102.9 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	37.2 MW	0.0 MW	35.2 MW	35.2 MW
Barrie	218.6 MW	225.2 MW	238.4 MW	238.4 MW	0.0 MW	218.0 MW	218.0 MW
Beeton	3.8 MW	4.3 MW	4.2 MW	4.2 MW	3.8 MW	2.0 MW	2.0 MW
Bradford	36.6 MW	38.6 MW	41.5 MW	41.5 MW	0.0 MW	36.6 MW	36.6 MW
Penetanguishene	15.9 MW	16.3 MW	22.1 MW	22.1 MW	0.0 MW	15.9 MW	15.9 MW
Thornton	1.6 MW	1.6 MW	1.6 MW	1.6 MW	0.0 MW	1.6 MW	1.6 MW
Tottenham	13.9 MW	14.6 MW	16.2 MW	16.2 MW	10.8 MW	3.0 MW	3.0 MW

05/08/2016 2:37:43 PM

Alert: Overall PowerStream Demand Increase

Sent: Wed 17/07/2013 4:01 PM

From: PI-Notifications
To: Vince Polsoni
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.

Outage Information Flow - PI System / OMS



PI Notifications - Feeder Protection Trip & Circuit Breaker Operation

Outage Management System

PI Notifications Outage Counts by Region

PI Alert: VTS2:Torstar:21M2 Feeder Protection Operation Notification

From: PI-Notifications
To: Vince Polsoni
Sent: Mon 28/09/2015 5:56 AM

Subject: PI Alert: VTS2:Torstar:21M2 Feeder Protection Operation Notification

Location: **VTS2:Torstar:21M2**

Time: 28/09/2015 05:55:22

Update:
VTS2:Torstar:21M2 Feeder Protection has operated and is now **Tripped** at 28/09/2015 05:55:22.

Breaker Status:
Breaker Status: Closed

Thank you,
Station Sustainment Department
PowerStream Inc.

Lo-Set Inst Overcurrent Protection: **Normal**
Trip Circuit Health: **Normal**

Number of Customers potentially affected: **1866**

Thank you,
Station Sustainment Department
PowerStream Inc.

See more about: PI-Notifications.

Update Outage # 736124 - Vaughan - Message (HTML)

From: PowerStream Outage Info <noreply@powerstream.ca>
Sent: Mon 28/09/2015 7:27 AM

Update Outage # 736124 - Vaughan

Incident #: 736124
Feeder: 21M2
Customers Affected: 136
Cause: UK - Unknown
Crew Status: Dispatched
Time Outage Occurred: Sep 28 2015 7:01AM
Estimated Restoration Time: Sep 28 2015 11:00AM
Time Restored:

Remarks:
Predicted fuse operation at V36FA1003. Crews dispatched.
Streets Affected:
HANLAN RD, HIGHWAY 7, PEARCE RD, STEELES AVE, WESTON RD
For more information go to www.PowerStream.ca/PowerOutages. You can also follow [@PowerStreamNews](https://twitter.com/PowerStreamNews) on Twitter for updates during major power outages.

To hear restoration details call 1-877-963-6900.

Do not reply to this message. If you have any questions regarding this service contact us at CustomerService@PowerStream.ca. If you no longer wish to receive future Power Outage Notifications [click here](#), log into [My Account Info](#) and unselect **Power Outage Notifications** in [Manage My Online Account](#).

Thank you, **Customer Service Department**

PowerStream Inc.
161 Cityview Boulevard, Vaughan, Ontario, L4H 0A9 | 1-877-963-6900
www.PowerStream.ca | CustomerService@PowerStream.ca

PI Alert: Outage Information Update (I/D by 100) - Message (HTML)

From: PI-Notifications
To: Vince Polsoni
Sent: Fri 25/03/2016 8:55 AM

Subject: PI Alert: Outage Information Update (I/D by 100)

Update:

There are currently **51** outage(s) affecting a total of **30709** PowerStream Customers:

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

For more details please see [Outage Map](#)

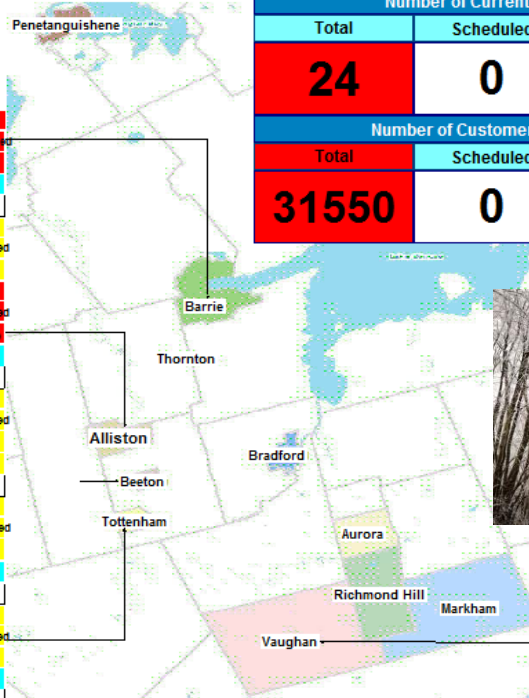
Thank you,
Station Sustainment Department
PowerStream Inc.

See more about: PI-Notifications.

Link to view PI Coresight Report

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

Current Outage Information



Number of Current Outages			System Demand
Total	Scheduled	Forced	
24	0	23	952 MW
Number of Customers Affected			Total Number of Customers
Total	Scheduled	Forced	
31550	0	31549	360777



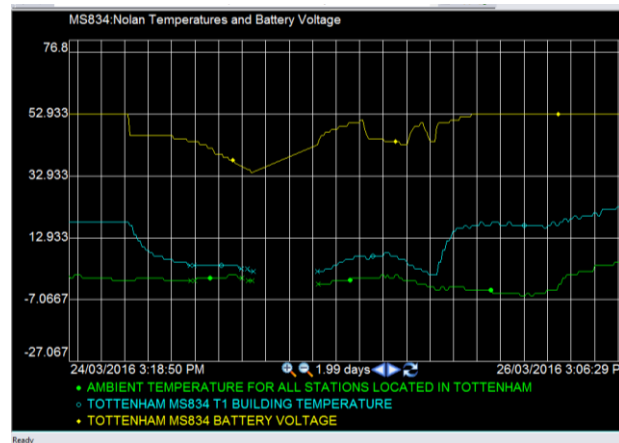
Barrie			
Current Outages	Customers Affected	Total Customers	% Customers Affected
13	23546	53652	43.8865%
Temperature	Wind Speed	Current Weather Conditions	
-2 Deg C	8 kmph	Snow	
Thornton			
Current Outages	Customers Affected	Total Customers	% Customers Affected
2	2	464	0.4310%
Alliston			
Current Outages	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



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 Wind: NNW 16 kmph
Light Snow

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

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

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

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

Penetanguishene: -14 °C Light Snow

Barrie: -13 °C Light Snow

Thornton: -12 °C Light Snow

Alliston: -10 °C Light Snow

Beeton: -10 °C Light Snow

Tottenham: -11 °C Light Snow

Aurora: -12 °C Mostly Cloudy

Richmond Hill: -10 °C Partly Sunny

Markham: -10 °C Partly Sunny

Vaughan: -9 °C Partly Sunny

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

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

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

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

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

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

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



PI Coresight Sustained Outage Causes Ad Hoc Display Vince Polsoni

Adverse Weather

Source: OMS

Cause	Number of Outages	2016 Total	2015 Total	2014 Total
Rain	0	1	1	1
Ice Storm	0	77	1	0
Snow	2	0	5	13
Wind	2	7	8	35
Extreme Temperature	0	0	0	0
Fog	0	0	0	0
Frost	0	0	0	0
Thunder Storm	0	8	8	27
Other	0	1	0	0
Adverse Weather Total	4	94	23	76

Defective Equipment

Cause	Number of Outages	2016 Total	2015 Total	2014 Total
Overhead transformer	4	42	3	3
Underground Transformer	8	91	1	1
Underground Transformer Vault	1	11	1	1
Underground Transformer Submer	0	1	1	1
Arrestor	4	21	1	1
Primary Cable	2	21	1	1
Secondary	22	19	1	1
Line Hardware	4	1	1	1
Station Equipment	1	1	1	1
Station Equipment - Breaker	0	1	1	1
Station Equipment - Transformer	0	1	1	1
Station Equipment - Recloser	0	1	1	1
Switch	12	1	1	1
Switch - LIS/Recloser	0	1	1	1
Switch - Manual LIS	1	1	1	1
Termination	1	1	1	1
Elbow Arrestor	1	1	1	1
Elbow	1	1	1	1
Splice	8	1	1	1
Switching Unit	5	1	1	1
Insulator	1	1	1	1
Other	0	3	4	3
Defective Equipment Total	79	638	748	986

Supply Loss

Cause	Number of Outages	2016 Total	2015 Total	2014 Total
Grid Voltage Disturbance	0	0	0	0
Supply Loss Total	5	23	23	18

Lightning

Cause	Number of Outages	2016 Total	2015 Total	2014 Total
Lightning	0	9	32	46
Lightning Total	0	9	32	46

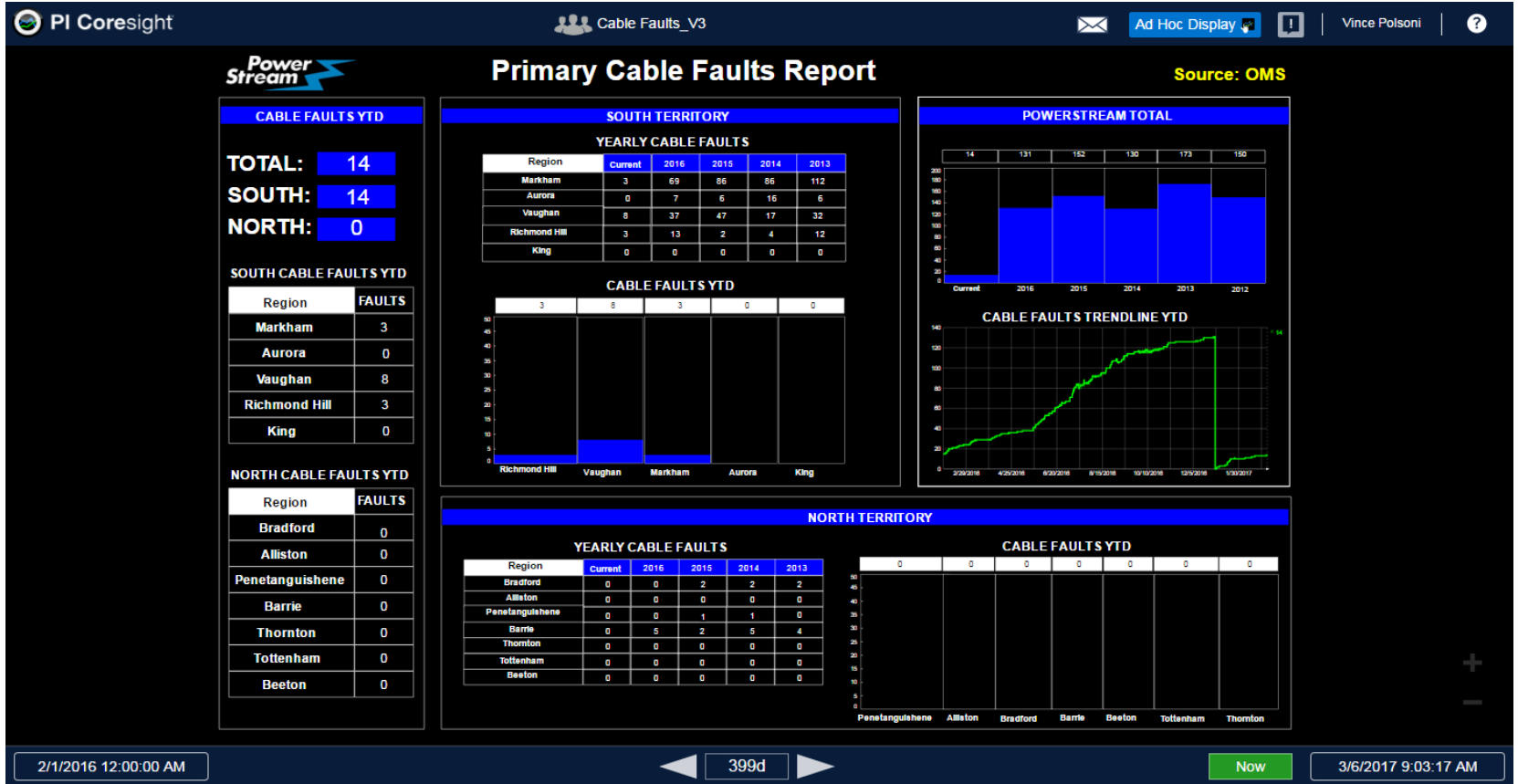
Environment

Cause	Number of Outages	2016 Total	2015 Total	2014 Total
Environment	0	3	0	8
Environment	0	6	65	20
Environment	0	0	0	0
Environment	0	0	0	0
Environment	0	0	0	0
Environment	0	3	2	2
Environment	0	0	1	1
Environment	2	4	37	0
Environment	0	0	0	0
Environment Total	2	16	105	31

Human Element

Cause	Number of Outages	2016 Total	2015 Total	2014 Total
Human Element	0	5	7	4
Human Element	1	8	13	6
Human Element	0	4	6	2
Human Element	0	0	1	2
Human Element	1	8	19	14
Human Element	0	0	0	0
Human Element	0	0	0	0
Human Element	0	4	2	0
Human Element Total	2	29	48	28

Primary Cable Fault Report



Daily Peak Projection Report



PI Coresight MaxDemandV2 Ad Hoc Display Vince Polsoni

Discover the possibilities

Uses Histor

Peak Demand

Today's Project Demand

Day	Projected Demand	Real Time Demand
Friday	1225.71 MW	1131.86 MW

Calculated in PLAF Analysis

Today's Maximum Demand Projection - Message (HTML)

Today's expected temperature forecast is:
Max Temperature : 30 °C
Min Temperature: 17 °C

Yesterday's Projected Peak	Yesterday's Recorded Peak	Time of Peak Demand	Percentage Accuracy
1480.3 MW	1509.2 MW	8/29/2016 4:14:43 PM	98.05%

Thank you,
 Station Sustainment Department
 PowerStream Inc.

Today's Maximum Projected Demand for PowerStream is expected to be **1518 MW**.

PI-Notifications Vince Polsoni

Today's Maximum Demand Projection

Tue 8:00 AM

Last 7 Day Max Demand Profile

Day	Projected Demand Peak	Actual Peak Demand	Time of Peak Demand	Percent Accuracy
Thursday	1233.46 MW	1194.39 MW	3/2/2017 7:15:59 PM	96.8321 %
Wednesday	1063.32 MW	1116.73 MW	3/1/2017 6:31:58 PM	94.9771 %
Tuesday	1126.57 MW	1132.42 MW	2/28/2017 6:20:18 PM	99.4806 %
Monday	1134.13 MW	1118.51 MW	2/27/2017 6:45:43 PM	98.6227 %
Sunday	990.11 MW	1051.60 MW	2/26/2017 6:51:28 PM	93.7894 %
Saturday	1020.72 MW	1039.24 MW	2/25/2017 6:43:28 PM	98.1855 %
Friday	1145.78 MW	1128.56 MW	2/24/2017 11:42:17 AM	98.4967 %

Prediction Accuracy (Last 7 Days)

OVERALL	97.2681 %
HIGHEST	00.0000 %
LOWEST	00.0000 %

Method 1 Method 2 Method 3

24/02/2017 3:21:48 AM

7d 12h



SubStation Maintenance Program Performance



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Exploring Event Frames – Alectra

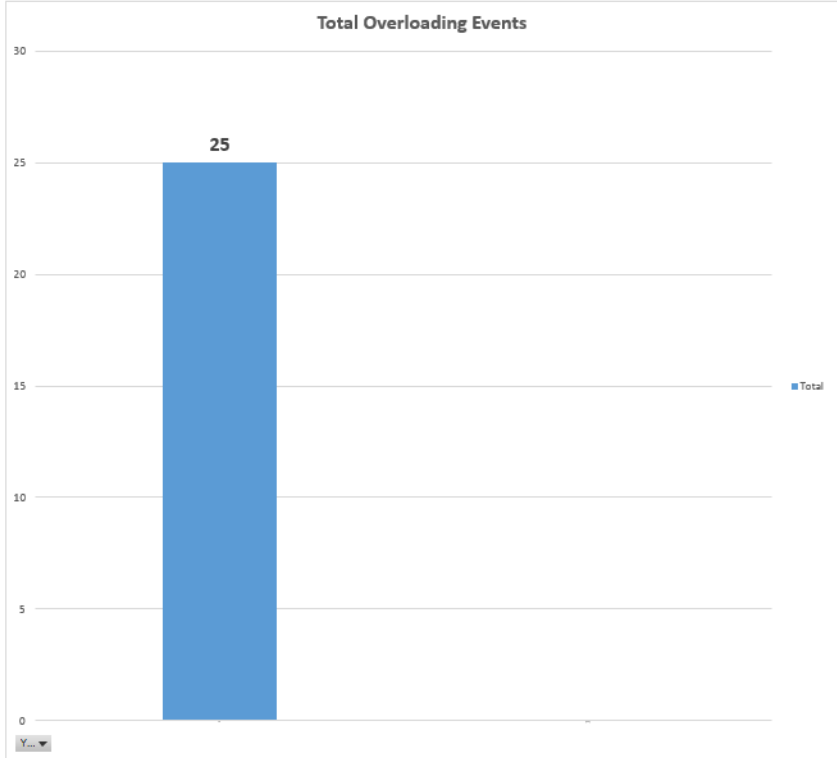
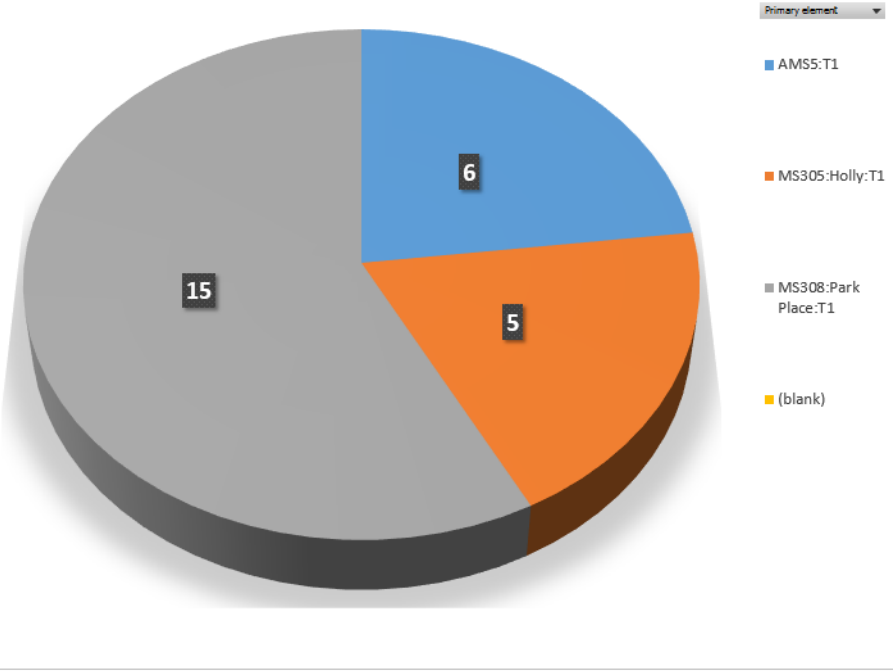
- Exploring Event Frames
 - Utilizing PI DataLink 2016
- Utilizing templates in PI AF
- Auto updating of Event Frame reports/charts for Dashboard's



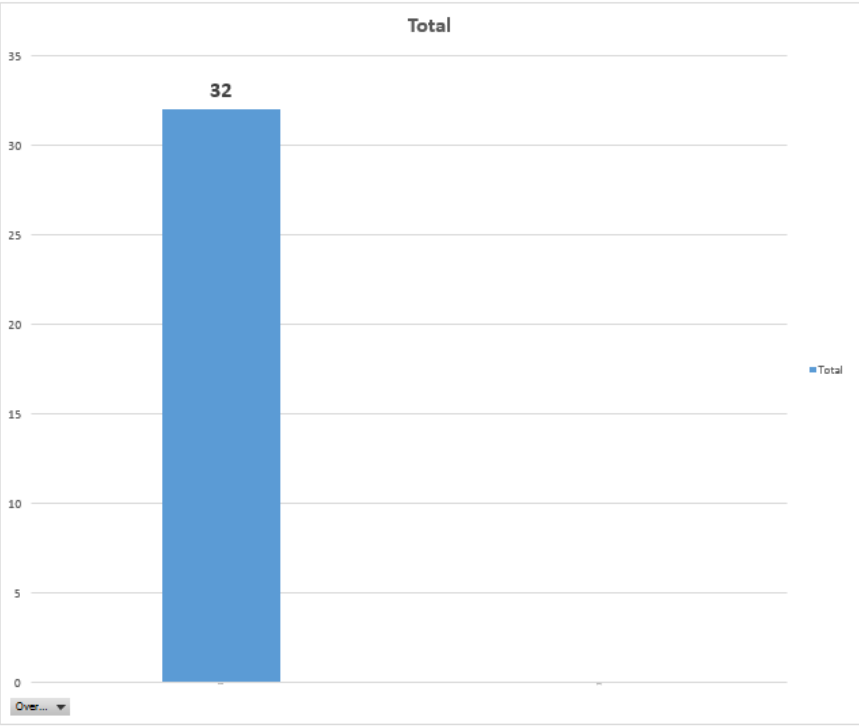
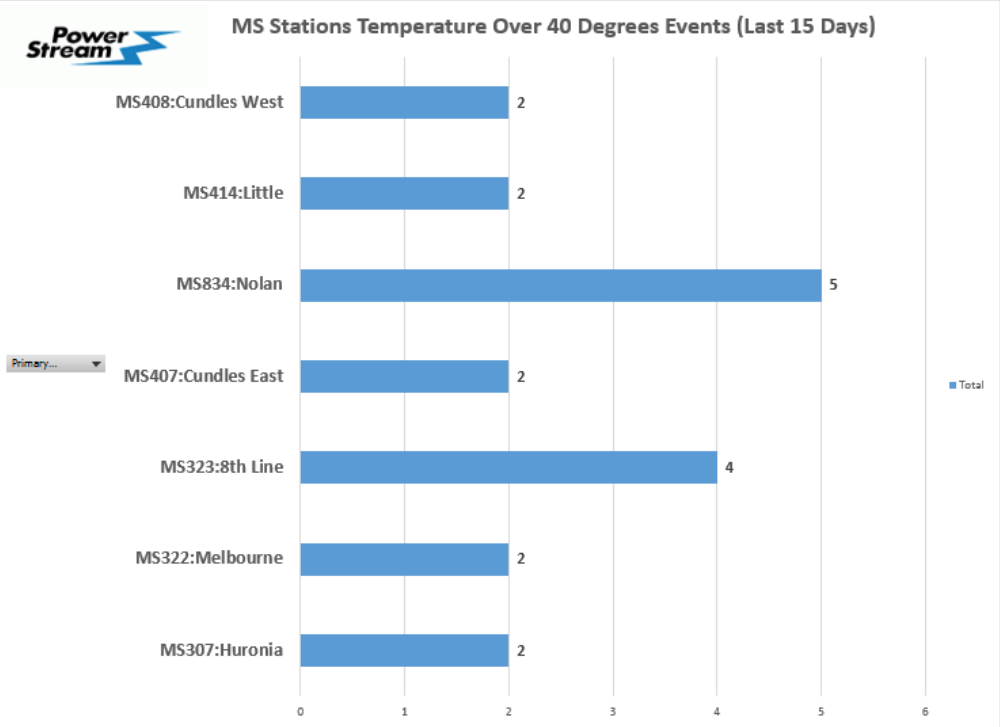
Substation Transformer 110% Overloading Events



110% MS Transformer Overloading Events (Last 2 months)

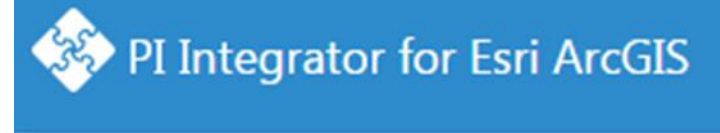


Substation Building Temperatures Over 40°C Events



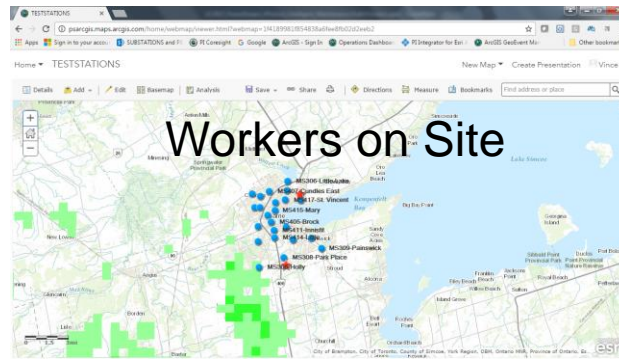
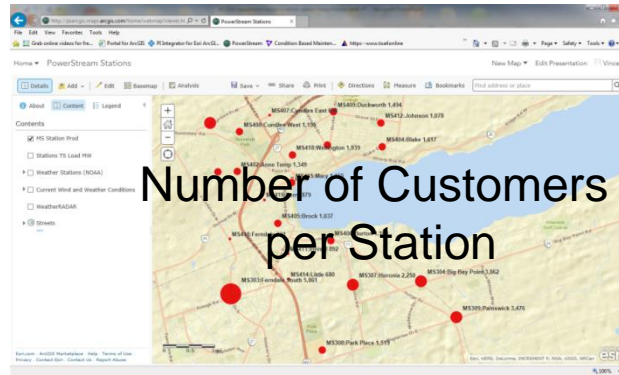
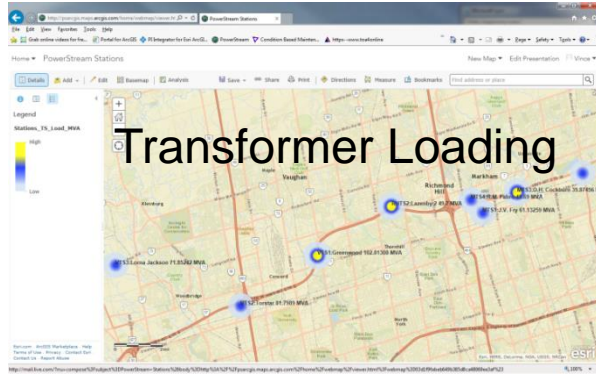
PI Integrator for ESRI ArcGIS

- 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



DEVONYUISTOCK.COM

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



PI Coresight - Distribution Automation Scheme Report (+Availability)(v6)

REAL-TIME DISTRIBUTION AUTOMATION SCHEMES

Intellteam: Markham

Team	Ready	Last 30 Days	YTD
Team 1	Ready	40.13	40.78
Team 2	Ready	16.67	44.43
Team 3	Ready	15.36	37.86
Team 4	Ready	44.06	32.46
Team 6	Ready	15.36	37.86

Lazenby 1 TS

FDIR	FDIR Status	FDIR Mode	EA	D	% EA	% D
27M1	Enabled	Auto	14.00	24.00	91.56	0.02
27M2	Disabled	Manual	0.00	100.00	0.00	3.71
27M3	Disabled	Manual	0.00	100.00	0.00	3.71
27M4	Enabled	Auto	89.00	10.00	94.29	1.14
27M5	Enabled	Semi-Auto	0.00	0.00	0.00	0.00
27M7	Enabled	Auto	99.00	0.00	95.78	0.01
27M8	Enabled	Auto	78.00	21.00	71.56	0.00
27M9	Enabled	Semi-Auto	0.00	0.00	0.00	0.00
27M10	Enabled	Semi-Auto	0.00	0.00	0.00	0.00
27M11	Enabled	Auto	100.00	0.00	98.50	0.00
27M12	Disabled	Manual	0.00	100.00	0.00	3.71

FDIR: Richmond Hill

FDIR	FDIR Status	FDIR Mode	EA	D	% EA	% D
36M1	Enabled	Auto	92.00	7.00	9.18	1.01
36M2	Enabled	Auto	99.00	0.00	8.48	0.00
36M3	Enabled	Auto	94.00	4.00	5.04	0.44
36M4	Disabled	Manual	0.00	100.00	0.00	3.71
36M5	Disabled	Manual	0.00	100.00	0.00	3.71
36M6	Enabled	Auto	88.00	13.00	9.51	1.11
36M7	Disabled	Manual	0.00	100.00	0.00	3.71
36M8	Disabled	Manual	0.00	100.00	0.00	3.71
36M9	Disabled	Manual	0.00	100.00	0.00	3.71
36M10	Disabled	Manual	0.00	100.00	0.00	3.71

Capacitor Bank: Penetanguishene

Capacitor Bank	% ON	Last 30 Days	YTD
Robert MS Capacitor Bank	ON	99.99	99.99

AFR: Vaughan

Scheme Setting	Scheme Status	% Enabled
Enabled	Enabled	6.00
Recloser Topology	Auto Restore	14.09
Normal	Disabled	95.00
		48.36

AFR: Markham

Scheme Setting	Scheme Status	% Enabled
Enabled	Enabled	11.00
Recloser Topology	Auto Restore	8.92
Normal	Enabled	15.00
		13.58

27/07/2016 3:01:20 PM 7d Now 03/08/2016 3:01:20 PM

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



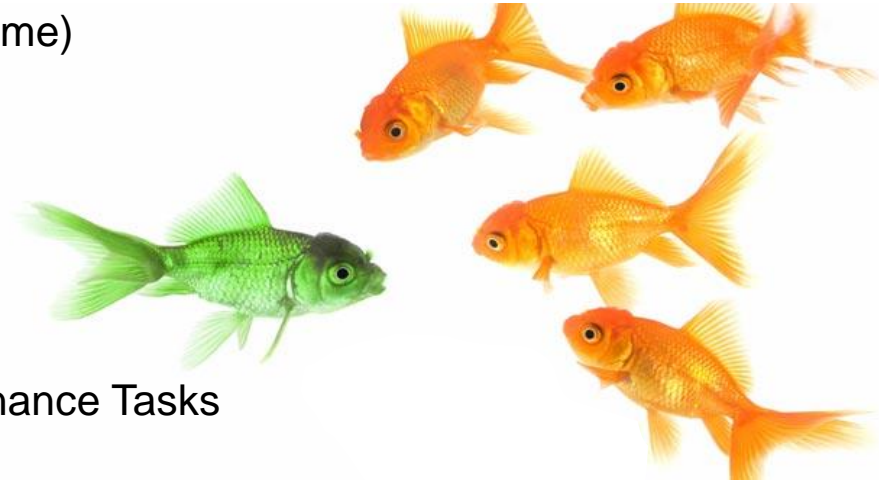
Decrease in Preventive / Predictive Maintenance Tasks



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
 - OSIssoft 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.**



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

Vince Polsoni

vince.polsoni@alectrautilities.com

Manager Station Sustainment

Alectra Utilities Inc.



Questions

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



State your **name & company**

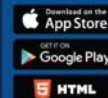
Please remember to...

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HTML

search OSISOFT in the app store

<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



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

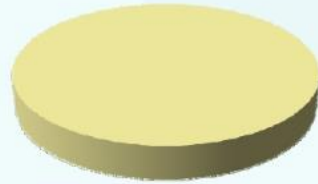


The Alectra Intelligent Maintenance Plan

The Plan

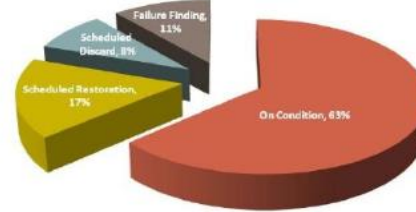


Original Maintenance Program



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

Original Maintenance Program



RCM2 (Reliability Centered Maintenance)



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



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



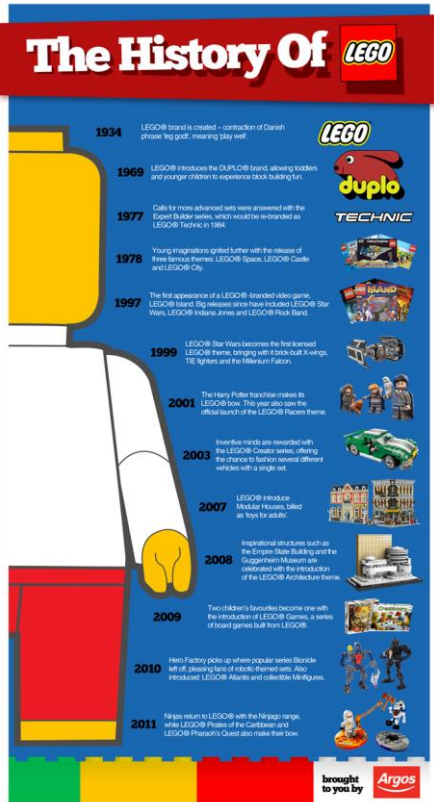
Event Frames - Examples

- 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...



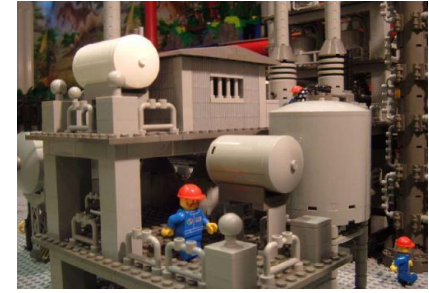
- World Wide user base
- Worldwide support 24/7
- Multiple languages

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

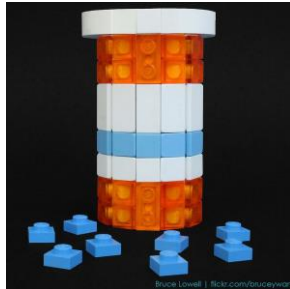


Digital Transformation - Industries using IIOT with PI System (Lego Style)

Oil & Gas



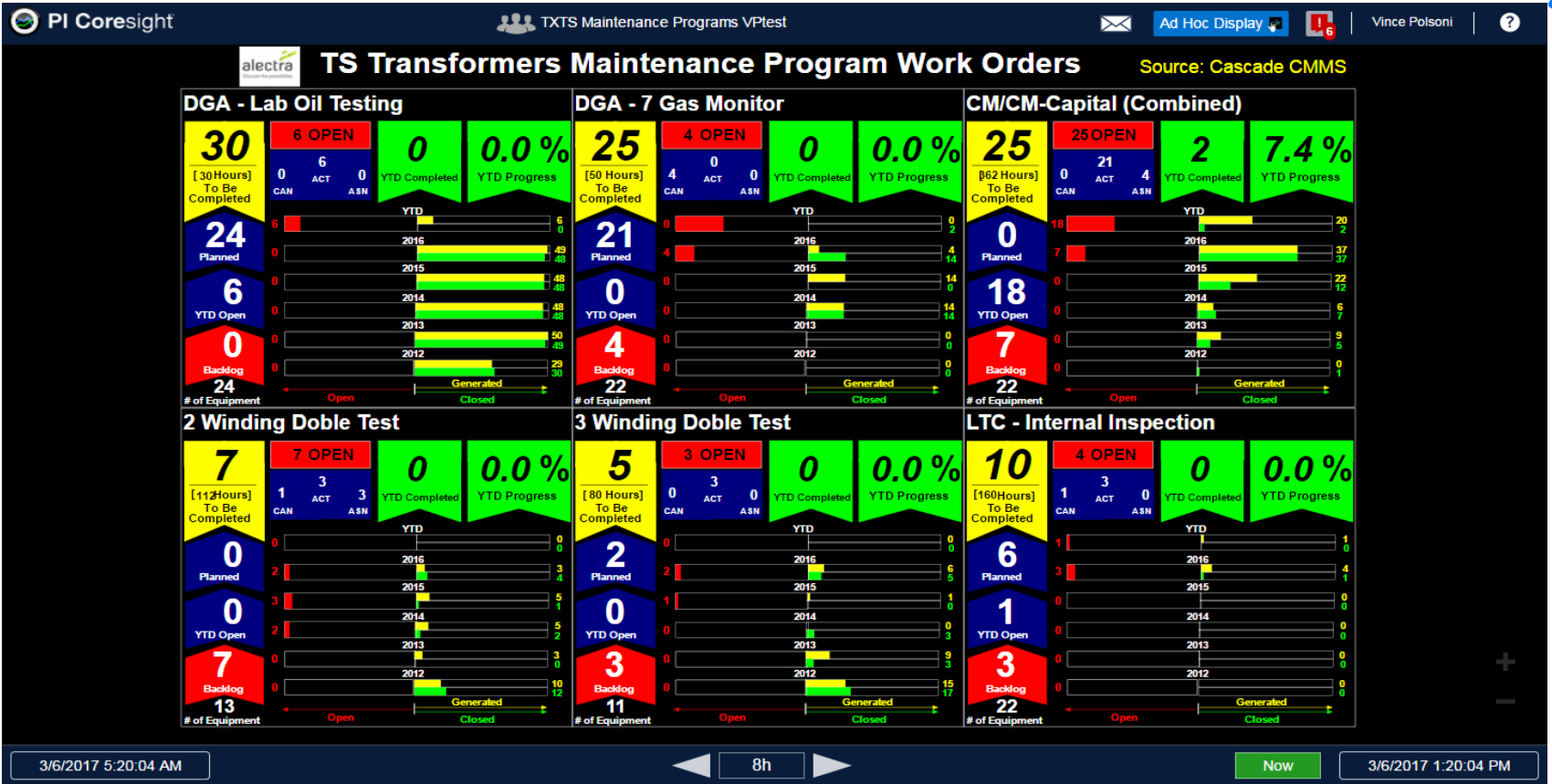
Pharma



- Asset Management
- Operations

- Production/Uptime
- Safety / Environment

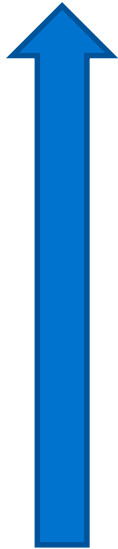
TS Transformer Maintenance Program Performance



Circuit Breaker Maintenance Program Performance



PI Notifications and OMS Notifications – Transformer Differential



Sequence
of Events

Inbox - vince.polsoni@powerstream.ca - Outlook

File Home Send / Receive Folder View Tell me what you want to do...

New Email Items New Clean Up Delete Reply Reply All Forward Meeting IM Team Email Reply & Delete To Manager Done Create New Move Rules OneNote Unread / Read Categorize Follow Up Search People Address Book Filter Email Find

All Unread Search Current Mailbox (Ctrl+E) Current M

FROM	SUBJECT	RECEIVED	IMAP...	SIZE	CATEGORIES
PI-Notifications Location: MTS3:D.H. Cockburn:T2	PI Alert: MTS3:D.H. Cockburn:T2 Secondary Breaker Status Update	Wed 06/05/20...		9 KB	
PI-Notifications Location: MTS3:E.D.H. Cockburn Expansion:T4	PI Alert: MTS3:E.D.H. Cockburn Expansion:T4 Secondary Breaker Status Update	Wed 08/03/20...		10 KB	
PI-Notifications Location: MTS2:A.M. Walker:T2	PI Alert: MTS2:A.M. Walker:T2 Secondary Breaker Status Update	Wed 08/03/20...		9 KB	
PI-Notifications Location: MTS2:A.M. Walker:T2	PI Alert: MTS2:A.M. Walker:T2 Transformer Loading Update	Wed 08/03/20...		9 KB	
PI-Notifications Location: MTS3:D.H. Cockburn:T2	MTS3:D.H. Cockburn:T2 Transformer Loading Update	Wed 08/03/20...		9 KB	
PI-Notifications Location: MTS3:E.D.H. Cockburn Expansion:T4	MTS3:E.D.H. Cockburn Expansion:T4 Transformer Loading Update	Wed 08/03/20...		9 KB	
PI-Notifications Location: MTS3:D.H. Cockburn:T2	PI Alert: MTS3:D.H. Cockburn:T2 Primary Switch Status Update	Wed 08/03/20...		10 KB	
PI-Notifications Update:	PI Alert: Transformer Differential Protection Alarm at MTS3:D.H. Cockburn:T2	Wed 08/03/20...		8 KB	
PowerStream Outage Info <https://www.powerstream.ca/images/email_logo.jpg> Power Outage Information	Update: Power Outage # 752645 - Markham	Wed 08/03/20...		26 KB	
PI-Notifications Update:	PI Alert: Outage Information Update (I/D by 500)	Wed 08/03/20...		23 KB	
PI-Notifications Update:	PI Alert: Outage Information Update (I/D by 100)	Wed 08/03/20...		23 KB	
PowerStream Outage Info <https://www.powerstream.ca/images/email_logo.jpg> Power Outage Information	Update: Power Outage # 52548 - Markham	Wed 08/03/20...		26 KB	
PI-Notifications Update:	PI Alert: Outage Information Update (I/D by 500)	Wed 08/03/20...		23 KB	
PI-Notifications Update:	PI Alert: Outage Information Update (I/D by 500)	Wed 08/03/20...		23 KB	
PI-Notifications Location: MTS3:E.D.H. Cockburn Expansion:26M14	PI Alert: MTS3:E.D.H. Cockburn Expansion:26M14 Circuit Breaker Operation Notification	Wed 08/03/20...		10 KB	
ECAlertMe Issued at 2017-03-08 6:23PM EST by Environment Canada:	Alert for PowerStream Weather (001KD)	Wed 08/03/20...		19 KB	

Items: 21,049 Unread: 12,428 Reminders: 1 This folder is up to date. Connected to: Microsoft Exchange

PI Notifications

OMS Notifications

PI Notifications

OMS Notifications

PI Notifications

